IBM

DISPLAYWRITER SYSTEM

Service Theory Manual

Revised May, 1982
S241-6247-2

Work Station

IBM has prepared this maintenance manual for the use of IBM Customer Engineers in the installation, maintenance and repair of the specific machines indicated. IBM makes no representations that it is suitable for any other purpose.

Information contained in this manual is subject to change from time to time. Any such change will be reported in subsequent revisions or distributed through Customer Engineering Memorandums (CEMs) to all subscribers.

Requests for copies of IBM publications should be made to your IBM representative or to the IBM Branch Office servicing your locality.

Comments about the publications may be addressed to (IBM Corporation, 740 New Circle Road N.W., Publications Department 901, Lexington, Ky. 40511). IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation whatever. You may, of course, continue to use the information you supply.

"It is possible that this material may contain reference to, or information about, IBM products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that IBM intends to announce such IBM products, programming, or services in your country."

SAFETY PRECAUTIONS

All IBM Customer Engineers are expected to take every safety precaution possible and observe the following safety practices when servicing IBM equipment.

Mechanical Safety:

1. *Safety glasses must be worn.*
2. *All safety devices, such as guards, shields, signs, ground wires, etc., must be restored after maintenance. When a guard or shield is removed to observe or make an adjustment, that shield must be replaced when work in the area is completed.*
3. *Watches, rings, necklaces, ID bracelets, etc., must be removed when servicing the machine.*
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.*

Electrical Safety:

1. *The equipment referenced in this manual may use high voltages. Check voltage labels!*
2. *Safety glasses must be worn when checking energized circuits.*
3. *If a circuit is disconnected for servicing or parts replacement, it must be reconnected and tested before allowing the use of the machine.*
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.*
5. *Meter continuity checks should be used instead of voltage checks whenever possible.*
6. *Do not apply power to any part, component, or subassembly when it is not physically mounted in the machine, or in its approved service position.*

General Safety:

1. *Each Customer Engineer is responsible to be certain no action on his/her part makes the product unsafe or exposes customer personnel to hazards.*
2. *Store the removed machine covers in a safe, out of the way place where no one can trip over them.*
3. *If you must leave the machine in a down condition, always install the covers and disconnect the power before leaving the customer's office.*
4. *Always place CE 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 CEs 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 nine 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 for the IBM Licensed Program Textpack 1. 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 Display and 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, and figures showing component locations.

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.

IBM DISPLAYWRITER SYSTEM

SERVICE THEORY MANUAL CONTENTS

The IBM Displaywriter System is a modular family of word processing products. The available modules include a display module, an electronics module, a single or a dual diskette unit, a keyboard module, and a printer. (Figure 1)

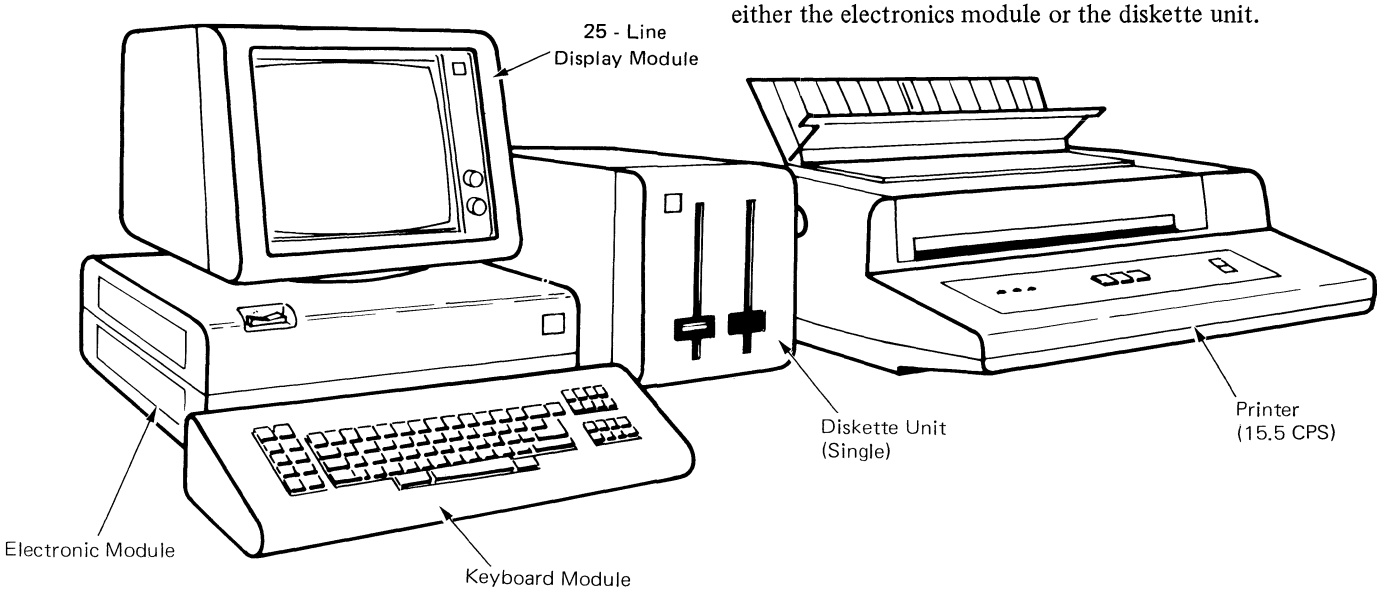


Figure 1 - IBM Displaywriter System

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,

  or,

  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 adjusted 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 160 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.

WORK STATION

When either a single or a dual 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 drive mechanism for the flexible diskette storage. The diskette unit is controlled by, and receives its power from the electronics module.

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 2).

The display module is cable connected 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.

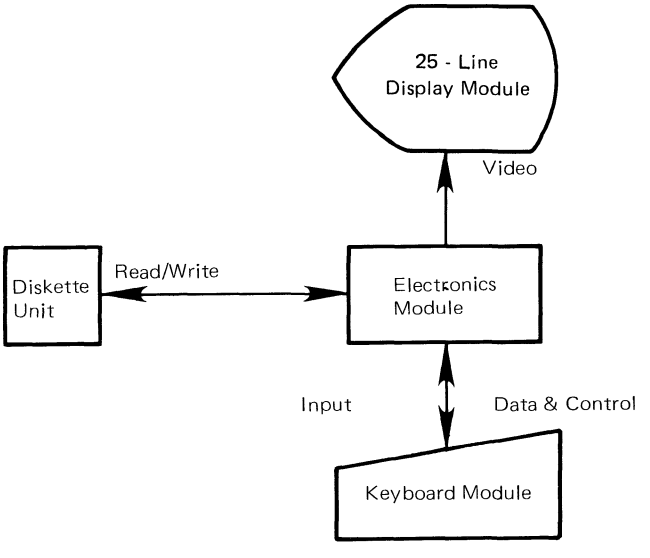


Figure 2 - Work Station Data Flow

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 two types of diskettes used with the Diskette Unit are the IBM Diskette 1 and Diskette 2D. The IBM Diskette 1 (one-sided diskette) can hold up to 284,000 bytes of usable information. The IBM Diskette 2D, a high density, two-sided diskette, can have information stored on both sides of the diskette with more information stored in the same amount of space. The IBM Diskette 2D can hold up to 985,000 bytes of usable information.

PRINTERS

Several printers can be used with the IBM Displaywriter System.

- The IBM "Selectric" Element Printer (Figure 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).

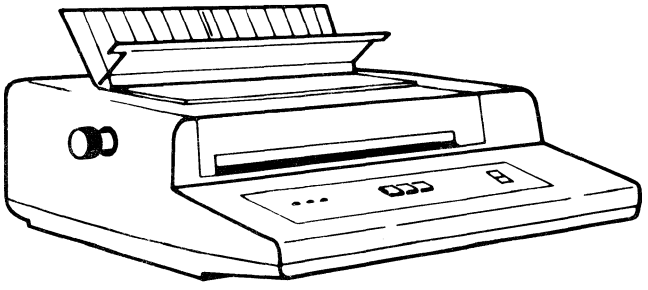


Figure 3 - "Selectric" Element Printer

- Two bidirectional printwheel printers (Figure 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.

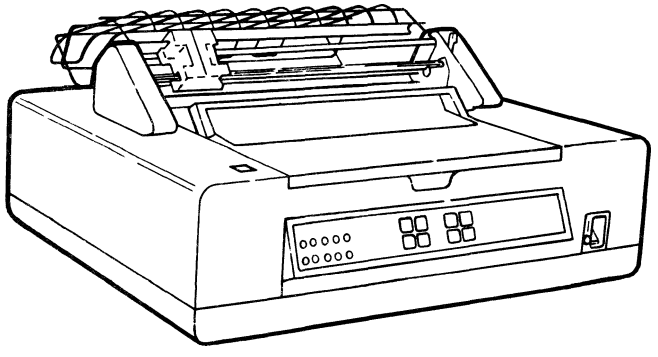


Figure 4 - Printwheel Printer (With Optional Tractor Feed)

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 4).
- The Sheet-Feed Paper Handler is a two-tray paper handler which holds up to 400 sheets of paper. It feeds and stacks individual sheets of paper (Figure 5).

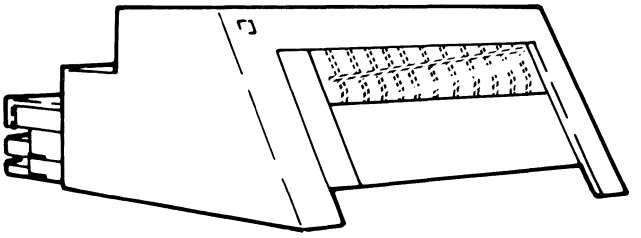


Figure 5 - Sheet Feed Paper Handler

MAG CARD UNIT

The Mag Card Unit is cable connected to the Electronics Module to permit the reading and the recording of magnetic cards (Figure 6).

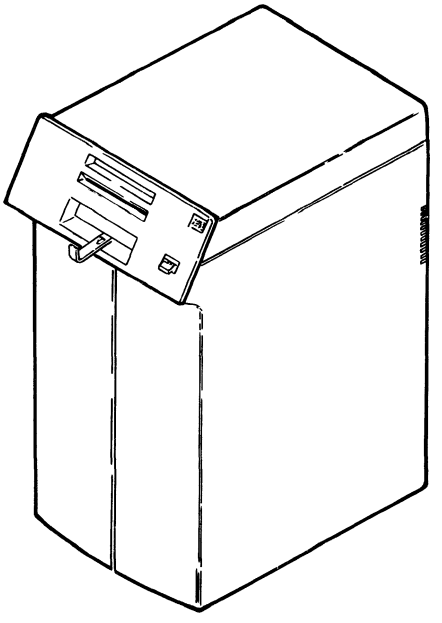


Figure 6 - Mag Card Unit

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.

OPERATING INSTRUCTIONS

CONTENTS

This section explains some of the basic operations of the IBM Displaywriter System using the IBM Licensed Program Textpack 1. This is not a complete operator manual. If further information is needed, refer to the operator's reference information.

Two types of diskettes, work diskettes and program diskettes, are used to perform operator applications. Documents are stored on work diskettes, and programs that permit the operator to perform various functions are loaded into the Displaywriter System from program diskettes.

After the system successfully completes all the tests during Power On Reset (POR), 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 typed 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.

This section describes the five areas of the display:

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

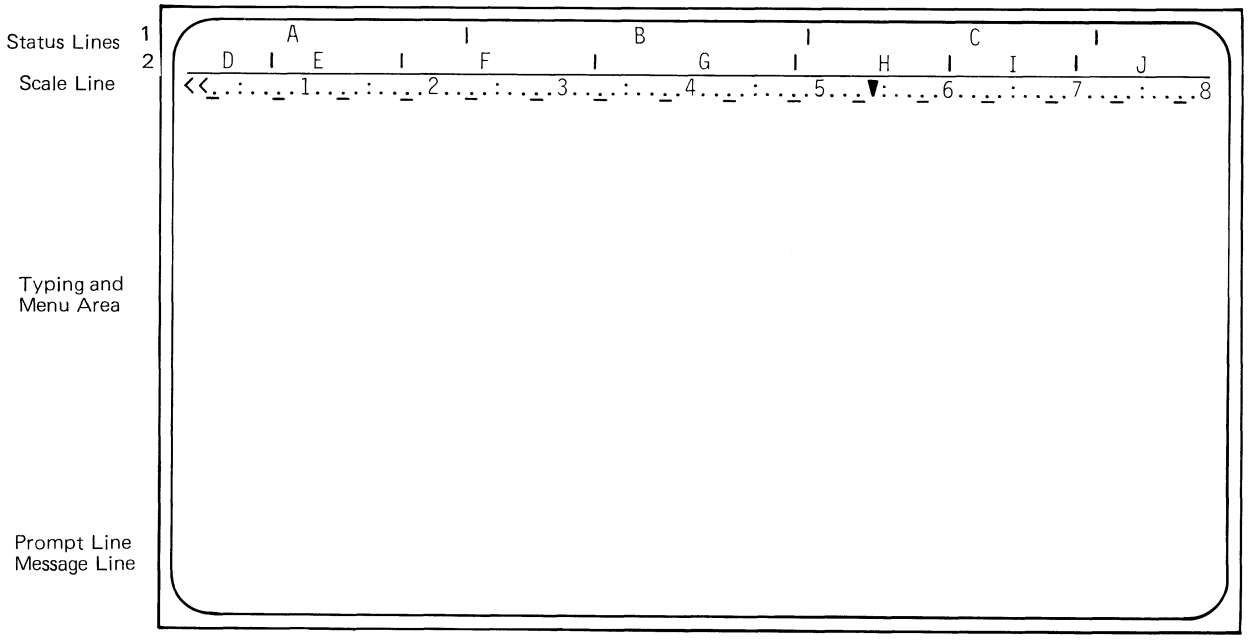


Figure 1 – Display Format

STATUS LINES

The two status lines have information about the current task. 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 cursored 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.

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 number of the keyboard in use.

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

SCALE LINE

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

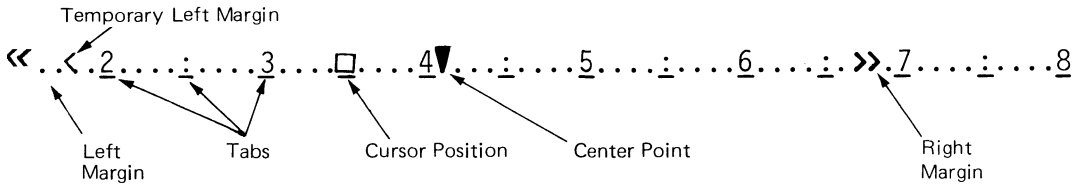


Figure 2 – Scale Line

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 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.

Twenty text lines can display at a time. Document pages with more than 20 lines can be displayed by scrolling, which moves the text vertically through the display. Attempting to move the cursor past the upper or lower typing area boundaries will move the text through the display.

PROMPT LINE

The system uses the prompt line to indicate an action that must be taken (for 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 lines displayed on the screen.

MESSAGE LINE

The system uses the message line to indicate the status of tasks (for example, a print job completion), printer needs such as a request for paper, or when an error occurs. The system can hold up to 6 messages. Pressing the Message (MSG) key when the ⇒ symbol is on the message line displays the waiting message and clears the message being displayed.

The operator uses the four groups of keys on the keyboard (Figure 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. These special keys have the additional operation name printed on the front of them.

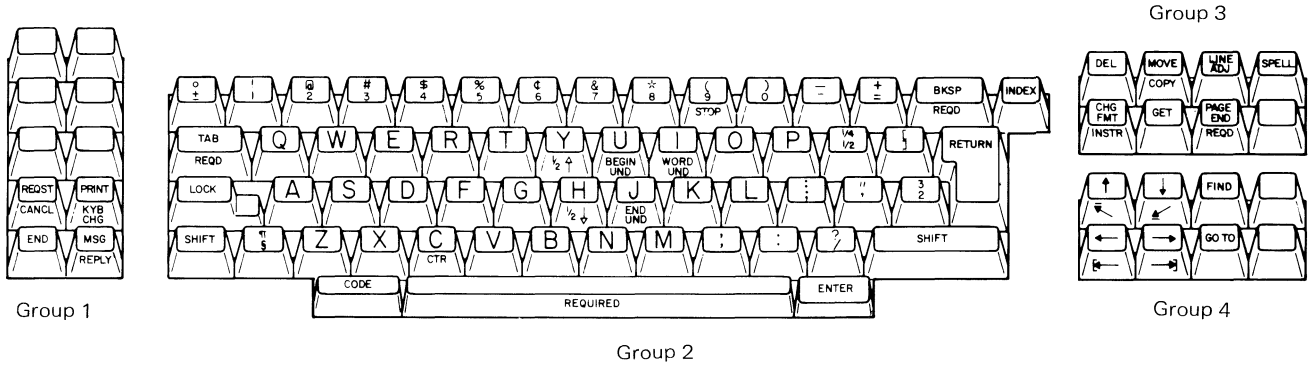


Figure 3 – Displaywriter Keyboard

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.

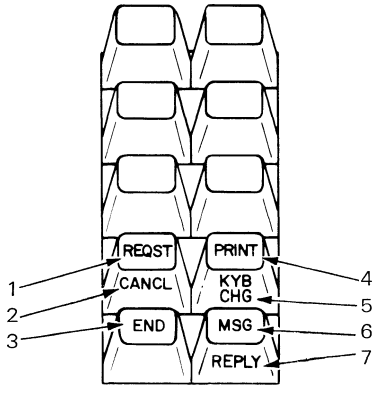


Figure 4 – Work Station Control Keys (Group 1)

ALPHANUMERIC KEYS

1. TAB: moves the cursor to the next tab setting.
2. REQD (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. SPACE BAR: 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.
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.

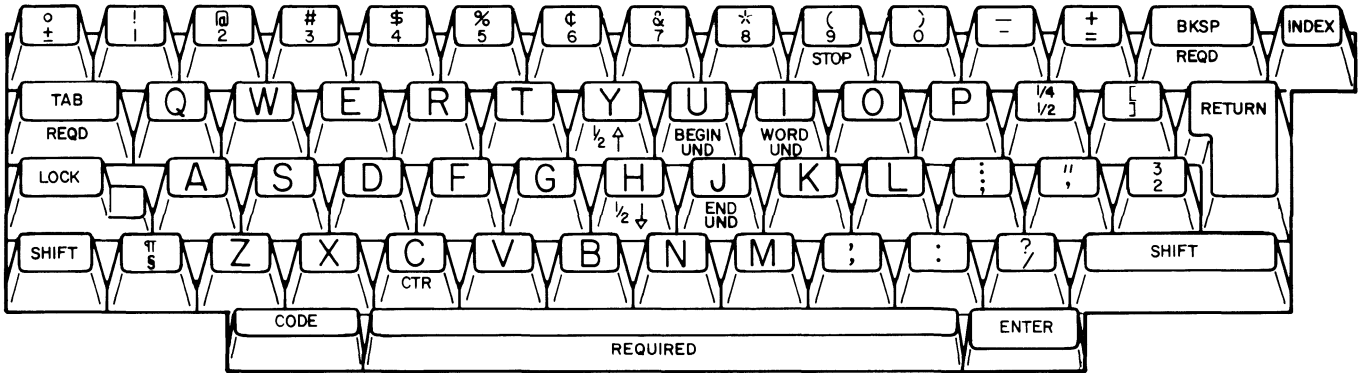


Figure 5 – Alphanumeric Keys (Group 2)

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.

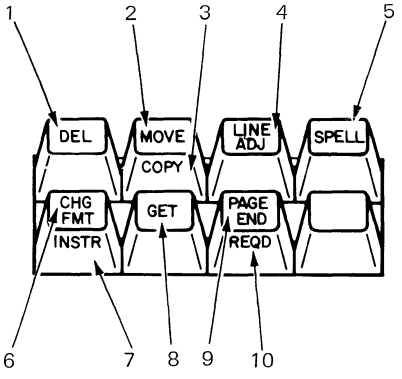


Figure 6 – Function Control Keys (Group 3)

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.

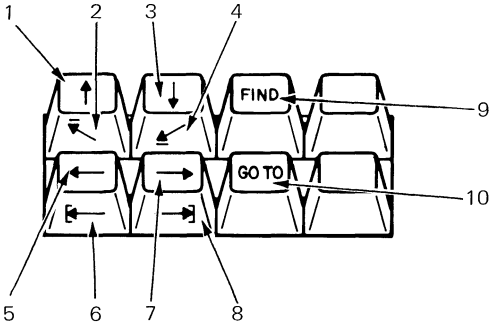


Figure 7 – Cursor Movement Keys (Group 4)

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.

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 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 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 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 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 the 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

                          YOUR      POSSIBLE
ID  ITEM                  CHOICE    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:
```

Figure 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:
```

Figure 10 – Request Tasks Menu

MARGINS AND TABS

The Margins and Tabs Menu (Figure 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.

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.

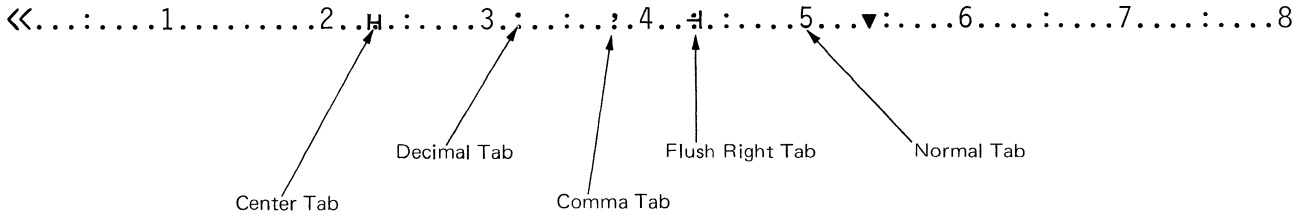


Figure 11 - Margins and Tabs

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 requried 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 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.

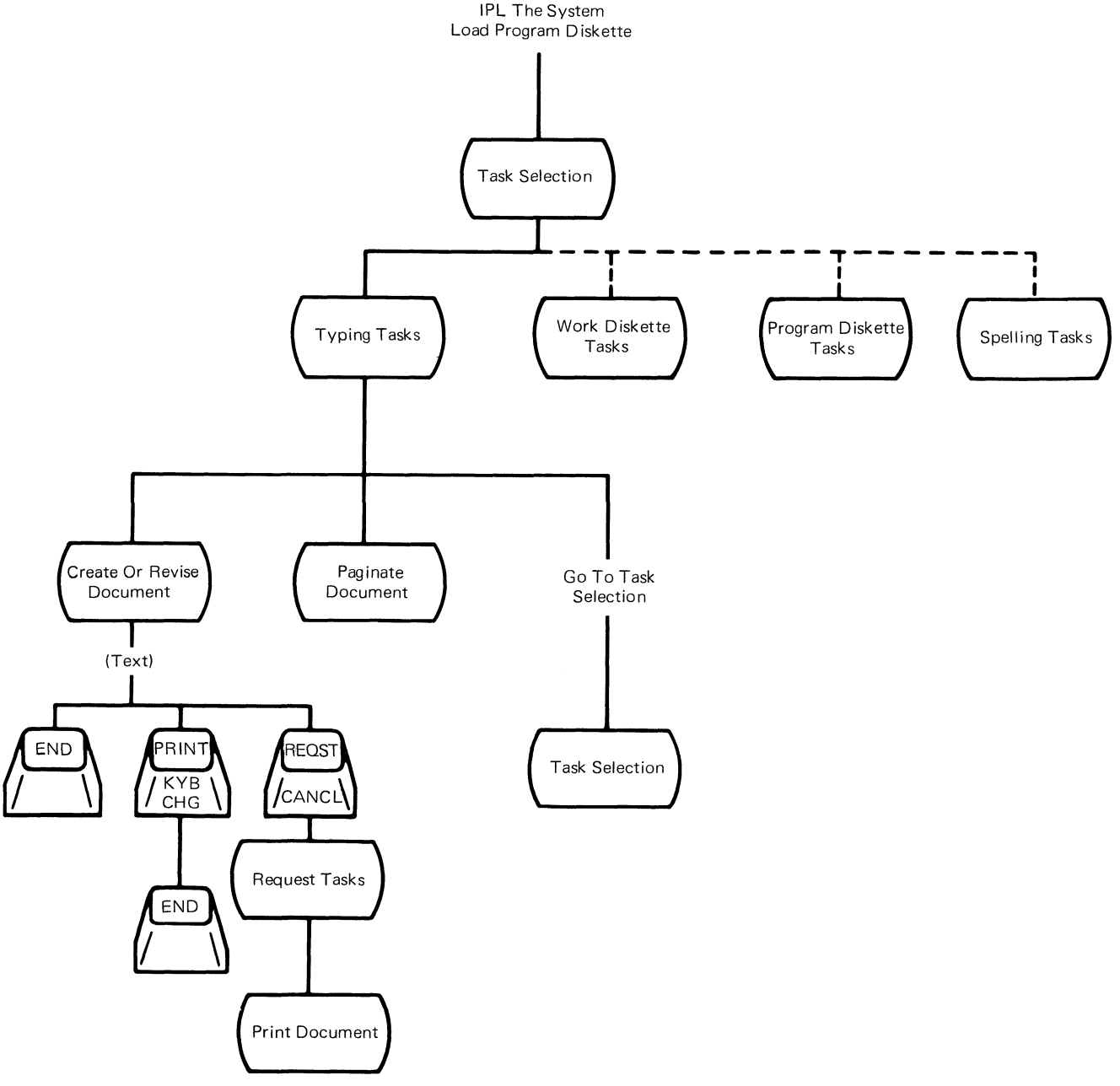


Figure 12 – Menu Sequence – Typing Tasks

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.

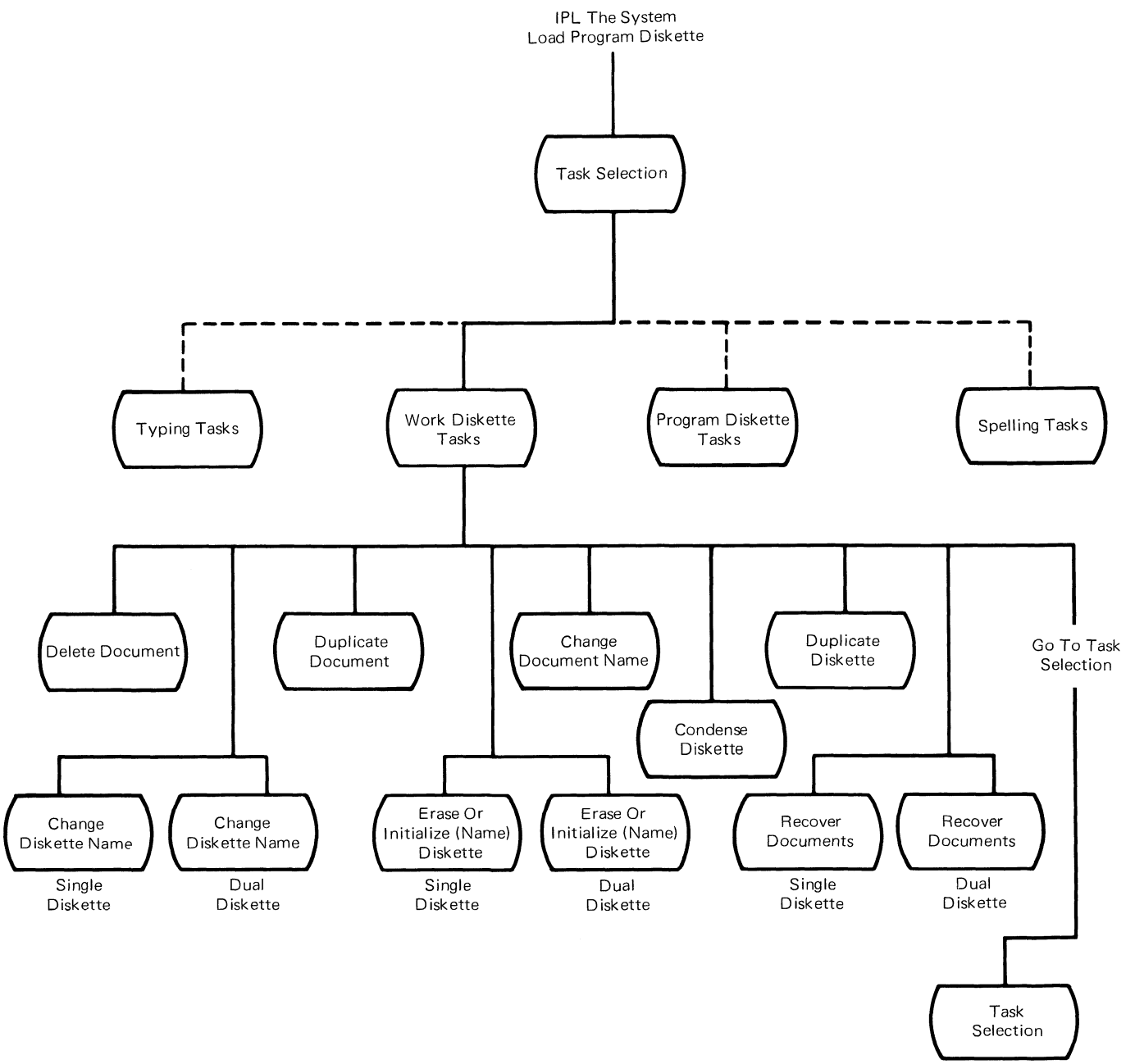


Figure 13 – Menu Sequence – Work Diskette Tasks

MENU SEQUENCE – PROGRAM DISKETTE TASKS

The Program Diskette Tasks Menu sequence is used when the operator wants to change the system defaults or maintain the program diskette. To make the changes to the program diskette defaults effective, the operator must remove the program diskette, turn the system off and on (to IPL), and then 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.

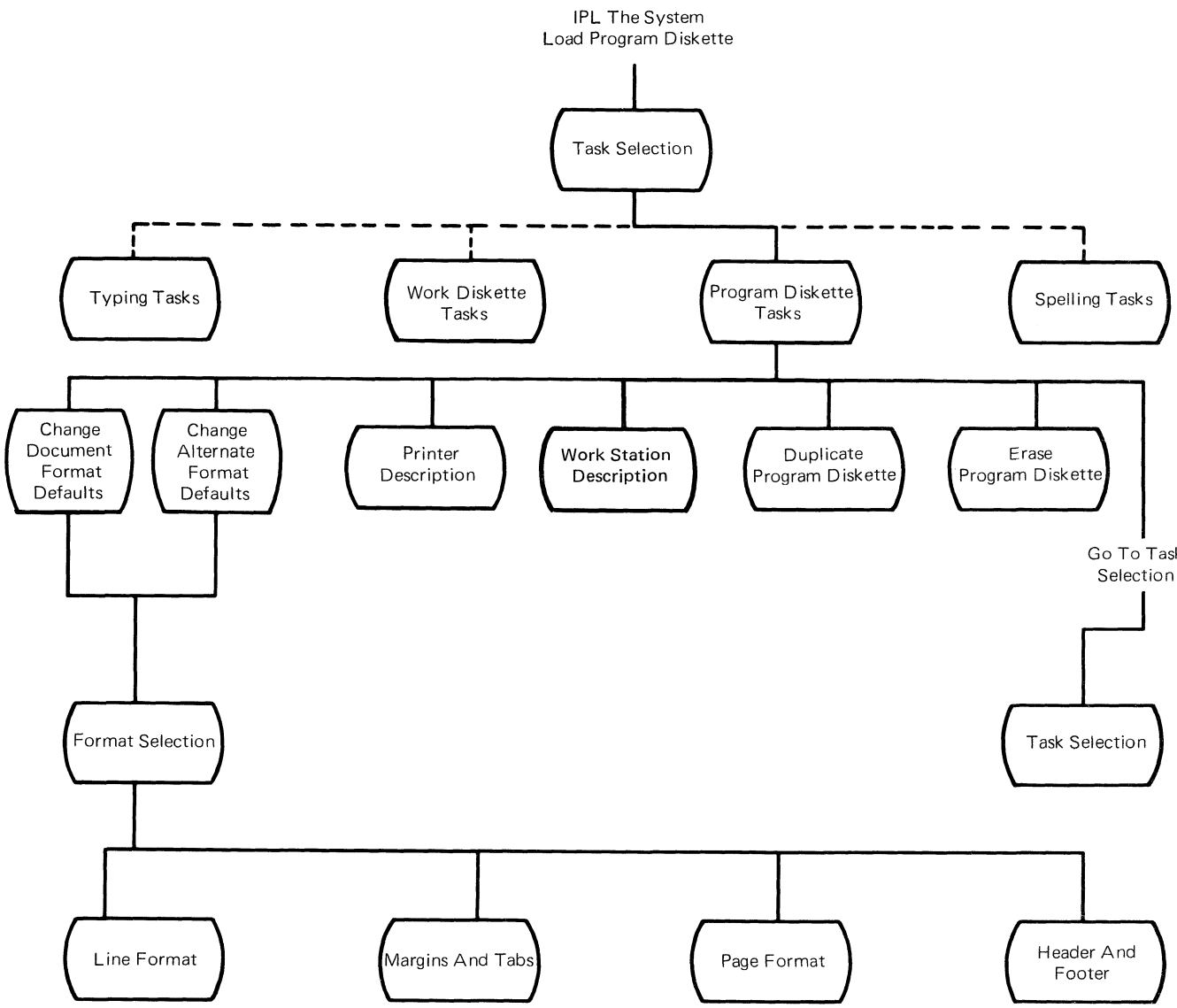


Figure 14 – Menu Sequence – Program Diskette Tasks

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 dictionary, 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.

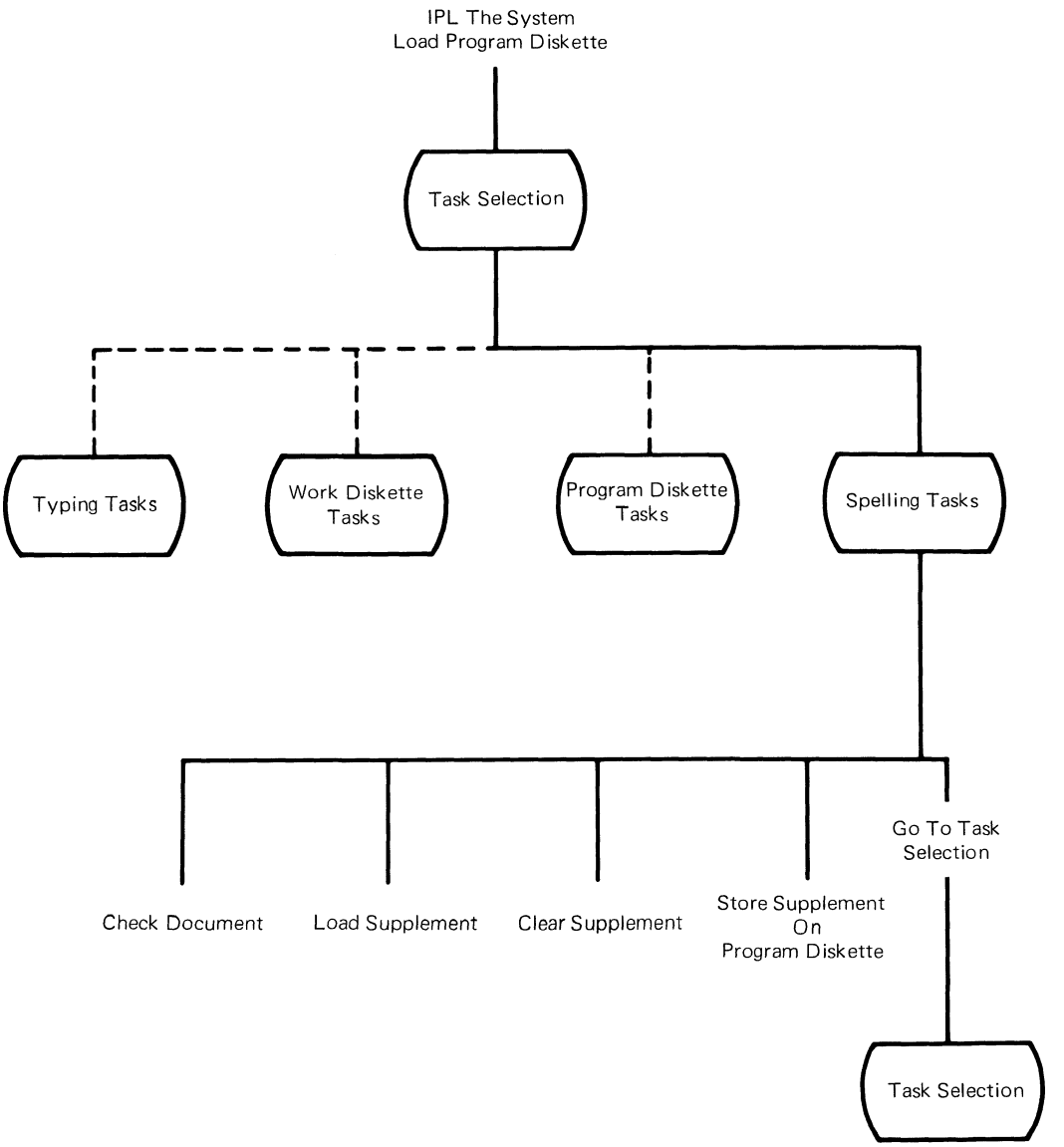


Figure 15 – Menu Sequence – Spelling Tasks

MENU SEQUENCE –
CHANGE FORMAT (CHG FMT) KEY

The Format Selection Menus 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.

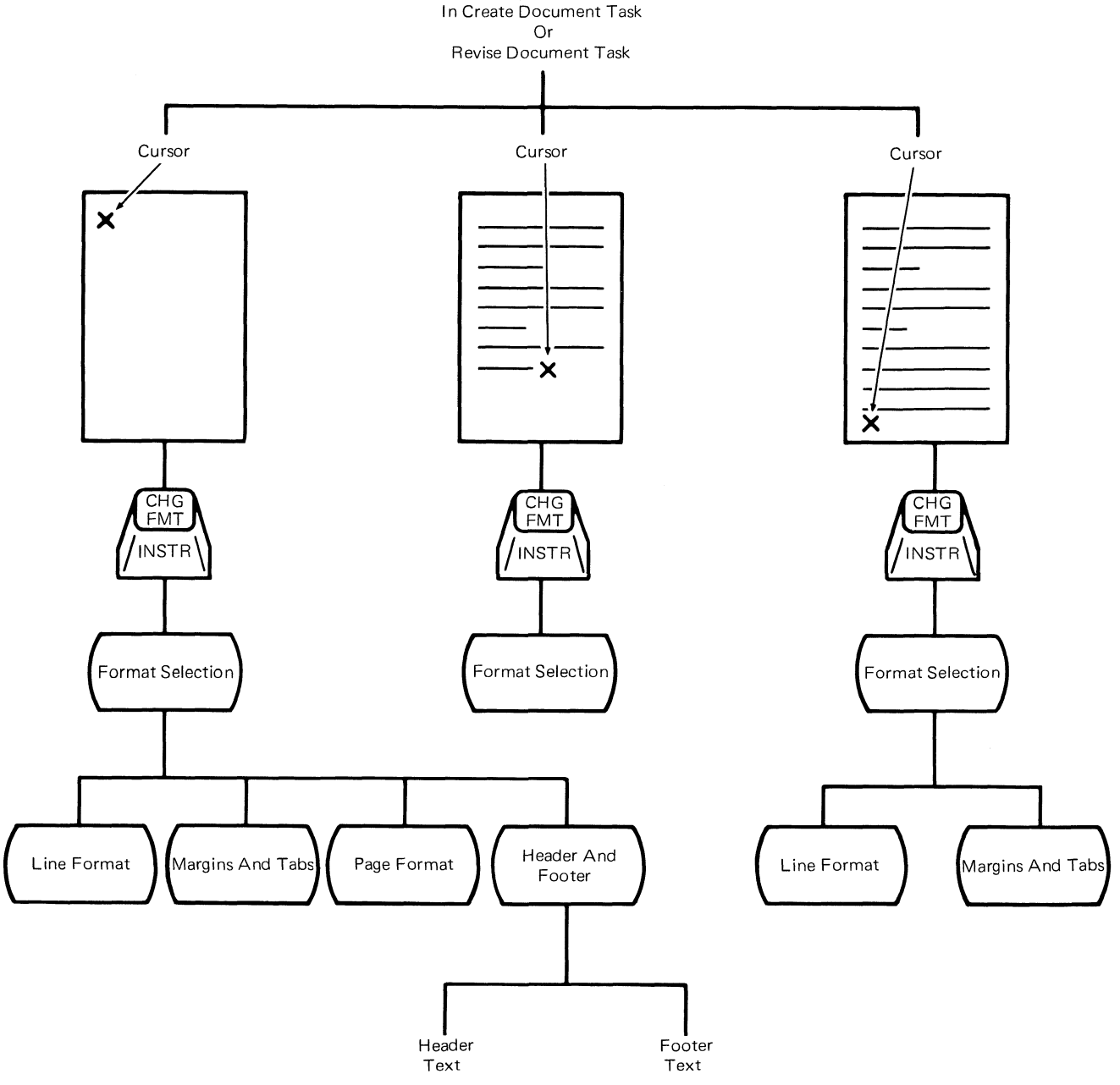


Figure 16 – Menu Sequence
Change Format (CHG FMT) Key

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.

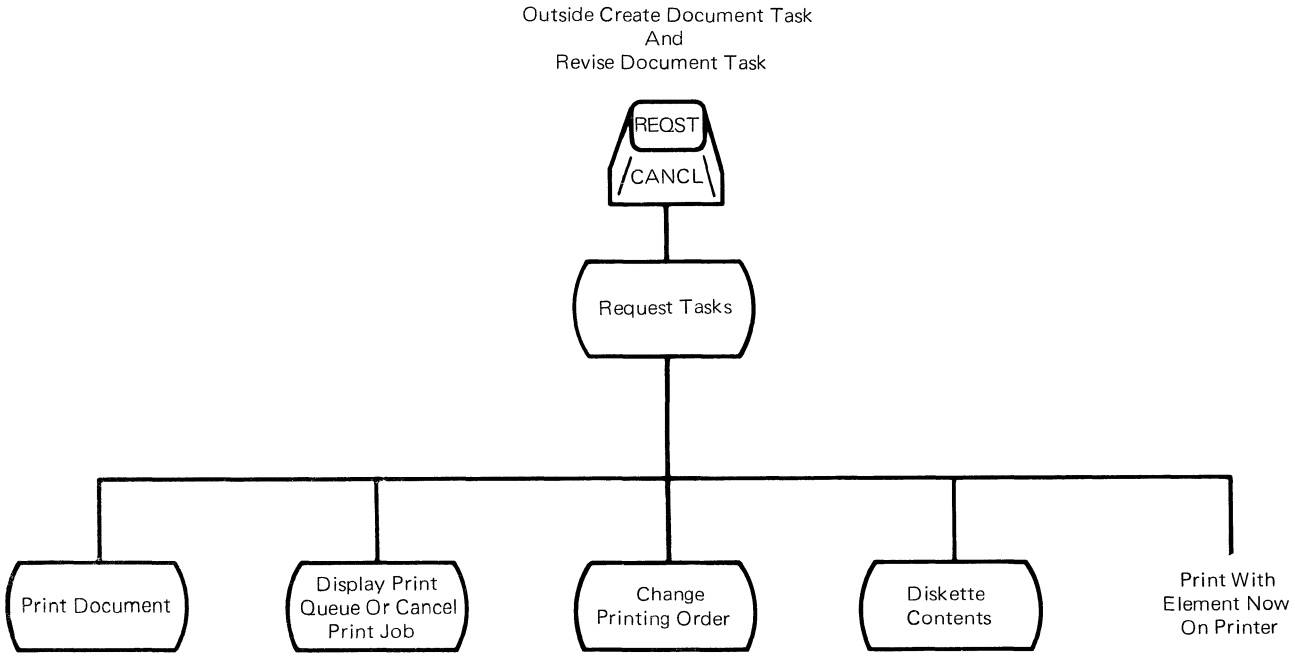


Figure 17 – Menu Sequence – Request (REQST) Key

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.

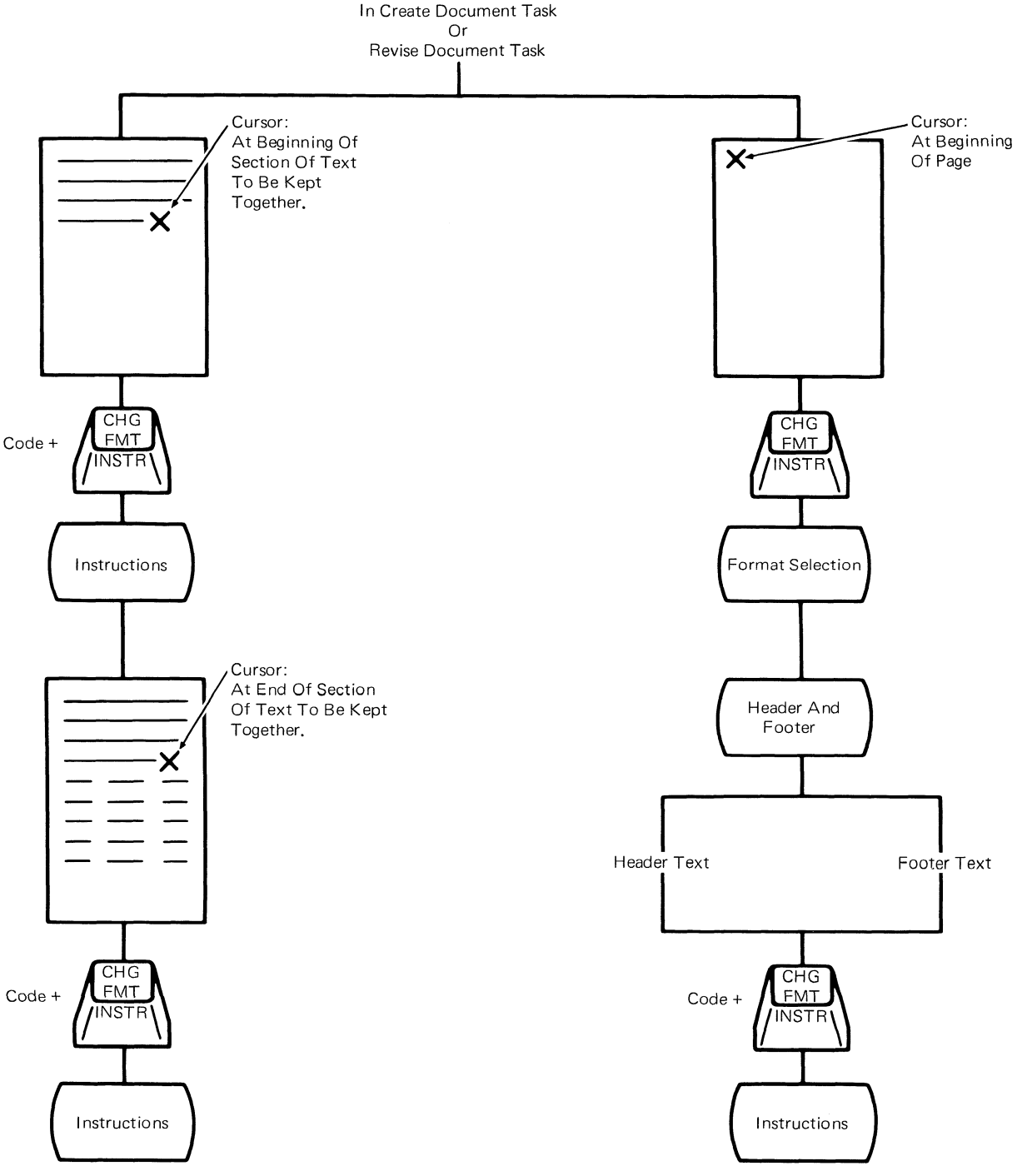


Figure 18 – Menu Sequence – Instructions

25-LINE DISPLAY

CONTENTS

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

CAUTION

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, 170 mm (6.7 inches) vertically, and can display 25 lines of information. The display area of the screen available for typing by 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.

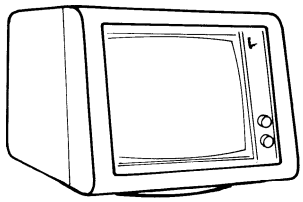
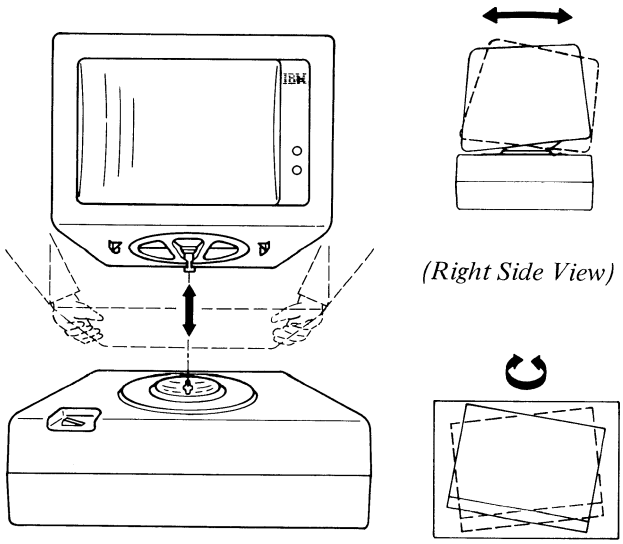


Figure 1 - Display Module

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 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.



(Front View) *(Right Side View)* *(Top View)*

Figure 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).

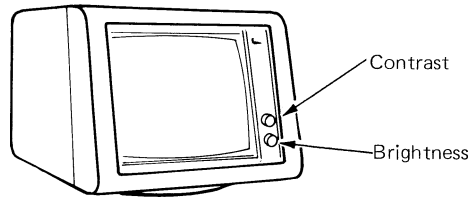


Figure 3 - Operator Controls

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 4).

Characters	Dot Matrix
Lower Case - i, l	3x9
Number - 0, 1	5x9
Upper Case - I	5x9
Lower Case - b, d, f, h, k, t	6x9
Upper Case - A, B, C, D, E, F, H, K, L, M, N, O, P, R, S, U, V, X, W	6x9
Numbers - 2, 3, 5, 6, 7, 8, 9	6x9

Characters	Dot Matrix
Upper Case - G, J, Q, T, Y, Z	7x9
Number - 4	7x9
Lower Case - a, c, e, n, o, s, v, w, x, z	6x6
Lower Case - g, p, r, y	6x7
Lower Case - j	4x10
Lower Case - m, u	7x6
Lower Case - q	7x7

Figure 4 - Character Size

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 5).

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 higher intensity (brighter) than the data being displayed. When the cursor is below a character, both the character and the cursor will be brighter (Figure 5).

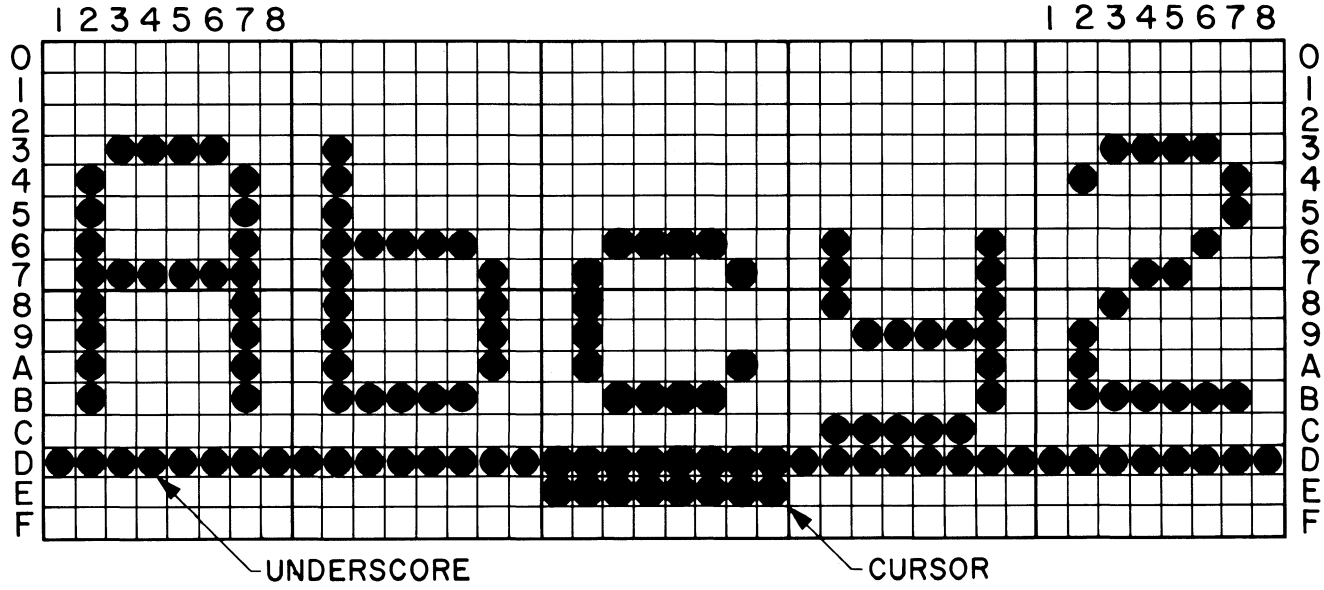


Figure 5 - Character Box Structure

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

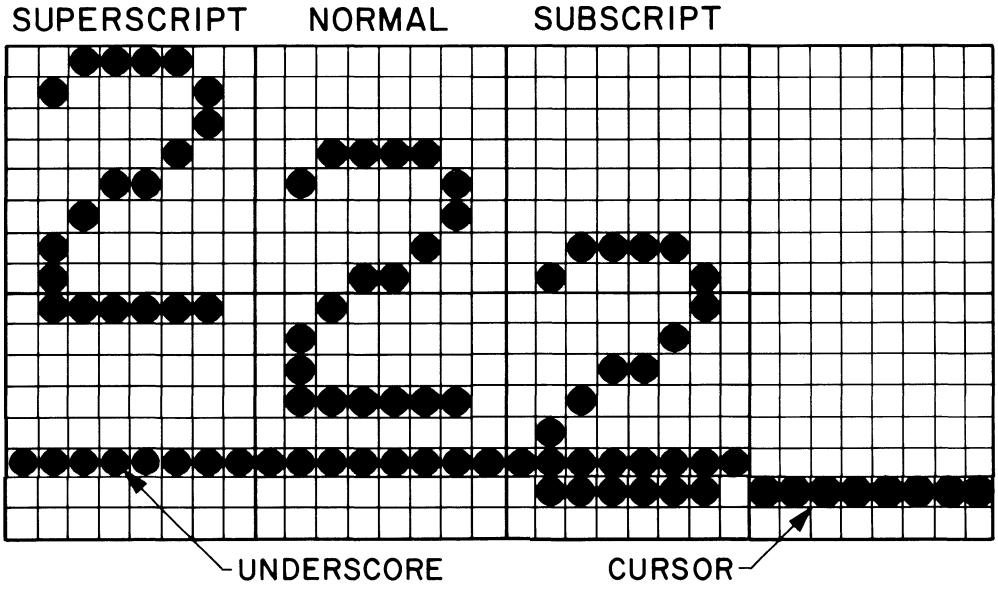


Figure 6 - Superscripts and Subscripts

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 7).

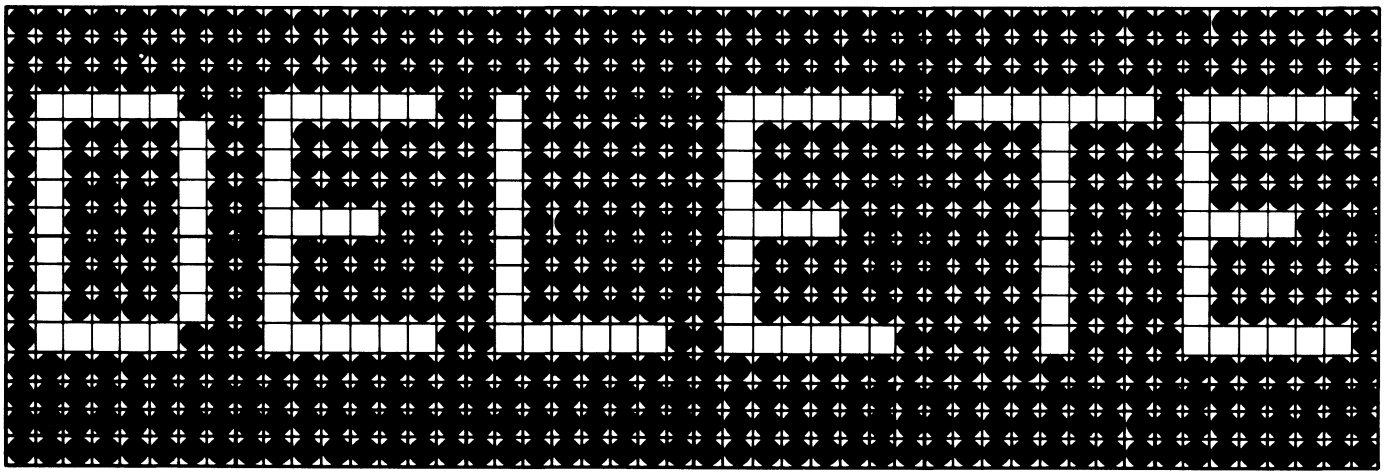


Figure 7 - Highlighted Characters

25-LINE DISPLAY FONTS

There are two different fonts on the display adapter card (Figure 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 8) contains alphanumeric characters and graphic symbols, and Font 2 (Figure 8) contains symbols, fractions, subscript numbers and superscript numbers. Each font contains a maximum of 256 characters.

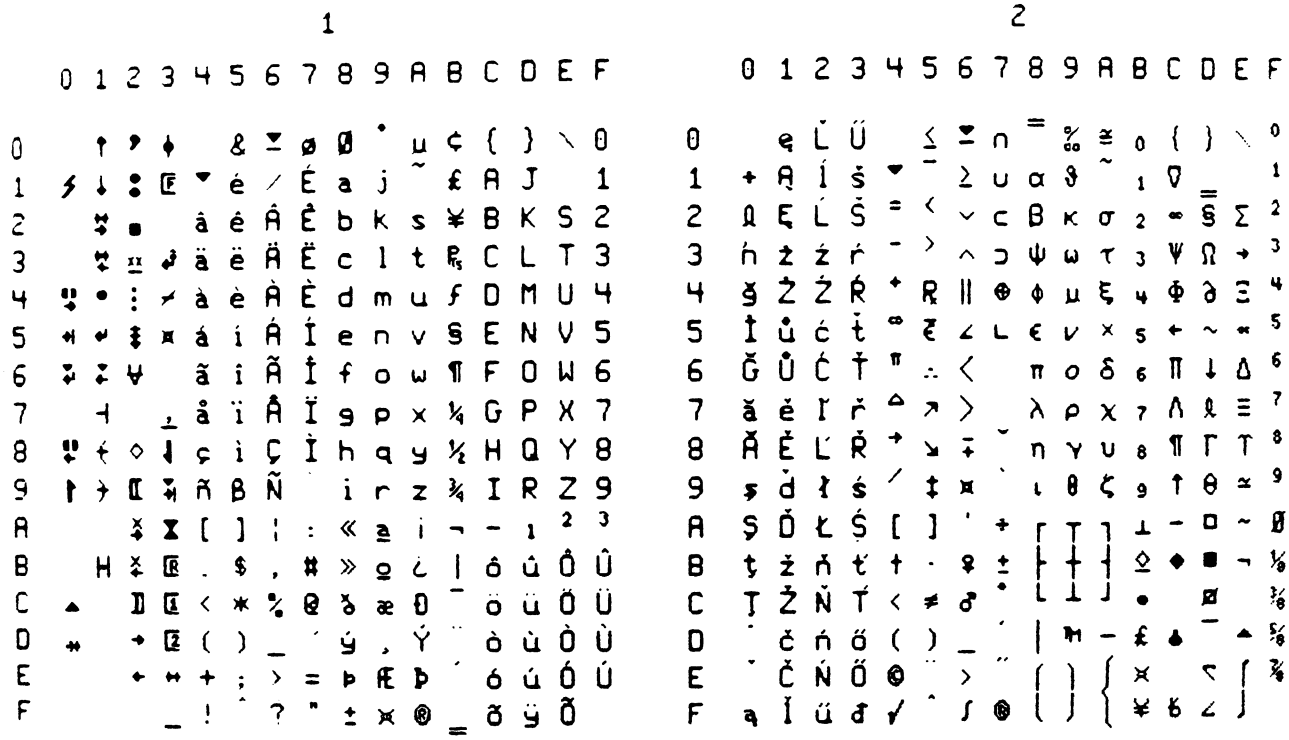


Figure 8 - 25-Line Display Fonts

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 9).

INPUT SIGNALS

CHARACTER CONTROLS
- Video Signal . . . . . Pin 10
- Bright Control . . . . . Pin 11
- Vertical Drive . . . . . Pin 12
- Horizontal Drive . . . . . Pin 13

POWER SUPPLY
- +12 VDC ± 5% . . . . . Pin 3
- + 5 VDC ± 10% . . . . . Pin 7

GROUND
- Signal Ground . . . . . Pin 2
- Signal Ground . . . . . Pin 4
- Signal Ground . . . . . Pin 15
- Bypass Ground . . . . . Pin 8

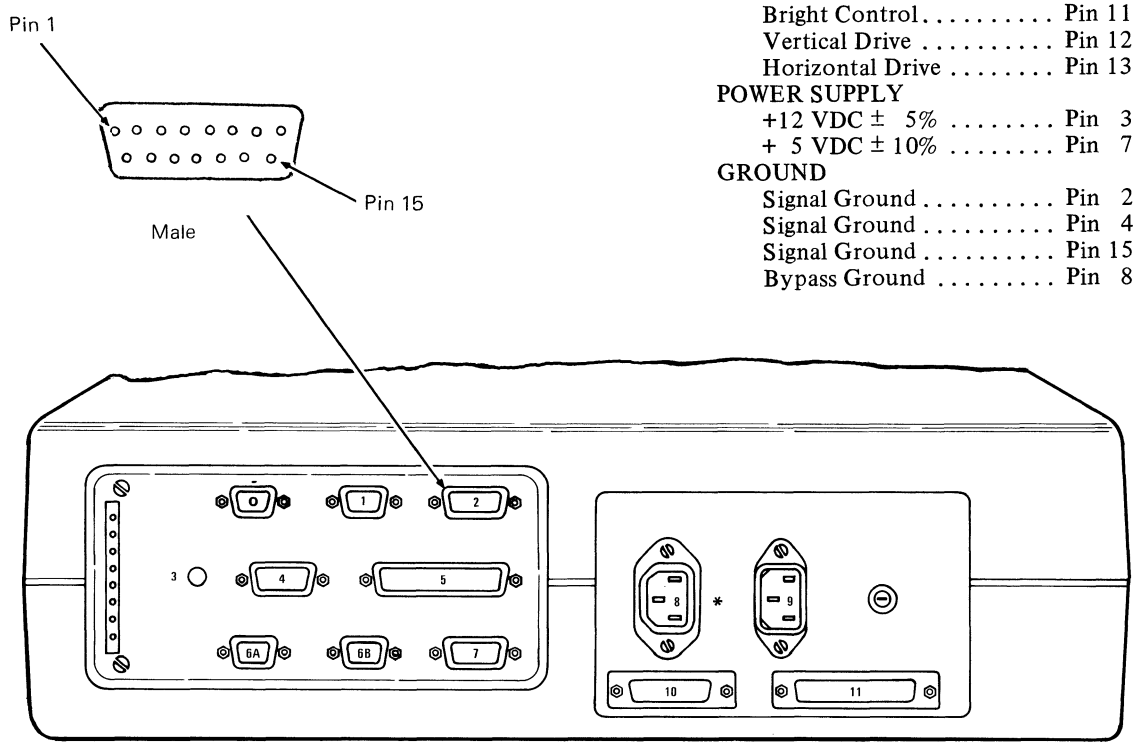


Figure 9 - Display Connector

* 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 electronic beam from the left to the right of the screen. This signal is also used to generate the high voltage for the CRT. The horizontal and the vertical signals drive the beam from left to right, top to bottom, row by row.
- Bypass Ground - This is a frame ground.

The 25-Line Display Module is a field replaceable unit (FRU) which is not field serviceable.

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

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 (Figure 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 loss of the input signals.

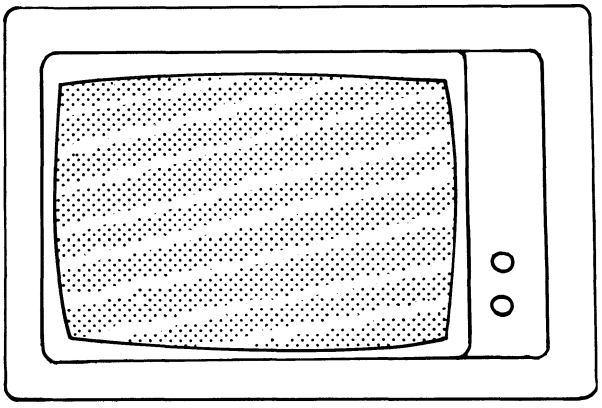
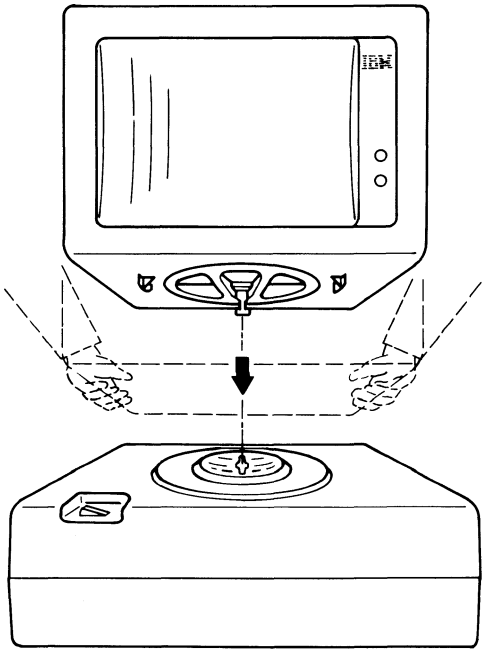
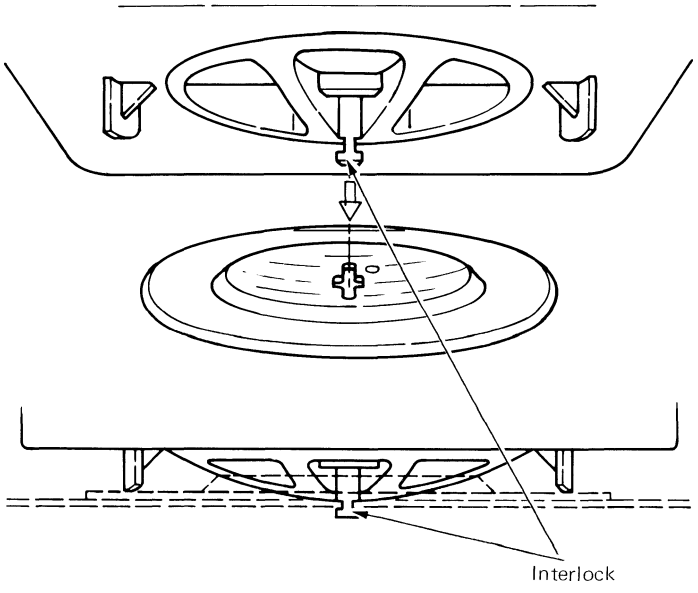


Figure 10. 25-Line Display Raster

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.
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.





LARGE DISPLAY

CONTENTS

LARGE DISPLAY OPERATIONAL THEORY

The Large Display Module (Figure 1) 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 pounds). 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.

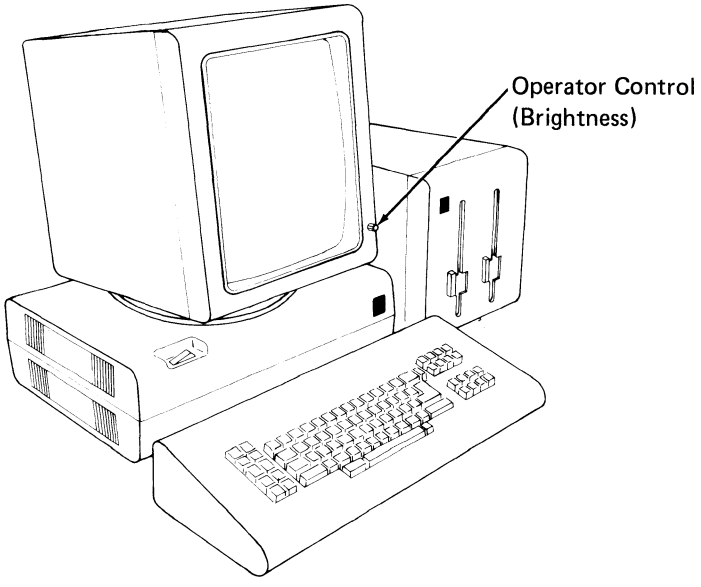


Figure 1 - Large Display Module

CABLING

The Large Display Module is installed on top of the Electronics Module. The Large Display receives AC power from Connector 12 on the Electronics Module Panel 2. The AC power for the diskette unit comes from Connector 2 on the Electronics Module Panel 1 (see Figure 2).

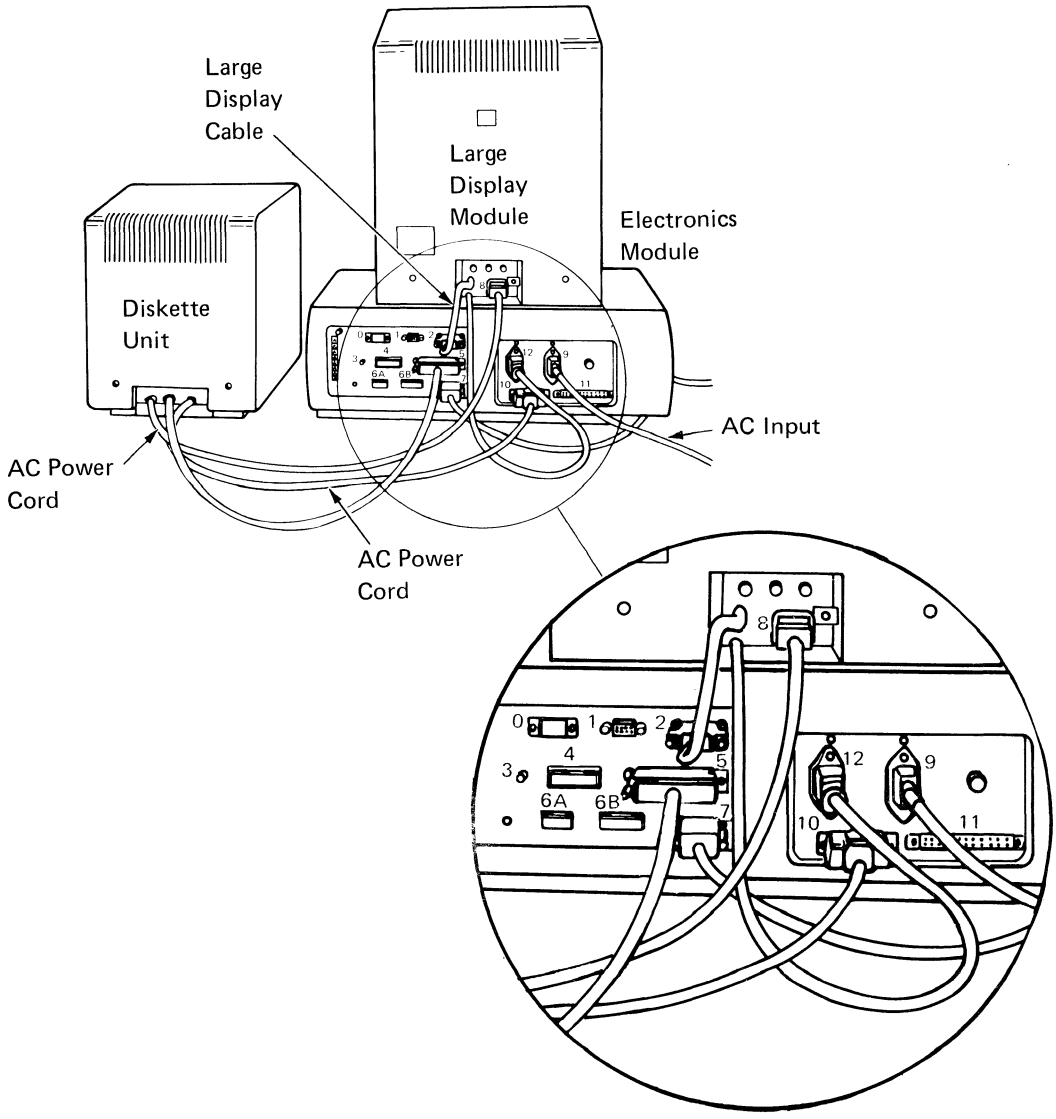


Figure 2 - Large Display Module Cabling

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 3). 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.

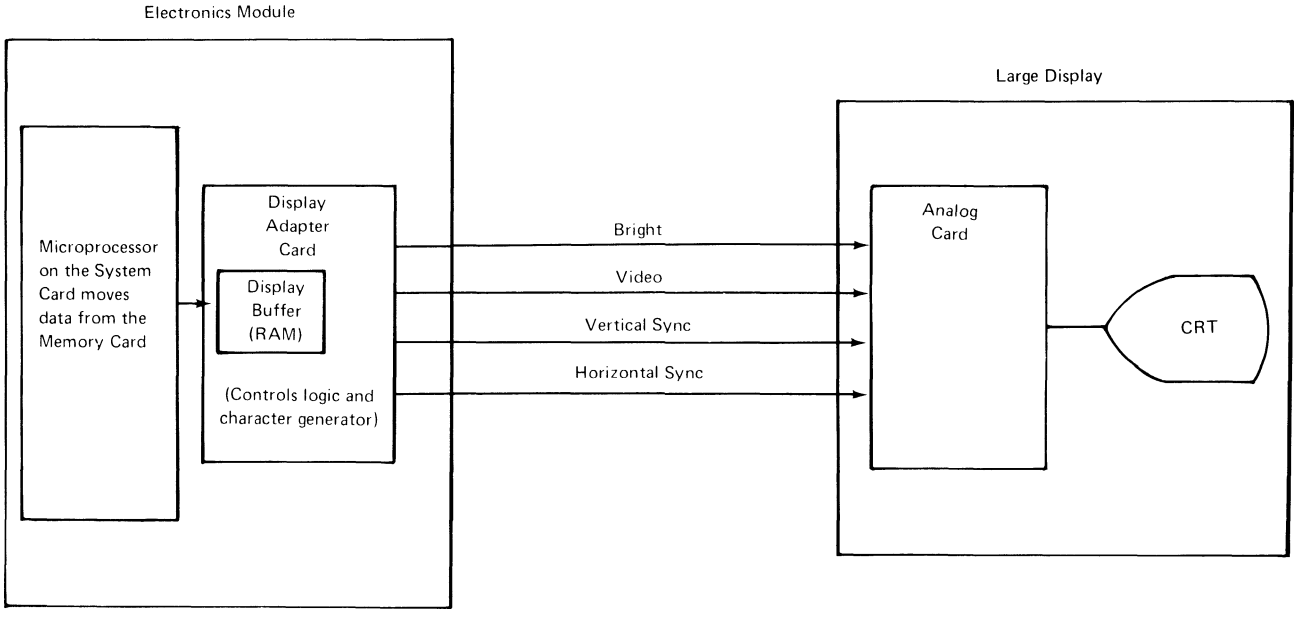


Figure 3 - Large Display Data Flow

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 25-Line Display Module screen. 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 summarizes the size of characters within the character boxes.

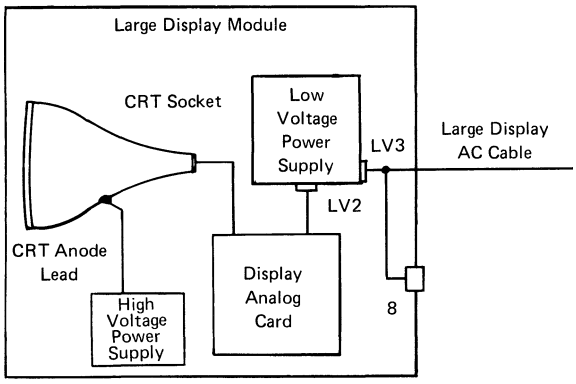
Character	Dot Matrix
Upper Case	6 X 11 or 7 X 11
Lower Case (Ascender)	6 X 8
Lower Case (Descender)	6 X 9

Figure 4 - 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. These power supply voltage levels are required 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-DC converter-type power supply (see Figure 5).



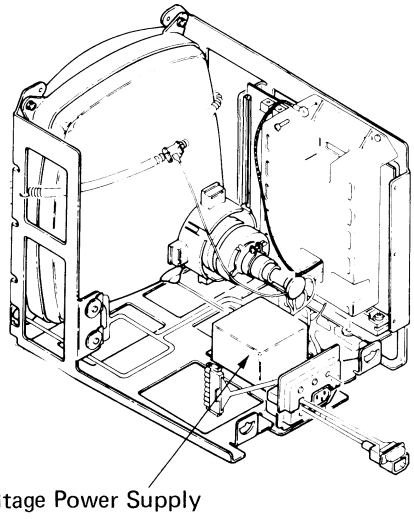


Figure 5 - High Voltage Power Supply

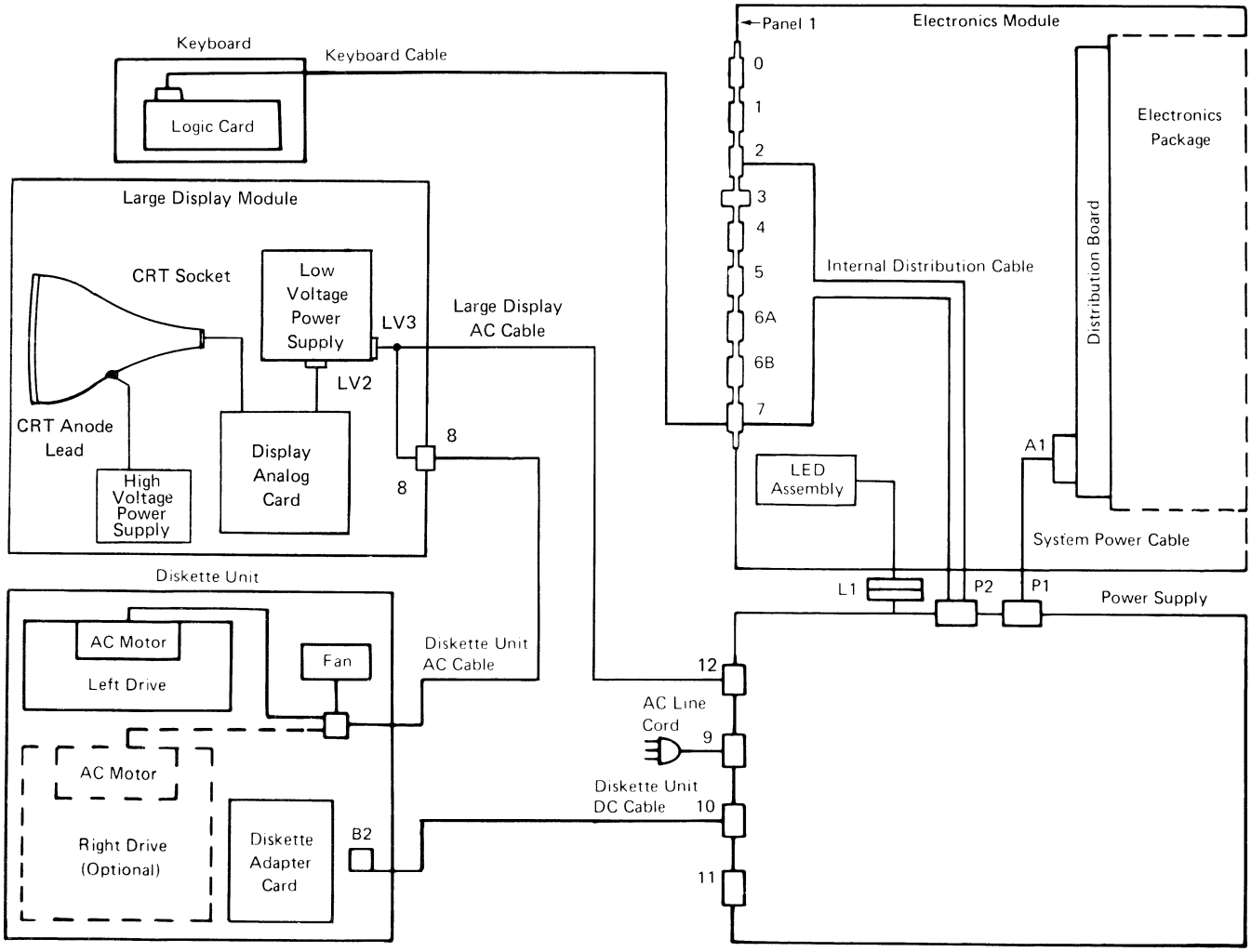


Figure 6 - Power Supply Distribution Schematic

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 7).

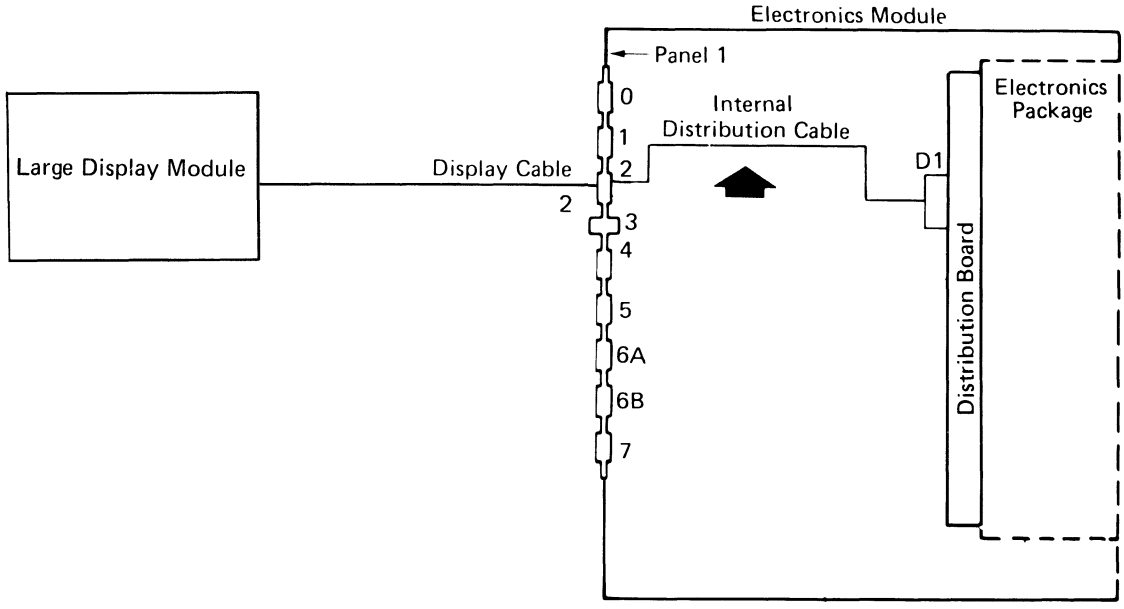


Figure 7 - Internal Distribution Cable

INPUT SIGNALS

Four signals control how characters appear on the display screen (see Figure 8). 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.

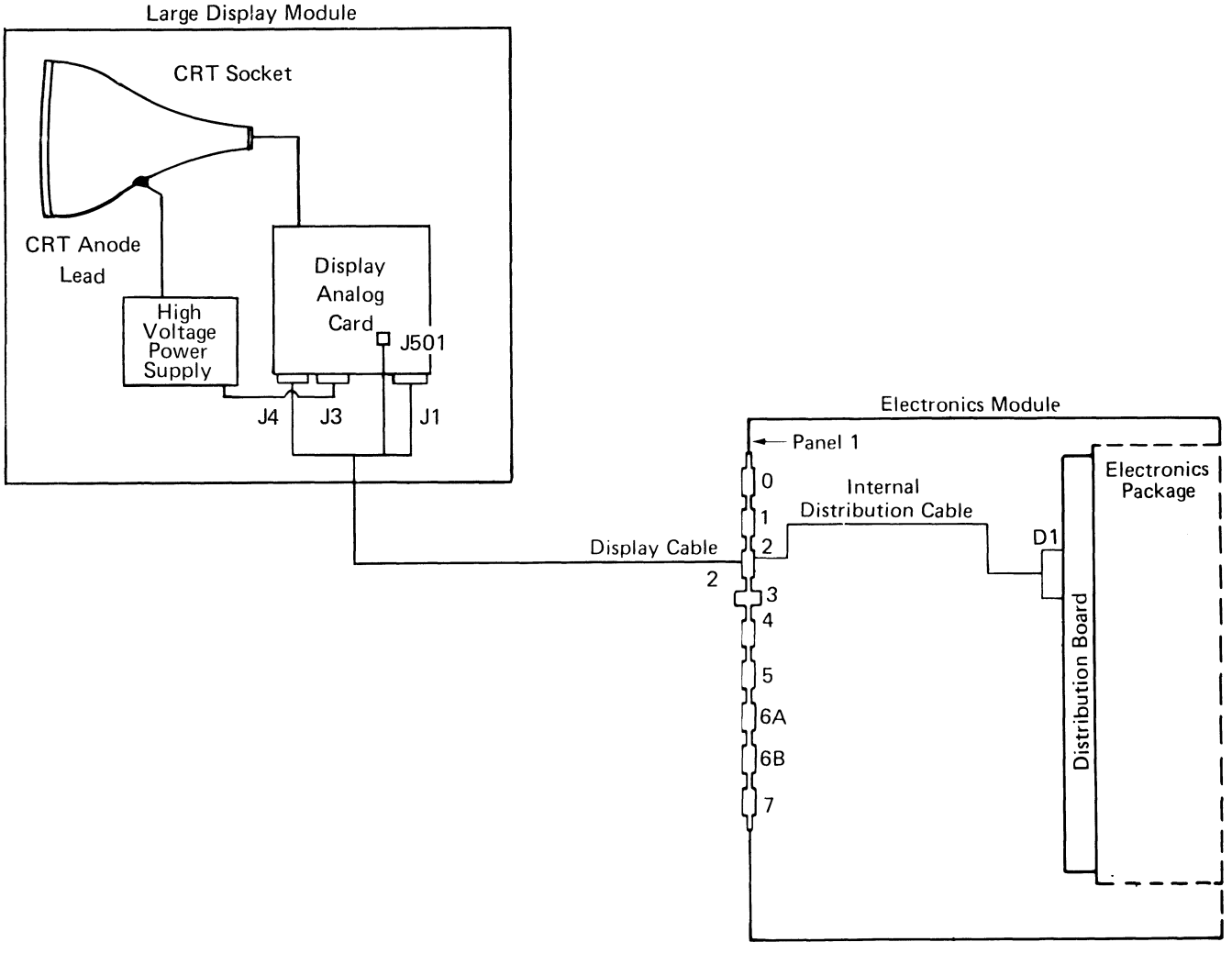


Figure 8 - Signal Distribution Schematic

DANGER

Operating voltages up to 17,000 volts are present inside the Large Display. A bleeder circuit is provided. However, 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 ❶ (see Figure 9). 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.

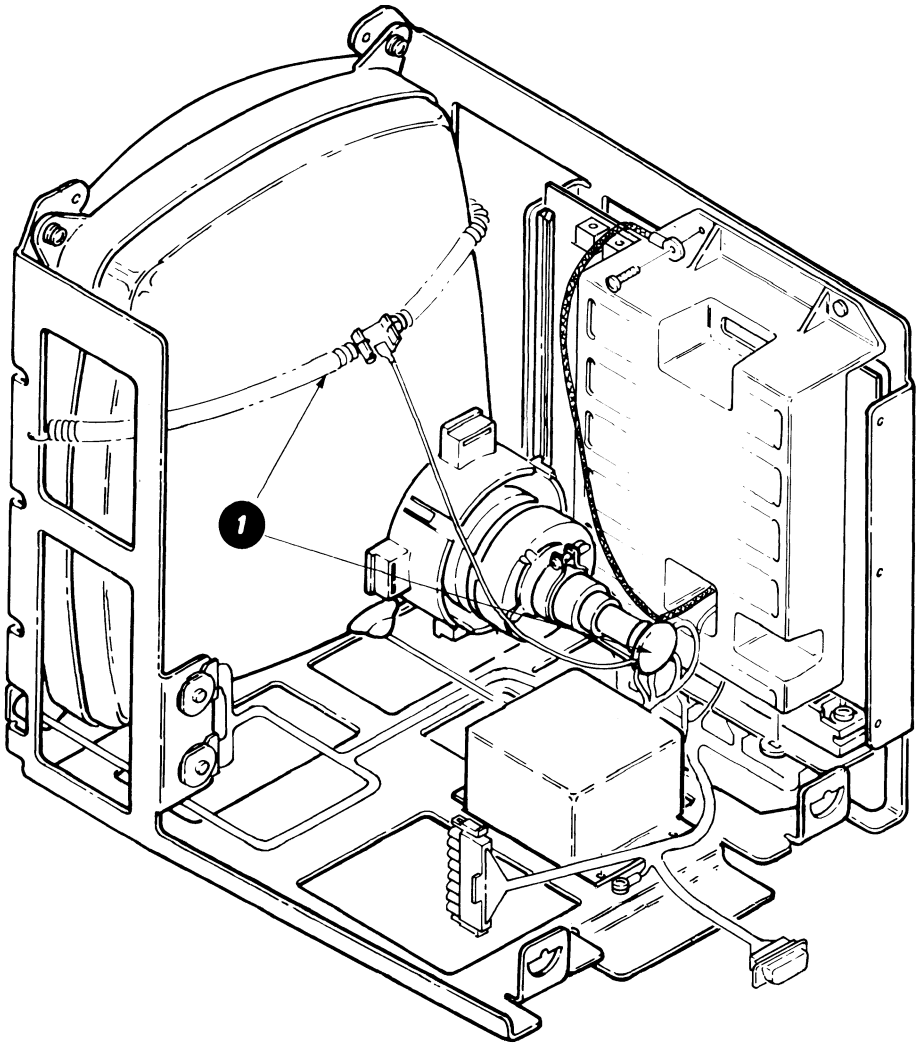


Figure 9 - CRT Ground Spring

CRT ANODE DISCHARGE PROCEDURE

1. Turn the system power off and disconnect the system 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 ❶. Visually ensure that the probe tip touches the metal prongs on the anode lead (see Figure 10).
7. Remove the probe from the anode, and ensure that the anode boot is securely seated against the 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.

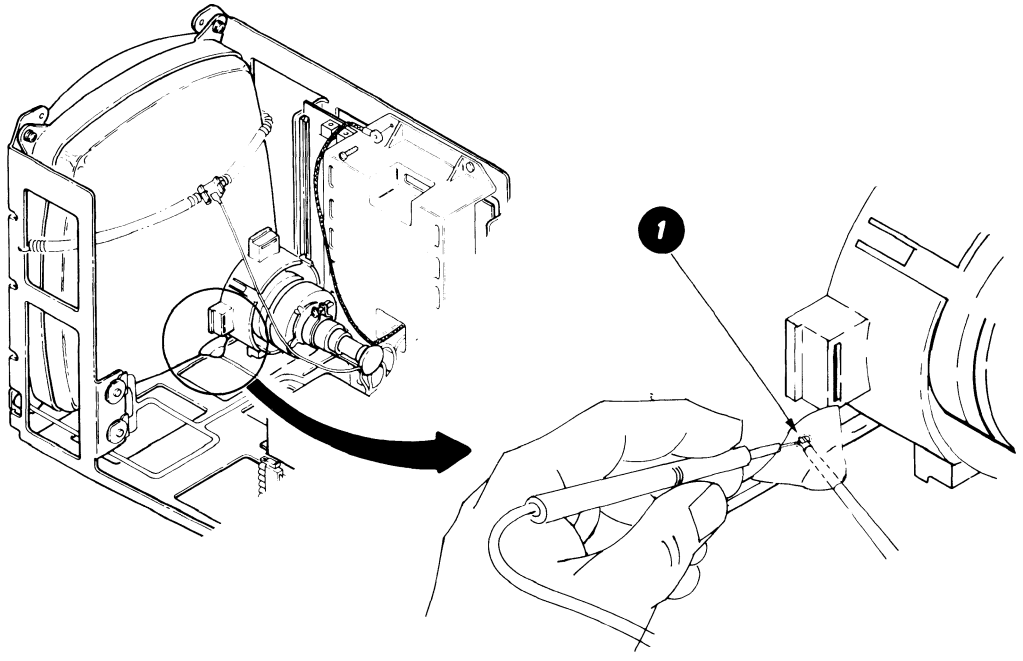


Figure 10 - Anode Boot

® Trademark of John Fluke Manufacturing, Inc.

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 11). 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 loss of, the input signals.

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

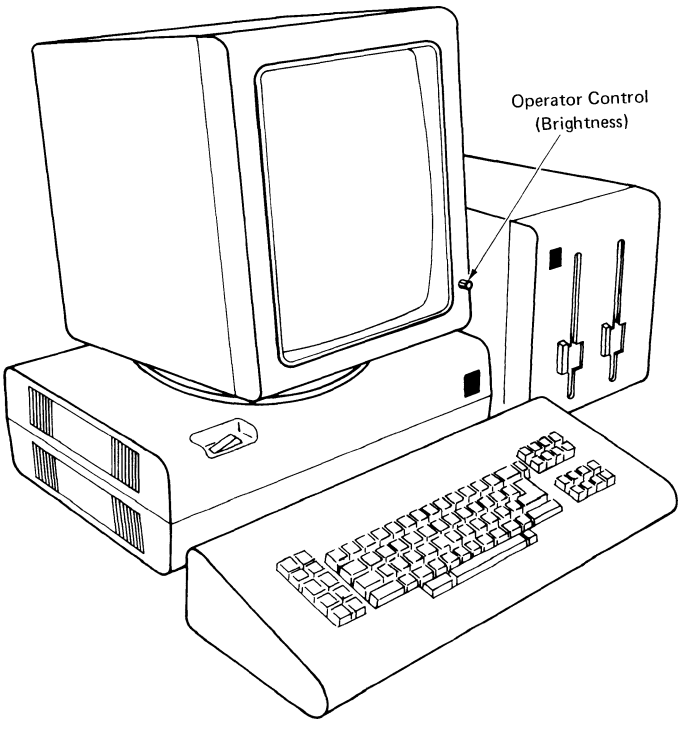


Figure 11 - Large Display Screen

DISPLAY INDICATORS

Three display indicators are on the back of the display module (see Figure 12):

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 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 cuased 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

Note: Loss of horizontal beam deflection causes both indicators 1 and 2 to be **OFF**.

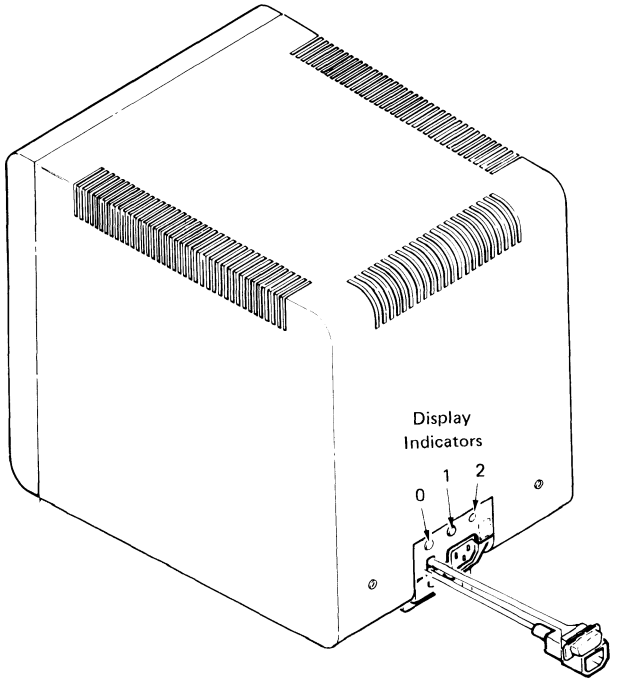


Figure 12 - Display Indicators

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 13).

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 14.)

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 on the screen, use the Image Centering Adjustment to correct the problem.

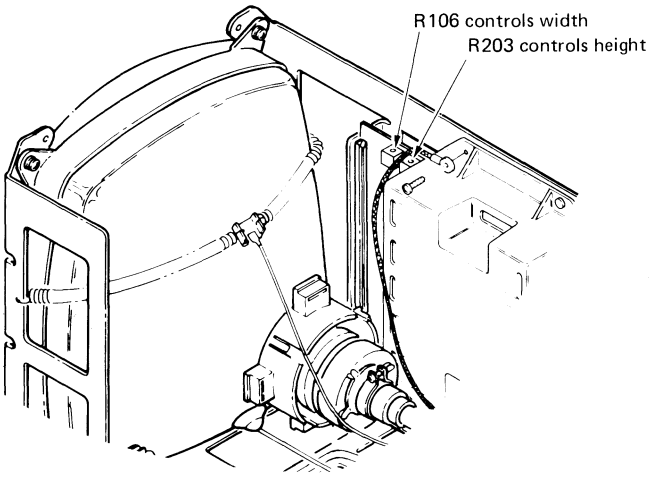


Figure 13 - Image Adjustment Screws

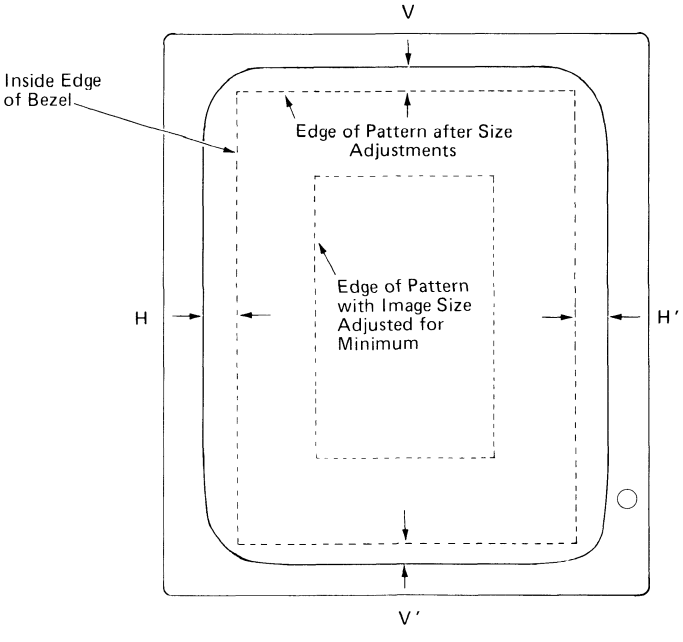


Figure 14 - Image Size Adjustment

IMAGE CENTERING ADJUSTMENT

CAUTION
Be very careful when making this adjustment because power must be ON.

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 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 ❶ until the square tabs on the two rings are aligned (see Figure 15).

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 16).

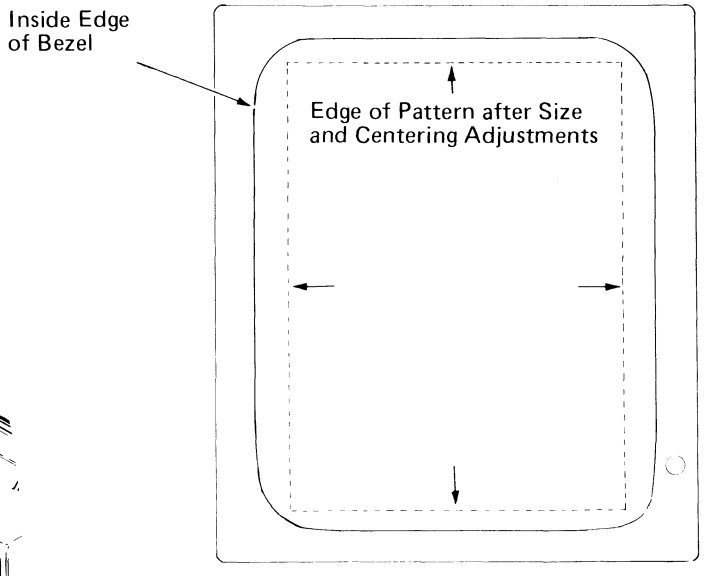


Figure 16 - Image Size After Adjustments

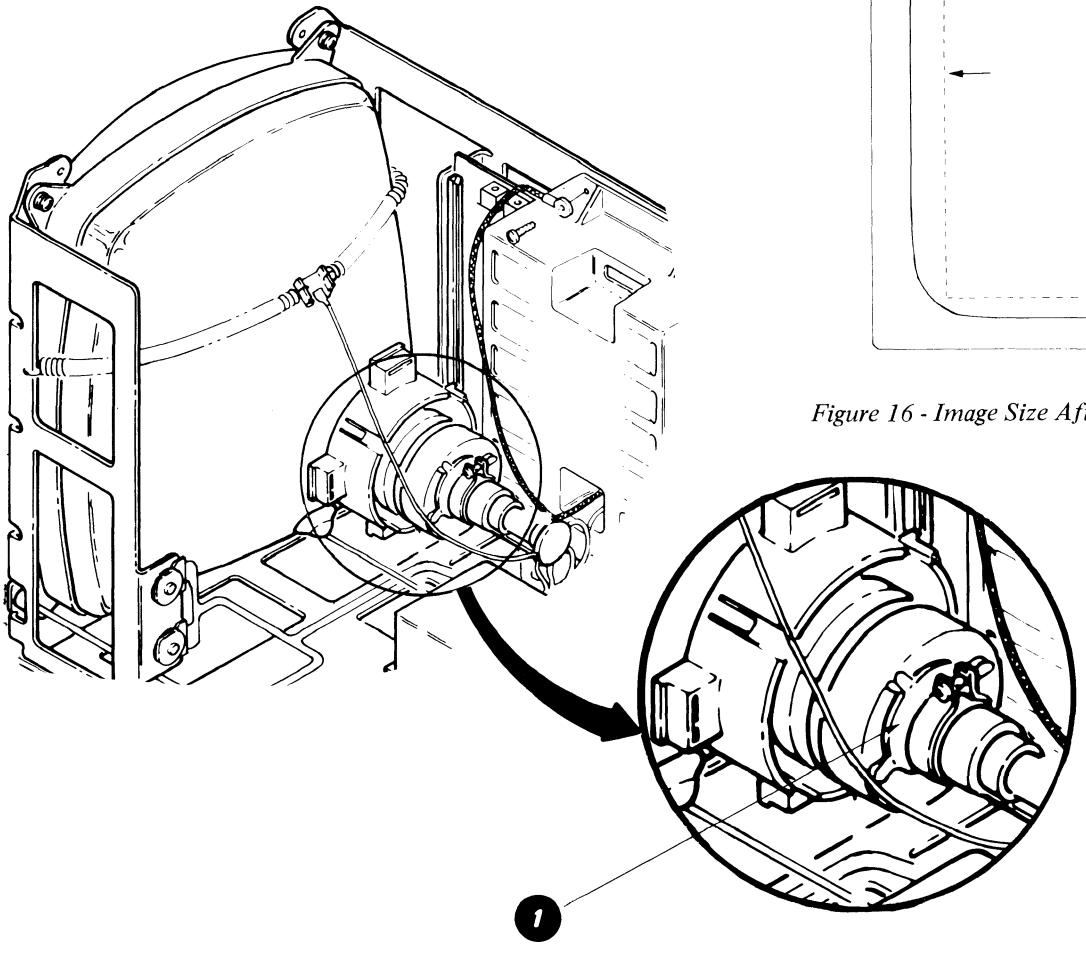


Figure 15 - Centering Rings

LARGE DISPLAY MODULE REMOVAL

1. Turn the system power off.

2. Disconnect the two AC power cords (Connectors 8 and 12).

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 17).

5. Lift the display module up to release the interlock (see Figure 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.

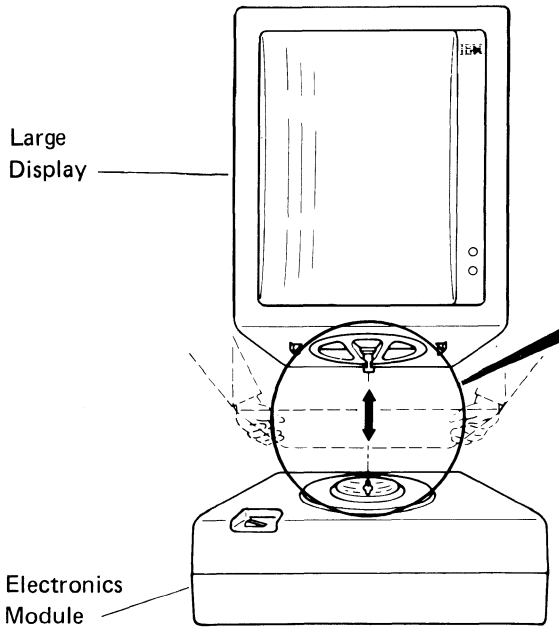


Figure 17 - Large Display Module Removal

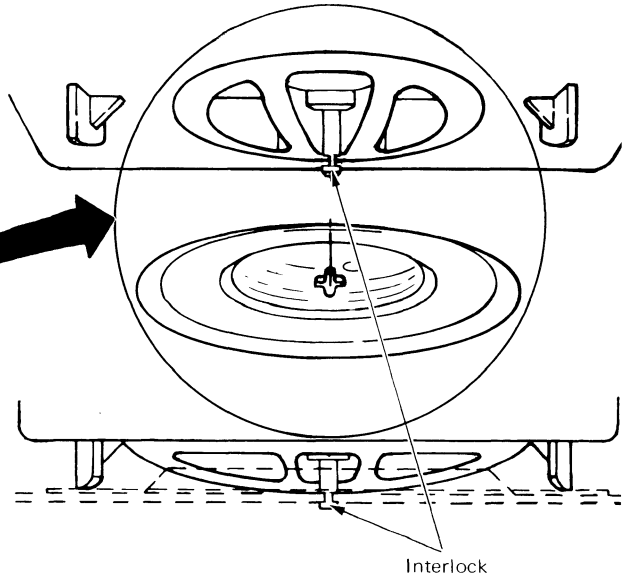


Figure 18 - Large Display Module Interlock

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 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.

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

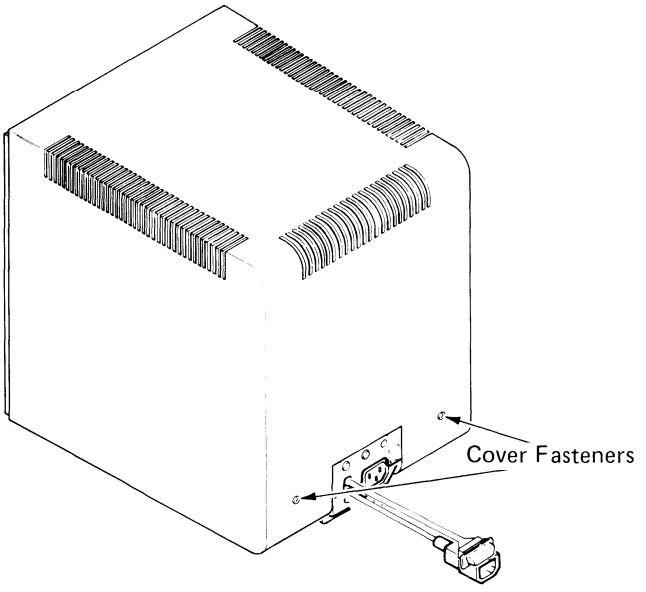


Figure 19 - Quarter-Turn Cover Fasteners

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 ❶ (see Figure 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; for shipping only.)
5. Remove the two screws ❷ 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 ❸.
7. Carefully slide the analog card ❹ up and out of the card guides.

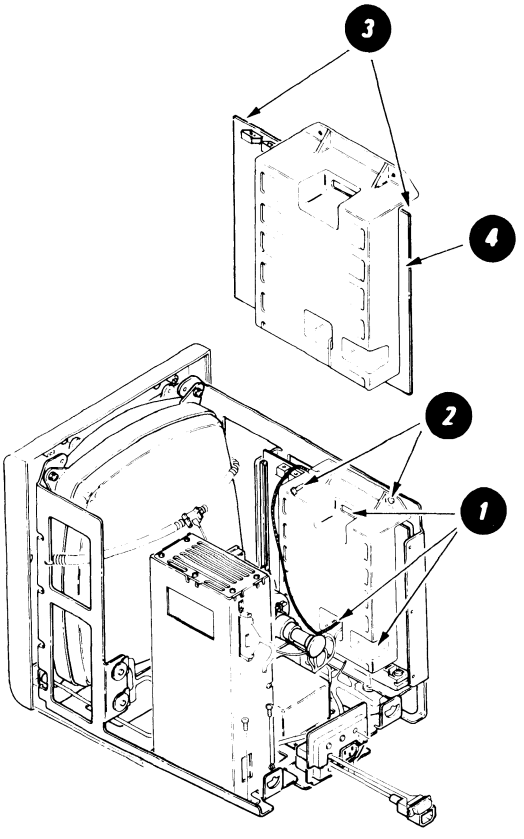


Figure 20 - Analog Card Removal

LOW VOLTAGE POWER SUPPLY REMOVAL

1. Turn the system power off.
2. Perform the rear cover removal.
3. Disconnect the two AC power cords (Connectors 8 and 12).
4. Disconnect LV1 (LED 0), LV2 (DC), and LV3 (AC) connectors ❶ from the low voltage power supply (see Figure 21).
5. Remove the four screws and the power supply ❷ .

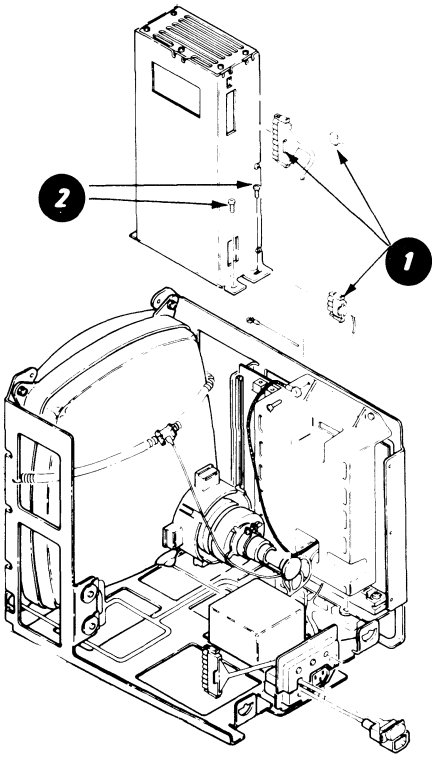


Figure 21 - Low Voltage Power Supply Removal

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 ❶ from the CRT (see Figure 22).

5. Disconnect cable plug J3 from the connector strip ❷.

6. Remove the two screws ❸, and slide the power supply to the rear until free. (Save the two starwashers that are between the power supply cover and the mainframe.)

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.

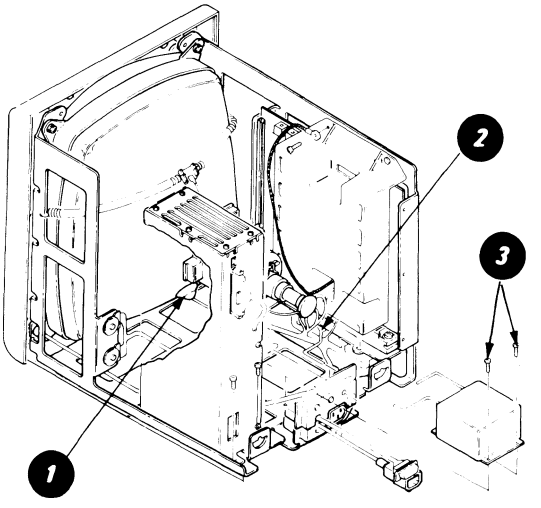


Figure 22 - High Voltage Power Supply Removal

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 ❶ (see Figure 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, skip to Step 8.

6. Remove the three screws, the Cable/Display Indicator Panel, and the AC Cable Assembly ❸ 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 ❷ that hold the mainframe assembly to the front cover.

10. Lift the mainframe ❹ from the front cover, and place it in a shipping carton for safe handling during transport.

CAUTION
The CRT may slowly recharge 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.)

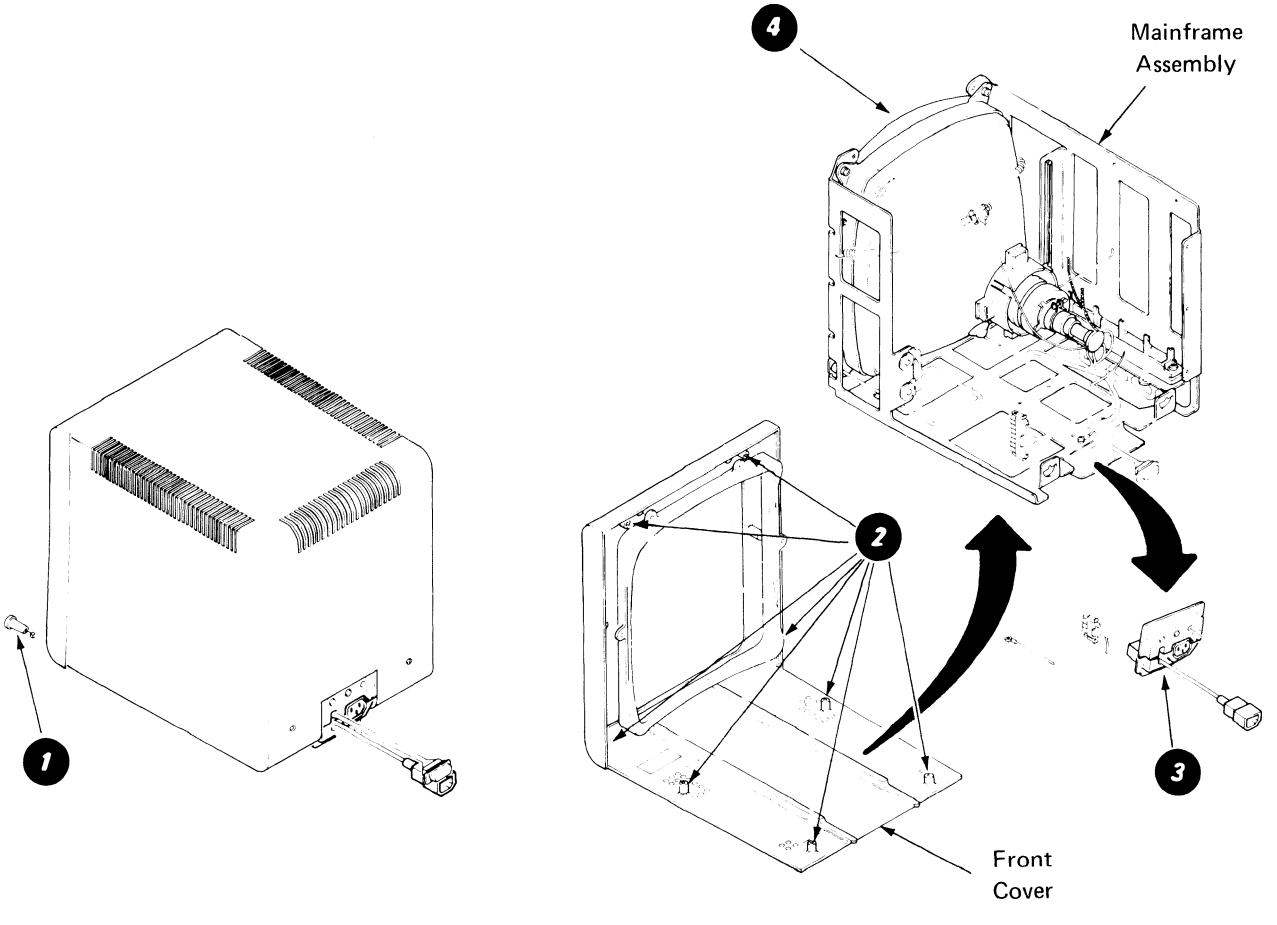


Figure 23 - Mainframe Assembly and Front Cover Removal

KEYBOARD

CONTENTS

The IBM Displaywriter System uses the standard 92 and 96 character electronic keyboards, with other arrangements including the Dvorak keyboard as options. Other keyboards (such as 88 and 96 character) will be simulated using the touch type method. Some of the key positions are typamatic. The major components of the keyboard are the logic card, pad card and the key modules (Figure 1).

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

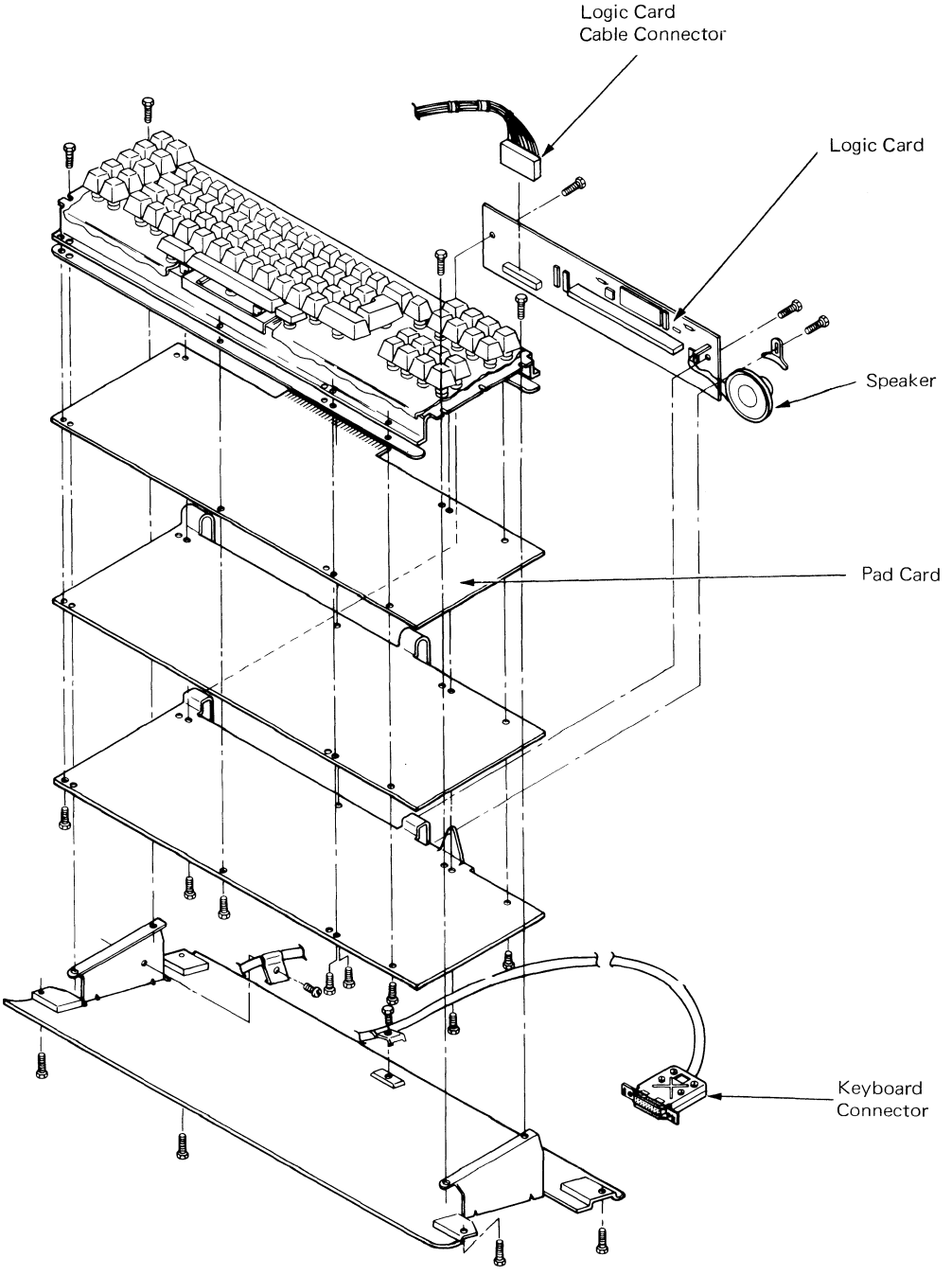
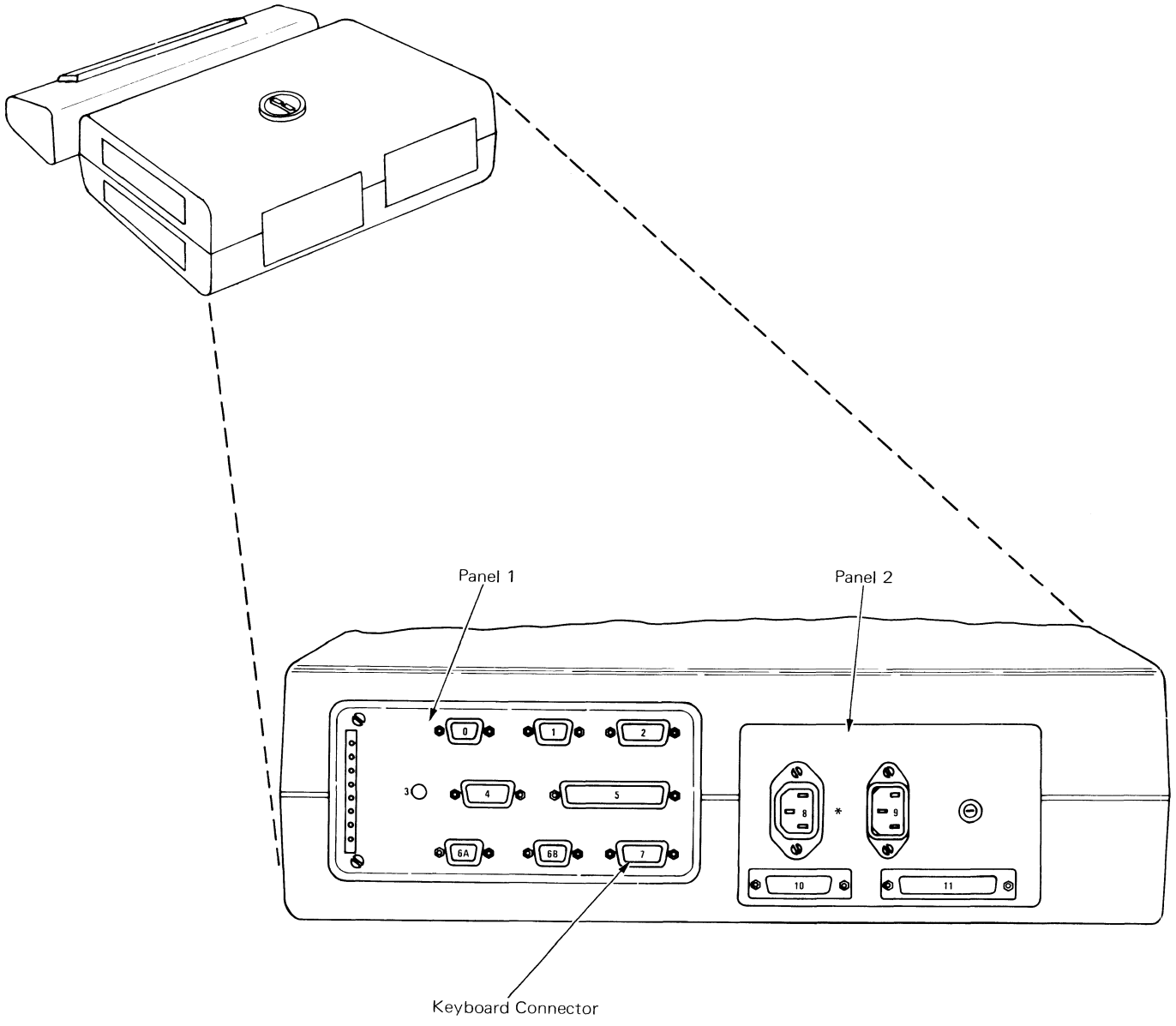


Figure 1 - Keyboard Components

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 2). The necessary voltages and signals are supplied by the electronics module, and the cable allows placement of the keyboard for individual operator comfort.



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

Figure 2 - Keyboard Connector Location

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 capacitor plate on the pad card. Pressing the key moves the fly plate away from the capacitor plate (Figure 3), causing a change in the electrical condition of the capacitor plate. This electrical change is sensed by the keyboard electronics and is transmitted to the system electronics.

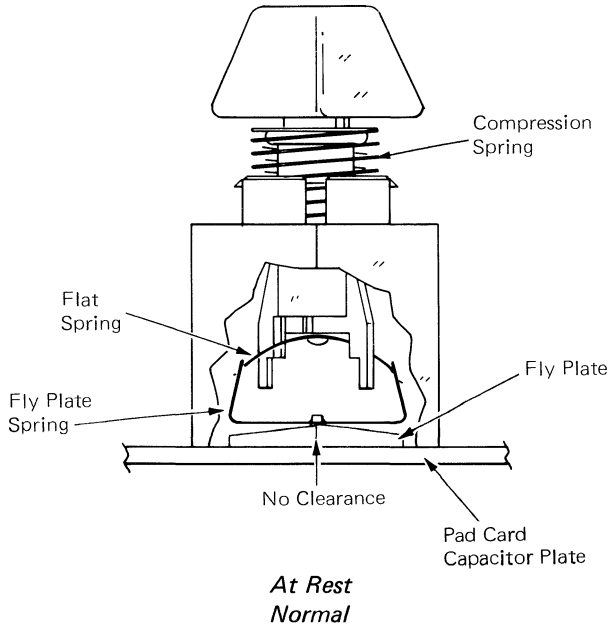


Figure 3 - Key Module Operation

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 4).

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 and shift lock keys, code key, and the control key (Position 3).

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 (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.

Non-active keys are unused key modules electronically inactivated (normally a blank key).

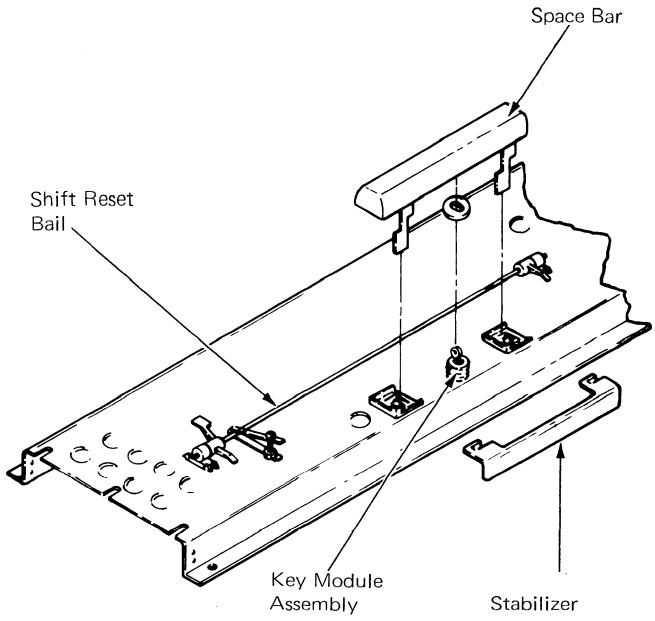


Figure 4 - Shift-Lock Restoring Mechanism

KEYBOARD ELECTRONICS

The pad card and keyboard logic card are the electronic parts of the keyboard. The keyboard logic card is connected to the pad card through a 30 position edge 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 plate (Figure 5).

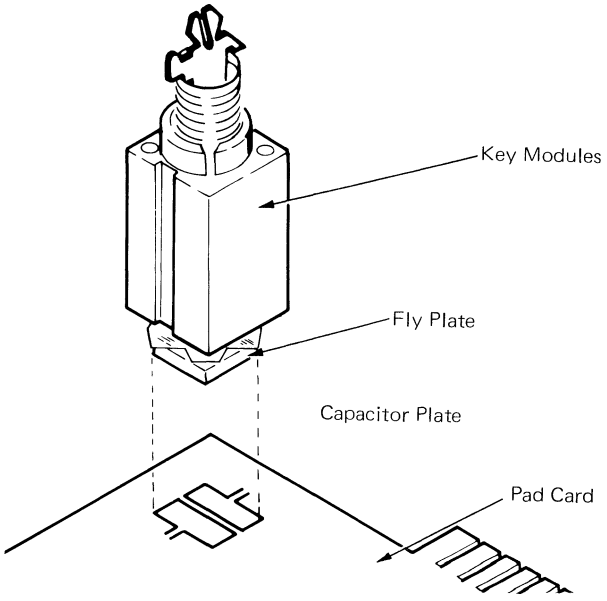


Figure 5 - Key Module and Capacitor Plate

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 12 x 8 matrix (Figure 6). 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.

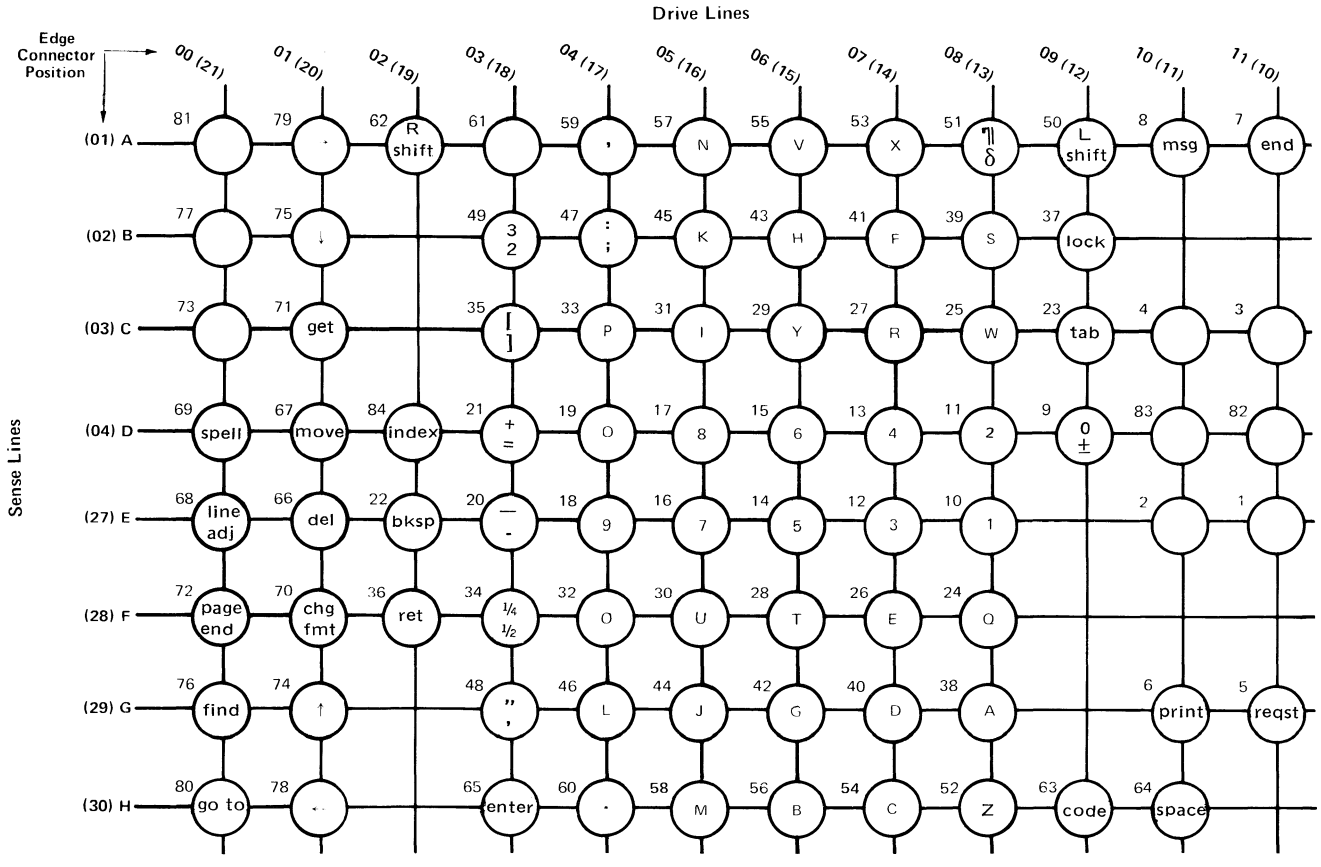


Figure 6 - Keyboard Matrix Chart

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 7).

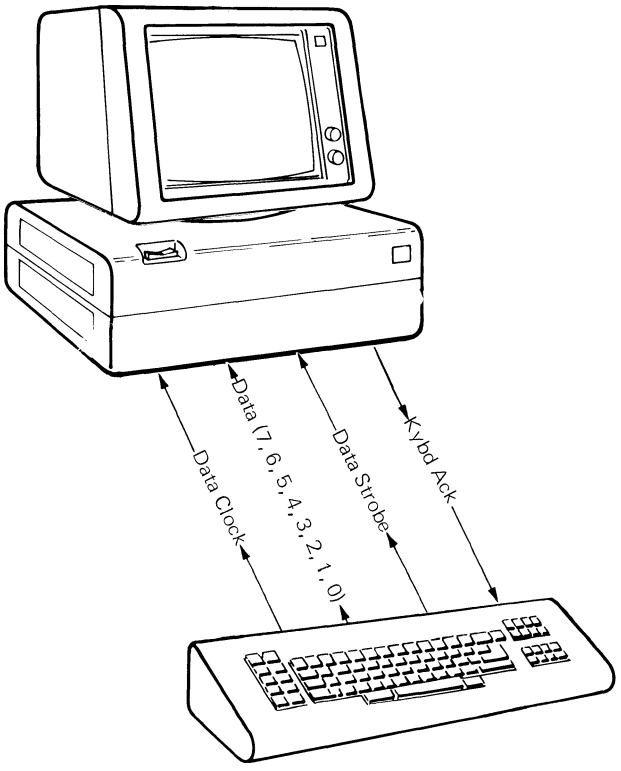


Figure 7 - Keyboard Serial Data Transfer

- 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 8.

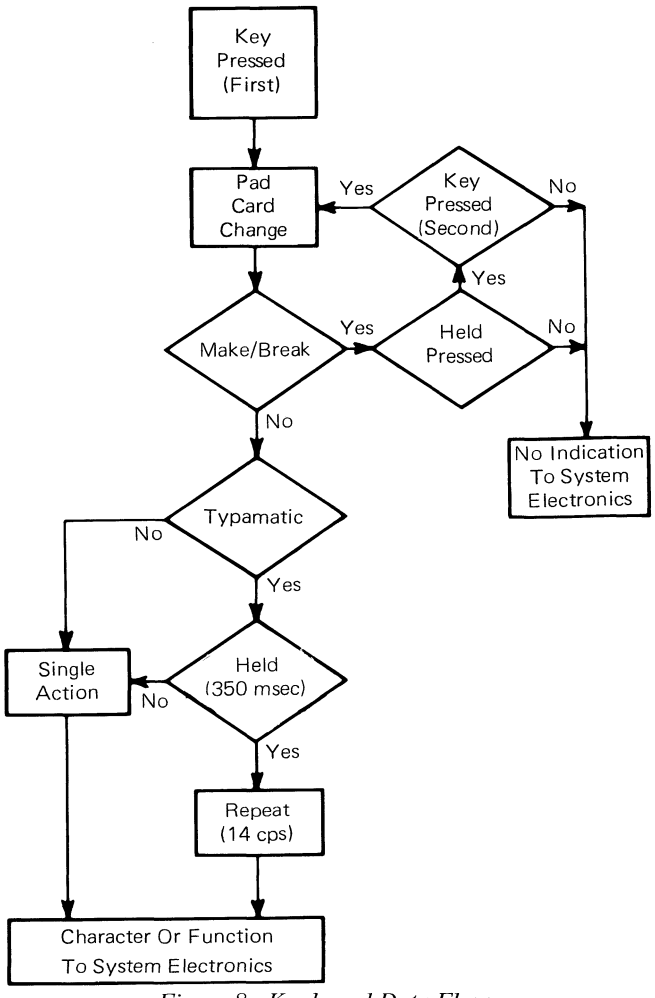


Figure 8 - Keyboard Data Flow

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 will verify the keyboard microprocessor, located on the keyboard logic card, 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 9).

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

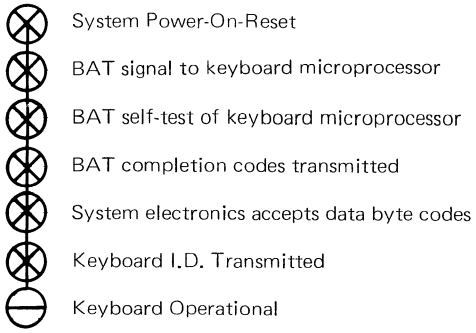


Figure 9 - BAT Sequence

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 13 - Keyboard Arrangement Options) determines 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 10. Key positions marked with a "T" are typamatic keys, positions marked "N-A" are non-active, and those 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.

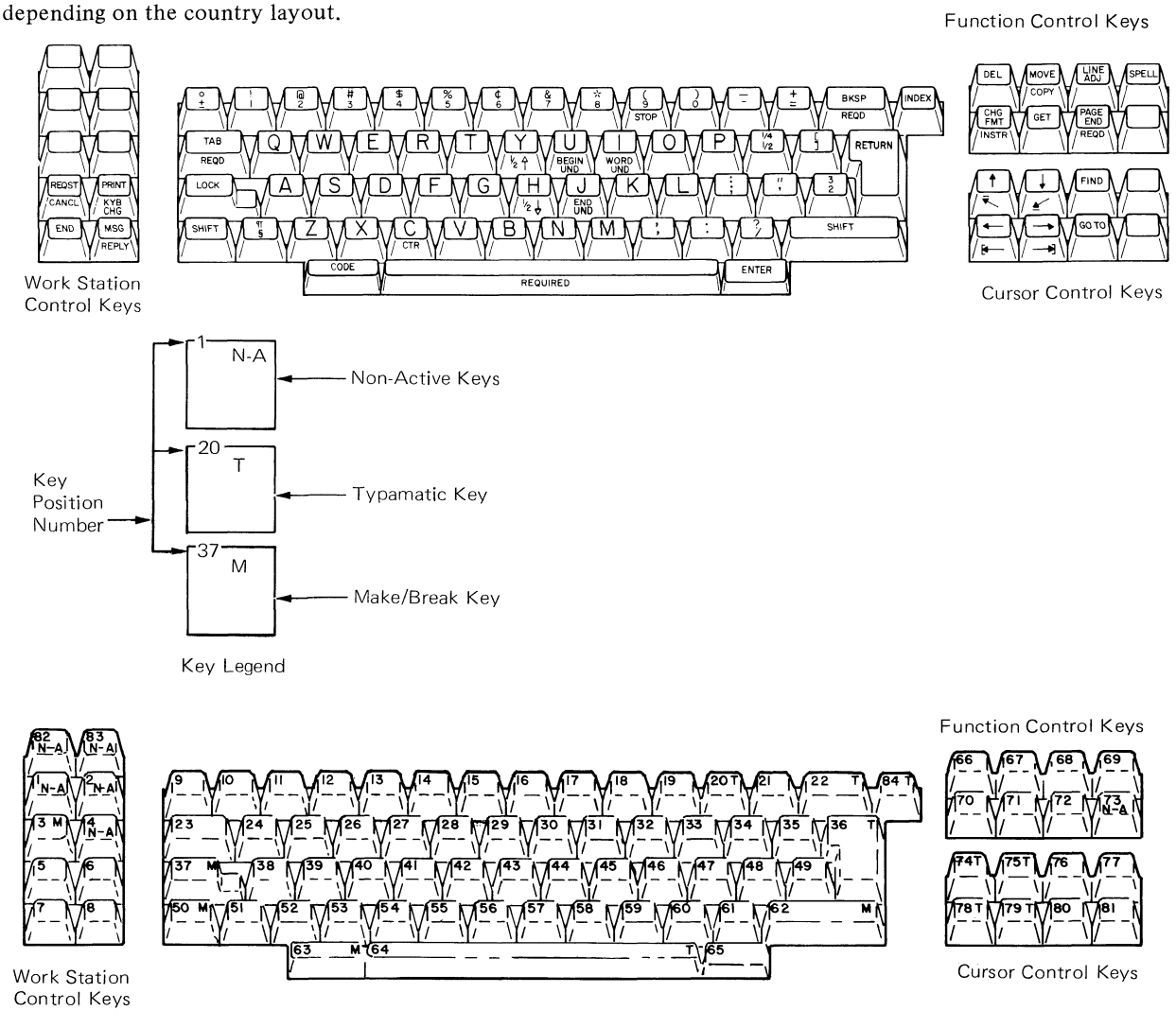


Figure 10 - Keyboard Layout

CODE KEY

The CODE key (Figure 11) 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 key.

ENTER KEY

The ENTER key (Figure 11) 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 prompt sequence.

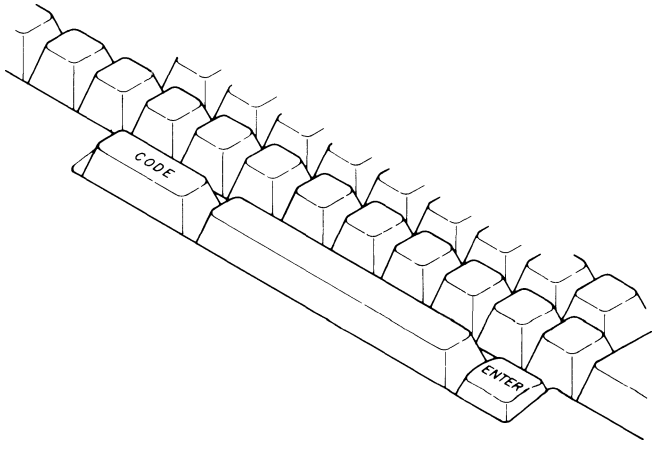


Figure 11 - CODE and ENTER Keys

KEYBOARD SPEAKER

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 keyboard speaker is attached to the keyboard frame and is electronically connected to the keyboard Logic Board by a two pin connector (Figure 12).

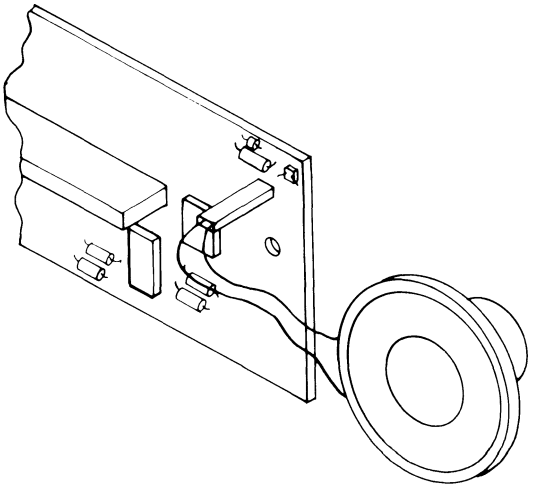


Figure 12 - Keyboard Speaker

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 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 CE Diagnostic Diskette is loaded, the keyboard ID that identifies the position of the jumpers is displayed in the Keyboard field. The chart (Figure 13) shows the keyboard IDs and the corresponding position of the ID jumpers in the keyboard.

	STRAP IDs		ID JUMPERS*							
LANGUAGE SUPPORT	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 13 – Keyboard Arrangement Options

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).

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 14).

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 14 - SEVEN BIT-DP (ASCII) Code Chart

KEYBOARD LOGIC CARD

The Keyboard Logic Card is the interface between the Pad Card and the System. The logic card is connected to the Pad card by a 30 pin edge connector and to the system by the logic card cable connector (Figure 15).

LOGIC CARD CABLE CONNECTOR

Pin No.	Identification
1	+8.5 VDC*
2	+5.0 VDC**
3	Click
4	Ground
5	Kybd Ack
6	Ground
7	Serial Data Clock
8	Serial Data
9	Data Strobe
10	Speaker Tone
11	–
12	Power-On-Reset
13	Key
14	Spare

*+8.5 VDC, ± 10%: Supplies power for the keyboard speaker

**+5.0 VDC, ± 10%: Supplies power for the Logic Card

SPEAKER CONNECTOR

Pin No.	Signal Name	Type
1	Speaker Drive	Output
2	+8.5 VDC	Power

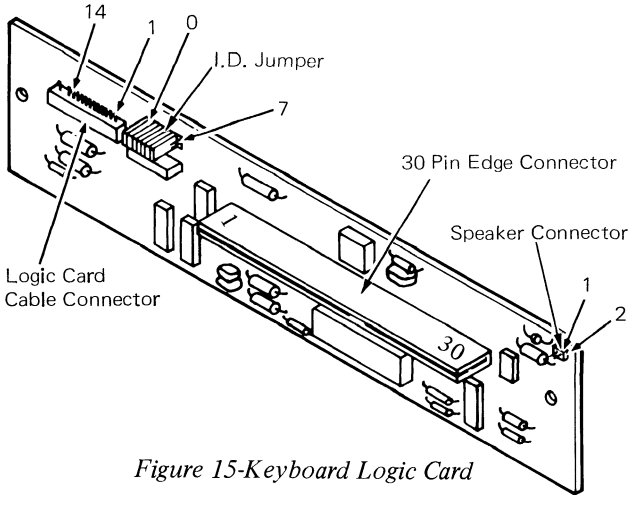


Figure 15-Keyboard Logic Card

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.

Kybd Ack - The Keyboard Acknowledge signal from the system electronics notifies 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 - The Serial Data Clock synchronizes the keyboard and system electronics, and indicates to the system electronics a data byte is being transmitted.

Serial Data - Serial Data, when transmitted to the system electronics, indicates which key has been pressed.

Data Strobe - Data Strobe signals the system electronics that eight data bits (one byte) have been transmitted.

Power-on-Reset (POR) - The Power-on-Reset signal from the system electronics is required 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 - The click signal triggers the keyboard electronics which generates a pulse that is used as one form of speaker drive. The click indicates a successful key operation.

The Keyboard Assembly requires no scheduled preventive maintenance.

TOOLS AND EQUIPMENT

The following equipment is required to service the 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

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.

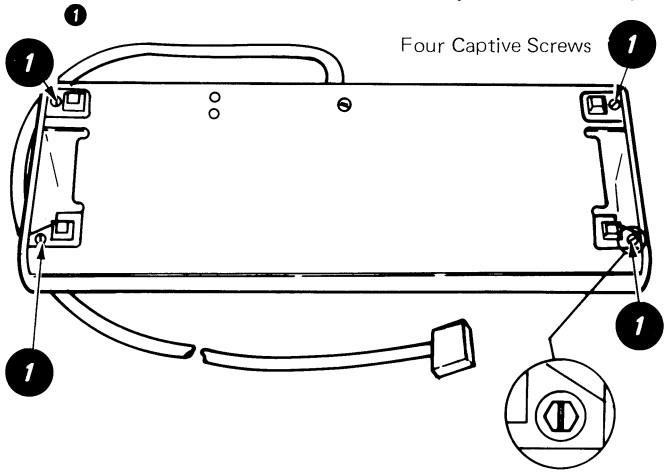
The pad card and key module fly plates are cleaned by carefully wiping each with an alcohol pad followed by a lint free cloth. Care should be taken not to dislodge or remove fly plates from key modules.

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.

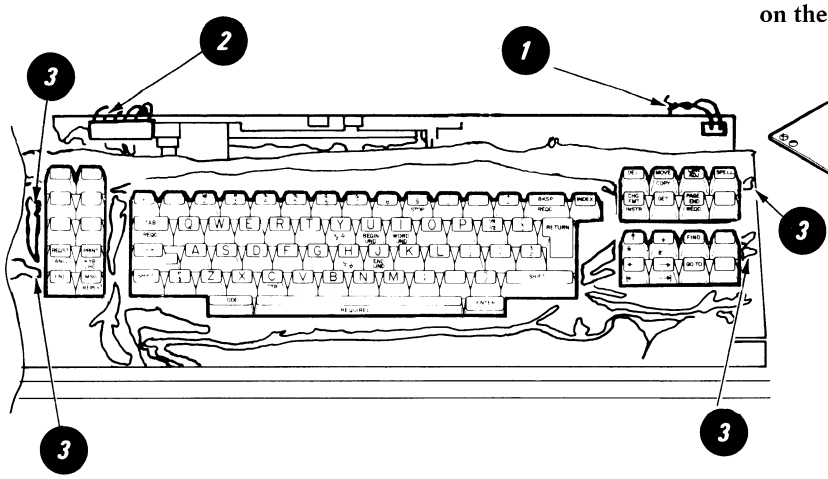
KEYBOARD COVER

1. Turn system power off.
2. Remove the top cover by loosening the four captive screws on the bottom of the keyboard assembly. ❶



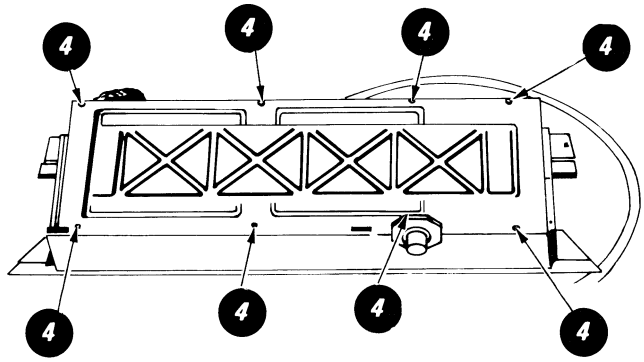
PAD CARD

1. Turn system power off.
2. Remove the top cover by loosening the four captive screws on the bottom of the keyboard assembly (see keyboard cover removal).
3. Remove the two screws holding the keyboard logic card. Disconnect the speaker cable ❶ and the keyboard cable ❷. 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 two mounting screws on each side of the keyboard under the contaminated shield. ❸
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.

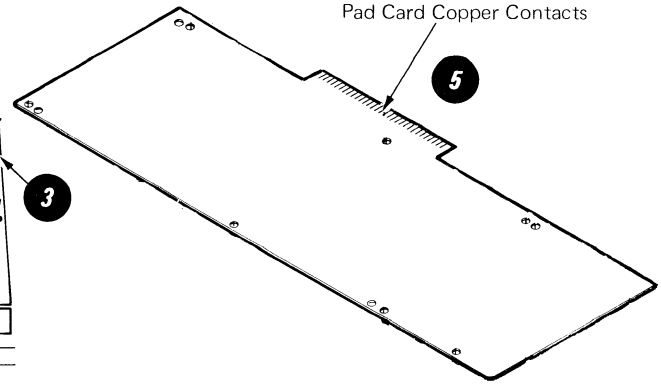
8. Ensure there is no pressure on any keys.
9. Remove the screws from the pad card. ❹
10. Lift the pad card from the key assembly.



Pad Card Screws

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 ❺
    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.

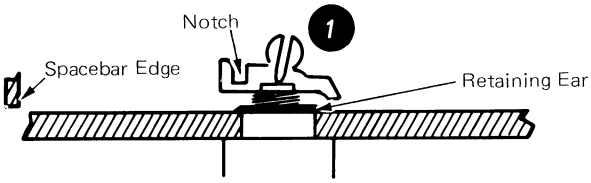


KEY MODULE

Removal

1. Use the keybutton removal tool (Part Number 9900373) to lift the key button 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. ❶

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

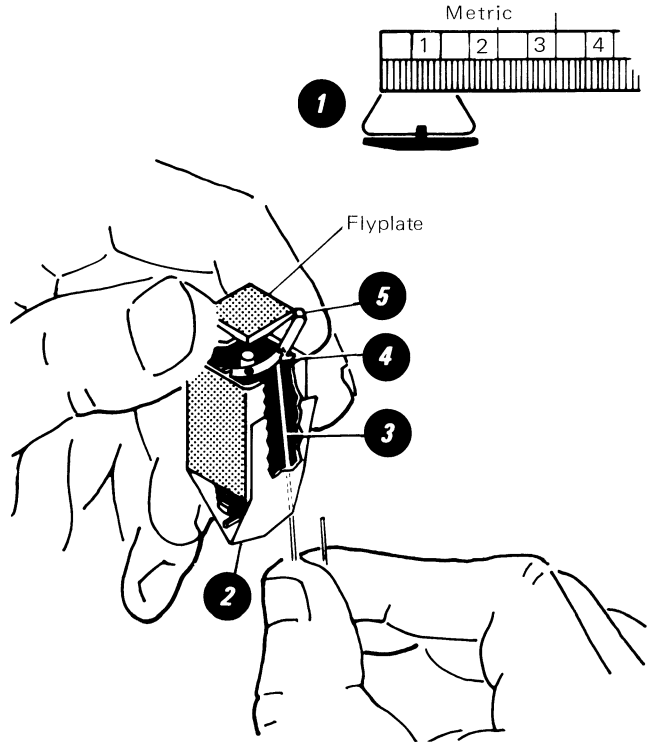
1. Insert the key module. Match the opening in the key module with the aligning lug in the mounting hole. The key stem notch must be positioned toward the spacebar edge of the keyboard.
2. Reinstall the pad card.
3. Turn the key assembly over and, if necessary, re-position the contamination shield.
4.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

FLY PLATE REPLACEMENT

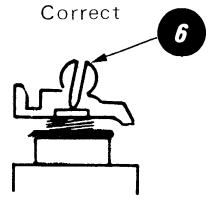
Reinstalling a disconnected fly plate in a key module is not recommended.

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 12.7mm (0.5 inch) between the ends of the spring. ❶
4. Tape the key stem down as shown. ❷
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.

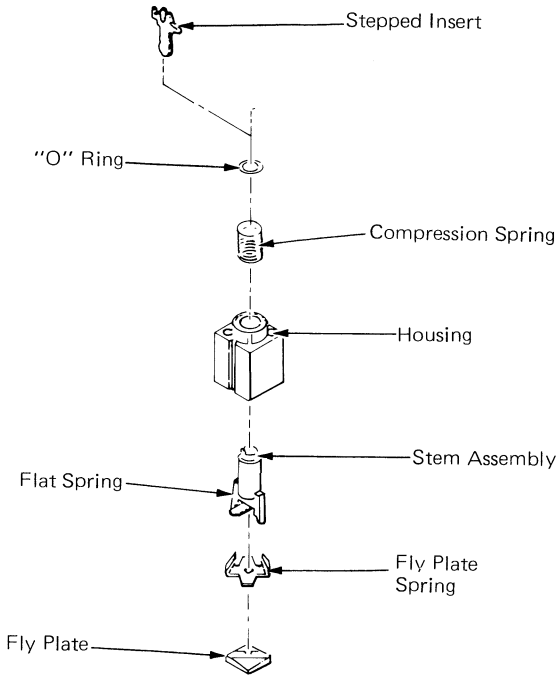


6. Insert a small stylus or straightened paper clip through one of the access holes in the key module. ❸
7. Push the tip of the flat spring up on the inside of the fly plate spring. ❹
8. Move the flat spring down until the tab drops into the opening of the fly plate spring. ❺
9. Attach the other end 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. ❻



12. Install the key module in the key assembly frame.

13. Reassemble keyboard and replace the keybutton.



SHIFT-LOCK MECHANISM

1. Perform the pad card removal procedures.

2. Remove both left and right shift keybuttons and the shift-lock keybutton.

3. Remove screw and shift brake from shaft assembly.

4. Slide the shaft assembly out of the pivot housings.

5. Remove 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

1. Perform pad card removal procedures.

2. Remove the enter keybutton. ❶

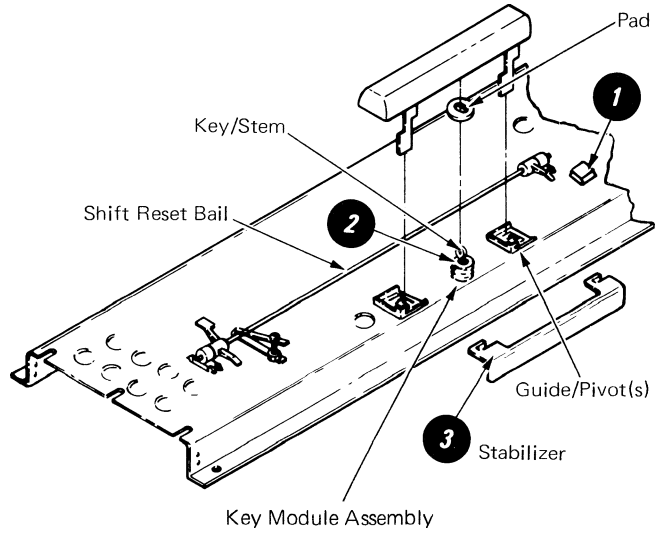
3. Hold the spacebar to keep it from being pressed.

4. Push the key module key stem ❷ down to disconnect it from the spacebar.

5. Slide the spacebar as far to the right as it will go.

6. Slide the stabilizer ❸ to the left and pull the spacebar upward and out of the keyboard - be careful not to tear the shield.

7. Remove the stabilizer by pulling it forward.



SYSTEM ELECTRONICS/POWER SUPPLY

CONTENTS

The electronics module contains electronic cards connected to a distribution board (Figure 1). 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.

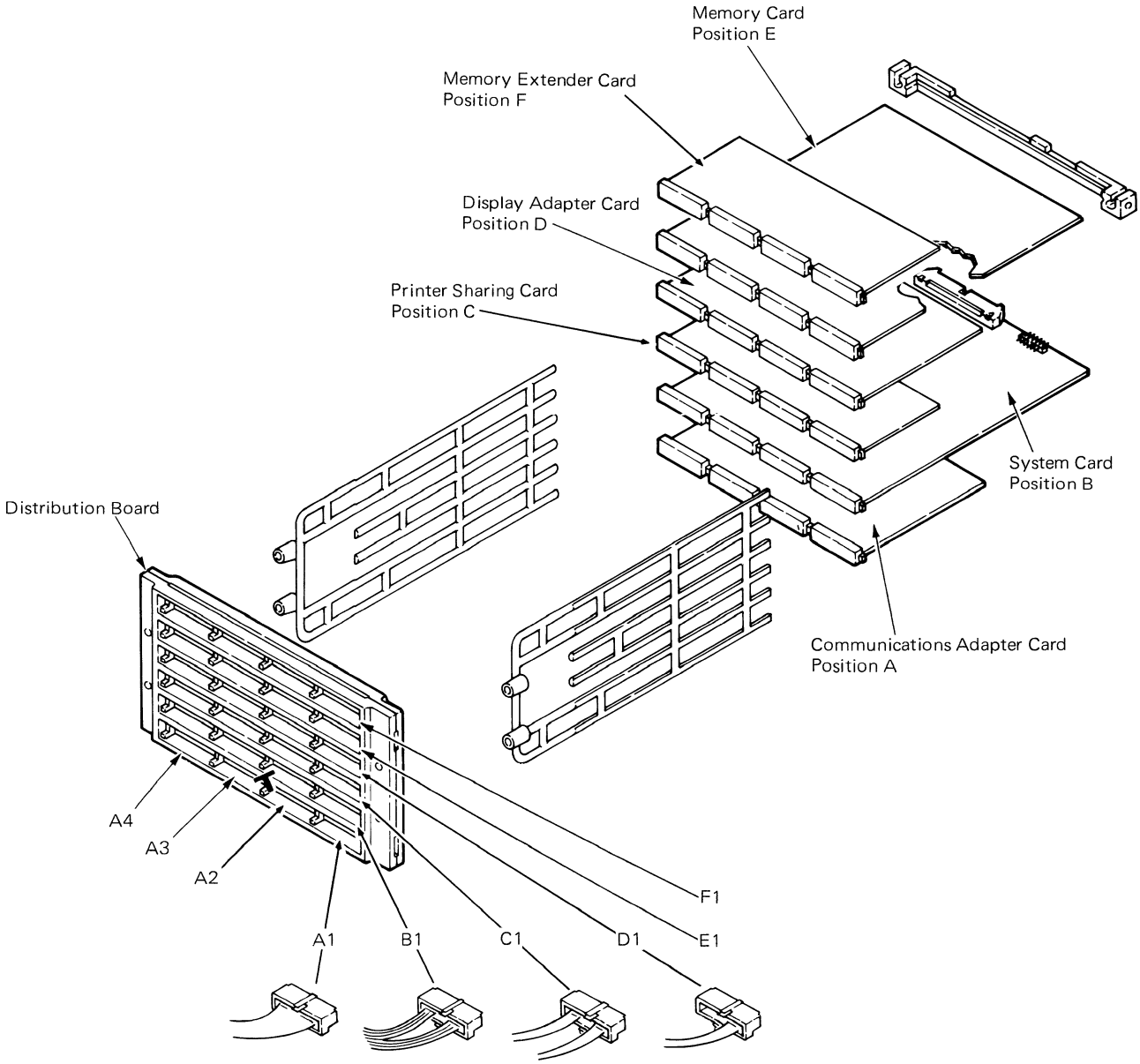


Figure 1 - Work Station Electronics

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 2) 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.

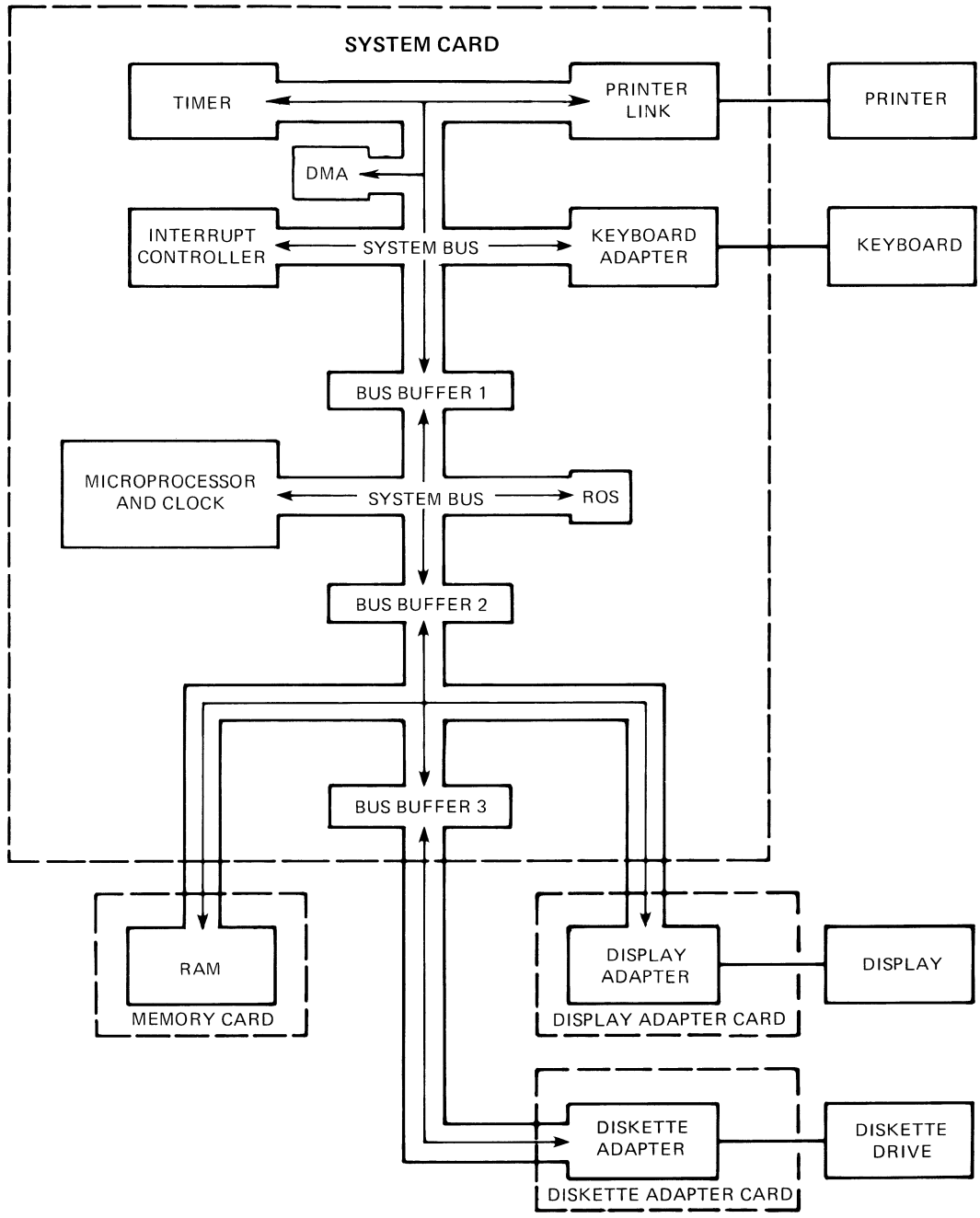


Figure 2 - System Bus

The bus buffers are system bus isolating devices (switches) used to separate the electronics into four sections (Figure 3) 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 3).

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.

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), Initial 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.

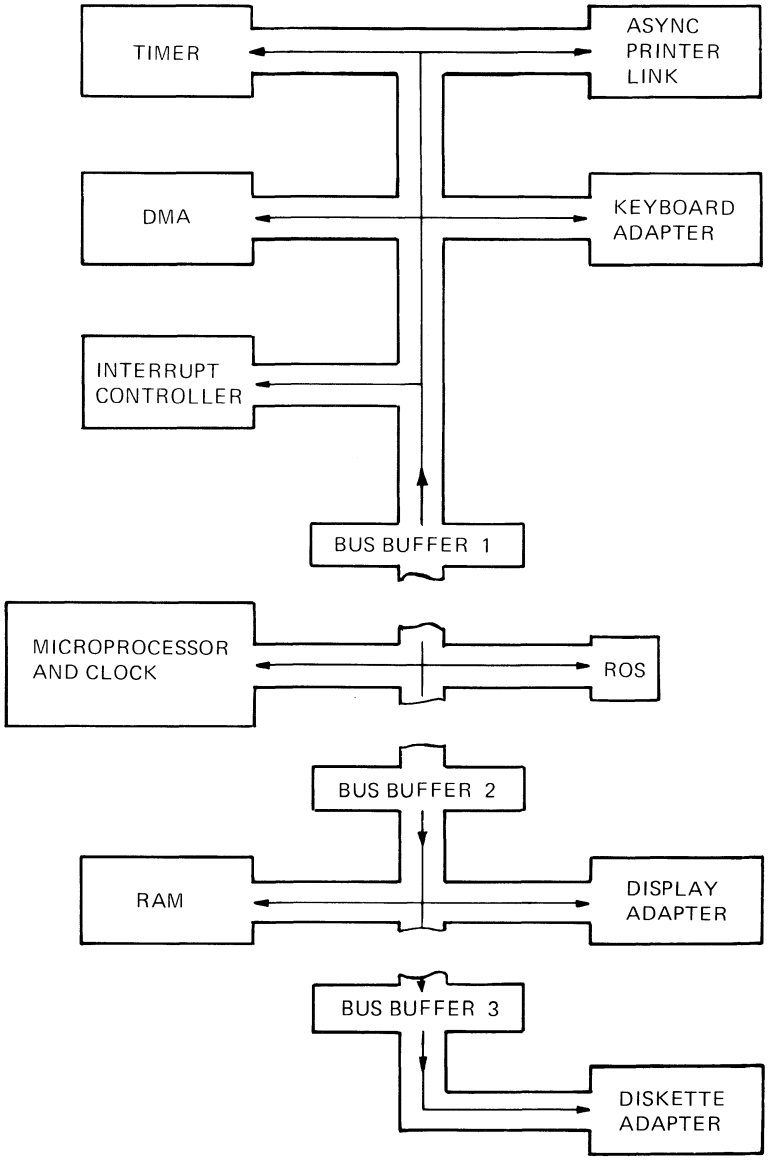


Figure 3 - System Bus Isolation During BAT

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 of priority and are maskable interrupts.

Level 0 - Incoming data for printer sharing
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 4). Once the maskable interrupt routine is complete, the main program will continue from where it was interrupted.

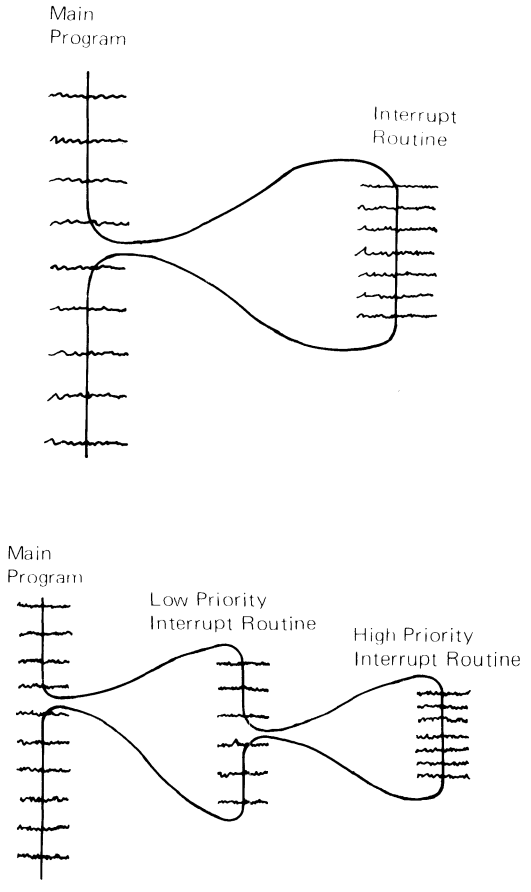


Figure 4 - Interrupt Handling

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 read/write operation.

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 CARD

The memory card is a single purpose card located in position E in the distribution board. The memory card has a maximum of 192K Bytes of storage. This storage holds the customer application program that is being executed and temporarily stores the data records as they are processed.

Each storage location can hold one byte which is a data character, or part of an instruction.

The microprocessor determines the storage position of the data or the instructions. Machine instructions in the form of commands are read out of memory one at a time and are interpreted by the control section of the microprocessor. The control section sets up the needed circuits to perform the instructions. If data is needed, the instruction directs the microprocessor to the data in memory. If a system device is to be controlled, the instruction specifies the device and the operation to be performed.

MEMORY EXTENDER CARD

When customer application programs need more memory than is available on the memory card, a memory extender card can be used to expand total memory to 384K bytes. The memory extender card is located in position F on the distribution board.

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.

Textpack I	192K
Textpack II	192K
ASYNC Communications	192K
BSC Communications	256K
Textpack III	256K
Textpack IV	256K

There are two types of memory card, Type A and Type B. When replacing memory cards, care must be taken to replace like card for like card. For example, a 128A card must be replaced with a 128A card, and a 128B card must be replaced with a 128B card. This is necessary to insure proper operation of the system and to maintain machine level control (MLC).

Memory sizes can be configured as follows:

128K bytes of storage: 128A
128B

192K bytes of storage: 192A
192B

256K bytes of storage: 256B
192A (base card)+64B (extender)
192B (base card)+64B (extender)

320K bytes of storage: 256B (base card)+64B (extender)

DISKETTE ADAPTER CARD

The diskette adapter card is located in the diskette unit. The electronics interface with the extended system bus to the diskette file card(s) located on the diskette adapter.

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 provides the necessary control logic to interface between the diskette drives and the system bus. The diskette adapter 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. The command and status information which identify the current condition of the drives is contained in the command and status portions of the adapter. The microprocessor provides automatic cyclic redundancy checks (CRC).

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

DISPLAY ADAPTER CARD

This card is connected to the distribution board assembly in position D. The display adapter 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 5).

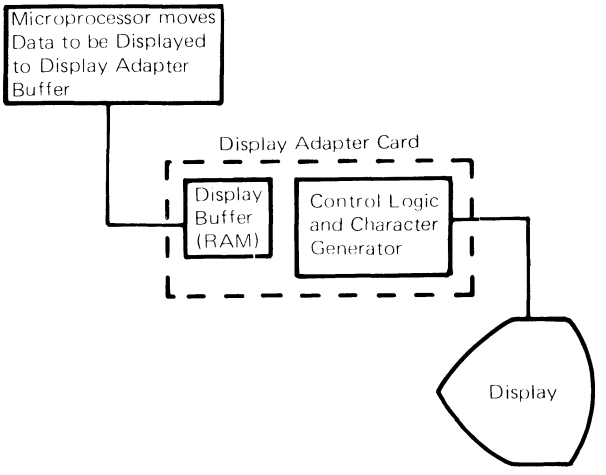


Figure 5 - Display Data Flow

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).

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.

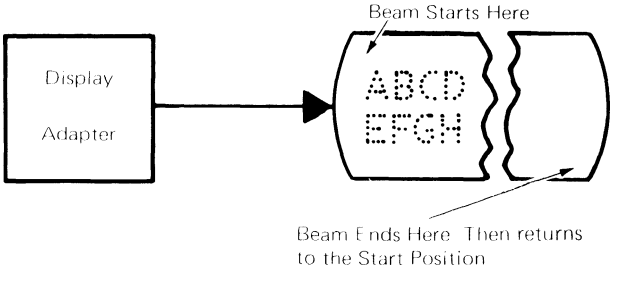


Figure 6 - Display Character Formation

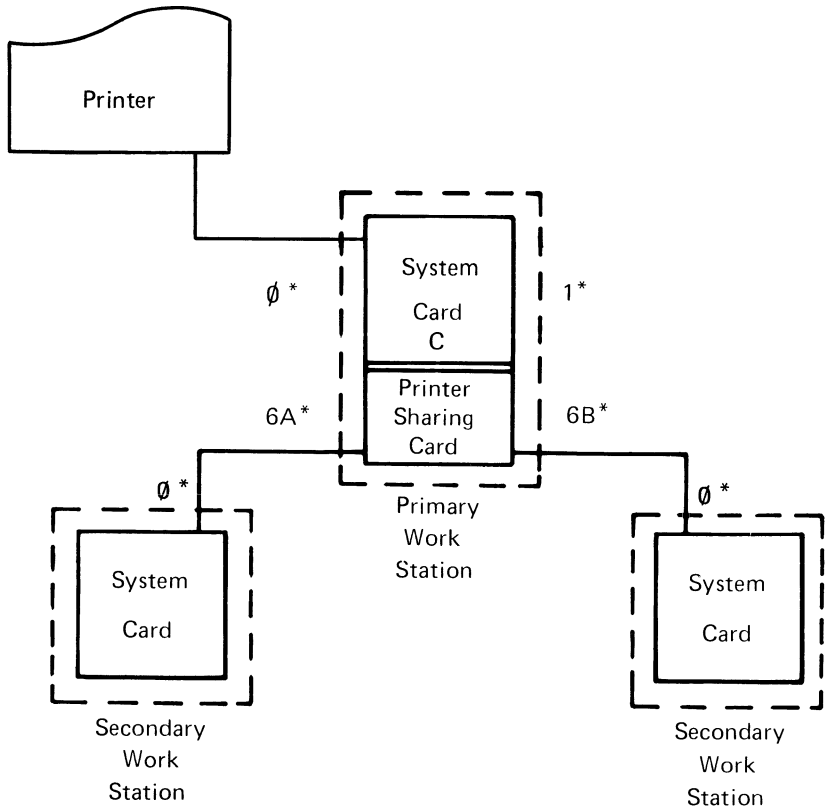
PRINTER SHARING CARD

Printer sharing between work stations is an optional feature of the system for the 40 and 60 cps printers, but it 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 7, 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 requested the task being printed.

The printer sharing feature requires a minimum of Textpack II and 192K bytes of memory. The work stations share only the printer. Control of the printer is assigned by the software, and the work station is assigned by the printer sharing card. Once a work station has control of the printer, it has 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 7 - 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 8).

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

	VOLTAGE TOLERANCE	FUSE
US/Canada	104 – 127 VAC	7 Amp
WT (Except Canada)	90 – 137 VAC	6.3 Amp
WT (Except Canada)	180 – 254 VAC	5 Amp

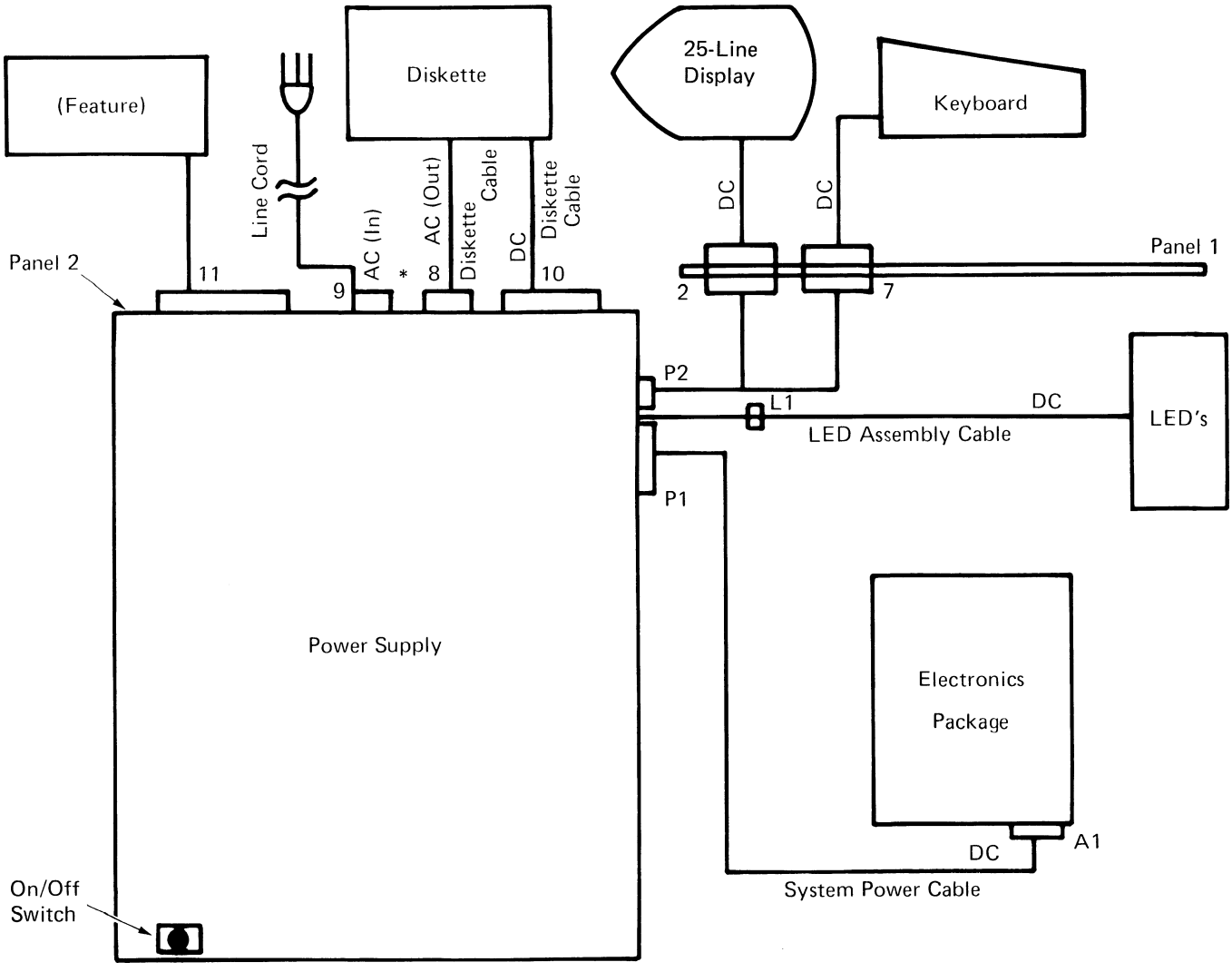
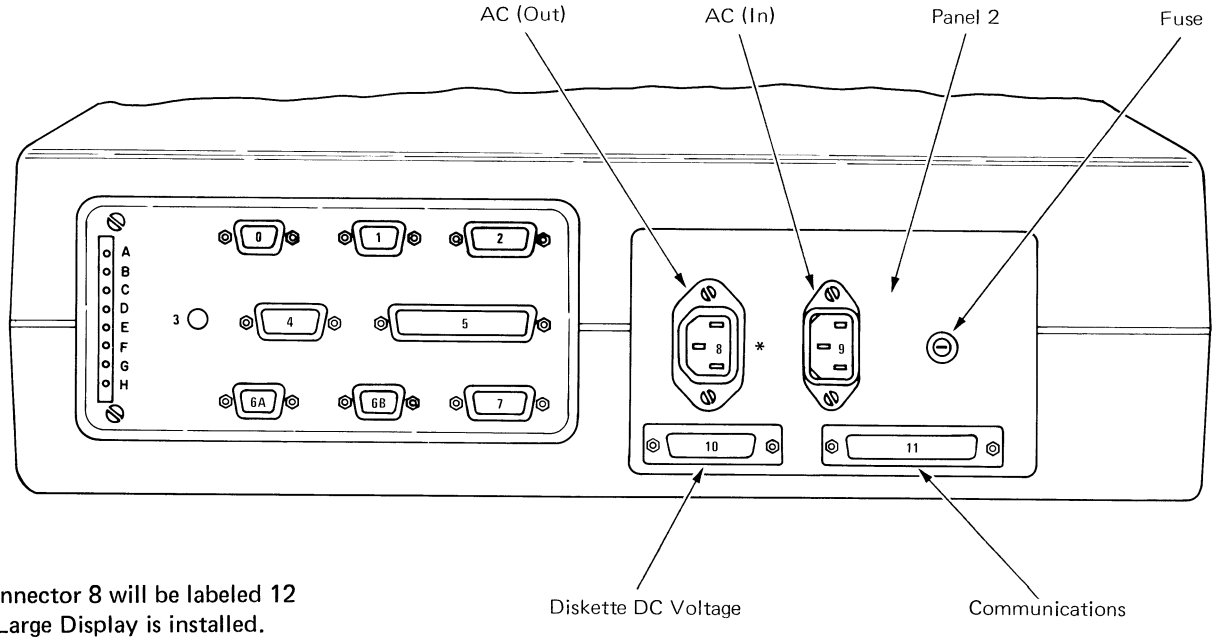


Figure 8 - Power Supply Voltage Distribution

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

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 9). Located on panel 2 are the sockets for AC power in, switched AC power out (to the diskette module or the Large Display Module), DC voltage out (to the diskette module), DC voltage for communications, and the primary fuse.



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

Figure 9 - Electronics Panel 2 (Rear View)

The power supply must have the ability to provide the following DC voltages and currents to the system:

OUTPUT VOLTAGES	TOTAL REGULATION (PERCENT)	OPERATING CURRENT * (AMPERES)
+24 VDC	+10, -8	1.3
+12 VDC	+10, -8	.9
+12 VDC	+ 5, -5	1.6
+8.5 VDC	+ 5, -5	2.5
+5 VDC	+10, -8	16.0
-5 VDC	+10, -8	0.5
-12 VDC	+10, -8	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 and power supply 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 10).

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

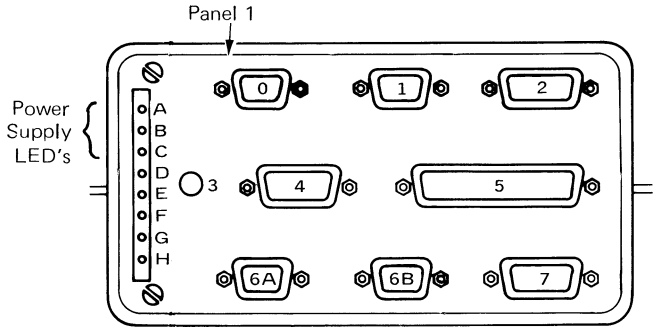


Figure 10 - Electronics Panel 1 (Rear View)

POWER ON RESET

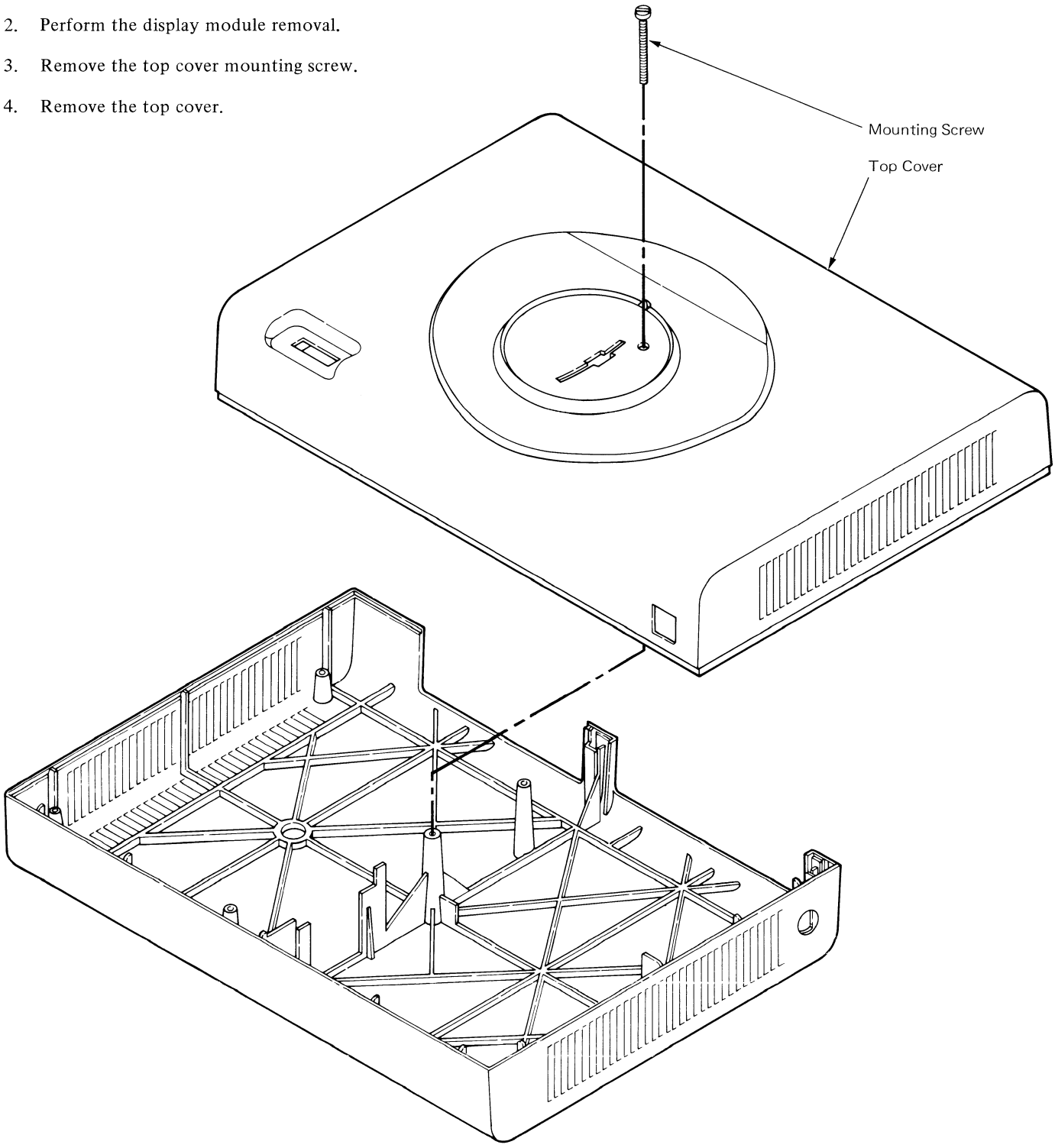
A power on reset (POR) sequence occurs each time the power is turned on. It ensures the electronic logic is set to start at a specific point. The power supply generates two reset signals to start the POR sequence. The first reset signal, POR system signal (-PORSYS), is sent to the system card. This signal 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 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.

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.

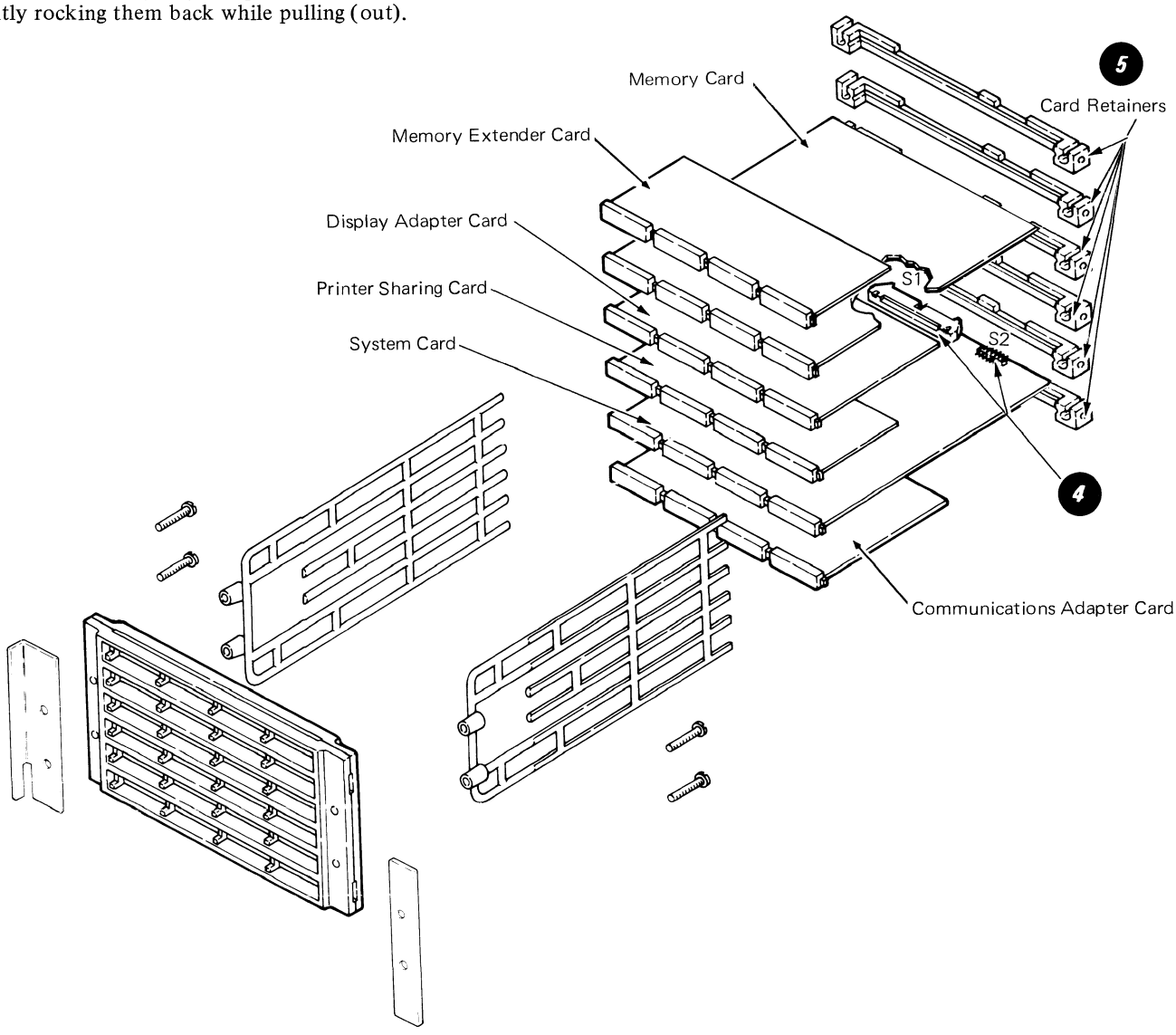
COVER REMOVAL

1. Turn 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

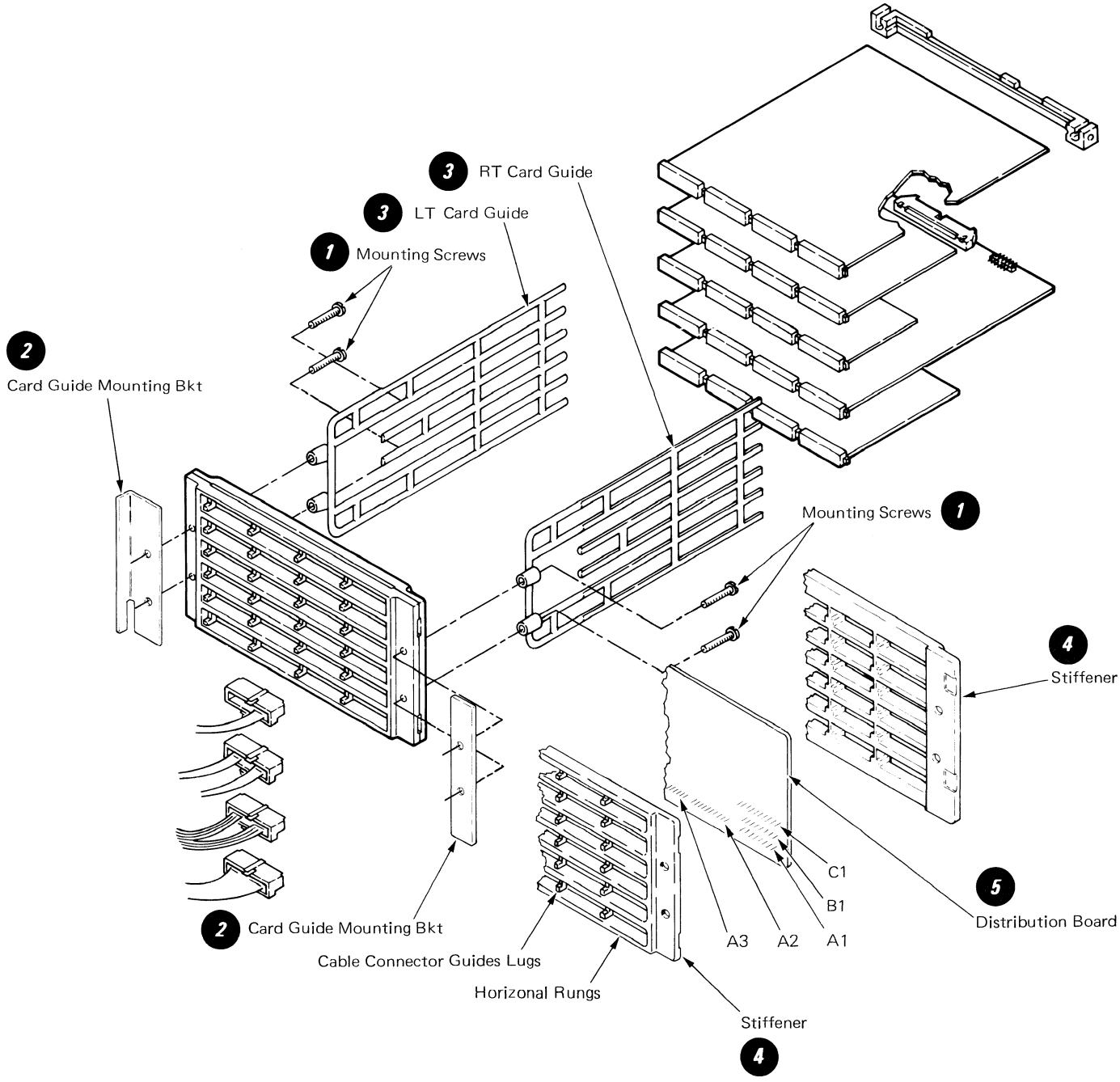
1. Turn system power off.
2. Perform the display module removal.
3. Perform the electronic module cover removal.
4. Lift the electronic package out of the bottom cover.
5. Disconnect the S1 and S2 connectors if necessary ❹ .
6. Remove the card retainer(s) ❺ .
7. Remove the card(s) by grasping them on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



DISTRIBUTION BOARD REMOVAL

1. Turn system power off.
2. Perform the display module removal.
3. Perform the top cover removal.
4. Disconnect the following connectors: S 1, S 2, A 1, B 1, C 1, and D 1.
5. Perform the electronics card(s) removal.
6. Remove the four card guide mounting screws ❶, two card guide mounting brackets ❷, and two card guides ❸.
7. Separate the two stiffeners that enclose the distribution card ❹

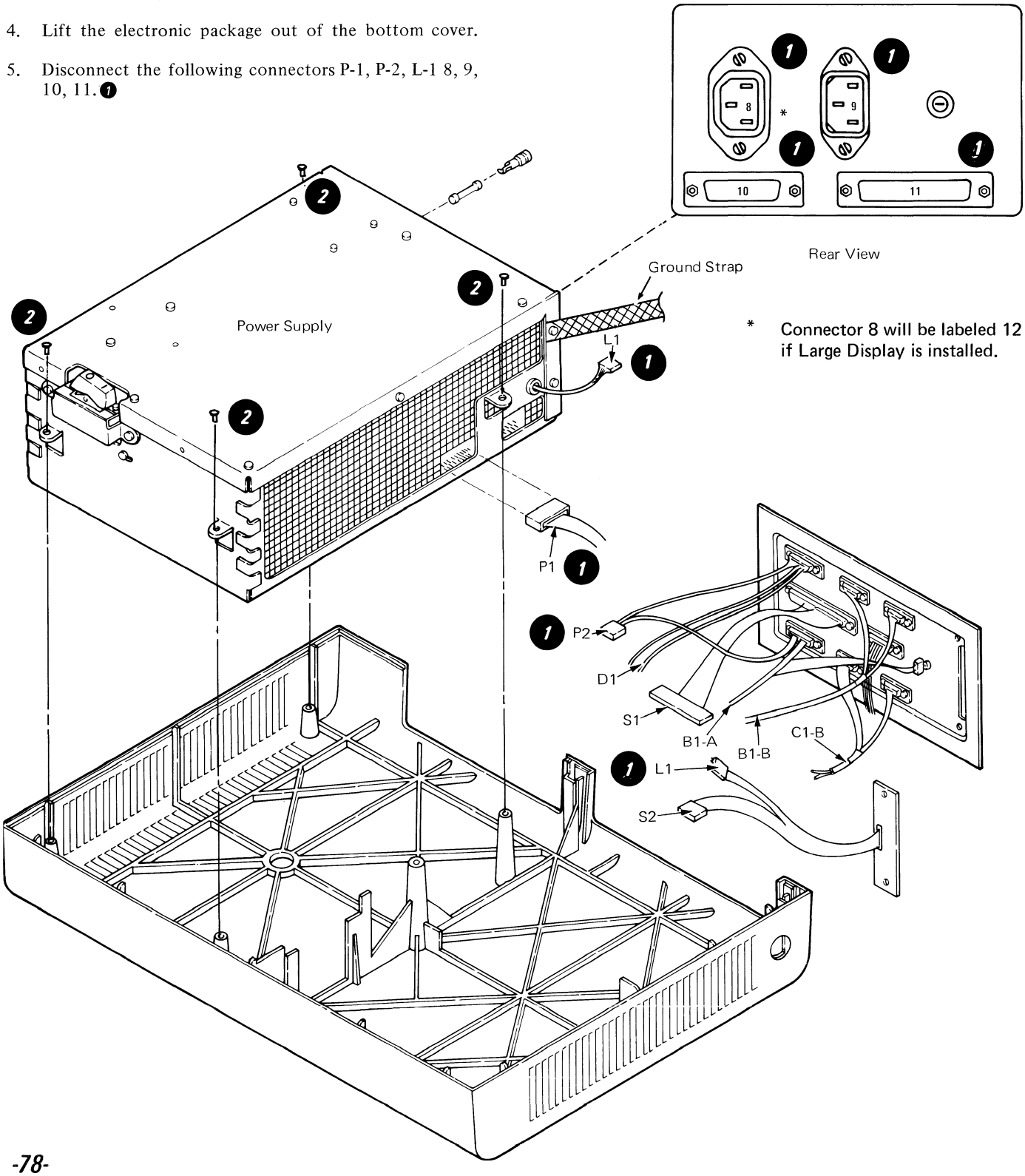
   NOTE: When reassembling the distribution board ❺ and stiffeners use the following procedure to prevent multiple card damage.
8. Position the distribution board so connector A1 is in the lower right hand corner, as observed from the front of the Electronics module.
9. The cable connector guide lugs must 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 system power off and disconnect system line 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, 11. ❶
6. Disconnect the ground strap from the power supply.
7. Reinstall the electronic package.
8. Remove the four power supply mounting screws. ❷
9. Lift the power supply up and out of the bottom cover.



DISKETTE UNIT

CONTENTS

The diskette drive is used to read or write data and relies on the system for power, commands and controls. The diskette drive uses magnetic diskettes for data exchange and data storage (Figure 1). 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.

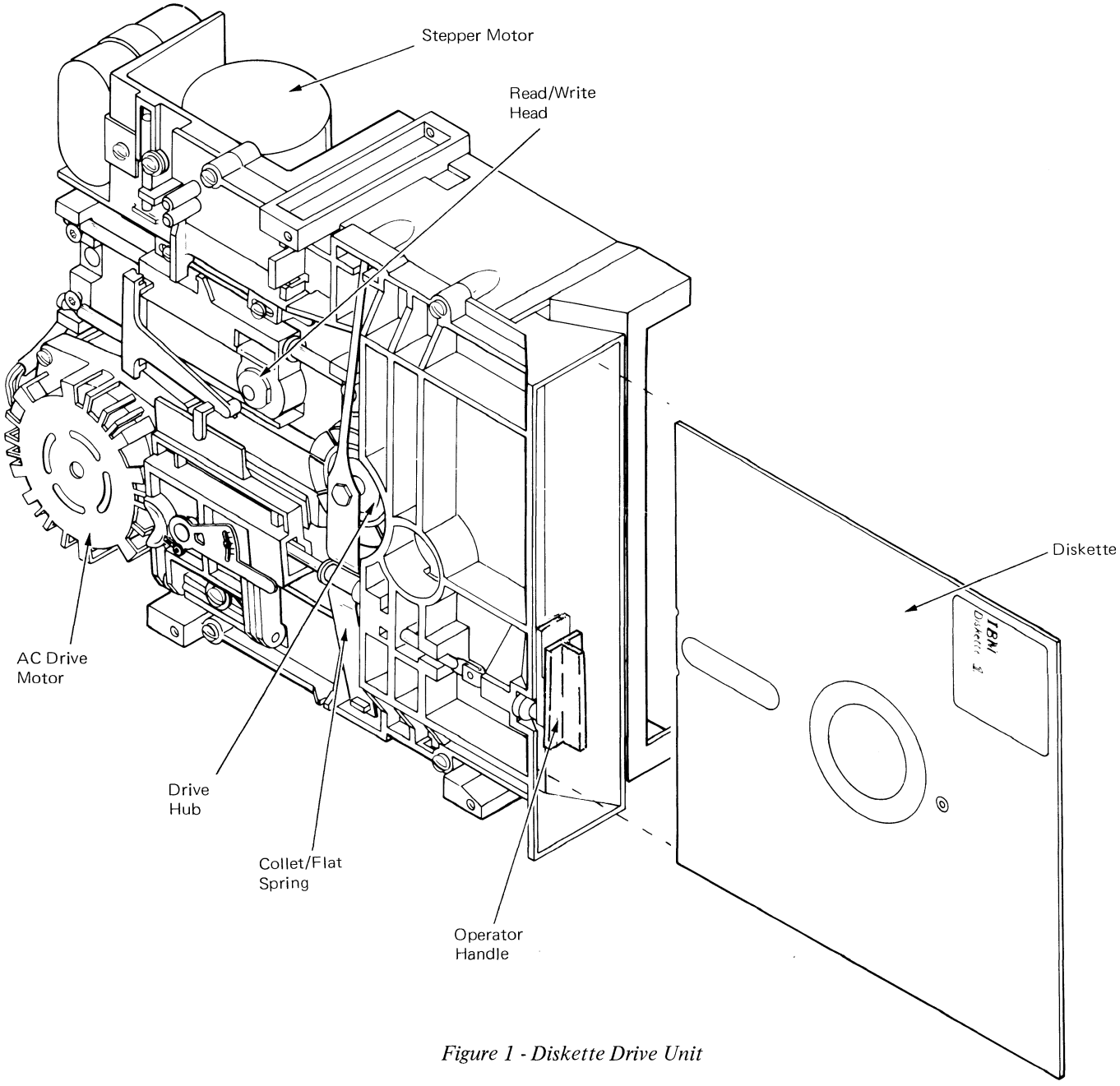


Figure 1 - Diskette Drive Unit

DISKETTE THEORY

The IBM Diskette is divided into 77 circular tracks numbered 00 through 76 (Figure 2). 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. Each data track is divided into 15 sectors for the diskette 1 and 26 sectors for the diskette 2D. Track numbers 75 and 76 are reserved to take the place of any primary tracks (01-74) that have failed. The diskette 1 can hold up to 284,000 bytes of usable information and the diskette 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.

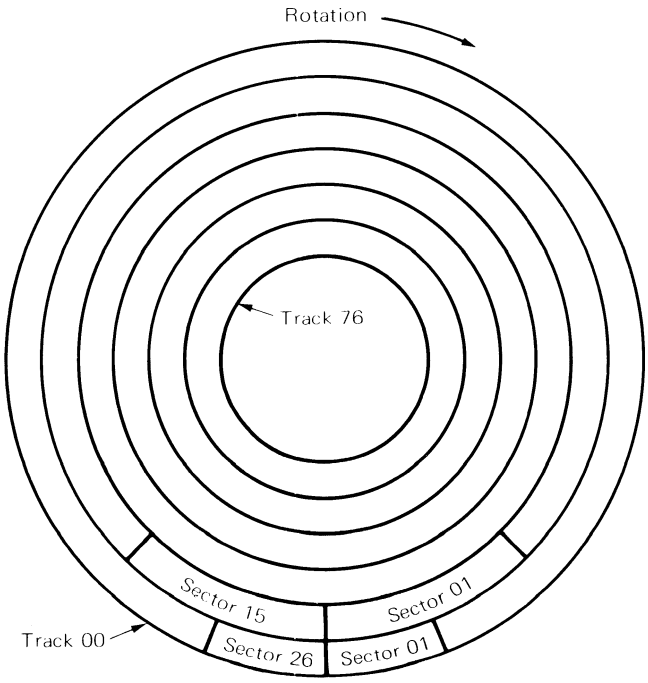


Figure 2 - Diskette Tracks and Sectors

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.

There are six physical features on all diskettes (Figure 3):

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 (Diskette 1): 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 (Diskette 2D): 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.

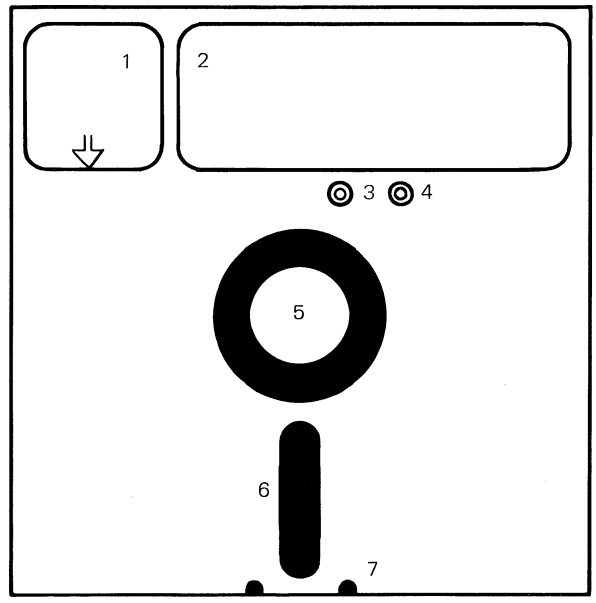


Figure 3 - Diskette Features

DISKETTE HANDLING

To prevent diskette damage, observe the following procedures and precautions (Figure 4):

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.

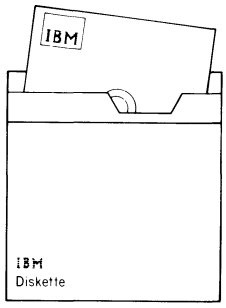
Always return the diskette to its storage envelope after it is removed from the diskette drive.

Contaminated diskettes (pencil marks, finger prints, cleaning fluid) can cause data errors, equipment errors, or head damage.

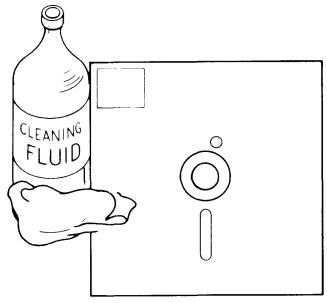
Diskettes that are creased or bent can cause read/write head damage and should not be used.

Damaged diskettes should not be inserted into the drive.

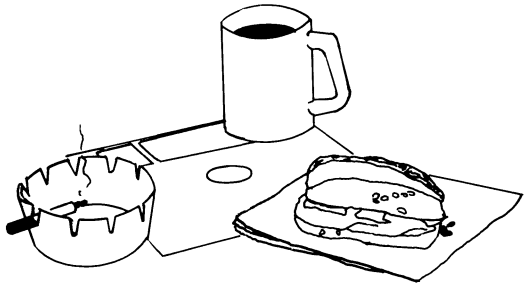
Return a diskette to its envelope when it is removed from the diskette drive.



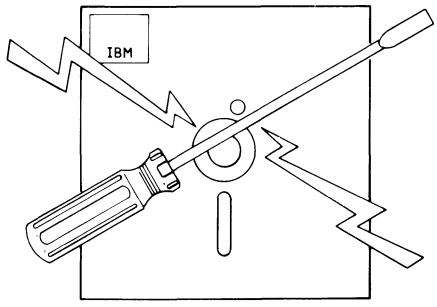
Do not touch or attempt to clean diskette surfaces. Contaminated diskettes will not work correctly.



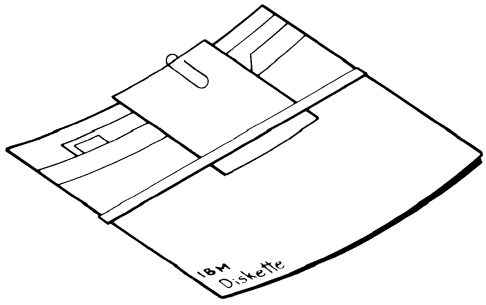
Do not lay diskettes near smoke or other things that can cause the disk to be contaminated.



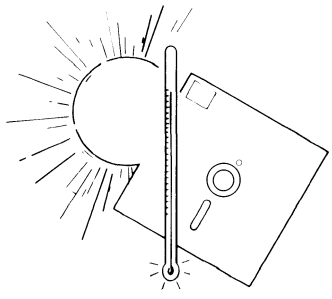
Do not place diskettes near magnetic materials. Data can be lost from a diskette exposed to a magnetic field.



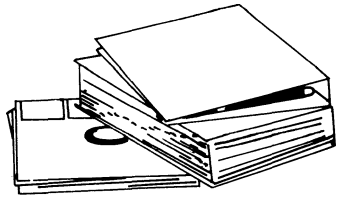
Do not use clips or rubber bands on a diskette.



Do not expose diskettes to heat greater than 51.7° C (125°F) or direct sunlight.



Do not place heavy books on diskettes.



Do not write outside the label area on diskettes.

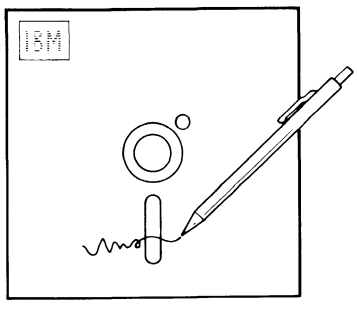


Figure 4 - Diskette Handling

The diskette must be inserted properly for correct operation. Follow this procedure (Figure 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.

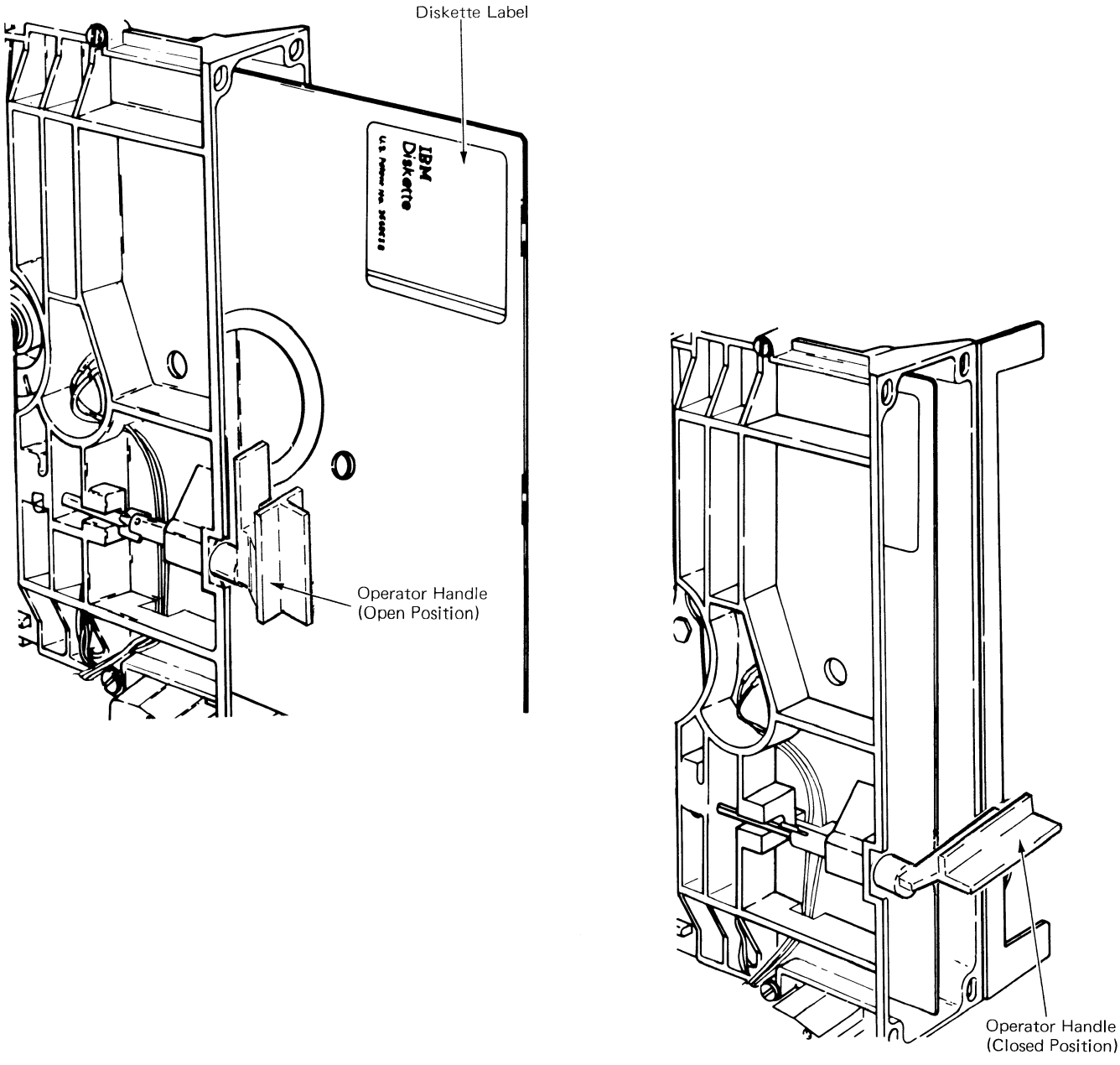


Figure 5 - Inserting Diskette Into Drive Unit

MOTOR AND DRIVE

The purpose of the motor and drive is to turn the diskette at a constant speed (Figure 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.

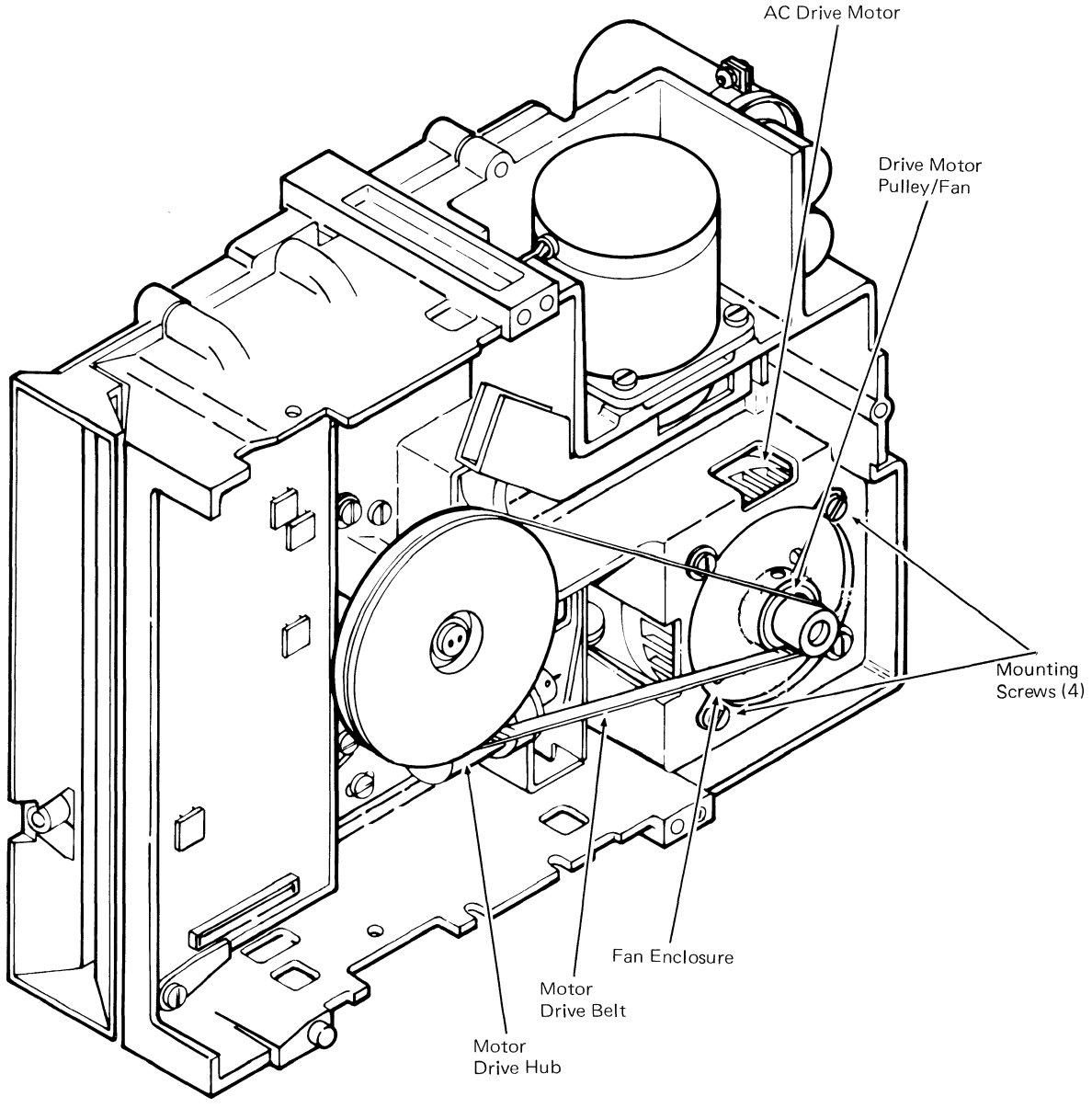


Figure 6 - Motor and Drive

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 assembly trapping the diskette (Figure 7). The diskette then turns with the drive hub assembly.

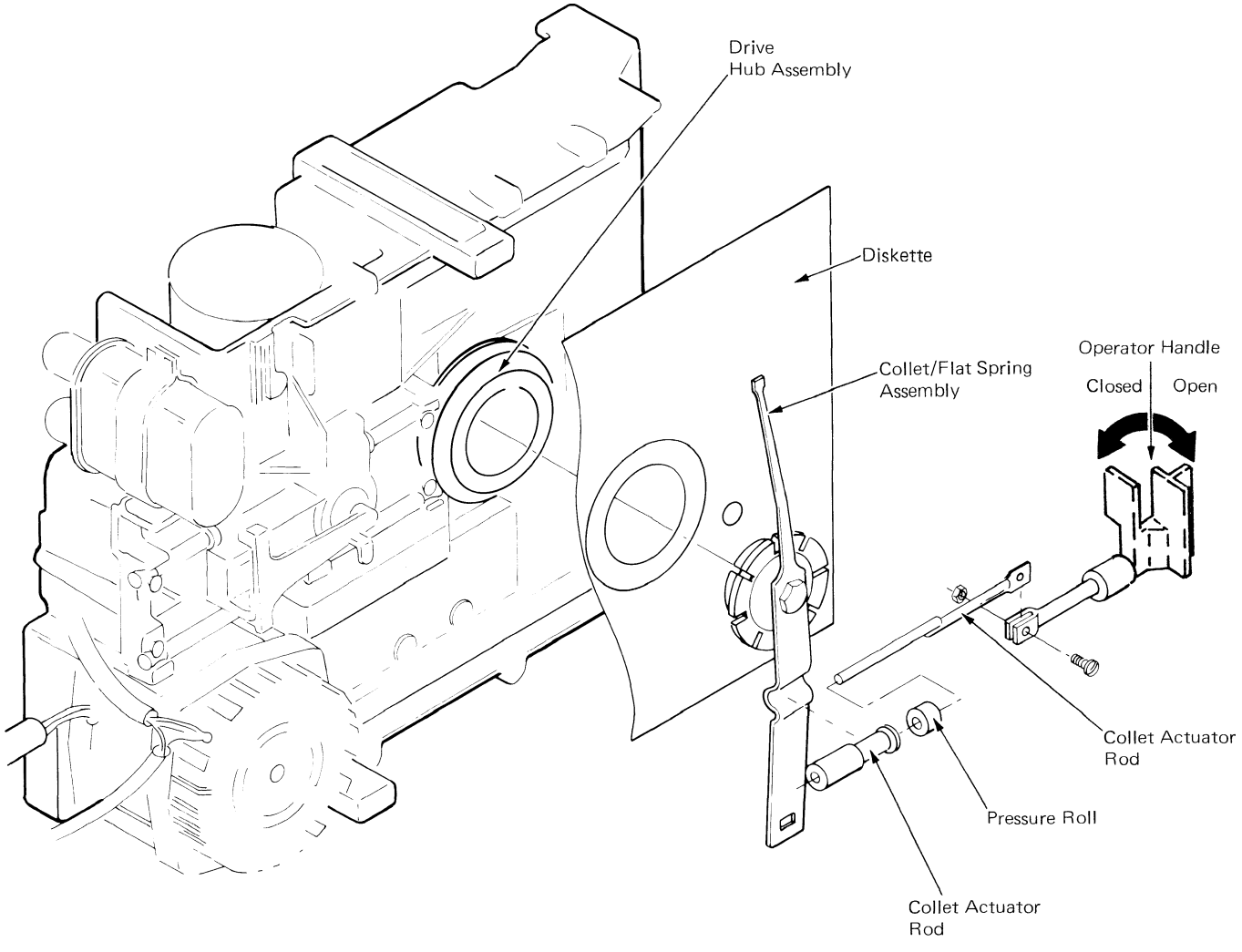


Figure 7 - Hub Drive Collet (Left Rear View)

LED/PTX

A Light Emitting Diode (LED) and a Phototransistor (PTX) are used to sense diskette rotation (Figure 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 a reference point 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 duel LED that also indicates to the file control card the type of diskette turning in the drive.

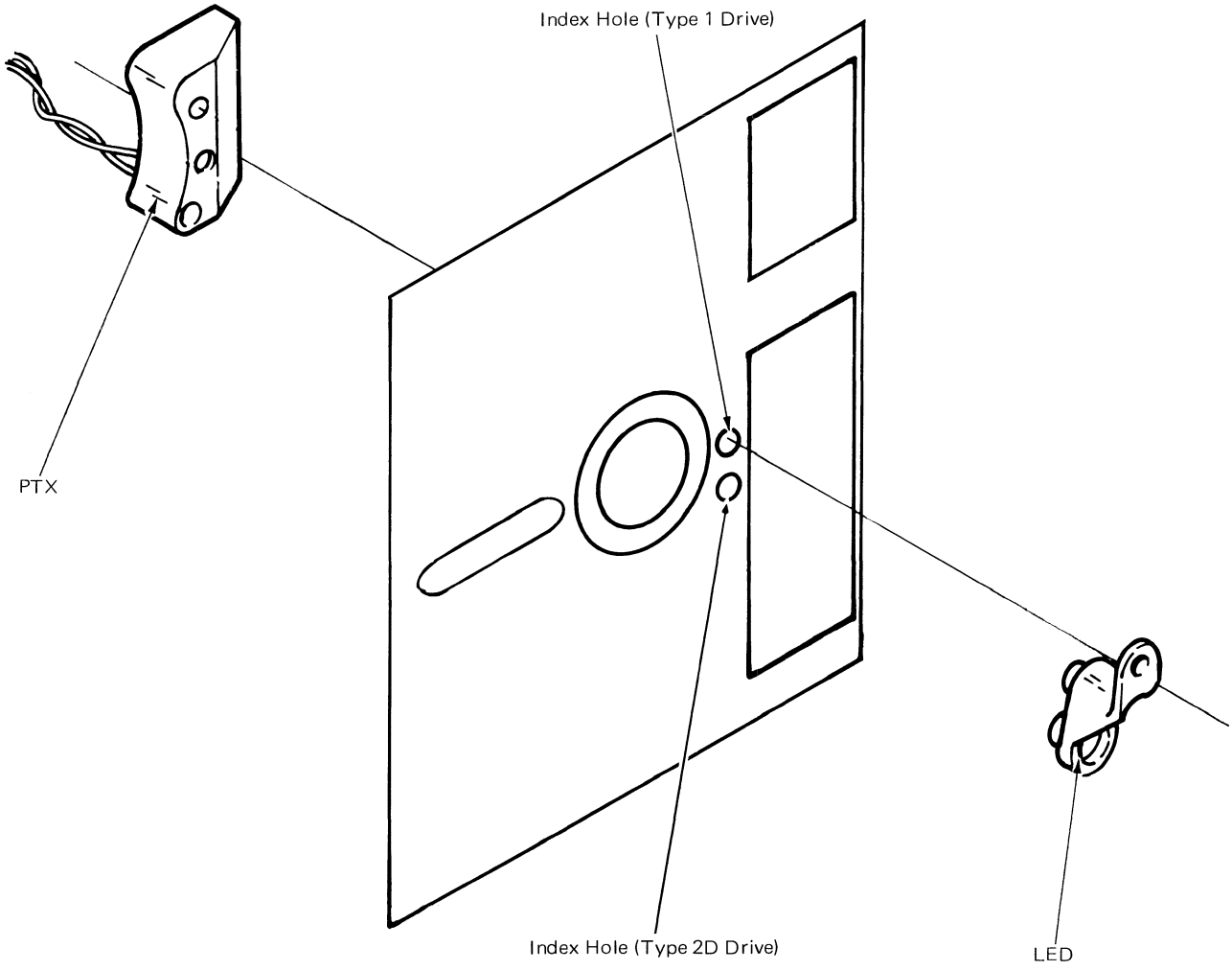
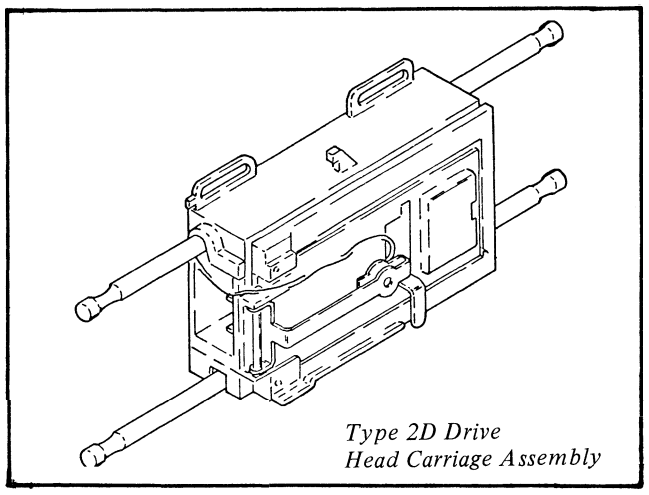


Figure 8 - LED/PTX

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 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).



Type 2D Drive
Head Carriage Assembly

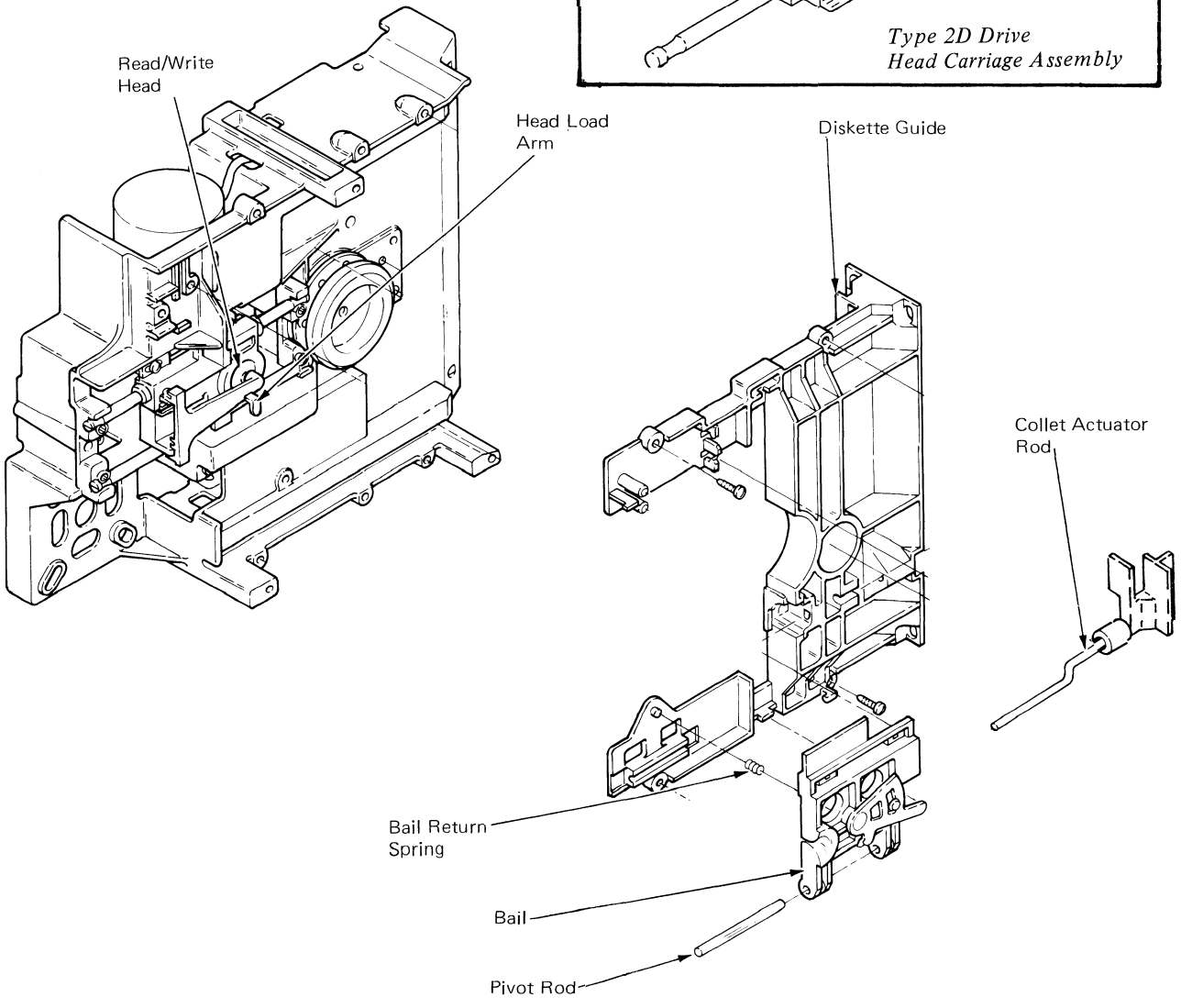


Figure 9 - Head Load Assembly

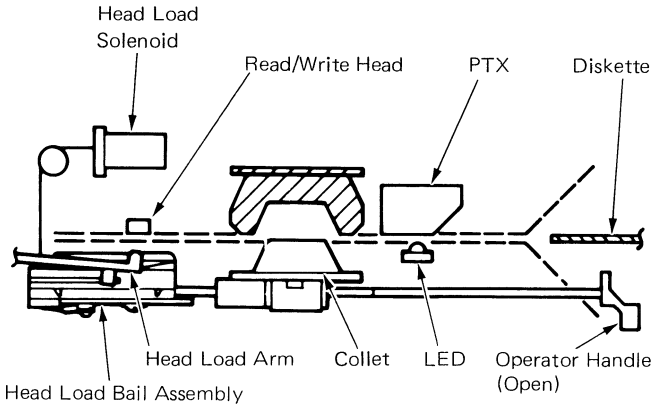


Figure 10A - Head Load Mechanism

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 10B).

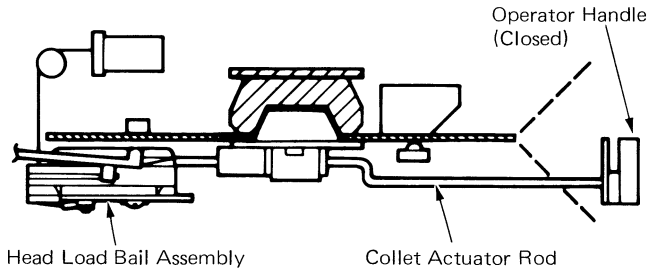


Figure 10B - Head Load Solenoid De-activated

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 11).

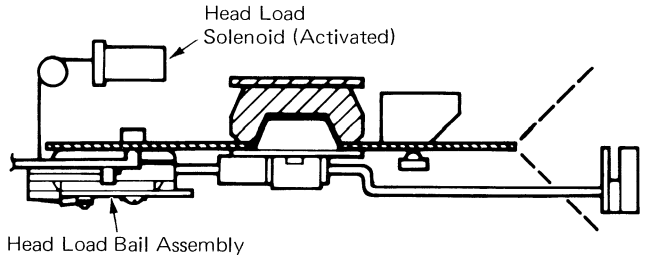


Figure 11 - Head Load Solenoid Activated

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.

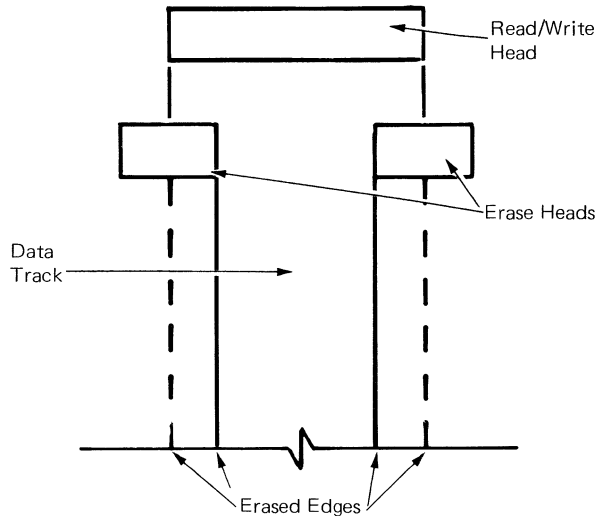


Figure 12 - Read/Write Data Track

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 13).

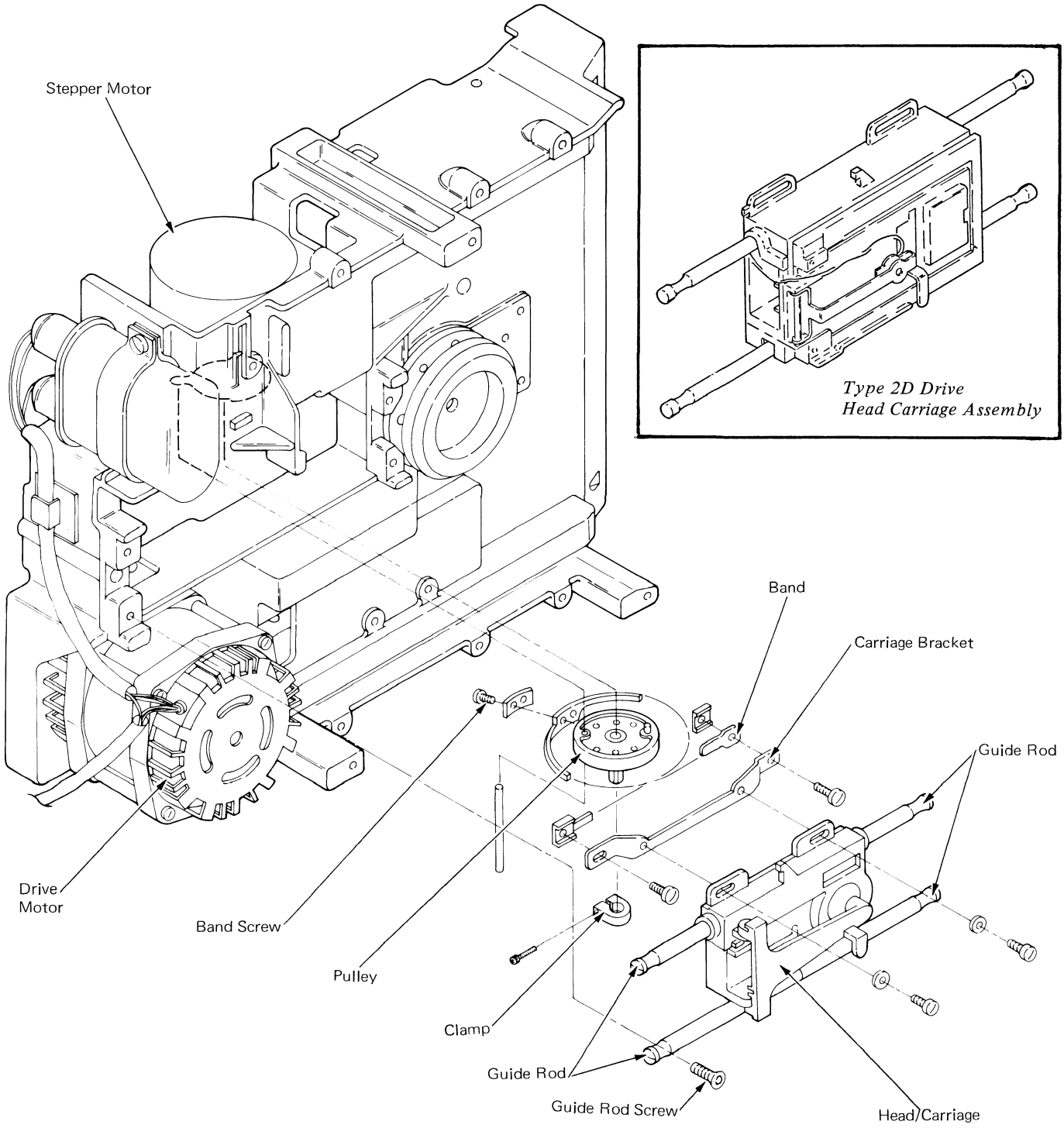


Figure 13 - Head Carriage Assembly

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 diskette adapter tests itself following each power on reset. This test is in two sections; first the cable from the system card to the diskette adapter card is checked, then the read function on the diskette adapter is tested.
Drive Status	This feature generates an interrupt request if a write signal is present when no write operation is occuring or is not present during a write operation.
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/photo-transistor.
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 14) 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 used with the inner tracks line only during a high density read operation.

Write/Erase Enable: This signal is activated by the file card when the write or erase gate signals are sensed.

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.

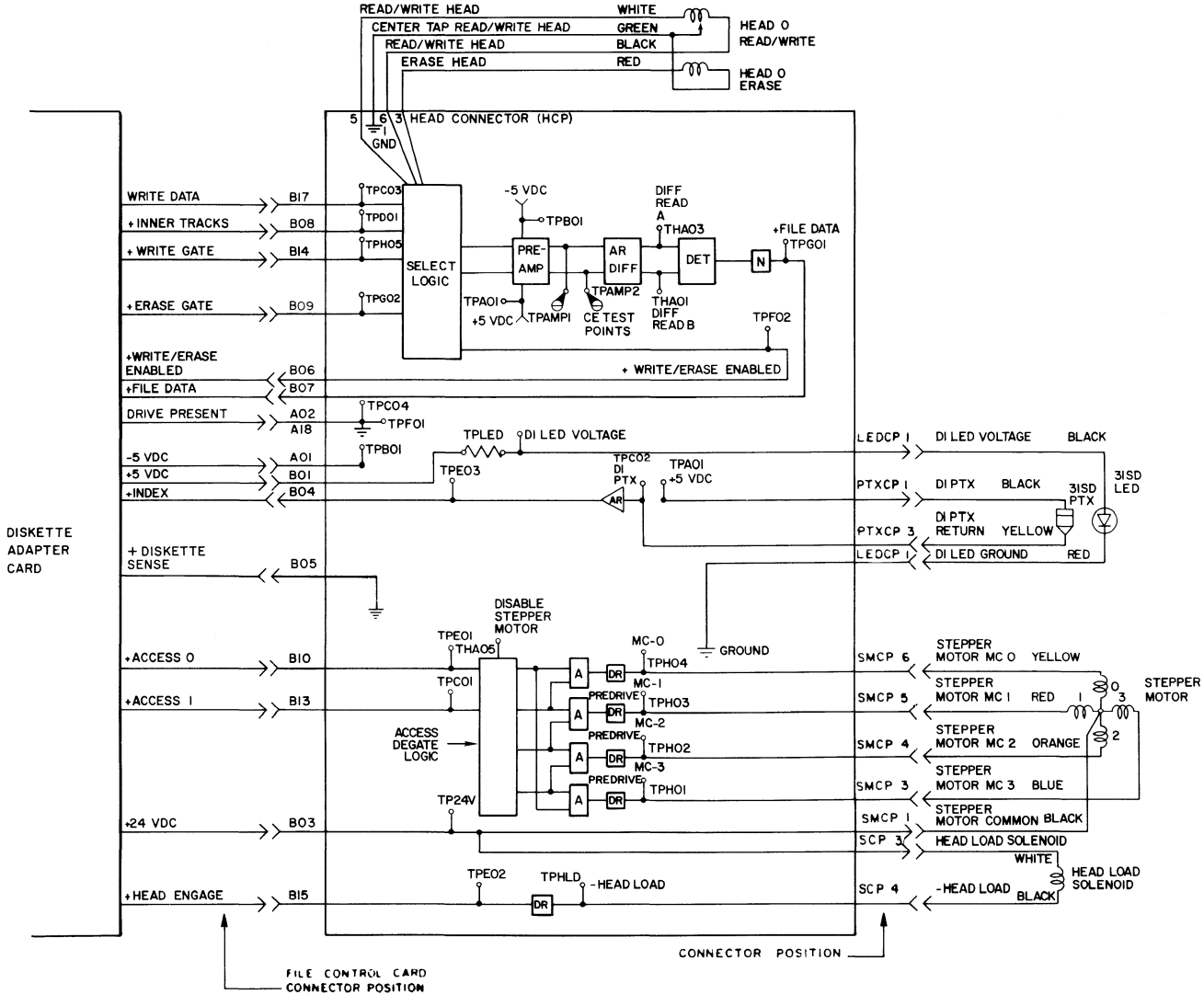


Figure 14 - File Control Card - Type 1 Drive

Drive Present: This signal indicates to the diskette adapter that there is a drive unit present.

Access Ø& 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.

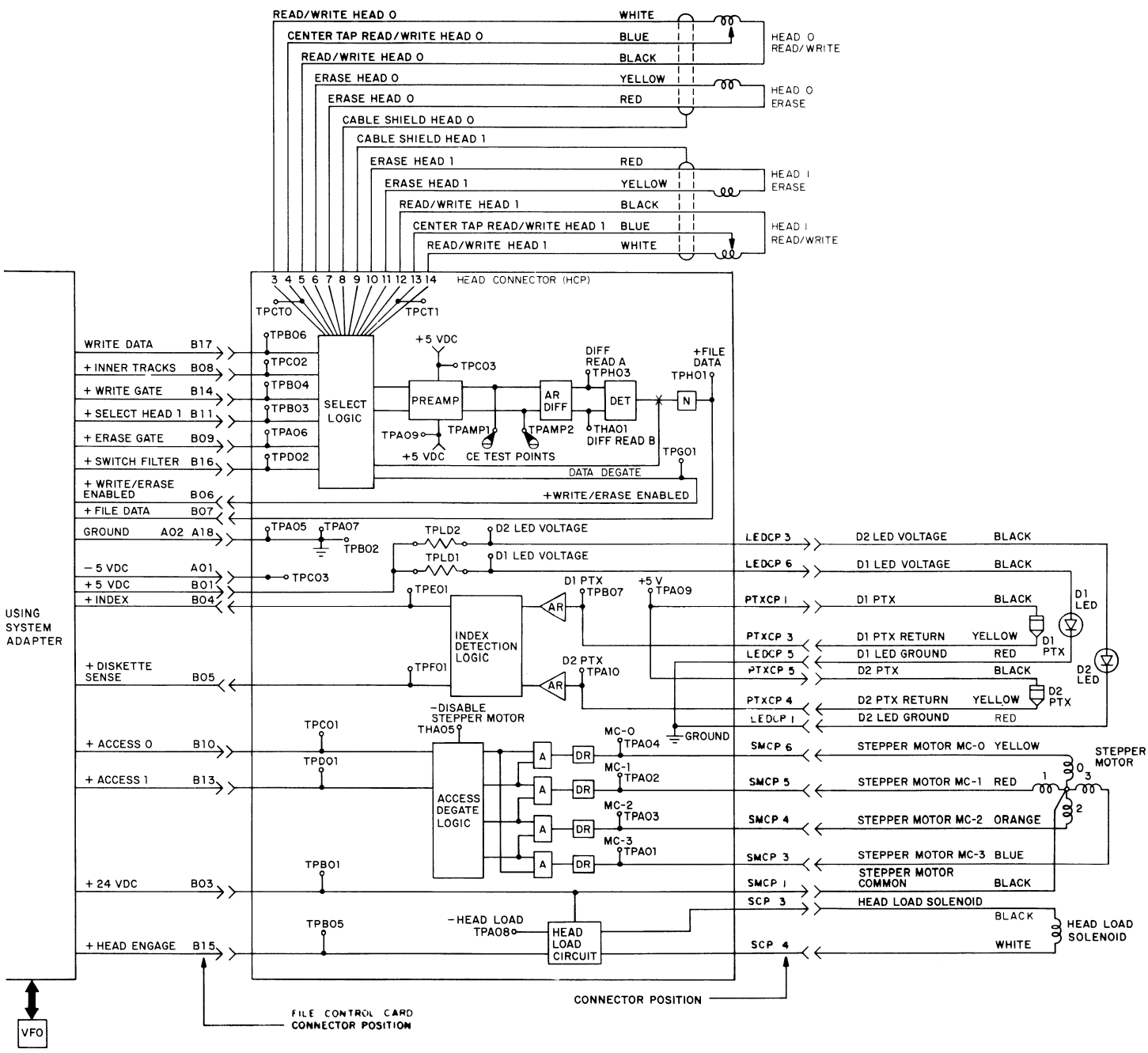


Figure 14A - File Control Card - Type 2D Drive

Two signals, access Ø and access 1, activate the stepper motor. These two signals are sent through an Access Degate logic block (Figure 15A) 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 Ø 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 signals the access lines again.

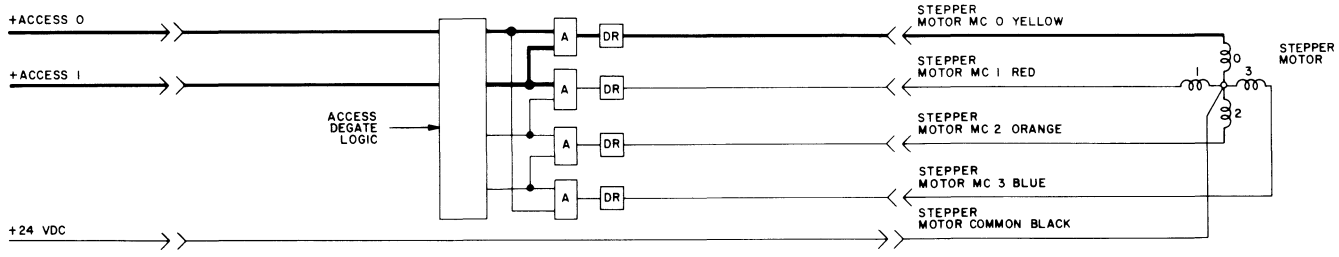


Figure 15A – Stepping Signals

When the next access signal through the access degate logic and selects stepper motor line 1 (Figure 15B) 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.

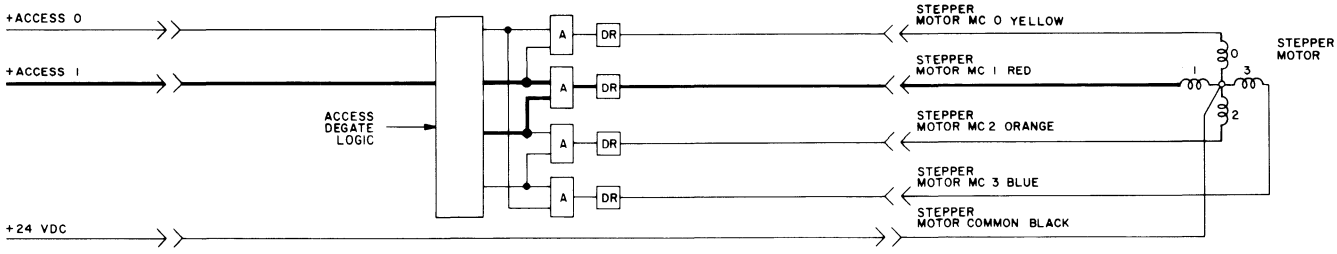


Figure 15B – Stepping Signals

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 16).

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.

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

\+ Indicates an active state.
– Indicates an inactive state.

Figure 16 – 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 17). 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 on systems with the 25-Line Display or from the Large Display (when it is installed). 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 adpater card.

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

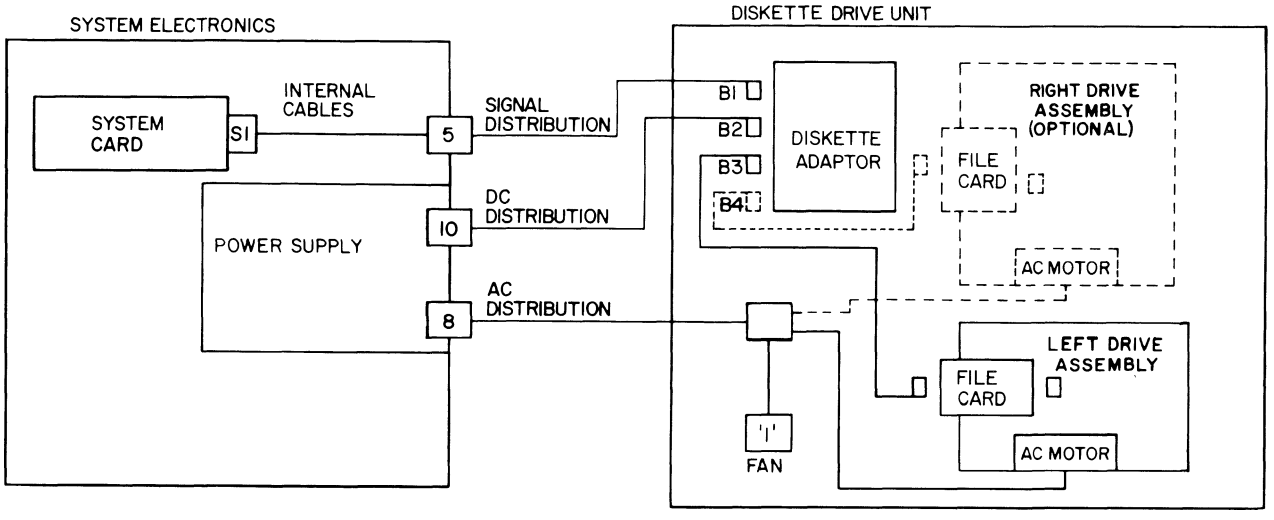


Figure 17 - Diskette Drive/System Interface

NOTE: Figure 17 represents system with 25-Line Display installed.

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 18 is a flow chart showing the error routines for both read and write operations.

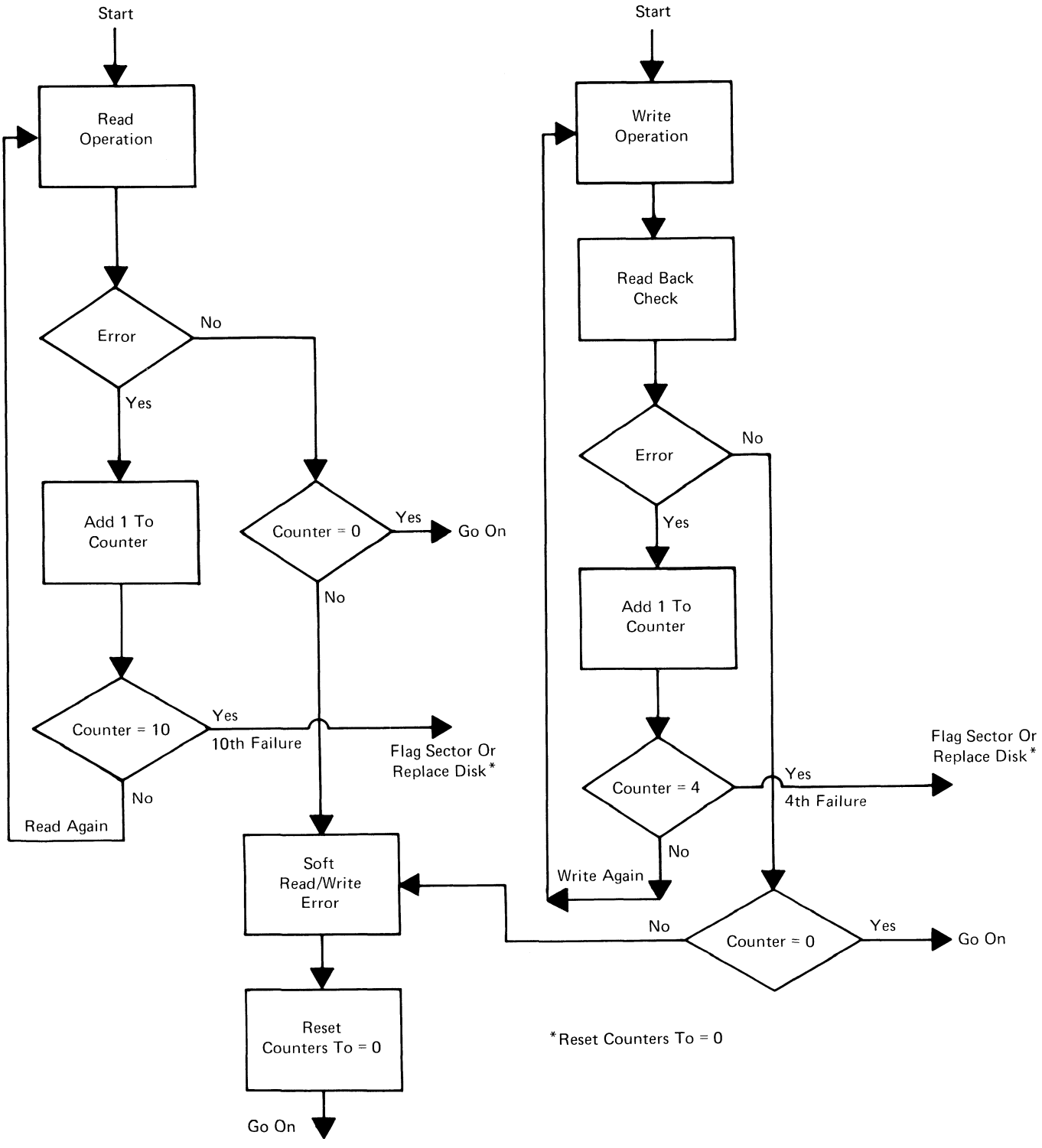


Figure 18 - Read/Write Error Counting

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 19).

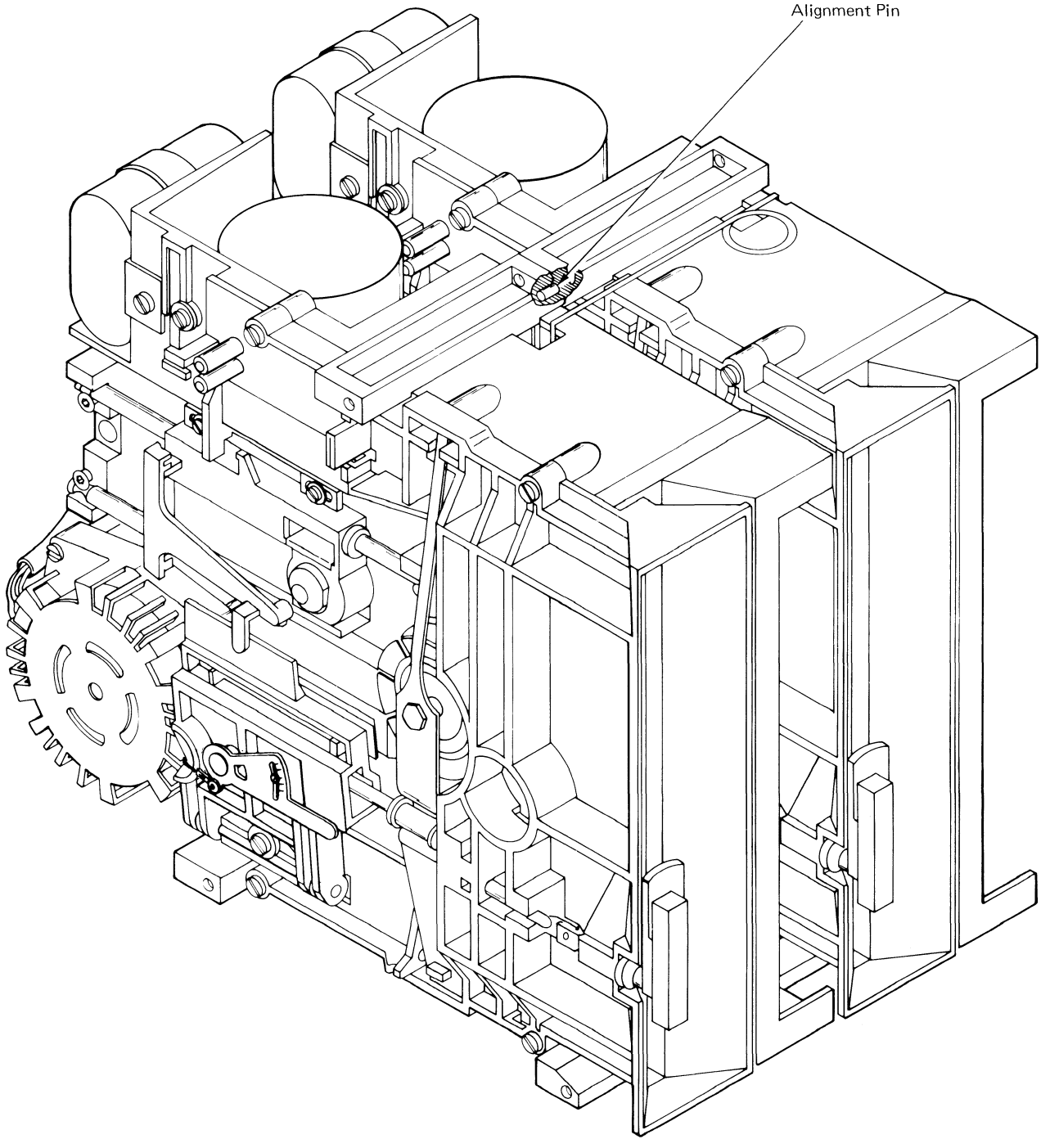


Figure 19 - Dual Diskette Drive

The diskette drive requires no scheduled maintenance. The diagnostics guide the CE to procedures in the Product Support Manual when an adjustment, service checks, or part replacement is necessary. A repair should be verified by using the system diagnostic procedures.

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 the CE meter may damage the head and should not be attempted.

SPECIAL TOOLS

The three special tools needed to service the diskette drive are stored on the frame of each drive (Figure 20). Their use is described in the Adjustment section.

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

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 of Figure 20 with a deviation of +1.5 mm (0.060 inch) acceptable.

NOTE

The Timing Pin may be stored on the diskette drive frame or under the head cable guide.

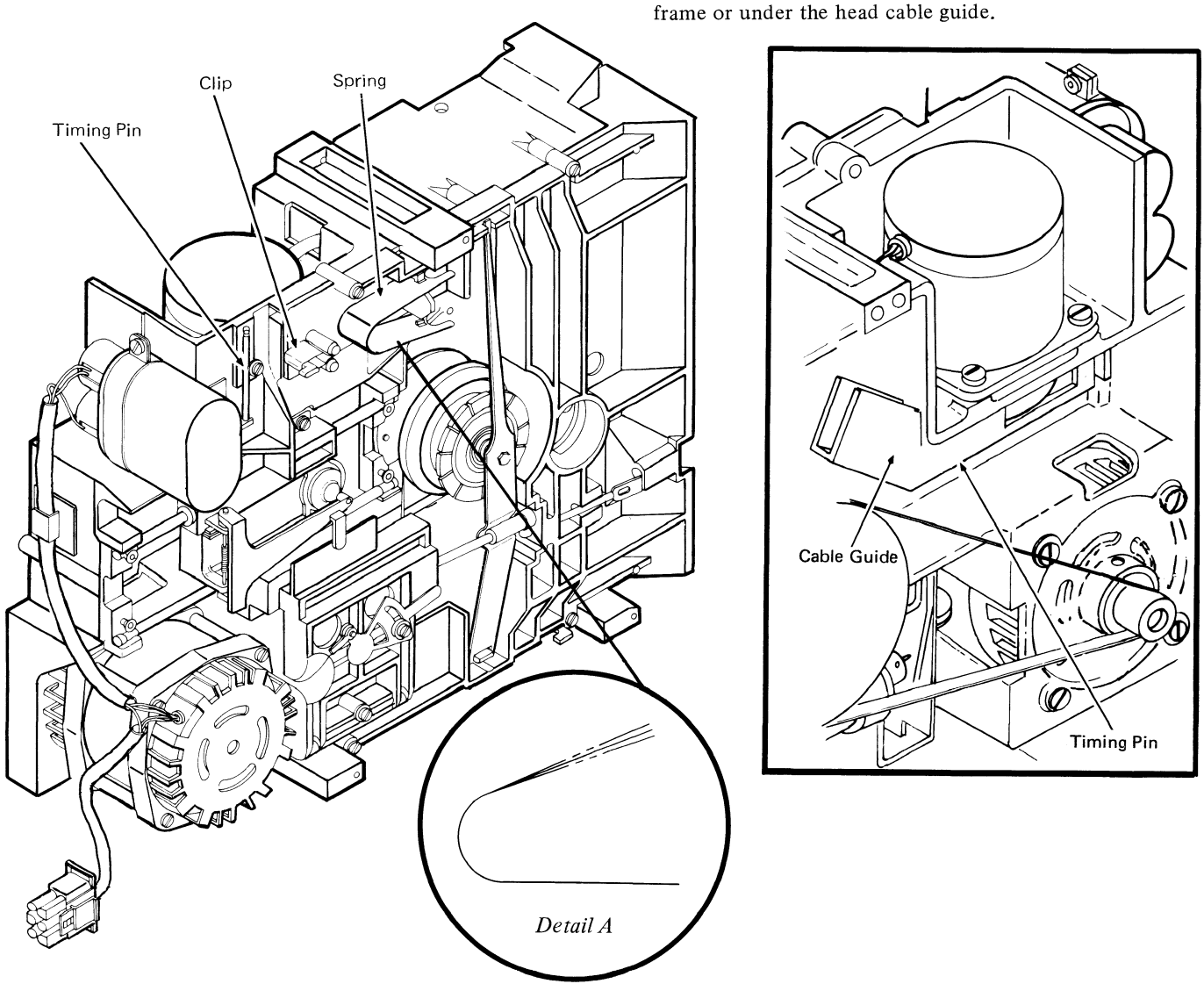
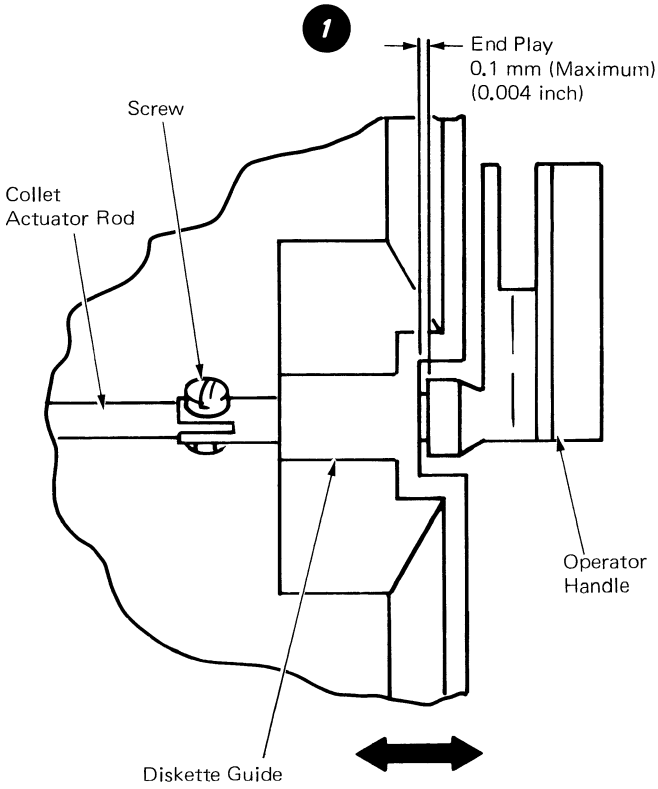


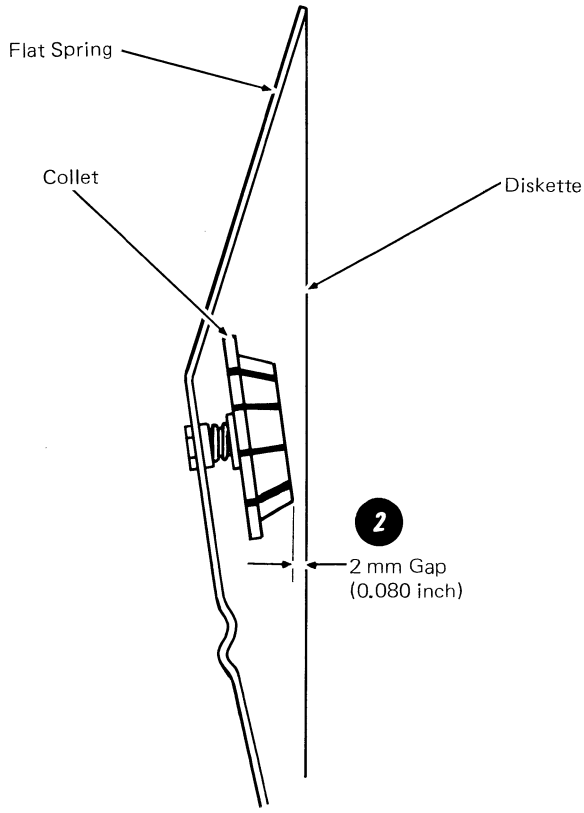
Figure 20 - Special Tools

Operator Handle Adjustment,
Collet/Flat Spring Adjustment Check

1. Loosen the collet actuator rod screw and adjust the operator handle to obtain a maximum of 0.1 mm (0.004 inch) gap between the operator handle and the diskette guide. ❶

2. Insert a diskette and with the operator handle open, check for a 2 mm (0.080 inch) gap between the collet and a diskette. The flat spring is not adjustable, and should be replaced to obtain this adjustment. ❷





Solenoid and Bail Adjustment

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for Ø 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 lever screw. ❶

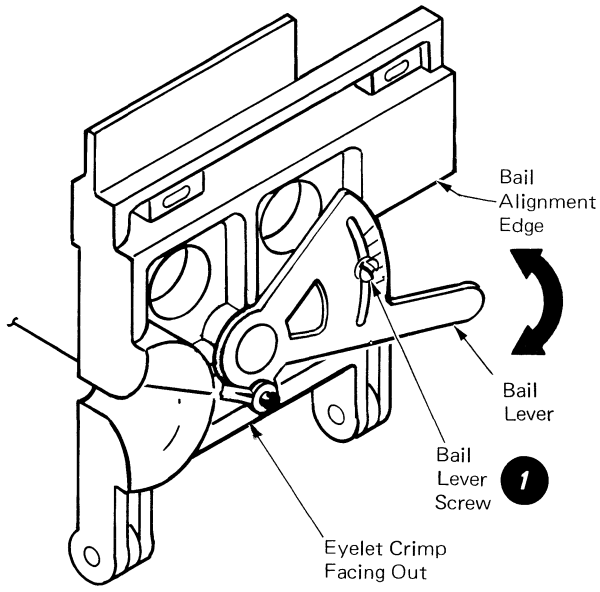
   For the type 1 drive, move the bail lever until the head load arm pad just touches the head.

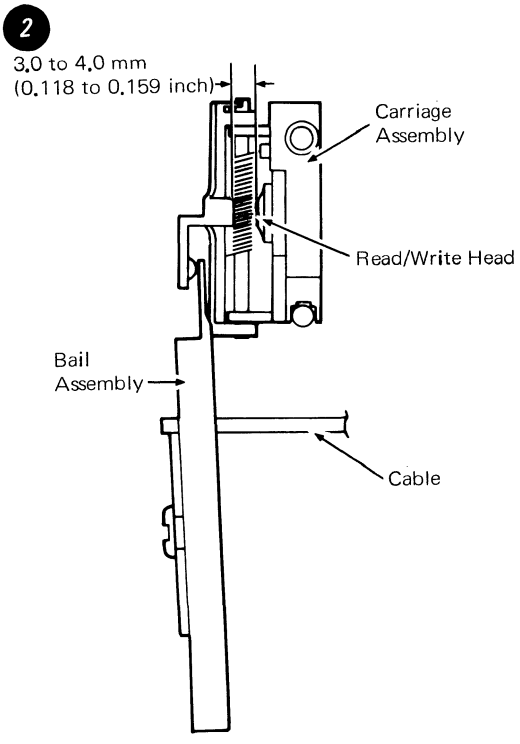
   For the type 2D drive, move the bail lever until the two head just touch.
5. Observe the marks on the bail lever relative to the bail alignment edge.
6. For the type 1 drive, turn the bail lever one and one half spaces (marks) clockwise and tighten the bail lever screw.

   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. ❷

   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.

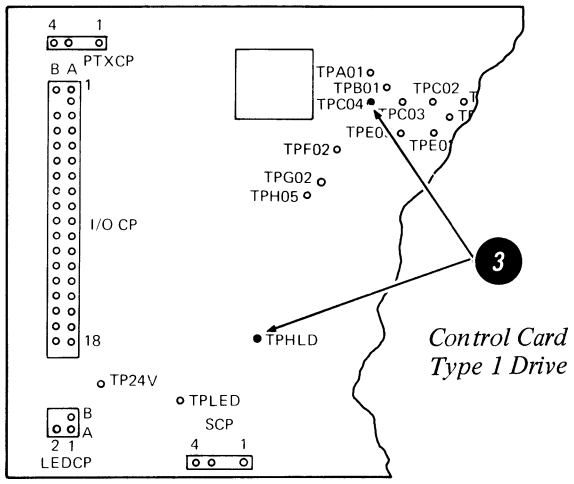




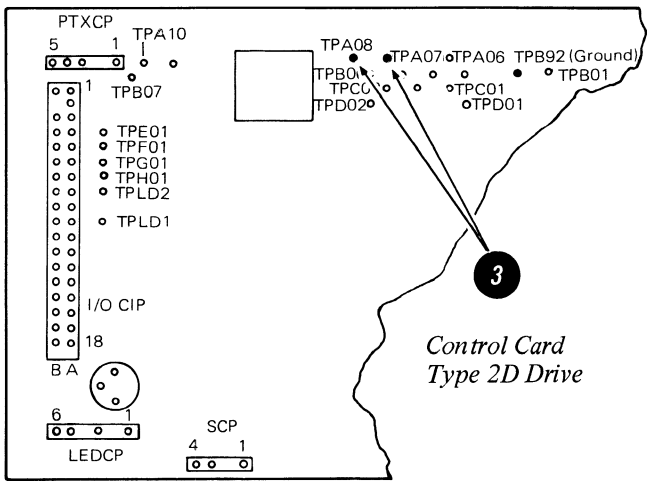
Head Load Solenoid De-activated

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

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



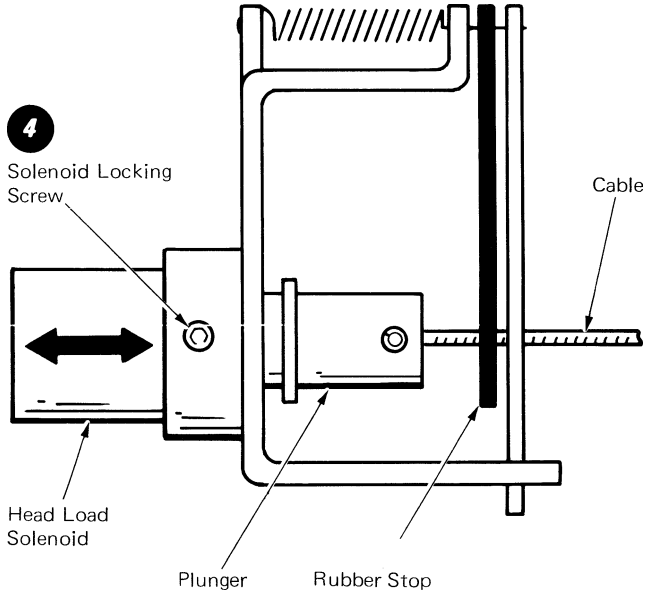
Control Card Type 1 Drive



Control Card Type 2D Drive

10. Loosen the solenoid locking screw. ❹

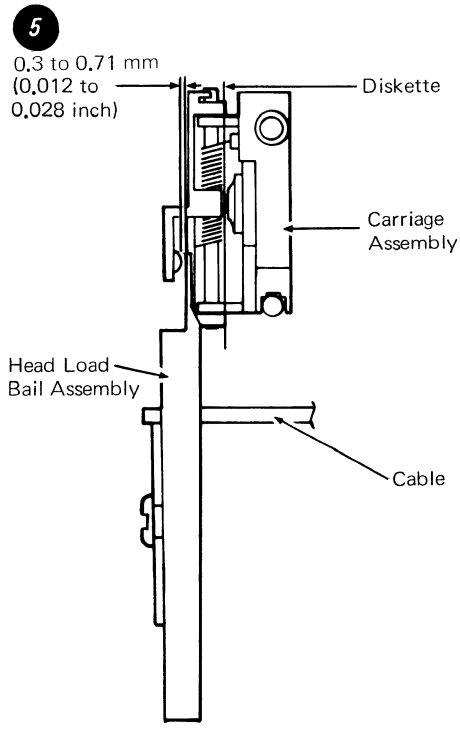
WARNING
Do not let the solenoid plunger and cable turn while making this adjustment.



11. Turn the solenoid in the mounting bracket to obtain 0.30 mm to 0.71 mm (0.012 to 0.028 inches) gap between the head load arm and the head load bail. Tighten the locking screw. Remove the jumper. ❺

12. Turn the system power off.

13. Reconnect Diskette Unit AC cable.



Head Load Solenoid Activated

Stepper Drive Band Adjustment

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for Ø ohms between the Diskette Unit base and the diskette drive.

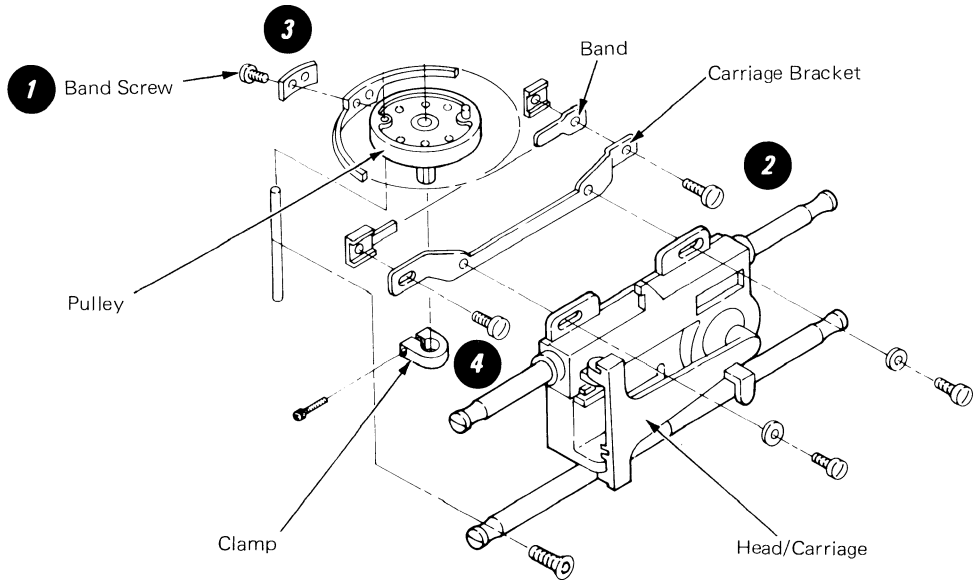
1. Turn the System Power Off.
2. Remove the Read/Write head cable connector and guide.
3. Place the head carriage at track 40 (timing holes in pulley and casting are aligned). Observe this condition visually.
4. Loosen the screws that attach the band to the pulley and the carriage bracket. ❶
5. Tighten the right hand carriage bracket screw ❷ and the band clamp screw ❸ keeping the band parallel to the edge of the pulley.
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 ± 10% grams (2.5 ± 10% pounds) of force, and tighten the left hand carriage bracket screw. This adjustment ensures the drive band tracks evenly and tightly over the stepper pulley. ❹
8. Carriage must move freely from track 00 to track 76.
9. Load the CE diskette and run the head alignment utility. The display will indicate correct or incorrect alignment.

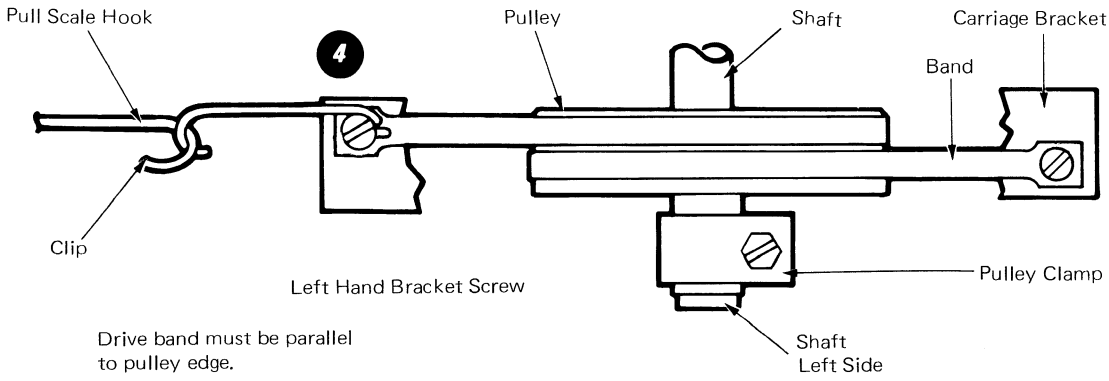
NOTE
Check the Head Carriage adjustment and adjust if necessary.

Head Carriage Adjustment

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for Ø ohms between the Diskette Unit base and the diskette drive.

1. Power on with the Dump button pressed to place the system in Resident Non-Automatic diagnostic. Select the diskette drive to be adjusted (Test D).
2. Load a diskette.





3. Execute test L to place the stepper motor at Phase O (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 ❶ and rotate the pulley to align the timing pin holes in the pulley and casting. ❷

6. Insert the timing pin into the timing pin holes and tighten the pulley keeping the band parallel to the pulley 2.03mm ± 0.25mm (0.08 ± 0.01 inches) from the casting. ❸

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: ❹ Attach a 0.508mm (0.02 inch) feeler gauge to the track 40 adjusting surface using the clip. ❺

10. Install the carriage pressure spring to hold the carriage against the feeler gauge ❻ Tighten the carriage bracket screws. ❹

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 CE diskette and run the alignment verification test.

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

NOTE
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.

- 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).

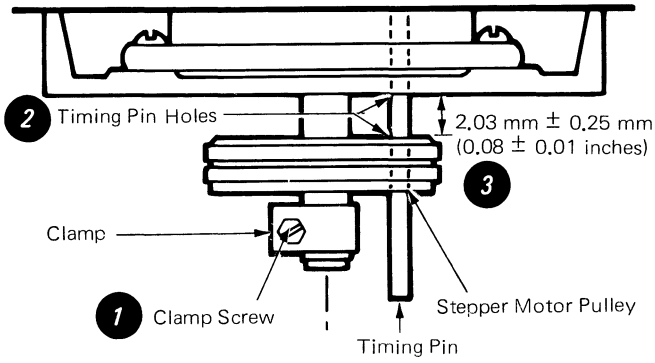
  For the type 2D drive, install a second jumper between TPA07 (ground) and TPA04 (motor control 0).

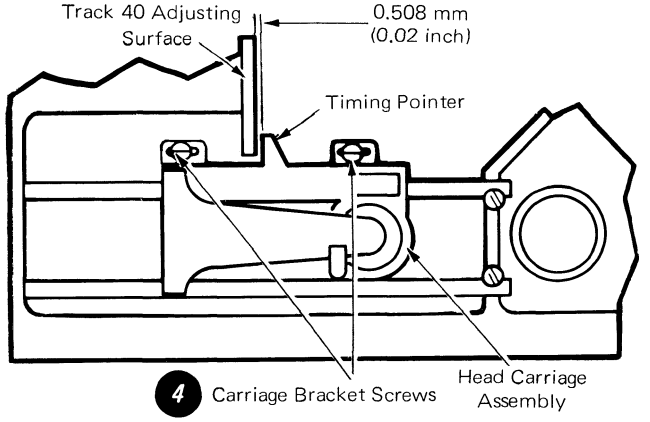
- For the type 1 drive, remove jumper end from TPH04 and install it on TPH01 (motor control 3). The carriage will move from track 40 to track 39.

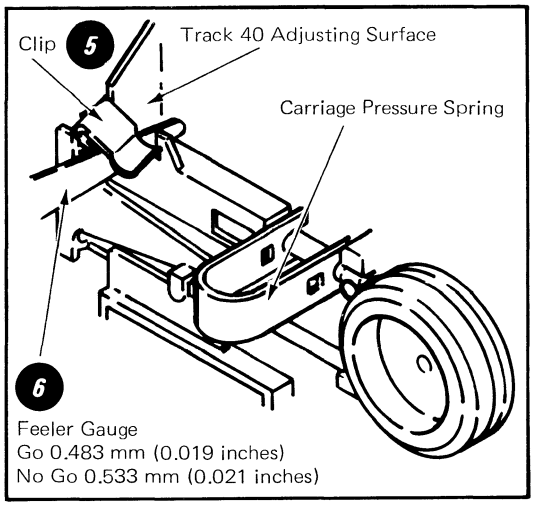
  For the type 2D drive, remove the jumper end from TPA04 and install it on TPA01 (motor control 3). The carriage will move from track 40 to track 39.

- 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.

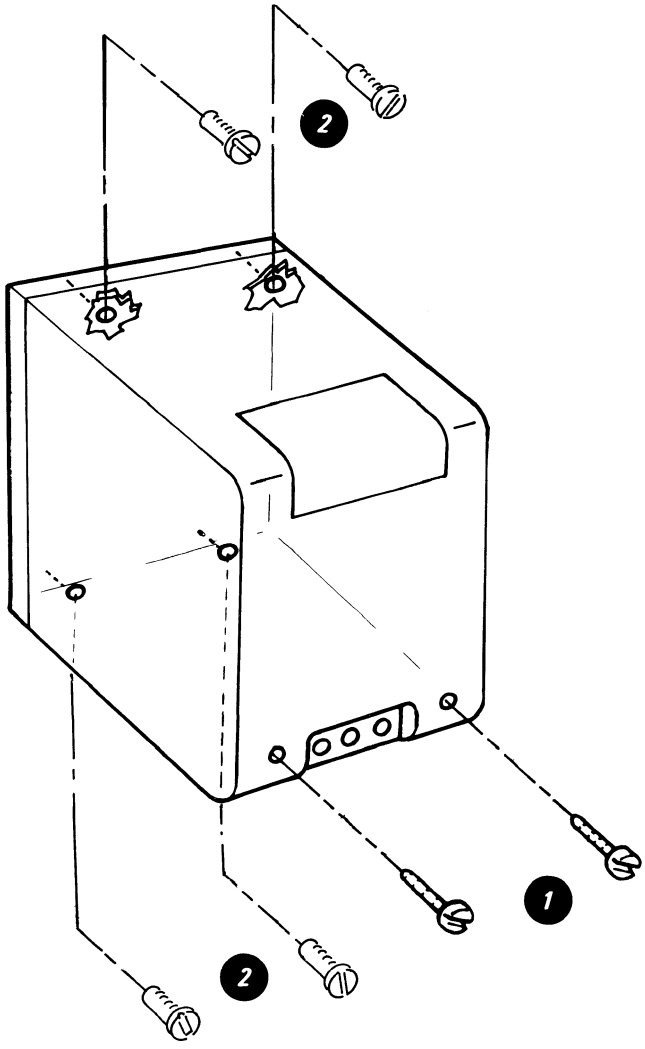






COVER REMOVAL

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

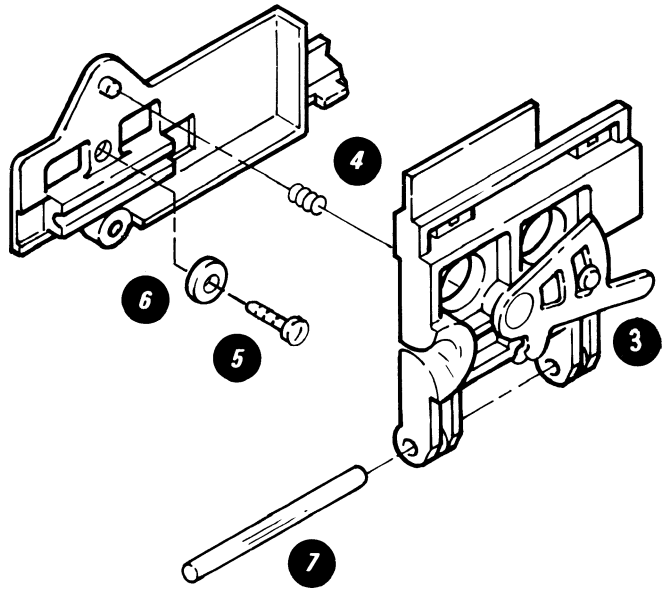


HEAD LOAD BAIL REMOVAL

1. Turn the system power off.
2. Close the diskette handle.
3. Disconnect the bail actuator cable from the bail cable stud. ❸
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 ❹ and loosen the bail retainer screw ❺ and pivot the bail retainer down. ❻
6. Remove the bail, bail return spring, and pivot rod. ❼



COLLET/FLAT SPRING REMOVAL

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

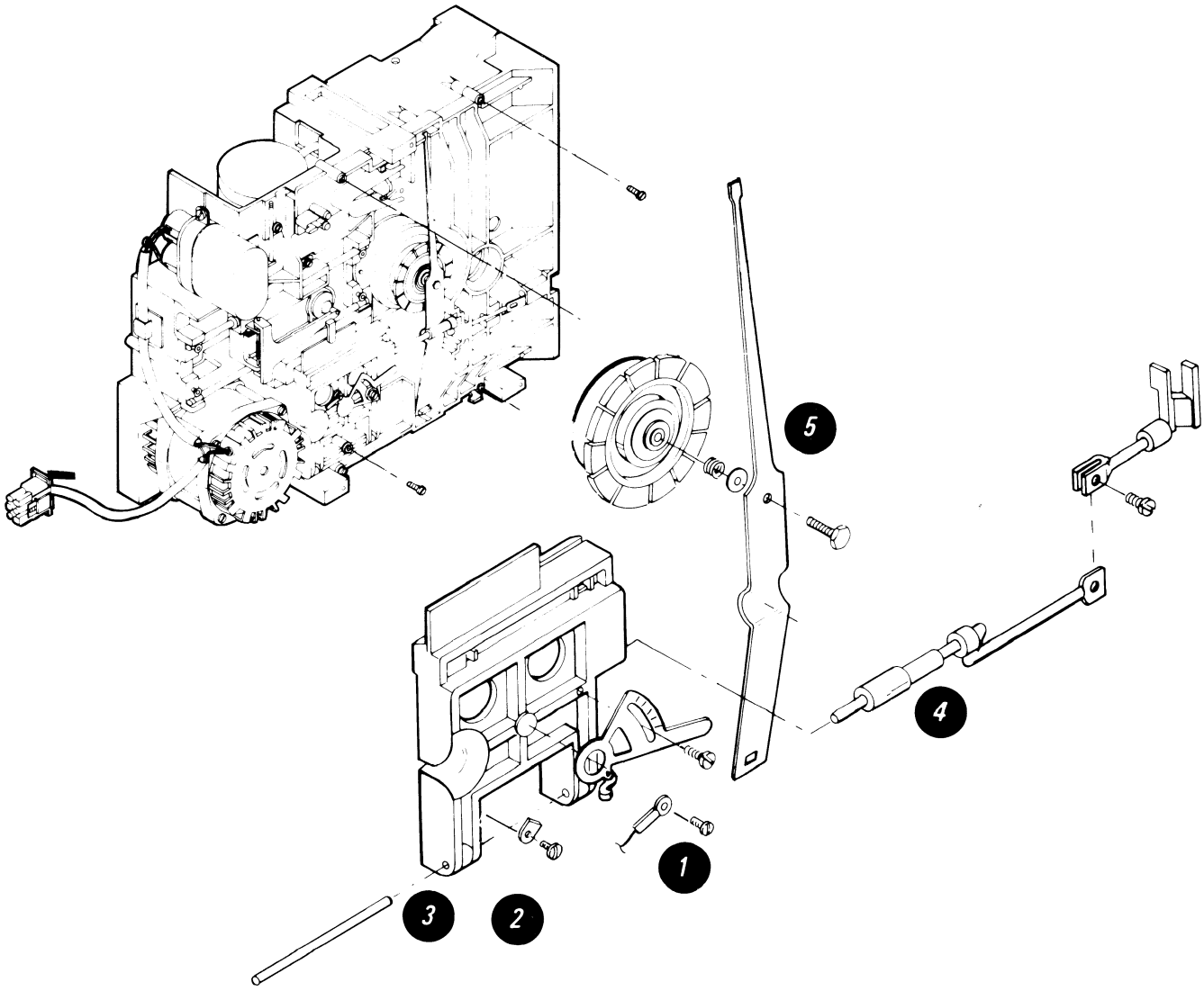
1. Turn the system power off.
2. Close the diskette handle.
3. Push the bail in slightly, and disconnect the bail actuator cable from the bail cable stud. ❶.
4. Open the diskette handle.

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

5. Remove the diskette handle. ❷
6. Observe the position of the bail return spring, and loosen the bail retainer screw. Pivot the retainer down. ❸
7. Remove the bail, the bail return spring, and the pivot rod.
8. Remove the collet actuator roll and the pressure roll. ❹
9. Turn the collet actuator rod up and out of the way.

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

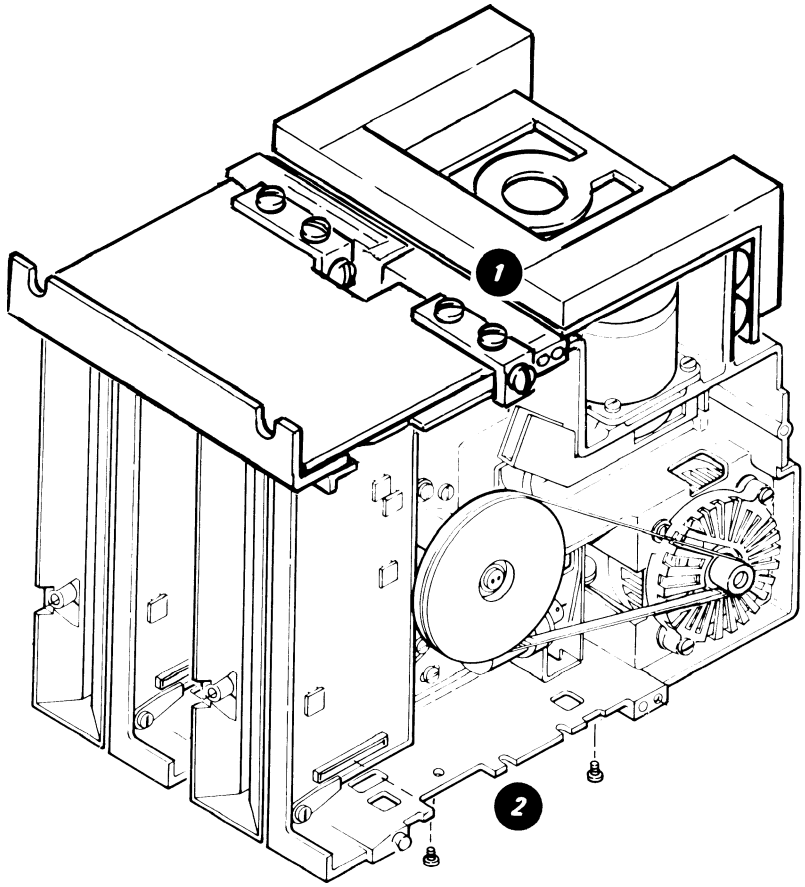
10. Remove the collet/flat spring assembly. ❺
11. Remove the collet actuator rod. ❻



RIGHT DISKETTE DRIVE REMOVAL

CAUTION: **When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for 0 ohms between the Diskette Unit base and 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 remove the bracket. ❶
5. Loosen the two screws that hold the drive mounting bracket. ❷
6. Slide the drive mounting bracket, and lift the drive up and out of the Diskette Unit.



HEAD LOAD ARM PAD

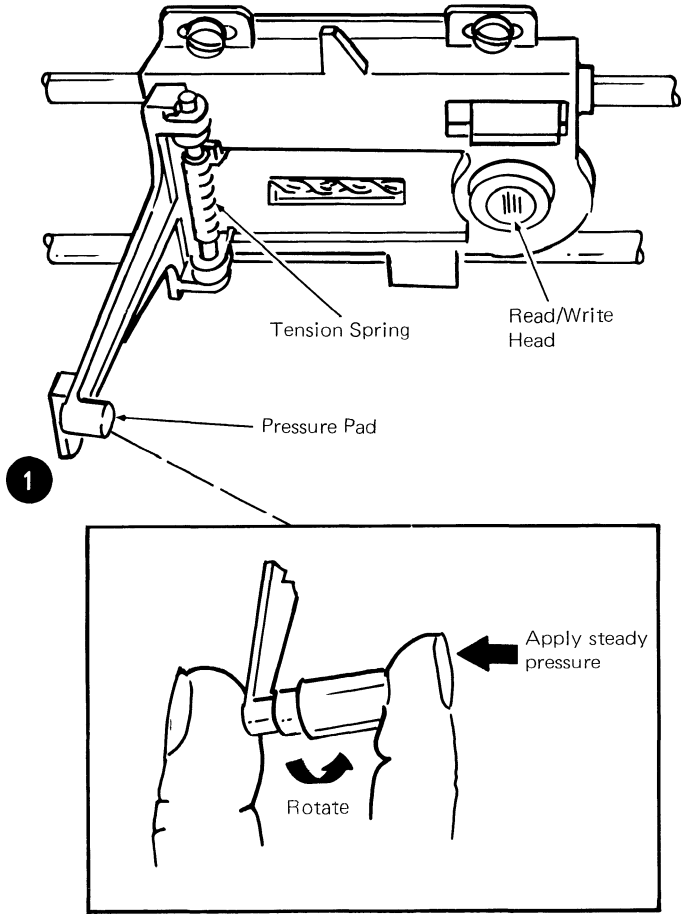
SERVICE WARNING

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. ❶
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.
9. Carefully restore the head load arm to its operating position.



DISKETTE GUIDE ASSEMBLY REMOVAL

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for Ø ohms between the Diskette Unit base and the diskette drive.

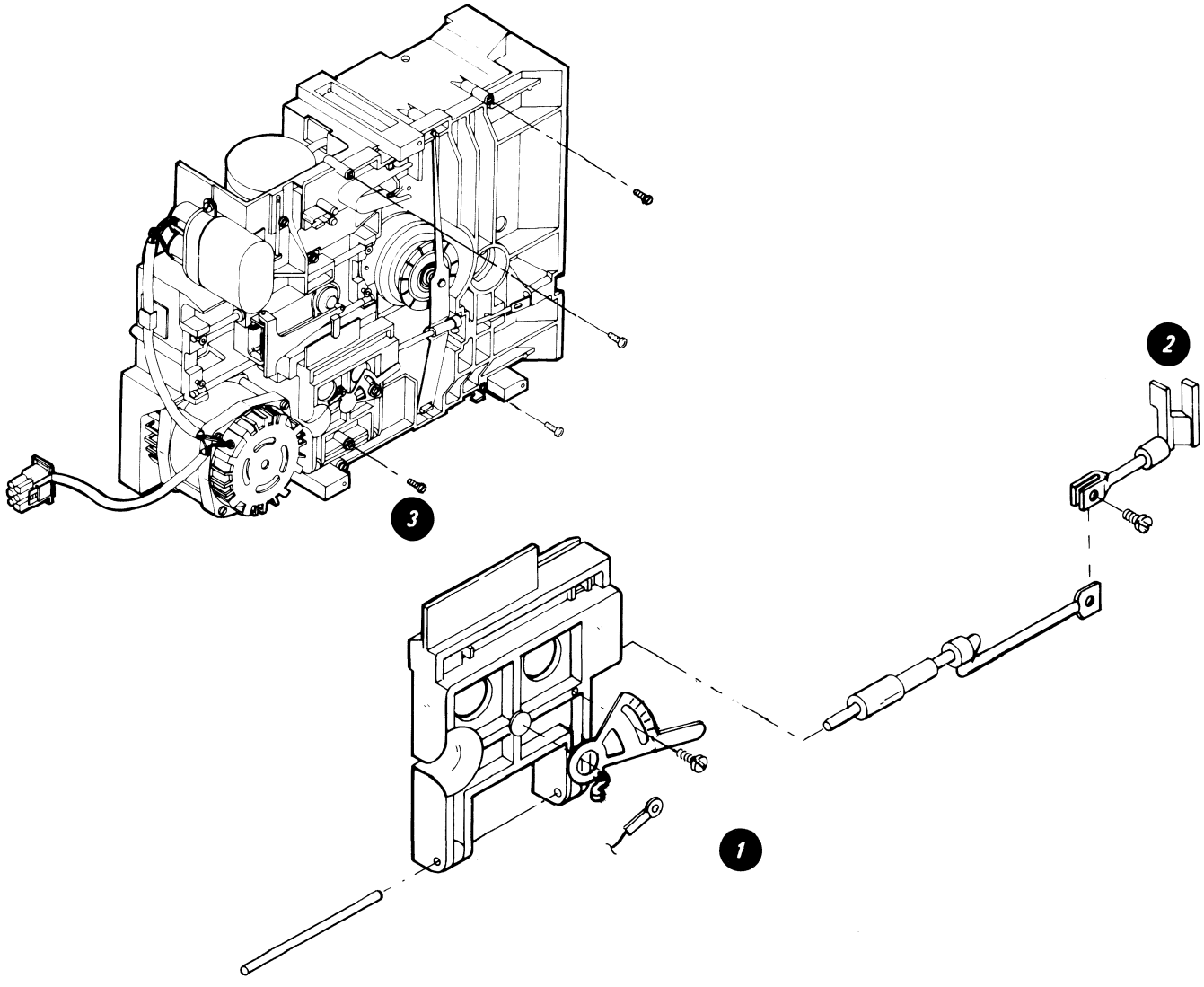
1. Turn the system power off.
2. Close the diskette handle.
3. Push the bail in slightly, and disconnect the bail actuator cable from the bail cable stud. ❶
4. Open the diskette handle.
5. Remove the diskette handle. ❷
6. Remove the LED cable from the file card.

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. ❸

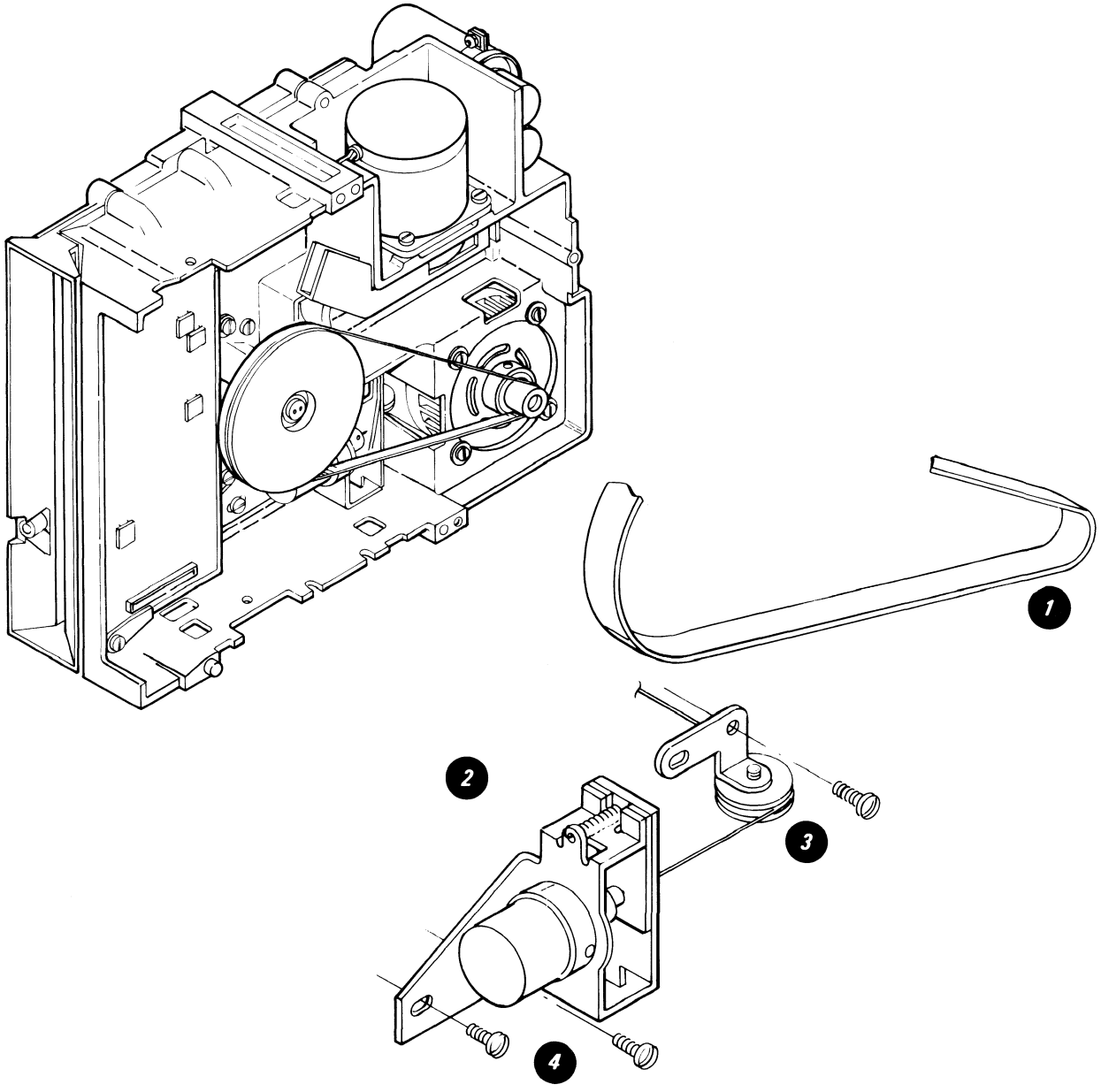
NOTE
After replacement, perform the following adjustments:

- Operator Handle Adjustment
- Solenoid and Bail Adjustment.



BAIL SOLENOID AND IDLER REMOVAL

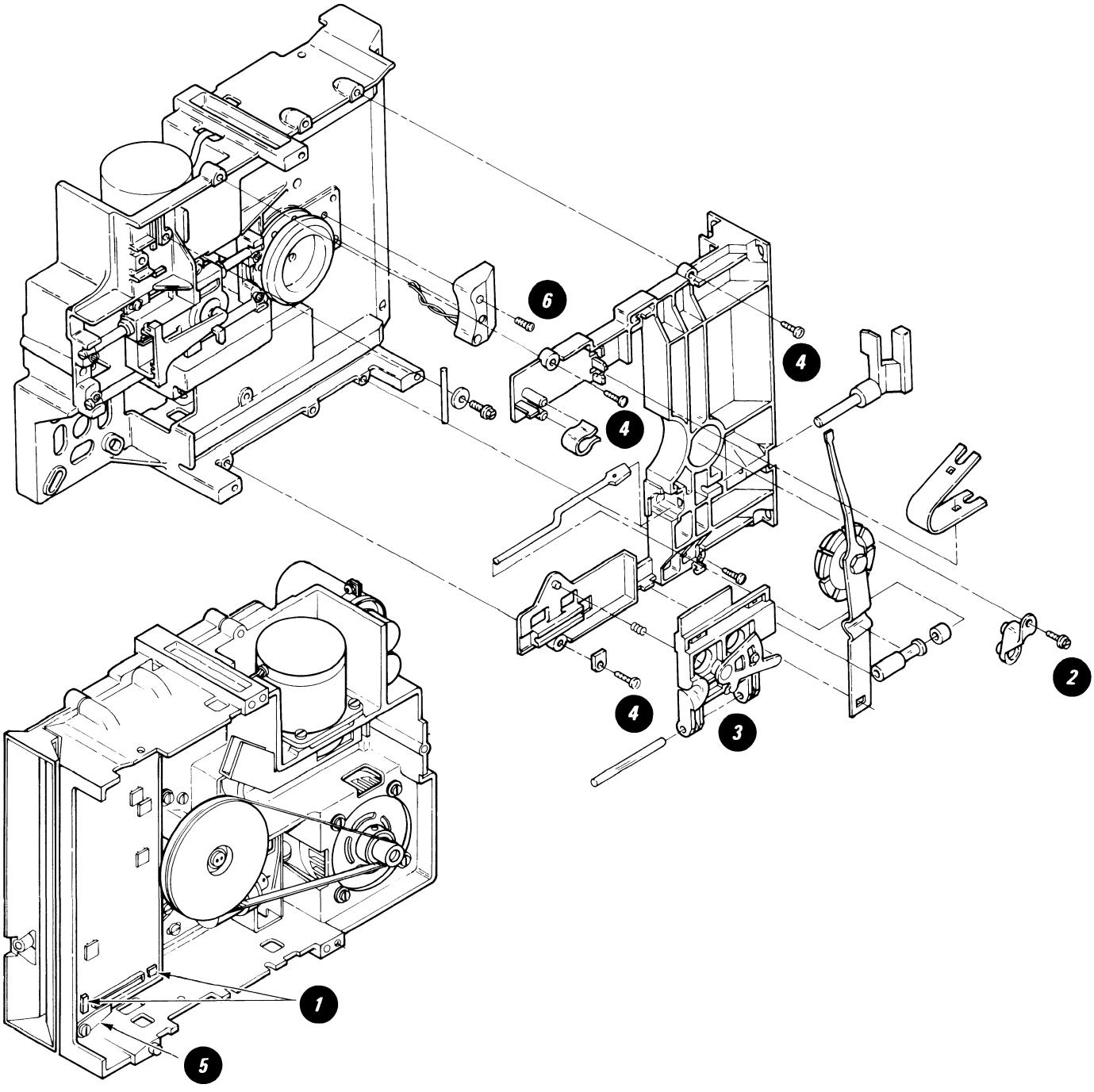
1. Turn the system power off.
2. Disconnect the bail actuator cable from bail cable stud.
3. Remove the solenoid cable connector from the file control card.
4. Remove the AC motor drive belt. ❶
5. Remove the solenoid, bracket and cable as a unit. ❷
6. Remove the idler. ❸
7. Loosen the solenoid locking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



LED AND PTX/FILE CONTROL CARD REMOVAL

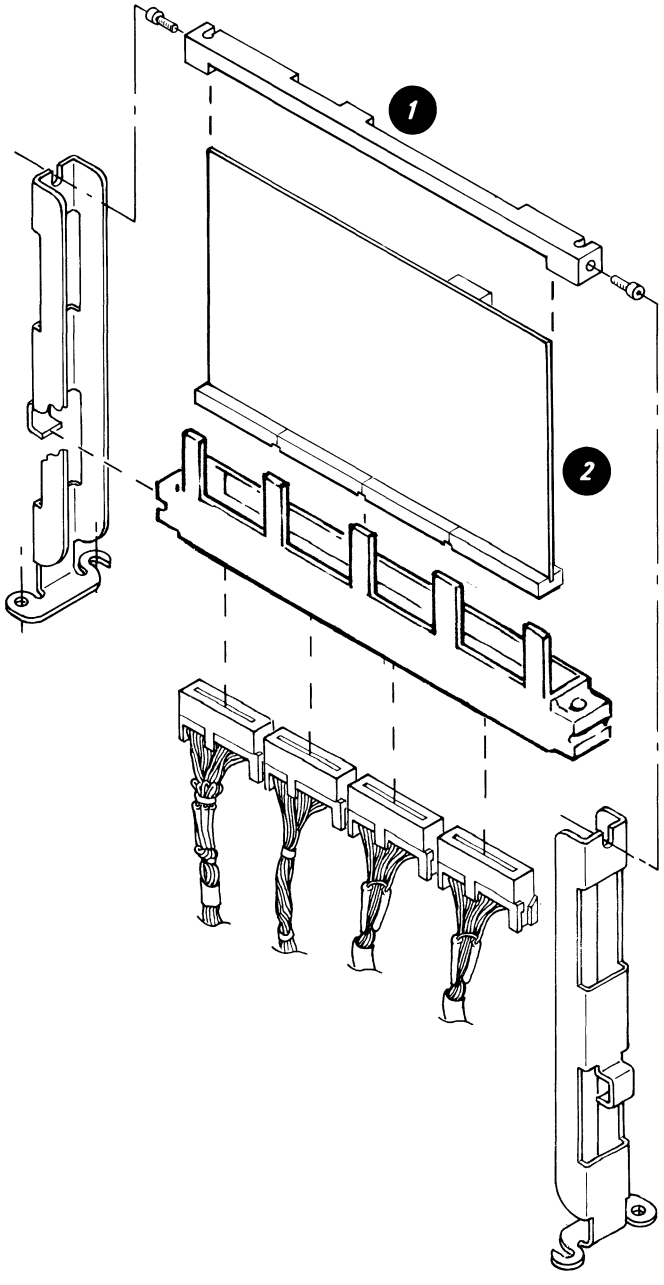
CAUTION: When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for 0 ohms between the Diskette Unit base and the diskette drive.

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



DISKETTE ADAPTER CARD REMOVAL

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



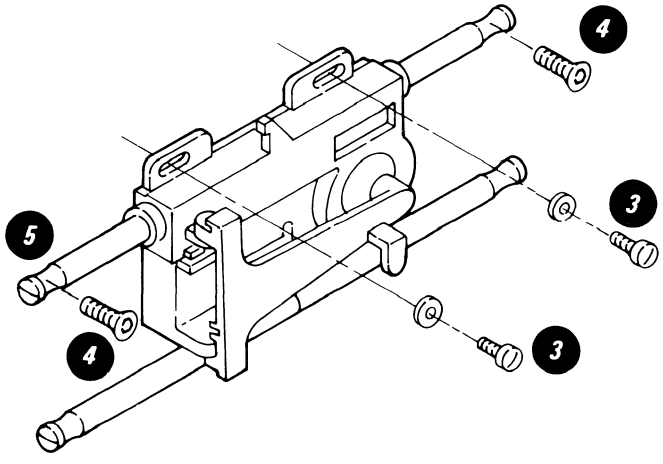
HEAD/CARRIAGE ASSEMBLY REMOVAL

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for ∅ 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 guard.

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

4. Remove the carriage bracket from the head carriage band. ❸
5. Loosen the two top guide rod screws ❹
6. Slide the top guide rod to the left and remove the head carriage assembly. ❺



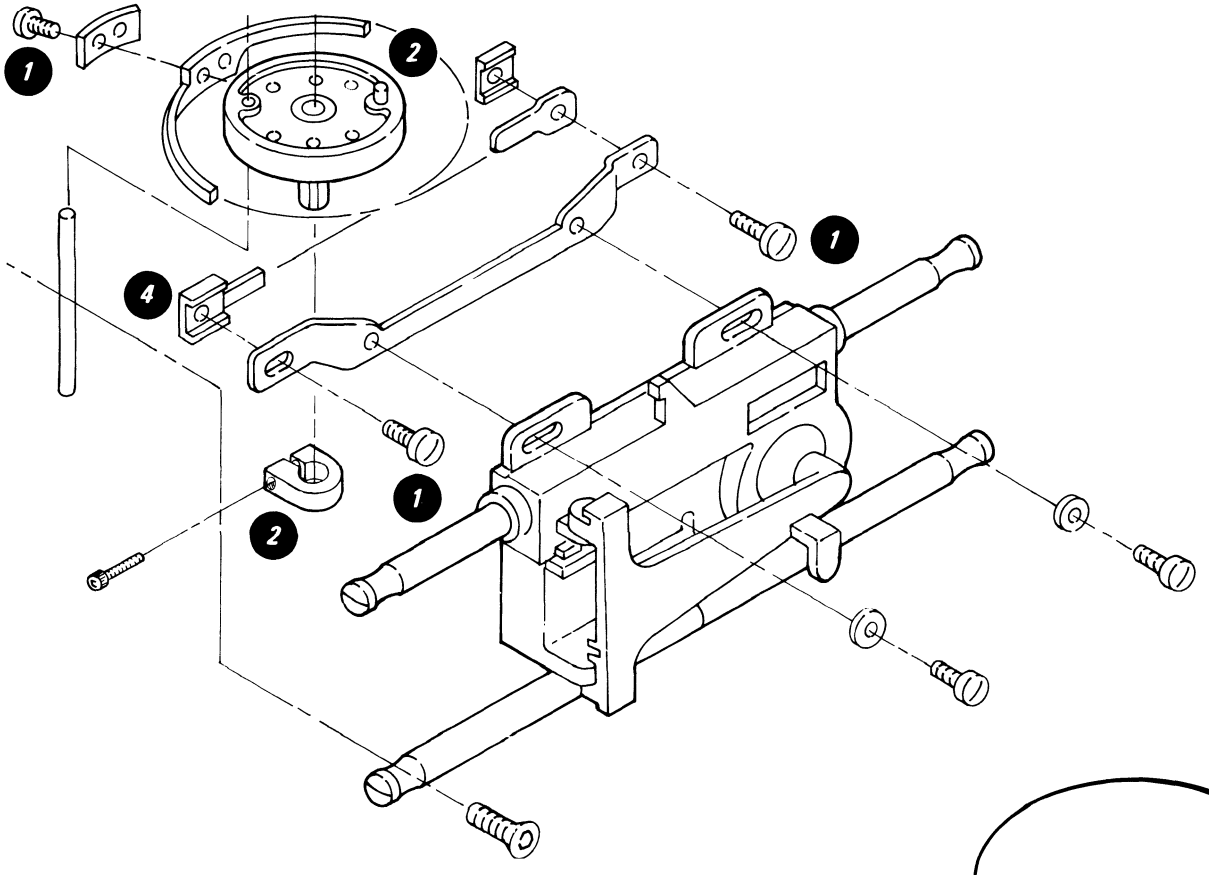
PULLEY AND DRIVE BAND REMOVAL

CAUTION
When a diskette drive is removed from its mounting, the ground through the AC connector must be verified. Verify the ground by checking for Ø 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).

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

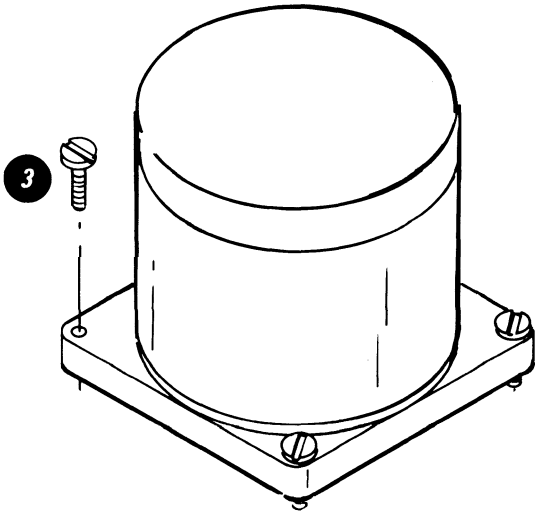


DRIVE BAND REPLACEMENT

1. Attach the end of the band with the welded adapter to the adjustable end of the carriage bracket. ❹ Leave the screw loose.
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). ❶
3. Attach the other end of the band to the carriage bracket. Ensure that the band is parallel to the carriage bracket. ❶
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. ❶
6. While holding the pulley ❷ and the timing pin, remove the four screws that mount the stepper motor. ❸

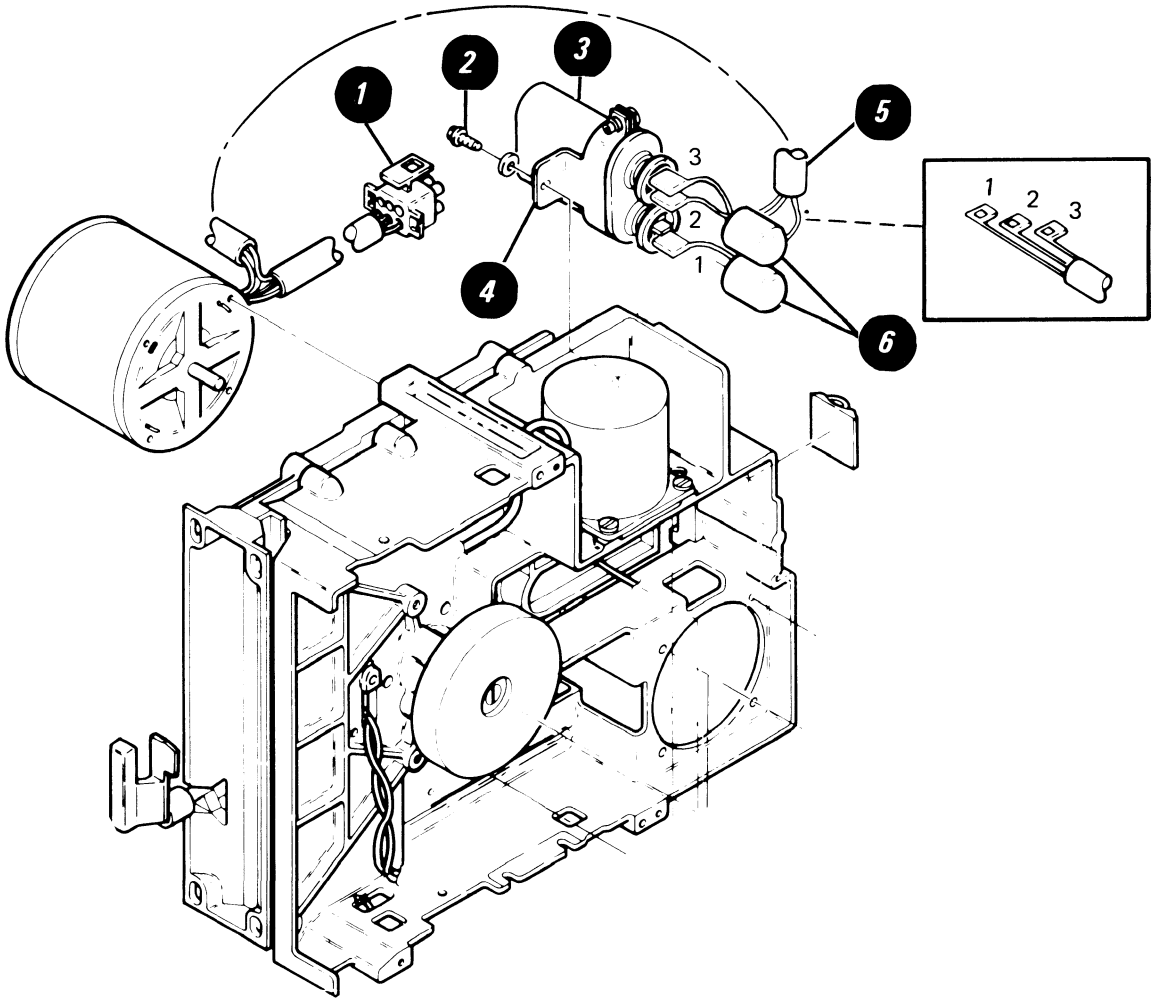


AC DRIVE MOTOR CAPACITOR REMOVAL

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. ❶

DANGER
High voltage may be present at the capacitor terminals.

6. Remove the two insulator caps ❻ from the capacitor terminals.
7. Discharge the capacitor ❸ by jumpering its terminals with the large-bladed screwdriver.
8. Remove the three motor leads ❺ from the capacitor terminals.
9. Remove the screw ❷ and remove the capacitor bracket assembly ❹



AC DRIVE MOTOR REMOVAL

1. Turn the system power

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. ❷
6. Remove the AC drive motor belt. ⓫

DANGER
The motor case becomes HOT after continuous use.

7. On all domestic machines or World Trade machines (before EC 841505), remove the two fan enclosure mounting screws ❾ and remove the fan enclosure ❹ . On World Trade machines with EC841505 and later, remove the two mounting screws ❾ and remove the AC drive motor. ❶
8. Loosen the setscrew ❻, then remove the AC drive motor pulley/fan assembly. ❼

DANGER
High voltage may be present at capacitor terminals.

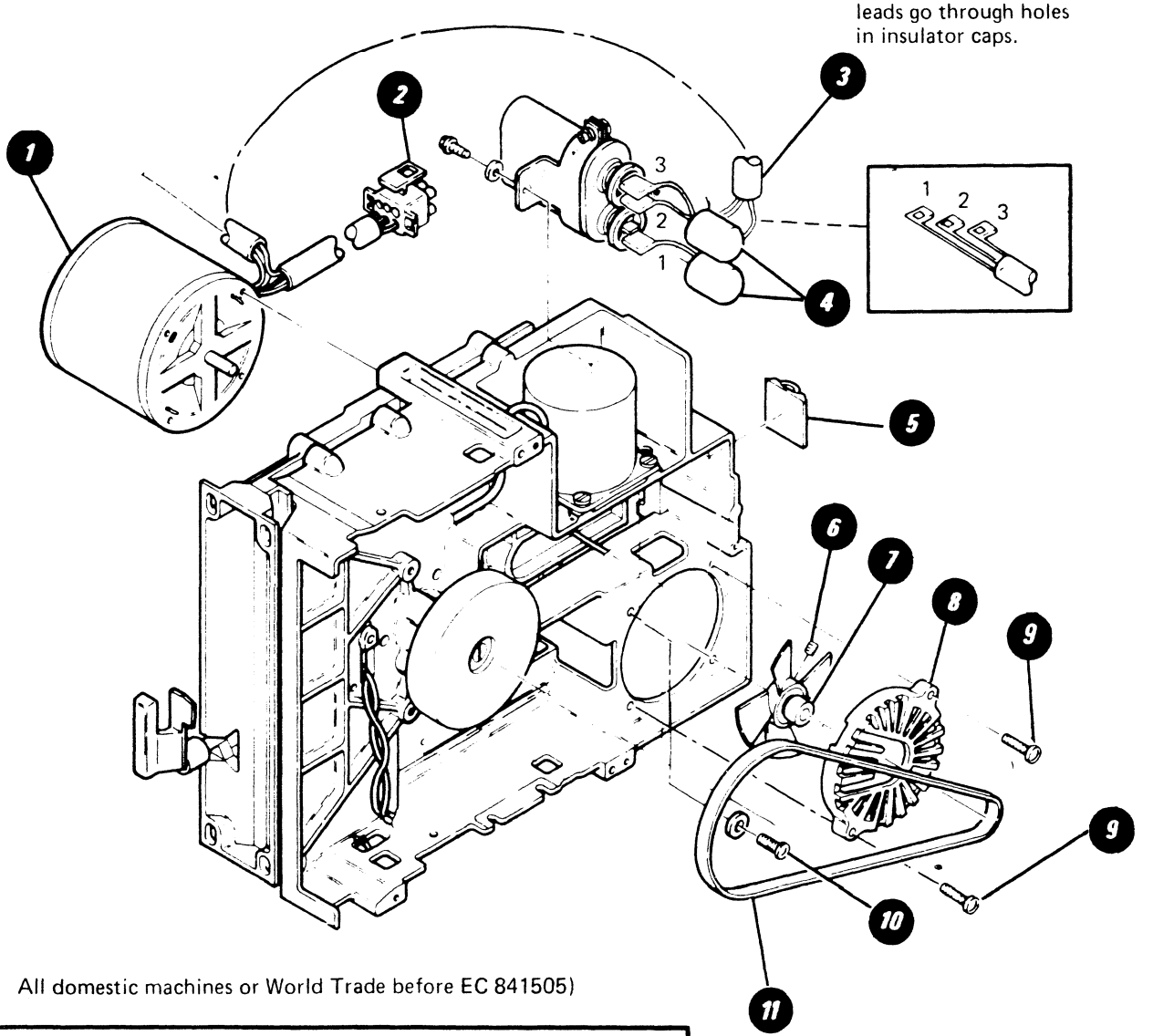
9. Remove the two insulator caps ❹ from the capacitor terminals.
10. Discharge the capacitor by jumpering its terminals with the large-bladed screwdriver.
11. Remove the AC drive motor leads ❸ from the capacitor terminals.
12. Remove the AC drive motor capacitor leads from the cable guide ❺ on the casting.
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 ⓬ and remove the AC drive motor ❶ . On World Trade machines with EC841505 and later, skip this step.

AC DRIVE MOTOR REPLACEMENT

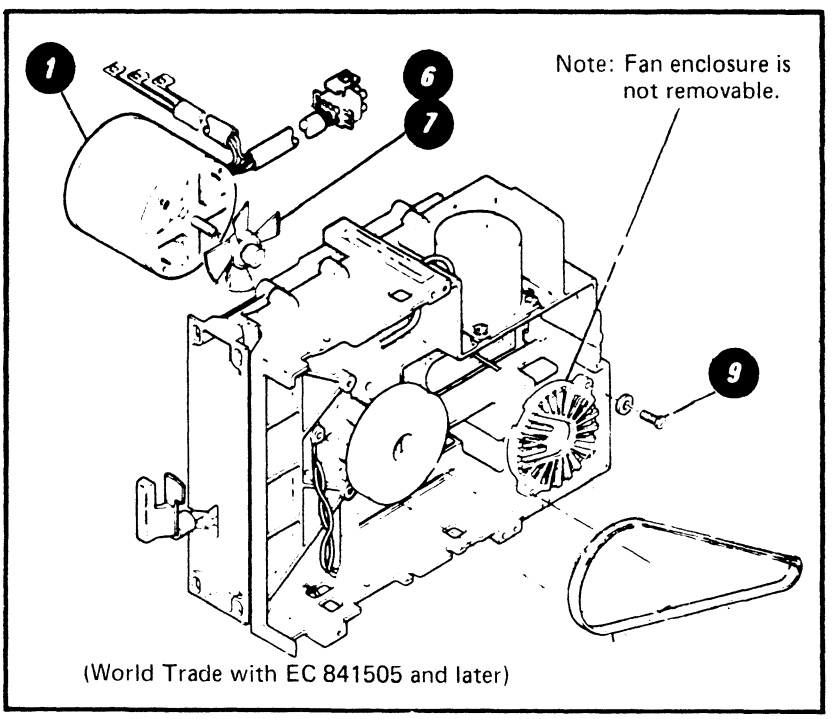
To reinstall the AC drive motor, observe the following exceptions and reverse the steps in the removal procedure.

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 ⓬ of 0.5 mm + 0.1 mm (0.020 inches + 0.004 inches) between the motor face and the fan hub.

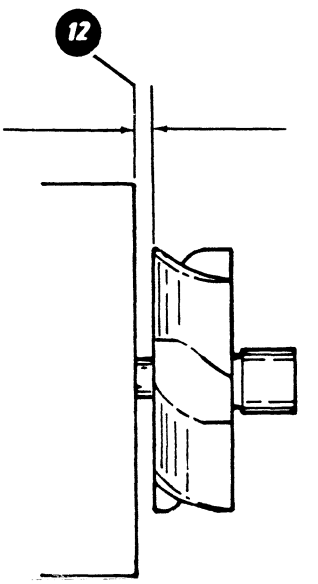
Note: Motor capacitor leads go through holes in insulator caps.



All domestic machines or World Trade before EC 841505)



(World Trade with EC 841505 and later)



CABLES/CONNECTORS/TEST POINTS

CONTENTS

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

When instructed by MAPs to measure a voltage:

- Refer to the Locator Chart (Figure 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 2) shows the hardware locations and can be used with the Hardware Locator Chart (Figure 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 a 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.

*Trademark of John Fluke Manufacturing, Inc.

ELECTRONICS MODULE

Connector/Card	Go To Figure
0 (Panel 1 - Printer)	9, 11
1 (Panel 1 - MCU)	9, 12
2 (Panel 1 - Display Modules)	9, 13, 14
3 (Panel 1 - Dump Switch)	9
4 (Panel 1 - Communications)	9, 12
5 (Panel 1 - Diskette Signal)	9, 14
6A (Panel 1 - Printer Sharing 1)	9, 17
6B (Panel 1 - Printer Sharing 2)	9, 17
7 (Panel 1 - Keyboard)	9, 18
8 (AC Output)	4
9 (AC Input)	4
10 (Diskette DC)	4, 14
11 (Communications)	4
12 (Large Display)	4
A1 (To Distribution Board)	6, 8
B1 (To Distribution Board)	6, 8
C1 (To Distribution Board)	6, 8
D1 (To Distribution Board)	6, 8
L1 (LED Board to P/S L1)	4, 10
P1 (To Power Supply)	4
P2 (To Power Supply)	4
S1 (To System Card)	5, 7
S2 (To System Card)	5, 7, 10
Communications Adapter Card	8
Display Adapter Card	8
Memory Card	8
Printer Sharing Card	8
System Card	8

DISKETTE UNIT

Connector/Card	Go To Figure
B1 (To Diskette Adapter Card)	19, 20
B2 (To Diskette Adapter Card)	19, 20
B3 (To Diskette Adapter Card)	19, 20
B4 (To Diskette Adapter Card)	19, 20
AC Fan Connector	19
Diskette AC Connector	4, 19
Diskette DC Connector (To 10)	4, 19, 20
Diskette Adapter Card	19
Diskette Signal Connector (To 5)	9, 19, 20
File Control Card	19, 21
File Control Card Connector	19, 20
Stepper Motor Connector	21

LARGE DISPLAY MODULE

Connector/Card	Go To Figure
2 (Panel 1 - Large Display Module)	14, 15, 9
J1 (Display Cable Connector)	15, 17
J4 (Display Cable Connector)	15, 17
J501 (Video Input Cable)	15, 18
LV1 (Low Voltage Power Supply Cable)	16
LV2 (Low Voltage Power Supply Cable)	16
LV3 (Low Voltage Power Supply Cable)	16
Analog Card Connector Strip	17
J2 (Display Cable Connector)	17
J3 (Display Cable Connector)	17
CRT Socket	17
J301 (Deflection Output Cable)	18
J302 (Deflection Indicator Cable)	18
J502 (Video Output Cable)	18

KEYBOARD MODULE

Connector/Card	Go To Figure
30-Pin Connector For Pad Card	23
Keyboard Cable Connector (To 7)	23
Keyboard Logic Card	23
Keyboard Logic Card Connector	23
Pad Card	23
Speaker Connector	23

MISCELLANEOUS PARTS

	Go To Figure
Connector Strip (Diskette)	19
Distribution Board Assembly	6, 8
Fuse (7 Amp)	4
Keyboard Jumpers	23
LED Board	10
On/Off Switch	5, 9, 11, 12, 13, 22
Ring Terminal (Frame Ground)	4, 7
Stiffener	6

Figure 1 – Locator Chart

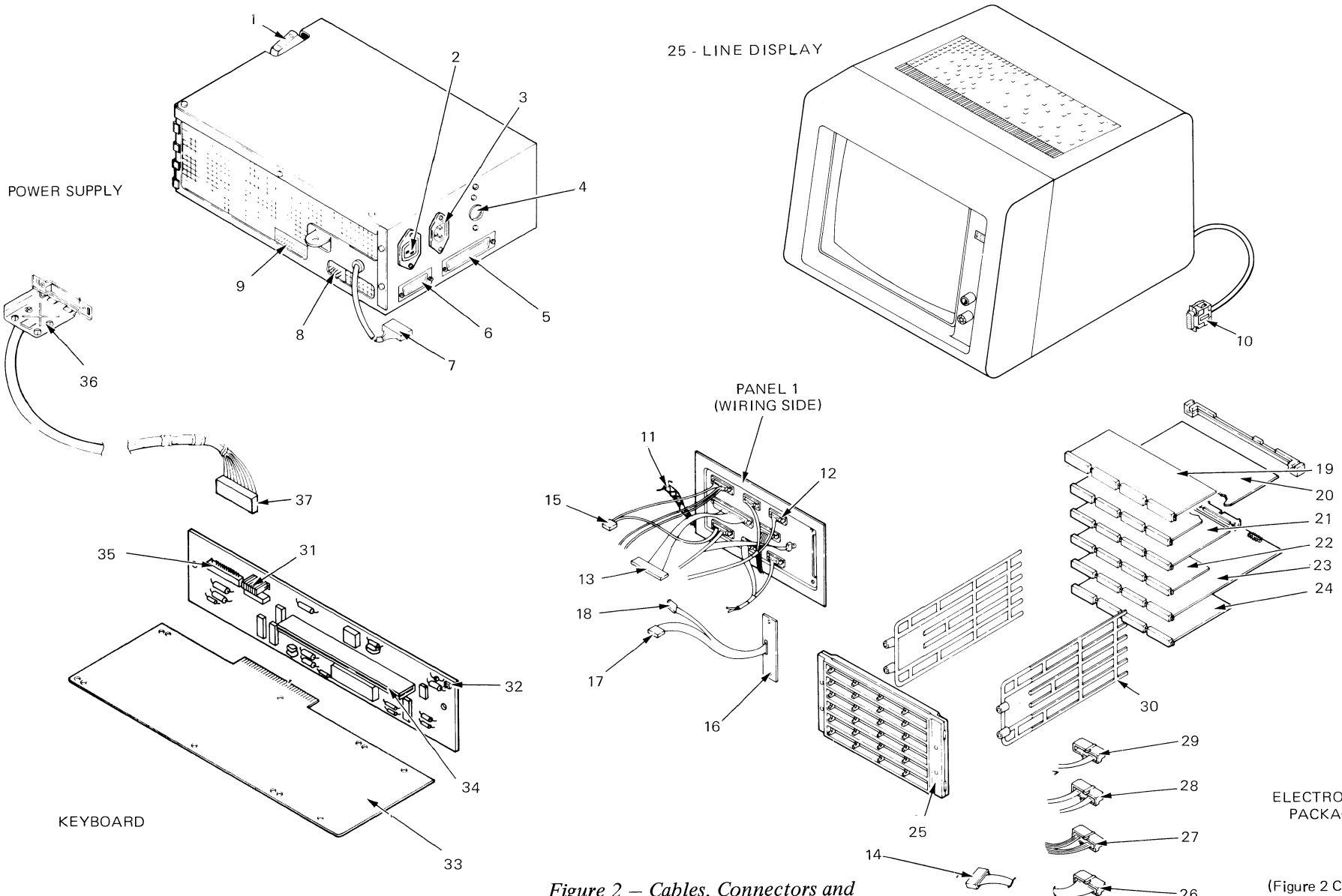


Figure 2 – Cables, Connectors and Test Points Locators

(Figure 2 Continued On Next Page)

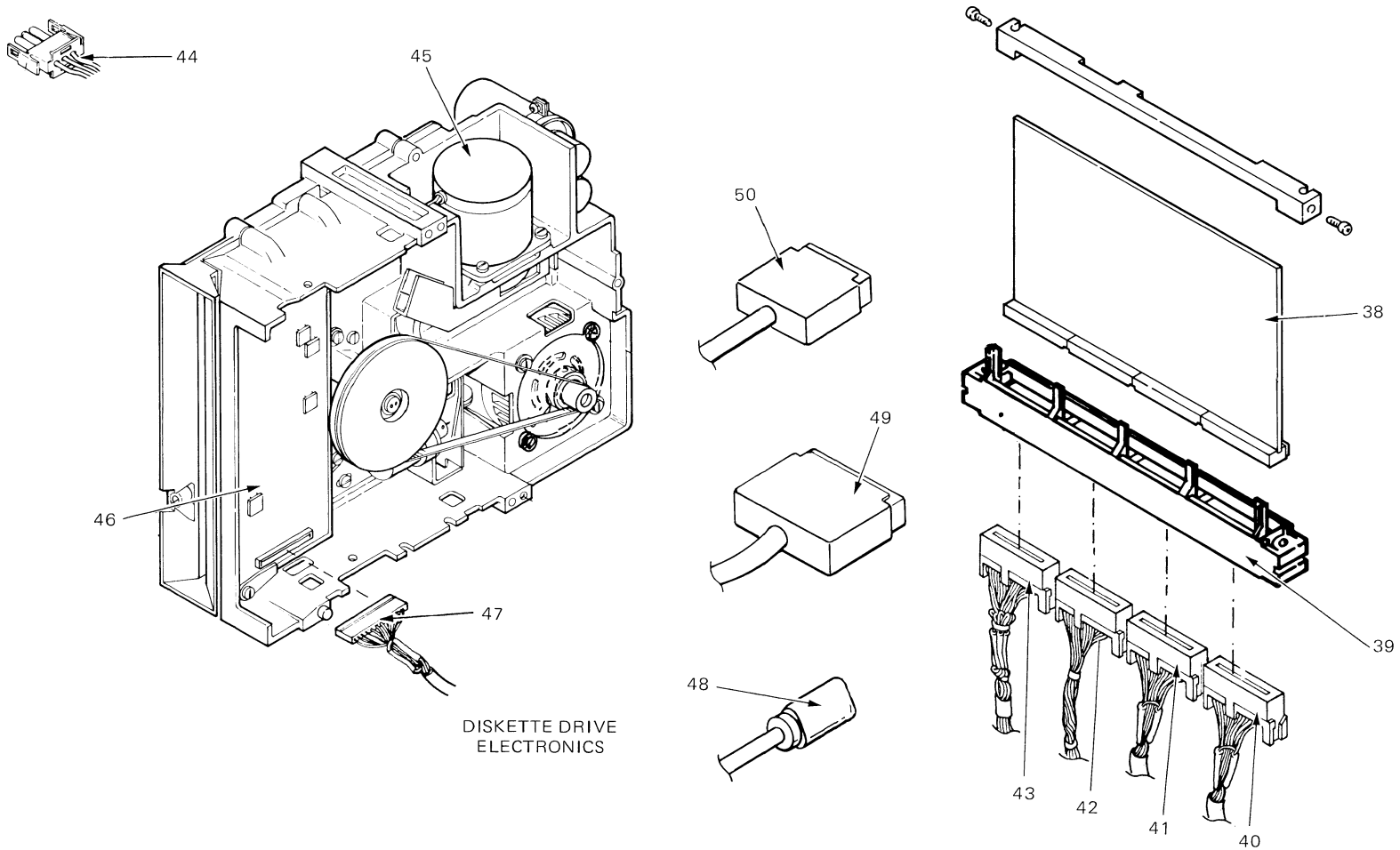


Figure 2 – Cables, Connectors and Test Points Locators (Continued)

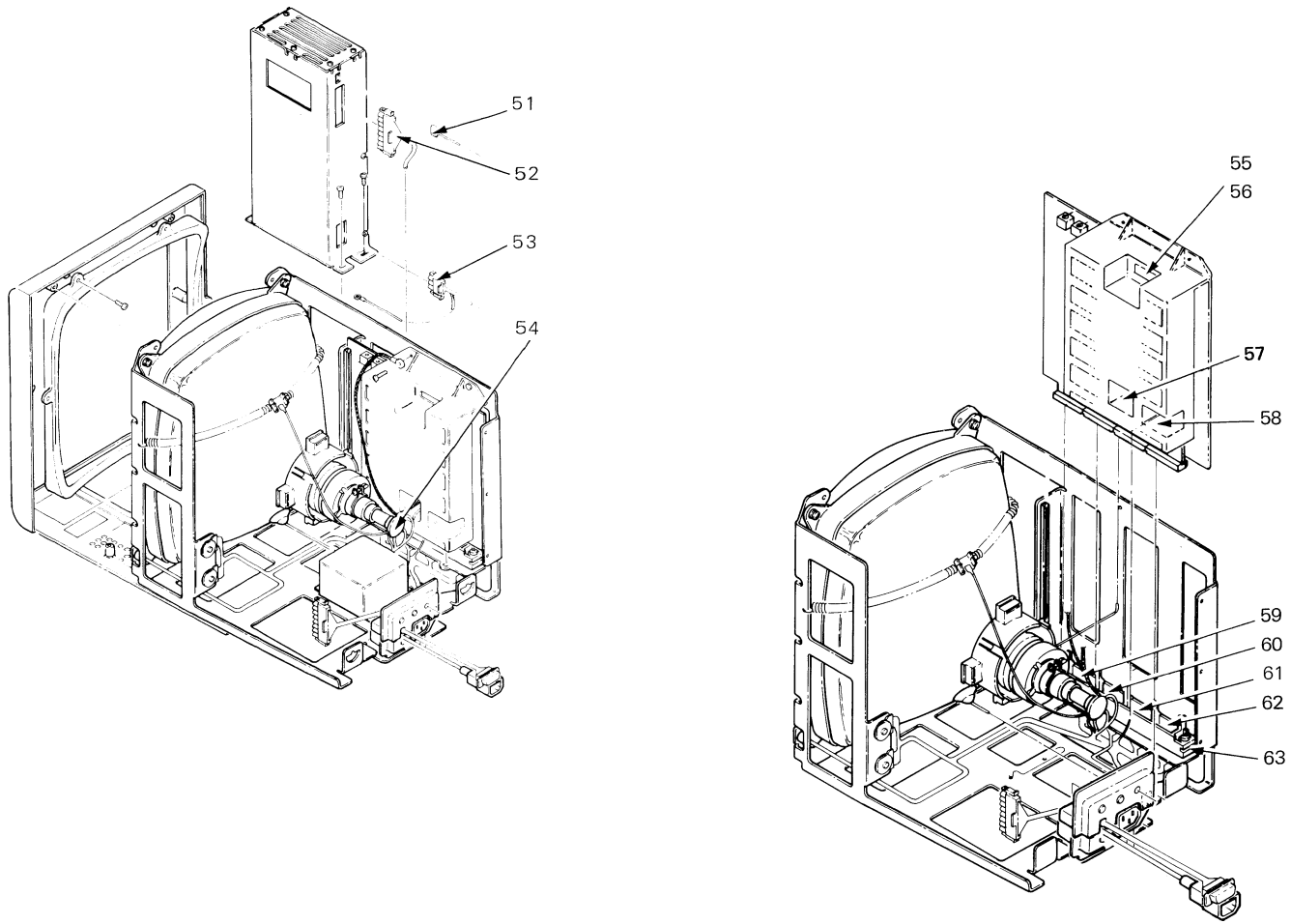


Figure 2 - Large Display Cables, Connectors and Test Points Locators (continued)

No.	Name	Go To Figure
1	On/Off Switch	4
2	Connector 8 or Connector 12 (AC Output)	4, 19
3	Connector 9 (AC Input)	4
4	Fuse	4
5	Connector 11 (Communications)	4
6	Connector 10 (Diskette DC)	4, 19
7	Connector L1 (P/S To LED Board L1)	4, 10
8	Connector P2 (Power Supply)	4
9	Connector P1 (Power Supply)	4
10	Connector 2 (Display Modules)	9, 13, 14
11	Ring Terminal (Frame Ground)	4
12	Panel 1 (Electronics Module)	5, 9, 11 12, 13, 22
13	Connector S1 (To System Card)	5, 7
14	Connector P1 (To Power Supply)	4
15	Connector P2 (To Power Supply)	4
16	LED Board	10
17	Connector S2 (To System Card)	5, 7, 10
18	Connector L1 (LED Board to P/S L1)	4, 10
19	Memory Extender Card	8
20	Memory Card	8
21	Display Adapter Card	8
22	Printer Sharing Card	8
23	System Card	8
24	Communications Adapter Card	8
25	Distribution Board Assembly	6, 8
26	Connector A1 (To Distribution Board)	6, 8
27	Connector B1 (To Distribution Board)	6, 8
28	Connector C1 (To Distribution Board)	6, 8
29	Connector D1 (To Distribution Board)	6, 8
30	Stiffener	6
31	Keyboard ID Jumpers	23

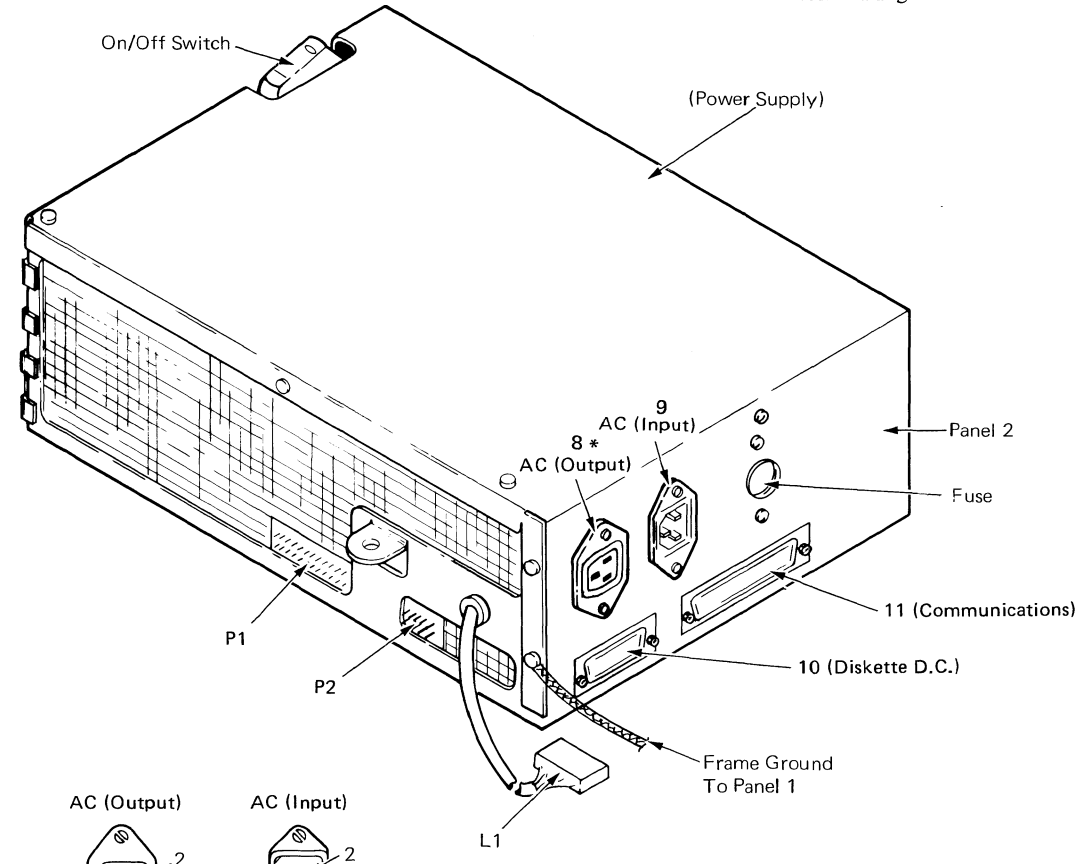
No.	Name	Go To Figure
32	Speaker Connector	23
33	Pad Card	23
34	30-Pin Connector For Pad Card	23
35	Keyboard Logic Card	23
36	Keyboard Cable Connector (To 7)	23
37	Logic Card Connector	23
38	Diskette Adapter Card	19
39	Connector Strip (Diskette)	19
40	Connector B4 (To Diskette Adapter Card)	19, 20
41	Connector B3 (To Diskette Adapter Card)	19, 20
42	Connector B2 (To Diskette Adapter Card)	19, 20
43	Connector B1 (To Diskette Adpater Card)	19, 20
44	AC Fan Connector	19
45	Stepper Motor Connector	21
46	File Control Card	19, 21
47	File Control Card Connector	19, 20
48	Diskette AC Connector (To 8)	4, 19
49	Diskette Signal Connector (To 5)	9, 19, 20
50	Diskette DC Connector (To 10)	4, 19, 20
51	LV1 (Low Voltage Power Supply Cable)	16
52	LV2 (Low Voltage Power Supply Cable)	16
53	LV3 (Low Voltage Power Supply Cable)	16
54	CRT Socket	17
55	J301 (Deflection Output Cable)	18
56	J302 (Deflection Indicator Cable)	18
57	J502 (Video Output Cable)	18
58	J501 (Video Input Cable)	18
59	J4 (Display Cable Connector)	15, 18
60	J3 (Display Cable Connector)	15, 17
61	J2 (Display Cable Connector)	17
62	J1 (Display Cable Connector)	15, 17
63	Analog Card Connector Strip	17

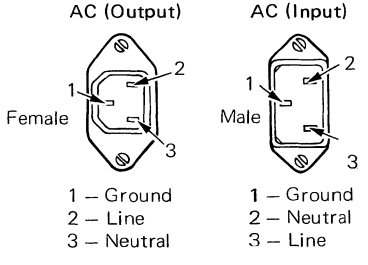
Figure 3 – Hardware Locator Chart

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.

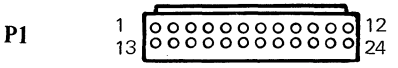
NOTE: All connectors shown from wiring side.





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

Figure 4 – Power Supply, Connector Pin Locations



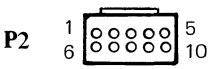
P 1 (SYSTEM POWER CABLE)

Pin No.	Termination Conn. 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

(Continued on next page)

L 1 (LED ASSEMBLY CABLE)

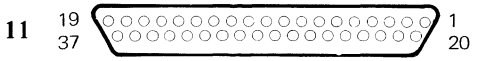
Pin No.	Termination LED Board	Identification
1	7	LED C (Thermal)
2	8	LED B (Over Current)
3	9	LED A (Over/Under Voltage)
4 (Key)	–	Not Used
5	10	+16.0 VDC



P 2 (INTERNAL DISTRIBUTION CABLE)

Pin No.	Termination Conn. 2	7	Identification
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

Figure 4 – Power Supply, Connector Pin Locations (Continued)



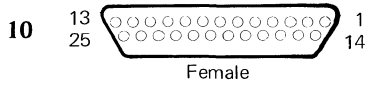
Female

11 (COMMUNICATIONS D.C. CABLE)

Pin No.	Termination Conn. Communications	Identification
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

NOTE: All connectors shown from wiring side.

(Continued on next page)



10 (DISKETTE DC CABLE)

Pin No.	Termination Conn. B 2	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 4 - Power Supply, Connector Pin Locations (Continued)

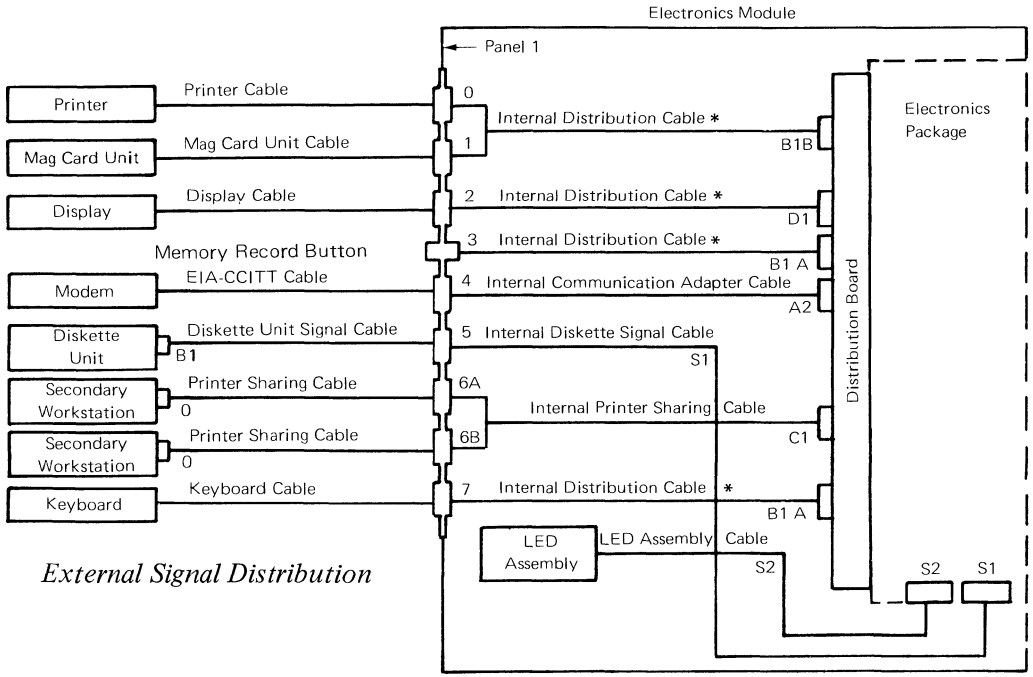
ELECTRONICS MODULE

The System Electronics Package consists of a distribution board and five plugable cards: the communications card, the system card, the memory card, the display adapter card, and an optional 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 male connectors.

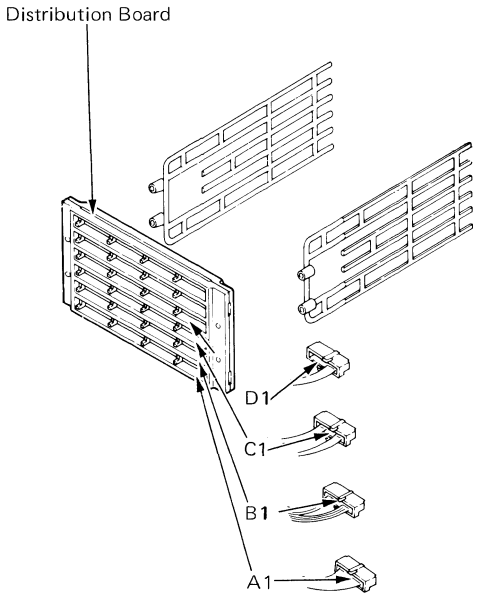
NOTE: All connectors shown from wiring side.



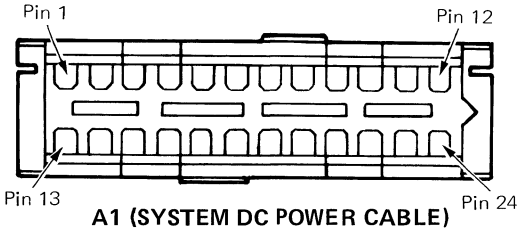
External Signal Distribution

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

Figure 5 — Signal Distribution Schematic



NOTE: All connectors shown from wiring side.

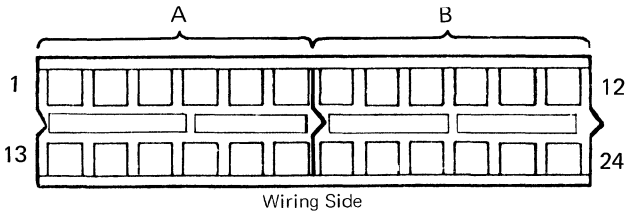


A1 (SYSTEM DC POWER CABLE)

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

Figure 6 – Distribution Board Connectors

(Continued on next page)



B 1 (INTERNAL DISTRIBUTION CABLE)

Pin No.	Termination Conn. 1	7	0	Identification
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

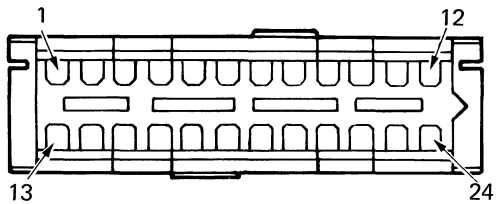
NOTE: All connectors shown from wiring side

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)

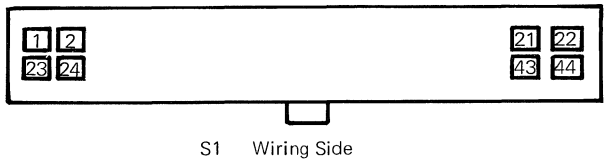
Pin No.	Termination Conn. 6A	6B	Identification
1	–	–	–
2	–	–	–
3	–	–	–
4	–	–	–
5	–	–	–
6	–	–	–
7	9	–	Data Set Ready
8	3	–	Receive Low
9	4	–	Receive High
10	1	–	Transmit Low
11	–	–	–
12	2	–	Transmit High
13	–	–	–
14	–	–	–
15	–	–	–
16	–	–	–
17	–	–	–
18	–	–	–
19	–	9	Data Set Ready
20	–	–	–
21	–	3	Receive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

Figure 6 – Distribution Board Connectors (Continued)



D 1 (INTERNAL DISPLAY CABLE CONNECTOR)

Pin No.	Termination Conn. 2	Identification
1	10	Video
2	11	Brightness
3	12	Vertical
4	13	Horizontal Drive
5	–	–
6	15	Signal Ground
7	–	–
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	–	–
16	–	–
17	–	–
18	–	–
19	–	–
20	–	–
21	–	–
22	–	–
23	–	–
24	–	–



S1 Wiring Side

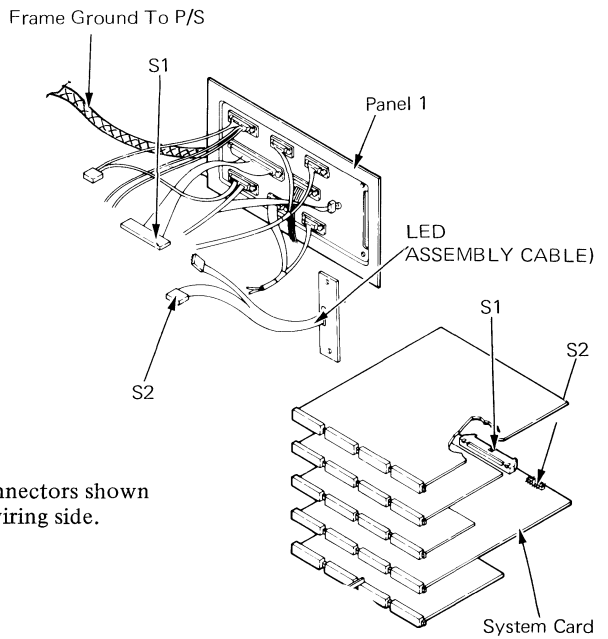
S 1 (INTERNAL DISKETTE SIGNAL CABLE)

Pin No.	Termination Conn. 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	–	–

Wiring Side

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

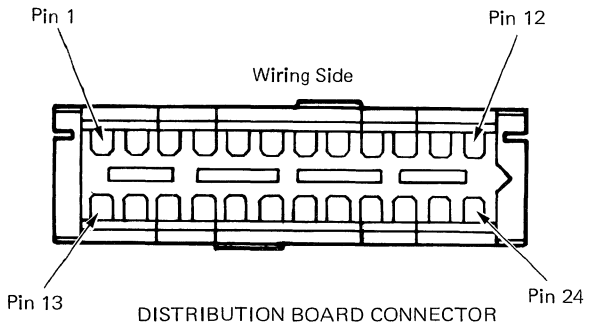


NOTE: All connectors shown from wiring side.

Figure 7 – System Card Connectors

F4	F3	F2	F1
E4	E3	E2	E1
D4	D3	D2	D1
C4	C3	C2	C1
B4	B3	B2	B1
A4	A3	A2	**A1**

Memory Extender Card (Position F
Memory Card (Position E)
Display Adapter Card (Position D)
Printer Sharing Card (Position C)
System Card (Position B)
Communications Card (Position A)



DISTRIBUTION BOARD CONNECTOR

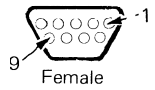
NOTE: All connectors shown from wiring side.

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**	

Pin	Voltage	Pin	Voltage
3	Ground	13	-5 VDC
4	Ground	15	+8.5 VDC
5	Ground	16	Ground
6	Ground	17	Ground
8	-12 VDC	18	Ground
9	+5 VDC	20	+12 VDC
10	+5 VDC	22	+5 VDC
11	+5 VDC	23	+5 VDC
12	+5 VDC	24	+5 VDC

Figure 8 – Distribution Board – Pin, Test Point and Card Locator

NOTE: All connectors shown from wiring side.



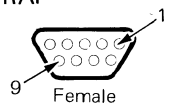
0 — Printer

0 (INTERNAL DISTRIBUTION CABLE)

Termination Conn.

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



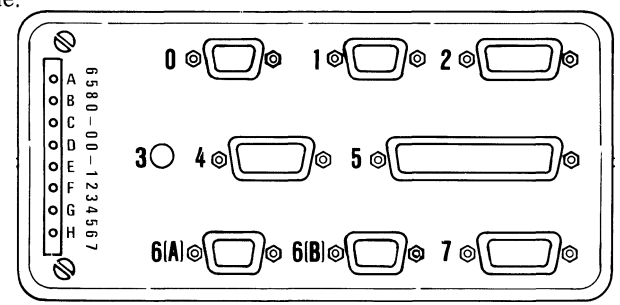
1 — MCU

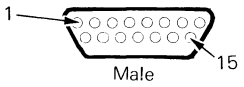
1 (INTERNAL DISTRIBUTION CABLE)

Termination Conn.

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 — Display

2 (INTERNAL DISTRIBUTION CABLE)

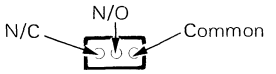
Termination Conn.

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

Figure 9 — Panel 1 Connectors

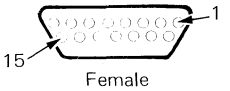
(Continued on next page)



3 — Memory Record Switch

3 MEMORY RECORD SWITCH (INTERNAL DISTRIBUTION CABLE)

Pin No.	B1 A	Identification
N/C	—	—
N/O	6	Frame Ground
Common	15	System Dump



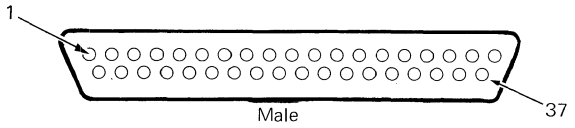
4 — Communications

4 (INTERNAL COMMUNICATION ADAPTER CABLE)

Termination Conn.

Pin No.	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 — Diskette Signal



5 INTERNAL (DISKETTE) SIGNAL CABLE

Termination Conn.

Pin No.	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

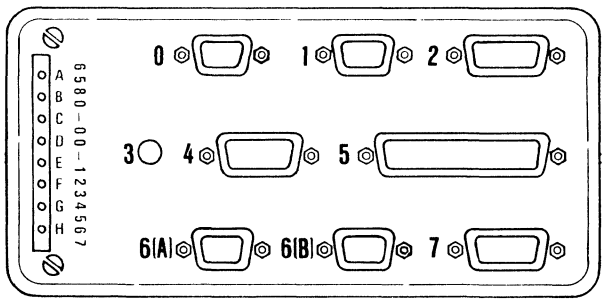
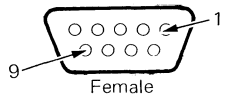


Figure 9 — Panel 1 Connectors (Continued)



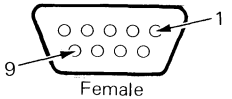
6A — Printer Sharing — 1

6 A (INTERNAL PRINTER SHARING CABLE)

Termination Conn.

Pin No.	C1	6B	Identification
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



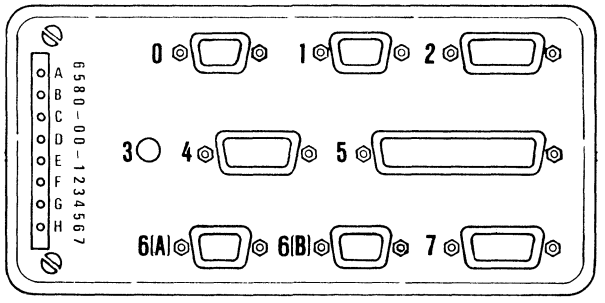
6B — Printer Sharing — 2

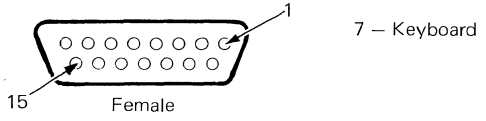
6 B (INTERNAL PRINTER SHARING CABLE)

Termination Conn.

Pin No.	C1	6A	Identification
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





7 – Keyboard

7 (INTERNAL DISTRIBUTION CABLE)

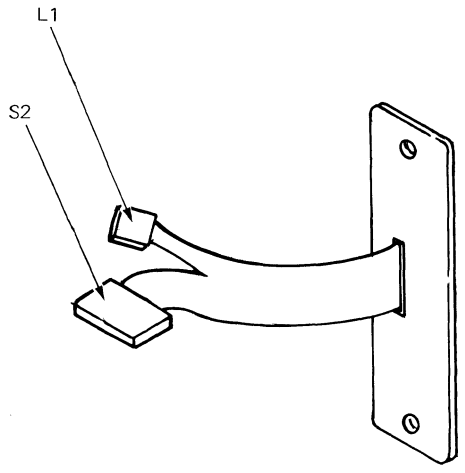
Pin No.	Termination Conn. P2	B1 A	Identification
1	–	5	Serial Data
2	–	–	–
3	–	4	Serial Data Clock
4	–	16	Power-Out-Reset
5	–	3	Click (Speaker)
6	–	2	Tone (Speaker)
7	–	14	Kybd Acknowledge
8	–	1	Data Strobe
9	4	–	+8.5 VDC
10	–	–	Frame Ground
11	3	–	+5.0 VDC
12	–	–	Frame Ground
13*	–	–	Frame Ground
14*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

*Ring Terminal

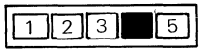
Figure 9 – Panel 1 Connectors (Continued)

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.



NOTE: All connectors shown from wiring side.

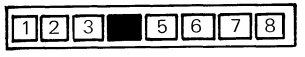


Wiring Side

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

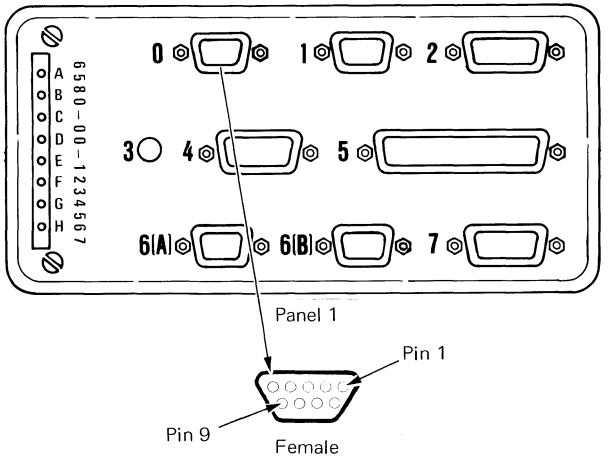
S2 (LED ASSEMBLY CABLE)

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 10 – LED Board Connectors

PRINTER

The printer to work station interface connection is at the system electronics module panel 1 at connector 0 (Figure 11).



Pin No.	Termination Conn.	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

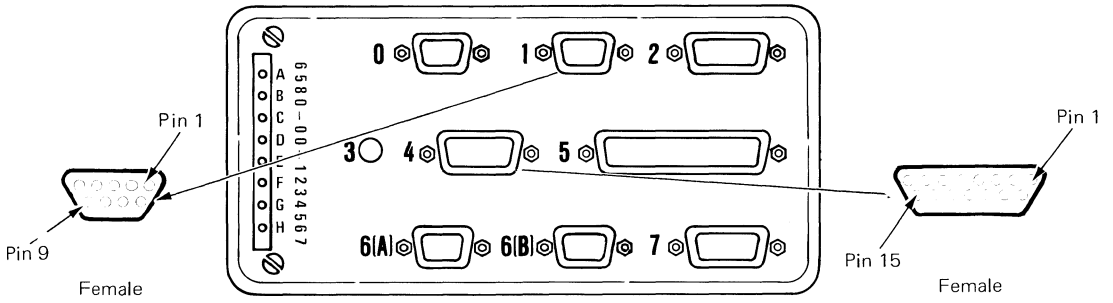
Figure 11 – Printer Connector Panel 1

MAG CARD UNIT

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

COMMUNICATIONS CONNECTOR

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



Panel 1

Pin No.	Termination Conn.	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

Termination

Pin No.	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

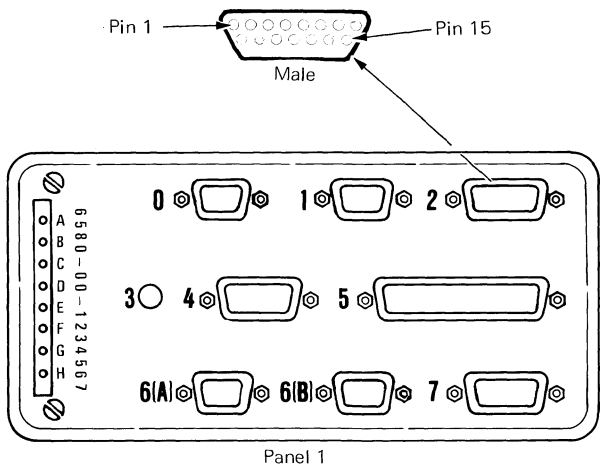
Communications

NOTE: All connectors shown from wiring side.

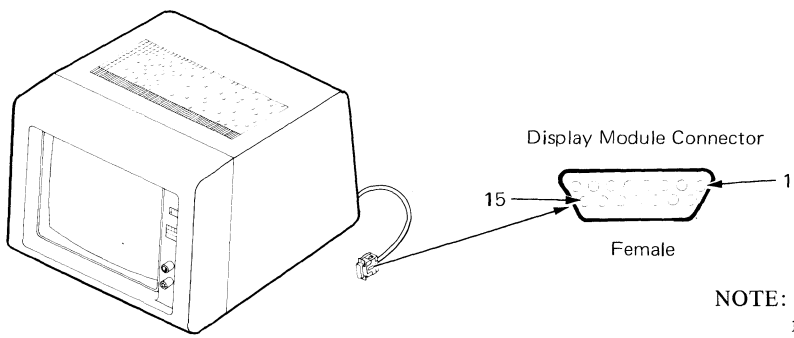
Figure 12 – Mag Card Unit and Communications Connector Panel 1

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 13.



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

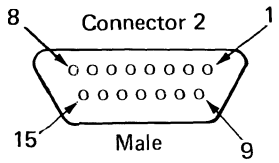


NOTE: All connectors shown from wiring side.

Figure 13 - 25-Line Display Module Connectors

LARGE DISPLAY

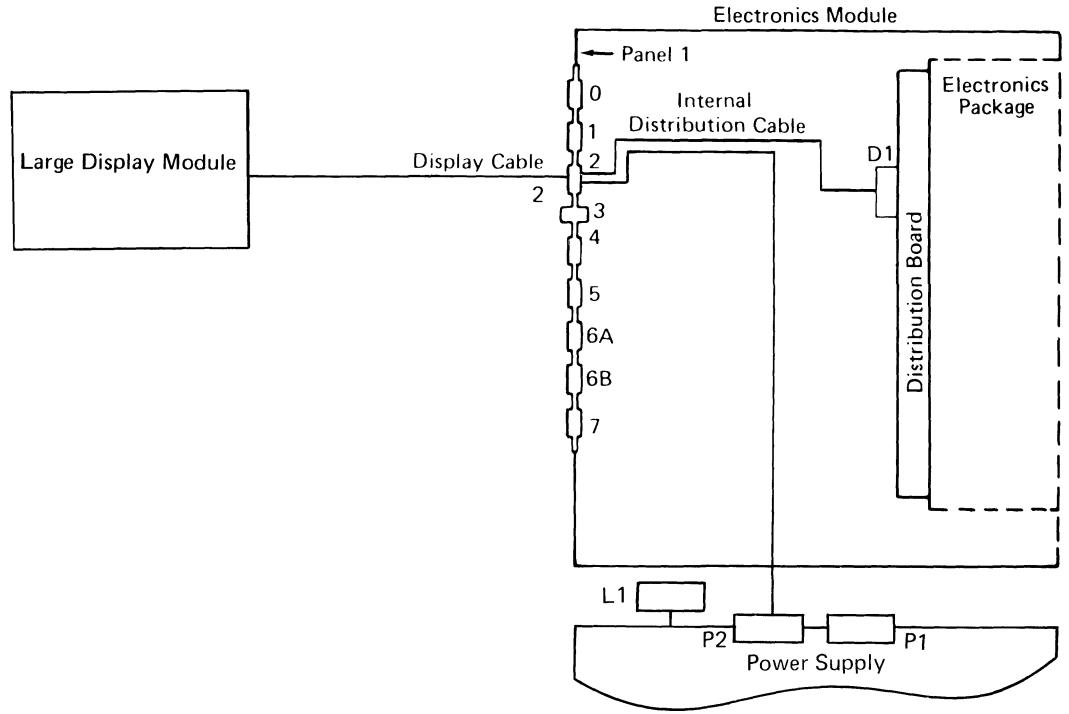
NOTE: All Panel 1 Connectors are shown from the outside rear view of the Electronics Module. All other connectors are shown from the wiring side.



CONNECTOR 2

Pin No.	P2	D1	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 (Ring Terminal)
9	–	6	Signal Ground
10	–	1	Video
11	–	2	Bright
12	–	3	Vertical Sync
13	–	4	Horizontal Sync
14	–	–	–
15	–	6	Signal Ground

* 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.



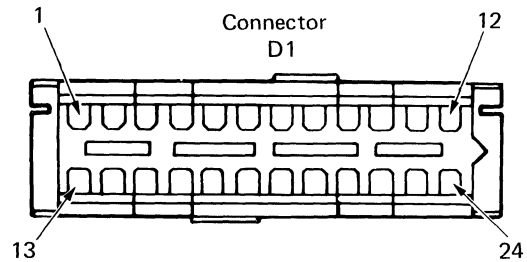
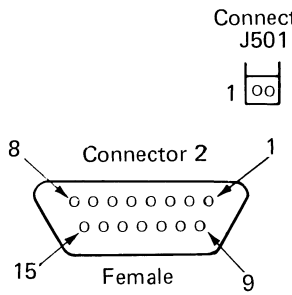
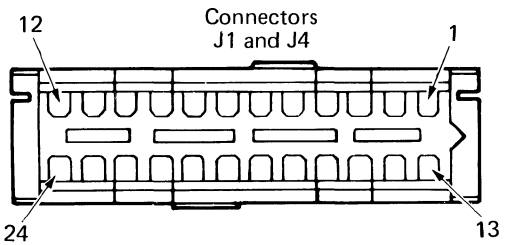


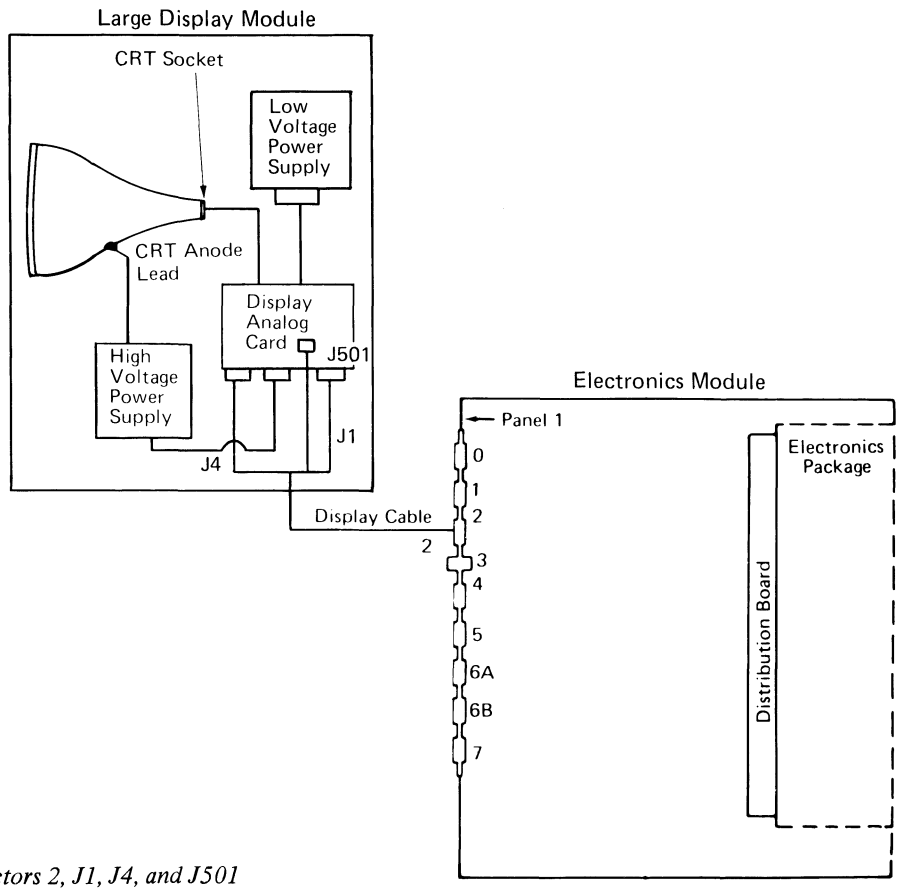
Figure 14 - Panel 1, Connector 2

NOTE: Connectors J1, J4, and J501 are shown from the wiring side.

Connector 2 is shown from the pin side.







CONNECTOR 2

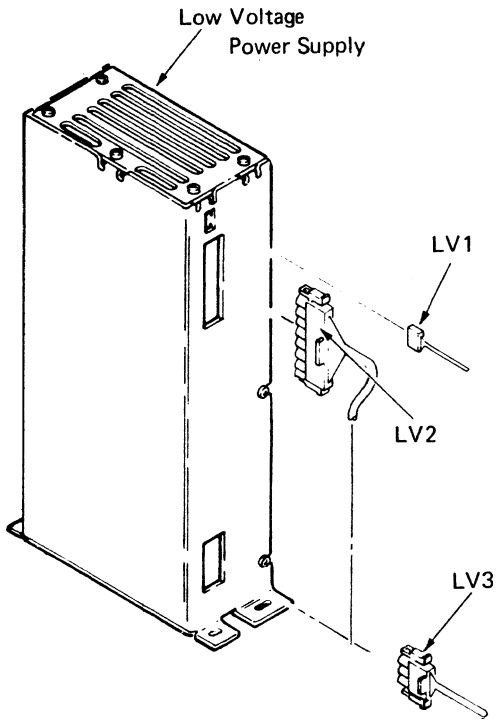
Termination Conn.

Pin No.	J501	J1	J4	Identification
1	–	–	–	–
2	–	–	–	–
3	–	–	–	–
4	–	–	–	–
5	–	–	–	–
6	–	–	–	–
7	–	–	–	–
8*	–	–	–	Frame Ground
9	2	–	–	Signal Ground
10	1	–	–	Video
11	–	1	–	Bright
12	–	–	24	Vertical Sync
13	–	–	23	Horizontal Sync
14	–	–	–	–
15	–	–	11 12	Signal Ground

* Ring Terminal

Figure 15 - Large Display Cable Connectors 2, J1, J4, and J501

NOTE: All connectors shown from wiring side.



LV1

4	○
3	○
2	●
1	○

LV1

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

LV2

8	◘
7	○
6	○
5	○
4	○
3	○
2	○
1	◘

LV2

Pin No.	J1	J4	Identification
8	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	7	—	+32 VDC

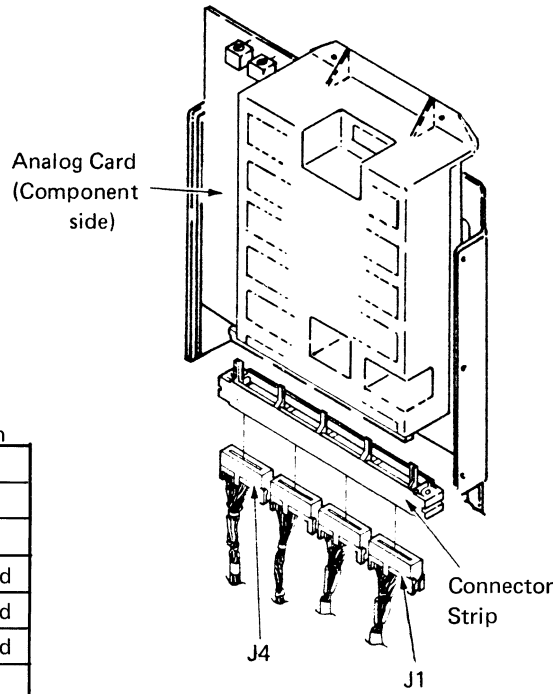
Termination Conn.

LV3

3	○
2	○
1	◘

LV3

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



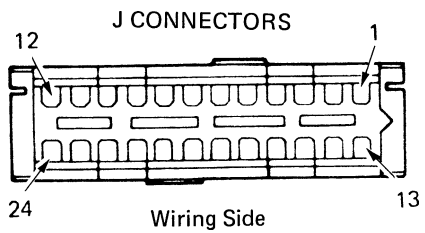
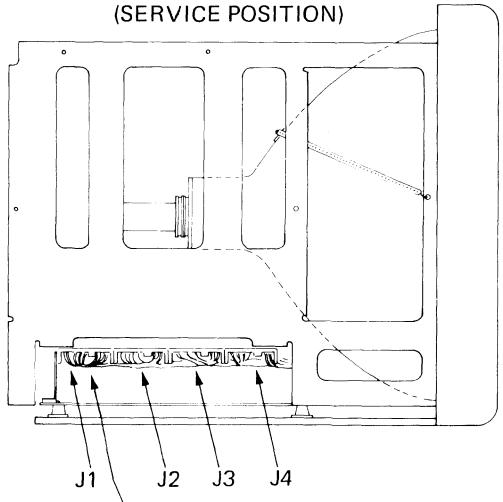
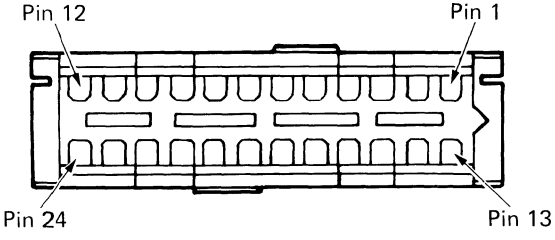
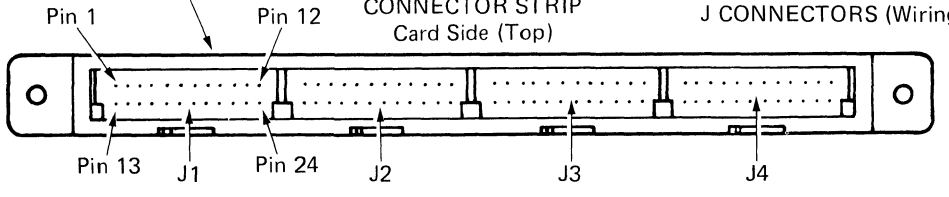


Figure 16 - Large Display Low Voltage Power Supply Cable Connectors







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

J1

Termination Conn.

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 17–Large Display Analog Card Connector Strip, Cable Connectors J1 through J4, and CRT Socket (Continued)

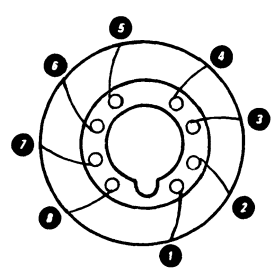
J2

Termination Conn.

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

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



CRT SOCKET (Pin Side)

J4

Termination Conn.

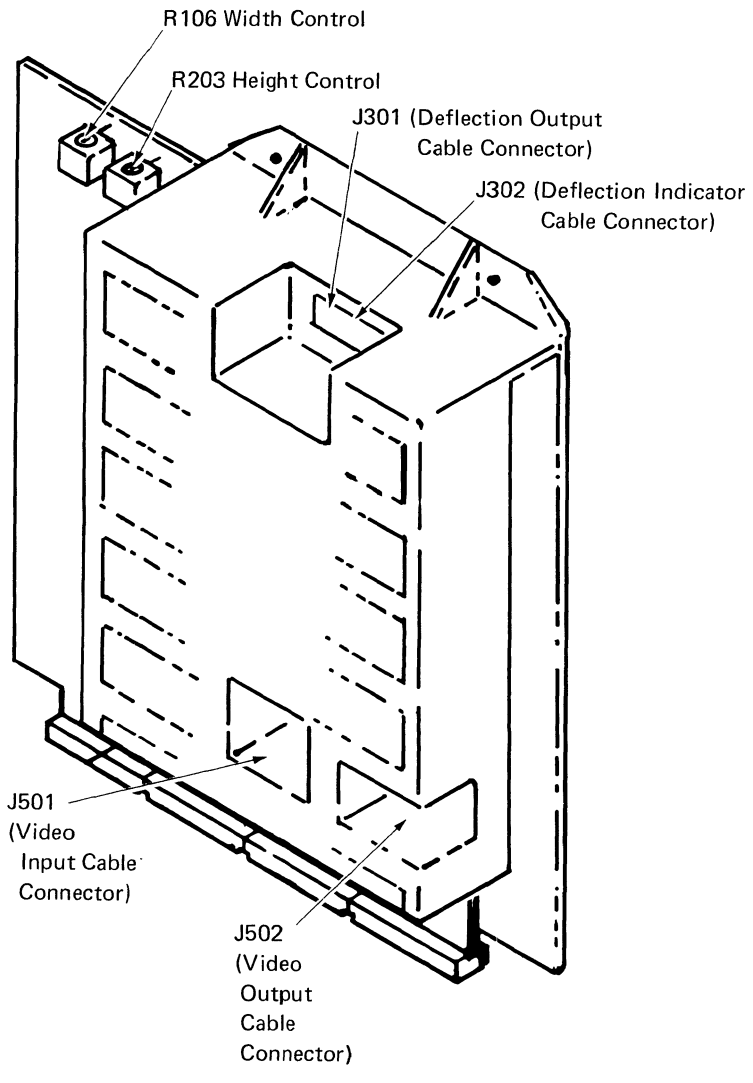
Pin No.	2	LV2	Pot 2	Pot 1	Identification
1	–	4	–	–	Signal Ground
2	–	–	–	–	Not Used
3	–	5	–	–	Signal Ground
4	–	–	–	–	Not Used
5	–	–	1	1	Signal Ground
6-10	–	–	–	–	Not Used
11	15	–	–	–	Signal Ground
12	15	–	–	–	Signal Ground
13	–	2	–	–	+ 32 VDC
14	–	–	–	–	Not Used
15	–	–	–	–	+ 18 VDC
16	–	–	–	–	Not Used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

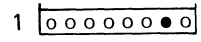
CRT SOCKET

Termination Conn.

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 17 - Large Display Analog Card Connector Strip, Cable Connectors J1 through J4, and CRT Socket (continued)

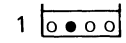




J301 (DEFLECTION OUTPUT CABLE)

Termination Conn.

Pin No.	Yoke	Identification
1	*	Vertical Yoke
2	*	Vertical Yoke
3	*	Vertical Yoke Center Tap
4		+ 32 VDC
5		+ 32 VDC
6	*	Horizontal Yoke
7		(Key)
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)

J501 (VIDEO INPUT CABLE)

Termination Conn.

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

J502 (VIDEO OUTPUT CABLE)

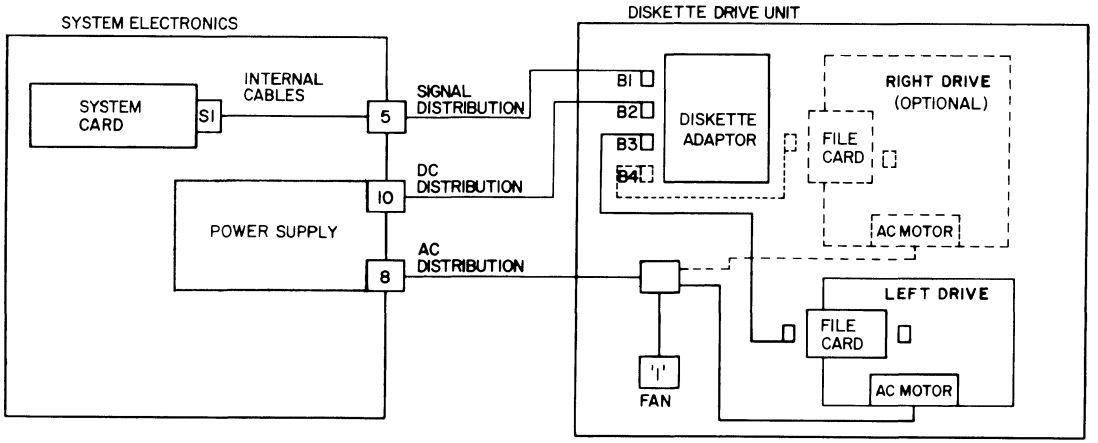
Termination Conn.

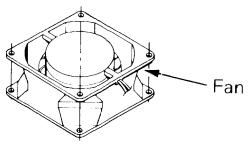
Pin. No.	CRT Socket	Identification
1	7	Cathode
2	–	(Not Used)
3	–	(Key)
4	6	Grid 1

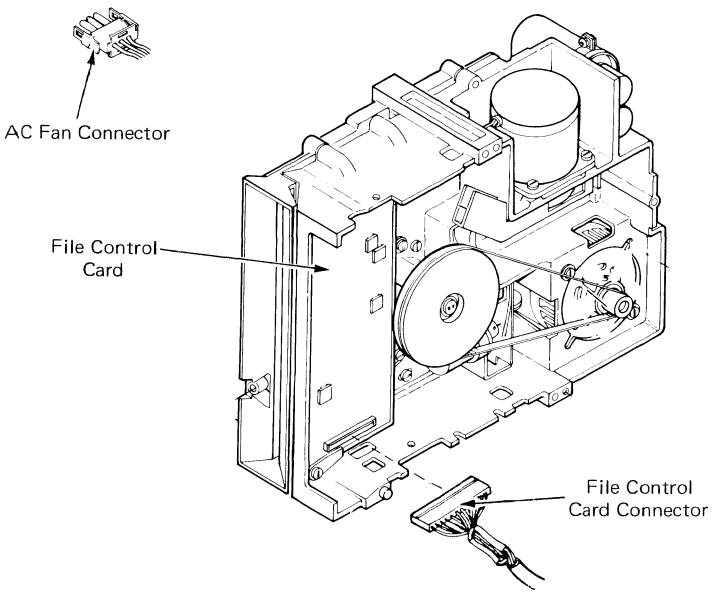
Figure 2 - Large Display Cables, Connectors and Test Points Locators (continued)

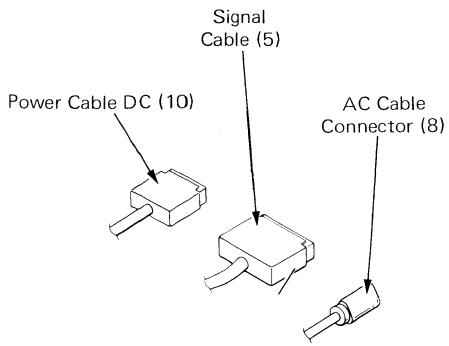
DISKETTE UNIT

The signal, AC and DC cables from the diskette unit connect to the electronics module at connectors 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 signal and DC and Connector 8 on the rear of the display for AC. The signal cable attaches to the diskette adpater 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.









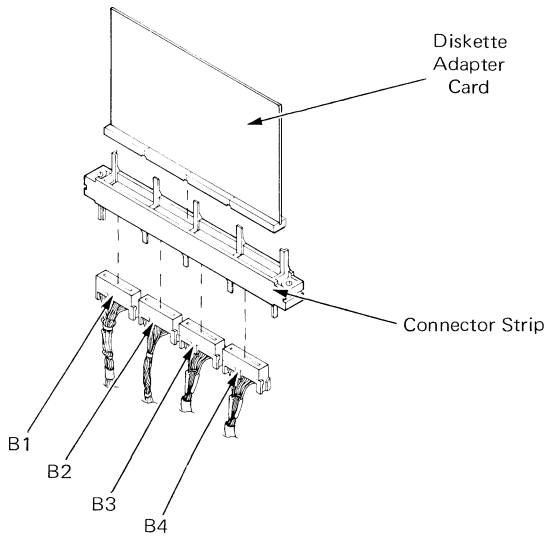


Figure 19 - Diskette Drive Connectors

(Continued on next page)

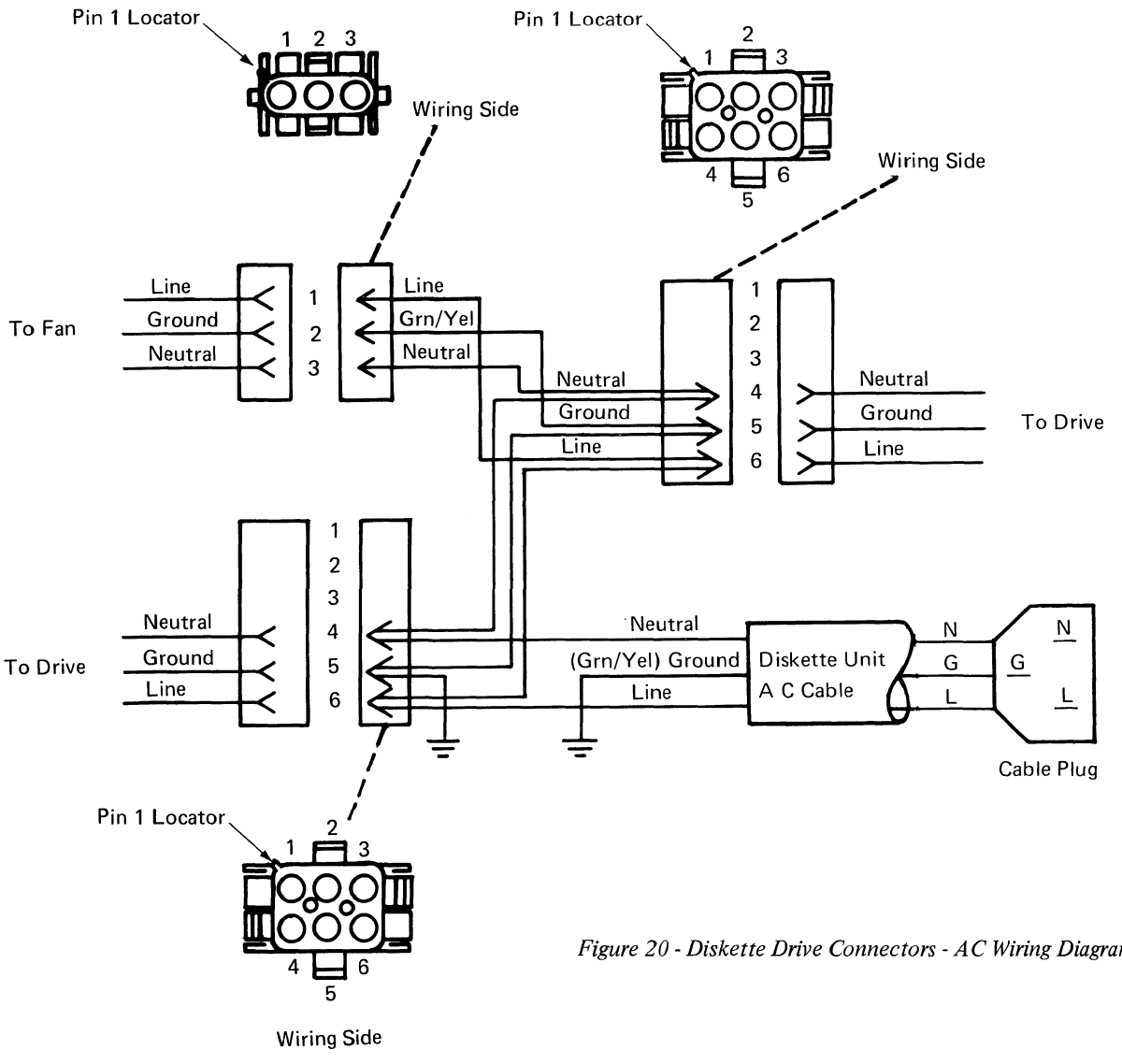
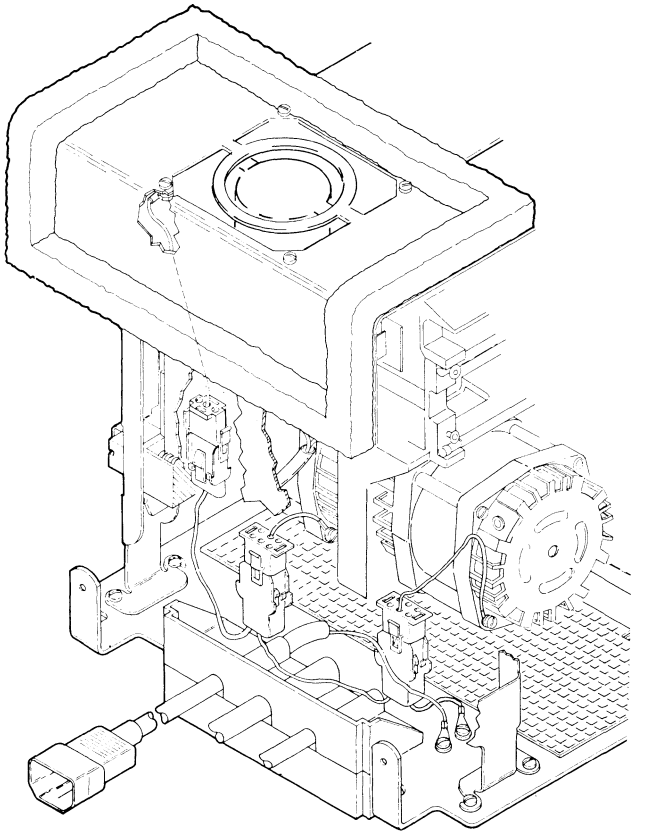


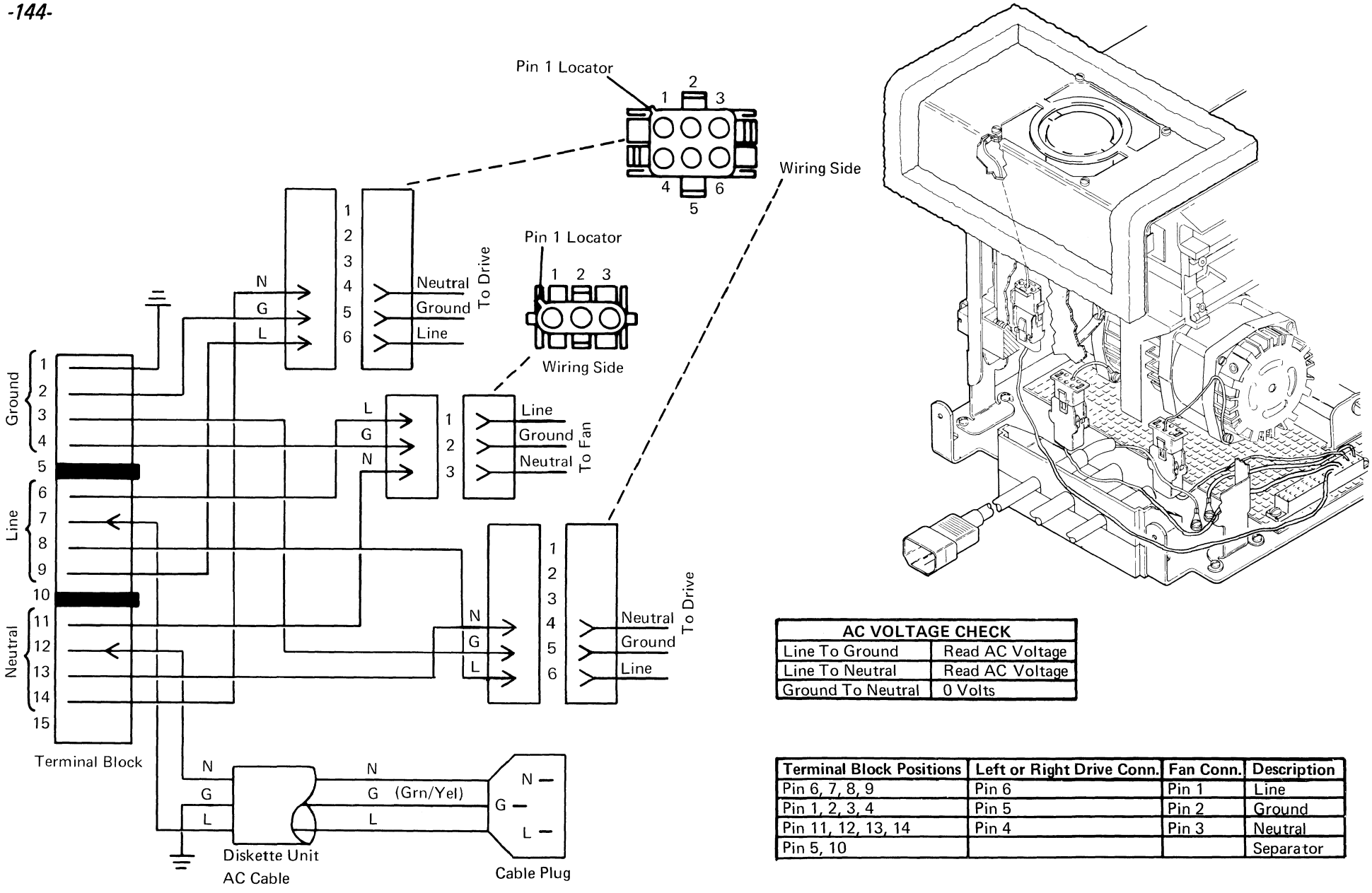
Figure 20 - Diskette Drive Connectors - AC Wiring Diagram



AC VOLTAGE CHECK

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

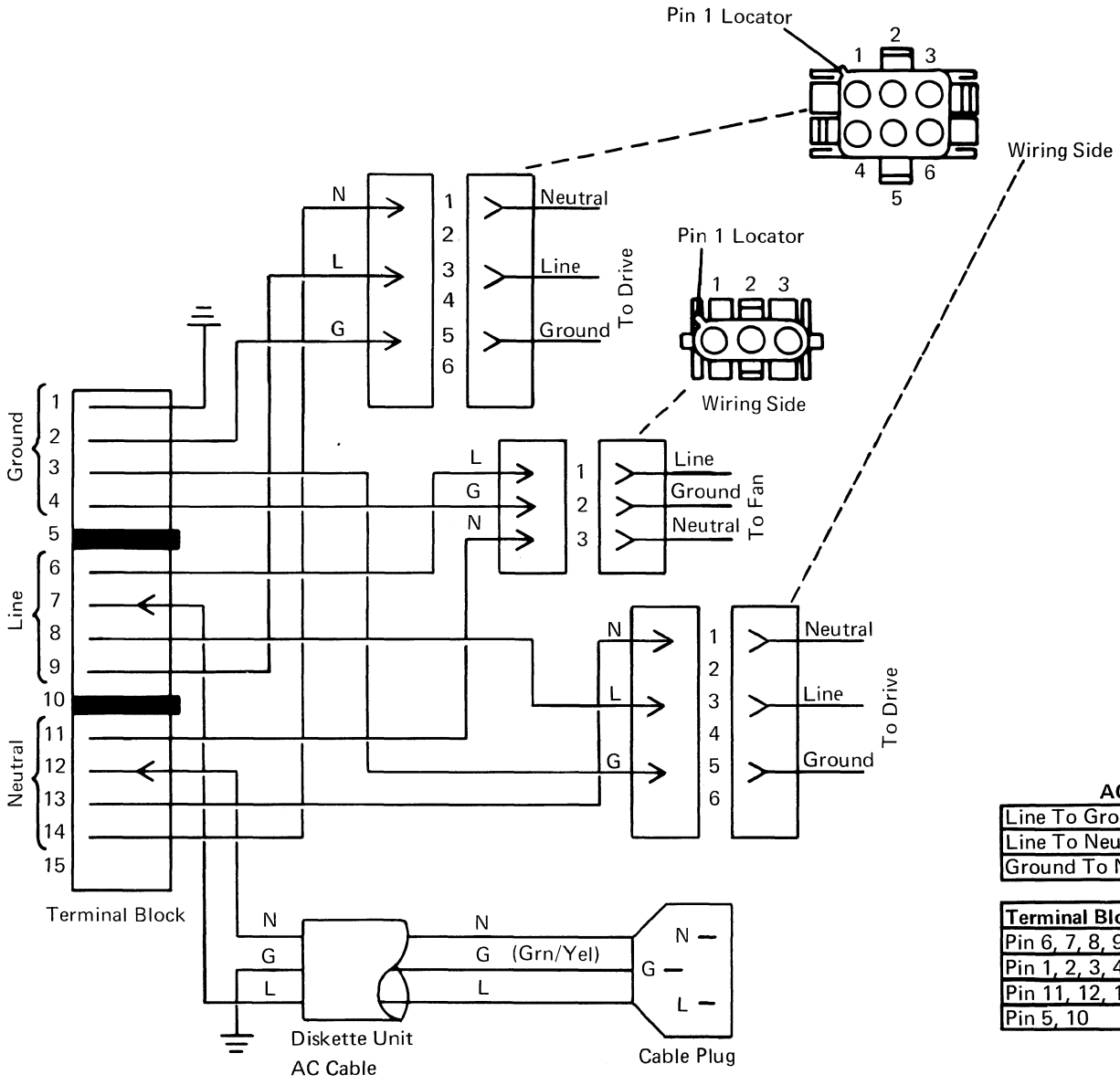
Left or Right Drive Conn.	Fan Conn.	Description
Pin 4	Pin 3	Neutral
Pin 5	Pin 2	Ground
Pin 6	Pin 1	Line

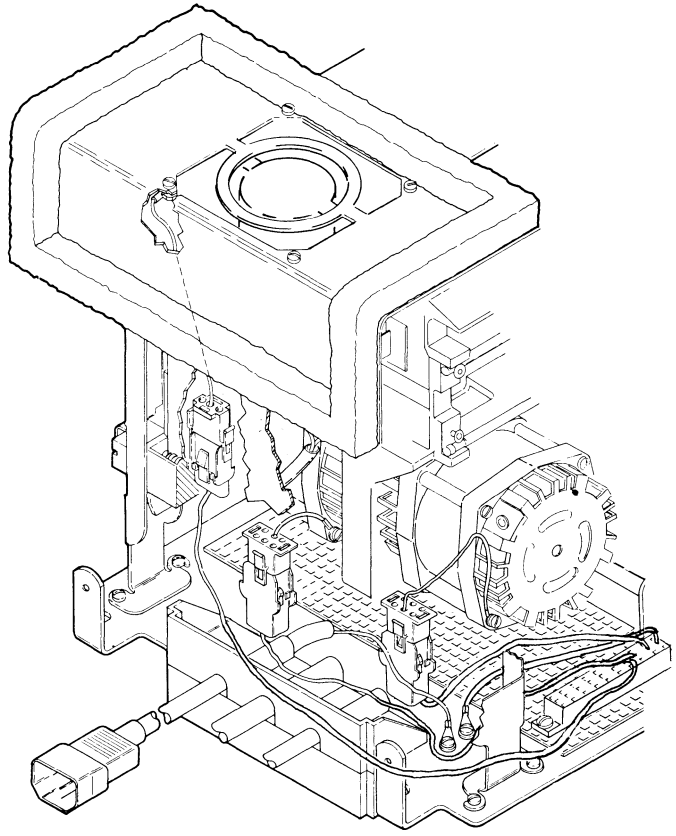


AC VOLTAGE CHECK	
Line To Ground	Read AC Voltage
Line To Neutral	Read AC Voltage
Ground To Neutral	0 Volts

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 21 - W. T. Diskette Drive AC Wiring Diagram 100/120 VAC 50 Hz Power Supply



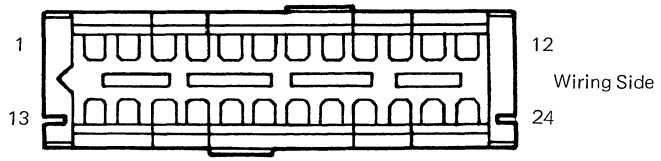


AC VOLTAGE CHECK

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, 13,114	Pin 1	Pin 3	Neutral
Pin 5, 10			Separator

Figure 22 - W. T. Diskette Drive AC Wiring Diagram 200/240 VAC 50/60 Hz Power Supply



NOTE: All connectors shown from wiring side.

B 1 (DISKETTE SIGNAL CABLE)

Termination Conn.

Pin No.	5 (Disk. Signal Cable)	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)

Termination Conn.

Pin No.	10 (Disk. DC Cable)	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	–	–

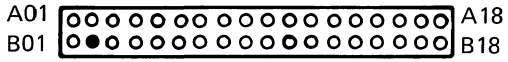
Figure 23 - Diskette Drive Cable Connectors

B 3 & B 4 (DISKETTE DRIVE CABLE)

Termination Conn.

Pin No.	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

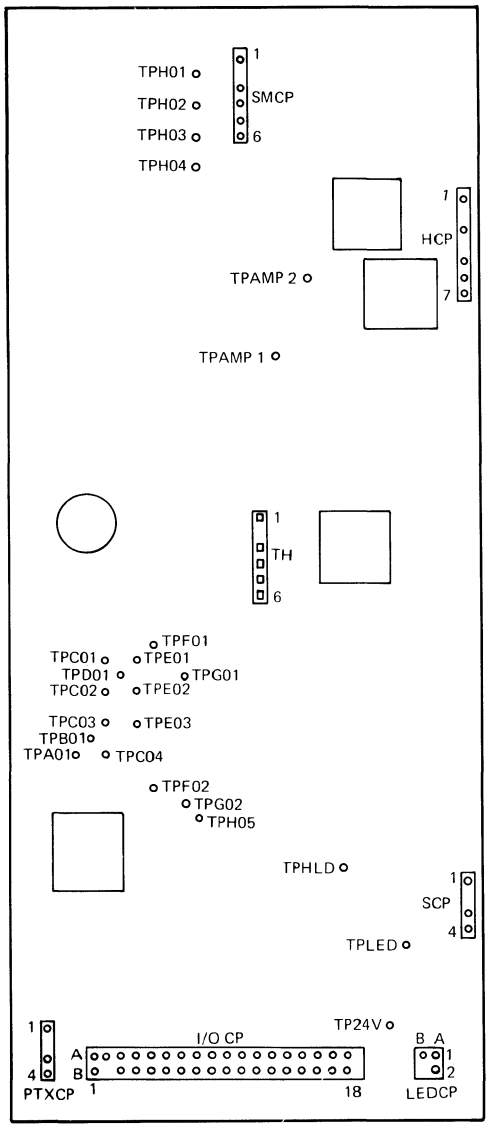
(Continued on next page)



FILE CONTROL CARD CONNECTOR

Pin No.	Termination Conn. 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 23 - Diskette Drive Cable Connectors (Continued)



Test Points	Line Names
TPA01	+5 VDC
TPB01	-5VDC
TPC01	+Access 1
TPC02	D1 PTX
TPC03	Write Data
TPC04	Ground
TPD01	+Inner Tracks
TPE01	+Access 0
TPE02	+Head Engage
TPE03	+Index
TPF01	Ground
TPF02	+Write/Erase Enabled
TPG01	+File Data
TPG02	+Erase Gate
TPH01	MC-3
TPH02	MC-2
TPH03	MC-1
TPH04	MC-0
TPH05	+Write Gate
TPAMP1	Preamp TP1
TPAMP2	Preamp TP2
TPHLD	-Head Load
TP24V	+24 VDC
TPLED	LED Voltage

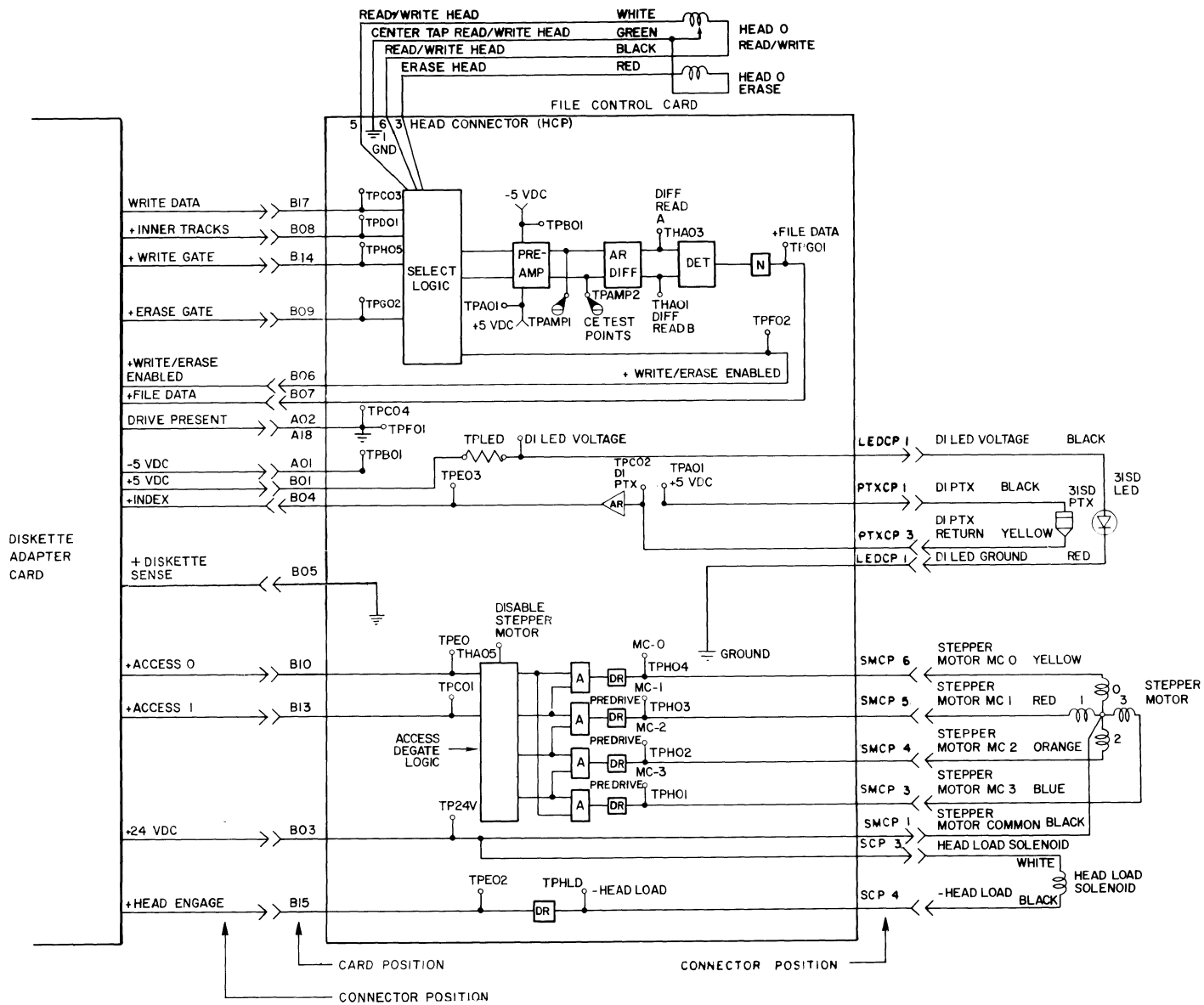
Test Points	Line Names
TH01	Diff Read B
TH02	No Pin
TH03	Diff Read A
TH04	Not Assigned
TH05	-Disable Stepper Motor
TH06	+18V

PTXCP – PTX Connector Pins
I/O CP – File Control Card Connector Pins
LEDCP – LED Connector Pins
SCP – Solenoid Connector Pins
HCP – Head Connector Pins
SMCP – Stepper Motor Connector Pins

LED (Light Emitting Diode)
PTX (Photo Transistor)

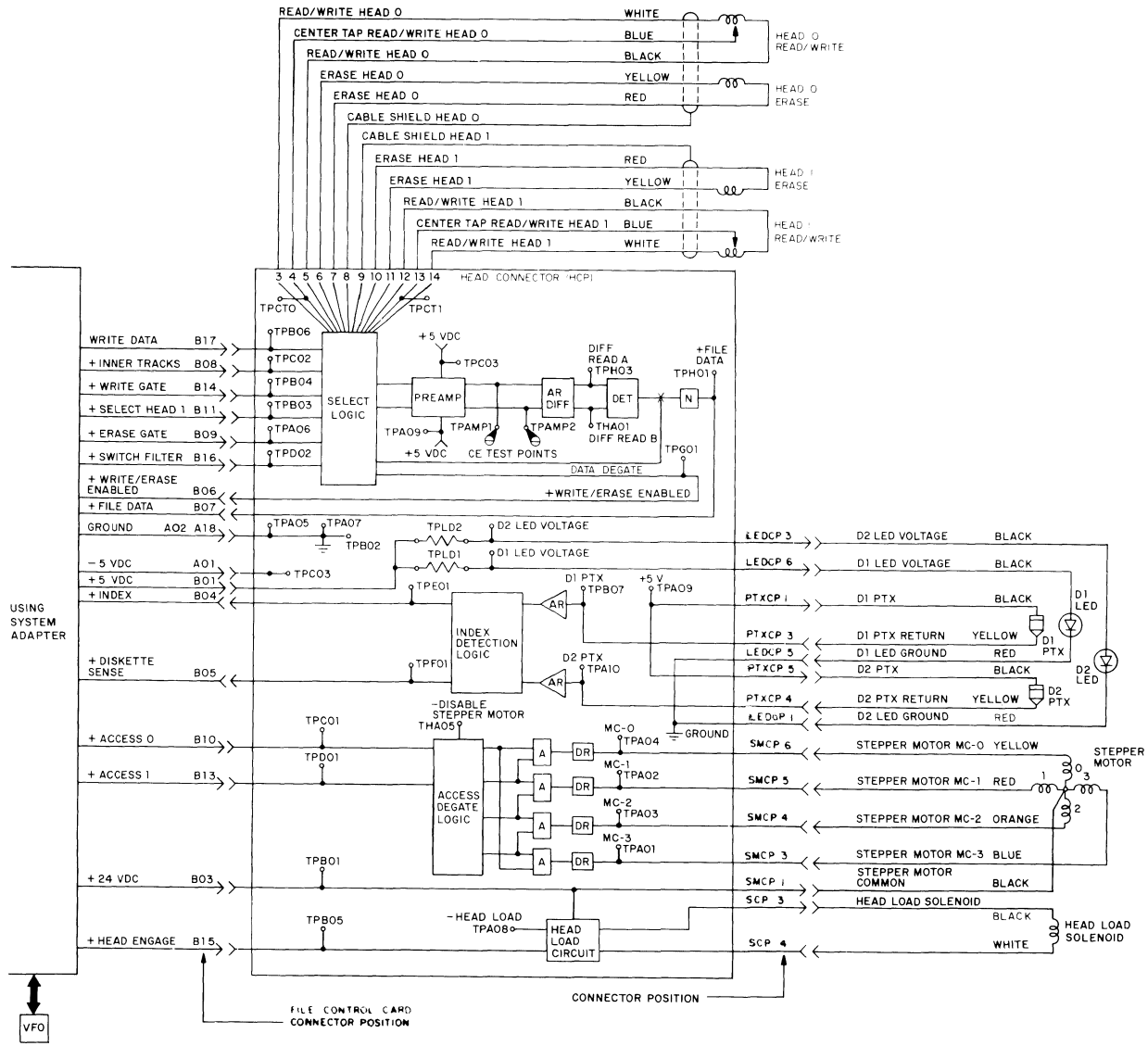
Type 1 Drive
Figure 24 - File Control Card, Test Points, Signals and Connectors

(Continued on next page)

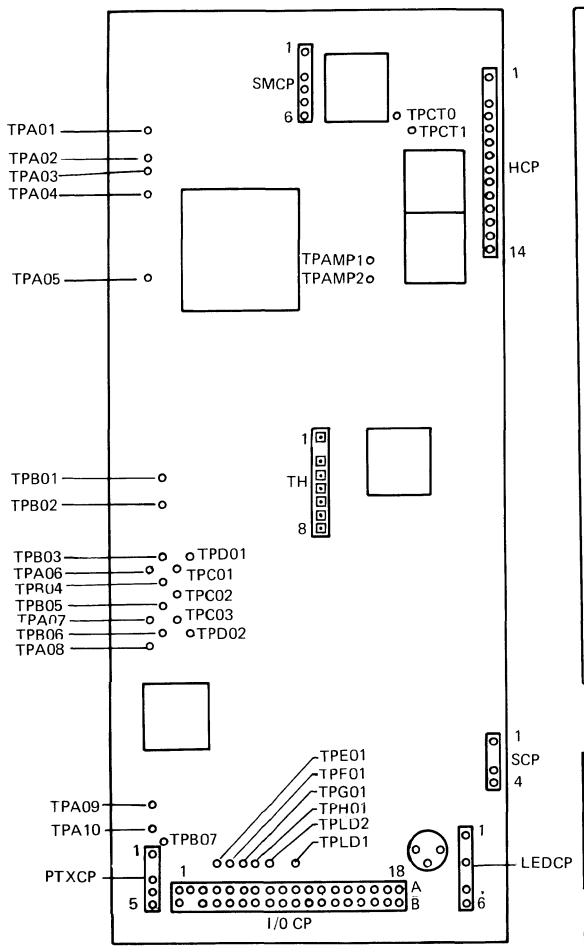


Type 1 Drive

Figure 24 - File Control Card, Test Points, Signals and Connectors (Continued)



Type 2D Drive
Figure 24 - File Control Card, Test Points, Signals and Connectors (Continued)



Test Points	Line Names
TPA01	MC–3
TPA02	MC–1
TPA03	MC–2
TPA04	MC–0
TPA05	Ground
TPA06	+Erase Gate
TPA07	Ground
TPA08	–Head Load
TPA09	+5 VDC
TPA10	D2 PTX
TPB01	+24 VDC
TPB02	Ground
TPB03	+Select Head 1
TPB04	+Write Gate
TPB05	+Head Engage
TPB06	Write Data
TPB07	D1 PTX
TPC01	+Access 0
TPC02	+Inner Tracks
TPC03	–5 VDC
TPD01	+Access 1
TPD02	+Switch Filter
TPE01	+Index
TPF01	+Diskette Sense
TPG01	+Write/Erase Enabled
TPH01	+File Data
TPLD2	D2 LED Voltage
TPLD1	D1 LED Voltage
TPAMP2	Preamp TP2
TPAMP1	Preamp TP1
TPCTO	Center Tap Head 0
TPCT1	Center Tap Head 1

Test Points	Line Names
TH01	Diff Read B
TH02	No Pin
TH03	Diff Read A
TH04	Not Assigned
TH05	Disable Stepper Motor
TH06	+18V

PTXCP – PTX Connector Pins
I/O CP – File Control Card Connector Pins
LEDCP – LED Connector Pins
SCP – Solenoid Connector Pins
HCP – Head Connector Pins
SMCP – Stepper Motor Connector Pins

LED (Light Emitting Diode)

PTX (Photo Transistor)

Type 2D Drive
Figure 24 - File Control Card, Test Points, Signals and Connectors (Continued)

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.

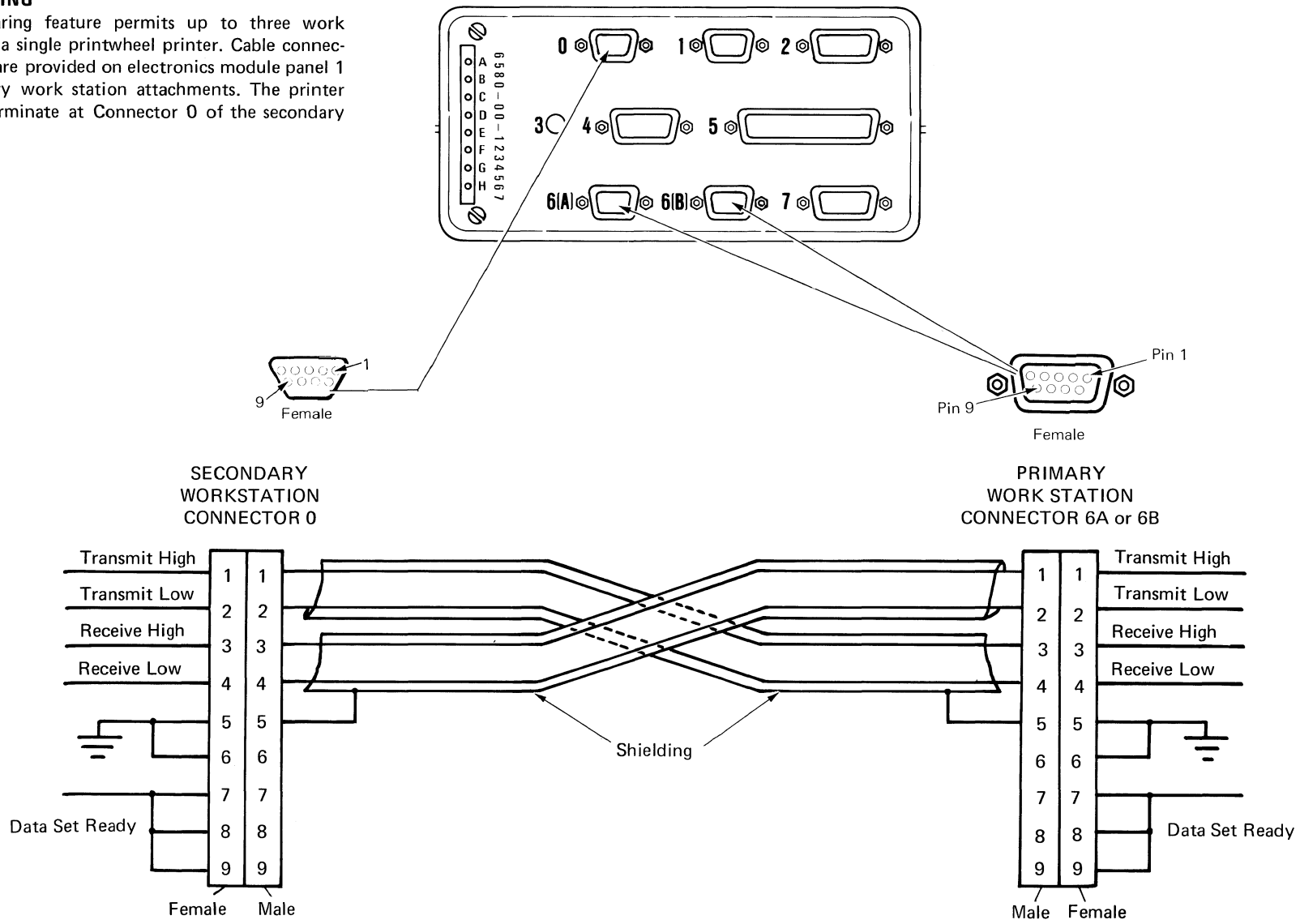
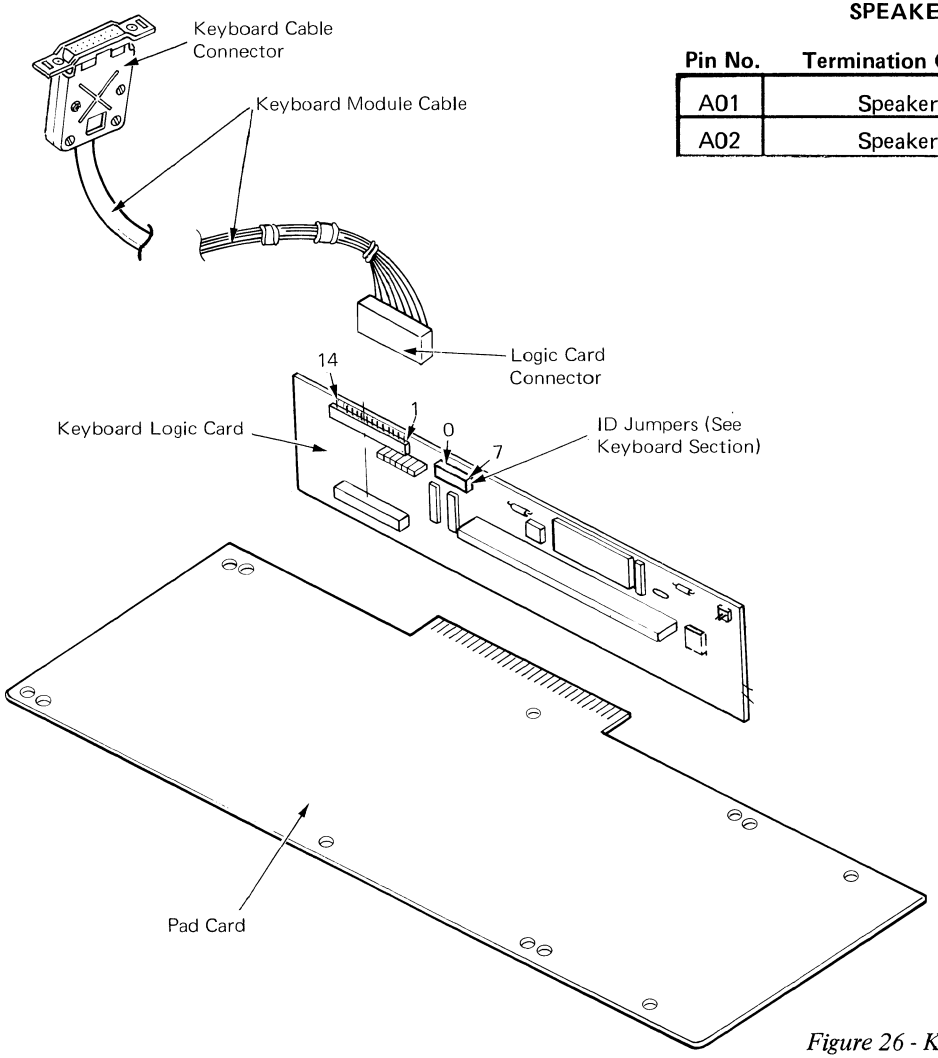
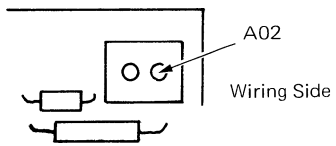


Figure 25 - Printer Sharing Cabling and Connectors

KEYBOARD MODULE

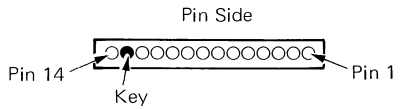
The keyboard and operational indicator voltages and signals are provided to the keyboard through the system electronics module panel 1 connector 7 by the keyboard cable. The keyboard cable connector, 30-pin edge connector, and speaker connector are shown in Figure 18.





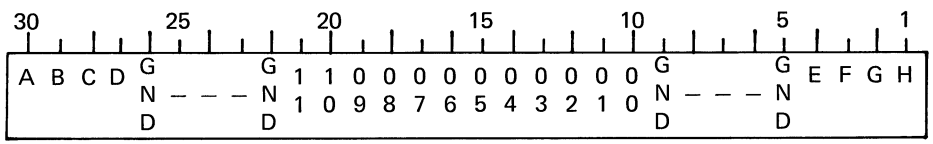
SPEAKER CONNECTOR

Pin No.	Termination Conn.	Identification
A01	Speaker	Drive
A02	Speaker	+8.5 VDC



LOGIC CARD CONNECTOR

Pin No.	Termination Conn. 7	Identification
1	9	+8.5 VDC
2	11	+5.0 VDC
3	5	Click (Speaker)
4	10	Signal Ground
5	7	Kybd. Acknowledge
6	12	Signal Ground
7	3	Serial Data Clock
8	1	Serial Data
9	8	Data Strobe
10	6	Tone (Speaker)
11	–	–
12	4	Power-On-Reset
13 (key)	–	–
14	–	–



30-Pin Edge Connector

Sense Lines – A-H
Drive Lines – 00-11
Ground – GND

Figure 26 - Keyboard Connectors

Grounding Points

1	Ground Spring on CRT to CRT Socket Pin 5
2	(AC) LV3-2 to Frame Ground
3	(AC) Connector 8 Ground to Frame Ground
4	(AC) Display Power Cable Ground to Frame Ground
5	Connector 2 Pin 8 to Frame Ground
6	Connector J1-17, 19, 21, and 23 to Frame Ground
7	Shield (for Video Output wires) to Frame Ground
0	(World Trade Only) Low Voltage Power Supply to Frame Ground

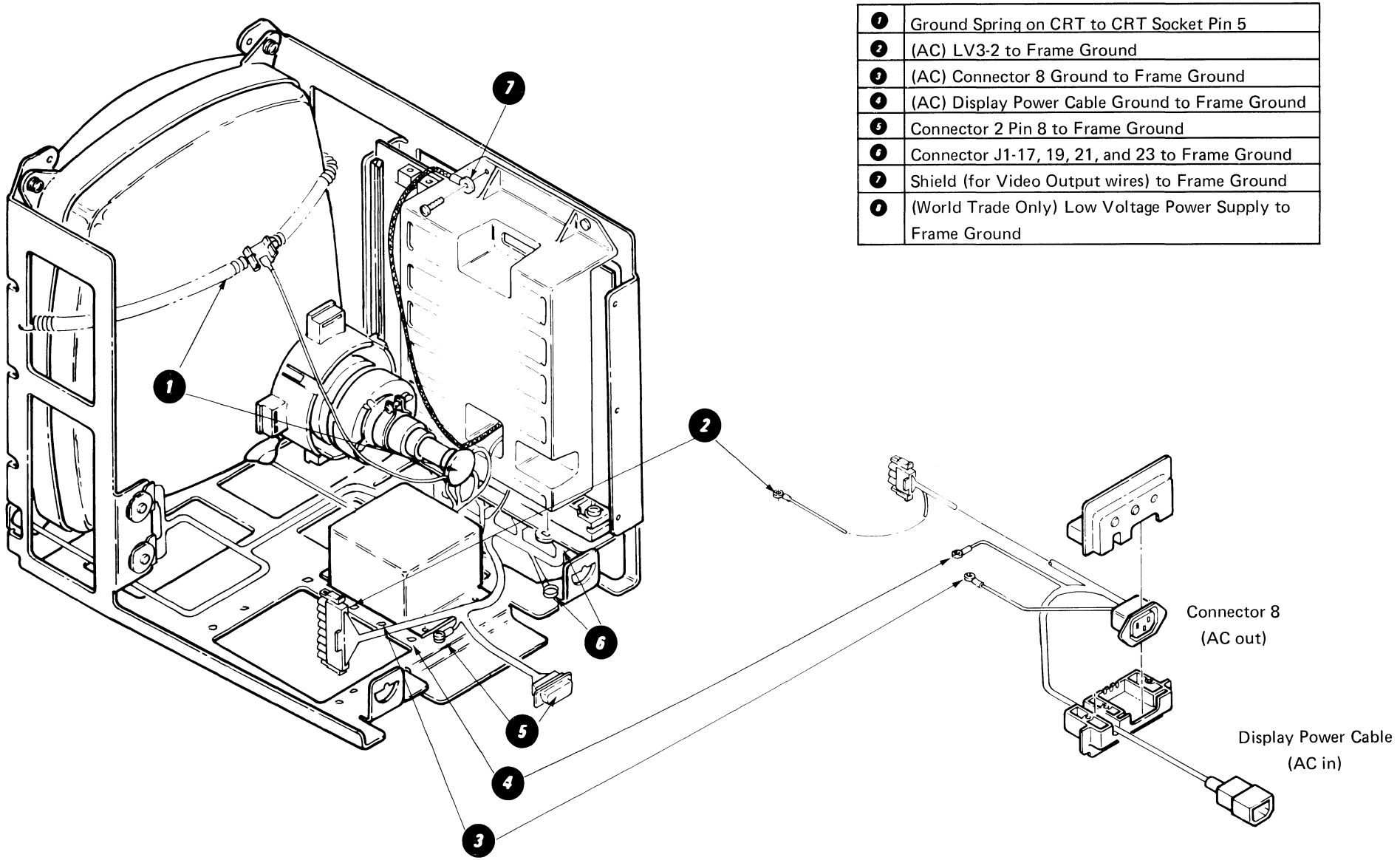
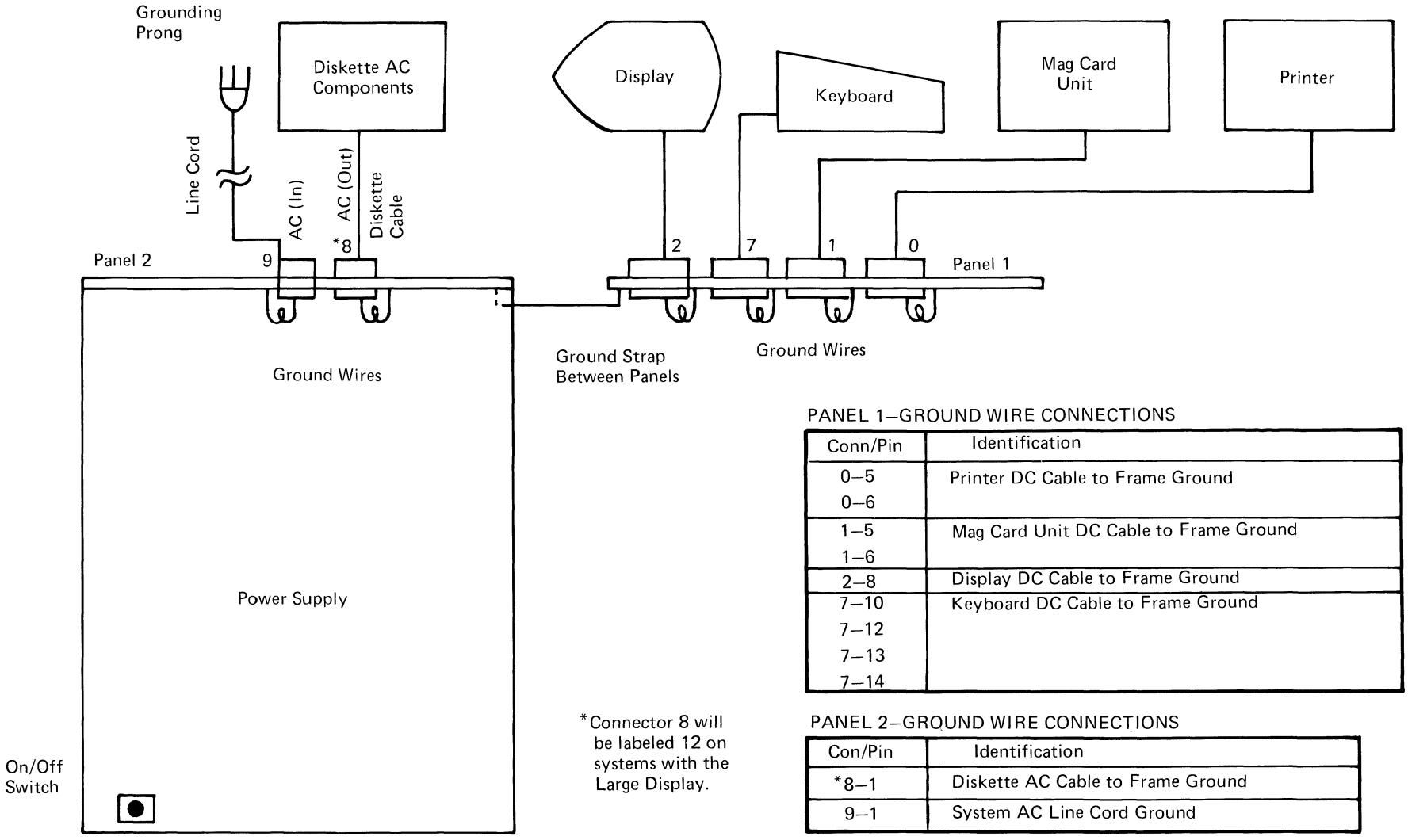


Figure 27 - Large Display Grounding Point Locator



PANEL 1—GROUND WIRE CONNECTIONS

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

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

PANEL 2—GROUND WIRE CONNECTIONS

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

Figure 28 - System Grounding Path Schematic

DIAGNOSTICS

CONTENTS

NOTE: 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 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, CE loaded 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 engineer. 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 CE diskette can not be loaded). These tests and utilities are described in the Resident Diagnostic Description Section.

The CE loaded diagnostics are tests and utilities on the CE Diagnostic Diskette and are loaded into the system from the diskette unit. The operation of these diagnostics is automated to speed repair actions. These diagnostics are in three areas.

- The MAP Diagnostic Integration (MDI) procedures are used to diagnose failures not sensed by the resident diagnostics.
- The CE Utilities give service personnel the ability to perform additional diagnostic functions.
- The System Exerciser is a diagnostic program that thoroughly tests the system.

These tests and utilities are described in the Customer Engineer Loadable Diagnostic Description 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. The BAT sequence supplies diagnostic support during the power on of the system. The Resident Non-Automatic Diagnostics 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 Assurace Test starts testing the System Card.

BASIC ASSURANCE TEST (BAT)

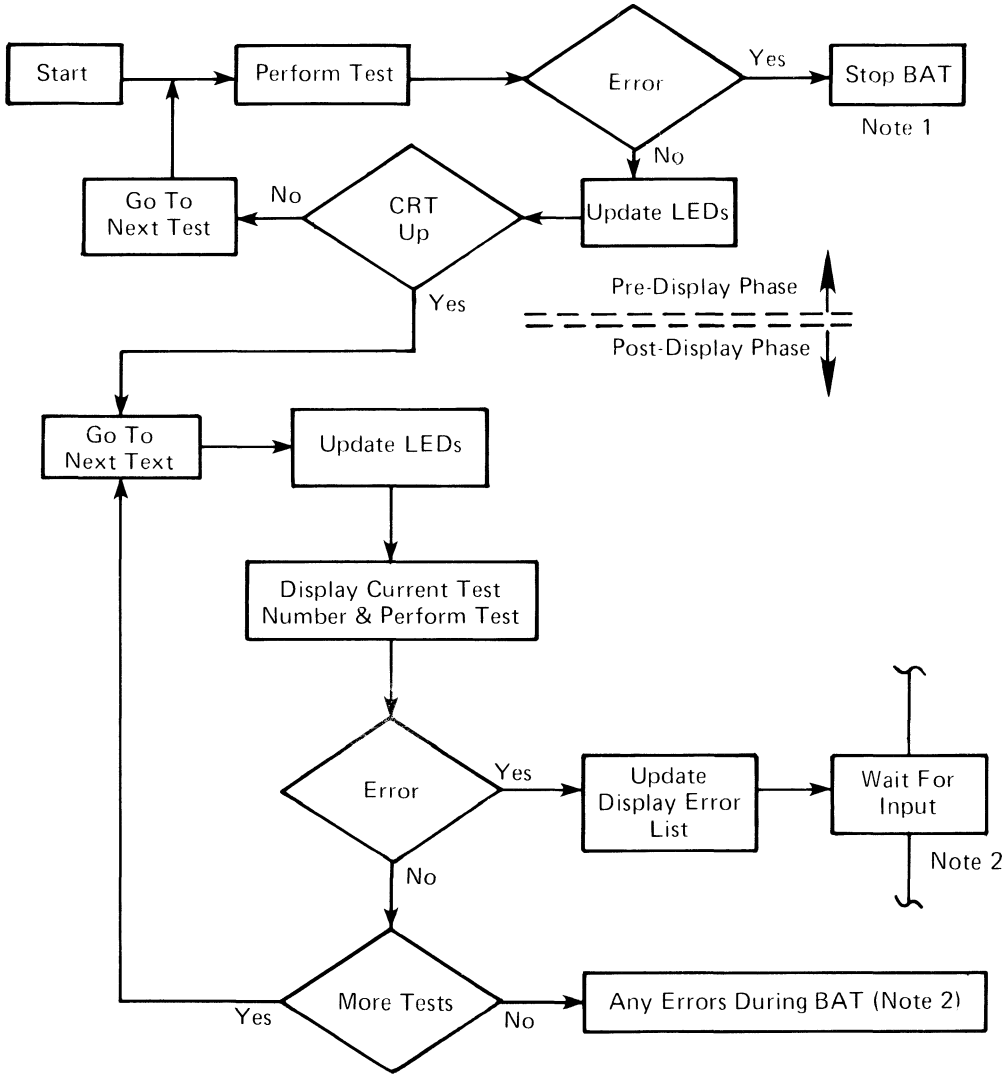
The Basic Assurance Test (BAT) is a series of tests executed in sequence. The BAT is part of ROS and is automatically started when the system is powered on. It can also be restarted by using the Memory Record Button located on electronics panel 1. The run time of the BAT is from 10 to 20 seconds, depending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

The major 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 system 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).
- Error sensing or handling of hardware and software failures during and after the system IPL.
- Loading diagnostics from the CE 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, CE Diagnostics, or customer Problem Determination Procedures.

The BAT is divided in two major parts; BAT before display initialization, and BAT after display initialization, depending on whether or not the display adapter has been tested (Figure 1).



Note 1: See "BAT Before Display Initialization" for more information.

Note 2: See "BAT After Display Initialization" for more information.

Figure 1 – Basic Assurance Test (BAT) Flowchart

There are two methods of indicating BAT progress. The first is the LEDS which are used at the start of BAT (Figure 2). The second is the display which is used to show BAT progress after the display adapter is tested and operational (initalized).

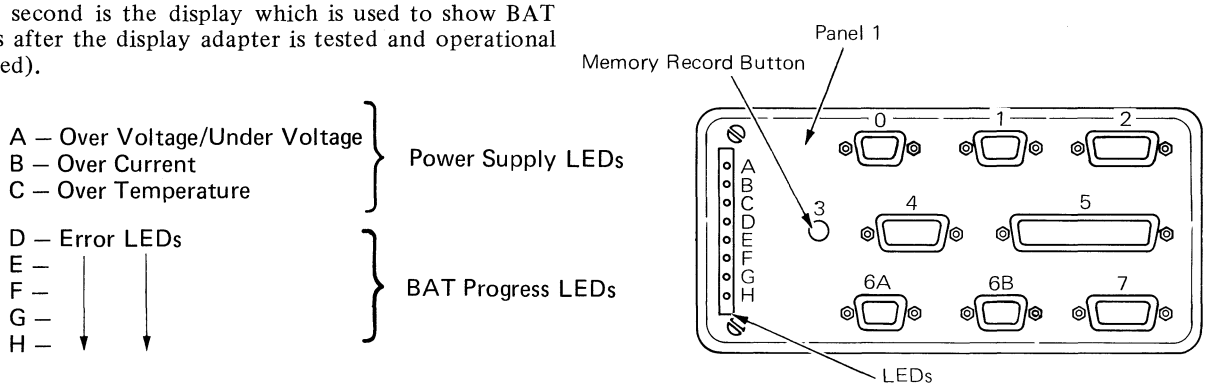


Figure 2 – Electronics Module (LEDs)

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 the electronic panel 1 where the five system status LEDs show 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 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.

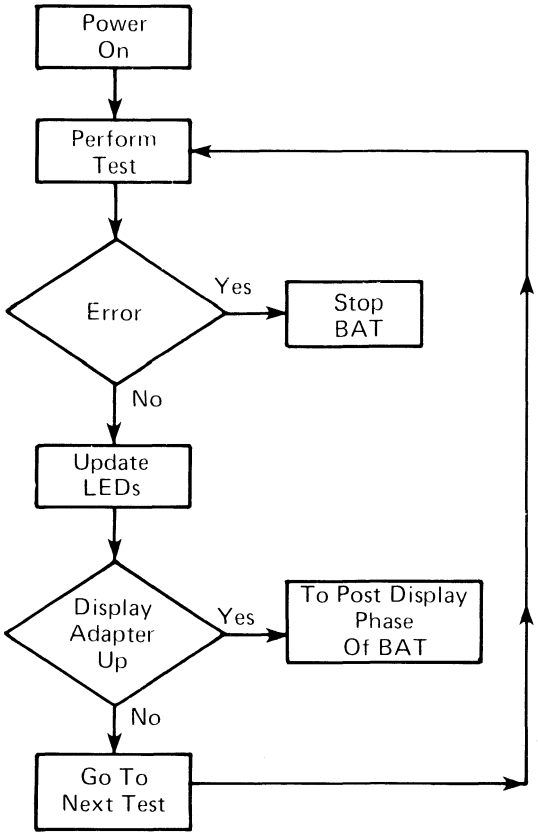


Figure 3 – BAT Before Display Initialization

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, a diagnostic format and the number of the test being performed appear at the bottom of the display. The IBM logo is displayed when the BAT completes correctly. Figure 4 is a flowchart of the BAT after display initialization.

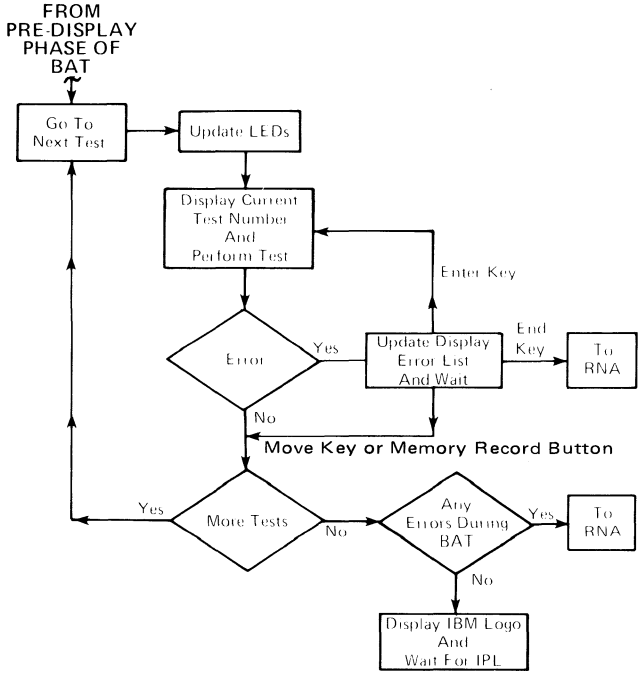


Figure 4 – BAT After Display Initialization

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 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.
- The message, test and error numbers are removed from the display when any of the above are pressed.

If the keyboard cannot be used because of a keyboard failure, the Memory Record Button can be used.

BAT PROGRESS/ERROR CODES

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

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

The LEDs are read in binary. That is, 0 is off and 1 is on. Where and 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.

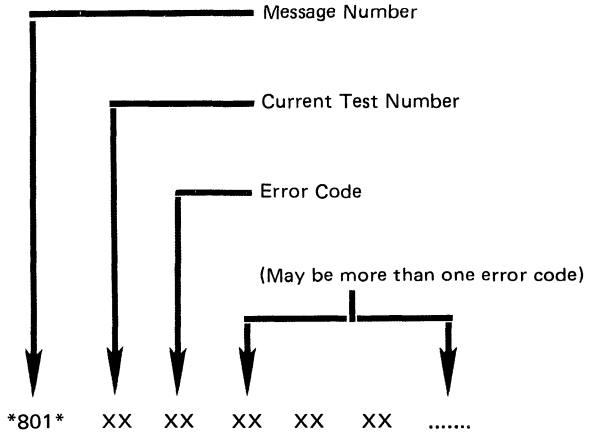


Figure 5 – BAT Display Format

Description of Test	Error LED D	LEDs EFGH	Display Failure Codes
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.

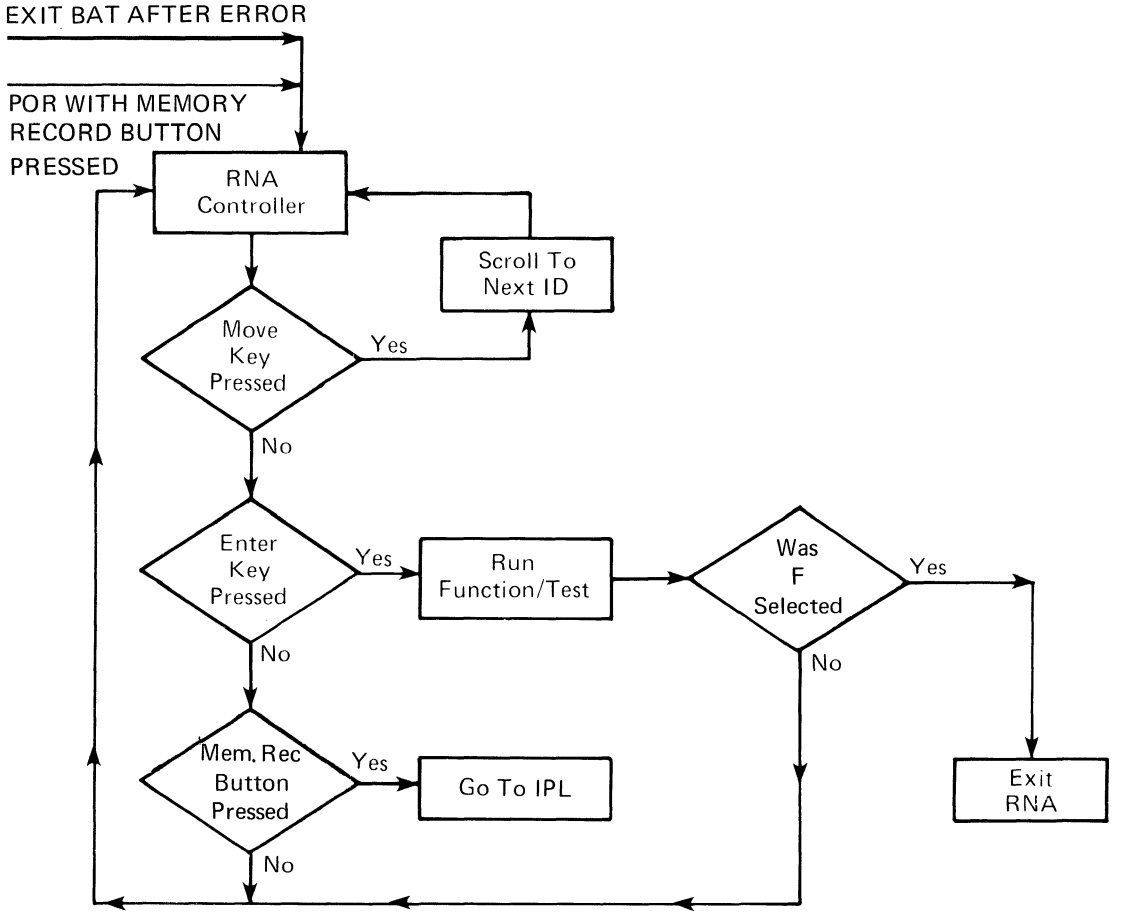
Figure 6 – BAT Progress/Error Codes

When the BAT will not complete because of an error, the system can 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.

The Resident Non-Automatic Diagnostics (RNA) are contained in the system electronics but do not run during BAT. For example, they are used when the diagnostics cannot be loaded from the CE 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 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 that 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 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 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 two-digit failure code is used with MAPs.

L (Ø) – This selected drive number is L (or 0) 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.

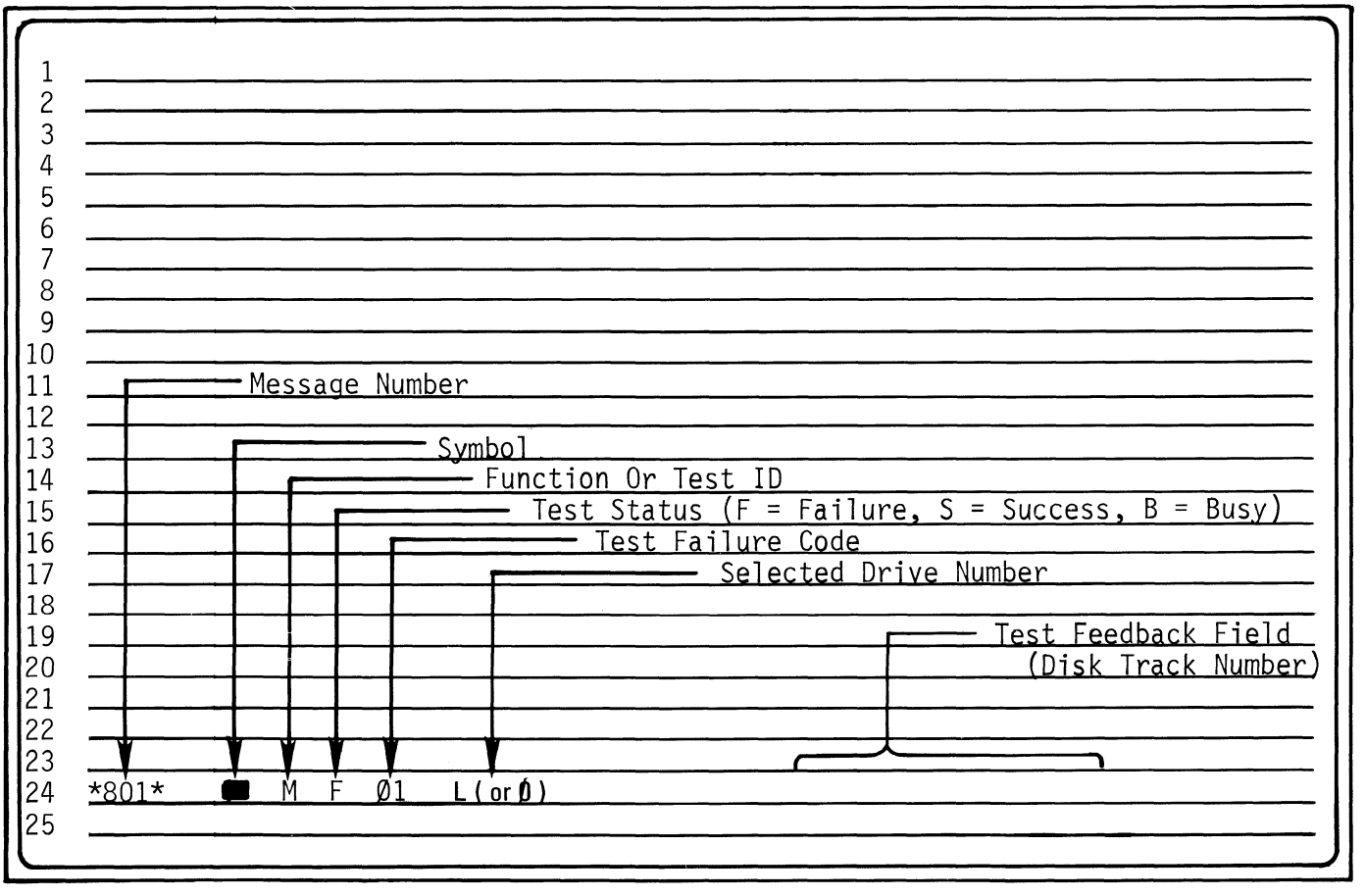


Figure 8 – RNA Diagnostic Display Format

Shown in Figure 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.

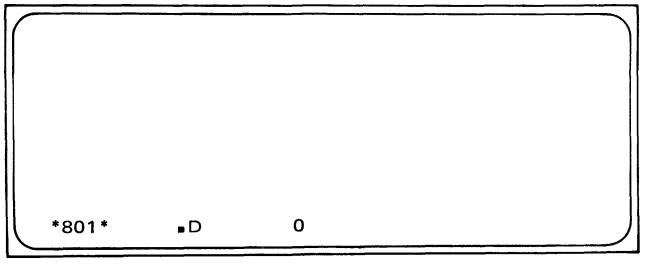


Figure 9 – Initial RNA Display Format

RESIDENT NON-AUTOMATIC 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 CE 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: This causes the system to 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 Ø) 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 IPL 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 get out of this mode at a specific time during the test. This period of time is known as the exit window. 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 before returning system control to RNA. The exit window can be recognized by a distinct pattern in the LED display (1110) which will be displayed continuously during the exit window.

When BAT is run from the RNA controller, the system control goes to the BAT controller. Because of this, the RNA display will disappear, and the interface with BAT will be through the normal BAT display formats.

L Run Diskette Drive Set Ready Test: The CE 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 CE Diagnostic Diskette must be loaded in the selected drive before running this test. This test determines if the diskette stepper motor is operating correctly in each phase. When an error occurs during this test, the last correct track ID that was read will be displayed in the test feedback field. The sequence and the Track ID's read are: 0, 1, 2, 3, 36, 44, 45, 46, 47, 73, 74, 75, 76, 47, 46, 45, 44, 3, 2, 1, 0. 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 MOVE key will end this test. The system will return to RNA controller 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.

These 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 and "F" will appear in the test results field. When the END key is pressed, the system return to the RNA test selection mode.

P Looping ROS CRC Test: Check the ROS on the Processor Card in the same way the BAT does.

Q Looping Display Path Test: Checks the RAM used for the CRT on the Display Adapter Card.

R Looping Base RAM Test: Check 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.

Customer Engineering (CE) Loadable Diagnostics are on the CE Diagnostic Diskette. They include:

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

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

The CE 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 (See Operating Instructions). To cause a soft IPL when the Task Selection Menu is displayed:

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

When the CE 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 CE Loadable Diagnostic Flowchart is shown in Figure 10.

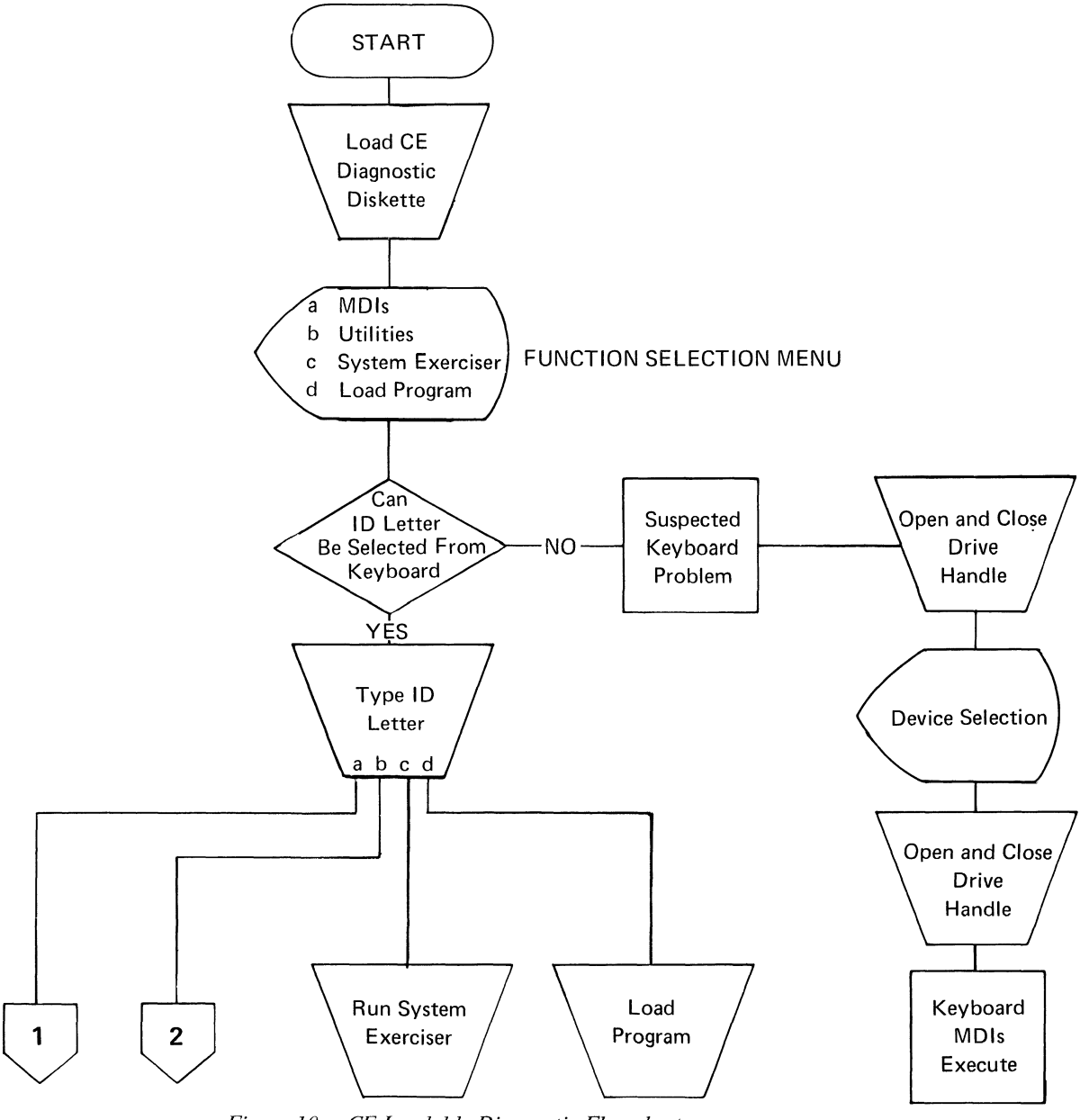


Figure 10 – CE Loadable Diagnostic Flowchart

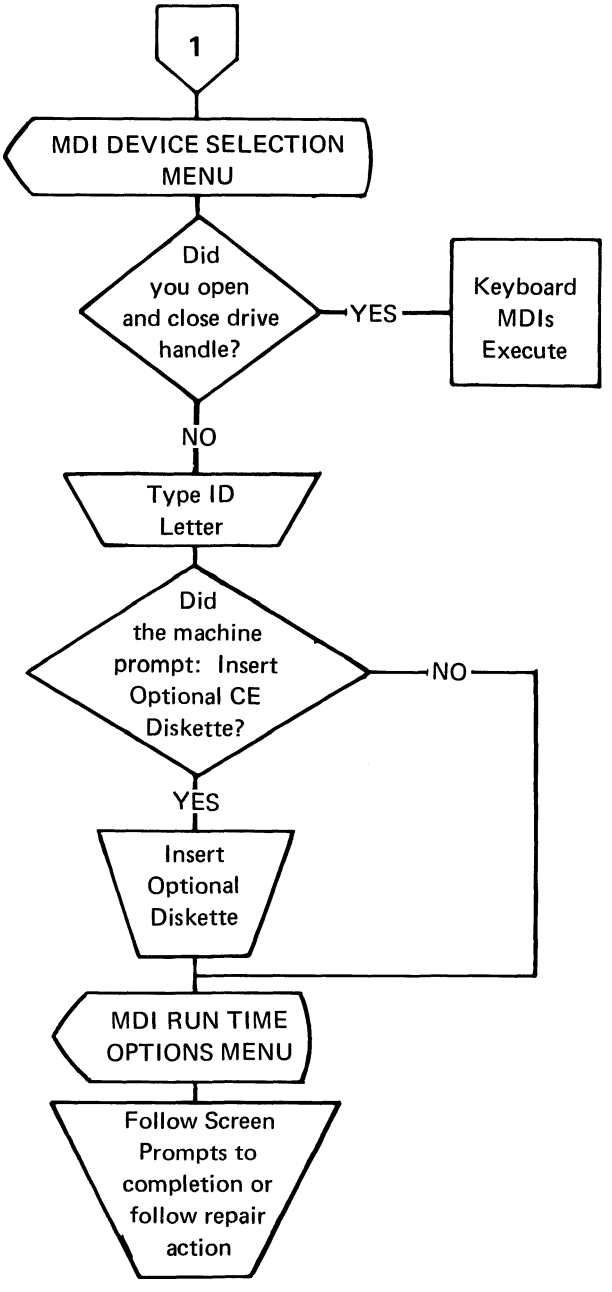


Figure 10 – CE Loadable Diagnostic Flowchart (continued)

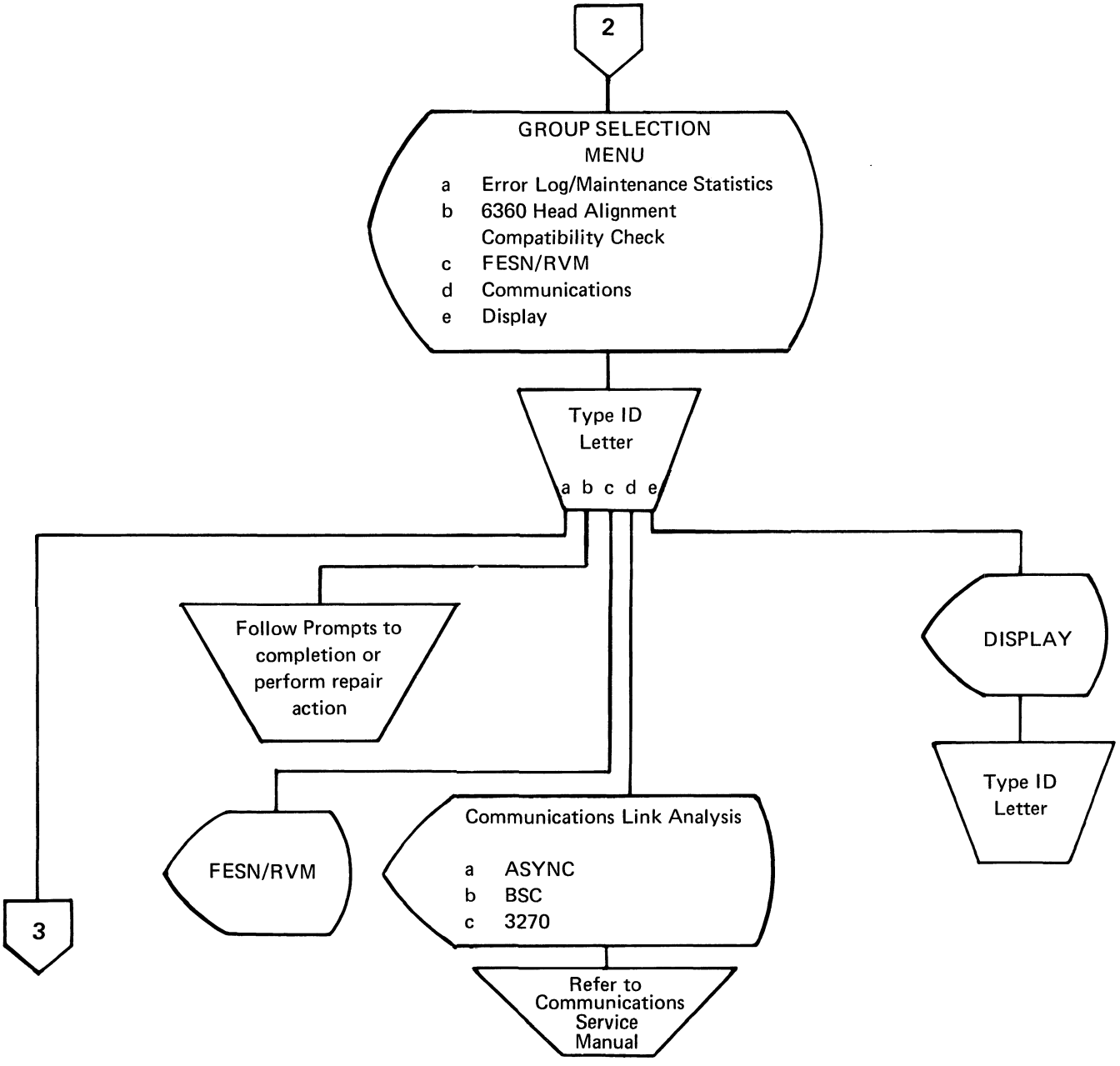


Figure 10 – CE Loadable Diagnostic Flowchart (continued)

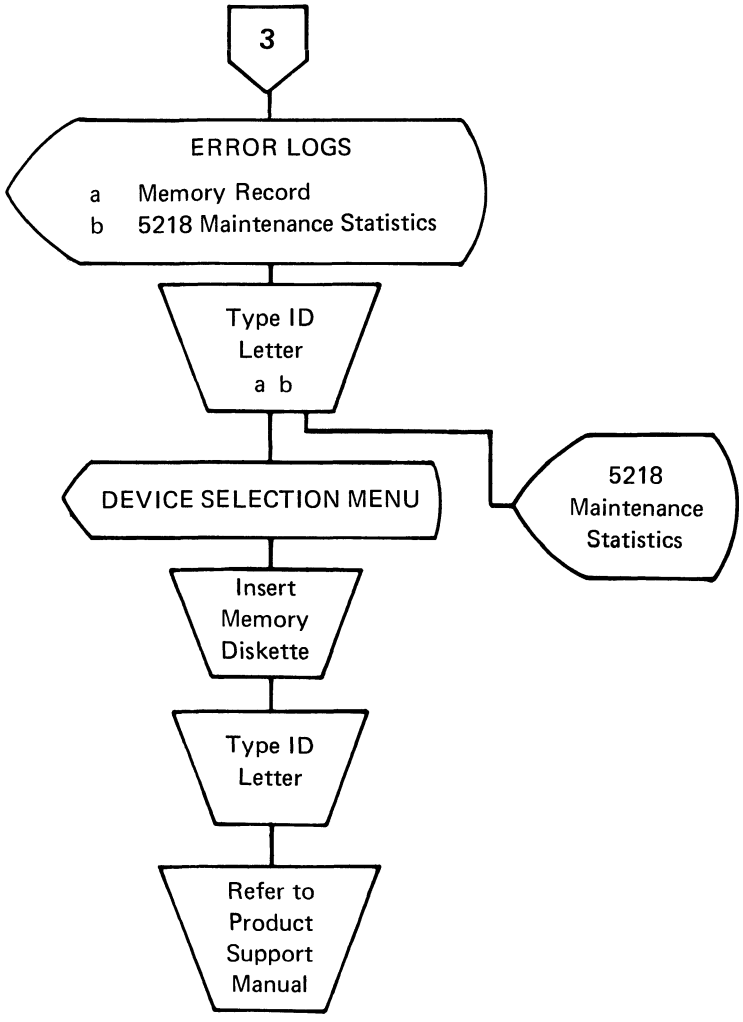


Figure 10 – CE Loadable Diagnostic Flowchart (continued)

CE LOADABLE DIAGNOSTIC DISPLAY FORMAT

The 25 lines of the CE diagnostic display show the following line information (Figure 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 CE Loadable Diagnostic mode, this field will display the CE 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.

  A – Type A card in position E.
  B – Type B card in position E.
  C – 160A card in position E, 32B card in position F.
  D – 192A card in position E, 32B card in position F.
  E – 256B card in position E.

NOTE: The error code *900* 00D0 will display if an operator trys 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.

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 of a dual drive system. In a single drive system this field will display the diskette name.

- 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.

- Communcations Status Field - Indicates the status of communications. The display in the field changes with the protocol.

- Keyboard ID Field - DIsplays the keyboard identification code which is selected with the keyboard logic board jumpers. For more information on keyboard ID see the Keyboard section of this Service Theory Manual.

Lines three 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.

- 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

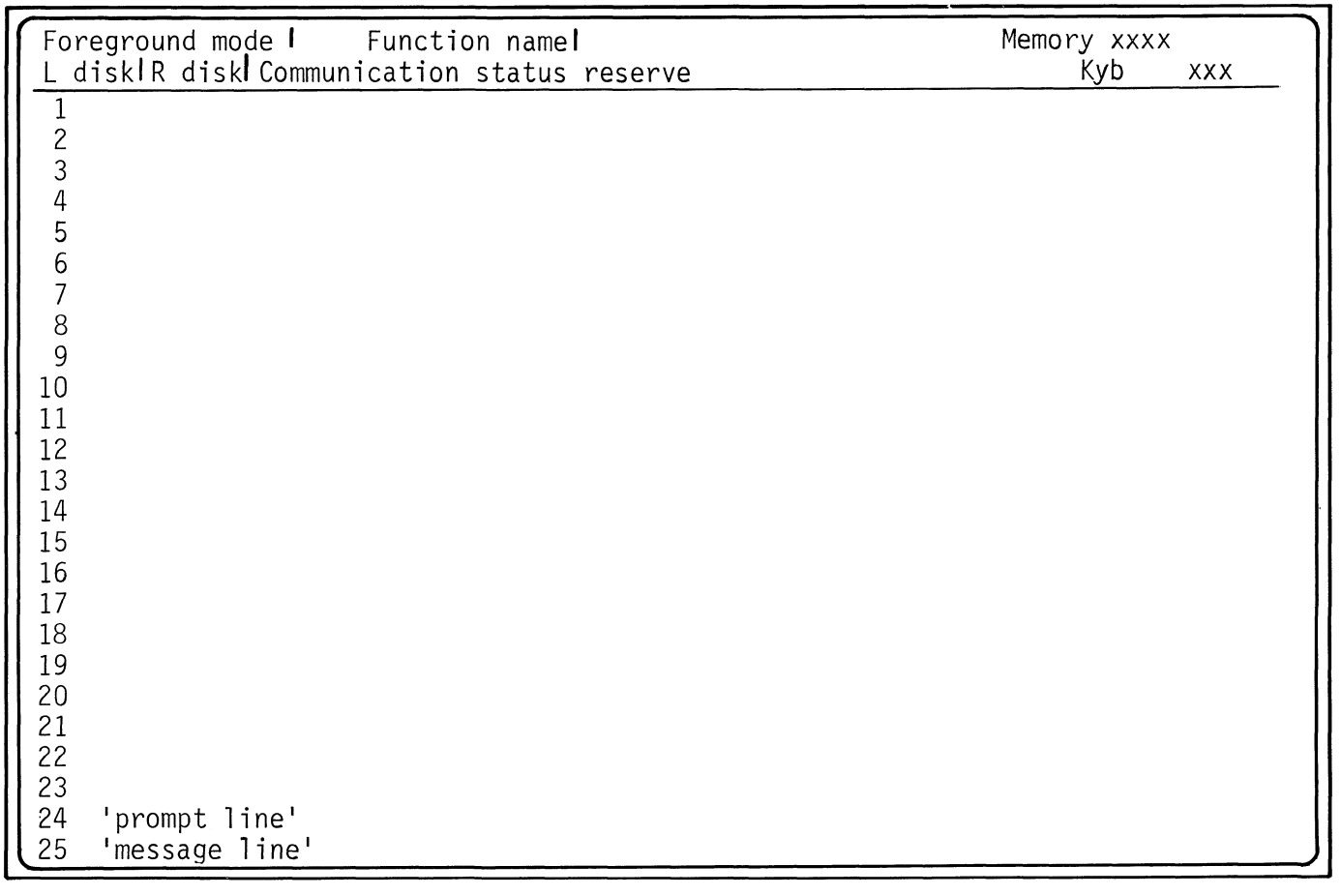


Figure 11 – CE Loadable Diagnostic Display Format

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.

CE LOADABLE DIAGNOSTICS KEYBOARD FUNCTIONS

NOTE: When diagnostics are loaded or selected from the CE 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 from the function selection menu and return 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 three 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 the message "Printer Error" to appear on the message line.

CE LOADABLE DIAGNOSTICS FUNCTION SELECTION

When CE Loadable Diagnostics are loaded, the display will show a menu of the functions available (see Figure 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" is the invalid ID letter.)

```
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 12 – CE Diagnostic Function Selection Menu

MAP DIAGNOSTIC INTEGRATION (MDI)

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

MDI ENTRY

NOTE: When diagnostics are loaded or selected from the CE 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.

When the CE Diagnostic Diskette is loaded, any function from the diagnostic function menu can be selected. If there is a keyboard problem, the MDI 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 13). The run time option for the device is then selected from the 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 CE responses to questions. The MDI display will show:

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

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

```
C.E. Diagnostics    MDIs                                  Memory xxxx
CED201                                                      Kyb xxx
                          DEVICE SELECTION

                  ID   ITEM
                  a    Display Module
                  b    Keyboard Module
                  c    Electronics Module
                  d    Diskette Unit
                  e    Printer
                  f    Shared Resource (Primary)
                  g    Shared Resource (Secondary)
                  h    Mag Card Unit
                  i    Communications

Configuration indicated by "  "


Press END to return to Function Selection Menu.
Type ID Letter to choose ITEM; press ENTER:
```

Figure 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 CE to select the device to be tested from this menu.

If a device selection is made for a device not in the system, 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" is the invalid ID letter).

If a wrong choice 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" is the invalid ID letter).

MDI RUN TIME OPTIONS

Run time options are entered through the MDI Run Time Options Menu (Figure 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 CE 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 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 the REQST key must be pressed.

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 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

                          YOUR    POSSIBLE
                  ID  ITEM    CHOICE  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 CANCL 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 14 – MDI Run Time Options Menu

MDI TEST UNIT NUMBERING

Each device is assigned a two-digit section number from the possible MDI section numbers from 10 through 90 (Figure 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 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 one through three.

1 – Stop if the answer is YES
2 – 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 through 999)
d	=	Decision (y, n, g, f, or m)
y	=	Step result was Yes
n	=	Step result was No
g	=	Step result was to go to another step
f	=	Step result was a fix
m	=	Step result was to go to another map
mmss	=	The MDI ID number for a GO TO MAP step
	mm =	Section Number (10 – 99)
	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 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 word 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.

```
C.E. Diagnostics    MDIs Diskette Module                    Memory xxxx
CED201                                                        Kyb xxx

START  mmss
001-y   003-y   005-y   007-y   009-y   011-y   013-y   015-y   017y   -END-


                                                  Section    - 80
                                                  Subsection - 70
                                                  Step       - 019
Press PRINT to print screen.                      Mode       - Run
Press ENTER to continue:
```

Figure 16 – MDI Trace Display

MDI DISPLAY TYPING AREA OR MENU AREA

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

- Command Text
- Question Text
- Fix/Stop Text
- Supplementary Text (Additional information about the step)
- Prompts and Instructions
- Application Status (Mode or Step Number)
- Decision Data or Test Condition (Symbol is displayed for each condition)
  - EQ (Equal To)
  - GR (Greater Than)
  - LT (Less Than)
  - NE (Not Equal To)
  - ON or OFF as in bit arrangement in the status byte
  - In Range (HILOW) – Results should be inside range
  - Selected bits on (ON) – Bits that are on in the mask must be on in the result
  - Selected bits off (OFF) – Bits that are on in the mask must be off in the result
  - Yes – Result is Yes or No
  - Expected (What the test results should be)
  - Received (What the test results are)
  - Next Step (Number of the next step in MDI)
- Test Unit Unique Information (Information about the test which is running)
  - Adapter Status
  - Any information which is common only to the test now being run
  - Special Instructions

```
C.E. Diagnostics    MDIs                                    Memory xxxx
CED201                                                        Kyb xxx

  COMMAND TEXT, FIX TEXT,                    SUPPLEMENTARY TEXT AREA
  and QUESTION TEXT AREA                     (13 lines of 39 characters)
  (19 lines of 39 characters)




                                             TEST UNIT UNIQUE AREA
                                             (4 lines of 39 characters)

                                        DECISION        STATUS
    DIRECTIVE TEXT AREA                 DATA AREA       AREA

'Prompt Line'
'Message Line'
```

Figure 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 options menu (Figure 14) to enter new options. From the options menu press ENTER to return to the step which you were on.

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

YES (y)
NO (n)
GO TO STEP (g)
GO TO MAP (m)
FIX (f)

When a "GO TO MAP" step occurs, the trace table will contain the MDI number as the entry following the "GO TO MAP" step.

While displaying the trace table pressing ENTER will 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 steps, return to the 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 18). Automatic resume occurs when the MDI step instructs you to turn the system off to perform a service check. When the CE Diagnostic Diskette is reloaded and MDIs are selected, the system will instruct to press ENTER to resume MDI processing. To resume on an MDI step that is not automatic, it is necessary to type an "r" and press ENTER before turning the system off.

```
C.E. Diagnostics     MDIs Shared Primary                    Memory xxxx
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
                                             failure.
GO TO MAP 4312, ENTRY POINT A.

                                   Automatic RESUME at Step 132

                                                  Section    - 42
                                                  Subsection - 70
CANCL to return to Device Selection.              Step       - 131
END to return to Function Selection.              Mode       - Run
Type y,n,(b,o,t,r); press ENTER:
```

Figure 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 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 xxxx
CED201                                                        Kyb xxx

Did all Keys work without fault?

                                                  Section    - 01
                                                  Subsection - 70
CANCL to return to Device Selection;              Step       - 005
END to return to Function Selection.              Mode       - Step
Type y,n,(b,o,t,r); press ENTER:
```

Figure 19 – Question Prompt

Command Text 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 20).

```
C.E. Diagnostics     MDIs Keyboard Module                Memory xxxx
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    - 01
                                                  Subsection - 70
CANCL to return to Device Selection;              Step       - 005
END to return to Function Selection.              Mode       - Step
Type (b,o,t,r); press ENTER:
```

Figure 20 – Command Text Prompt

Test Unit Prompt – One of the following is displayed when a step is run in the STEP mode (Figure 21). The results of the test unit are checked, and a decision is made by the MDI controller. This may be overriden 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
                                    MAP Description:
Good Test Unit results?             This MAP isolates Keyboard problems.

                                    Overrun test for the keyboard

                                    Test     - YES     Section    - 10
                                    Received - YES     Subsection - 70
CANCL to return to Device Selection;                   Step       - 001
END to return to Function Selection.                   Mode       - Step
Type y,n,(b,o,t,r); press ENTER: y
```

Figure 21 – Test unit Prompt Display

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

Good Test Unit results?

                                    Test     - EQ      Section    - 20
                                    Received - 0000    Subsection - 70
                                    Expected - 0000    Step       - 001
CANCL to return to Device Selection;                   Mode       - Step
END to return to Function Selection.
Type y,n,(b,o,t,r); press ENTER: y
```

Figure 21 – Test Unit Prompt Display (Continued)

Test Unit – Question Prompt – The following is displayed when a test or step unit is running and needs a response (Figure 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
                                    (13 lines of 39 characters)
(19 lines of 39 characters)

                                    TEST UNIT UNIQUE AREA
                                    (4 lines of 39 characters)

                                                  Section    - xx
CANCL to return to Device Selection;              Subsection - xx
END to return to Function Selection.              Step       - 024
To reply, press REQST:                            Mode       - Run
```

Figure 22 – Test Unit – Question Prompt

Fix/Stop Prompt – The following is displayed when a FIX or STOP step is indicated (Figure 23). 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                    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
CANCL to return to Device Selection;             Step       - 007
END to return to Function Selection.             Mode       - Step
Type (b,o,t,r); press ENTER:
```

Figure 23 – Fix/Stop Display

CE UTILITIES

The CE Loadable Diagnostics include Utilities normally used with MAPS. When the Utilities are selected from the Function Selection Menu (Figure 24), the Utility Group Selection Menu will be displayed (Figure 25). Once the utility group has been selected, a specific group utility menu will be displayed. The specific group utility menu will differ 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 24 – CE Loadable Diagnostic Function Selection Menu

```
C.E. Diagnostics                                 Memory xxxx
CED201                                              Kyb xxx
                       GROUP SELECTION

                ID  Item
                a   Error Log
                b   6360 Head Alignment Compatibility Check
                c   FESN/RVM

Press END to return to Function Selection Menu.
Type ID Letter to choose ITEM; press ENTER:
```

Figure 25 – CE Utility Group Selection Menu

ERROR LOG UTILITY GROUP

The Error Log utilities permit a review of error log information which has been stored in RAM and then written (dumped) to a diskette(s) called the Memory Record Diskette(s). This error log information aids in finding intermittent failures by showing where the failure(s) have occured. 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 26 is displayed, and the device error log is selected. When the device is selected, a prmpt to insert the Memory Record Diskette is displayed, and the Error Log for the selected drive will be displayed.

```
C.E. Diagnostics    Utilities                          Memory xxxx
CED201                                                    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 CANCL 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 26 – Error Log Utility Device Selection Menu

All the Error Logs follow the same basic format as the one shown in figure 27, and all counters start from the latest IPL.

- Lines 1 and 2 are the same as all other CE Diagnostic Displays in CE 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 during logging (amount of time from last IPL to time when memory was dumped to the Memory Record Diskette(s).
- Line 6 is blank.
- Lines 7 through 11 contain the number and types of 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                                    Memory xxxx
CED201                                                 Kyb xxx
                    DISKETTE DRIVE ERROR LOG

Duration of Logging     2 hrs  17 min  41 sec     Program Disk   xxxxxx

Read Operations     Write Operations    Seek Operations     Data Field Errors
xxxxxxxxxx          xxxxxxxxxx          xxxxxxxxxx          xxxxxxxxxx

Read Data Errors    Write Fault Errors  Seek Errors         No Data Errors
xxxxxxxxxx          xxxxxxxxxx          xxxxxxxxxx          xxxxxxxxxx

Status Reg 1        Status Reg 2        Status Reg 3        Last Diskette
10110100            11110111            10111011            xxxxxx

Press CANCL 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 27 – Device Error Log

SYSTEM ERROR LOG

The system logs (records) errors in the system memory, and this information can be stored on a diskette by either the operator or the CE. The CE 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 CE 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 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(s) 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.

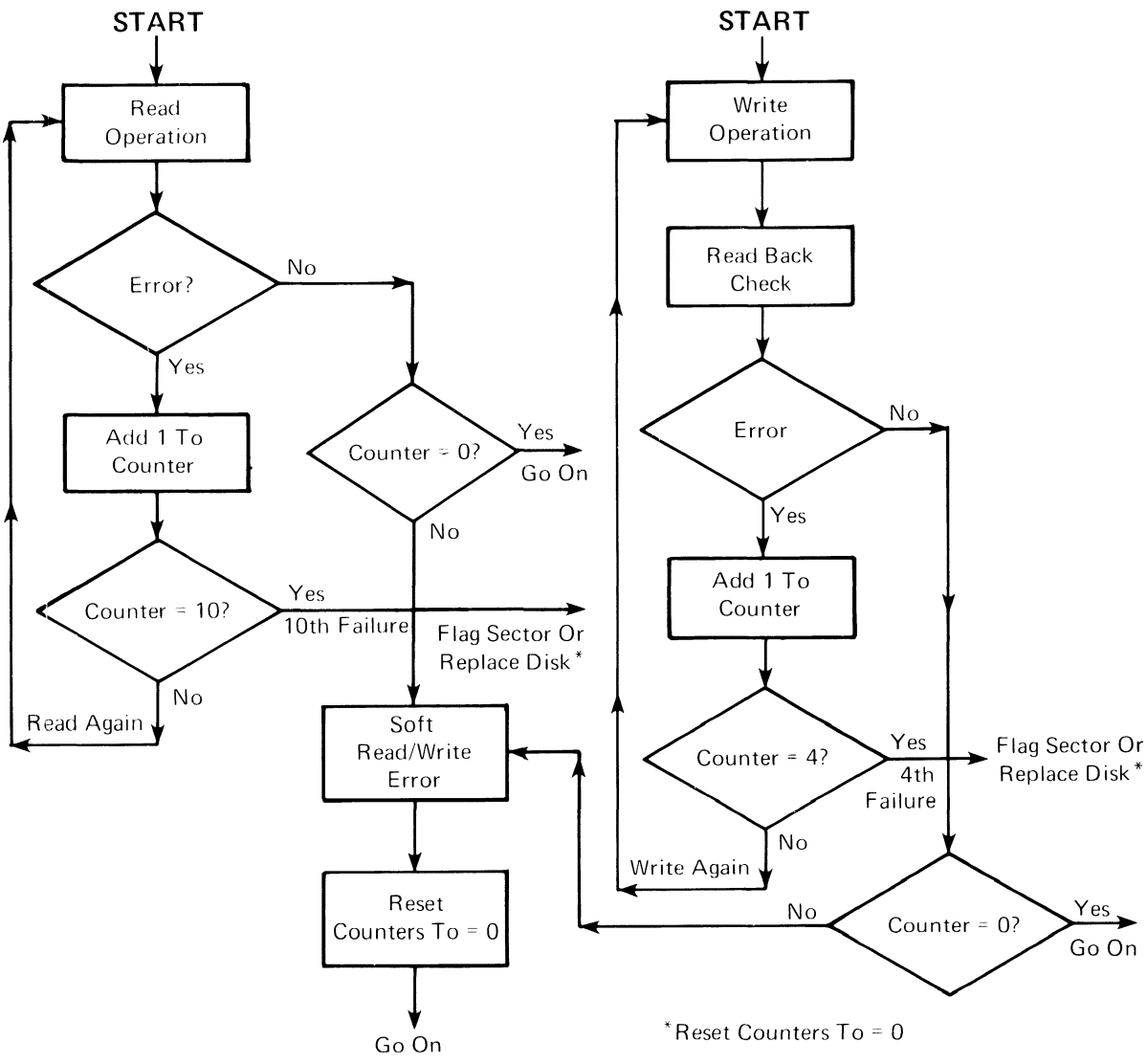


Figure 28 – Diskette Read/ Write Error Recovery Routine

ERROR LOG DUMP PROCEDURE

The error log in RAM and system memory is dumped to diskette by using the following procedure:

- Leave the system in the normal operating mode.
- Remove all diskettes from the diskette unit. (The Error Log Dump Procedure will write over the information on the diskette.)
- Press the Memory Record Button once. Error codes will be displayed. (Refer to Figure 29)
- Press the Memory Record Button a second time.
- Load the Memory Record Diskette in the left drive (drive Ø).

When the Memory Record Diskette is loaded, the error log is automatically dumped to the diskette from RAM.

```
               1                                   1 Memory xxxx 1
  I     1                  1            1               Kyb xxx
                     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 Dikette Name, Recover Documents
               c    Program Diskette Tasks:
                     Default Formats, Duplicate Setups,
                     Printer and Work Station Description,
                     Duplicate and Erase Program Diskette
               d    Spelling Tasks

*900*  FFF2  0111  1000  00  003C  0034  0170  1A9AIA
```

Figure 29 – Error Log Dump Error Codes

The error log dump messages (*xxx*) are listed below:

- 900 – A software error has been detected.
- 901 – 256K bytes recorded; Insert another Memory Record diskette.
- 902 – Dump complete.
- 903 – Read/write error on dump diskette.
- 904 – Dump diskette improperly formatted.
- 90A – Indicator that the left drive has become ready.
- 90B – Left drive is not ready.
- 90C – Left drive had a read error.
- 90D – Left drive is ready.
- 90E – Left drive had a seek error.
- 90F – Left drive is not present.

DISKETTE UNIT (6360) HEAD ALIGNMENT COMPATIBILITY CHECK

This utility checks the compatibility of the read/write head alignment of two or more diskette drives by using one CE diskette. One of three results will be displayed; return codes, diskette drive problem, or unexpected diskette failure.

- The return codes of the diskette drives checked are compared to determine which diskette drive(s), if any, need to be mechanically checked and/or adjusted with the head alignment procedure in this manual.

  The return codes +1, 0, or -1 are displayed, and indicate the result of the check.

  A variation in return codes of the drives indicates the 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 the Product Support Manual. 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 is displayed (Figure 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  1A9AIA                                              Kyb xxx

DISKETTE                               FESN            RVM
Textpack 2 (IPL) U.S. English          xxxxxxx         xxx
```

Figure 30 – FESN/R VM 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 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 CE. The keyboard may be tested anytime during the test.

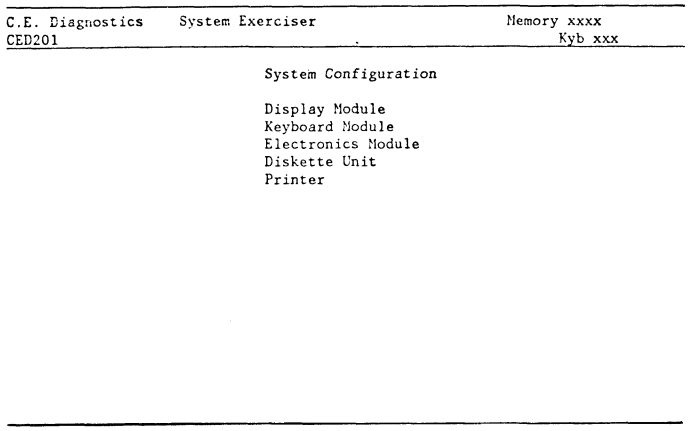


Figure 31 – System Exerciser Display

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 status column will show which device or combination of devices are suspected. The printed output, shown in Figure 32, should also be checked for errors.

The system exerciser takes approximately 2 to 3 minutes to complete. When the system exerciser is completed, the END key may be pressed to return to the Function Selection Menu, or the ENTER key may be pressed to place the system exerciser in loop mode.

In loop mode the exerciser will repeat until an error is sensed or the CANCL key is pressed.

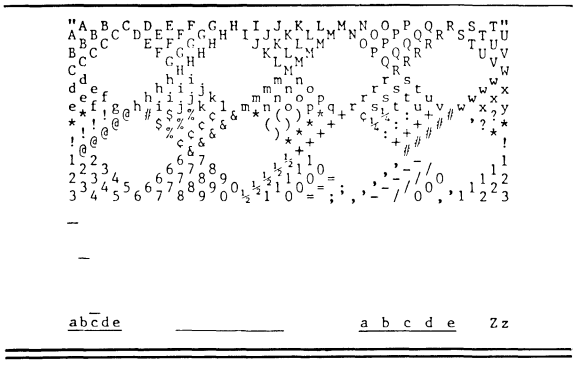


Figure 32 – System Exerciser Printed Output

LOAD PROGRAM FUNCTION

The Load Program Function is selected from the CE Diagnostic Function Selection Menu to perform a soft 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.

This function may also be used to execute Diskette MDIs from the opposite diskette drive.

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 33). In this mode, the customer's program diskette may be inserted in the diskette drive in place of the CE diskette. The system will then IPL the inserted program diskette.

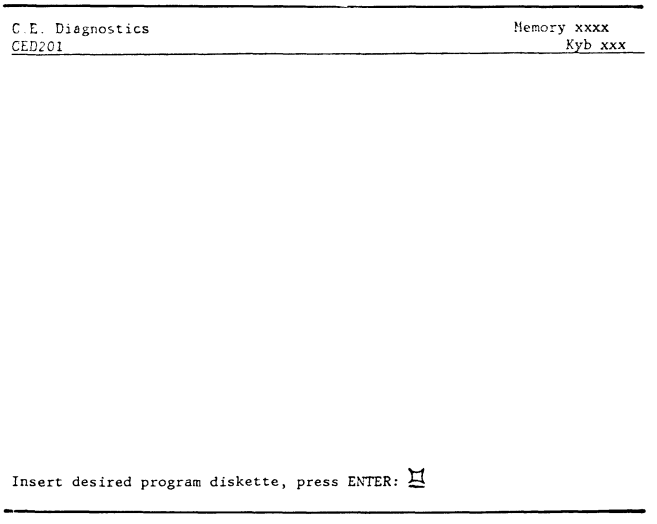


Figure 33 - Load Program Function Display

The MAPs include directions for the following activities: System Entry (Start of Call), Power Distribution, IPL failures, repair action verification, 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.

MAPS FORMAT

Maintenance Analysis Procedure (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. Figures 34 and 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 page. (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)

SYSTEM ENTRY MAP (1)

MAP 0010-1 (3)

PAGE 1 OF 5 (2)

ENTRY POINTS

FROM MAP NUMBER	ENTER THIS MAP ENTRY POINT	PAGE NUMBER	STEP NUMBER
0015	A	1	001
8061	A	1	001
8062	A	1	001

(4)

EXIT POINTS

EXIT THIS MAP PAGE NUMBER	STEP NUMBER	TO 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

(5)

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 (7)

4 4 3 2
A B C D (10)

Figure 34 – MAP Format Sample

MAP 0010-1

D
1 (9)

SYSTEM ENTRY MAP

MAP 0010-2

PAGE 2 OF 5

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) (8)

Is the Power Supply Fuse bad?
Y N

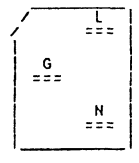
006

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

(WT-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.

3 3
E F

MAP 0010-2

Figure 35 – MAP Format Sample

The Displaywriter System performs a Basic Assurance Test (BAT) each time it is turned on. The successful completion of BAT is followed by a customer initial program load (IPL) procedure. In addition to the BAT, the system hardware and software will perform a certain amount of automatic error recovery during system operation.

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 operator response 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 signals such as LEDs, keyboard tone, or diskette noise.

The operator may then be directed to load the Problem Determination Diskette (PDD) by the Problem Determination Guide (PDG). This diskette contains system verification tests and utilities that can be selected and run by the operator. When the operator selects the system area to be tested, the PDD will continue 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 are operating. This will be reinforced by the use of audible signals. These additional tests are not in the BAT.

Most of the tests on the Problem Determination Diskette (PDD) will not require operator intervention. However, it may be necessary for the operator to perform simple tasks to expand the diagnostic information gathered in the automatic problem determination procedure.

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 Program Determination Guide will direct the operator to place a service call. While placing the service call, the operator will give a description of the problem, along with the error codes.

GLOSSARY

This glossary includes definitions developed by the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). This material is reproduced from the *American National Dictionary for Information Processing,* copyright 1977 by the Computer and Business Equipment Manufacturers Association, copies of which may be purchased from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

ANSI definitions are preceded by an asterisk. The symbol "(SC1)" at the beginning of a definition indicates that it is reprinted from an early working document of ISO Technical Committee 97, Subcommittee 1 and that agreement has not yet been reached among its members.

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 communications.

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 insolating 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

CE loadable diagnostics. Diagnostics that are loaded from a diagnostic diskette.

CE Utilities. Programs in general support of the processes of the system.

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.

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

logo. The name, symbol, or trademark of a company.

M

MAP Diagnostic Integration (MDI). A diagnostic program on the CE Diagnostic 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(s). The diskette(s) 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 condition.

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.

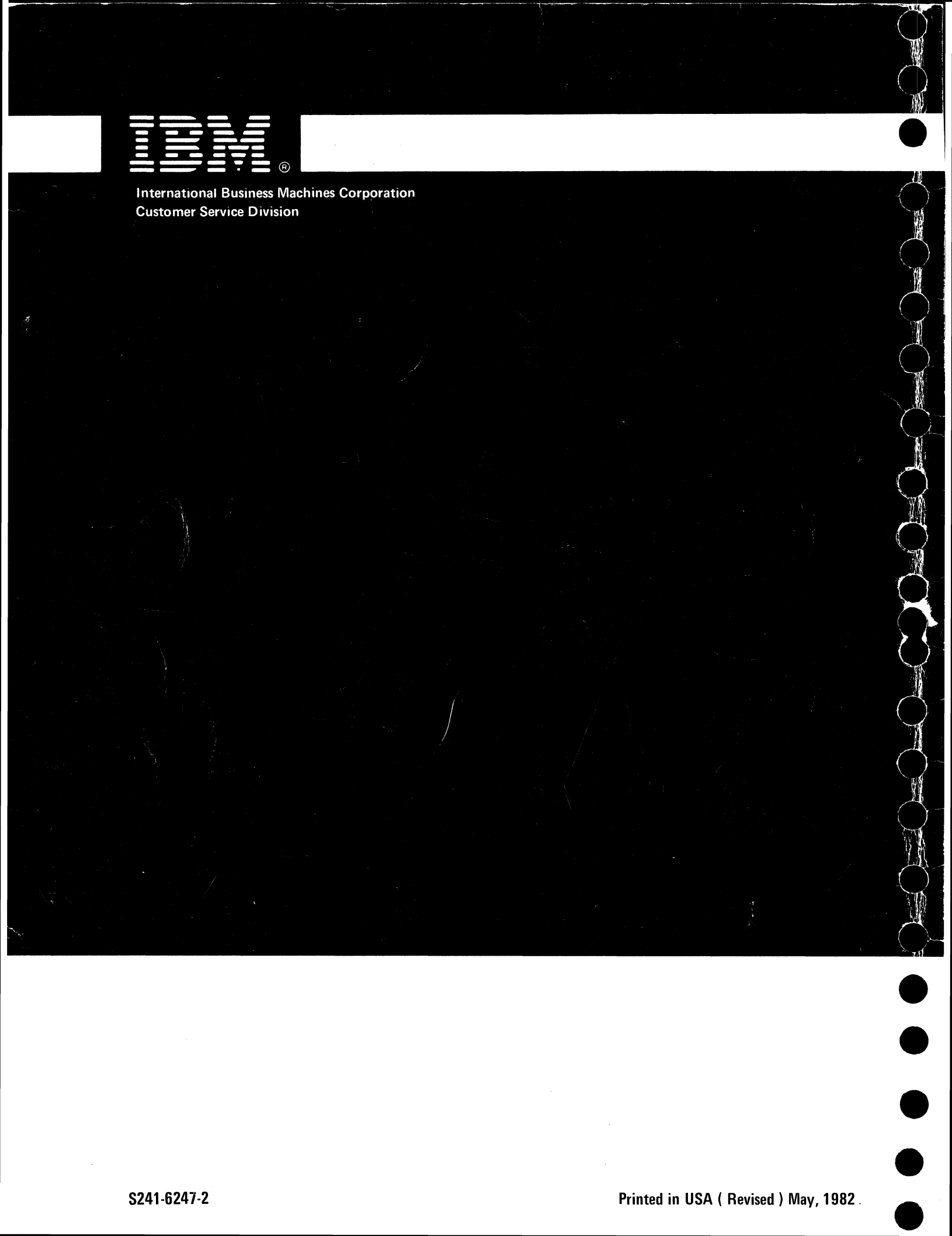
V

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.



International Business Machines Corporation
Customer Service Division

S241-6247-2

Printed in USA (Revised) May, 1982 .