IBM

IBM System/23 Service Library

Volume 1

IBM 5324 Computer Service Manual

IBM

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Volume 1

IBM 5324 Computer Service Manual

Preface

This service manual, which is Volume 1 of the IBM System/23 Service Library, is intended to be used for servicing the IBM 5324 Computer. Service personnel using this manual are assumed to have completed the 5324 computer training course.

The manual contains the maintenance procedures, theory of operation, and parts catalog for the 5324 computer, including the processor, processor features, power supply, CRT display unit, keyboard, and internal diskette drives.

Contents

IBM 5324 Computer Service Manual

Personal Safety

Refer to the handbook, *Electrical Safety for IBM Customer Engineers,* S229-8124, for additional safety information.

CE SAFETY PRACTICES

All Customer Engineers are expected to take every safety precaution possible and observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you MUST work alone.

2. Remove all power, ac and dc, when removing or assembling major components, working in immediate areas of power supplies, performing mechanical inspection of power supplies, or installing changes in machine circuitry.

3. After turning off wall box switch, lock it in the Off position or tag it with a "Do Not Operate" tag, Form 229-1266. Pull power supply cord whenever possible.

4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, observe the following precautions:
   a. Another person familiar with power off controls must be in immediate vicinity.
   b. Do not wear rings, wrist watches, chains, bracelets, or metal cuff links.
   c. Use only insulated pliers and screwdrivers.
   d. Keep one hand in pocket.
   e. When using test instruments, be certain that controls are set correctly and that insulated probes of proper capacity are used.
   f. Avoid contacting ground potential (metal floor strips, machine frames, etc.). Use suitable rubber mats, purchased locally if necessary.

5. Wear safety glasses when:
   a. Using a hammer to drive pins, riveting, staking, etc.
   b. Power or hand drilling, reaming, grinding, etc.
   c. Using spring hooks, attaching springs.
   d. Soldering, wire cutting, removing steel bands.
   e. Cleaning parts with solvents, sprays, cleaners, chemicals, etc.
   f. Performing any other work that may be hazardous to your eyes. REMEMBER — THEY ARE YOUR EYES.

6. Follow special safety instructions when performing specialized tasks, such as handling cathode ray tubes and extremely high voltages. These instructions are outlined in CEMs and the safety portion of the maintenance manuals.

7. Do not use solvents, chemicals, greases, or oils that have not been approved by IBM.

8. Avoid using tools or test equipment that have not been approved by IBM.

9. Replace worn or broken tools and test equipment.

10. Lift by standing or pushing up with stronger leg muscles—this takes strain off back muscles. Do not lift any equipment or parts weighing over 60 pounds.

11. After maintenance, restore all safety devices, such as guards, shields, signs, and grounding wires.

12. Each Customer Engineer is responsible to be certain that no action on his part renders products unsafe or exposes customer personnel to hazards.

13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.

14. Ensure that all machine covers are in place before returning machine to customer.

15. Always place CE tool kit away from walk areas, where no one can trip over it; for example, under desk or table.

16. Avoid touching moving mechanical parts when lubricating, checking for play, etc.

17. When using stroboscope, do not touch ANYTHING — it may be moving.

18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.

19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.

20. Before starting equipment, make certain fellow CEs and customer personnel are not in a hazardous position.

21. Maintain good housekeeping in area of machine while performing and after completing maintenance.

> Knowing safety rules is not enough.
> An unsafe act will inevitably lead to an accident.
> Use good judgment—eliminate unsafe acts.

ARTIFICIAL RESPIRATION

General Considerations

1. Start Immediately — Seconds Count
   Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim, or apply stimulants.

2. Check Mouth for Obstructions
   Remove foreign objects. Pull tongue forward.

3. Loosen Clothing — Keep Victim Warm
   Take care of these items after victim is breathing by himself or when help is available.

4. Remain in Position
   After victim revives, be ready to resume respiration if necessary.

5. Call a Doctor
   Have someone summon medical aid.

6. Don't Give Up
   Continue without interruption until victim is breathing without help or is certainly dead.

Rescue Breathing for Adults

1. Place victim on his back immediately.

2. Clear throat of water, food, or foreign matter.

3. Tilt head back to open air passage.

4. Lift jaw up to keep tongue out of air passage.

5. Pinch nostrils to prevent air leakage when you blow.

6. Blow until you see chest rise.

7. Remove your lips and allow lungs to empty.

8. Listen for snoring and gurglings — signs of throat obstruction.

9. Repeat mouth to mouth breathing 10-20 times a minute. Continue rescue breathing until victim breathes for himself.

Thumb and
finger positions

Final mouth-to-
mouth position

Installation warning

Warning: The 5324 computer can contain diskette units that use magnetic reading and writing methods. Electromagnetic devices such as television sets or other display terminals can cause interference with the operation of the system. To ensure that the system will operate correctly, do not install any electromagnetic devices in a radius of 0.61 m (2 ft) of the 5324.

Chapter 1. Using the IBM System/23 Service Library

Contents

The service
library

Using the IBM System/23 Service Library

The service library

Service library book 1 contains the service manuals.

Service library book 2 contains the diagnostic user guide, MAPs, and diagnostic diskette

The service library contains the maintenance documents and the diagnostic-program diskette that will aid you in locating and repairing problems in the IBM System/23. The service library contains the:

- Maintenance analysis procedures (MAPs)
- CE diagnostic diskette
- Diagnostic user guide
- Service manuals

The procedures for using the contents of the service library are described in this chapter; however, if you already understand these procedures, you can use the flowchart on the next page as a review.
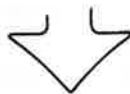
Always begin each
service call with
the START MAP.

START MAP
(MAP 1000)

Depending on your answers
to the MAP questions about
the failure indications, the
START MAP directs you to:

other MAPs

MAP 1400

MAP 1300

MAP 1200

a procedure in
a service manual

Service
manual

run a diagnostic program

Diagnostic
user
guide

Diagnostic
diskette
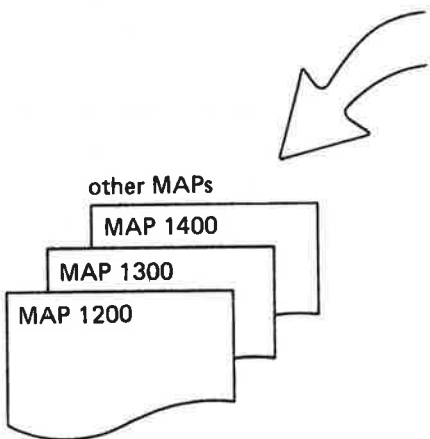
The MAPs guide you through
the service call by asking
questions about error codes,
diagnostic program results,
logic-probe levels, and
service checks.
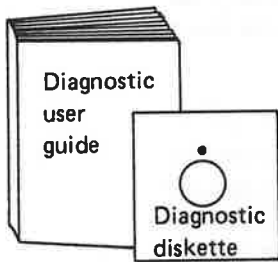
The diagnostic user
guide tells you how
to run the diagnostic
programs and how to
interpret the results.
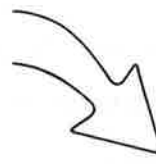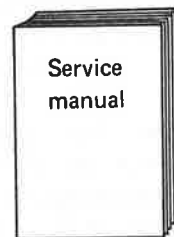
The service manuals
provide information
about machine
locations, service
checks, adjustments,
removal, and replace-
ment procedures,
and theory of
operation.

Using the IBM System/23 Service Library

Maintenance analysis procedures (MAPs)

The MAPs use step-by-step instructions for testing and locating failures in the IBM 5324 Computer and the input/output (I/O) devices. The MAPs guide you through the service call with questions about error codes, diagnostic program results, logic-probe levels, and service checks. The MAPs use a logical method for locating the possible causes of a machine problem and point you to that part of the 5324 computer or I/O device that needs adjustment or replacement.

You should always use the START MAP (MAP 1000) as the entry point for any service call.

MAP entry points

Always use the entry points of the MAPs. The entry points are specified by references in other MAPs or by a Failure Index (at the start of the MAP) that contains error codes or failure symptoms.

Using the MAPs

When using the MAPs, you must:

Read carefully. The MAPs can aid you in finding the problem only if you follow instructions and answer questions carefully.

Follow the sequence. Follow the MAP sequence at all times. Sometimes the MAP instructions do not seem important; however, you must follow them in order to determine the exact error conditions.

Follow instructions. MAP instructions must be carried out exactly in the order given. Questions are relative to instructions that immediately precede the questions. Do not change the conditions set by the instructions before answering the questions. Do not operate any switch or key until you are requested to do so.

When the MAPs request you to probe a line, the line name and its active level are given. For example:

Probe H2 G06 (− machine check).

The − (minus) in front of machine check indicates that this line is active at a minus (down) level.

MAP example

An example of an IBM System/23 MAP is shown on the next two pages. Comments have been added to describe the MAP format and statements.

MAP name

MAP number

FILE MAP

MAP 1500-1

MAIN STRATEGY

PAGE   1 OF   3

Entry and exit points—shows all entry and exit points to and from this MAP.

ENTRY POINTS

FROM	ENTER THIS MAP

| MAP | ENTRY   PAGE   STEP |
NUMBER	POINT NUMBER NUMBER
1000	A 1 001
1530	B 2 007

EXIT POINTS

EXIT THIS MAP	TO

| PAGE   STEP | MAP   ENTRY |
NUMBER NUMBER	NUMBER POINT
3 014	1000 B
3 016	1000 B
3 017	1225 A
2 006	1530 A
2 010	1530 A
3 012	1540 A

Step number

001
(ENTRY POINT A)
DID POWER-ON TEST RUN OK?
Y N

Entry point—indicates a possible starting point in this MAP. This point is usually referenced from a step within a MAP.

| 002
| HALT 38?
| Y N

Question—answer either yes or no. Continue from your answer to the next question or instruction.
Y=Yes, N=No

| | 003
| | NO 24V TO DRIVE 1
| | CHECK PIN B03 ON CABLE FOR
| | VOLTAGE AND CONTINUITY
| |
| 004
| PROGRAM   SENSES   DRIVE   1   NOT
| ATTACHED
| CHECK PIN A18 AND CABLE FOR
| GROUND AND CONTINUITY
| (SEE   SM 1212)   REPLACE   IF
| NEEDED

Reference number—refers to a location graphic, maintenance procedure, chart, or other pertinent information in a service manual.

Off-page reference—identifies the page and trace on which this MAP leg continues. The 2 indicates that this leg continues on page 2. The A indicates that this leg continues at trace A.

2
A

MAP 1500-1

(Continued on next page)

On-page reference—indicates the trace and page from which this MAP leg came. The 1 indicates that this leg came from page 1. The A indicates that this leg came from trace A.

```
A              FILE MAP
1                                                    MAP 1500-2
|              MAIN STRATEGY
|
|              PAGE    2 OF    3
|
|
005
1.   POWER OFF.
2.   POWER ON.
3.    WHEN  'READY' APPEARS AT THE
BOTTOM OF THE CRT
PRESS 'CMD TEST'  TO SELECT   THE
ROS RESIDENT
DISKETTE PID 1500.
4.    SELECT DISKETTE DRIVE '1'.
5.     SELECT  'DISK  WITHOUT LOOP'
OPTION TO RUN
TEST ON DISKETTE DRIVE 1
TEST RUN OK?
Y N
|
| 006
| PID 1500 DISKETTE FAILURE.
| GO TO MAP 1530, ENTRY POINT A.
|
007
(ENTRY POINT B)
1.   LOAD DCP PROGRAM
2.   WHEN DCP MENUE IS DISPLAYED
ENTER OPTION '0' TO LOAD PID 1505
DISKETTE FLT (PART 1).
3.   RUN PID 1505 WITHOUT LOOP ON
DRIVE 1.
DOES DISPLAY INDICATE
PROPER     NUMBER      OF     DRIVES
INSTALLED?
Y N
|
| 008
| CHECK PIN A18 AND CABLE FOR
| GROUND AND CONTINUITY,   REPLACE
| IF NEEDED.   (SEE SM 1212)
|
009
TEST RUN OK?
Y N
|
| 010
|
| GO TO MAP 1530, ENTRY POINT A.
|
|
|
|
|
3
B
```

External exit point—indicates the MAP and entry point to go to.

Instruction—establishes conditions for answering the next question.

Action—possible fixes for the failure. Replace, repair, or adjust in the order given. (Check/replace means to check first, then replace if defective.)

Diagnostic and CE utility programs

Diagnostic programs

There are three types of diagnostic programs to aid you in observing and locating failures in the IBM System/23. They are:

- Power-on diagnostics
- ROS resident diskette diagnostics
- CE diskette resident diagnostics

Power-on diagnostics. The power-on diagnostics are contained in ROS (read-only storage) and are run automatically when the system is switched on. If an error is found, an error code is displayed to describe the failure. Descriptions of the routines and error codes used by the power-on diagnostics are in the diagnostic user guide.

ROS resident diskette diagnostics. The ROS resident diskette diagnostics are diagnostic routines for the diskette drives. These routines aid you in locating failures on a diskette drive when the diskette resident diagnostics cannot be loaded. The instructions for using these ROS resident diskette routines are in the diagnostic user guide.

CE diskette resident diagnostics. The CE diskette resident diagnostics are on the diagnostic program diskette. These diagnostics contain the diagnostic control program (DCP) and the device diagnostics to aid you in locating and repairing problems of the smallest field replaceable unit (FRU). The diagnostic program diskette is in service library book 2. The instructions for using these diskette resident diagnostics are in a diagnostic user guide.

CE utility programs

The CE utility programs are on the diagnostic program diskette and are loaded under control of the diagnostic control program (DCP). The functions performed by the utility programs are:

- Diskette format
- Diskette copy
- Diskette read/verify
- Diskette VTOC display
- Engineering change (EC) and program temporary fix (PTF) support
- Error log display
- Configuration display

The instructions for using the CE utility programs are in the diagnostic user guide.

The service library

Using the IBM System/23 Service Library

Diagnostic user guide

A diagnostic user guide, in service library book 2, contains the information you need to use the diagnostic and CE utility programs. Program descriptions, operating procedures, options, halt codes, and error codes are included in the guide.

The descriptions for the halt and error codes can be useful when you are diagnosing difficult or intermittent machine failures.

An example of a page from the guide is shown on the next page.

   2.4   PROGRAM RUN INSTRUCTIONS

      2.4.1 END COMMAND

            2.4.1.1 A "9" KEY ENTRY ON THE NUMERIC KEYPAD RETURNS CONTROL TO DCP.

      2.4.2 EXIT ROUTINE PROCEDURE

            2.4.2.1 ROUTINE 1 - MAY BE EXITED BY DEPRESSING THE "TEST" KEY TWICE.

            2.4.2.2 ROUTINE 2 - MAY BE EXITED BY FORCING 2 ERRORS (HITTING THE
                    WRONG KEY ON PURPOSE) AND THEN DEPRESSING THE
                    TEST KEY.

      2.4.3 LOOP ROUTINE COMMAND - N/A

   2.5 CONTROL PROGRAM HALTS

      2.5.1 ROUTINE 1 - THERE ARE NO HALTS.

      2.5.2 ROUTINE 2 - ONE RETRY IS ALLOWED AFTER EACH OF THESE HALTS.

```
************************************************************
*HALT *                                    *      ACTION   *
*CODES*                CONDITION           *     REQUIRED  *
************************************************************
* 110 * INCORRECT SCAN CODE                * RE-ENTER KEY  *
*-----*------------------------------------*---------------*
* 120 * NO SCAN CODE RECEIVED              * RE-ENTER KEY  *
*-----*------------------------------------*---------------*
* 130 * MORE THAN ONE SCAN CODE RECEIVED ON MAKE-* RE-ENTER KEY *
*     * ONLY KEYS                         *                *
*-----*------------------------------------*---------------*
* 140 * CORRECT SCAN CODE RECEIVED BUT TYPAMATIC *RE-TRY OPERATION*
*     * FUNCTION FAILED                    *                *
************************************************************
```

3.0 INDEX OF HALTS AND PRINTOUTS

      3.1 ROUTINE 1 (TEST SINGLE KEY) - THERE ARE NO HALTS IN THIS ROUTINE.

      3.2 ROUTINE 2 - SEE FOLLOWING CHART.

```
************************************************************************
*                       HALT IDENTIFIER TABLE                         *
************************************************************************
*HALT*                                               *                *
* ID *                  MEANING                       *    ACTION      *
*    *                                               *                *
************************************************************************
*     *                                              *                *
* 150 * AN INVALID SCAN CODE WAS RECEIVED FROM KEYBOARD * REPLACE KEYBD *
*     *                                              *                *
*-----*----------------------------------------------*----------------*
*     *                                              *                *
* 160 * AN INCORRECT SCAN CODE WAS RECEIVED ON THE SECOND* REPLACE     *
*     * ATTEMPT                                      * KEYBOARD       *
*     *                                              *                *
*-----*----------------------------------------------*----------------*
*     *                                              *                *
* 170 * NO INPUT RECEIVED ON SECOND ATTEMPT          * REPLACE KEYBD  *
*     *                                              *                *
*-----*----------------------------------------------*----------------*
*     *                                              *                *
* 180 * MULTIPLE SCAN CODES WERE RECEIVED FROM A KEY THAT* REPLACE     *
*     * SHOULD HAVE ONLY PRESENTED A SINGLE INTERRUPT * KEYBOARD      *
*     *                                              *                *
*-----*----------------------------------------------*----------------*
*     *                                              *                *
* 190 * TYPAMATIC FUNCTION FAILED ON SECOND ATTEMPT  * REPLACE KEYBD  *
*     *                                              *                *
*-----*----------------------------------------------*----------------*
```

The service library

Using the IBM System/23 Service Library

Service manuals

The service manuals, which are located in book 1 of the IBM System/23 Service Library, contain additional reference information you need to diagnose and repair machine failures.

Volume numbers

Each service manual is assigned a volume number, as follows:

- Volume 1—5324 Computer, including the power supply, CRT display unit, keyboard, and internal diskette drives
- Volume 2—5241 Printer
- Volume 3—5242 Printer
- Volume 4—5246 Diskette Unit
- Volume 5—Communications Feature
- Volume 6—5247 Disk Unit

The MAPs use the volume number as the first digit of a four-digit number, which is the reference number of a maintenance procedure in the service manual.

Service manual contents

Each service manual contains information about:

- Maintenance procedures—describes and shows how to do the service checks, adjustments, and removal/replacement procedures requested by the MAPs
- Location diagrams—shows the location of the field replaceable units (FRUs), test points, and jumper pins
- Theory of operation—describes how the machine operates
- Parts catalog—contains the part numbers for the FRUs
- Tools and test equipment—describes and shows how to use the tools and test equipment needed to diagnose and repair machine failures
- Glossary—defines the abbreviations, acronyms, and terms that are used in the service manual

The volume number is used by the MAPs as the first digit of the maintenance procedure number.
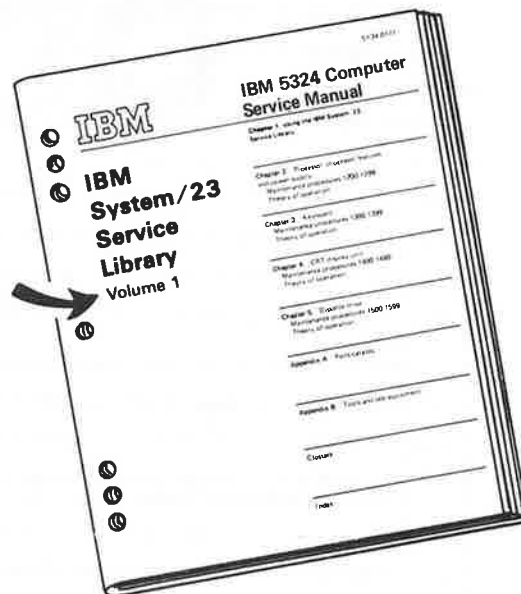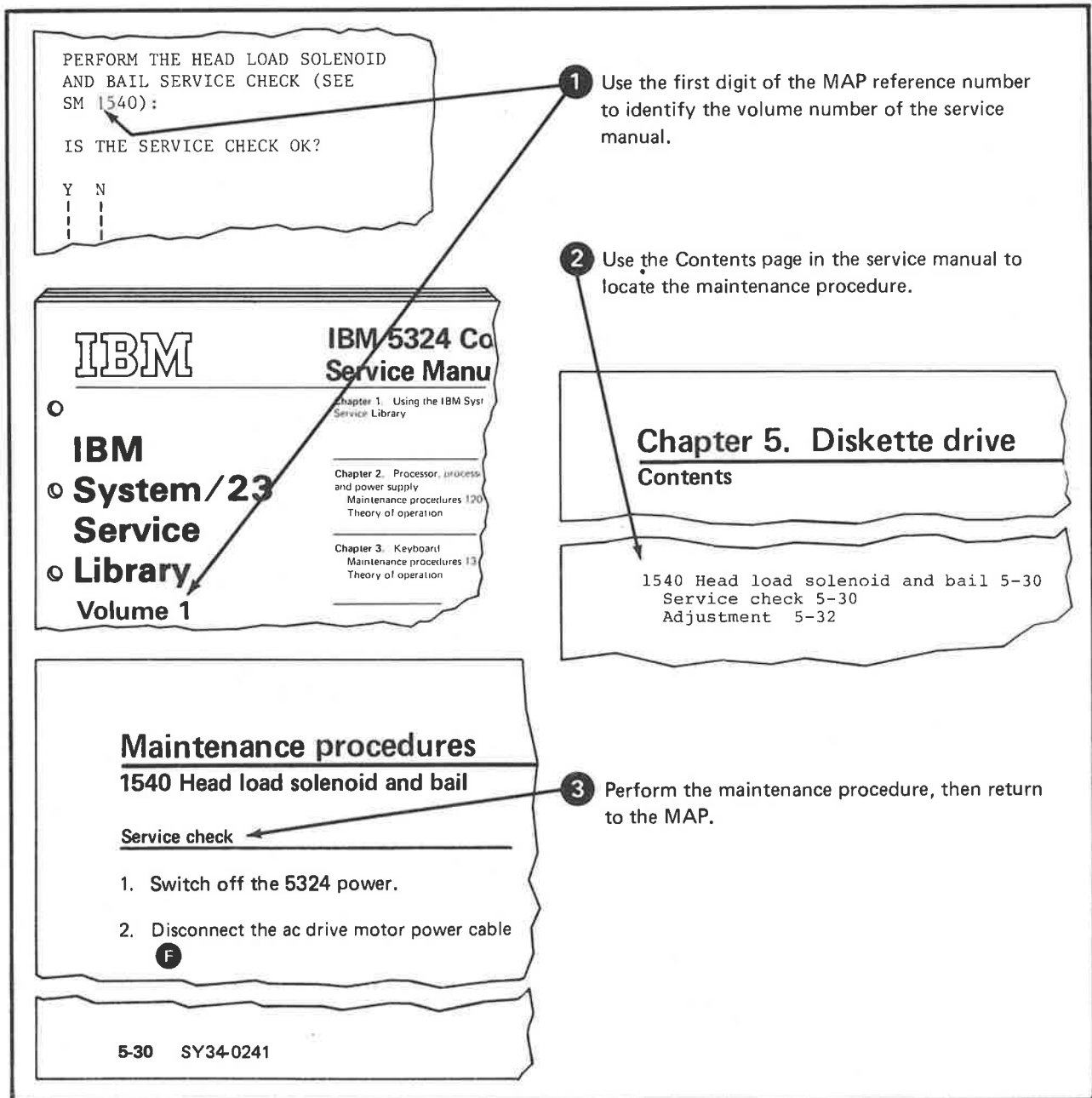
Using the service manuals

Your primary use of the service manuals is in the sections for maintenance procedures. The maintenance procedures contain location diagrams and the service check, adjustment, and removal/replacement procedures.

The MAPs use a four-digit number to guide you to a location diagram or a maintenance procedure in a service manual.

The first digit identifies the volume number of the service manual. The three remaining digits identify either a location diagram or a field replaceable unit (FRU) procedure in that volume.

The following diagram shows how the MAPs guide you to a specific maintenance procedure:


```
PERFORM THE HEAD LOAD SOLENOID
AND BAIL SERVICE CHECK (SEE
SM 1540):

IS THE SERVICE CHECK OK?

Y   N
|   |
|   |
```

1 Use the first digit of the MAP reference number to identify the volume number of the service manual.

2 Use the Contents page in the service manual to locate the maintenance procedure.

IBM

**IBM
System/23
Service
Library**
Volume 1

IBM 5324 Co
Service Manu

Chapter 1. Using the IBM Syst
Service Library

Chapter 2. Processor, process
and power supply
Maintenance procedures 120
Theory of operation

Chapter 3. Keyboard
Maintenance procedures 13
Theory of operation

Chapter 5. Diskette drive
Contents

```
1540 Head load solenoid and bail 5-30
    Service check 5-30
    Adjustment  5-32
```

Maintenance procedures
1540 Head load solenoid and bail

Service check

1. Switch off the 5324 power.

2. Disconnect the ac drive motor power cable
F

3 Perform the maintenance procedure, then return to the MAP.

5-30   SY34-0241
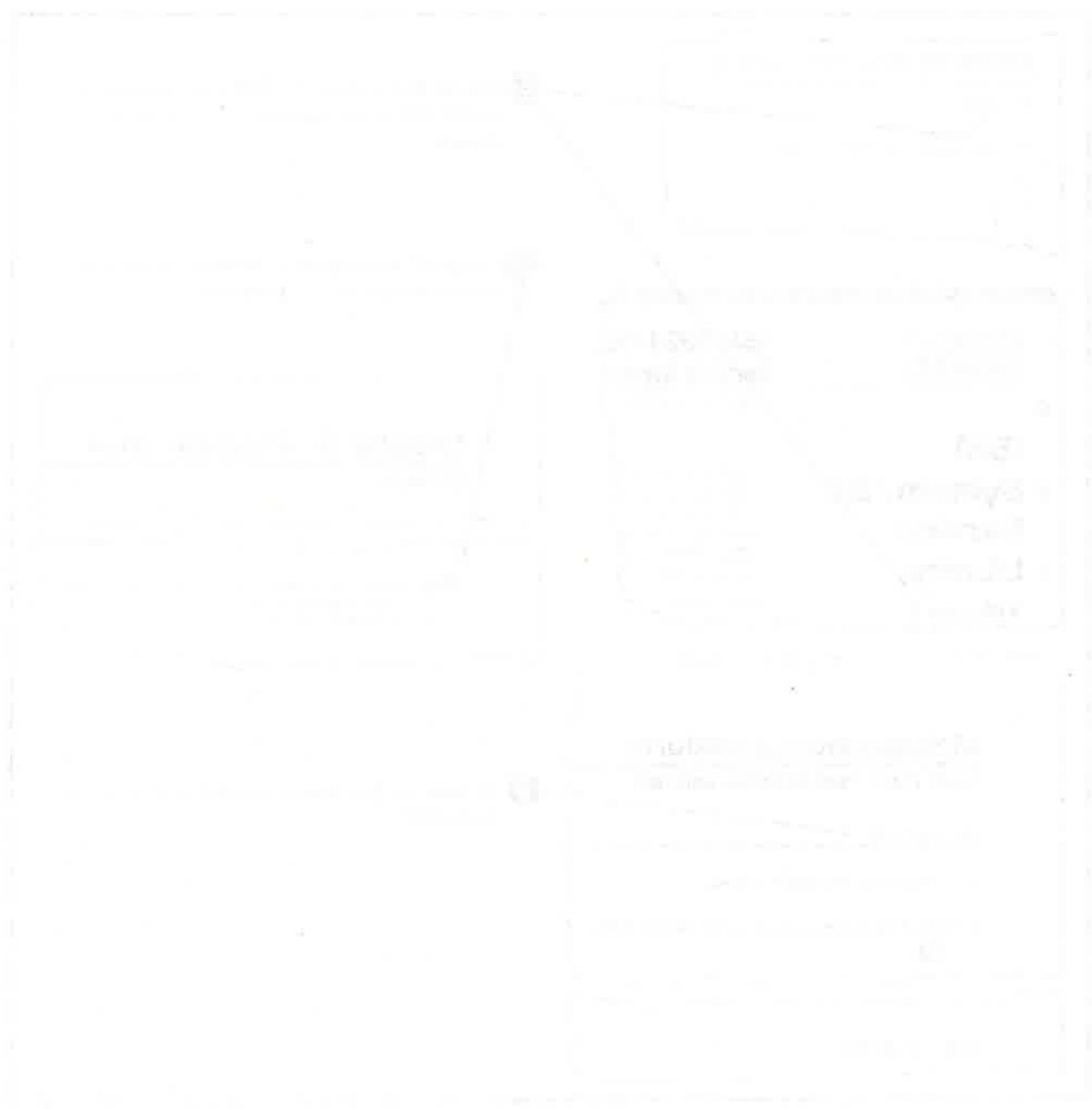
Chapter 2. Processor, processor features, and power supply

Contents

Processor power supply

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1200 Locations

Functional units

A CRT display unit

B Keyboard

C 5324 unit
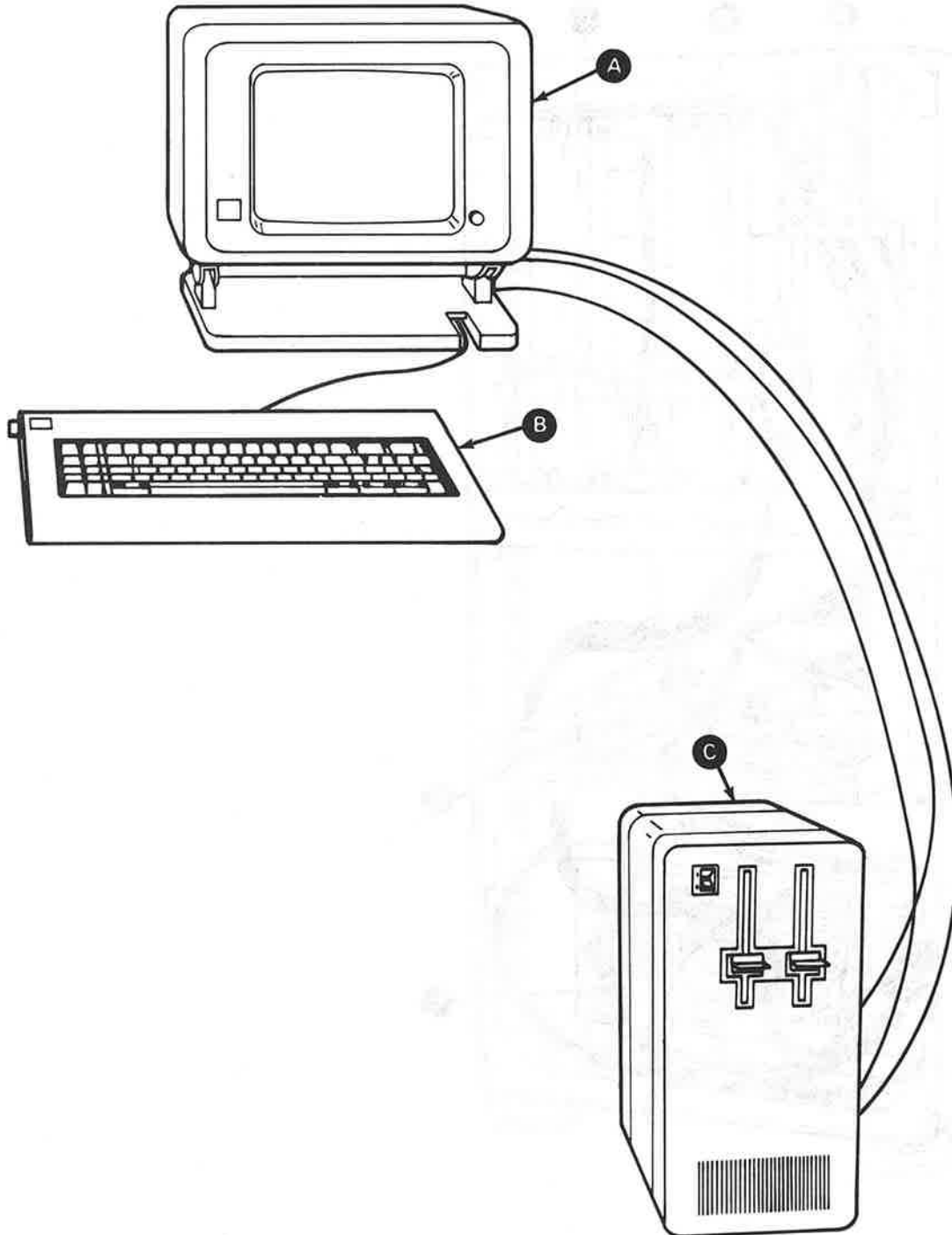
Processor, processor features, and power supply

1200 Locations (continued)

Functional units (front view)

- **A** Power switch
- **B** Diskette drive 1
- **C** Diskette drive 2
- **D** CPU planar board
- **E** Power supply
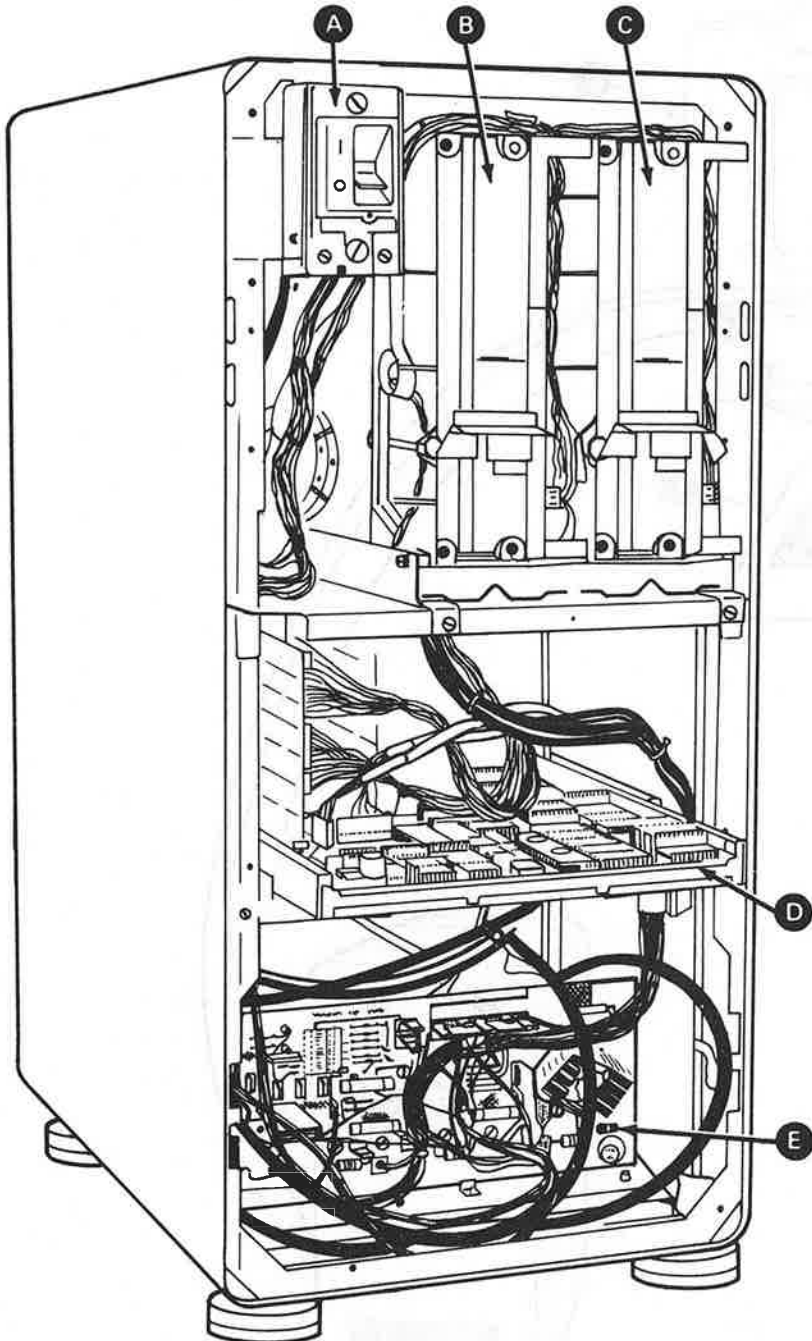
Functional units (rear view)

- **A** Cooling fan
- **B** Rear cover
- **C** Connector panel
- **D** Power supply
- **E** I/O cable connectors
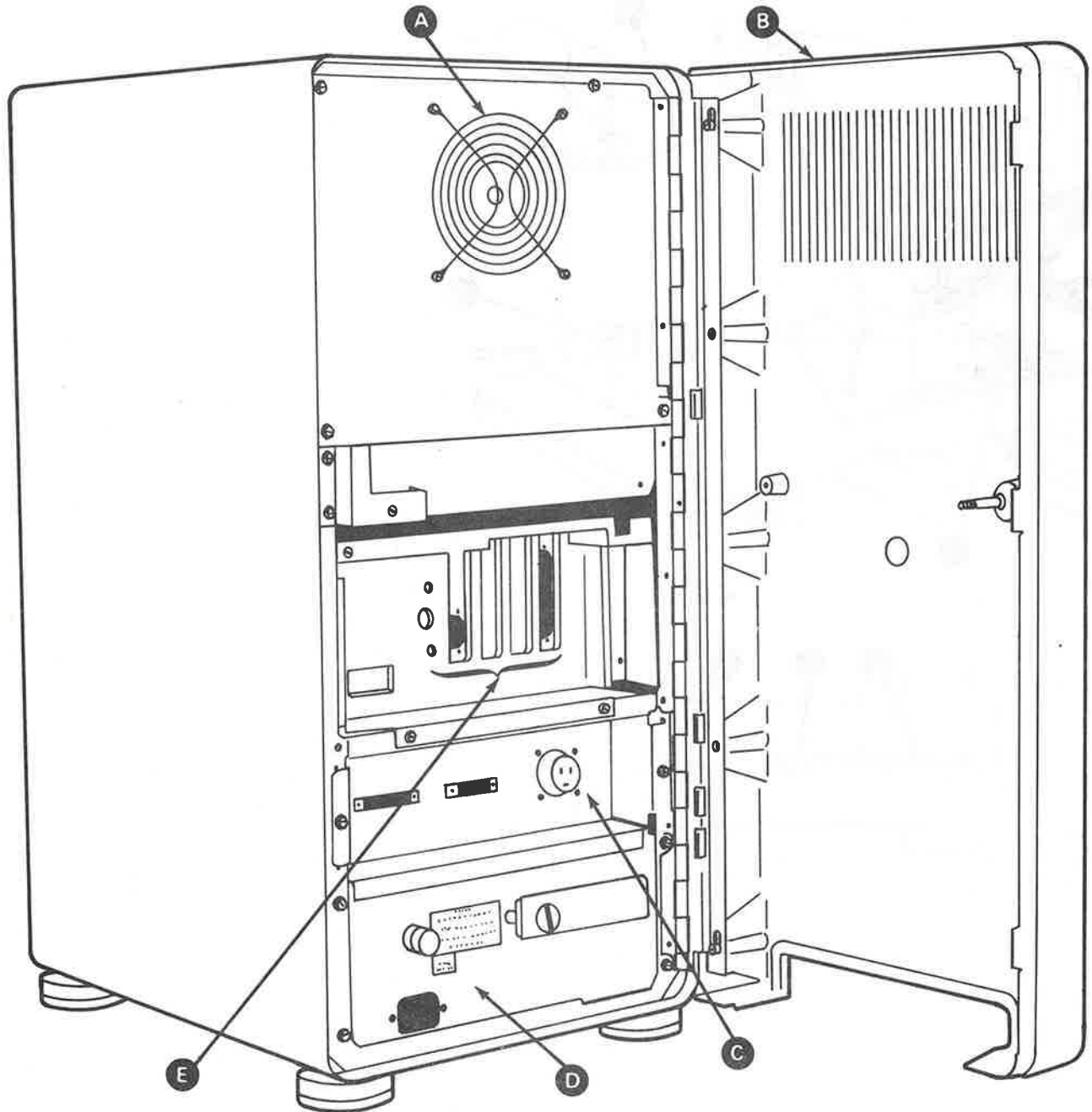
Processor, processor features, and power supply

1200 Locations (continued)

Functional units (rear view)

(A) Logic strap   (D) Keyboard connector

(B) I/O cable connectors   (E) CRT D/C connector

(C) Planar board   (F) CRT A/C power
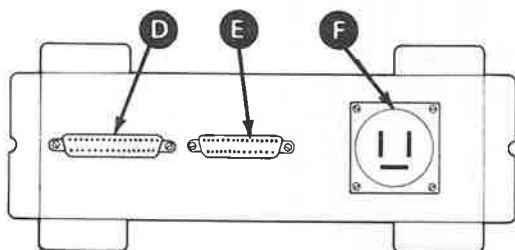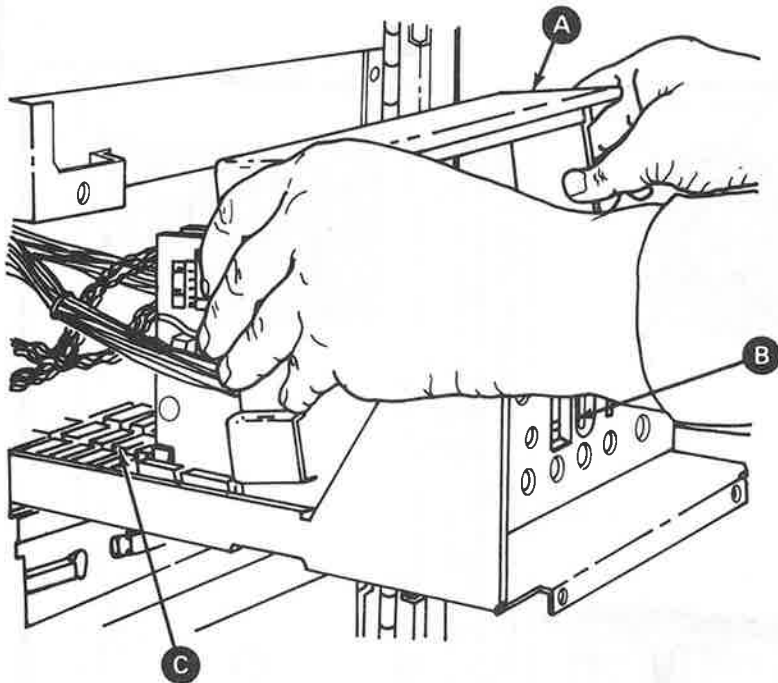
Operator switches and controls

A Display screen brightness control

B Diskette drive 1 latch

C Diskette drive 2 latch

D Power switch

E Keyboard adjustable leg
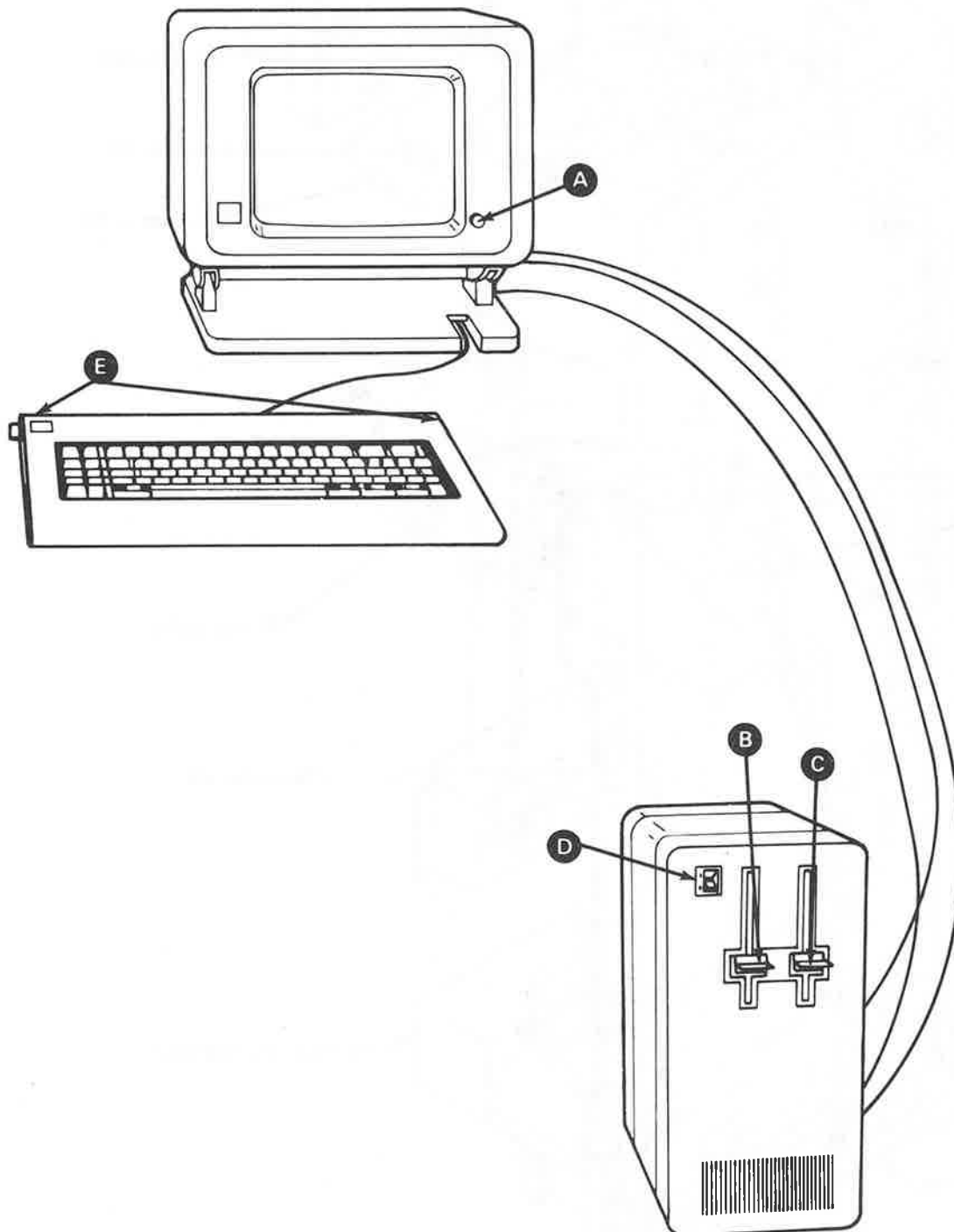
Processor, processor features, and power supply

1200 Locations (continued)

Cables and connectors

Connector P5

Fan assembly

Connector P1

Connector P2

Connector J2
Connector J3
Connector U3
Connector U4

Connector P4

Connector P3

Power supply assembly

Enclosure assembly
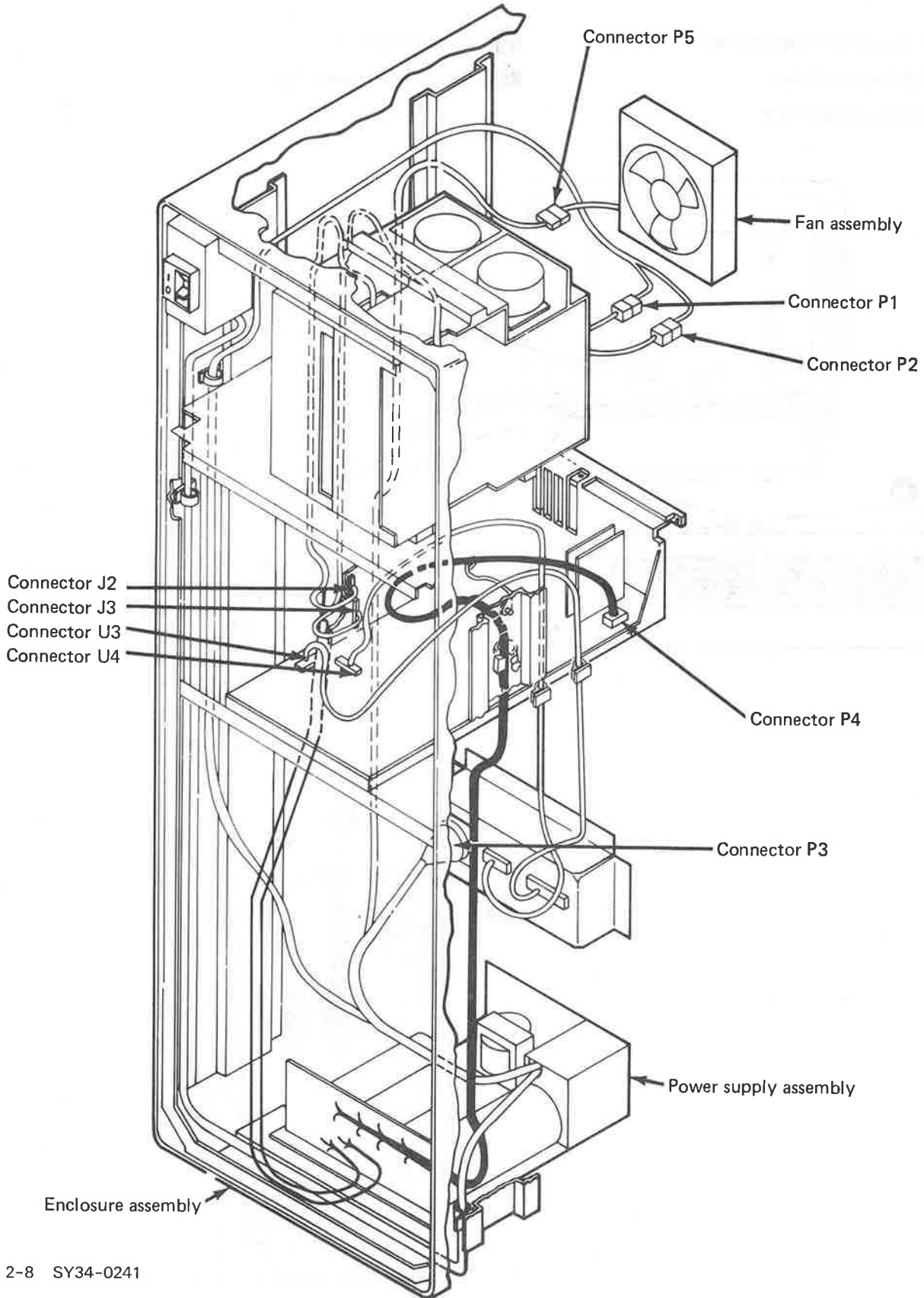
AC safety ground locations
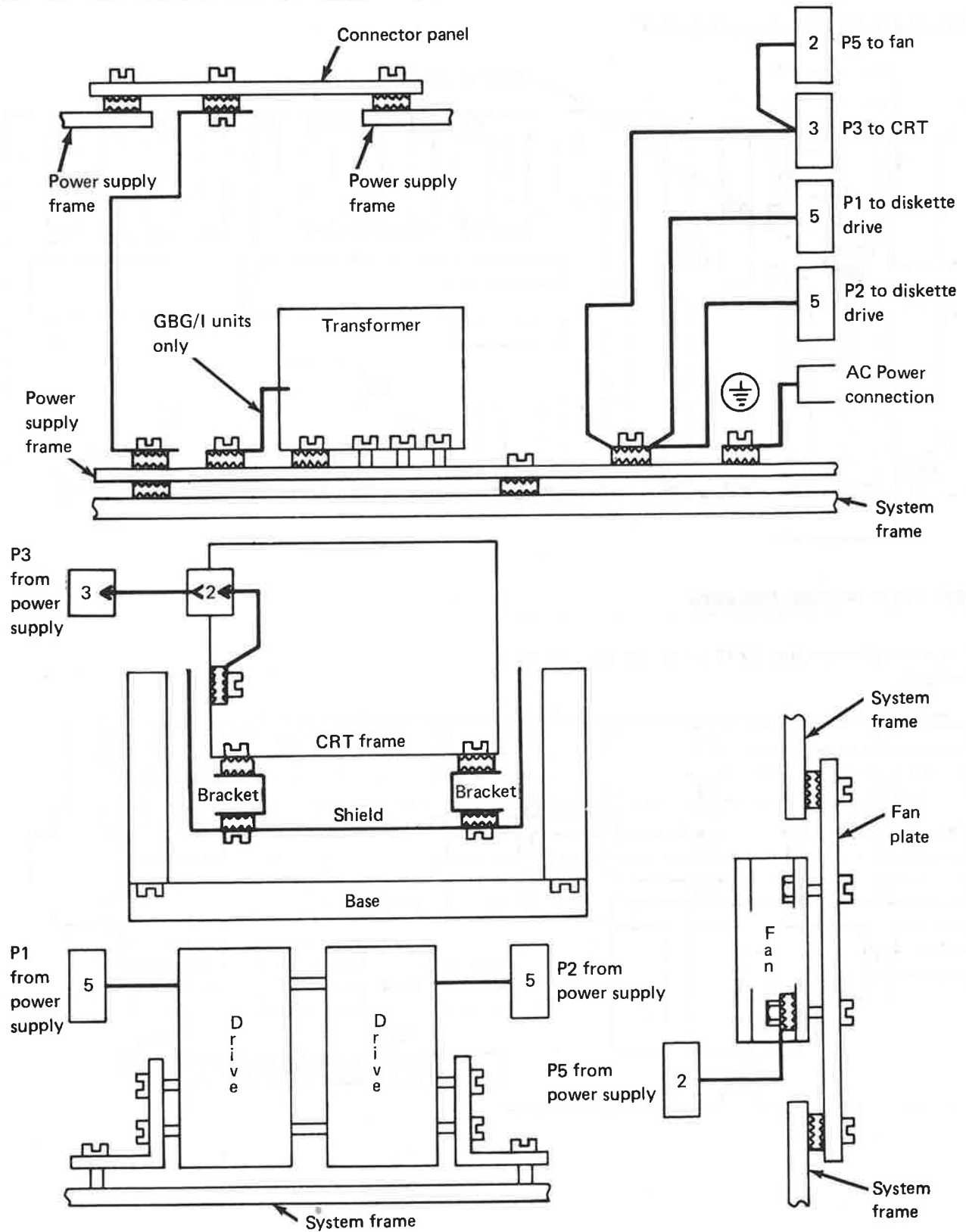
Connector panel

Power supply frame

Power supply frame

GBG/I units only

Transformer

Power supply frame

2   P5 to fan

3   P3 to CRT

5   P1 to diskette drive

5   P2 to diskette drive

AC Power connection

System frame

P3 from power supply   3 ← 2

CRT frame

Bracket   Bracket

Shield

Base

System frame

Fan plate

Fan

P1 from power supply   5

Drive   Drive

5   P2 from power supply

P5 from power supply   2

System frame

System frame

Processor, processor features, and power supply

1205 Feature card diagrams

Word processing feature card

This card is installed on models 4XX.

Connector # 2

Jumper as shown

Connector # 1
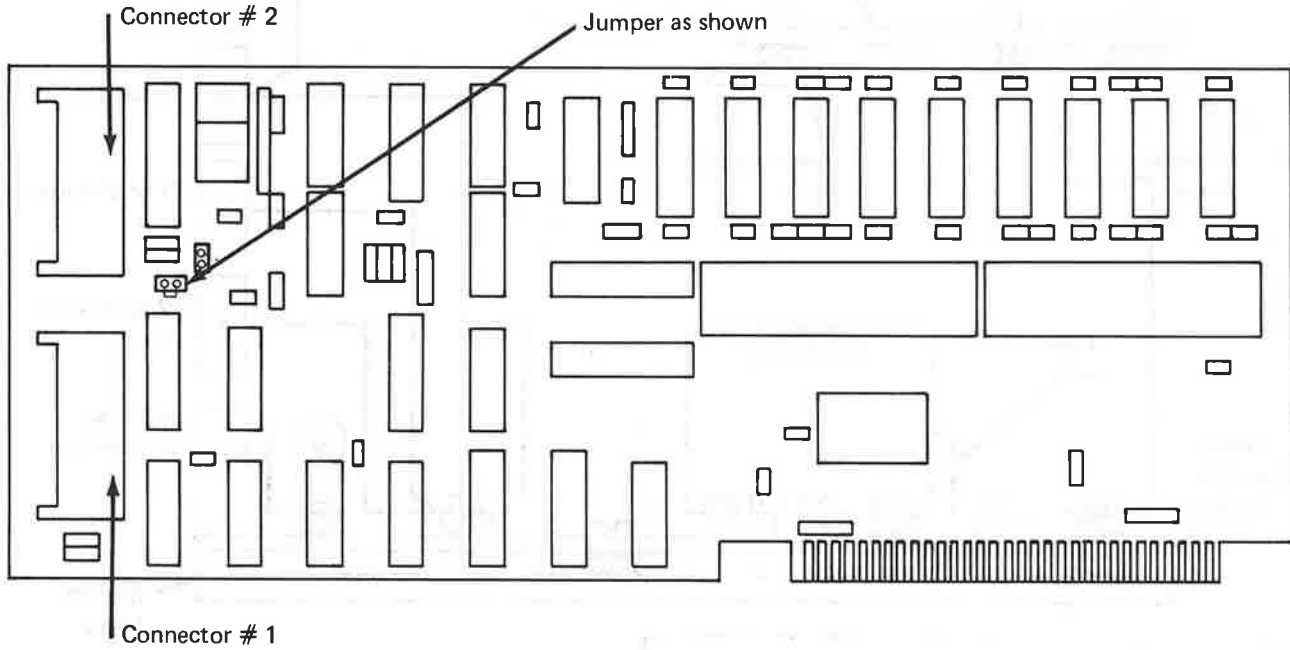
5247 Work station SIA card

This card permits the 5247 to be connected to the 5324.
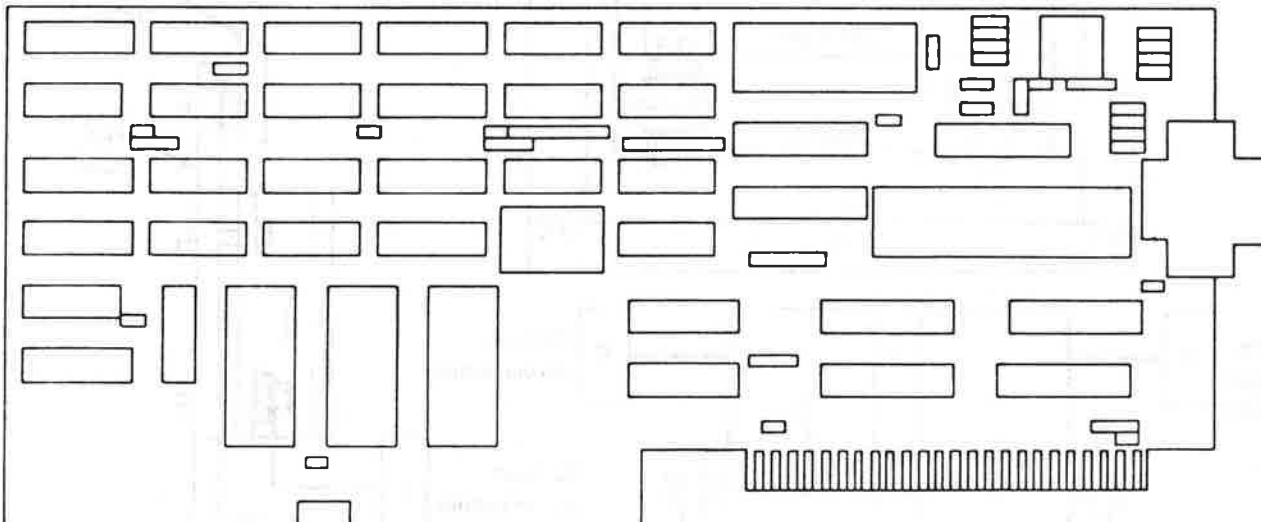
Second printer attachment

This card permits a second printer to be connected to the 5324.
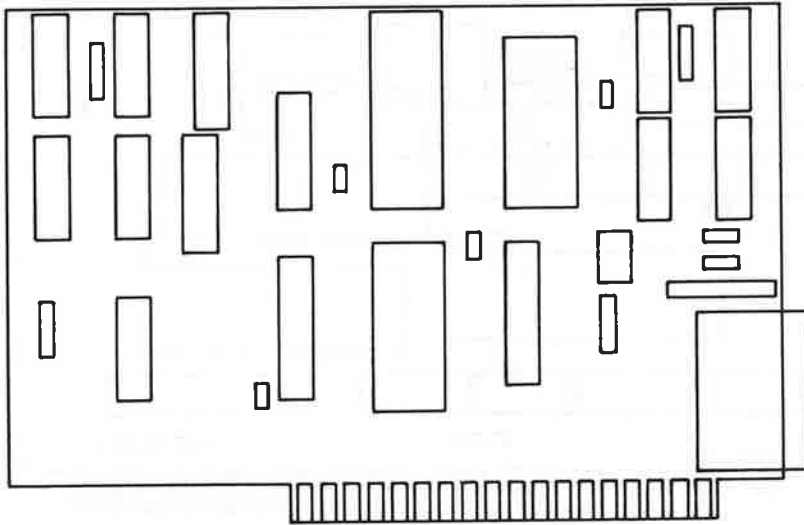
64K Storage Card

The location and jumpering for this card is shown in procedure 1230.
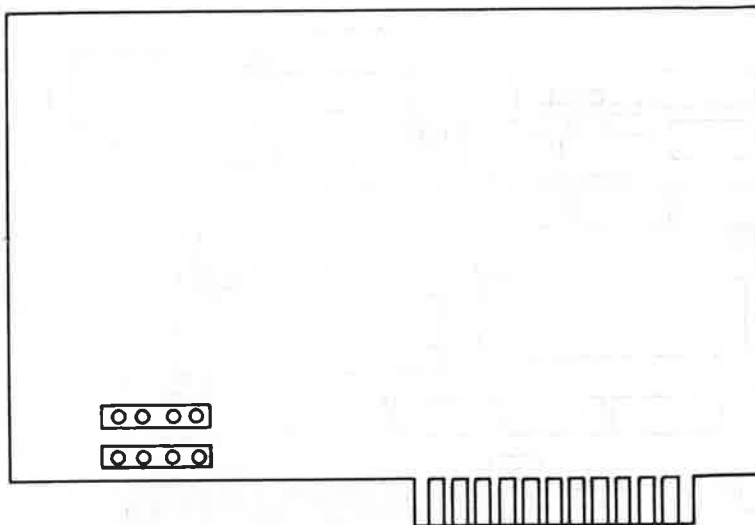
Processor, processor features, and power supply

1205 Feature card diagrams (continued)

Internal diskette

This card permits one or two internal diskette drives to be installed in the 5324.
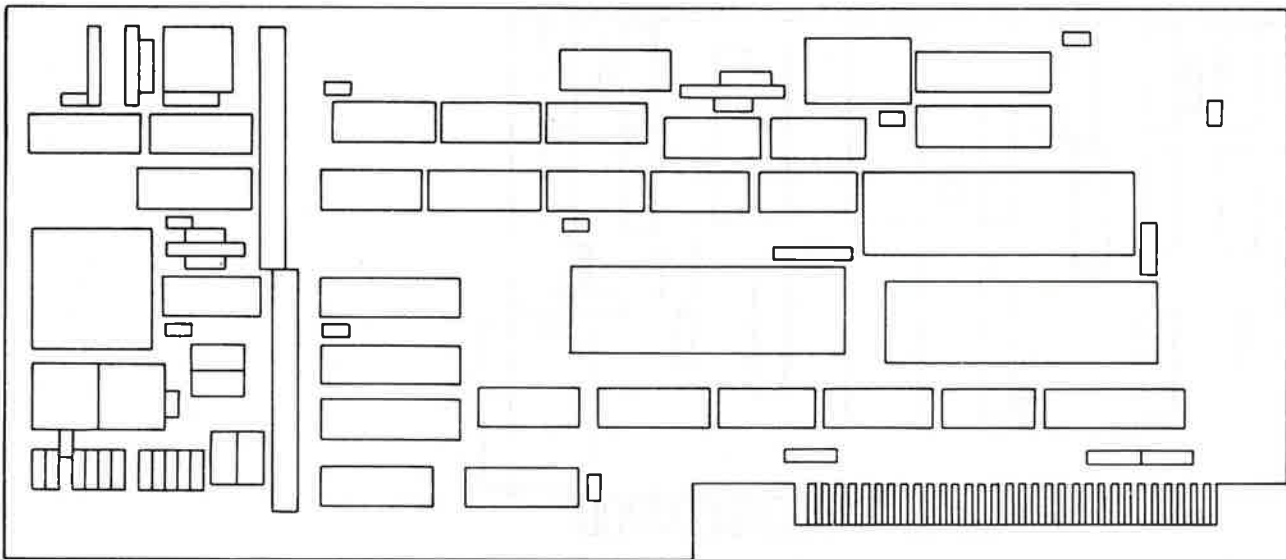
External diskette attachment

This card permits one or two internal diskette drives to be installed in the 5324; in addition it permits a 5246 Diskette Unit to be attached to the 5324.
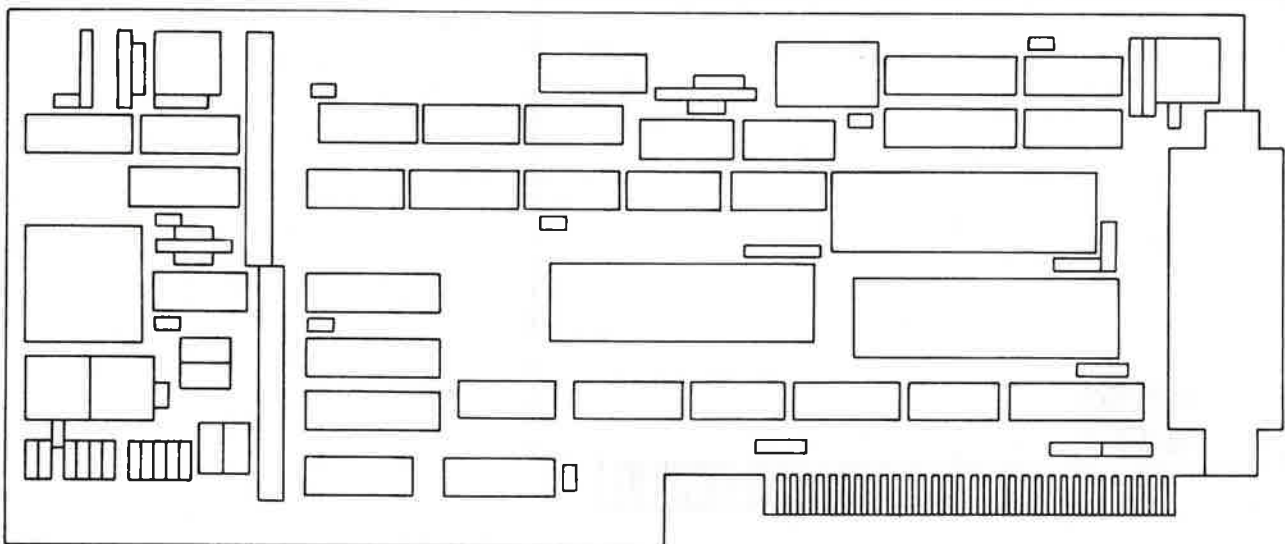
1206 Locations

Alternate power supply

This alternate power supply may be installed in some 5324 computers. Use this page only when directed here by the MAPs.
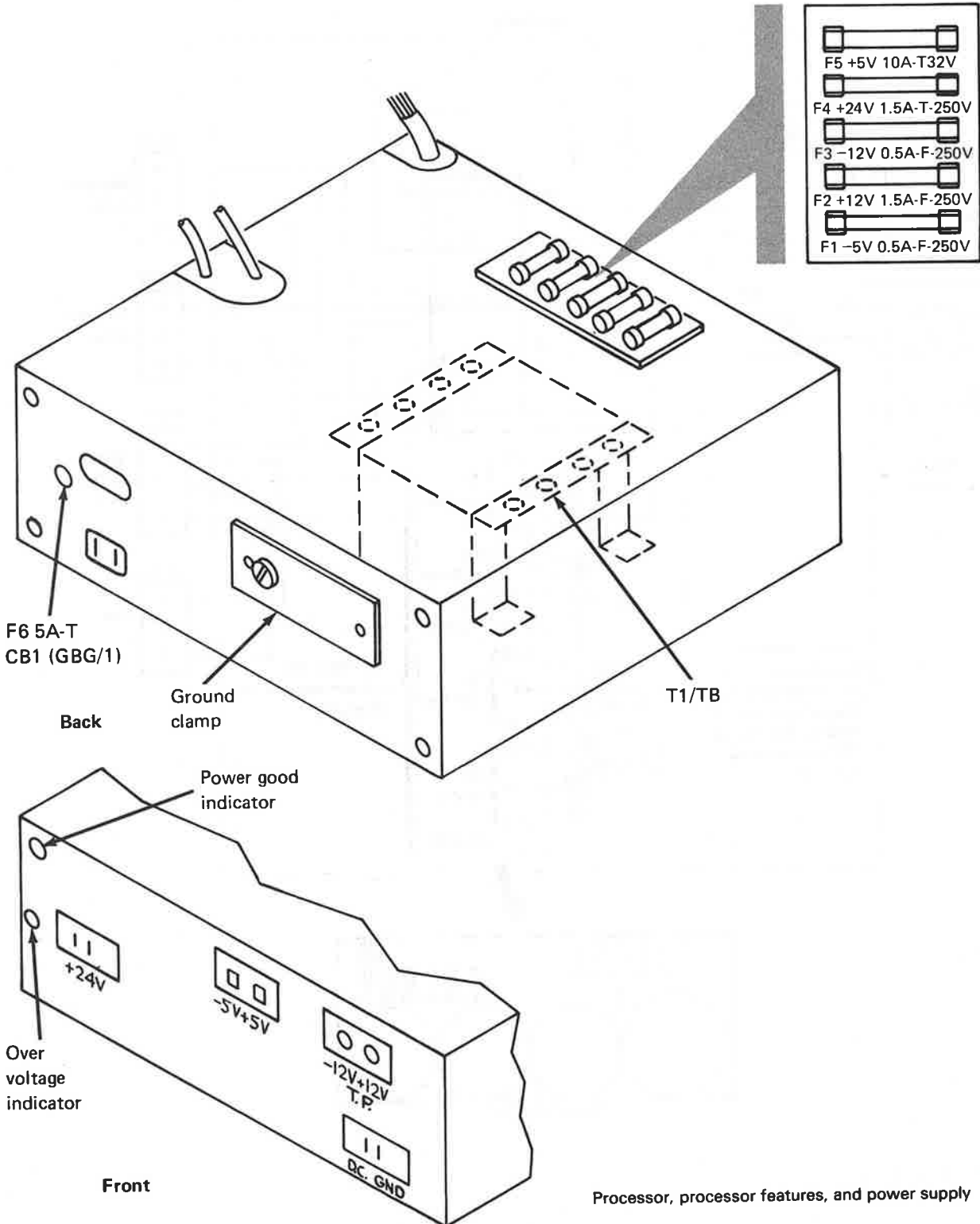
F5 +5V 10A-T32V

F4 +24V 1.5A-T-250V

F3 −12V 0.5A-F-250V

F2 +12V 1.5A-F-250V

F1 −5V 0.5A-F-250V

F6 5A-T
CB1 (GBG/1)

Back

Ground
clamp

T1/TB

Power good
indicator

+24V

−5V +5V

−12V +12V
T.P.

Over
voltage
indicator

DC. GND

Front

1210 AC voltage distribution diagrams

60-Hz power supply (Canada and U.S.)

This diagram is for power supply PN 8257843 *only*. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply.

Note: There are no ac voltage options for this power supply. The ac input voltage must be 104 Vac to 127 Vac (120 Vac nominal).

A1 card (rear view)
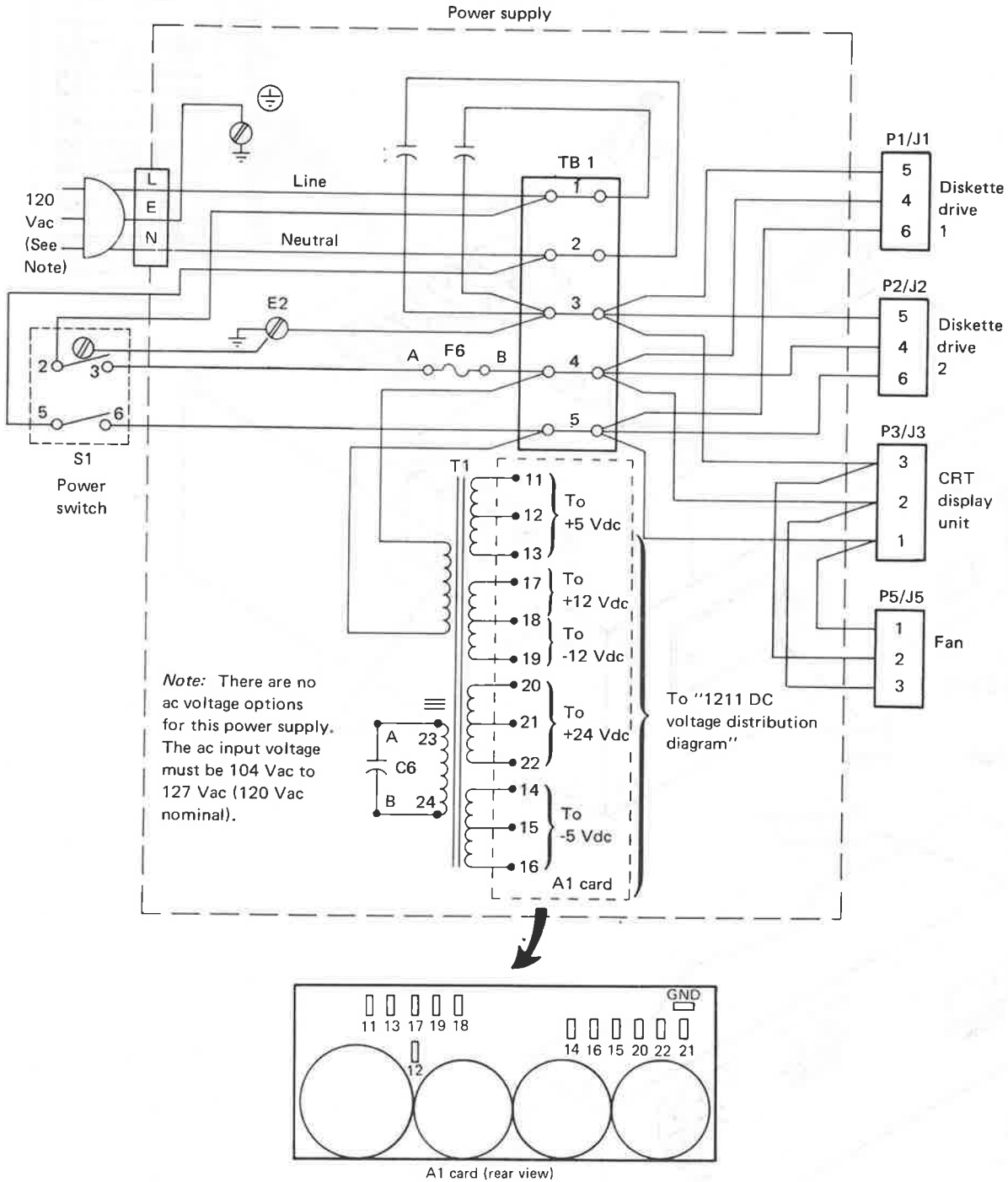
60-Hz power supply (GBG/I)

This diagram is for GBG/I[1] power supply PN 8257844 *only*. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply.

Power supply

TB 1

P1/J1
5
4
6
Diskette drive 1

P2/J2
5
4
6
Diskette drive 2

P3/J3
3
2
1
CRT display unit

P5/J5
1
2
3
Fan

AC input

Line

Neutral

S1 Power switch

CB1 Circuit breaker

E2

T1/TB (See Note)

To +5 Vdc
11
12
13

To +12 Vdc
17
18

To −12 Vdc
19

To +24 Vdc
20
21
22

To −5 Vdc
14
15
16

A1 card

To "1211 DC voltage distribution diagram"

Note: T1/TB is shown wired for 220 Vac input. Refer to the AC voltage chart for other ac voltage options.

C6

25 From electro magnetic metal shield, if present

A1 card (rear view)

1113 17 1918

12

14 16 15 20 22 21

GND

AC voltage chart

AC input voltage	T1/TB line connection	T1/TB jumpers
100	1-7	1-6, 2-7, 4-9
110	1-8	1-6, 3-8, 4-9
120	1-9	1-6, 4-9
127	1-10	1-6, 5-10, 4-9
200/208	1-7	2-6
220	1-8	3-6
240	1-9	4-6

GBG/I—General Business Group/International

1210 AC voltage distribution diagrams (continued)

50-Hz power supply (GBG/I)

This diagram is for power supply PN 8257845 *only*. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply.
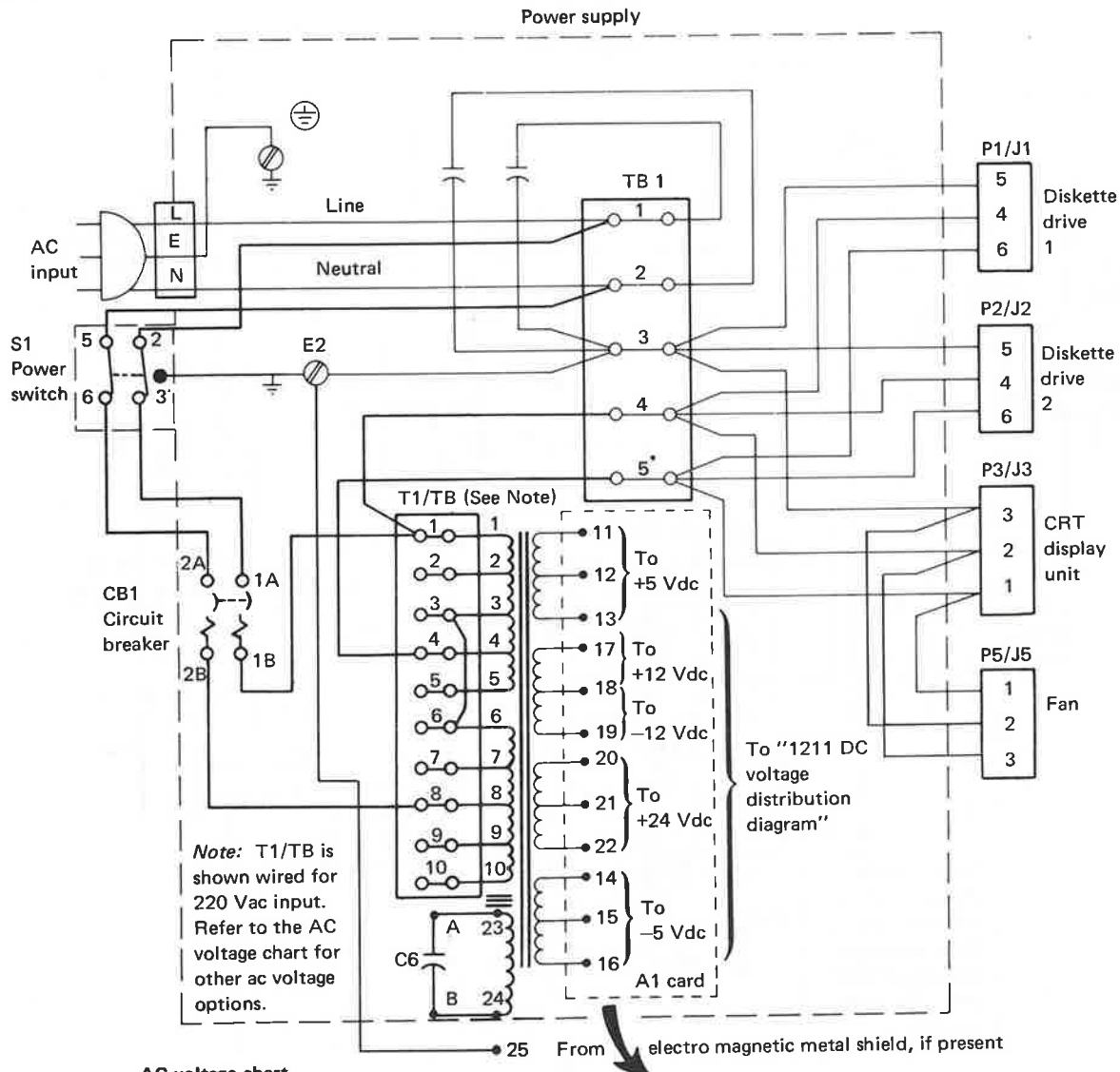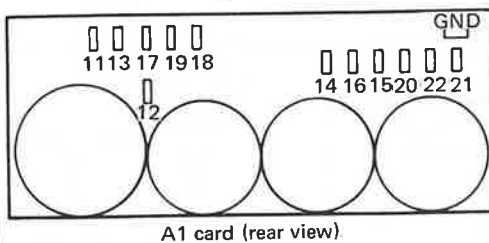

Power supply

TB 1

P1/J1 — 5, 4, 6 — Diskette drive 1

P2/J2 — 5, 4, 6 — Diskette drive 2

P3/J3 — 3, 2, 1 — CRT display unit

P5/J5 — 1, 2, 3 — Fan

AC input

S1 power switch

CB1 circuit breaker

E2

T1/TB (See Note)

To +5 Vdc
To +12 Vdc
To −12 Vdc
To +24 Vdc
To −5 Vdc

C6

A1 card

To "1211 DC voltage distribution diagram"
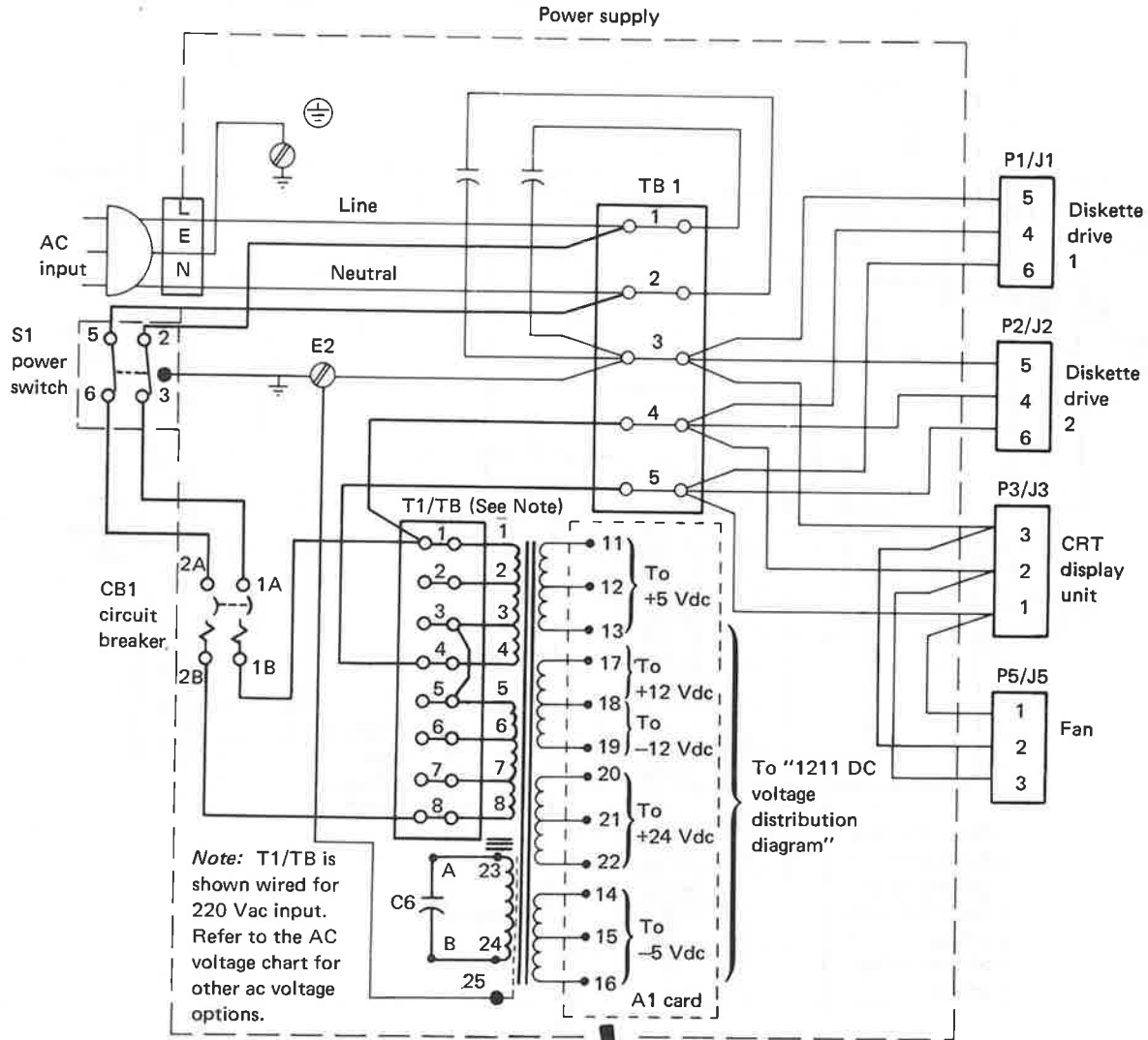
Note: T1/TB is shown wired for 220 Vac input. Refer to the AC voltage chart for other ac voltage options.

AC voltage chart

AC input voltage	T1/TB line connection	T1/TB jumpers
100	1-6	1-5, 2-6, 4-8
110	1-7	1-5, 3-7, 4-8
200	1-6	2-5
220	1-7	3-5
230	1-8	3-5
240	1-8	4-5

11 13 17 19 18
12
14 16 15 20 22 21
GND
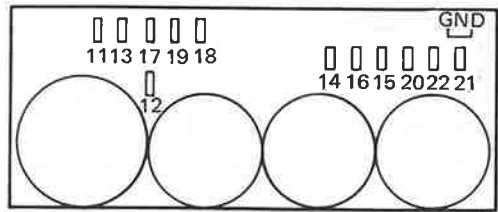
A1 card (rear view)

1211 DC voltage distribution diagram

This diagram is for power supplies PN 8257843, 8257844, and 8257845. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply for the locations of the voltage test points that are shown on the A1 card in this diagram.

P4 Planar board power cable

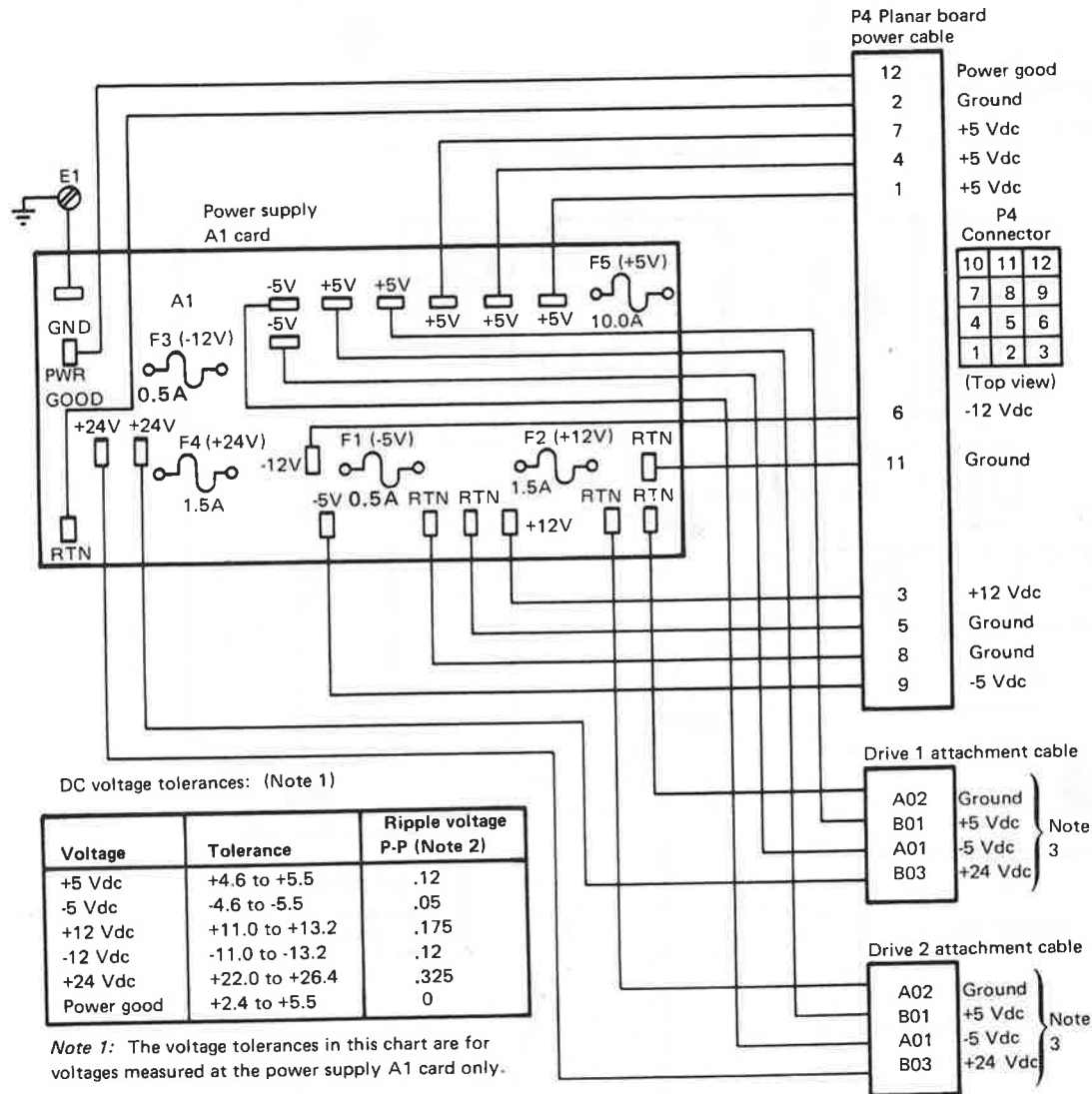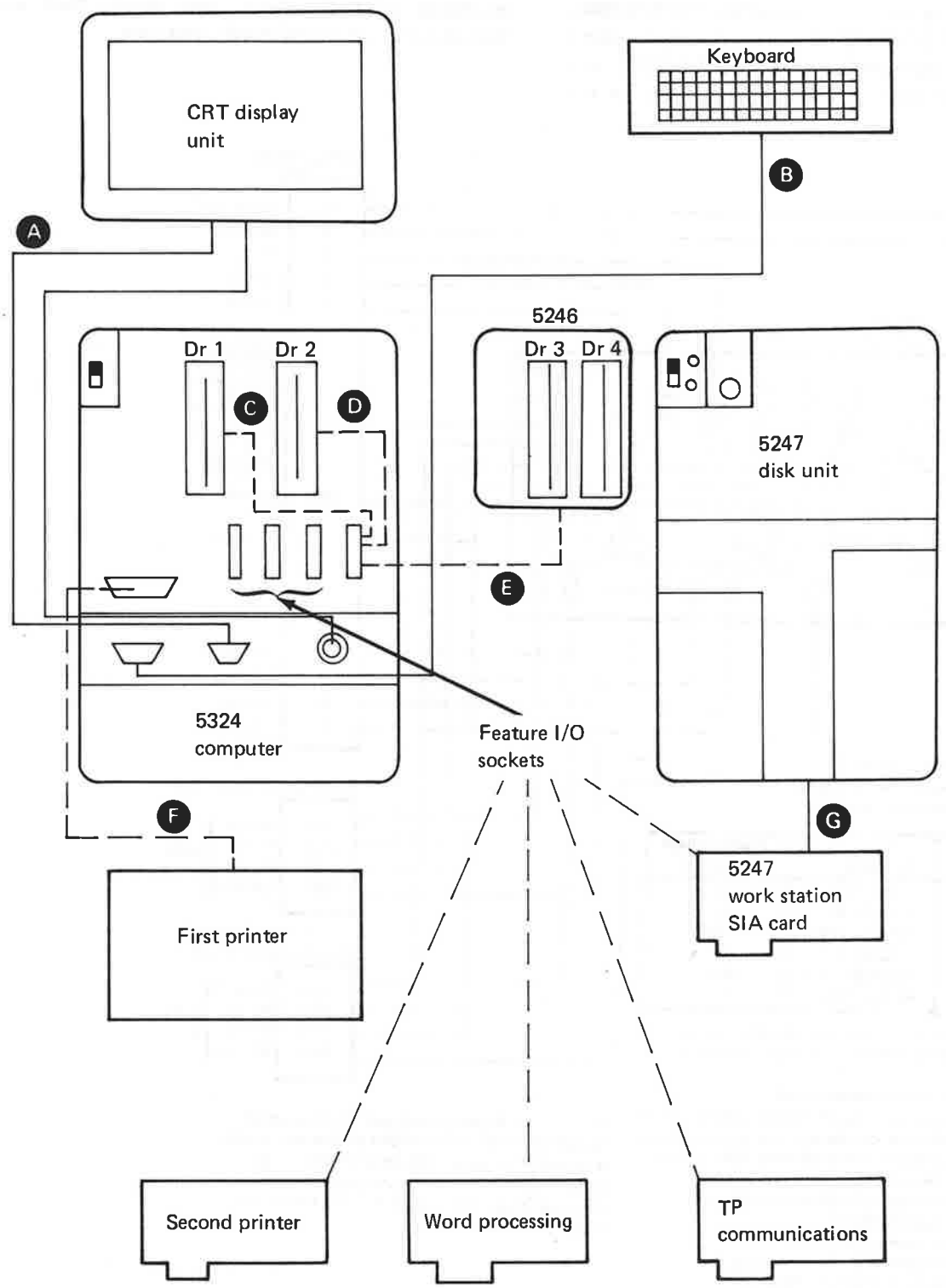| Pin	Signal
12	Power good
2	Ground
7	+5 Vdc
4	+5 Vdc
1	+5 Vdc

P4 Connector

10	11	12
7	8	9
4	5	6
1	2	3

(Top view)

Pin	Signal
6	-12 Vdc
11	Ground
3	+12 Vdc
5	Ground
8	Ground
9	-5 Vdc

Power supply A1 card

A1
E1
GND
F3 (-12V)
0.5A
PWR GOOD
+24V +24V
F4 (+24V)
1.5A
RTN
-5V +5V +5V
-5V
+5V +5V +5V
F5 (+5V)
10.0A
F1 (-5V)
-12V
-5V 0.5A RTN RTN
F2 (+12V)
1.5A
+12V
RTN RTN RTN RTN

Drive 1 attachment cable

Pin	Signal	
A02	Ground	Note 3
B01	+5 Vdc	
A01	-5 Vdc	
B03	+24 Vdc	

Drive 2 attachment cable

Pin	Signal	
A02	Ground	Note 3
B01	+5 Vdc	
A01	-5 Vdc	
B03	+24 Vdc	

DC voltage tolerances: (Note 1)

Voltage	Tolerance	Ripple voltage P-P (Note 2)
+5 Vdc	+4.6 to +5.5	.12
-5 Vdc	-4.6 to -5.5	.05
+12 Vdc	+11.0 to +13.2	.175
-12 Vdc	-11.0 to -13.2	.12
+24 Vdc	+22.0 to +26.4	.325
Power good	+2.4 to +5.5	0

Note 1: The voltage tolerances in this chart are for voltages measured at the power supply A1 card only.

Note 2: Ripple voltage measurement
Ripple voltage can be measured most accurately with an oscilloscope. However, an alternate way to get an indication of ripple voltage is with a CE meter (PN1749231).
a. Connect a capacitor (0.22 μF or larger, 50 Vdc or higher) in series with one of the meter leads. (Capacitor not furnished.)
b. Set the meter range to 2.5 Vac.
c. Connect one meter lead to the dc voltage in question, the other lead to frame ground. (Remember, a capacitor is in series with one of the leads.)
d. If the meter pointer leaves zero on the meter scale, excess ripple voltage may be present.

Note 3: The -5 Vdc, ground, and +5 Vdc connect to cable pins A01, A02, and B01 only at the diskette drive end of the cable. The +24 Vdc connects to cable pin B03 at both ends of the cable (diskette drive and attachment card). See "1505 Locations—Diskette attachment cable."

Processor, processor features, and power supply

1212 Signal cable distribution diagram

A CRT display cable (internal signal)

CPU planar board		Connector panel
Pin	Line name	Pin
B03	Highlight	10
A05	Horizontal retrace return	11
B05	Horizontal retrace signal	3
A06	Video drive signal	1
B06	Video drive return	9
A07	Vertical retrace return	4
B07	Vertical retrace signal	12
B08	Ground	13
A09	Highlight return	2
A11	+12 Vdc	5

A CRT display cable (external signal)

Display receiver card		Connector panel
Pin	Line name	Pin
A1	+12 Vdc	5
B1	Ground	13
A2	Shield	
A3	Vertical retrace return	4
B3	Vertical retrace signal	12
A4	Highlight	10
B4	Highlight return	2
A5	Horizontal retrace return	11
B5	Horizontal retrace signal	3
A6	Video drive signal	1
B6	Video drive return	9
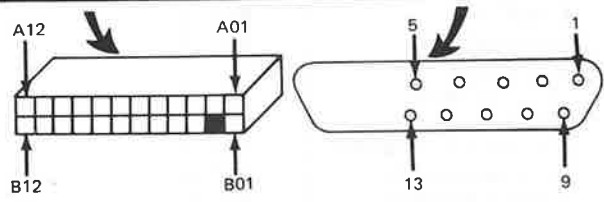
B Keyboard cable (internal)

CPU planar board		Connector panel
Pin	Line name	Pin
A1	Not used	13
B1	Program reset	10
A2	Delay strobe	9
Key		
A3	+12 Vdc	12
B3	Data strobe	1
B4	Scan code bit 6	2
A5	Scan code bit 0	8
B5	Scan code bit 5	3
B6	Scan code bit 4	4
A7	Scan code bit 1	7
B7	Scan code bit 3	5
A8	Ground	14-25
B8	Scan code bit 2	6
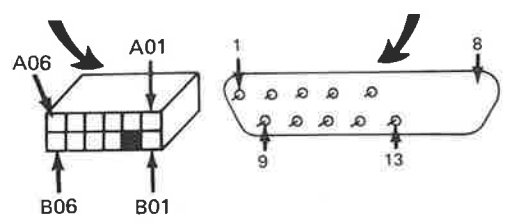
B Keyboard cable (external)

Receiver card		Connector panel
Pin	Line name	Pin
A01 to A14	Ground return	14 to 25
B01	Data strobe	1
B03	Scan code bit 6	2
B04	Scan code bit 5	3
B05	Scan code bit 4	4
B06	Scan code bit 3	5
B07	Scan code bit 2	6
B08	Scan code bit 1	7
B09	Scan code bit 0	8
B10	Not used	13
B11	Delay strobe	9
B12	Program reset	10
B13	Not used	11
B14	12 Vdc	12
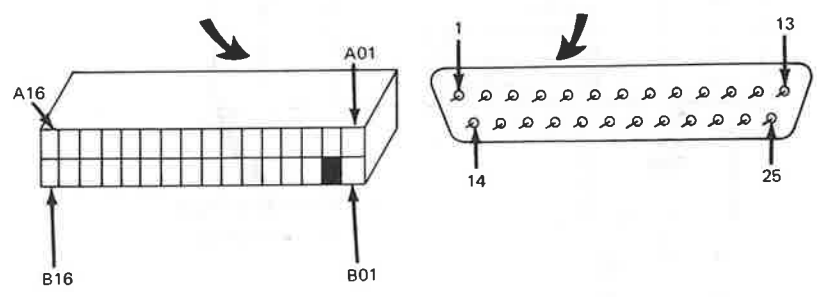
Processor, processor features, and power supply

1212 Signal cable distribution diagram

C **D** Diskette drive cable

(Diskette attachment card on
CPU planar board)

Pin	Line name	Internal diskette drives Pin
Not used	−5 Vdc *	A01
Not used	Ground *	A02
Not used	+5 Vdc *	B01
B03	+24 Vdc *	B03
A04		A04
Through	Ground (twisted pair)	Through
A17		A17
A18	Sense ground	A18
B04	Index	B04
B05	Diskette sense	B05
B06	Write/erase enabled	B06
B07	File data	B07
B08	Inner tracks	B08
B09	Erase gate	B09
B10	Access 0	B10
B11	Select head 1	B11
B13	Access 1	B13
B14	Write gate	B14
B15	Head engage	B15
B16	Switch filter	B16
B17	Write data	B17

*From power supply A1 card

A18   A01   A18   A01

B18   B01   B18   B01
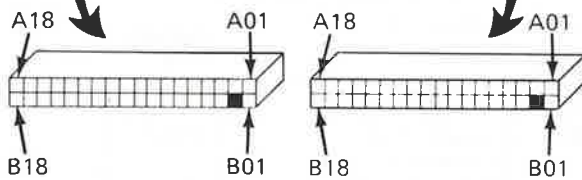
E 5246 diskette drive cable

(Diskette attachment card on
CPU planar board)

Pin	Line name	5246 MPX card Pin
1	Load access	B10
2	Drive 3/4 write data	B01
3	Drive 3/4 access 0	B03
4	Drive 3/4 access 1	B09
5	Inner tracks	B14
6	Drive 3/4 head engage	B08
7	Drive 3/4 diskette sense	B11
8	Switch filter	B13
9	Read/write drive 4	B05
10	Drive 3 attached	B06
11	Seek drive 4	B04
12	Drive 4 index	B12
13	Select head 1	B15
14	Drive 3 index	B17
15	Drive 3/4 file data	B16
16	Not used	
17	Drive 3/4 current enabled	B07
18	Drive 3/4 erase gate	B19
19	Drive 3/4 write gate	B18
—	Port 1 attached/port 2 attached	B20*
—	+5 Vdc	A02
—		A01
20	Ground (twisted pair)	A03
Through		Through
37		A20

*A jumper
is installed
between
A20 and
B20

20   37   A20   A01

1   19   B20   B01
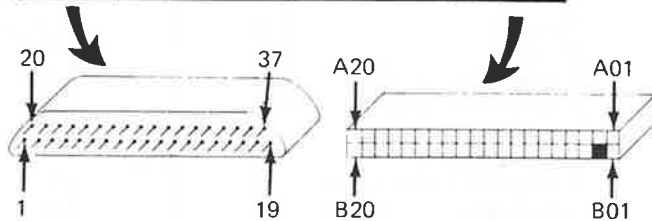
F 5241 or 5242 printer cable

(CPU 1st or 2nd printer port)

Pin	Line name	Printer Pin
1	Xmit printer data	*
2	Xmit printer data return	
3	Rcv printer data	
4	Rcv printer data return	
5	Ground	
6	Ground	
7	Printer baud rate 1	
8	Printer baud rate 2	
9	Printer baud rate 4	

5   1

9   6
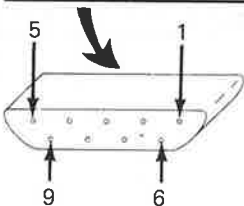
*Refer to printer
service manual

G 5247 disk unit cable

SIA card on base planar board (5247)		Work station SIA card
Pin	Line name	Pin
1	Twinax A	1
5	Twinax A	5
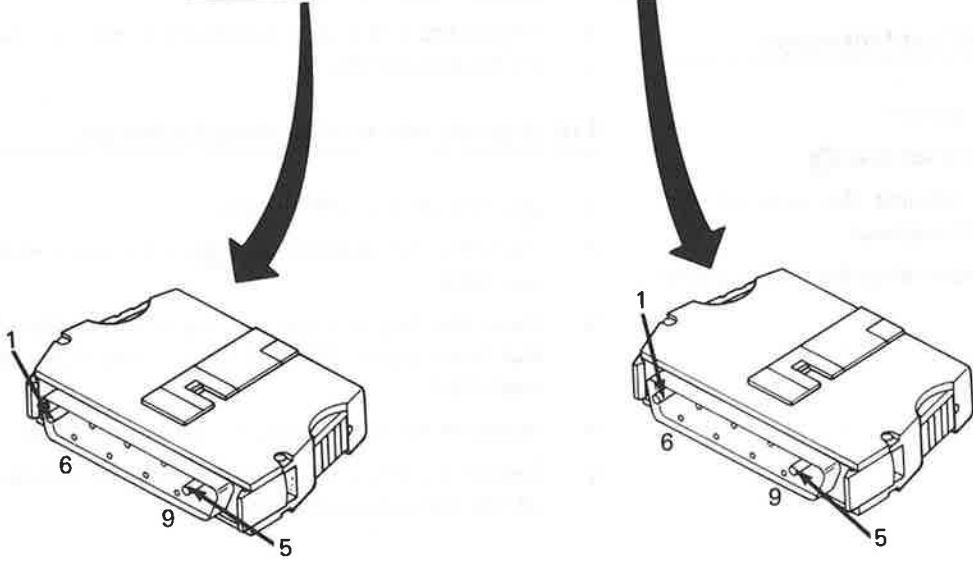
# Processor, processor features, and power supply

1220 Covers

Keyboard cover removal and replacement

1. Switch off the 5324 power.
2. Remove the four cover screws **B**.
3. Lift the keyboard cover **A** to remove.
4. Install the cover by reversing the order of the removal procedure.

CRT cover removal and replacement

1. Switch off the 5324 power.
2. Remove the two cover screws **C**
3. Pull the top cover toward the rear of the 5324 ; then remove the cover.
4. Install the cover by reversing the order of the removal procedure.
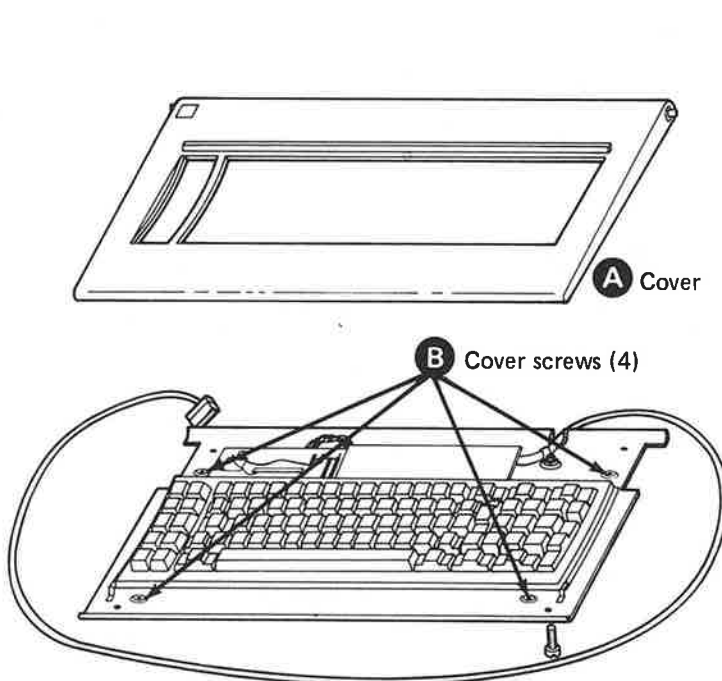
Rear access cover removal and replacement

1. Switch off the 5324 power.
2. Turn the rear cover knob **F** counterclockwise 1/4 turn and pull the cover open. Remove screws **G** and loosen screws **H**. Lift the cover to remove.
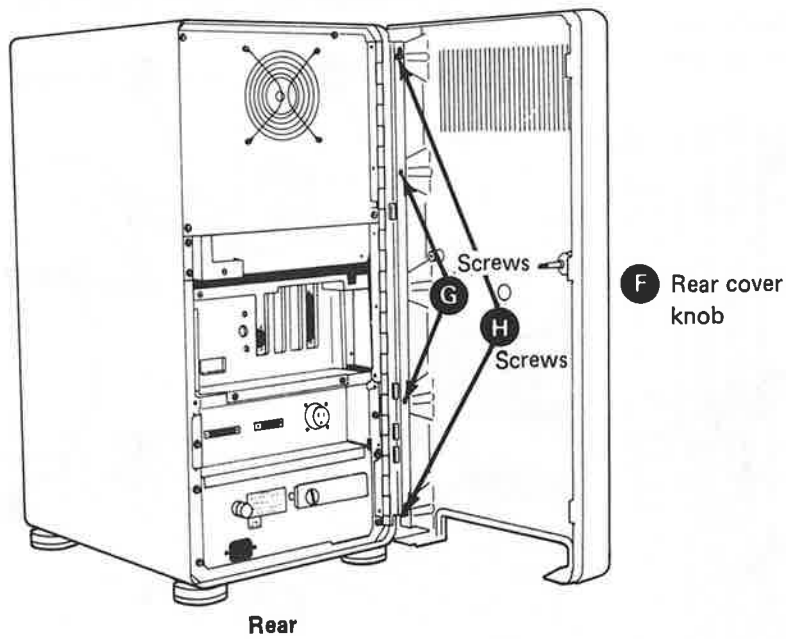3. Install the cover by reversing the order of the removal procedure.

Front cover removal and replacement

1. Switch off the 5324 power.
2. Turn the diskette latches **D** to the horizontal position.
3. Turn the two screws located on the side of the front cover **E** 1/2 turn to the front of the 5324.
4. Remove the front cover by pulling forward.
5. Install the front cover by reversing the order of the removal procedure.

C Cover screws (2)

A Cover

B Cover screws (4)

Front

D Diskette latch

E Screws

Rear

Screws

G

H Screws

F Rear cover knob
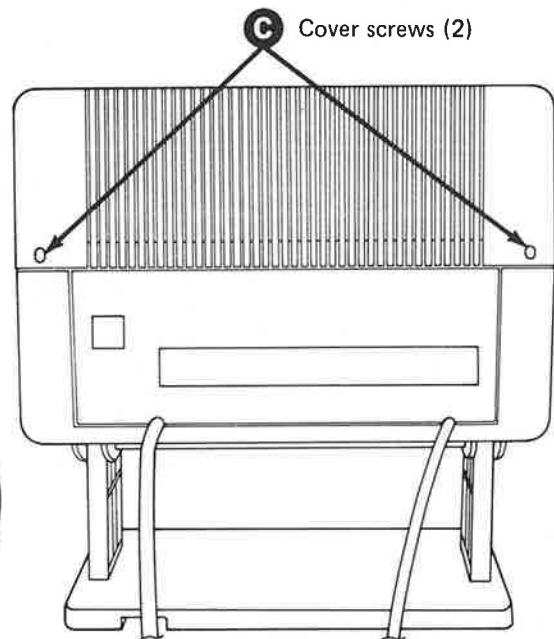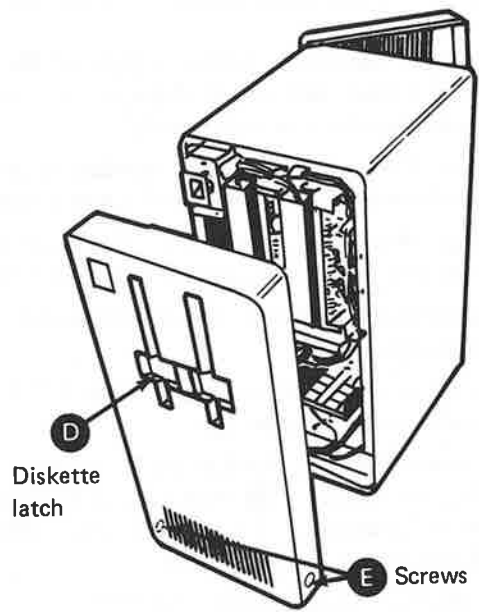
# Processor, processor features, and power supply

1230 CPU planar board

Removal

1. Switch off the 5324 power and open the 5324 rear access cover (1220).

2. Disconnect any I/O device cables that are connected to the ground clamp **C**.

3. Remove the two screws **B** from the rear of the planar board drawer.

4. Slide the planar board drawer **G** out to the service position.

   Note: When the drawer is in the service position, the attachment cards, cables, CE test pins, and feature jumper pins are accessible. If you are installing a new planar board , continue with the following steps:

5. Remove the card strap **F** by spreading the sides.

6. Label and remove all I/O attachment cards **E**, R/W storage cards, and cables from the planar board and the I/O cable connectors **A**. See the planar board diagram for card and cable locations.

7. Remove the mounting pin **D** that holds the planar board to the drawer and remove the planar board.
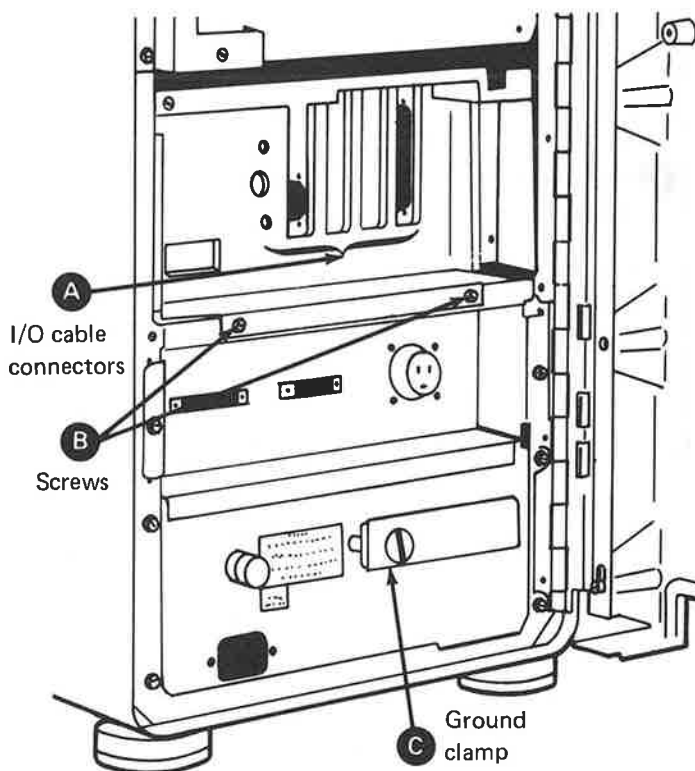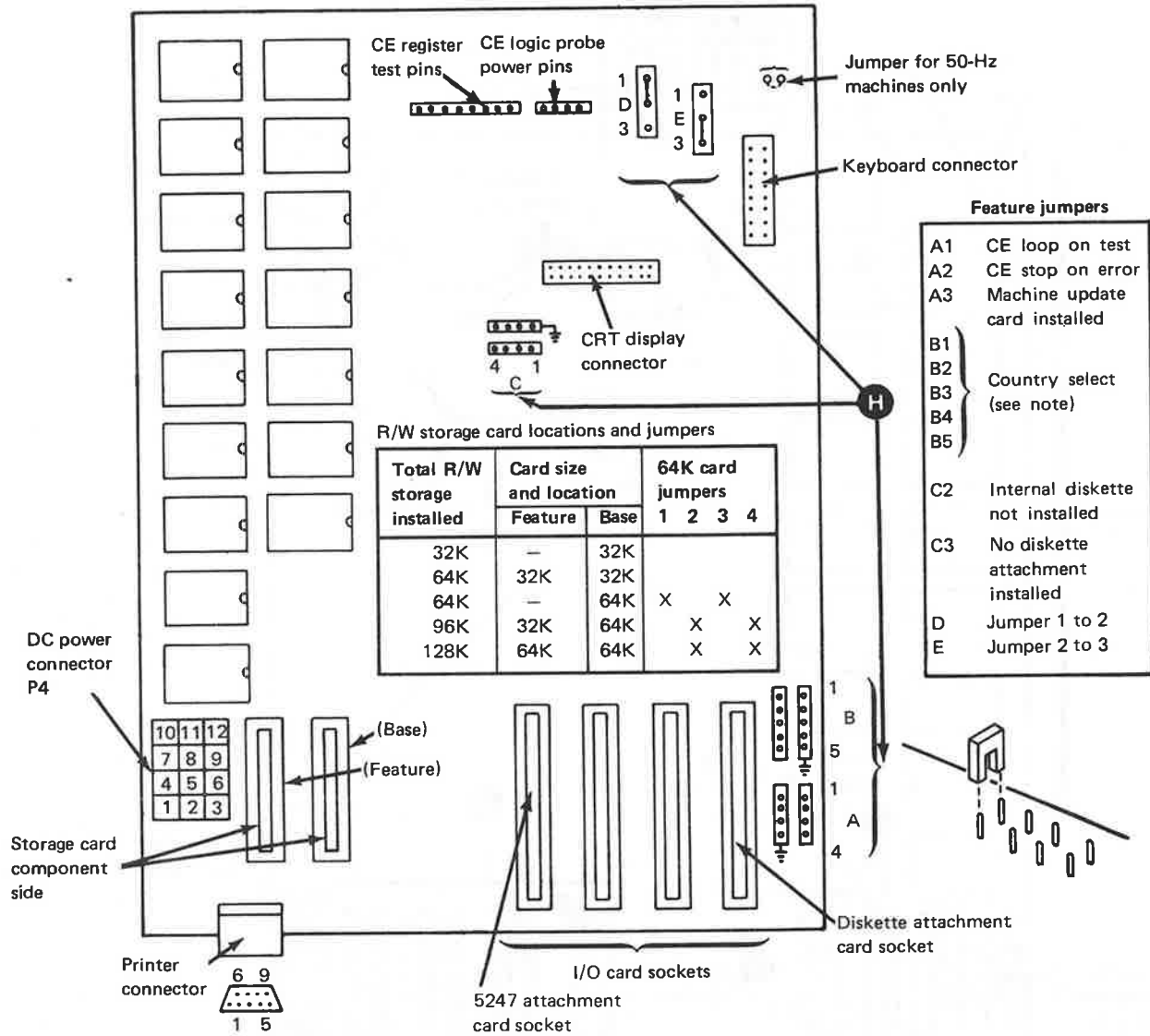
Replacement

1. Remove any feature jumpers **H** from the old planar board and install them on the *same* pin positions in the new board.

2. Place the drawer in the service position **G** and install the planar board in the drawer.

3. Install the attachment and R/W storage cards that were removed from the old board.

4. Connect all cables to the planar board and attachment cards.

5. Slide the planar drawer **G** into the 5324 and install the two screws **D**.

6. Connect the I/O device cables to the I/O cable connectors **A** and clamp the cable ground shields in the ground clamp **C** on the rear of the power supply.

7. Close the rear access cover (1220).

   Note: If a new CPU planar board is installed, check that the display is centered horizontlly. If necessary, see "Horizontal centering potentiometer" adjustment (1440).

D Mounting pin   **E** Attachment card   **F** Card strap

I/O cable connectors — **A**

B Screws

C Ground clamp

G Planar drawer service position
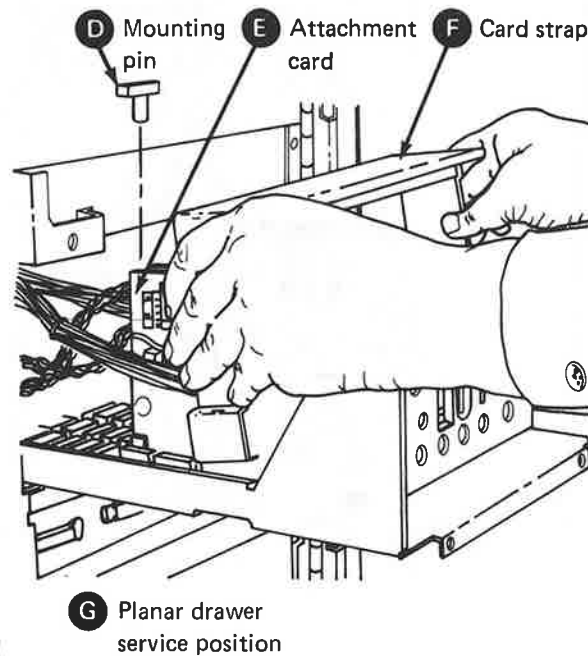
CPU planar board locations and jumpers

CE register test pins

CE logic probe power pins

Jumper for 50-Hz machines only

Keyboard connector

1 D 3

1 E 3

CRT display connector

4 1 C

R/W storage card locations and jumpers

Total R/W storage installed	Card size and location		64K card jumpers			
	Feature	Base	1	2	3	4
32K	—	32K				
64K	32K	32K				
64K	—	64K	X		X	
96K	32K	64K		X		X
128K	64K	64K		X		X

Feature jumpers

A1	CE loop on test
A2	CE stop on error
A3	Machine update card installed
B1	
B2	
B3	Country select (see note)
B4	
B5	
C2	Internal diskette not installed
C3	No diskette attachment installed
D	Jumper 1 to 2
E	Jumper 2 to 3

DC power connector P4

10	11	12
7	8	9
4	5	6
1	2	3

(Base)

(Feature)

Storage card component side

1 B 5

1 A 4

Printer connector

6 9

1 5

I/O card sockets

5247 attachment card socket

Diskette attachment card socket

Note: Install jumpers as indicated by a "1" for country select

Country	B1	B2	B3	B4	B5
Australia/Canada (English)/ United States	0	0	0	0	0
Austria/Germany	1	0	0	0	0
Belgium	1	0	0	1	0
Canada (French)	0	1	1	0	0
Denmark	1	0	1	1	0
Finland	1	1	1	1	0
France (Azerty keyboard)	0	1	1	1	0
France (Qwerty keyboard)	0	0	0	1	0

Country	B1	B2	B3	B4	B5
International	0	0	1	1	0
Italy	0	1	0	0	0
Japan	0	0	0	0	1
Norway	1	1	1	0	0
Spain/Spanish	1	1	0	0	0
Sweden	1	1	0	1	0
Switzerland (French)	0	1	0	1	0
Switzerland (German)	1	0	1	0	0
United Kingdom	0	0	1	0	0

There are additional jumper pins on the planar board that are not shown in this diagram; these pins are for manufacturing use only and are not jumpered for normal operation.

Processor power supply

Processor, processor features, and power supply

1230 CPU planar board (continued)

CPU planar board connector pin assignments

Notes:

1. See the diagnostic user guide for CE register test pin information.

2. See "1212 Signal cable distribution diagram" for connector pin assignments.

3. See "1211 DC voltage distribution diagram" for connector pin assignments.

4. See "Planar board diagram" on the preceding page for feature jumper information.
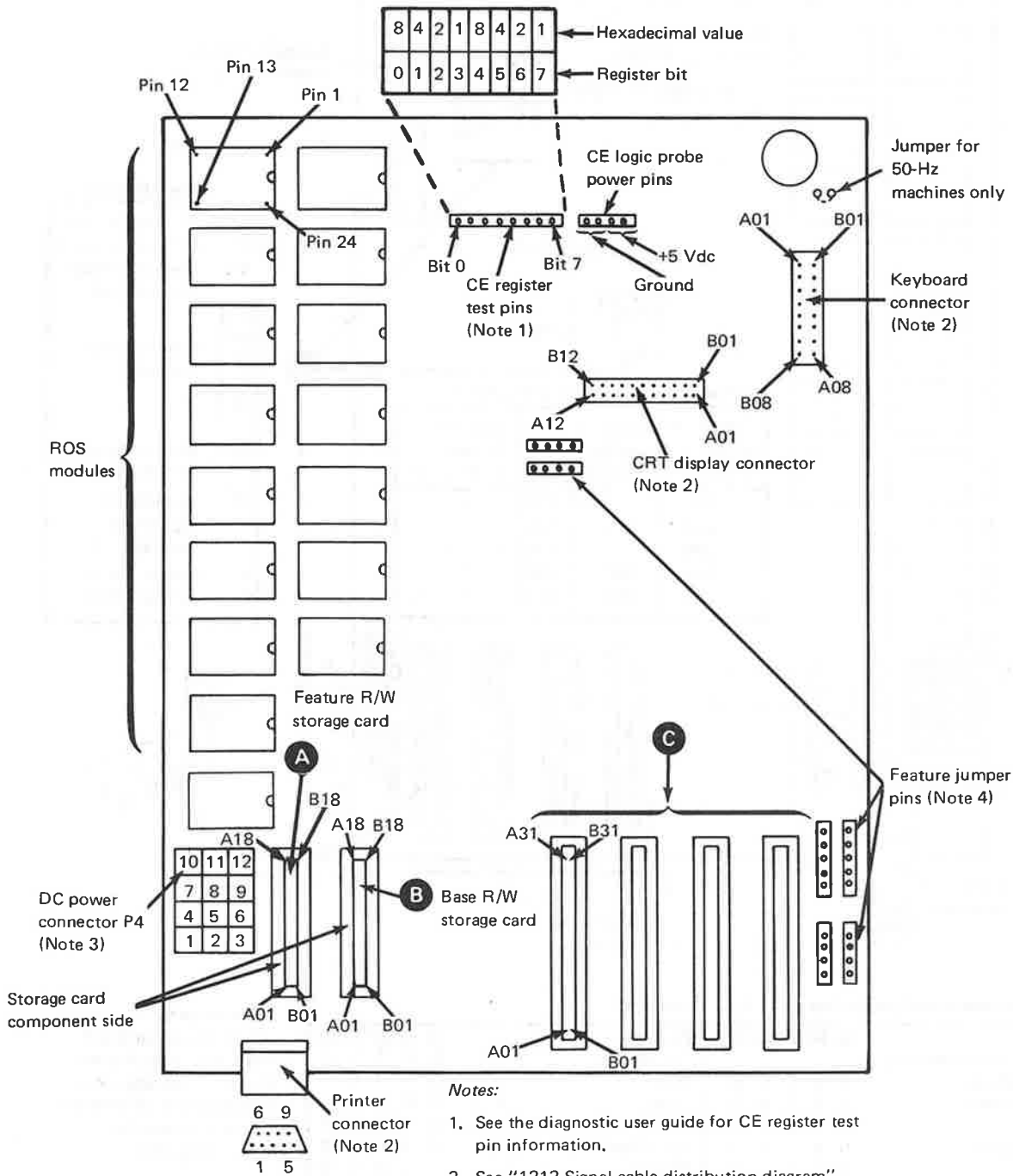
A Feature R/W storage card socket

Pin	Line name	Pin	Line name
A01	Storage data bit 4	B01	Storage data bit 3
A02	Storage data bit 2	B02	Storage data bit 1
A03	Storage data bit 0	B03	Column address strobe 2
A04	Not used	B04	Row address strobe 1
A05	Storage 2 64K	B05	Row address strobe 1
A06	Write enable	B06	Row address strobe 1
A07	Column address strobe 3	B07	Row address strobe 1
A08	Storage address bit 1	B08	Not used
A09	Ground	B09	Not used
A10	-5 Vdc	B10	Ground
A11	+12 Vdc	B11	Storage 2 installed
A12	Storage address bit 2	B12	Storage address bit 5
A13	Storage address bit 0	B13	Storage address bit 4
A14	Storage address bit 6	B14	Storage address bit 3
A15	Column address strobe 6	B15	+5 Vdc
A16	Column address strobe 7	B16	Not used
A17	Storage data bit 6	B17	Storage data bit 5
A18	Storage data bit P	B18	Storage data bit 7

B Base R/W storage card socket

Pin	Line name	Pin	Line name
A01	Storage data bit 4	B01	Storage data bit 3
A02	Storage data bit 2	B02	Storage data bit 1
A03	Storage data bit 0	B03	Column address strobe 0
A04	Column address strobe 2	B04	Row address strobe 1
A05	Storage 1 64K	B05	Row address strobe 1
A06	Write enable	B06	Row address strobe 0
A07	Column address strobe 1	B07	Row address strobe 1
A08	Storage address bit 1	B08	Not used
A09	Ground	B09	Column address strobe 3
A10	-5 Vdc	B10	Ground
A11	+12 Vdc	B11	Storage 1 installed
A12	Storage address bit 2	B12	Storage address bit 5
A13	Storage address bit 0	B13	Storage address bit 4
A14	Storage address bit 6	B14	Storage address bit 3
A15	Column address strobe 4	B15	+5 Vdc
A16	Column address strobe 5	B16	Not used
A17	Storage data bit 6	B17	Storage data bit 5
A18	Storage data bit P	B18	Storage data bit 7

C I/O card sockets

Pin	Line name	Pin	Line name
A01	I/O check	B01	Ground
A02	Data bus bit 7	B02	Reset I/O
A03	Data bus bit 6	B03	+5 Vdc
A04	Data bus bit 5	B04	Not used
A05	Data bus bit 4	B05	-5 Vdc
A06	Data bus bit 3	B06	-DMA request 0
A07	Data bus bit 2	B07	-12 Vdc
A08	Data bus bit 1	B08	Advance storage read
A09	Data bus bit 0	B09	+12 Vdc
A10	I/O ready	B10	I/O cycle
A11	I/O address enable	B11	Storage write to I/O
A12	Page bit 3	B12	Storage read to I/O
A13	Page bit 2	B13	I/O write
A14	Page bit 1	B14	I/O read
A15	Page bit 0	B15	DMA acknowledge 3
A16	Address bus bit 15	B16	DMA request 3
A17	Address bus bit 14	B17	DMA acknowledge 1
A18	Address bus bit 13	B18	DMA request 1
A19	Address bus bit 12	B19	+DMA acknowledge 0
A20	Address bus bit 11	B20	DMA request 0
A21	Address bus bit 10	B21	TP tx interrupt
A22	Address bus bit 9	B22	TP rec interrupt
A23	Address bus bit 8	B23	Interrupt request 5
A24	Address bus bit 7	B24	Diskette interrupt
A25	Address bus bit 6	B25	Interrupt request 3
A26	Address bus bit 5	B26	Word processing interrupt request
A27	Address bus bit 4	B27	Terminal count
A28	Address bus bit 3	B28	I/O address latch enable
A29	Address bus bit 2	B29	+5 Vdc
A30	Address bus bit 1	B30	Clock to I/O
A31	Address bus bit 0	B31	Ground

Processor power supply

Processor, processor features, and power supply

1240 power supply

Layout diagram

This diagram is for power supply PN 8257843, 8257844, and 8257845. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply for locations.

(A) DC power plug P4

(B) A1 card assembly

(C) Power-good LED

(D) Resonant capacitor C6

(E) I/O cable ground clamp

(F) Transformer T1

(G) AC input fuse F6/CB

(H) Terminal block TB1

(I) AC distribution box

(J) AC power plug P3

(K) AC power plug P1

(L) AC power plug P2

(M) AC power plug P5

(N) Cable to AC switch box

(O) AC power On/Off switch

(P) AC power switch box
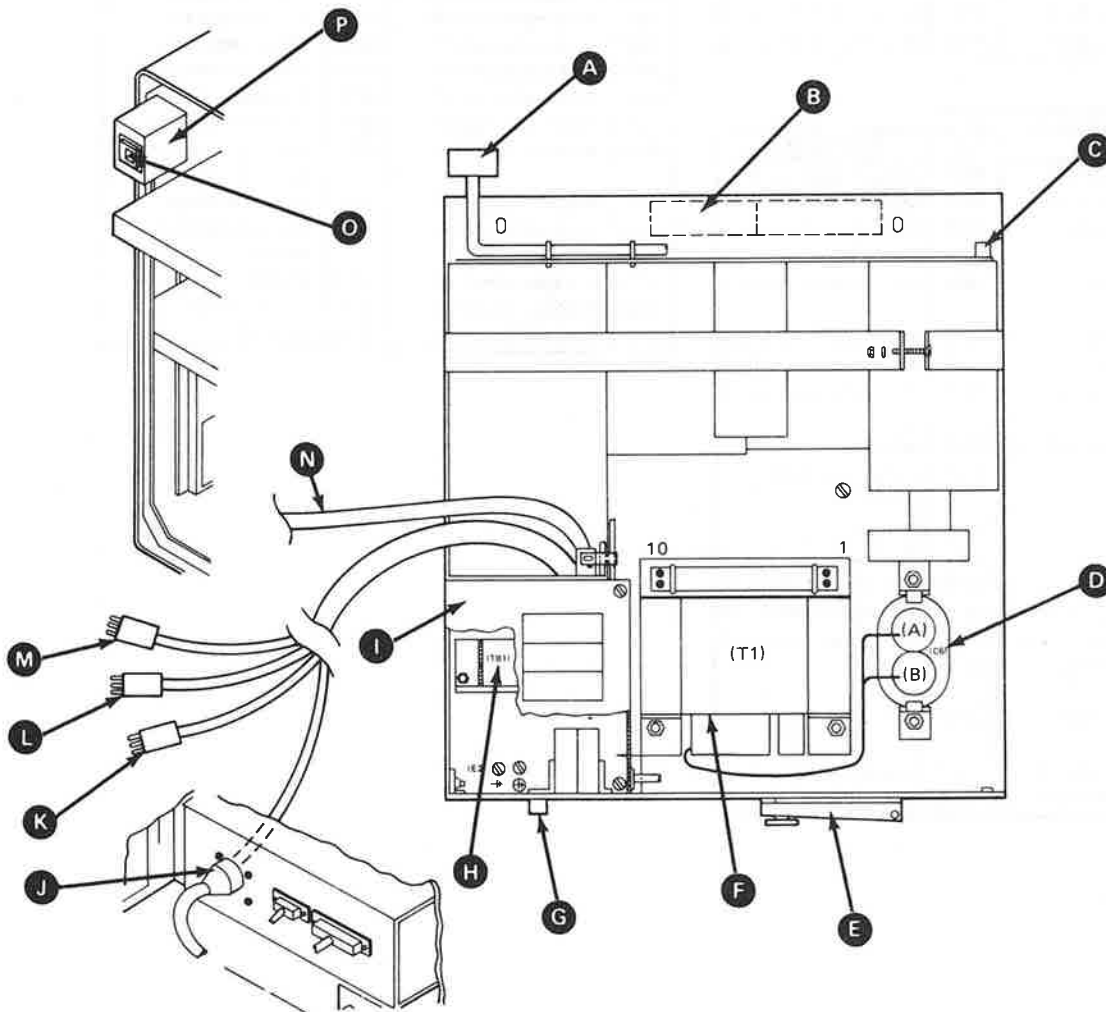
DANGER

Up to 800 Vac is generated in the power supply. Before removing the power supply or any power supply part, switch off the 5324 power and disconnect the power cable from the ac service outlet.

Removal

1. Switch off the 5324 power. Disconnect the power cable from the ac service outlet and from the power supply jack J1 **D**.

2. Open the ground clamp **E** and remove the I/O cables from the clamp. Remove P3 by turning the retainer ring counterclockwise **B**.

3. Remove the four screws **C** from the rear of the power supply.

4. Remove the front cover (1220).

5. Disconnect the voltage wires of the diskette drive attachment cable(s) from the +5 Vdc, -5 Vdc, +24 Vdc, and ground terminals on the power supply (1241).

6. Remove the connector panel and the four screws holding the CRT power connector P3 **B** and the green/yellow wire.

7. Place the planar board in the service position (1230 steps 3 and 4). Disconnect P4 from the planar and return the drawer to normal position.

8. Remove the two screws **A** from the front of the power supply.

9. Remove the diskette drives (1510 steps 3, 4, and 5) and place them on top of the unit.

10. Remove the power switch, cover, cable clamp, and ground wire screw (1245 steps 3, 4, and 5).

11. Disconnect the cable plugs P1, P2, and P5. (See 1200 Locations – Cables and connectors).

12. Remove the power supply from the front of the unit.

Replacement

1. Install the power supply in the 5324 from the front of the unit.

2. Install the power switch and the cable clamp (1245).

3. Install the cable plugs P1 through P5, the voltage wires, and the ground terminals (1200, 1241).

4. Install the four screws that hold the CRT power connector **B**. Be sure to fasten the green/yellow wire and install the connector panel.

5. Install the diskette drives (1510).

6. Install the four screws **C** in the rear of the power supply and the two screws **A** in the front.

7. Place the I/O cable ground shields in the ground clamp **E**; close and tighten the clamp.

8. Connect the ac power cable to the power supply jack J1 **D** and connect the power cable to the service outlet.

A Screws

B CRT power connector

C Screws

Screws **C**

C Screws

E Ground clamp

J1 **D**
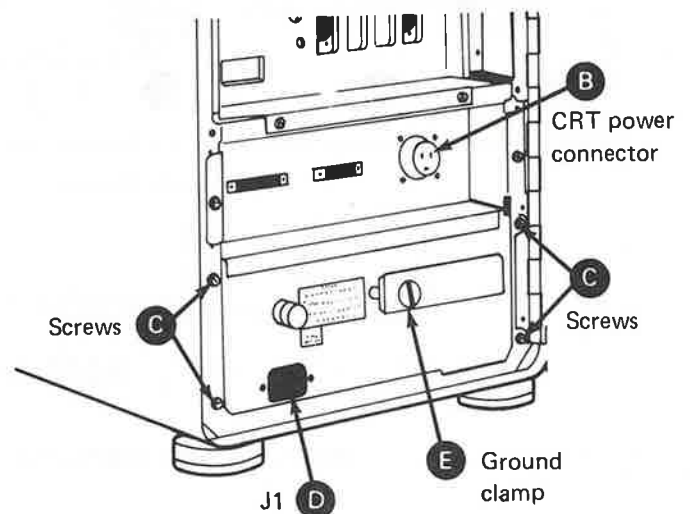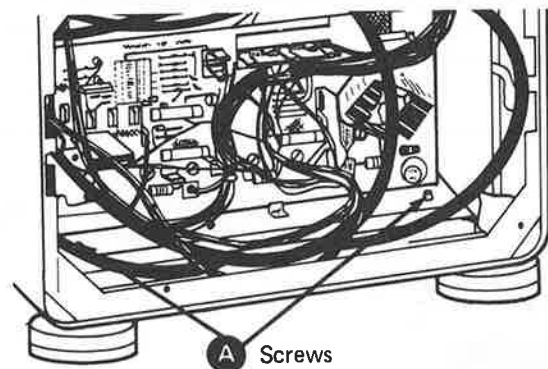
Processor, processor features, and power supply

1241 Fuses

DANGER

Up to 800 Vac is generated in the power supply. Before removing the power supply or any power supply part, switch off the 5324 power and disconnect the power cable from the ac service outlet.

Note: The diagram at the bottom of this page shows the fuse locations for power supply PN 8257843, 8257844, and 8257845. If a power supply with a different part number is installed in the 5324, see the labels attached to that power supply for the fuse locations.

F1–F5 removal and replacement

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.

2. Remove the front cover (1220). The power supply card is located behind the front cover.

3. To remove a fuse from the power supply, use a fuse puller. Fuses 1 through 5 are identified as follows:

F1 is the -5 Vdc fuse (0.5 ampere) **D**
F2 is the +12 Vdc fuse (1.5 amperes) **E**
F3 is the -12 Vdc fuse (0.5 ampere) **A**
F4 is the +24 Vdc fuse (1.5 amperes) **C**
F5 is the +5 Vdc fuse (10 amperes) **B**

Warning: Never replace a fuse with one of a higher ampere rating. Machine circuit damage can occur.

4. Install the fuse and power supply by reversing the order of the removal procedure.

Note: A load resistor **F** is installed between -5Vdc and the return on power supplies PNs 8257843, 8257844, and 8257845 for machines without diskette drives (model XX0).

F1–F5 service check

1. Remove the fuse from the power supply.

2. Use the CE meter set to the ohms RX1 position to check fuse continuity. If the meter does not indicate a short circuit (0 ohms), install a new fuse of the same ampere rating.
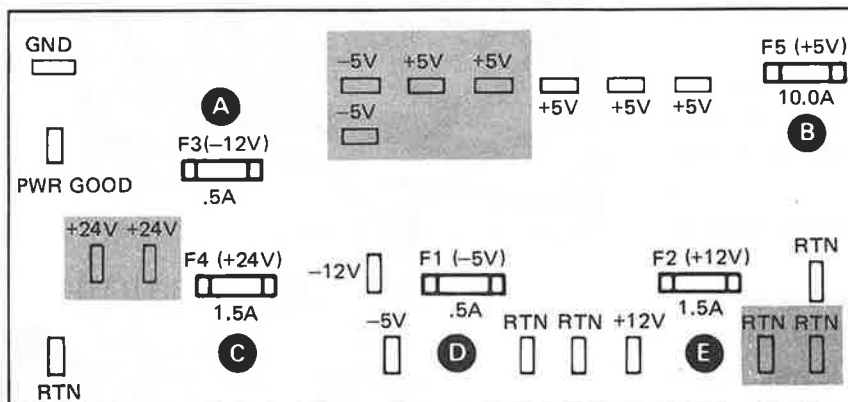
Power supply A1 card
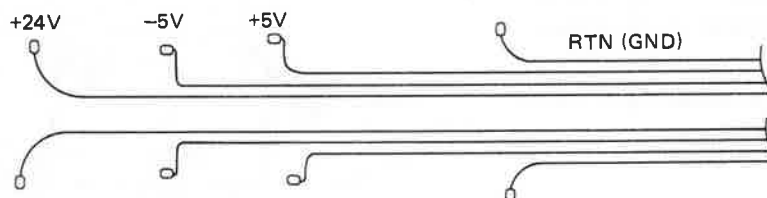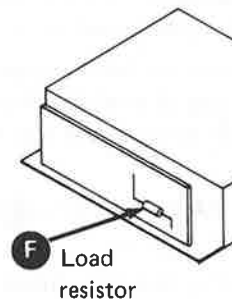
Diskette drive attachment cables

1241 Fuse (60-HZ Power Supply, Canada and U.S.)

DANGER

AC line voltage is located in the fuse socket. Before removing the fuse, switch off the 5324 power and disconnect the power cable from the ac service outlet.

F6 removal and replacement

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.

2. Open the 5324 rear access cover (1220).

3. Turn the fuse holder cap **A** counterclockwise and remove the cap and the fuse.

    Warning: Never replace a fuse with one of a higher ampere rating. Machine circuit damage can occur.

4. Install the fuse and rear access cover by reversing the order of the removal procedure.

F6 service check

1. Remove the fuse from the 5324.

2. Use the CE meter set to the ohms RX1 position to check the fuse continuity. If the meter does not indicate a short circuit (0 ohms), install a new fuse of the same ampere rating (5 amperes, slow-blow).

Processor power supply

Fuse holder cap **A**
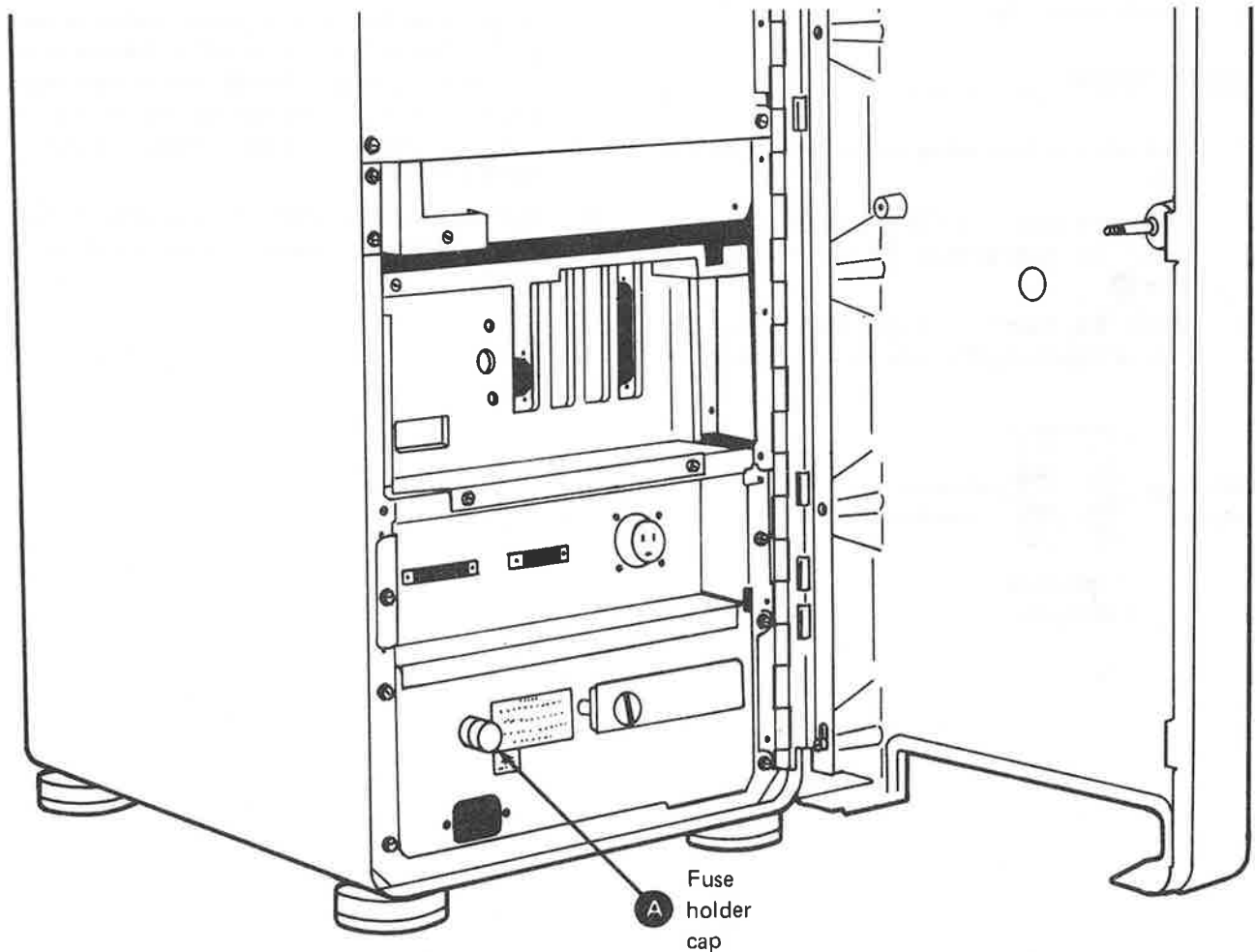
Processor, processor features, and power supply

1245 Power switch

DANGER

AC line voltage is located on the power switch terminals even when the switch is in the off position. Before removing the power supply and the switch, disconnect the power cable from the ac service outlet.

Removal

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.
2. Remove the front cover (1220).
3. Remove the two screws **C** and pull out the switch.
4. Label and disconnect the four wires from the switch terminals.
5. Remove the two switch mounting screws **A** and the ground wire **B**.
6. Remove the switch.

Replacement

1. Connect the four wires to the switch terminals.
2. Place the switch on the switch plate and install the two screws **A** and the ground wire **B**.
3. Install the switch and the two screws **C**. Before tightening the screws, ensure that the

grommet is positioned in the opening at the rear of the switch cover.
Install the front cover (1220).

Service check

DANGER

AC line voltage is located on the power switch terminals even when the switch is in the off position. Before removing the power supply and the switch cover, disconnect the power cable from the ac service outlet.

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.
2. Remove the power switch
3. Set the CE meter switch to the ohms RX1 position. Connect one meter test lead to power switch terminal 2, and connect the other meter test lead to power switch terminal 3. With the power switch in the off position, the CE meter should indicate an open circuit. With the power switch in the on position, the CE meter should indicate a short circuit.
4. Use the same procedure as in Step 3 and check between power switch terminals 5 and 6.

Switch terminals ⟶ | 5 | 2 | ⟶ Switch terminals
| 6 | 3 |

Power switch
(wiring side)

Box-switch

Clamp

Ⓑ Ground wire

Switch

Plate

Ⓐ Screw

Cover

Screw

Bezel

Ⓒ Screws (2)

794A
8R13698
1 2 3
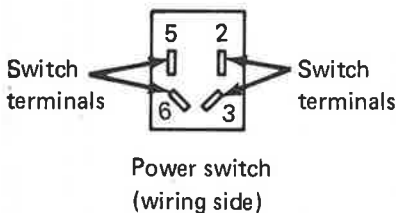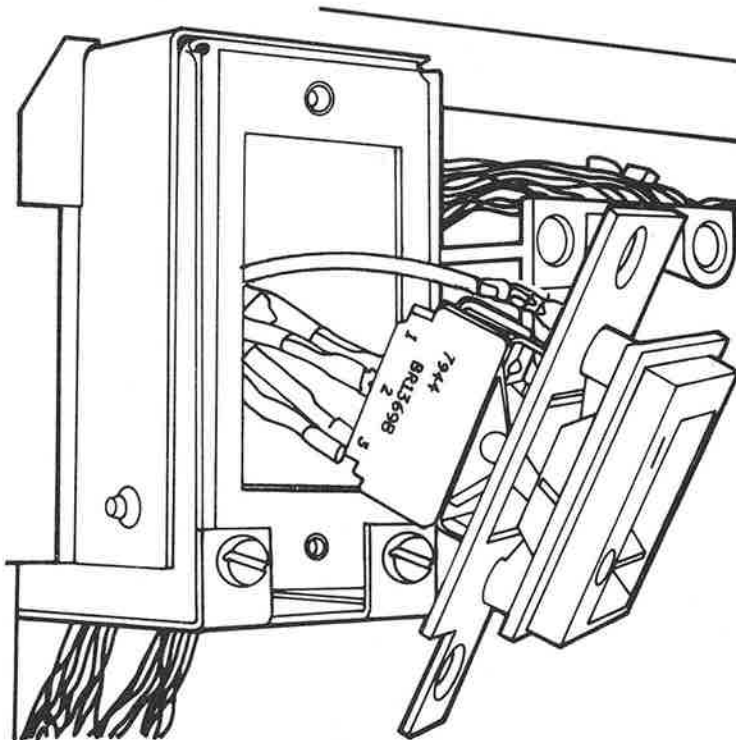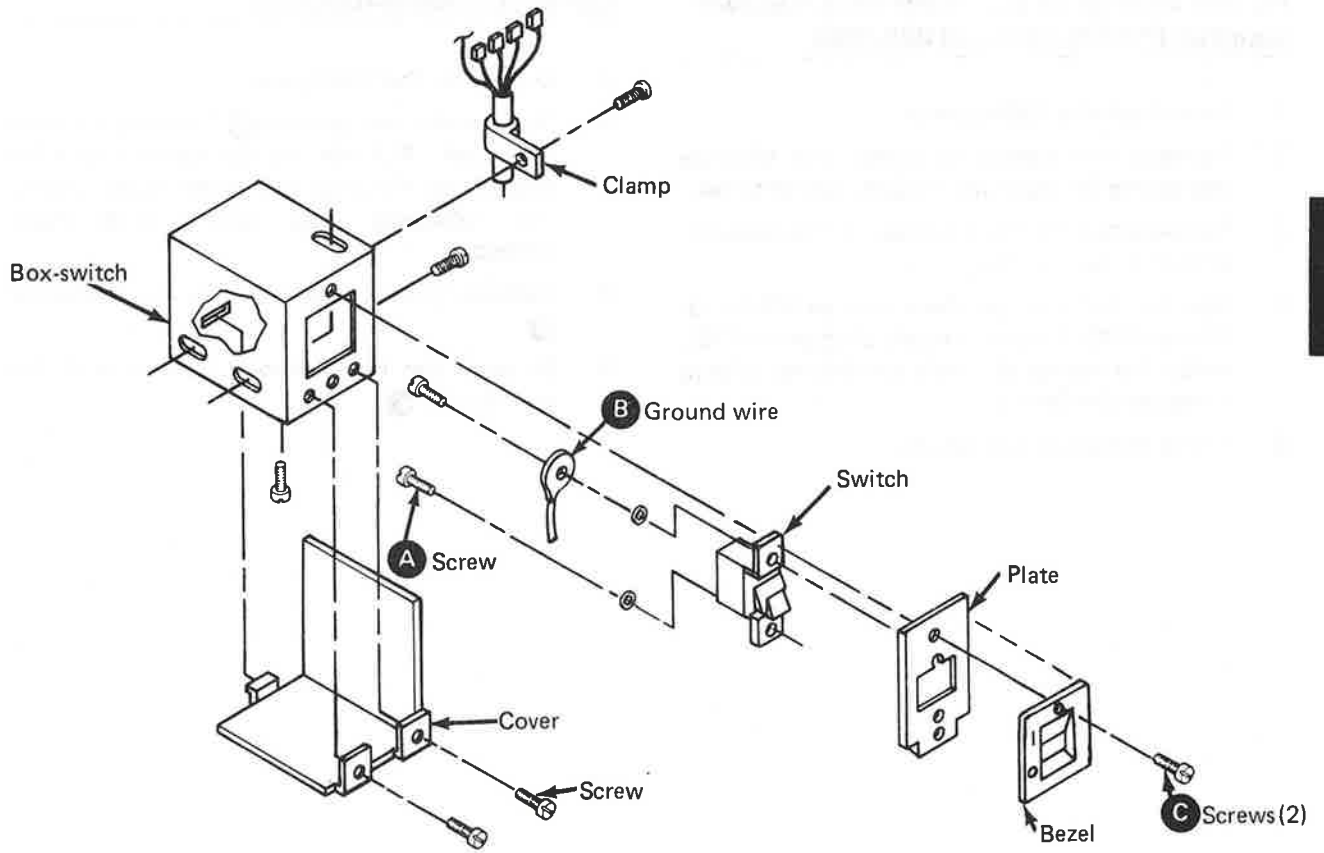
Processor, processor features, and power supply

1245 Power switch (continued)

AC line voltage selection for GBG/I power supplies PN 8257844 and 8257845

1. Switch off the 5324 power.
2. Remove the connector panel and observe the wiring for the power supply transformer.
3. Measure the ac input voltage at the customer's ac power outlet.
4. See the AC voltage chart on the 50-Hz or 60-Hz GBG/I power supply diagram (1210); make the wiring changes for the ac voltage measured in Step 3.
5. Install the connector panel.

Connector Panel Removal

1. Switch off the 5324 power.
2. Remove the two screws **A** from the connector panel. Pull out the connector panel far enough to observe the transformer wiring. The following steps will provide more access.
3. Remove the four screws from the connector **B**.
4. Remove the two screws from each of the connectors **C**.

A Screws

B CRT power connector

C Connectors
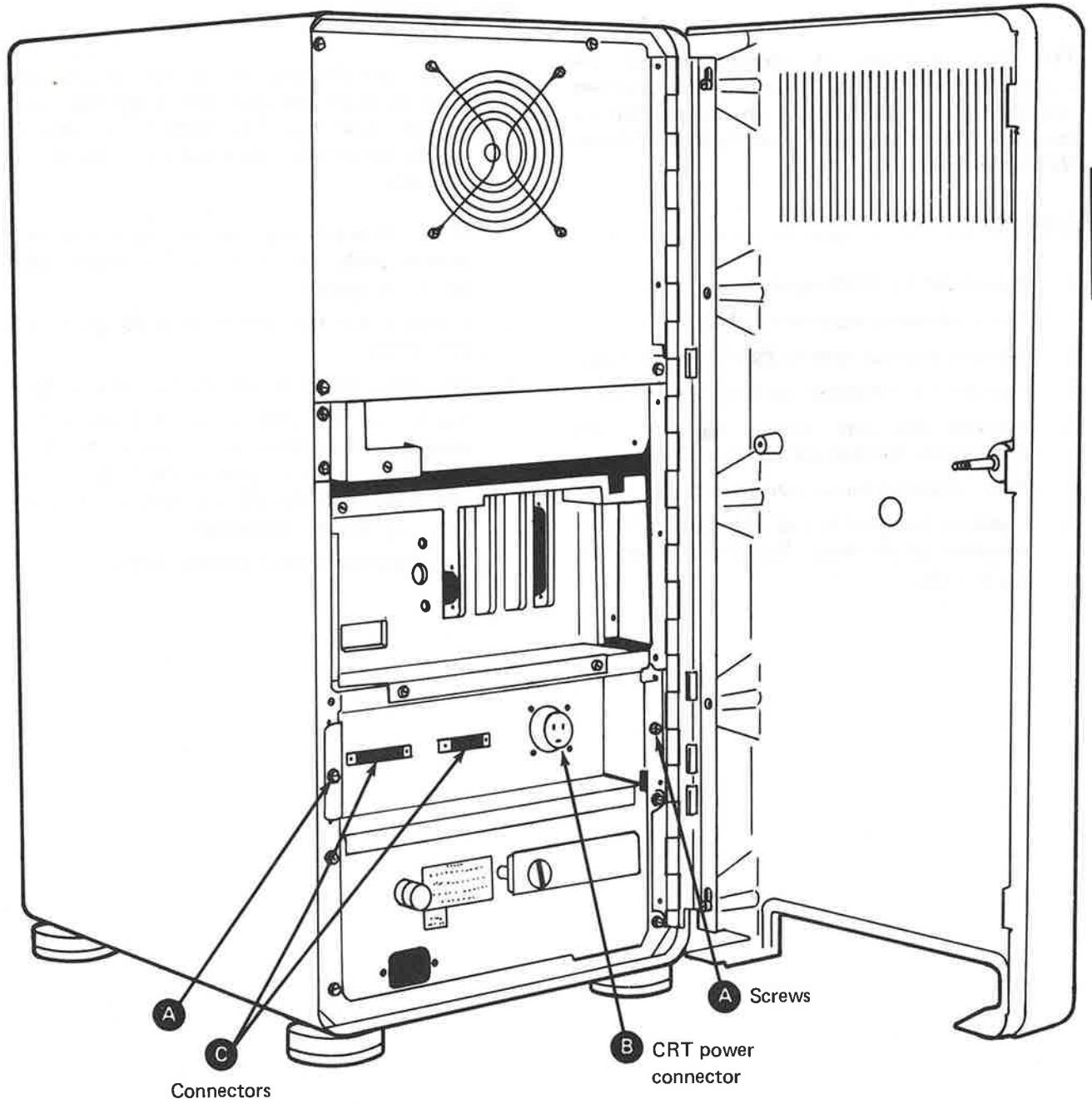
Processor, processor features, and power supply

1270 Cooling fan

DANGER

The fan housing is grounded by its connection to the fan bracket. To prevent possible electrical shock, do not switch on power to the fan when it is removed from the fan bracket.

Removal

1. Switch off the 5324 power.
2. Open the rear access cover (1220).
3. Remove the four screws Ⓐ on the fan plate.
4. Remove the fan assembly from the fan plate.
5. Remove the four screws Ⓒ and nuts. Ensure that the star washer is not lost.
6. Disconnect the fan power plug P5 Ⓑ.
7. Observe the position of the fan as to the direction of air flow. Remove the fan and fan guards.

Replacement

1. Install the fan and fan guards on the fan bracket, using the four screws Ⓒ and nuts. Ensure that the star washer is placed between the fan and bracket as shown in the diagram.

   Note: Position the fan to place the fan power cable and plug at the lower right corner as shown.

2. Connect the fan power plug P5 Ⓑ to its connector.
3. Install the fan plate with the four screws Ⓐ.
4. Switch on the 5324 power and check the direction of air flow from the fan. Air flow should be to the outside of the 5324; if it is not, switch off the 5324 power, remove the fan, and reverse its position.
5. Close the rear access cover (1220).

Ⓐ Screws

Plug P5

Ⓑ

Ⓒ Screws, nuts, washers
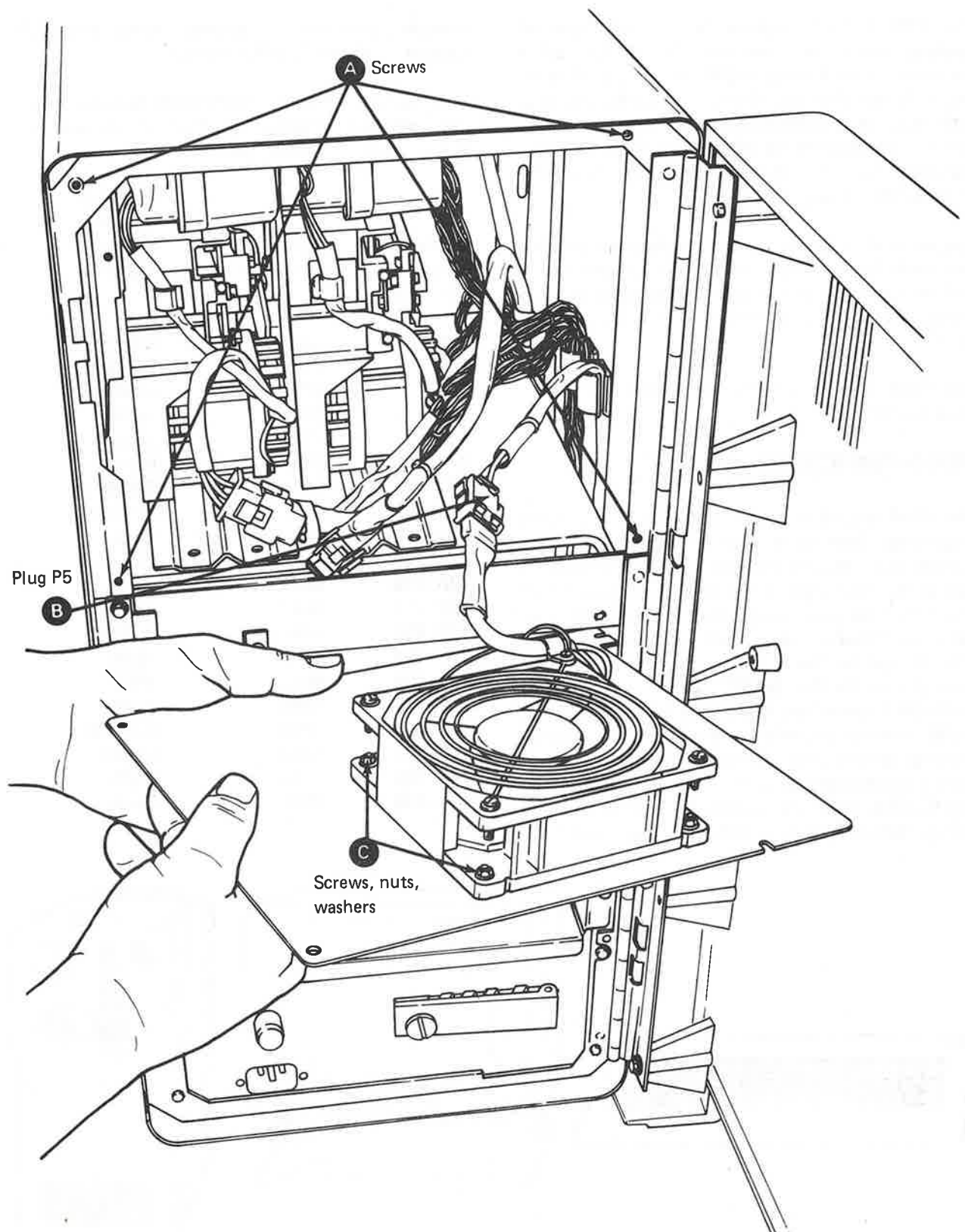
Processor, processor features, and power supply

Theory of operation introduction

The IBM 5324 Computer is a small, general purpose, business computer. It consists of a processor, a keyboard, a CRT display, and up to two internal diskette drives. External devices, such as printers and additional diskette drives can also be attached to the 5324. The 5324, and the attached external devices, is called the IBM System/23 Computing System.

Programs that are entered into read/write storage from the keyboard or from a diskette drive, and microprograms located in read-only storage (ROS), are used to control the operation of the 5324.

The 5324 computer uses the BASIC programming language.

5324 computer model numbers

The 5324 model numbers describe if the word processing feature is present, the read/write storage size, and the diskette storage capacity. A one in the first digit of the model number (1XX) indicates data processing only; a (4XX) indicates word processing and data processing. The second digit of the model number identifies the storage size: 1=32K, 2=64K, 3=96K, and 4=128K. (K=1,024 bytes of storage.) The third digit of the model number identifies the number of internal diskette drives and diskette storage capacity: 0=no internal diskette drives, 1=one diskette drive and 0.25Mb capacity, 2=two diskette drives and 0.5Mb capacity, 3=one diskette drive, and 1Mb

capacity, and 4=two diskette drives and 2Mb capacity. (Mb=1,000,000 bytes.)

The model numbers, read/write storage sizes, and internal diskette storage capacities are shown in the following table:

Model number DP WP	Read/write storage size	Internal diskette storage capacity
110	32K	None
111	32K	0.25Mb
112	32K	0.5Mb
113	32K	1Mb
114	32K	2Mb
120 420	64K	None
121 421	64K	0.25Mb
122 422	64K	0.5Mb
123 423	64K	1Mb
124 424	64K	2Mb
130 430	96K	None
131 431	96K	0.25Mb
132 432	96K	0.5Mb
133 433	96K	1Mb
134 434	96K	2Mb
140 440	128K	None
141 441	128K	0.25Mb
142 442	128K	0.5Mb
143 443	128K	1.Mb
144 444	128K	2Mb
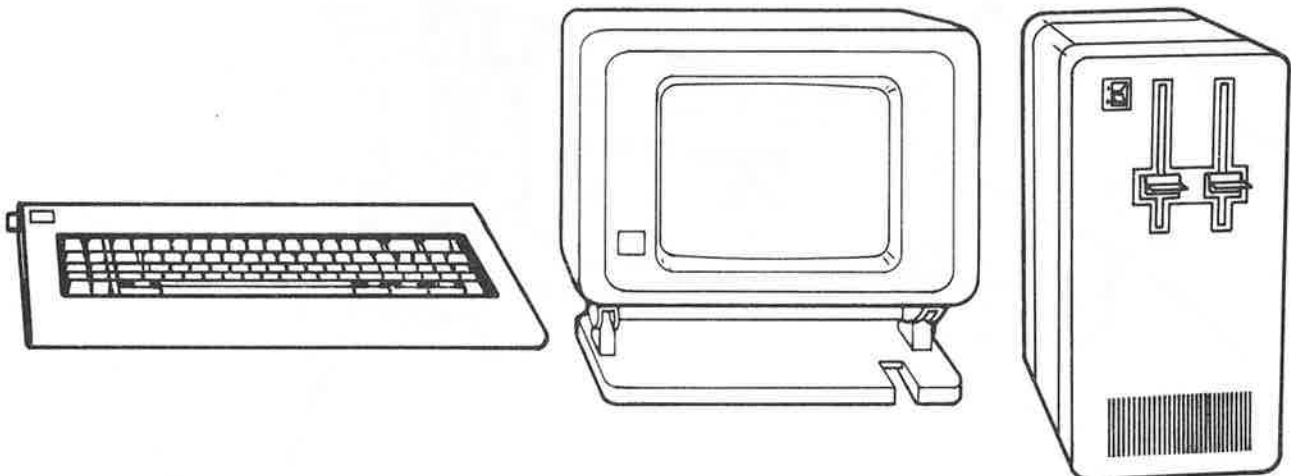
Standard features

Keyboard. The keyboard contains 83 keys and is used to enter alphameric and numeric data, BASIC program statements, and control functions into the 5324 computor. The keyboard is described in "Chapter 3 Keyboard."

CRT display unit. The CRT display unit has a 305 mm (12 in.) diagonal video screen and is used to display program information, data, and system status information. The display screen can display 24 lines of 80 characters (a total of 1920 characters). The CRT display unit is described in "Chapter 4 CRT display unit."

First printer attachment port. The first printer attachment port is used to attach an external printer and its printer attachment logic. The IBM printers are described in Volumes 2 and 3 of the IBM System/23 Service Library and in the *Using Your 5217 Printer* manual, SA34-1593.

Read/write storage. Read/write storage of 32K, 64K, 96K, or 128K bytes is available to store programs and data. The read/write (R/W) storage is located on circuit cards that plug into the R/W storage card sockets on the 5324 CPU planar board.

Read-only storage. Read-only storage (ROS) contains the microprograms used to decode the BASIC program language functions, control the operation of the I/O devices and features, and control the general operation of the computing system.

Audible alarm. The audible alarm is a programmable device that is used to signal the operator when the computing system needs operator intervention.

User library. The user library contains the manuals that the customer needs to install, operate, and learn how to program the 5324.

Service library. The service library contains the maintenance documents—service manuals, maintenance analysis procedures (MAPs), diagnostic user guide, and diagnostic diskette—that are needed to service and repair the 5324.

Optional features

Diskette drives. Up to two internal diskette drives can be used to store and retrieve data and programs. The diskette drives write data on, and read data from, flexible diskettes. Two types of diskette drives, which differ in storage capacity and the types of diskettes that can be used, can be installed in the 5324. The diskette drives are described in "Chapter 5 Diskette drive."

Second printer/5217 attachment port. This feature, which must be installed if a 5217 Printer is attached, permits a second printer and its attachment logic to be connected to the 5324.

External diskette attachment. This feature, which must be installed in 5324 Models 110, 120, 130, 140, 420, 430, and 440 but is optional for all other 5324 models, permits the 5324 to be attached to an IBM 5246 Diskette Unit. One or two 5324s can be attached to a single 5246; however, the 5246 must have the second port feature installed in order to attach the second 5324.

Word processing. The word processing feature (4XX) includes an additional card in an I/O slot with 16K of R/W storage and attribute support. Word processing permits text processing functions that include creating, reviewing, revising, storing, paginating, printing and deleting documents. Word processing requires a minimum of 64K of computer storage and 0.5M bytes of diskette storage. For more detail see the *System/23 Word Processing Operator Reference* manual, SA34-0161. Word processing data flow is described in "Chapter 4 CRT display unit."

External I/O devices

IBM 5217 Printer. The 5217 uses a 96-character print-wheel cartridge that can print either 10, 12, or 15 characters per inch. The 5217 prints up to 60 characters per second (10-pitch). It can be connected to the 5324 printer port. The printer power supply and attachment logic are contained in the printer. The 5217 is described in the *Using Your 5217 Printer* manual, SA34-1593.

IBM 5241 Printer. The 5241 is an 80 character-per-second matrix printer that can be connected to the 5324 printer port. The printer power supply and attachment logic are contained in the printer. The 5241 is described in Volume 2 of the IBM System/23 Service Library.

IBM 5242 Printer (Models 1 and 2). The 5242 is a matrix printer that can be connected to the 5324 printer port. The Model 1 prints at 160 characters per second. The Model 2 prints at 160 characters per second (standard print) and 40 characters per second (high-density print). The printer power supply and attachment logic are contained in the printer. The 5242 is described in Volume 3 of the IBM System/23 Service Library.

IBM 5246 Diskette Unit. The 5246 is a stand-alone diskette drive unit that can be connected to one or two 5324 computers through external cables. The 5246 contains its own power supply and one or two diskette drives that provide up to 2Mb of additional diskette storage capacity for the computing system. The 5246 is described in Volume 4 of the IBM System/23 Service Library.

IBM 5247 Disk Unit. The 5247 is a floor-standing unit that can connect with up to four 5322 or 5324 computers. The 5247 contains its own power supply and is available in either 15 or 30 megabytes of disk storage. The 5247 is described in Volume 6 of the IBM System/23 Service Library.

Functional description

Operator switches and controls

Power switch. Switching the power switch to the on position causes the ac and dc voltages to become active in the 5324. The power-on diagnostics are run automatically each time the 5324 is powered-on, and the diagnostic routine numbers are displayed on the display screen after each routine executes. For a description of the diagnostic routines and error indications, see "PID 1200 Power-on Test" in the diagnostic user guide.

If no errors are sensed by the diagnostic routines, the 5324 enters BASIC mode and a "READY INPUT" message is displayed on the display screen.

Display screen brightness control. Turning this control clockwise increases the brightness of the characters on the display screen. Do not operate the 5324 with the brightness control in the full clockwise position for long periods of time; the display screen could be damaged.

Diskette latches. When a diskette latch is in the vertical position, a flexible diskette can be inserted into, or removed from, the 5324 diskette drive. Turning the diskette latch clockwise to the horizontal position causes the diskette drive spindle to engage the diskette and the diskette to turn inside its outer envelope.

Keyboard. The operator uses the keyboard to control the operation of the computing system. The keyboard operations are described in "Chapter 3 Keyboard" of this service manual.

Diskette latches

Brightness control

Adjustable leg
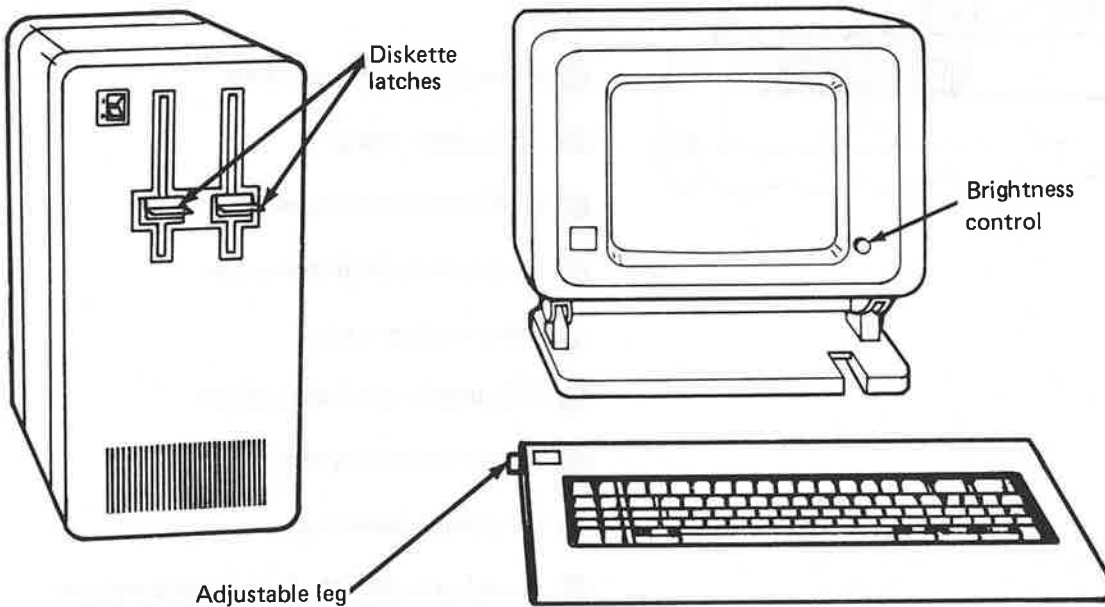
Processor, processor features, and power supply

Functional description (continued)

5324 processing unit

The 5324 computer contains the central processing unit (CPU) for the IBM System/23 Computing System. The CPU circuits are located on the CPU planar board.

CPU
planar
board
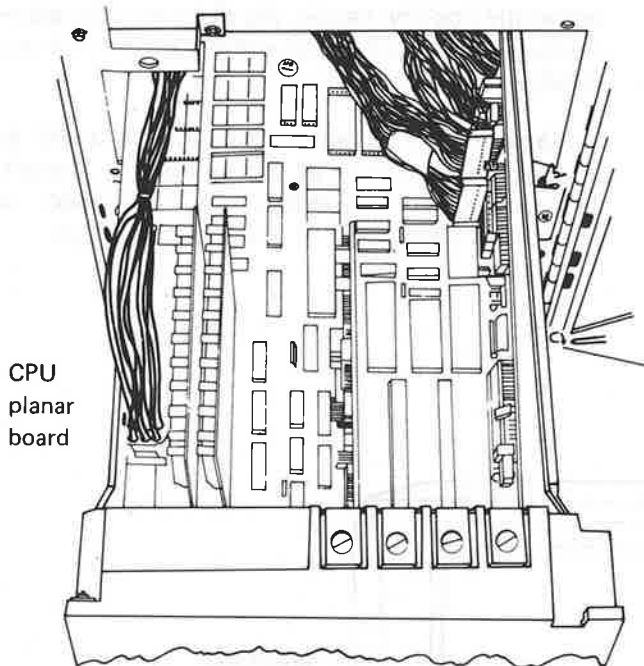
CPU planar board. The CPU planar board, which is approximately 228 x 355 mm (9 x 14 in.), is a field replaceable unit (FRU). It contains the:

- Central processing unit — microprocessor unit (MPU), I/O address decoder, timers, interrupt control, storage page registers, sense and control registers, error checking, direct memory access (DMA) control, bus control, and the control, data, and address buses
- Keyboard attachment
- Display attachment
- First printer attachment port
- Audible alarm
- Read-only storage
- Read/write storage card sockets
- I/O attachment card sockets

The CPU planar board diagram, located on the next page, shows the locations of the following units:

(A) CE logic probe power pins

(B) CE register test pins

(C) Keyboard cable connector

(D) Display unit cable connector

(E) Feature jumper pins

(F) I/O attachment card sockets

(G) Printer cable connector

(H) DC power connector

(I) Read/write (R/W) storage card sockets

(J) Read-only storage (ROS) modules

A CE logic probe
power pins

B CE register
test pins

C Keyboard
cable
connector

D Display unit
cable
connector

J ROS
modules

F I/O attachment
card sockets

E Feature
jumper pins

R/W storage
card sockets

I

DC power
connector

H

G Printer cable
connector
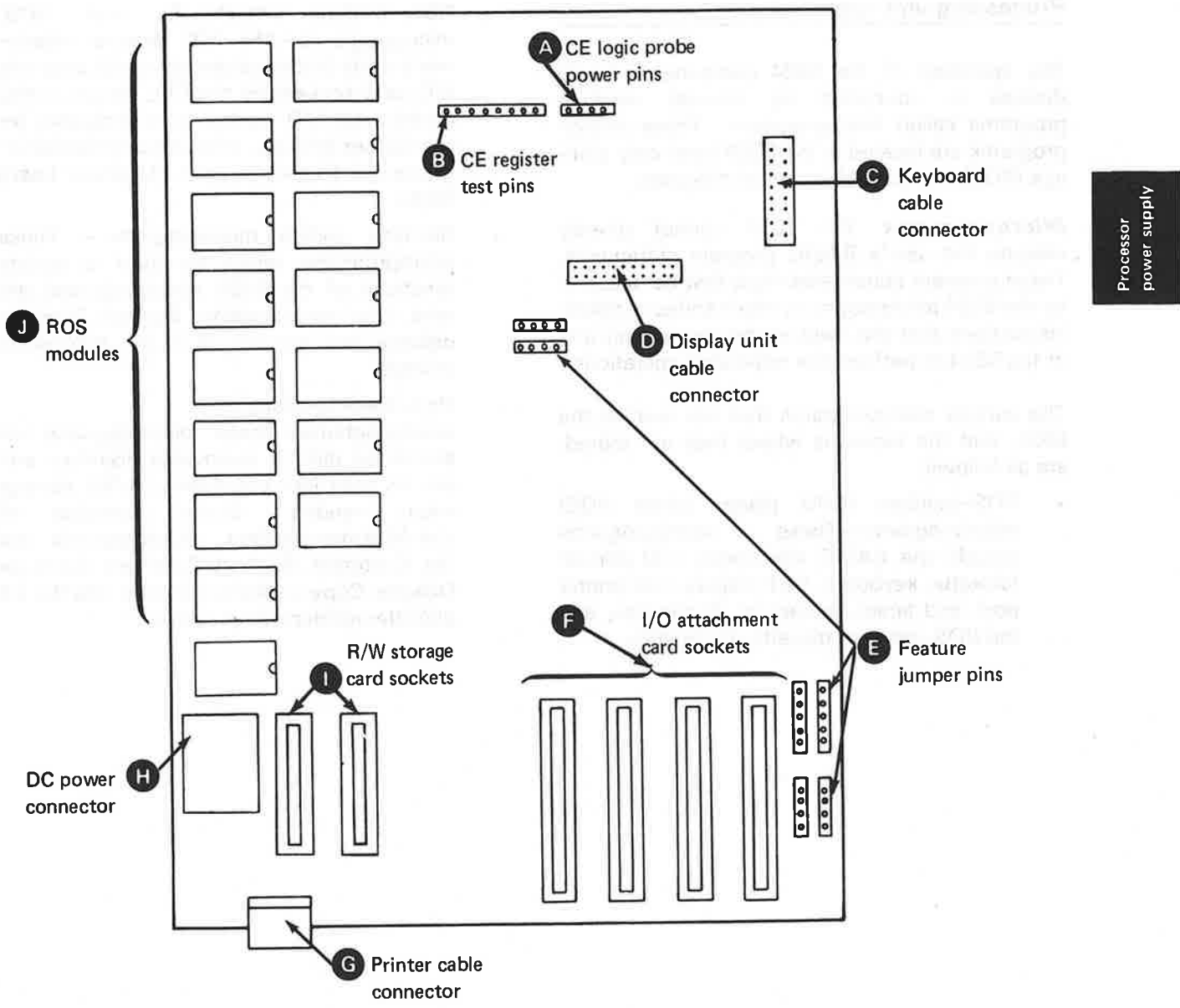
Processor, processor features, and power supply

Functional description (continued)

Processing unit operations

The operation of the 5324 computer and I/O devices is controlled by internal machine programs called microprograms. These microprograms are located in the 5324 read-only storage (ROS) and on IBM-supplied diskettes.

Microprograms. The 5324 cannot directly execute the user's BASIC program statements. These program statements must first be decoded by the 5324 microprograms into a series of micro-instructions that are used by the processing unit of the 5324 to perform the requested operations.

The various microprograms that are used in the 5324, and the locations where they are stored, are as follows:

- ROS-resident (CPU planar board ROS) microprograms—These microprograms include the BASIC interpreter, I/O control (diskette, keyboard, CRT display, first printer port, and timer), power-on diagnostics, and the ROS-resident diskette diagnostics.

- ROS-resident (attachment card ROS) microprograms—The I/O feature attachment cards (except diskette), which plug into I/O card sockets on the CPU planar board, contain the I/O control microprograms for the feature devices. (The diskette microprograms are located in the CPU planar board ROS.)

- Machine update microprograms— These microprograms, which are used to update functions of the 5324 microprograms, are read from the Customer Support Function diskette and are stored in the read/write storage.

- Disk/diskette-resident microprograms—These microprograms are stored on disk or removable diskettes and can be read into read/write (R/W) storage when needed. Some examples of disk/diskette-resident microprograms are the Customer Support Functions (such as Diskette Copy, Diskette Prepare) and the CE diskette-resident diagnostics.

CPU planar board functional data flow

```
┌─────────────────────────────────────────────────────────────────────────┐
│                            CPU planar board                               │
│  ┌──────────────────────────────────────────────────────────────────┐    │
│  │                     Central processing unit                        │    │
│  │                                                                    │    │
│  │   • Microprocessor              • I/O address                      │    │
│  │   • Clock                         decode                           │    │
│  │   • Timers                      • Storage page                     │    │
│  │   • DMA (direct memory            registers                        │    │
│  │     access) control             • Check control                    │    │
│  │   • Interrupt control           • Bus control                      │    │
│  │   • Sense/control                                                  │    │
│  │     registers                                                      │    │
│  └──────────────────────────────────────────────────────────────────┘    │
│                                                                           │
│                              Data bus                                     │
│                                                                           │
│                             Address bus                                   │
│                                                                           │
│                             Control bus                                   │
│                                                                           │
│  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐  │
│  │ Read-only    │  │ Read/write   │  │ Planar board │  │ Off-card I/O │  │
│  │ storage (ROS)│  │ (R/W)        │  │ I/O          │  │ channel      │  │
│  │ • 128K       │  │ storage      │  │ • CRT display│  │ • I/O        │  │
│  │ • Address    │  │ • 32K to 128K│  │ • Keyboard   │  │   attachment │  │
│  │   decode     │  │ • Address    │  │ • Printer    │  │   card       │  │
│  │              │  │   decode     │  │   port       │  │   sockets and│  │
│  │              │  │ • Parity     │  │ • Audible    │  │   internal   │  │
│  │              │  │   generator  │  │   alarm      │  │   hardware   │  │
│  │              │  │ • Parity     │  │              │  │   cards      │  │
│  │              │  │   check      │  │              │  │              │  │
│  └──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘  │
└─────────────────────────────────────────────────────────────────────────┘
                                                          │  │  │  │
                                                          ▼  ▼  ▼  ▼
                                                         External
                                                         I/O devices
```

Processor, processor features, and power supply

Functional description (continued)

Functional units

Microprocessor. The microprocessor (MPU) is the central arithmetic and logic unit of the 5324 computer. The MPU contains timing and control circuits, a program instruction counter, an instruction decoder, an arithmetic logic unit, an accumulator, and a group of temporary storage registers (registers A through E, H, and L). The MPU operates under control of the 5324 microprograms and generates and decodes the information on the data, address, and control buses.

Address bus. The 5324 address bus has sixteen lines (A0–A15) and is used by the MPU to address storage and the I/O devices. It is also used by the direct memory access (DMA) circuits to address storage during DMA I/O read and write operations.

Although the 5324 address bus has sixteen lines (A0–A15), the MPU address bus has only eight lines (A0–A7). During address time, the other eight address lines (A8–A15), which are needed for the 5324 address bus, are read from the MPU data/address buffer and are sent to the address A8–A15 latch. During the remainder of the MPU cycle, the data/address buffer is used for data.

Data bus. The 5324 data bus has eight lines (D0–D7) and is used to move data between the MPU and I/O devices, the MPU and storage, and the I/O devices and storage.

Control bus. The 5324 control bus contains the control lines that are used to time and control the movement of data and addresses between the MPU, storage, and I/O devices. The functions of the control lines are:

I/O read—indicates that the addressed I/O location is to be read from and that the data bus is available for the data.

I/O write—indicates that the data on the data bus is to be written into the addressed I/O location.

Storage read—indicates that the addressed storage location is to be read from and that the data bus is available for the data.

Storage write—indicates that the data on the data bus is to be written into the addressed storage location.

Clock—clock output for use as a system clock.

Reset in—sets the MPU program instruction counter to 0000 and resets interrupt enable and hold acknowledge. The MPU is held in the reset condition as long as 'reset-in' is active. The 'reset-in' line follows the status of the power-good signal from the power supply. During a power-on sequence, 'reset-in' is active until the power-good signal becomes active.

Reset out—indicates that the MPU is being reset. 'Reset-out' is used as a system reset.

Interrupt request—indicates that an interrupt request to the MPU is active.

Interrupt acknowledge—indicates to the interrupt controller that the MPU is ready to service the interrupt request.

Hold request—indicates that a device is requesting the use of the address and data buses. When the MPU receives 'hold request', it releases the buses to the requesting device on the next clock cycle.

Hold acknowledge—indicates that the MPU has received a 'hold request' and will release the buses on the next clock cycle.
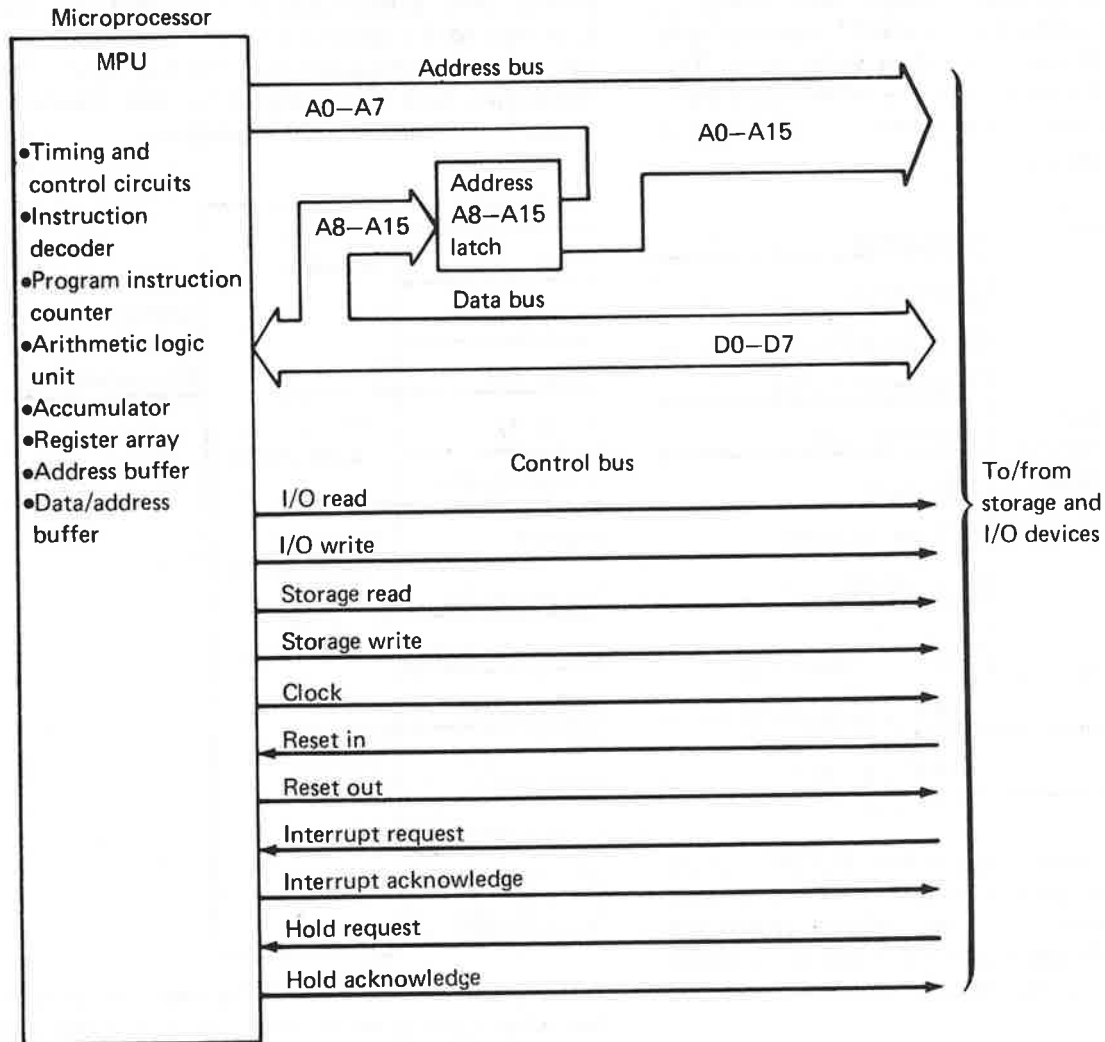
Microprocessor

MPU

- Timing and
  control circuits
- Instruction
  decoder
- Program instruction
  counter
- Arithmetic logic
  unit
- Accumulator
- Register array
- Address buffer
- Data/address
  buffer

Address bus

A0—A7

A0—A15

Address
A8—A15
latch

A8—A15

Data bus

D0—D7

Control bus

I/O read

I/O write

Storage read

Storage write

Clock

Reset in

Reset out

Interrupt request

Interrupt acknowledge

Hold request

Hold acknowledge

To/from
storage and
I/O devices

Functional description (continued)

I/O address decoder. When processing a microprogram instruction, the 5324 must address storage or a device to read or write data. The I/O address decoder uses the information from the 5324 address bus to select the device or a storage page register.
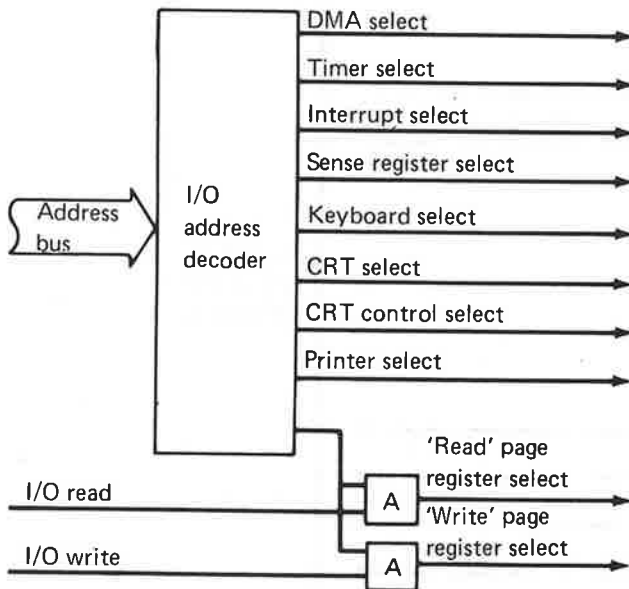
The device addresses, which are used only by the microprograms, are not described in this service manual. Options in the 5324 diagnostic programs permit the Customer Engineer to select the device(s) to be tested during diagnostic procedures.

Interrupts. Interrupts permit more efficient operation of the 5324 computer and I/O devices by letting the processing unit and I/O devices perform asynchronous operations until a device requests service from the processing unit.

The device informs the processing unit that it needs service by sending an interrupt request. This interrupt request informs the processing unit that it should complete the instruction being executed and to go to a specific program routine to service the requesting device.

An example of using interrupts is when a key is pressed on the 5324 keyboard. The keyboard sends an interrupt request to inform the processing unit that it has a character to send. The proc-

essing unit acknowledges the interrupt and branches to the program routine •that reads and translates the character from the keyboard. The processing unit then returns to, and continues execution of, the interrupted program.
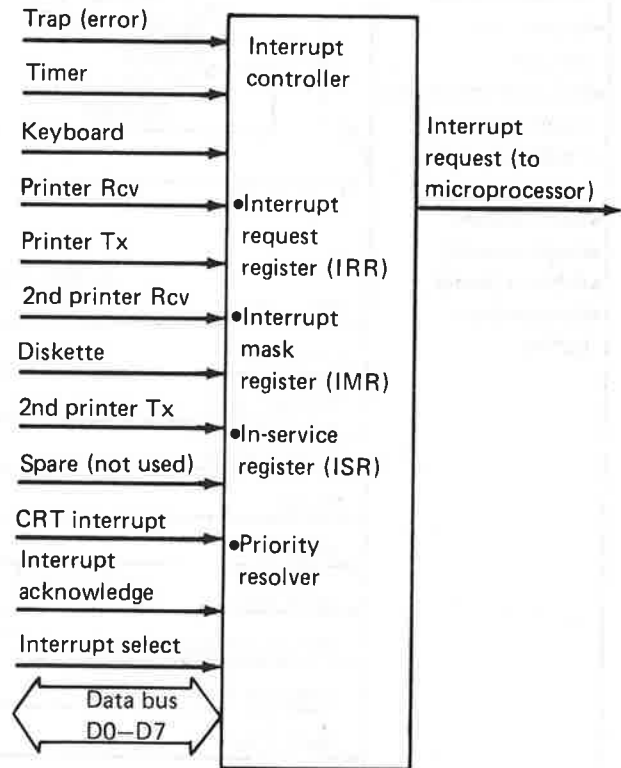
Interrupt service routines. The interrupt controller, after sending an interrupt request, must give the processing unit the information needed to find the service routine for the interrupting device. When the interrupt controller receives an interrupt acknowledge (INTA) signal from the processing unit, it places a "Call" instruction on the data bus. This instruction causes the processing unit to send two more INTA signals. The interrupt controller responds to these two INTA signals by placing the high and low halves of an address on the data bus. This address is that of the location in storage containing the address of the device's service routine. When the service routine is completed, the processing unit returns to the next sequential instruction of the program that was in process at the time the interrupt occurred.

Interrupt priority. Interrupts are assigned priorities, which means that a device with a higher interrupt priority is serviced by the processing unit before a device with a lower priority. Also, an active lower priority interrupt service routine can be interrupted to branch to the service routine for a higher priority device.

The interrupt assignments, starting with the highest priority interrupt are as follows:

- Trap (error)
- Timer
- Keyboard
- Printer receive ready (first printer)
- Printer transmit ready (first printer)
- Printer receive ready (second printer)
- Diskette
- Printer transmit ready (second printer)

Program control of interrupts. Interrupts can be enabled, disabled, or selectively masked by the 5324 microprograms. Interrupt masking gives the microprogram the ability to enable or disable one or more specific interrupt levels. Masking of a higher priority level does not affect the interrupt request lines of lower priority.

Trap interrupts. Trap (error) interrupts cannot be masked and are used to report machine checks that occur during the running of a BASIC or diagnostic program. When a trap interrupt occurs, the error information is displayed on the bottom lines of the display screen. The diagnostic user guide contains a description of the information that is displayed when a trap interrupt occurs.

Interval timer. The 5324 interval timer supplies three separate counting functions for the IBM System/23 Computing System. Each of the three counters can be addressed and controlled by the microprograms. These counter functions are:

Counter 0—used as a programmable baud-rate generator for the printer port.

Counter 1—used to generate the audible frequency tone for the 5324 audible alarm.

Counter 2—used as a general purpose system timer. A value can be loaded into the counter by program control. The counter then decreases this value by one each timer clock cycle. When the value in the counter reaches zero, a timer interrupt is sent to the processing unit.
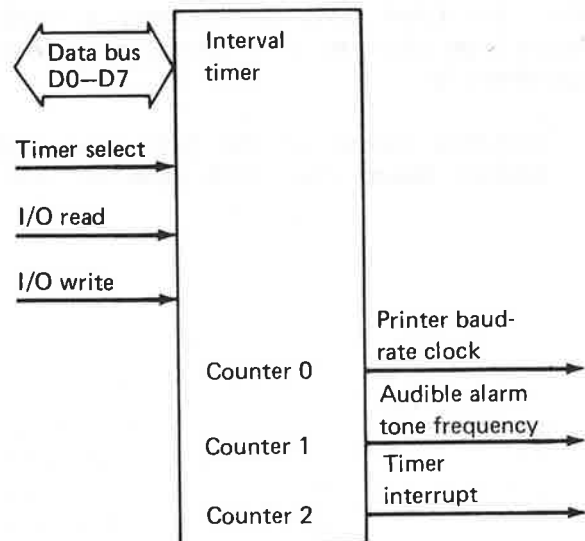
Functional description (continued)

Direct memory access. Direct memory access (DMA) is used to move blocks of data between storage and the CRT display and diskette drive attachments. The DMA controller must first be initialized by the microprogram with a storage address where the data transfer is to start and with a byte count that specifies the number of data bytes to be moved. The DMA controller can then move this block of sequentially addressed data between storage and the device without needing intervention from the processing unit.

DMA operations. The DMA controller has two modes of operation—DMA read and DMA write. DMA read causes data to be moved from storage to the requesting device, and DMA write causes data to be moved to storage from the requesting device. The diskette attachment uses both DMA read and write operations; the CRT display attachment uses only DMA read operations.

When the DMA controller receives a DMA request from either the CRT display or diskette attachment, it:

- Requests control of the 5324 data and address buses—The DMA controller acti-vates the 'hold request' line to the processing unit to request the use of the data and address buses. The processing unit responds to 'hold request' by activating the 'hold acknowledge' line to indicate that it will release the buses to the DMA controller on the next clock cycle.

- Acknowledges the DMA request—The DMA controller activates the 'DMA acknowledge' line to the requesting device. If the CRT display and diskette attachments have 'DMA request' lines active concurrently, the diskette attachment is given priority and is acknowledged first.

- Activates the address bus—The DMA controller places an address, which is the address of the first storage location that is to be accessed for the DMA operation, on the address bus. This address is increased by one for each following DMA storage cycle until either the byte count reaches zero or the device deactivates its 'DMA request' line.
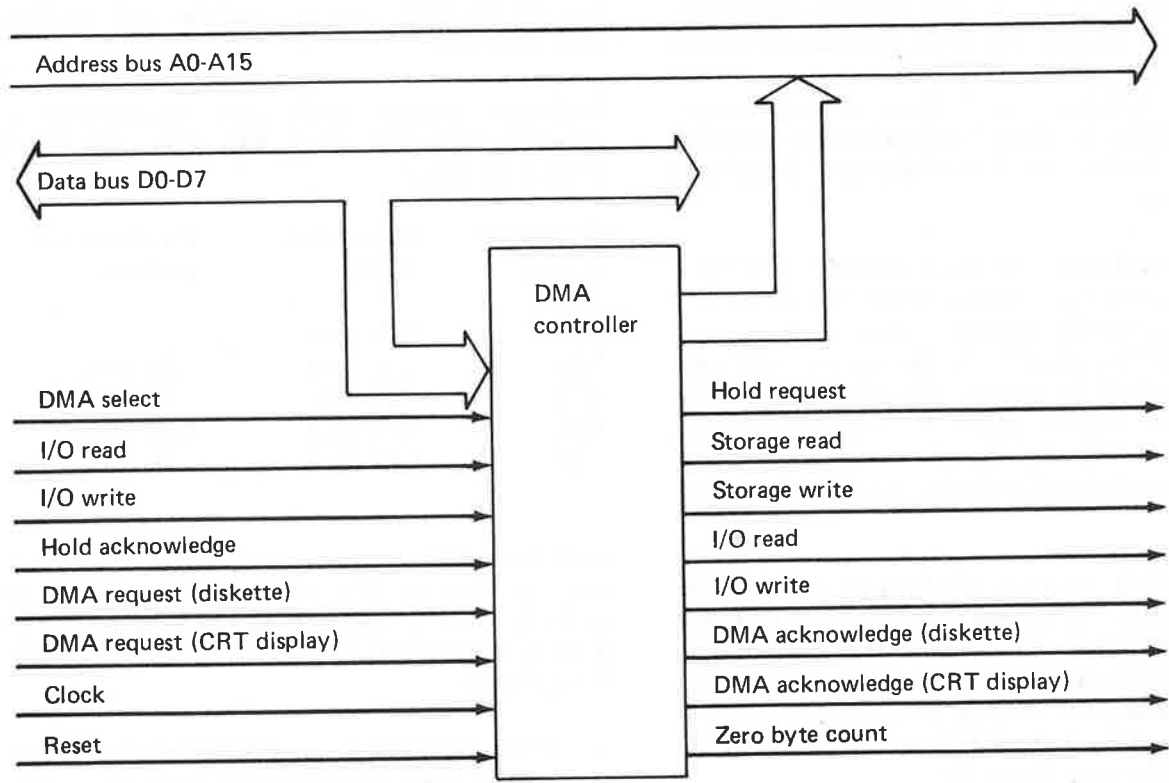
Address bus A0-A15

Data bus D0-D7

DMA
controller

DMA select

I/O read

I/O write

Hold acknowledge

DMA request (diskette)

DMA request (CRT display)

Clock

Reset

Hold request

Storage read

Storage write

I/O read

I/O write

DMA acknowledge (diskette)

DMA acknowledge (CRT display)

Zero byte count

Processor, processor features, and power supply

Functional description (continued)

- Generates the I/O and storage read/write control signals. The DMA controller activates the 'I/O read,' 'I/O write,' 'storage read,' and 'storage write' lines in the correct sequence to cause the data transfer between the device and the addressed location in storage.

Internal storage. The 5324 contains two types of internal storage—read-only storage (ROS) and read/write (R/W) storage.. *Read-only storage (ROS).* ROS contains microprograms and data that are used to control the operation of the 5324. The microprograms and data are written into ROS during the manufacturing process and cannot be changed (written) during 5324 operations.

Sixteen ROS modules are located on the CPU planar board. Additional ROS modules can also be located on the I/O attachment cards that plug into the I/O card sockets on the CPU planar board. Each ROS module contains 8K bytes of storage, and each storage byte contains eight bit positions (for data bits 0–7).

ROS is addressed using the data from the address bus and page registers (see "Storage addressing" later in this chapter), and the data byte read from ROS is placed on the data bus.

ROS is not checked for parity during normal 5324 operations; however, each time the 5324 is switched on, the power-on diagnostic performs a cyclic redundancy check (CRC) of the data in the ROS modules. Each ROS module contains a CRC check character, which the diagnostic compares with the CRC value that it calculates as it reads the ROS module during the diagnostic test.

Read/write (R/W) storage. Programs and data that are read from I/O devices and ROS can be stored in R/W storage. R/W storage is located on circuit cards that plug into the R/W storage card sockets on the 5324 CPU planar board. The storage cards are available in either 32K or 64K byte sizes. Minimum R/W storage in the 5324 is 32K bytes for models 1XX and 64K for model 4XX.

Additional storage cards[2] can be installed to increase R/W storage to 64K, 96K, and 128K bytes as follows:

Total R/W storage	Base card socket	Feature card socket
32K	32K card	--
64K	32K card	32K card
64K	64K card	--
96K	64K card	32K card
128K	64K card	64K card

Each byte of R/W storage contains nine bit positions (for data bits 0–7 and a parity bit). The parity bit is used to generate an odd bit count for each data byte that is written into R/W storage. For example:

- If the eight bits of the data byte to be written into storage are 00101010 (odd bit count), then no parity bit is added by the parity generator circuit before the storage write operation.

- If the eight bits of the data byte to be written into storage are 01101010 (even bit count), then a parity bit is added by the parity generator circuit before the storage write operation.

When a data byte is read from R/W storage, it is checked by the parity check circuit for an odd bit count. This test can sense most storage read or write failures. If a data byte is read from storage and contains an even bit count, the storage parity check is set and a trap interrupt is sent to the processing unit to indicate that a machine error occurred.

---

[2] See "1230 CPU planar board" in the maintenance section of this chapter for the locations of the R/W storage card sockets.

R/W storage is addressed using the information from the 5324 address bus and page registers (see "Storage addressing" later in this chapter), and the 5324 data bus is used to move the data

byte that is written to, or read from, R/W storage. Storage parity bits are not sent to the data bus.

Processor, processor features, and power supply

Functional description (continued)

Storage addressing. The 5324 can contain 256K bytes of internal storage (128K bytes of ROS and 128K bytes of R/W storage) plus additional ROS that can be located on the I/O attachment cards. The sixteen lines of the 5324 address bus (A0 through A15) permit a maximum addressing range of 64K bytes; therefore, page registers are used to expand the address range of the 5324.

The 64K-byte addressing range of the 5324 is divided into four equal blocks of 16K addresses each, as follows:

Note: All address values are in hexadecimal.

- 0000 through 3FFF—this block addresses the first 16K bytes of ROS, and page registers are not used.

- 4000 through 7FFF—this block addresses ROS and selects a page register that can address up to 256K bytes of ROS in this address space.

- 8000 through BFFF—this block addresses the first 16K bytes of R/W storage, and page registers are not used.

- C000 through FFFF—this block addresses R/W storage and selects a page register that addresses up to 112K bytes of R/W storage in this address space.

Storage page registers. The four storage page registers, which can be read and written by microprogram control, are the:

- ROS page register—selected when the address on the address bus is 4000 through 7FFF

- R/W write page register—selected when the address on the address bus is C000 through FFFF and the storage operation is a write operation

- R/W read page register—selected when the address on the address bus is C000 through FFFF and the storage operation is a read operation

- DMA page register—selected when the storage operation is a direct memory access (DMA) operation

Each of the page registers contains four addressing bits that can be written by the microprograms. The four bits can contain a value (0–F) to select up to sixteen pages of 16K bytes of storage. The separate read and write page registers permit data to be moved from one page to another (read from one page and written to another page) without changing the page value in the page registers.

The following diagram shows the relationship of the 16K-byte storage address blocks, the page registers, and the 16K-byte storage pages.

Storage
addresses
(hexadecimal)

0000	16K bytes ROS Non-paged address block
3FFF	
4000	16K bytes ROS Paged address block selected by: • ROS page register • DMA page register
7FFF	
8000	16K bytes R/W storage Non-paged address block
BFFF	
C000	16K bytes R/W storage Paged address block selected by: • R/W read page register • R/W write page register • DMA page register
FFFF	

See Note

F
E
D
C
B
A
9
8
7
6
5
4
3
2
1
Page 0

16K bytes ROS

Decoded by I/O channel

Decoded by CPU planar board ROS

See Note

7
6
5
4
3
2
1
Page 0

16K bytes R/W storage

Decoded by CPU planar board R/W storage

Note: ROS storage pages 2 and 3 and R/W storage page 7 are not used.

Processor power supply

Processor, processor features, and power supply

Functional description (continued)

Error checking

When a machine error occurs during the running of either a customer BASIC program or a diagnostic program, a trap interrupt is sent to the processing unit. The trap interrupt causes the 5324 to sense information about the error and to display the trap information at the bottom of the CRT display screen. MAP 1220 is used by the Customer Engineer to interpret this trap information and determine the cause of the error. A description of the trap data display is also in the diagnostic user guide.

Four types of machine errors cause the trap interrupt to be generated. They are:

- R/W storage parity check
- Write-to-ROS check
- I/O check
- Power check

R/W storage parity check. All data bytes in the 5324 read/write (R/W) storage contain nine bit positions (eight data bits and a parity bit). The parity bit is used, if needed, to generate an odd bit count (odd parity) on every R/W storage write operation, and parity is checked on every R/W storage read operation. (See "R/W storage" in this chapter for the description of parity generating and checking.) If a data byte is read from R/W storage that contains an even bit count

(even parity), a R/W storage parity check occurs and a trap interrupt is sent to the processing unit.

Note: During the 5324 power-on sequence, the parity check is cleared and held reset until the power-on diagnostic writes to all R/W storage locations. This is done to ensure that all positions of R/W storage contain odd parity.

Write-to-ROS check. If a storage write operation is attempted into a ROS (read-only storage) location, a write-to-ROS check is generated and a trap interrupt is sent to the processing unit.

I/O check. I/O check is a general purpose check that is specified by the I/O devices attached to the 5324. See the I/O device's service manual for a description of the specific I/O checks generated by the device.

Power check. When the +5 Vdc, -5 Vdc, +12 Vdc, and -12 Vdc voltages in the 5324 power supply are within approximately 80 percent of their nominal operating levels, the power supply generates a power-good signal to the processing unit. Loss of the power-good signal, indicating a power supply failure, causes a trap interrupt request and a reset to be sent to the processing unit. Because of this reset, the trap interrupt caused by loss of the power-good signal is not acknowledged by the processing unit and the power check indicator is not set.

Power supplies

The 5324 computer can contain either a ferrore-sonant or a transistor-switching-regulator (TSR) power supply. These two types of power supplies are functionally interchangeable and supply the same output voltages for the internal operation of the 5324.

Ferroresonant power supply description.
The ac input voltage connects to the power supply through a three-prong, grounded connector **A**. When the power switch **B** is set to the on position, the ac input voltage is supplied to the primary side of the transformer **D**. Fuse F6 **C** is the overcurrent protection for the ac input voltage.

Six output voltages are available from the power supply. Five of these voltages are converted to dc voltages and filtered by the power supply A1 card **F**. The dc output voltages **G** from the A1 card are −5, +5, −12, +12, and +24 Vdc. The sixth output voltage, 120 Vac **E**, is used to operate the internal diskette motors, the CRT display unit, and the cooling fan.

The power-good signal **H** becomes active when the −5, +5, −12, and +12 Vdc voltage levels are within approximately 80 percent of their nominal operating levels (see "Output voltages" later in this chapter). A light emitting diode (LED), which is visible from the rear of the power supply, indicates the status of the power-good signal. The power-good LED is on when the power-good signal is active.

Transistor-switching-regulator (TSR) power supply description.
The description for the operation of the TSR power supply is similar to that for the ferroresonant power supply except that the TSR type contains a transistor-switching-regulator card instead of card A1 **F**.
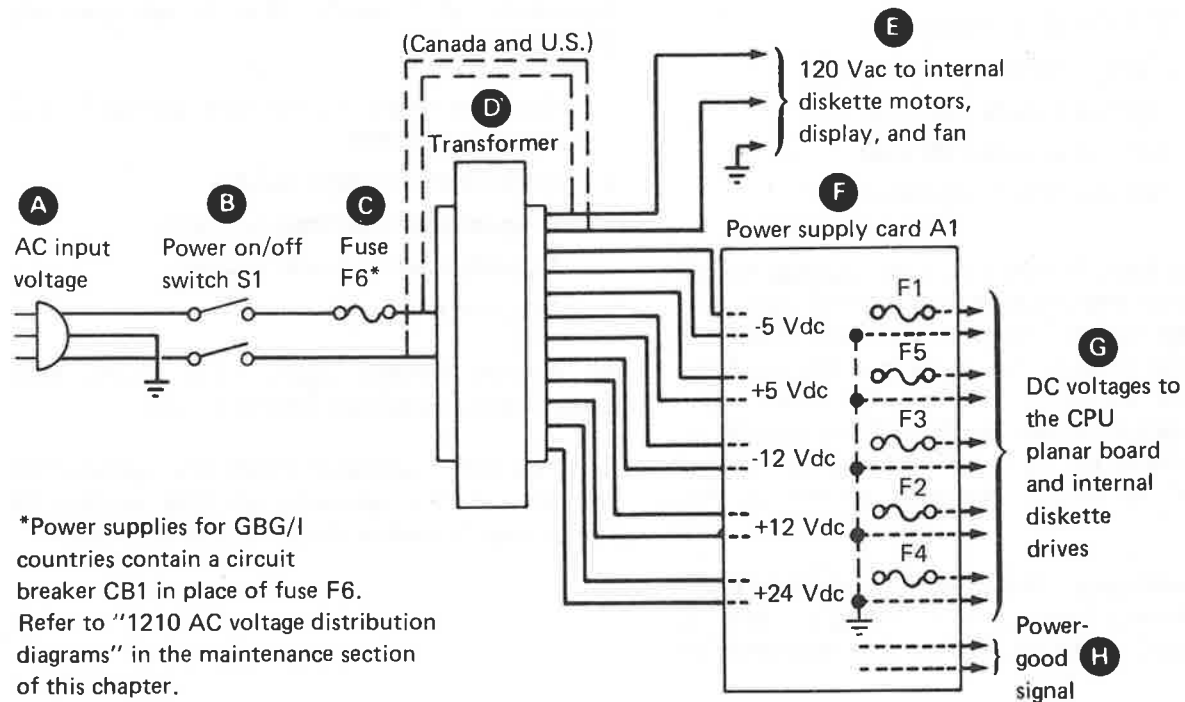
*Power supplies for GBG/I countries contain a circuit breaker CB1 in place of fuse F6. Refer to "1210 AC voltage distribution diagrams" in the maintenance section of this chapter.

Processor, processor features, and power supply

Functional description (continued)

Input voltages. The ac input voltage options that can be used to power the 5324 are as follows:. Canada and United States

- 60 Hz (59.5 to 60.5 Hz)
  - — 120 Vac (102 to 127 Vac)

General Business Group/International (GBG/I)

- 50 Hz (49.5 to 50.5 Hz)
  - — 100 Vac (90 to 110 Vac)
  - — 110 Vac (96.5 to 119 Vac)
  - — 200 Vac (180 to 220 Vac)
  - — 220 Vac (193 to 238 Vac)
  - — 230 Vac (202 to 249 Vac)
  - — 240 Vac (210 to 259 Vac)
- 60 Hz (59.5 to 60.5 Hz)
  - — 100 Vac (90 to 110 Vac)
  - — 110 Vac (96.5 to 119 Vac)
  - — 120 Vac (104 to 127 Vac)
  - — 127 Vac (111 to 137 Vac)
  - — 200 Vac (180 to 220 Vac)
  - — 208 Vac (180 to 220 Vac)
  - — 220 Vac (193 to 238 Vac)
  - — 240 Vac (208 to 254 Vac)

Note that there is only one input voltage option for machines manufactured for use in Canada and the United States. Machines manufactured for use in the GBG/I countries are designed to permit the Customer Engineer to select input voltage options of 100 Vac to 240 Vac (see the ac voltage charts in "1210 AC voltage distribution diagrams" in the maintenance section of this chapter).

Output voltages. The power supply generates the following six output voltages and a power-good signal for the internal operation of

the 5324:

- 120 Vac (101 to 130 Vac at 50 Hz, or 101 to 130 Vac at 60 Hz)
- -5 Vdc (-4.6 to -5.5 Vdc)
- +5 Vdc (+4.6 to +5.5 Vdc)
- -12 Vdc (-11.0 to -13.2 Vdc)
- +12 Vdc (+11.0 to +13.2 Vdc)
- +24 Vdc (+22.0 to +26.4 Vdc)
- Power-good signal (+2.4 to +5.5 Vdc when active; 0.0 to +0.4 Vdc when not active)

The CRT display unit, which contains its own power supply, uses the 5324 power supply +12 dc voltage.

Grounding. The importance of a correctly grounded electrical circuit cannot be over emphasized. The IBM System/23 Computing System will not operate correctly and can be a safety hazard if it is not grounded.

Symptoms of a system that is not correctly grounded can be:

- Electrical shock to machine operators and service personnel
- Intermittent machine failures
- Programs not operating correctly
- Diskette read and write errors
- Machine damage

All system devices (5324, 5242, 5246, etc.) should share a common ground source.

A typical office ac power distribution system that can be used for powering an IBM System/23 Computing System is shown on the following

AC power distribution in a typical commercial building

These buses must be tied to an approved ground source. They can be tied through wire (A) but, if possible, a ground source should be supplied through wire (B) also.

These buses must not be tied together in the power panel.

120 Vac receptacle (front view)
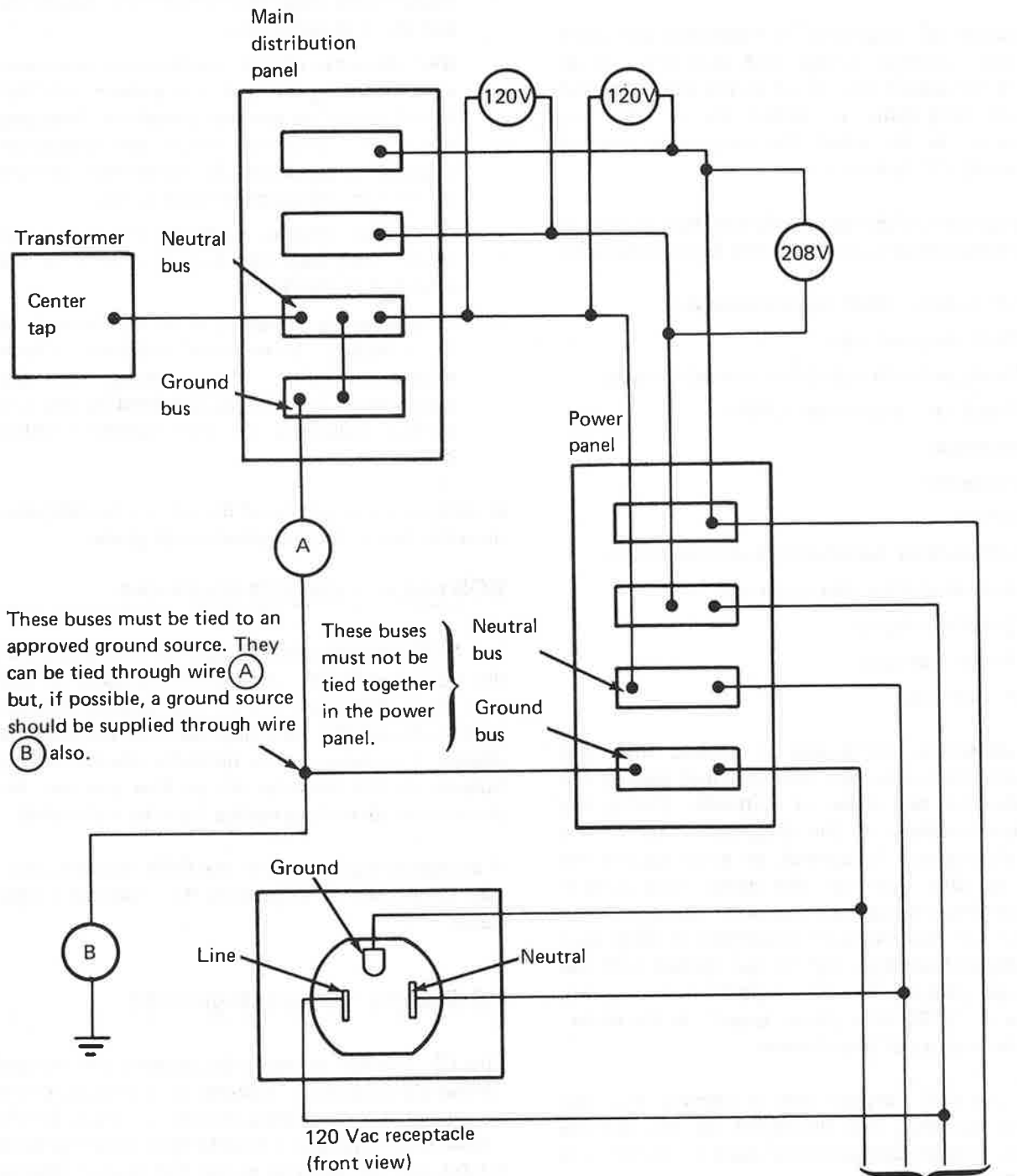
This diagram shows the power distribution for a 120 Vac system. Systems manufactured for use in GBG/I countries are designed to allow selection of input voltage options of 100 to 240 Vac. See "1210 AC voltage distribution diagrams" in the maintenance section of this chapter.

To other system I/O device power receptacles (5242, 5246, etc.)

Processor, processor features, and power supply

5324 Computer diagnostics

Power-on diagnostic

The power-on diagnostic is located in the 5324 read-only storage (ROS) and executes (1) at every 5324 power-on, (2) when the ROS resident diskette diagnostic is ended by a "9" key command, or (3) when the diagnostic control program (DCP) is terminated.

The purpose of this diagnostic is to test and verify the base operating units of the 5324, including:

- CPU planar board microprocessor
- Read-only storage
- Read/write storage (data and addresses)
- Direct memory access (DMA)
- Interrupt
- Translator
- Timers
- CRT vertical, horizontal, and video drives
- Keyboard microprocessor and ROS
- Diskette adapter
- Printer controller
- Printer wrap

The power-on diagnostic is divided into test routines. Errors sensed during a test routine are identified by two different methods. During the first test routines of the diagnostic (before the CRT display unit is started), an error causes the 5324 to stop and set the active test routine number into the CE test register. The eight pins of the CE test register represent a two-digit hexadecimal number and can be probed with the CE logic probe. The CE register test pins are shown in "1230 CPU planar board" in the maintenance section of this chapter.

After the CRT display unit is started, the test routine numbers are displayed on the display screen. The ending status of each of the tests is indicated as follows:

- Normal display number—the test routine ran without error.
- Flashing reverse video number—an error was sensed during the test of a system unit

that is critical to system operation. The 5324 stops after the power-on diagnostic sequence is completed.

- Reverse video display number—an error was sensed during the test of a system unit that is not critical to system operation. Pressing the Error Reset key when the power-on diagnostic sequence is completed permits the system initialization to continue.
- Underlined display number—the feature or device that this test routine checks is not attached to the 5324.
- Trap message (displayed at the bottom of the display screen)—a machine check occurred during the running of the diagnostic. The failure occurred in the test routine following the last routine number displayed.

A complete description of the power-on diagnostic is located in the diagnostic user guide.

ROS resident diskette diagnostic

The ROS resident diskette diagnostic is located in the 5324 read-only storage and is used to test and verify the operation of the diskette attachment card and the read data path for the diskette drives. This diagnostic is normally used to isolate failures in the diskette drives that prevent the diskette resident diagnostics from being loaded.

A complete description of the ROS resident diskette diagnostic is located in the diagnostic user guide.

CE diskette resident diagnostics

The CE diskette resident diagnostics are located on the CE diagnostic diskette and execute under control of the diagnostic control program (DCP). These diagnostics are mainly fault locating tests (FLTs) and are used to sense and isolate failures in the processing unit, storage, feature attachments, and I/O devices. CE utility programs (copy diskette, format diskette, configuration

display, etc.) are also on the CE diagnostic disk-
ette.

The instructions for using these diagnostics and
utility programs are in the diagnostic user guide.

Processor
power supply

Chapter 3. Keyboard

Contents

Keyboard

Keyboard

1300 Locations

A Cover   **C** Keyboard adapter card

B Cable connector   **D** Keyboard assembly
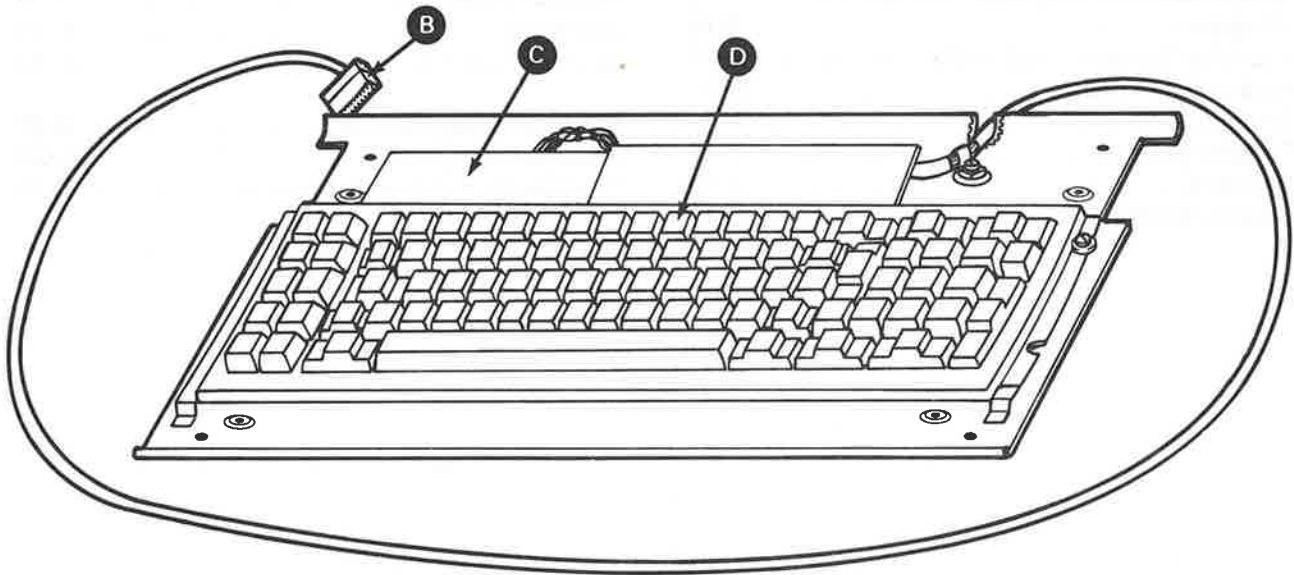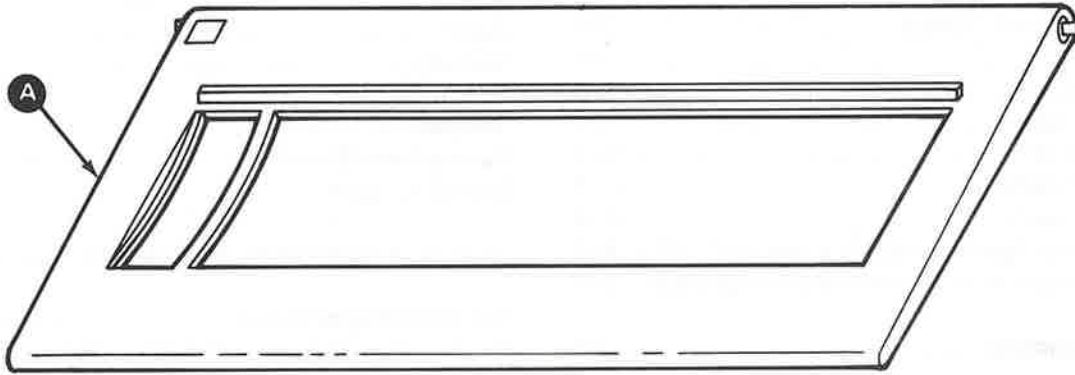
1310 Keyboard scan codes

Note: All keyboard models provide the same hexadecimal scan codes. (Key tops may be different for other languages.)
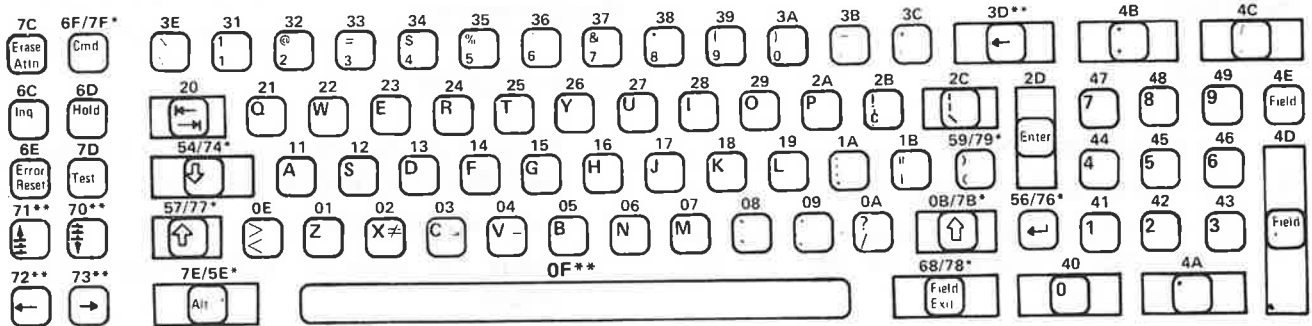
*Make/break key

**Typamatic key

Hexadecimal value to scan code bit conversion:

The scan codes shown in this diagram are hexadecimal values. Scan codes are transferred from the keyboard to the processing unit on scan code bit lines 0 – 6. To determine the relationship of the hexadecimal value to the actual scan code bits, use the following chart:

Hexadecimal value	4	2	1	8	4	2	1
Scan code bits	0	1	2	3	4	5	6

Example:
The A key (hex 11) ———► X   X
is represented by
scan code bits 2 and 6.

Keyboard

1320 Keyboard cables

Removal

External cable

1. Switch off the 5324 power.
2. Remove the keyboard cover (1220).
3. Disconnect the external keyboard cable from the keyboard adapter card **(A)** and the connector panel.
4. Remove the cable clamp.

Internal cable

1. Open the rear access cover (1220).
2. Remove the two connector panel screws **(B)**.
3. Remove the two screws **(C)** from the connector.
4. Place the CPU planar board in the service position (1230) and unplug the internal keyboard cable.

Replacement

External cable

1. Connect the keyboard cable to the adapter card **(A)** and to the connector panel.
2. Install the cable clamp.
3. Install the keyboard and keyboard cover (1220).

Internal cable

1. Install the two screws **(C)** that hold the internal cable to the connector panel.
2. Plug the other end of the cable into the planar board.
3. Slide the planar board into the 5324 and install the two screws **(B)**.
4. Close the rear access cover (1220).

Ⓐ
Cable connector

Ⓑ Screws

Ⓒ Screws
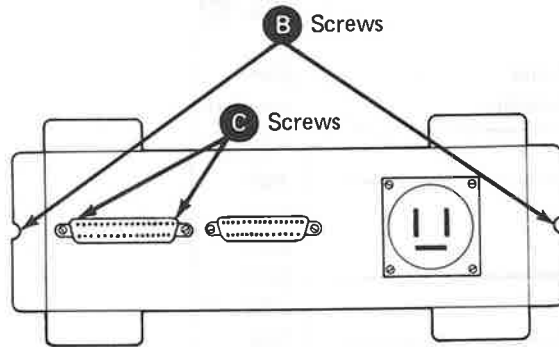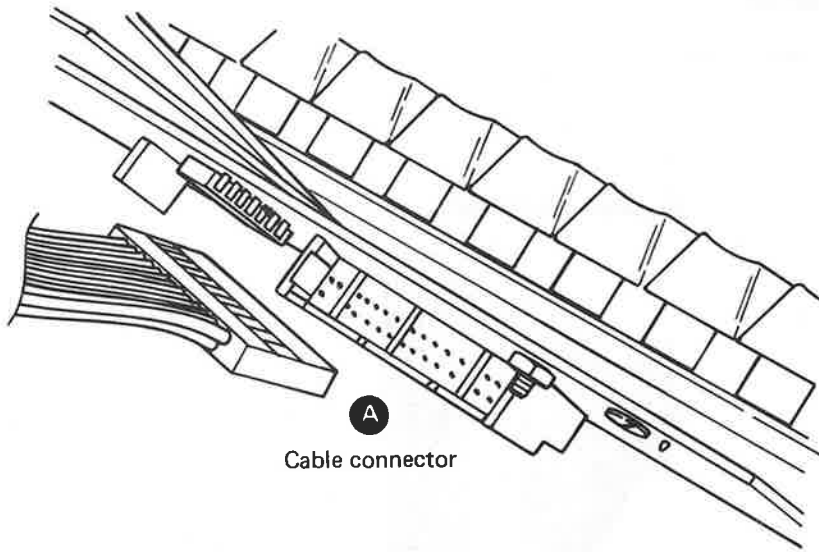
Keyboard

1320 Keyboard cables (continued)

Cable pin assignments for the external cable

Connector panel
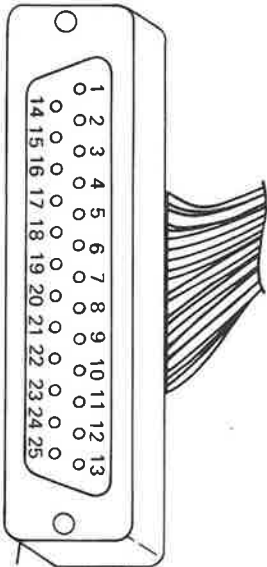
Keyboard DRV/RCVR card
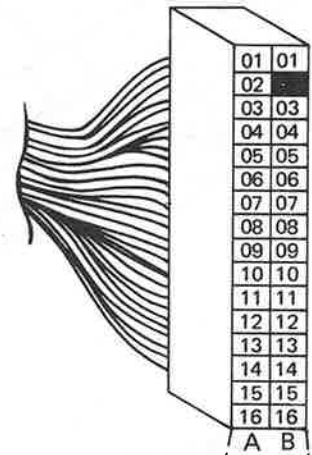
Pin number	Line name	Signal Direction	Pin number
14	Return		A01
1	Data strobe	←	B01
			Key
15	Return		A03
2	Scan code bit 6	←	B03
16	Return		A04
3	Scan code bit 5	←	B04
17	Return		A05
4	Scan code bit 4	←	B05
18	Return		A06
5	Scan code bit 3	←	B06
19	Return		A07
6	Scan code bit 2	←	B07
20	Return		A08
7	Scan code bit 1	←	B08
21	Return		A09
8	Scan code bit 0	←	B09
13	Not used		B10
22	Return		A11
9	Delay strobe	→	B11
23	Return		A12
10	Program reset	→	B12
24	Return		A13
11	Not used		B13
25	Return		A14
12	+12V		B14

Cable pin assignments for the internal cable

Connector panel

CPU planar board

Pin number	Line name	Signal direction	Pin number
13	Not used		A1
10	Program reset	←	B1
9	Delay strobe	←	A2
			Key
12	+12 Vdc		A3
1	Data strobe	→	B3
2	Scan code bit 6	→	B4
8	Scan code bit 0	→	A5
3	Scan code bit 5	→	B5
4	Scan code bit 4	→	B6
7	Scan code bit 1	→	A7
5	Scan code bit 3	→	B7
14-25	Ground		A8
6	Scan code bit 2	→	B8
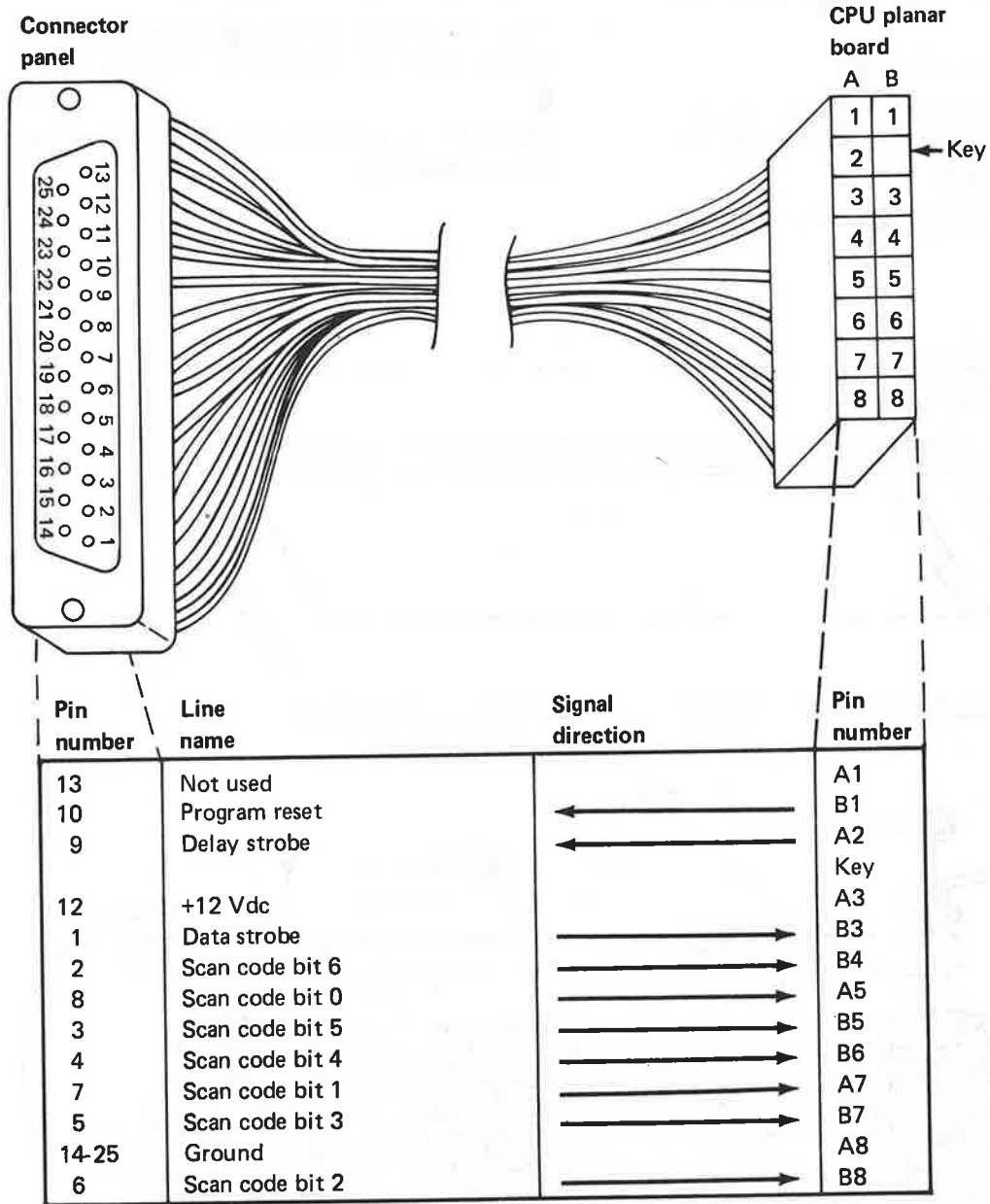
Keyboard

1330 Keyboard

Removal

1. Switch off the 5324 power.
2. Remove the four screws **F** from the keyboard cover.
3. Remove the keyboard cover **A**.
4. Remove the mounting screw **C** and disconnect the keyboard adapter card from the keyboard assembly **D**.
5. Remove the two screws **E** from the base assembly.

Replacement

1. Place the keyboard in position and replace screws **E** in the base assembly .
2. Connect the adapter card **C** to the keyboard assembly **D** and install the mounting screw **C**.
3. Install the keyboard cover **A** and the four cover screws **F**.

A Cover

B Cable connector

C Keyboard adapter card screw

D Keyboard assembly

E Screws

F Cover screws (4)

F Cover screws (4)
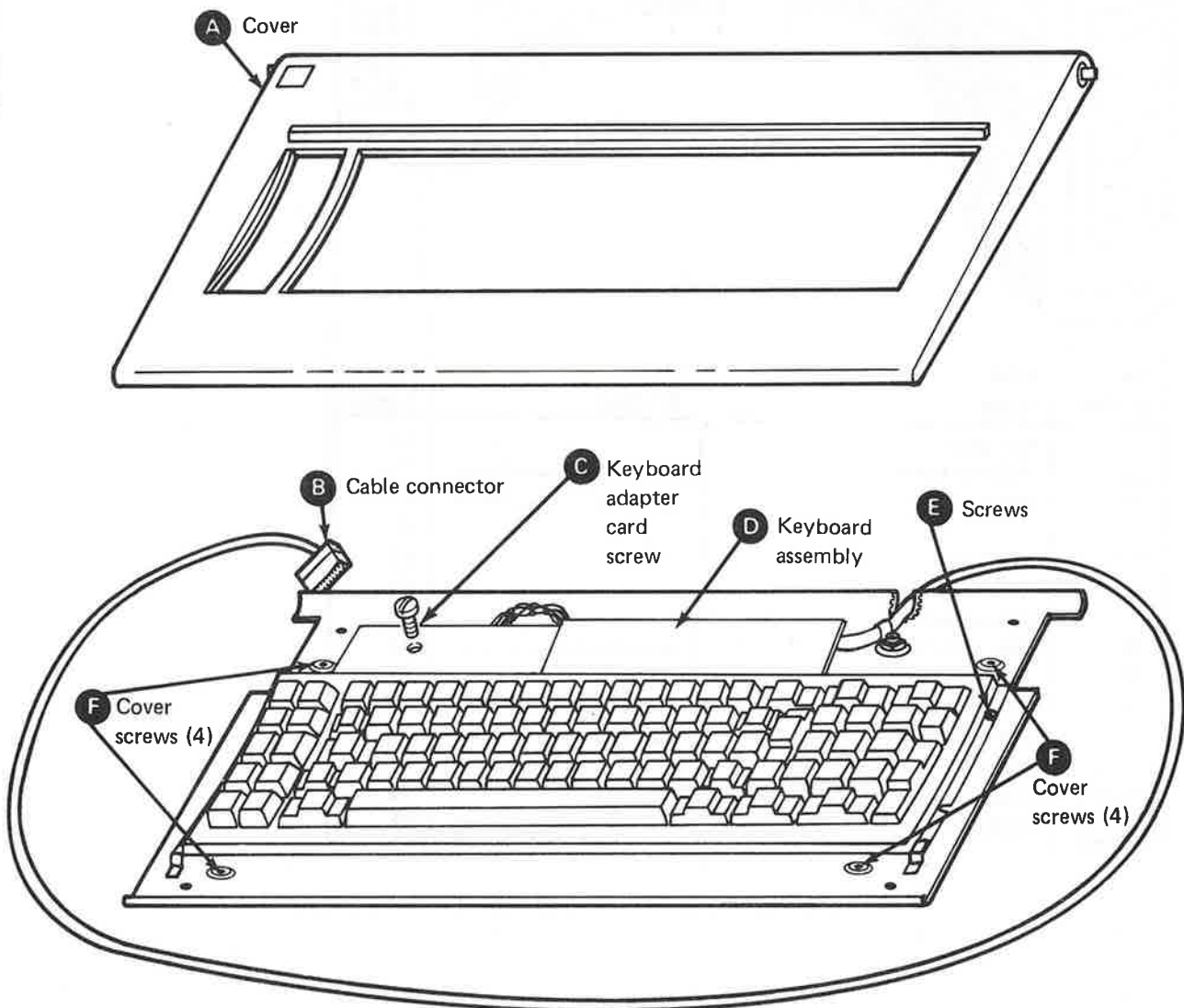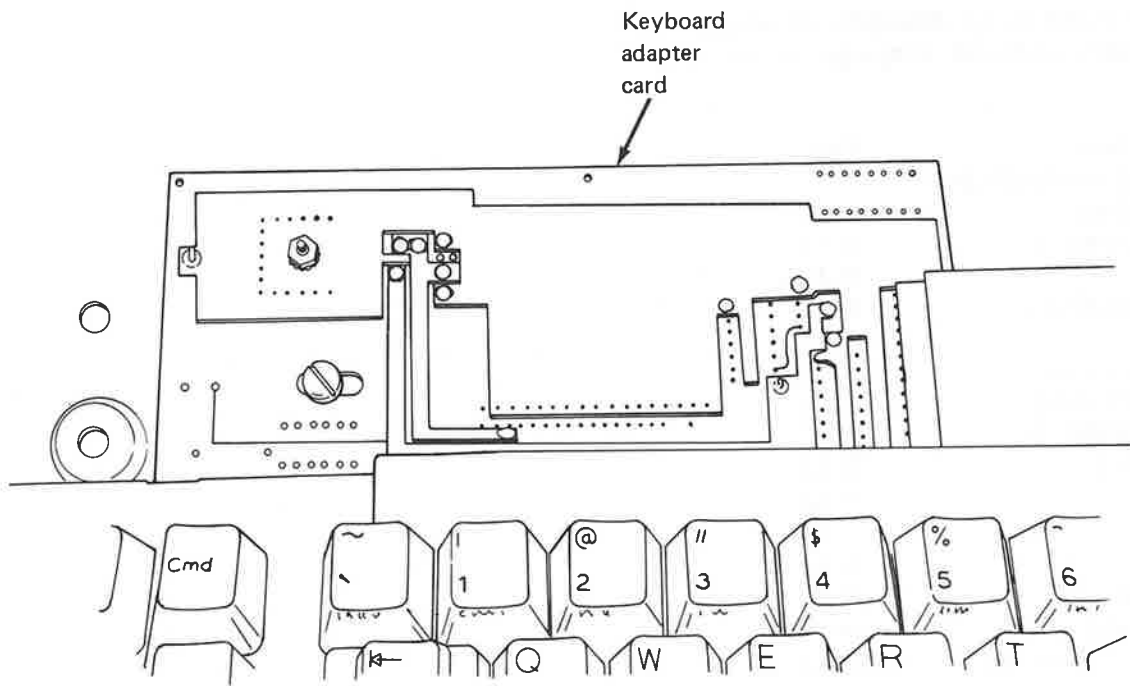
Keyboard
adapter
card

Keyboard

1340 Keyboard/language arrangement diagrams

This section contains the arrangement diagrams for the various keyboard language groups, as follows:

Australia/Canada (English)/United States

Austria/Germany
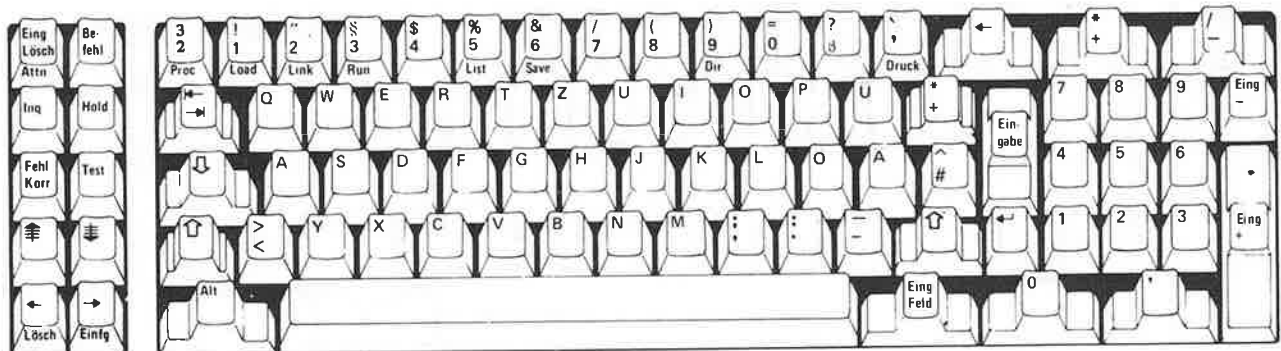
Belgium
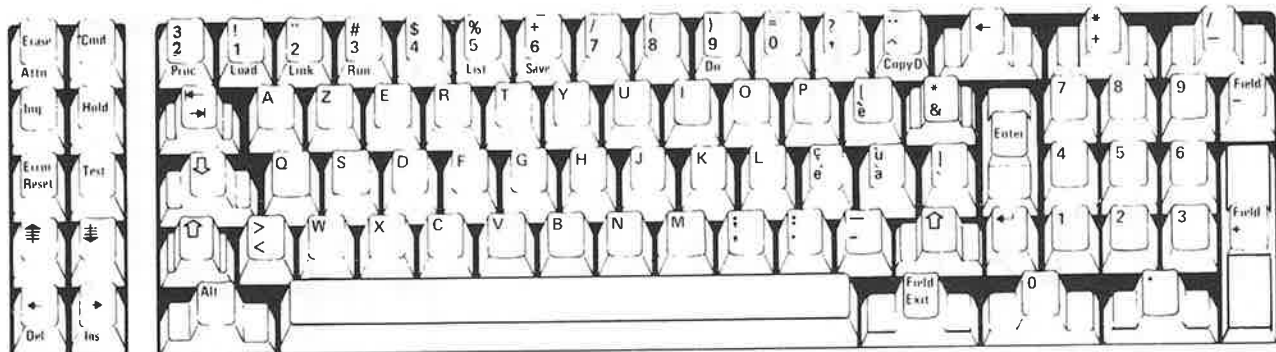
Keyboard

1340 Keyboard/language arrangement diagrams (continued)

Canada (French)
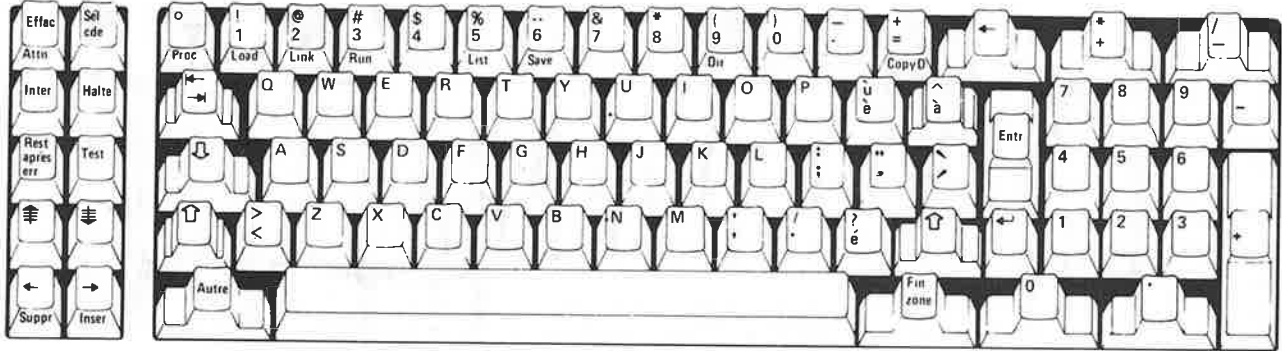
Denmark
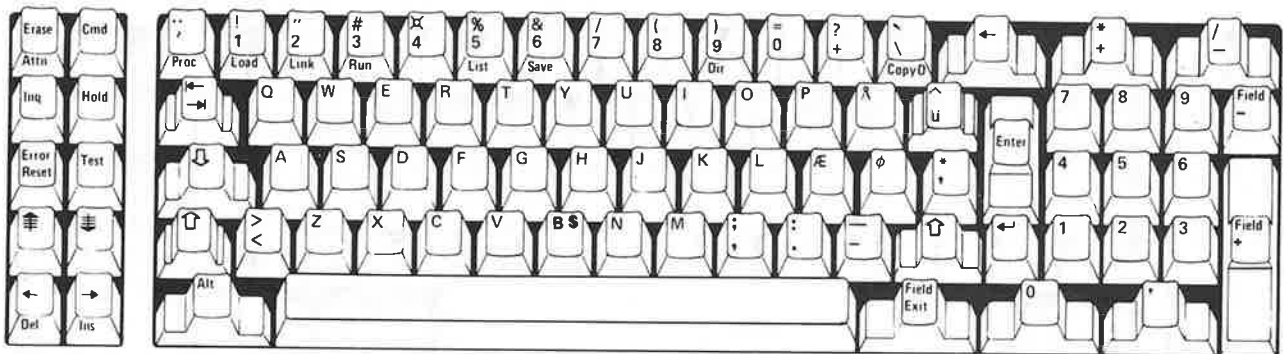
Finland/Sweden
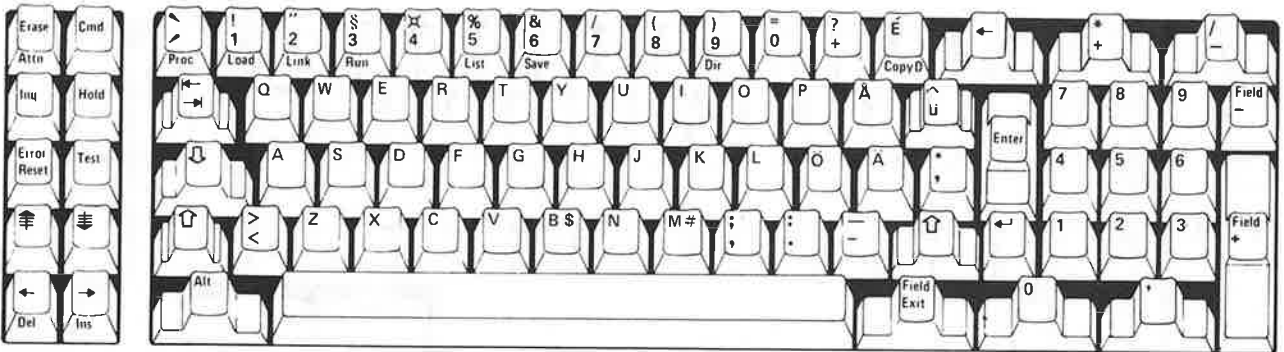
France (AZERTY)
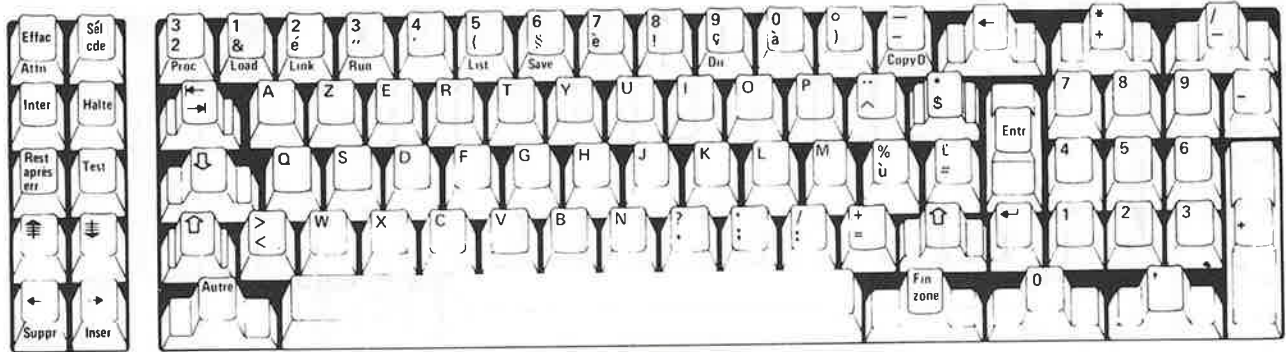
France (QWERTY)
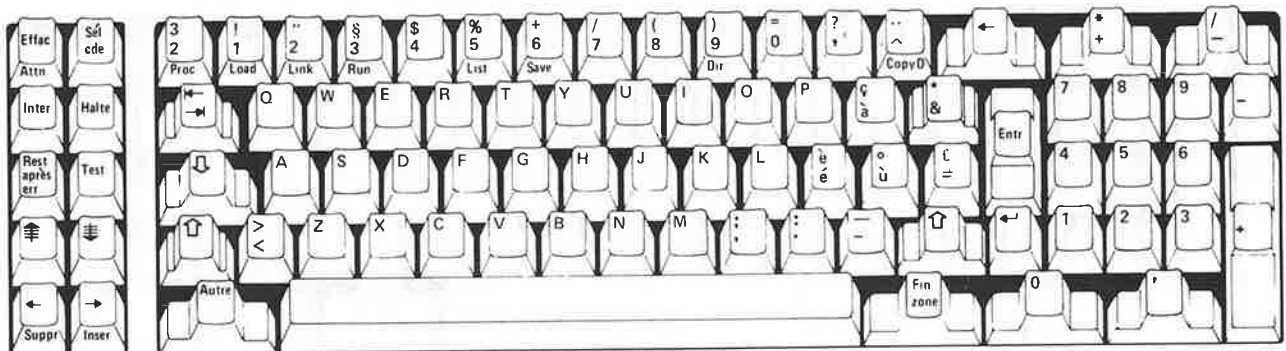
International
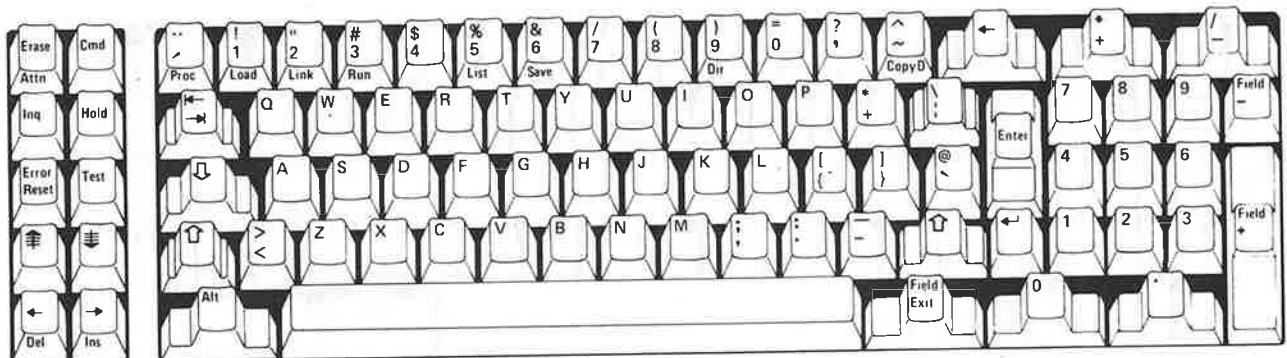
Keyboard

1340 Keyboard/language arrangement diagrams (continued)

Italy
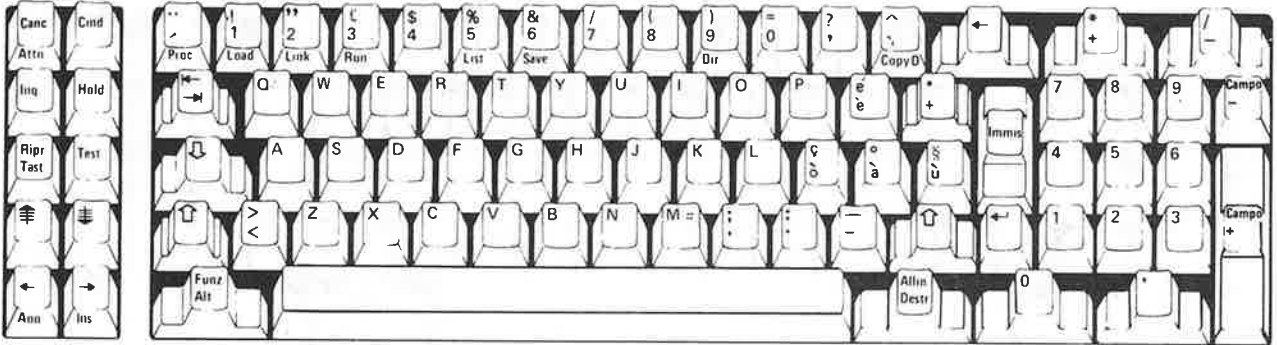
Japan
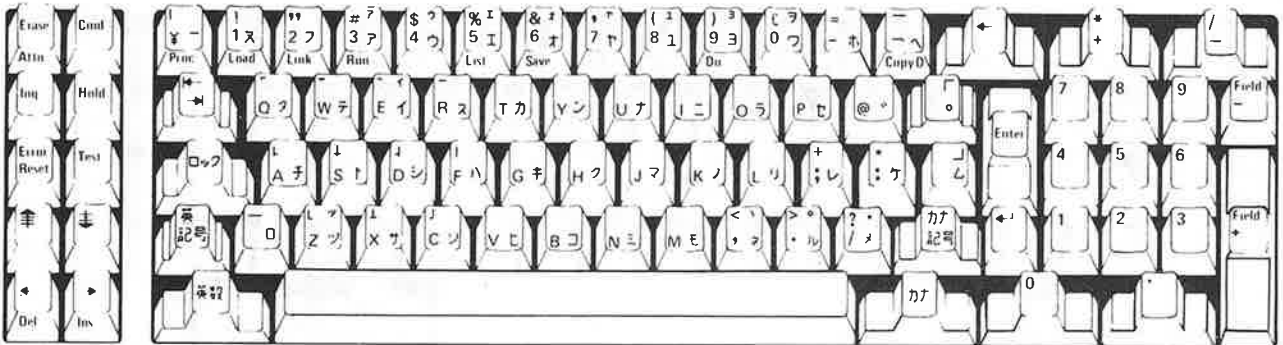
Norway
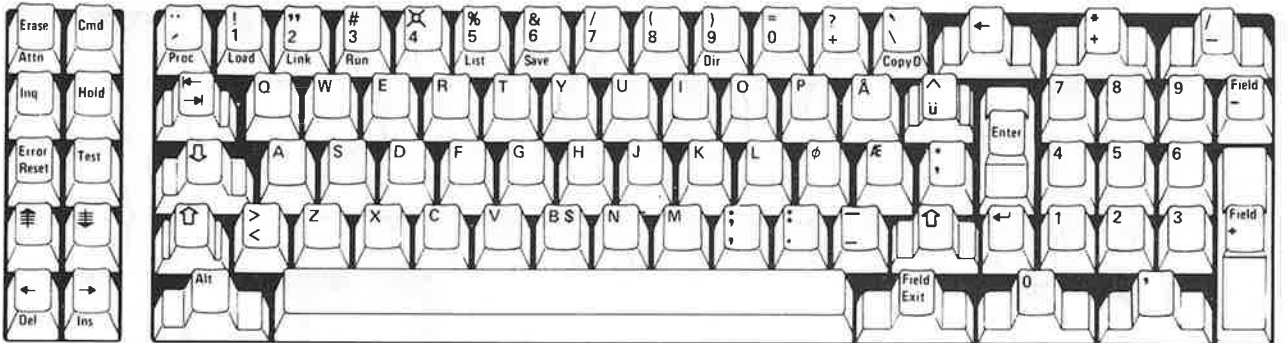
Spain/Spanish
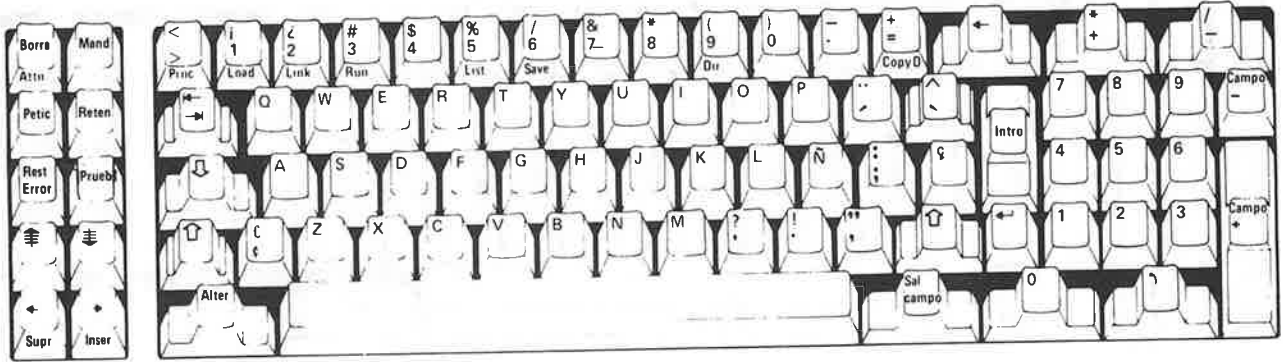
Switzerland (French)
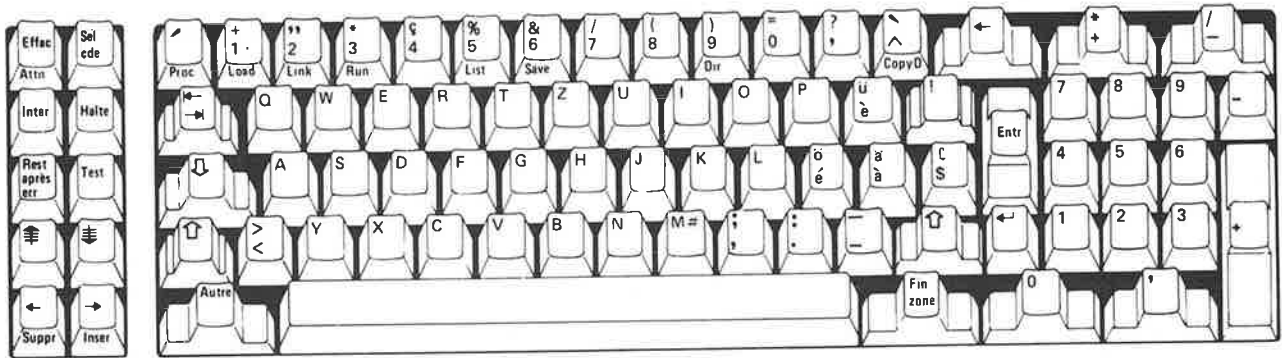
Switzerland (German)
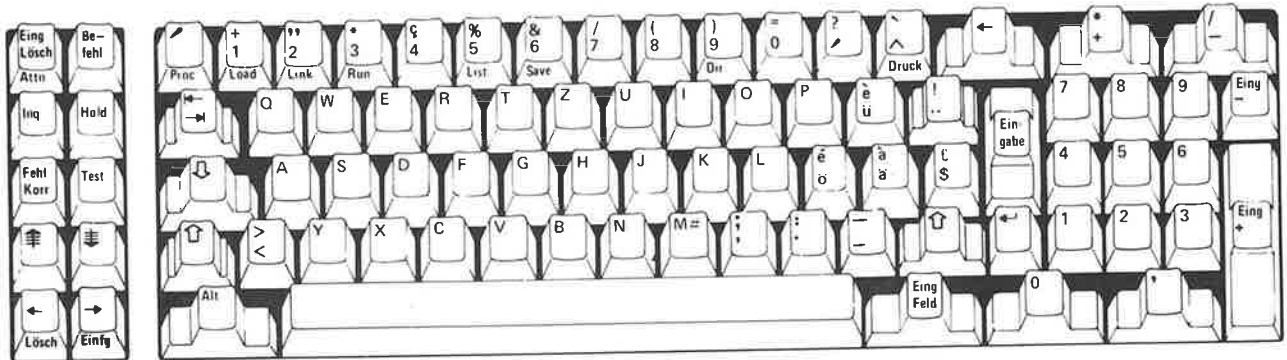
Keyboard

Keyboard

1340 Keyboard/language arrangement diagrams (continued)

United Kingdom
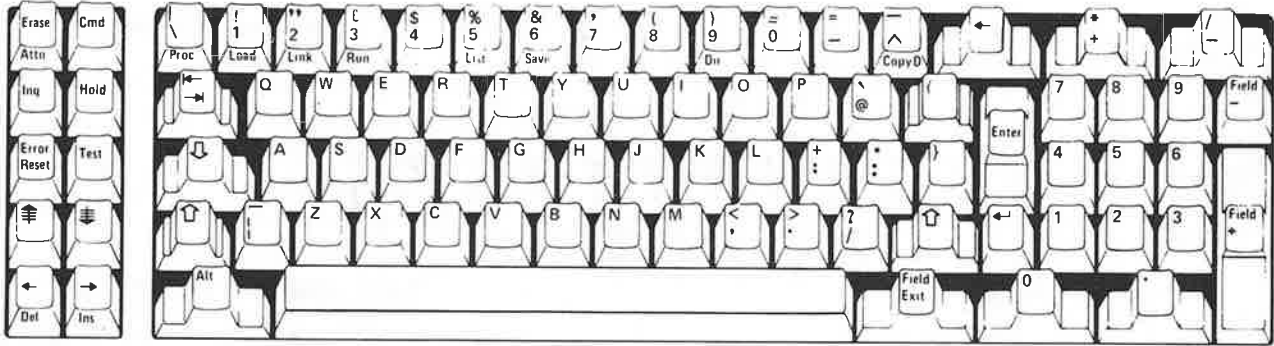
Theory of operation introduction

The keyboard is used to enter data, BASIC program commands, and control functions into the 5324 computer. The keyboard contains 83 keys, which are divided into three groups:

- Standard typewriter (alphameric) keys
- Numeric keys
- Function and control keys

When the 5324 is powered-on and operating under control of the BASIC control program, the keyboard permits the operator to enter programs and data, communicate with the executing program, and control the operation of the system. When the 5324 is operating under control of the diagnostic control program, the keyboard is used to call, enter responses to, and control the diagnostic programs.
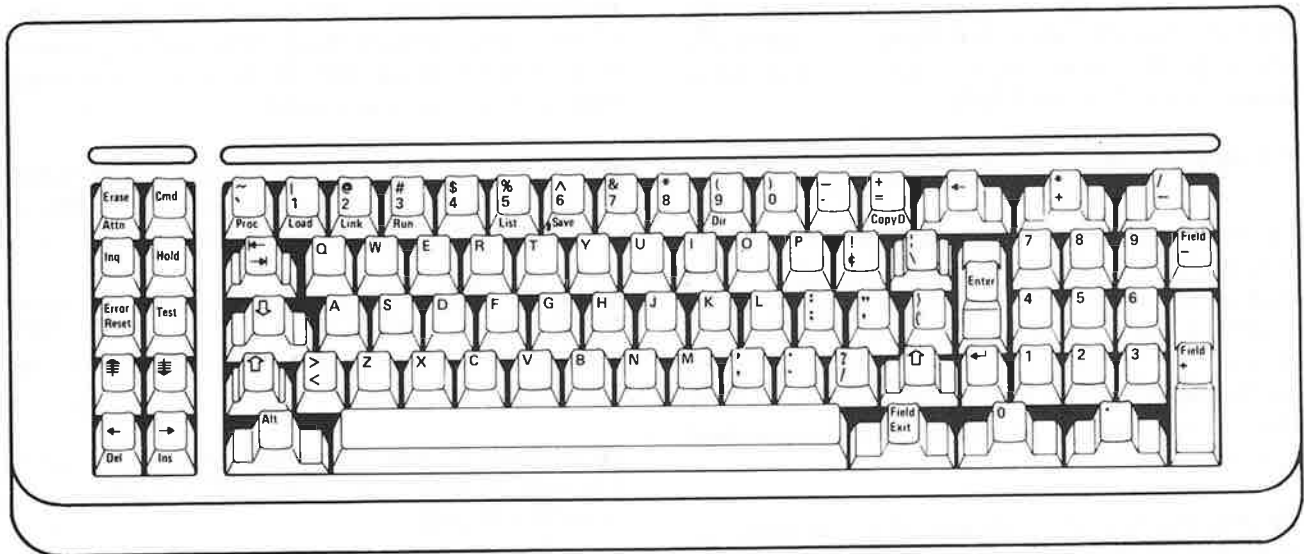
Keyboard

Keyboard operations

Keyboard operations in BASIC mode

In BASIC mode, the keyboard is fully operational, and all keys (alphameric, numeric, function, and control) can be used. A complete description of BASIC keyboard operations is located in the User Library manual, *Operator Reference*, SA34-0108.

BASIC mode can be canceled and the 5324 put into diagnostic mode by holding down the Cmd (Command) key **G** and pressing the Test key **H**, then by holding down the Cmd key again and pressing the Error Reset key. Only a 5324 power-on will restart BASIC.

Keyboard operations in diagnostic mode

In diagnostic mode, keyboard operations are limited, and only the keys described in this section are used to communicate with the diagnostic programs. The United States keyboard is shown in the diagram. See "1340 Keyboard/language arrangement diagrams," in this chapter, for the keyboard arrangements used in other countries.

A **Attention key**. This key (Attn) is used, as described in the diagnostic user guide, to interrupt or control the executing sequence of the diagnostic programs.

B **Copy Display key**. This key sets the alternate print option in the diagnostic control program. Pressing the Attn (Attention) and the Copy D (Copy Display) key causes all following CRT screen displays to print on the system printer (if attached). The alternate print option can be canceled by pressing the Attn (Attention) and the 0 (Zero) key.

C **Backspace key**. This key causes the cursor, which is displayed on the display screen, to move one position to the left. If there is a character above the cursor, it is erased.

D **Enter key**. This key causes the 5324 to either start processing data entered from the keyboard or to restart an interrupted operation.

E **Field - and field + keys**. These keys are used for the ROS resident diskette diagnostic (PID 1500) and are described in that section of the diagnostic user guide.

F **Alphabetic and numeric keys**. These keys are used to select the diagnostic programs and program options.
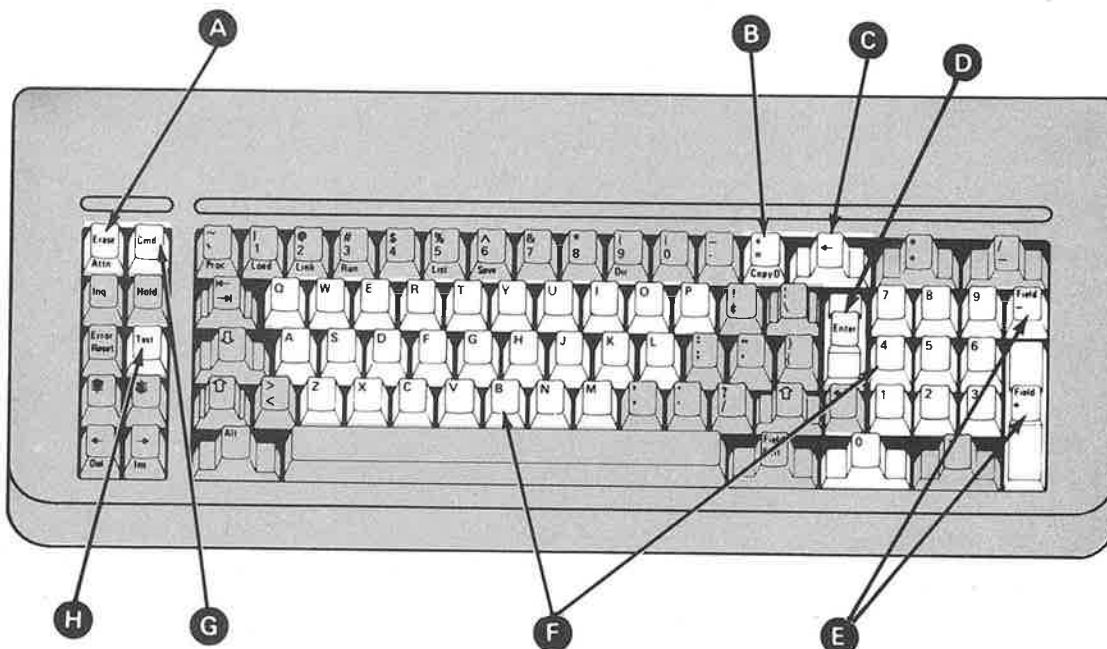
Functional description

Keyboard data flow

The keyboard assembly contains 83 keys, a keyboard base, capacitive matrix, and an electronic circuit card. The electronic circuit card contains a sense amplifier, a microprocessor with read-only and read/write storage, and the circuits needed to communicate with the 5324 data, address, and control buses. The complete keyboard assembly is a field replaceable unit (FRU).

The following sequence describes the data flow for a keyboard operation:

A The capacitive matrix contains a capacitor for each key. The capacitors are located under the keys and are part of the keyboard base.

B When a key is pressed, the capacitance of the key's capacitor increases.

C The keyboard microprocessor uses eleven drive lines to repeatedly scan the capacitive matrix.

D The increased capacitance of the active key's capacitor permits the drive-line scan pulse to appear at one of the eight input lines to the sense amplifier.

E The keyboard microprocessor uses the combination of the active drive line and sense amplifier input line to generate a scan code character (1 of 88) to determine which key was active when the scan pulse was sensed. Only 83 of the 88 scan codes are used for the 5324 keyboard.

F An interrupt request, indicating that the scan code character is available, is sent to the 5324 processing unit. Any additional keyboard interrupts are inhibited until this interrupt is serviced and the scan code character is read by the 5324.
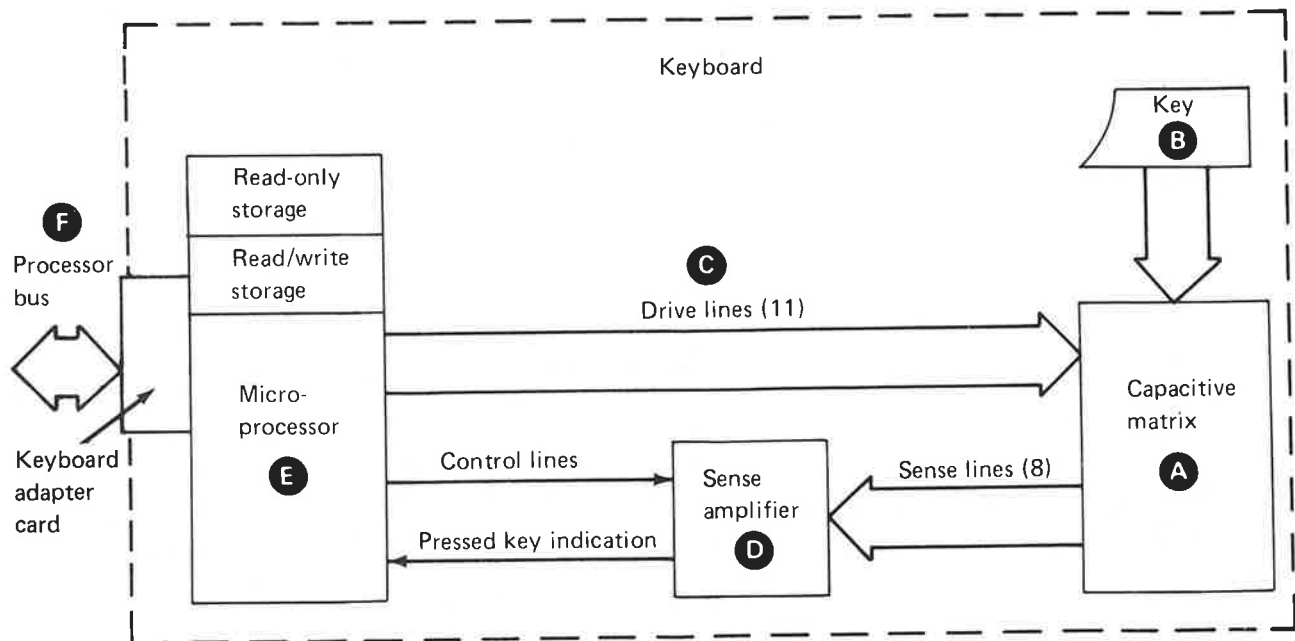
Keyboard

Functional description (continued)

Key types

Three types of keys are used in the 5324 keyboard: make-only, make/break, and typamatic.

Make-only keys. A make-only key causes one scan code character and interrupt to be generated when the key "makes."

Make/break keys. A make/break key causes one scan code character and interrupt to be generated when the key "makes" and a second scan code character and interrupt to be generated when the key "breaks."

Typamatic keys. A typamatic key causes a scan code character and interrupt to be generated repeatedly at the rate of approximately 10.4 characters-per-second for as long as the key is pressed down.

Keyboard scan codes

A scan-code chart is located in "1310 Keyboard scan codes" in the maintenance section of this chapter. The chart also indicates the type of key (make-only, make/break, or typamatic).

Keyboard diagnostics

Power-on diagnostic

The power-on diagnostic is contained in the 5324 read-only storage (ROS) and executes (1) at every system power-on, (2) when the ROS resident diskette diagnostic is ended by a "9" key command, or (3) when the diagnostic control program is terminated.

The keyboard section of the power-on diagnostic issues a program reset to the keyboard. This reset causes the keyboard microprocessor to perform a "self-test," which checks the operation of the keyboard's microprocessor, read-only storage, and read/write storage. The test also includes a keyboard scan to check for any active (binding) keys. When the test ends, the keyboard starts normal scanning operations.

See the diagnostic user guide for a description of the power-on diagnostic error codes.

CE diskette resident diagnostics

The CE diskette resident diagnostics for the keyboard are located on the CE diskette and execute under control of the diagnostic control program. These tests permit you to verify the manual keyboard operations and to display the scan code character as each key is operated.

A complete description of the CE diskette resident diagnostics is located in the diagnostic user guide.

Keyboard

Chapter 4. CRT display unit

Contents

CRT display
unit

CRT display unit

Maintenance procedures

Safety

DANGER

*To ensure your safety, you must be especial-
ly careful of the dangerous voltages.
contained in the display unit power supply
and cathode ray tube (CRT).*

*Use care when working near an uncovered
CRT. Do not place unusual pressure on the
CRT; it contains a high vacuum and can shat-
ter causing personal injury. Safety glasses
must be worn.*

1400 Display unit locations

A Adjustment label
B High-voltage anode lead
C Yoke clamping screw
D Circuit board
E Signal cable connector
F EMC shield (some models)

G AC fuse
H Power cable plug P3
I Centering rings
J Deflection yoke
K Cathode-ray tube (CRT)
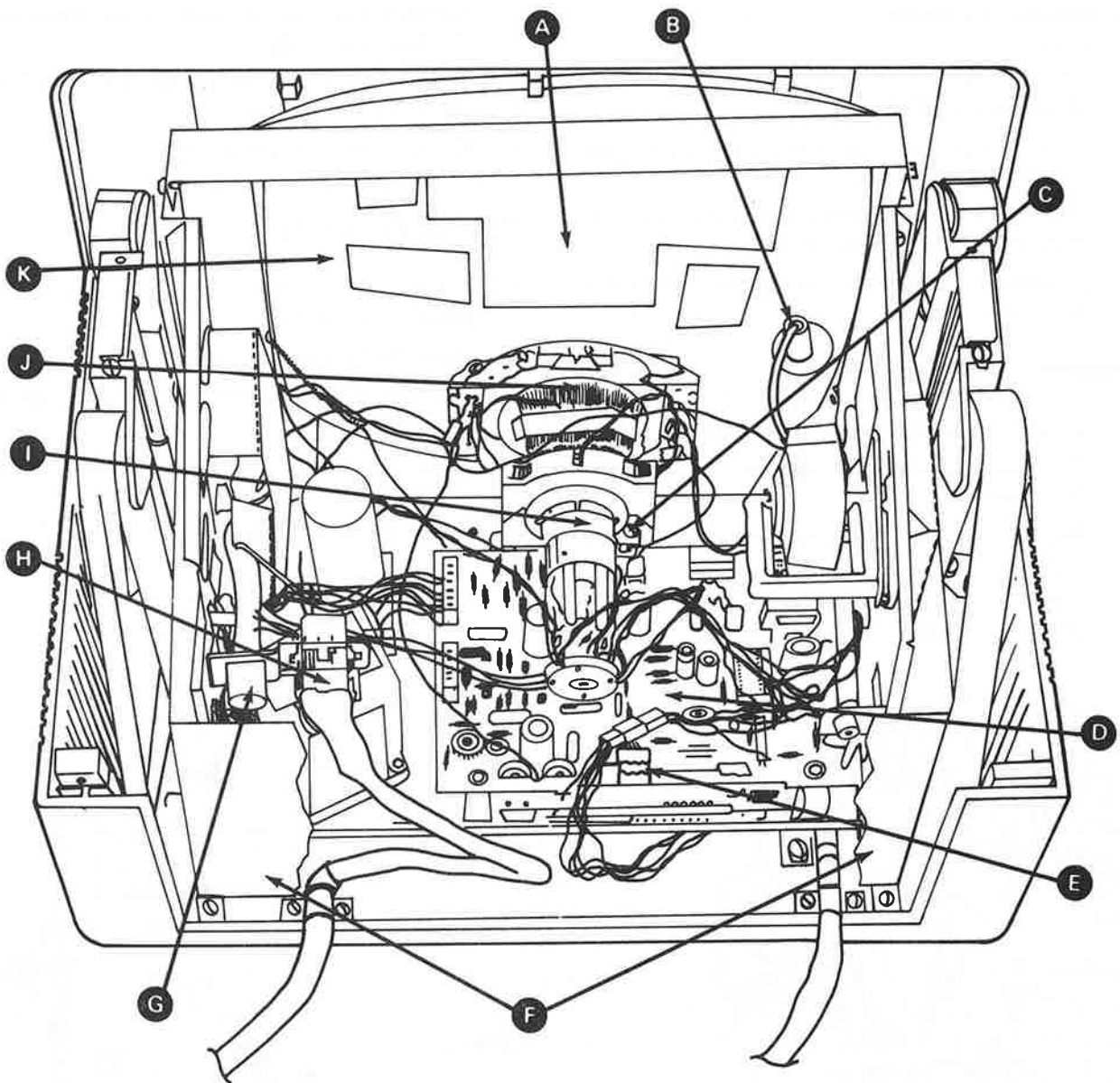
CRT display unit

CRT display unit

1411 Display unit signal cable

DANGER

The CRT high-voltage anode lead contains 15,000 volts. Keep hands and tools away from this lead.

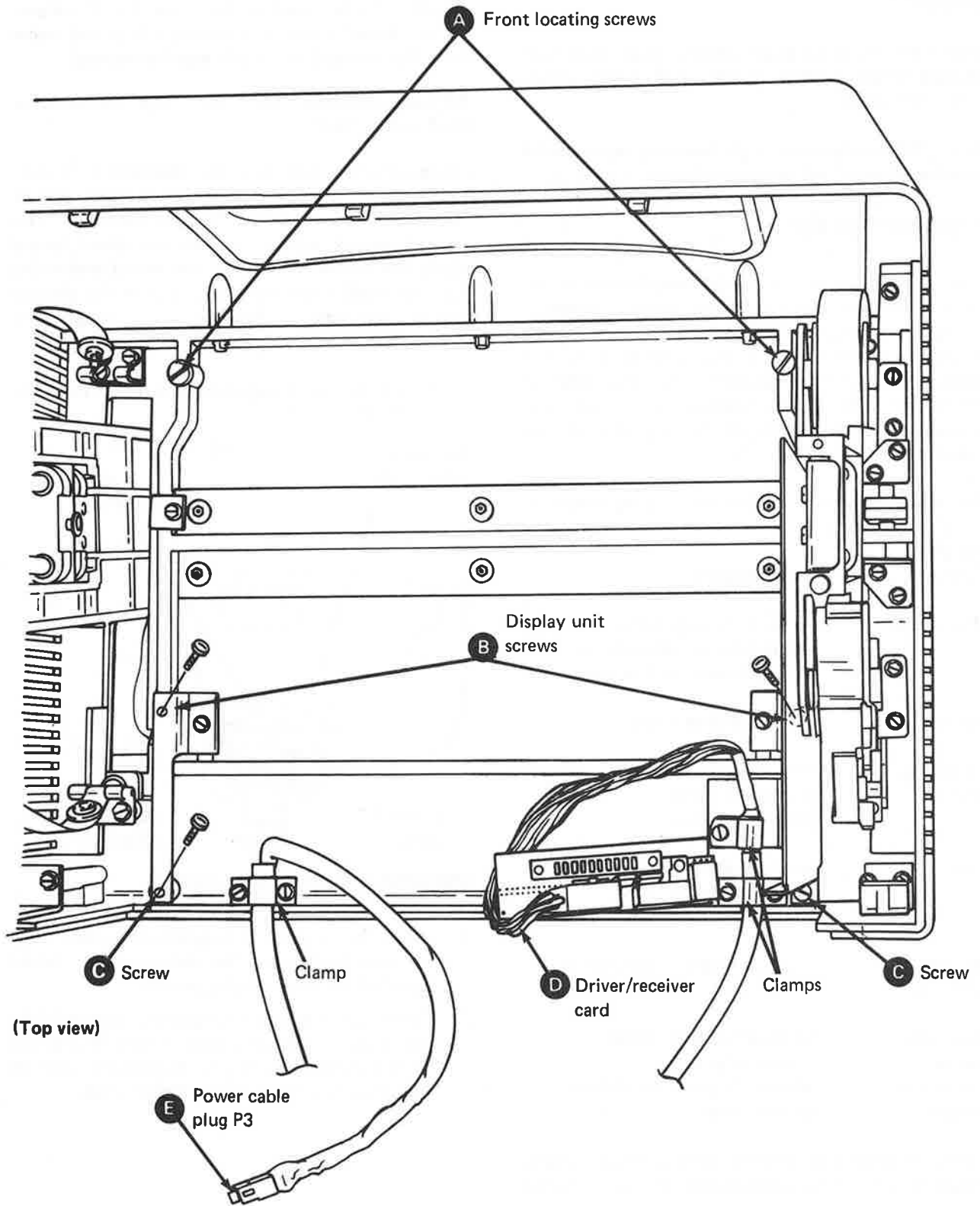*The CRT contains a high vacuum and could shatter if unusual pressure is placed on it.*

Removal

External CRT cable

1. Remove the CRT top cover (1220).
2. Remove the shield.
3. Disconnect the connector **A** from the driver/receiver card.
4. Remove the cable clamps. You may need to remove the display unit (1430).
5. Disconnect the CRT connector from the connector panel.

Internal CRT cable

1. Open the rear access cover (1220).
2. Remove the two screws **C** from the connector panel.
3. Remove the two screws **B** from the cable connector.
4. Slide the planar board out to the service position (1230).

5. Pull out the cable through the CPU planar end.

Replacement

Internal CRT cable

1. Install the cable through the planar end.
2. Connect the signal cable to the planar board connector **A**.
3. Install the cable connector to the panel with the two screws **B**.
4. Install the two screws **C** that hold the connector panel.
5. Close the rear access cover.

External CRT cable

1. Connect the cable connector **A** to the driver/receiver card.
2. Replace the cable clamps.
3. Connect the other end of the cable to the connector panel.
4. Install the shield with two screws and two star washers.
5. Install the CRT top cover (1220).

Connector **A**

Screws (2) **B**

Screws (2) **C**
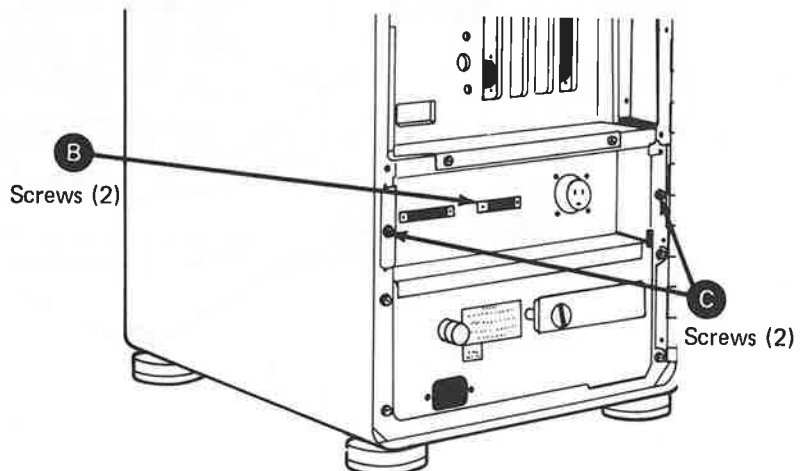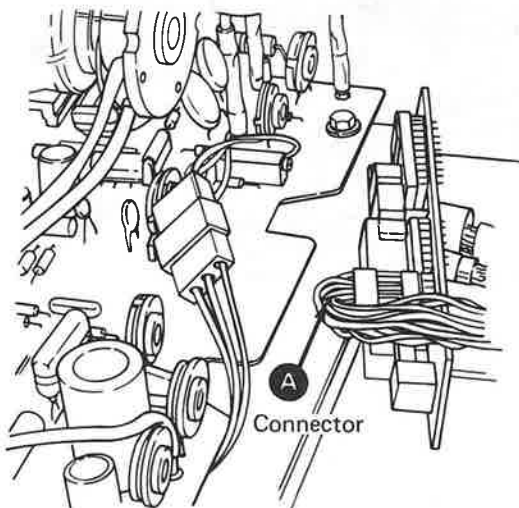
Cable pin assignments

External cable
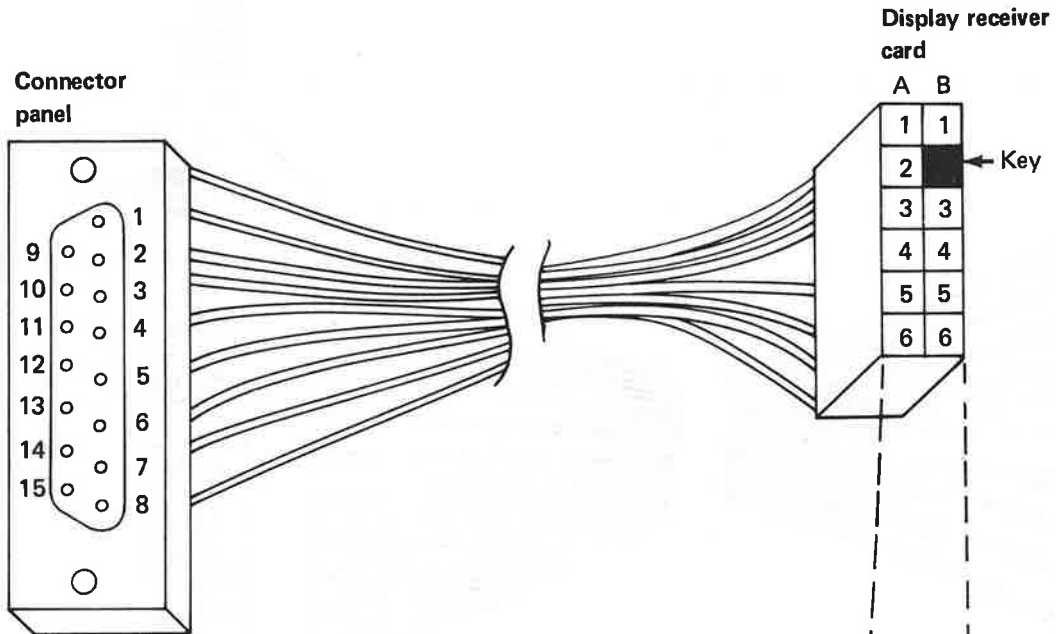
Pin number	Line name	Signal direction	Pin number
5	+12 Vdc		A1
13	Ground		B1
—	Shield		A2
4	Vertical retrace return		A3
12	Vertical retrace signal	⟶	B3
10	Highlight	⟶	A4
2	Highlight return		B4
11	Horizontal retrace return	⟶	A5
3	Horizontal retrace signal	⟶	B5
1	Video drive signal	⟶	A6
9	Video drive return		B6

CRT display unit

1411 Display unit signal cable (continued)

Cable pin assignments

Internal cable
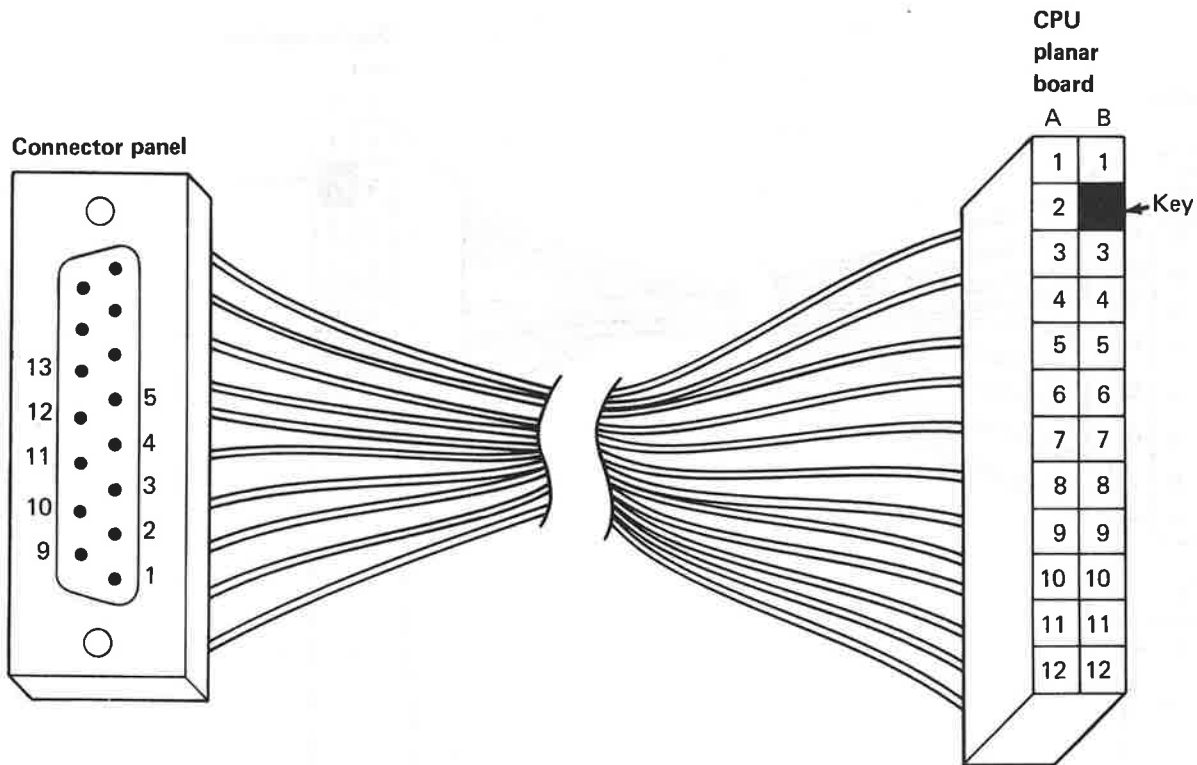
Pin number	Line name	Signal direction	Pin number
10	Highlight	←	B03
11	Horizontal retrace return	←	A05
3	Horizontal retrace signal	←	B05
1	Video drive signal	←	A06
9	Video drive return		B06
4	Vertical retrace return		A07
12	Vertical retrace signal	←	B07
13	Ground		B08
2	Highlight return		A09
5	+12 Vdc		A11

CRT Driver/receiver card

5 Vdc

B O O O O O O
A O O O O O O

A01   A04
+12 Vdc +Highlight

A B C D E F H J K L
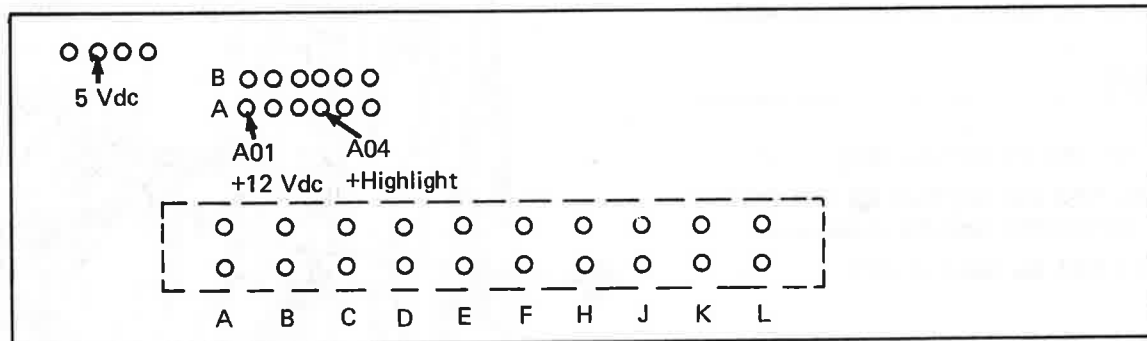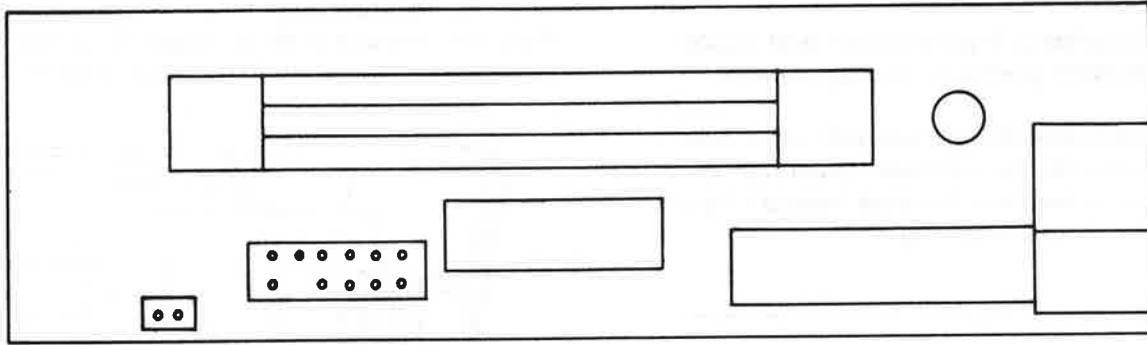
(Rear view)

CRT display unit

1420 Display unit ac fuse

DANGER

The CRT high-voltage anode lead contains 15,000 volts. Keep hands and tools away from this lead.

The CRT contains a high vacuum and could shatter if unusual pressure is placed on it.

Note: If a label with the ac fuse part number is installed near the display unit fuse holder, use the fuse part number given on the label instead of the part number in the parts catalog.

Removal

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.
2. Remove the CRT top cover (1220).
3. Push on the fuse cap and turn it counter-clockwise and remove the cap and the ac fuse **A**. (Some fuse caps may require a screwdriver for removal and replacement.)

Replacement

1. Insert the fuse into the fuse cap.
2. Insert the fuse cap and fuse **A** into the fuse holder and turn the fuse cap clockwise.
3. Install the CRT top cover (1220).

Service check

1. Remove the fuse.
2. SET the CE meter to the ohms RX1 position to check the fuse continuity. If the meter does not indicate a short circuit (0 ohms), install a new fuse of the *same* ampere rating.
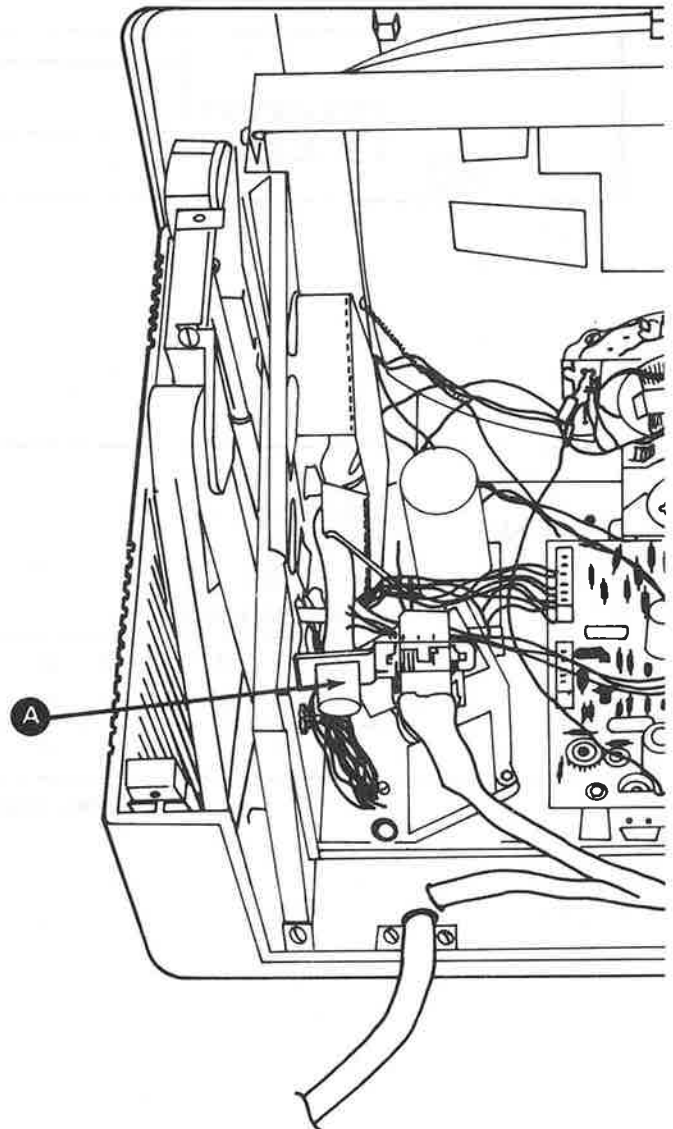
1425 Hub assembly

Removal

1. Switch off the 5324 power.
2. Remove the shield.
3. Remove the display unit (1430).

CAUTION
There may be sharp edges on the spring.

4. Carefully unhook the spring **A**.
5. Remove the hub screw **B**.
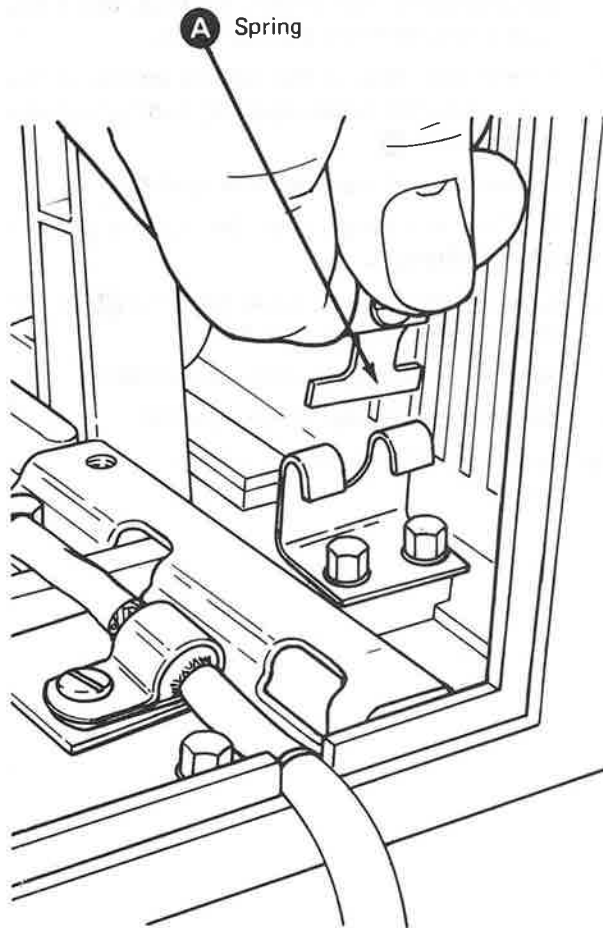
Replacement

1. Install the hub assembly and screw **B**.
2. Carefully hook the spring **A**.
3. Replace the display unit (1430).
4. Replace the shield with two screws and two star washers.

Adjustment

Align the two shoulder screws with the end of the sleeve as shown in **C** to support the display unit.

A Spring

B
Hub
screw

C
Shoulder screw
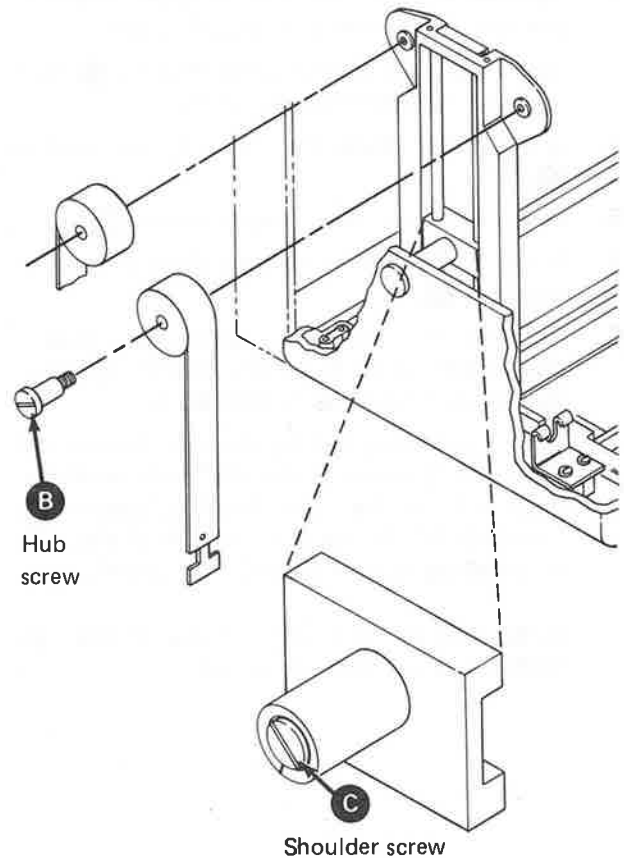
CRT display unit

1430 Display unit

DANGER

The CRT high-voltage anode lead contains 15,000 volts. Keep hands and tools away from this lead.

The CRT contains a high vacuum and could shatter if unusual pressure is placed on it.

Removal

1. Switch off the 5324 power and disconnect the power cable from the ac service outlet.
2. Remove the CRT top cover (1220).
3. Tighten the two shoulder screws (1425) to prevent movement of the display unit.
4. Disconnect the power cable plug P3 **E** from the display unit cable connector.
5. Remove the shield by removing the screws **C**.
6. Disconnect the driver/receiver card **D**.
7. Remove the two mounting screws and flat washers **B**.
8. Remove the operator's brightness control knob (located on the front of the CRT unit) by pulling it from the control shaft.
9. Hold the display unit by the side frames and slide it to the rear of the CRT unit to disengage it from the front locating screws **A**. Carefully lift the display unit out of the CRT unit and place it on a safe, flat surface.

   Note: Follow local regulations, if any, for disposal of cathode-ray tubes.

Replacement

Note: The new display unit may appear different than the old unit. Display units from several manufacturers are used in the CRT unit, and they are interchangeable.

1. Place the display unit into position and slide it to the front of the 5324 to engage the front locating screws **A**.
2. Install, but do not tighten, the two screws and flat washers **B**.
3. Install the operator's control knob on the control shaft. Notice that the knob has a key that aligns with the control shaft.
4. Center the face of the display screen in the CRT unit front cover opening and tighten the two screws **B**.
5. Connect the driver/receiver card **D**.
6. Replace the shield and the screws **C** and star washers.
7. Connect the power cable plug P3 **E** to the display unit cable connector.
8. Adjust the display if necessary (1440).
9. Adjust the shoulder screws (1425).
10. Install the CRT top cover (1220).

A — Front locating screws

Display unit
B — screws

C — Screw   Clamp   D — Driver/receiver   Clamps   C — Screw
                                    card

(Top view)

E — Power cable
    plug P3

CRT display unit

1440 Display unit adjustments

DANGER

The CRT high-voltage anode lead contains 15,000 volts. Keep hands and tools away from this lead.

The CRT contains a high vacuum and could shatter if unusual pressure is placed on it.

Adjustment preface

Display units from several manufacturers are used in the 5324 computer and are interchangeable with the originally installed unit. Some of the electrical adjustments in this section may not apply to all types of display units. The label on top of the CRT, which indicates the adjustment locations, shows which of the adjustments are present in the installed unit.

The adjustments that affect the display image on the CRT screen are:

Display image	Adjustment
Brightness	Operator's brightness control Brightness potentiometer Video drive potentiometer
Focus	Focus potentiometer
Centering and tilt	Horizontal centering potemtometer Centering rings Deflection yoke
Size	Vertical size potentiometer Horizontal width coil Deflection yoke
Vertical stability	Vertical hold potentiometer
Linearity (equal character height)	Vertical linearity phase potentiometer Vertical linearity amplitude potentiometer

Many display adjustments affect other display adjustments. The procedures in this section describe these related adjustments; however, always visually check the display image and make any other corrections which may be needed.

Adjustment tool. Use the fiber screwdriver (IBM part 460811).

Adjustment locations. The operator's brightness control is located at the lower right side of the display screen on the front of the 5324. The potentiometers are located on the circuit board inside the display unit. The horizontal width coil may be located on the side plate of the display unit in some models. See the label on top of the CRT for the exact locations of the adjustments.

For access to the adjustments, remove the CRT cover (1220).
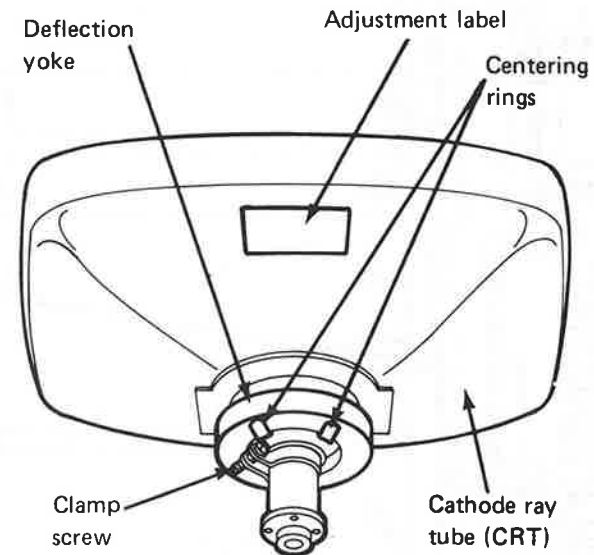
Operator's brightness control

1. Turn the operator's brightness control fully counterclockwise. No video image should be visible on the display screen.

2. Turn the operator's brightness control fully clockwise. The horizontal retrace lines of the video beam should just become visible on the display screen. (The retrace lines

may be difficult to see if the 5324 is located in a brightly lighted area.) For Germany only, the retrace lines should not be visible.

3. If the adjustment is not correct, perform the "Brightness potentiometer" adjustment.

Brightness potentiometer

1. Turn the operator's brightness control fully clockwise.

2. Observe the display screen and adjust the brightness potentiometer until the horizontal retrace lines of the video beam are just visible. For Germany only, turn it back until they just disappear.

3. Turn the operator's brightness control counterclockwise to obtain a normal brightness level on the display screen.

4. Check the "Video drive potentiometer" and "Focus potentiometer" adjustments.

Video drive potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 8 to display the attribute test pattern.

2. Observe the brightness difference between the normal reverse-video pattern and the highlighted reverse-video pattern on the display screen. Adjust the video drive potentiometer for maximum brightness difference between these two patterns. For Germany only, turn the operator brightness to maximun and adjust the video so that the highlighted fields are clear and not overly bright.

Focus potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Turn the operator's brightness control to obtain a normal brightness level on the display screen.

3. Observe one of the character/dot patterns near the center of the display screen and adjust the focus potentiometer for a good character/dot definition. Compare the characters at the center of the screen with the characters at the edges of the screen. If there is a difference in focus, adjust for best focus over the complete screen.

Deflection yoke

DANGER

The CRT high-voltage anode lead contains 15,000 volts. Keep hands and tools away from this lead.

The CRT contains a high vacuum and could implode if unusual pressure is placed on it. Do not overtighten the deflection yoke clamp or scratch the CRT surface when moving the deflection yoke.

Tilt adjustment. When turning the deflection yoke for this adjustment, do not allow the yoke to move either forward or backward on the CRT.

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Loosen the deflection yoke clamp screw enough to permit the yoke to be turned. Observe the display screen and turn the yoke until the alignment pattern is parallel with the upper and lower screen edges.

3. Before tightening the clamp screw, check that the display image size is correct. If not, perform the deflection yoke "Size adjustment." Tighten the clamp screw only enough to fasten the yoke to the CRT. DO NOT OVERTIGHTEN or the CRT MAY BREAK.

4. If the alignment pattern is not centered, perform the "Centering rings" adjustment.

CRT display unit

CRT display unit

1440 Display unit adjustments (continued)

Size adjustment. Use the deflection yoke to adjust the display image size only if the correct size cannot be obtained with the "Vertical size potentiometer" and "Horizontal width coil" adjustments.
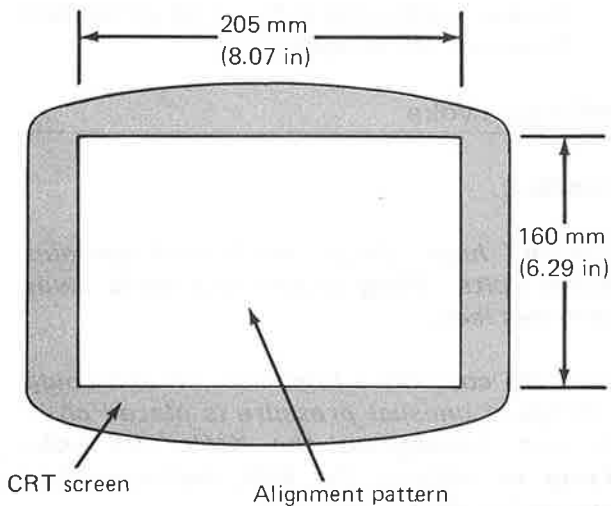
205 mm
(8.07 in)

160 mm
(6.29 in)

CRT screen

Alignment pattern

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Turn the vertical size potentiometer and the horizontal width coil to approximately the center of their adjustment range.

3. Loosen the deflection yoke clamp screw enough to permit the yoke to slide easily on the CRT surface. Observe the display screen and move the yoke toward the front of the CRT until the alignment pattern completely fills the display screen. Move the yoke toward the rear of the CRT until the alignment pattern is approximately 205 mm (8.07 in.) wide or 160 mm (6.29 in.) high.

4. Turn the yoke, if necessary, until the alignment pattern is parallel with the upper and lower screen edges. Tighten the clamp screw only enough to fasten the yoke to the CRT. DO NOT OVERTIGHTEN or the CRT MAY BREAK.

5. Perform the "Vertical size potentiometer" and "Horizontal width coil" adjustments.

Centering rings

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Observe the rectangular pattern on the CRT screen and turn the centering rings until the pattern is centered vertically and horizontally. It may be necessary to move each ring several times until the pattern is centered.

3. Perform the "Horizontal centering potentiometer" adjustment.

Horizontal centering potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Turn the operator's brightness control fully clockwise until the horizontal trace lines of the video beam are visible on the display screen. For Germany only, the retrace lines are not visible.

3. Observe the display screen and adjust the horizontal centering potentiometer to center the alignment pattern horizontally inside the rectangular pattern made by the horizontal trace lines.

4. Turn the operator's brightness control counterclockwise until the horizontal trace lines of the video beam are no longer visible. If the alignment pattern is not horizontally centered between the left and right edges of the screen, repeat the "Centering rings" adjustment.

Horizontal width coil

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Adjust the horizontal width coil for a horizontal dimension of 205±4.5 mm (8.07±0.18 in.) of the alignment pattern.

3. Check the "Horizontal centering potentiometer" adjustment.

Vertical size potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Adjust the vertical size potentiometer for a vertical dimension of 160±4.5 mm (6.29±0.18 in.) of the alignment pattern.

3. Check the "Vertical linearity phase potentiometer," "Vertical linearity amplitude potentiometer," and "Vertical hold potentiometer" adjustments.

Vertical hold potentiometer

1. Turn the vertical hold potentiometer clockwise until the image on the display screen becomes unstable. Note the position of the potentiometer.

2. Turn the vertical hold potentiometer counterclockwise until the image on the display screen again becomes unstable. Note the position of the potentiometer.

3. Set the vertical hold potentiometer at the center of the positions noted in Steps 1 and 2.

Vertical linearity phase potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Adjust the vertical linearity phase potentiometer for equal character height at the top and bottom of the display screen.

3. Check the "Vertical linearity amplitude potentiometer" and "Vertical size potentiometer" adjustments.

Vertical linearity amplitude potentiometer

1. Execute diagnostic PID 1400 (Screen Image Test Patterns) and select option 0 to display the alignment pattern.

2. Adjust the vertical linearity amplitude potentiometer for equal character height at the center and the top and bottom of the display screen.

3. Check the "Vertical size potentiometer" adjustment.

High voltage adjust potentiometer

DO NOT ADJUST. This potentiometer is adjusted at the factory, and the CE should not attempt to adjust it.

CRT display unit

CRT display unit

1450 Display/language character sets

This section contains the display character sets for the various language groups, as follows:

Character set 1 (Australia, United States/English)

ABCDEFGHIJKLMNOPQRSTUVWXYZ023456789+-*/^=²⟨⟩½³#$!:;.,?&"()%@£'\
▮abcdefghijklmnopqrstuvwxyz{}[]ïüéáãçñíßÃÇÑø«»±°º°µ¡¿®¢₧§¶¼¾óõúô
ÓÚÙÛÙ
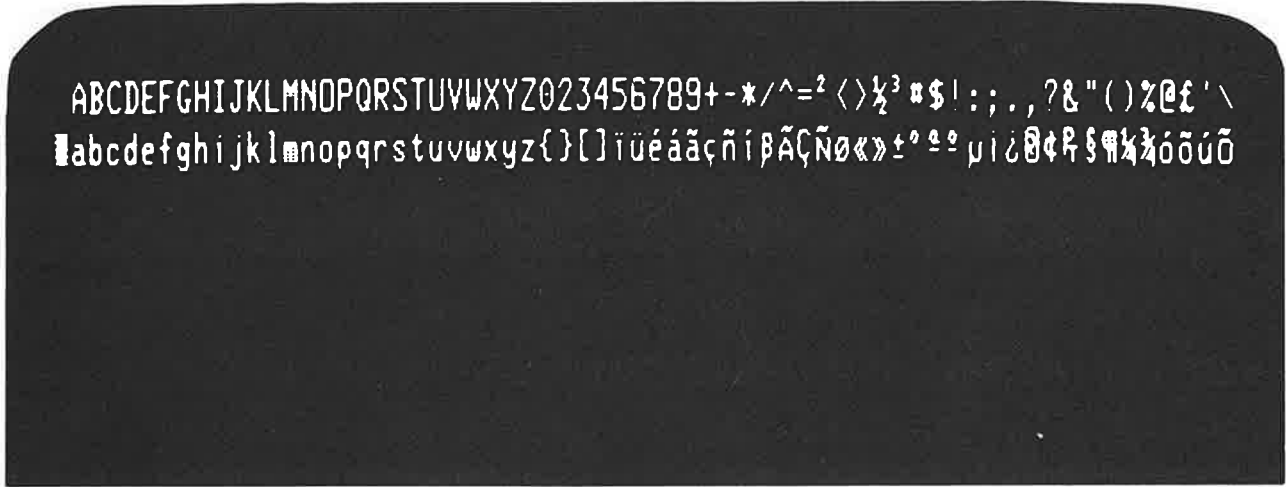
Character set 2 (Canadian French)

ABCDEFGHIJKLMNOPQRSTUVWXYZ023456789+-*/^=²⟨⟩½³#$!:;.,?&"()%@£'\
▮abcdefghijklmnopqrstuvwxyz{}[]ïüéâàçëêèïÂÀÇÉÊËÈÎÏ«»°µ¢§ôúùyÔÛÙ
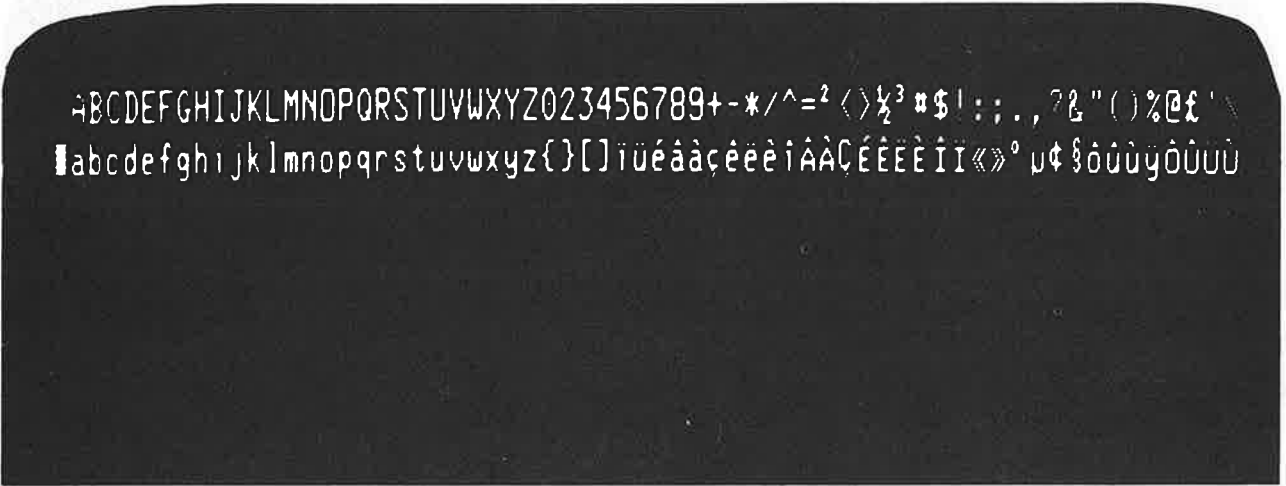
CRT display unit

1450 Display/language character sets (continued)

Character set 3 (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom)

Germany only

Character set 4 (Nordic)

Character set 5 (Spanish)

ABCDEFGHIJKLMNOPQRSTUVWXYZ023456789+-*/^=² ()½³¤$!:;.,?&"()Ż@£'\
\,ŦØ£'\ labcdefghijklmnopqrstuvwxyz{}[]ïüéâäàáçñëéèìíììßAÇÑªº¡¿¢ôöòóúùúÖÜ
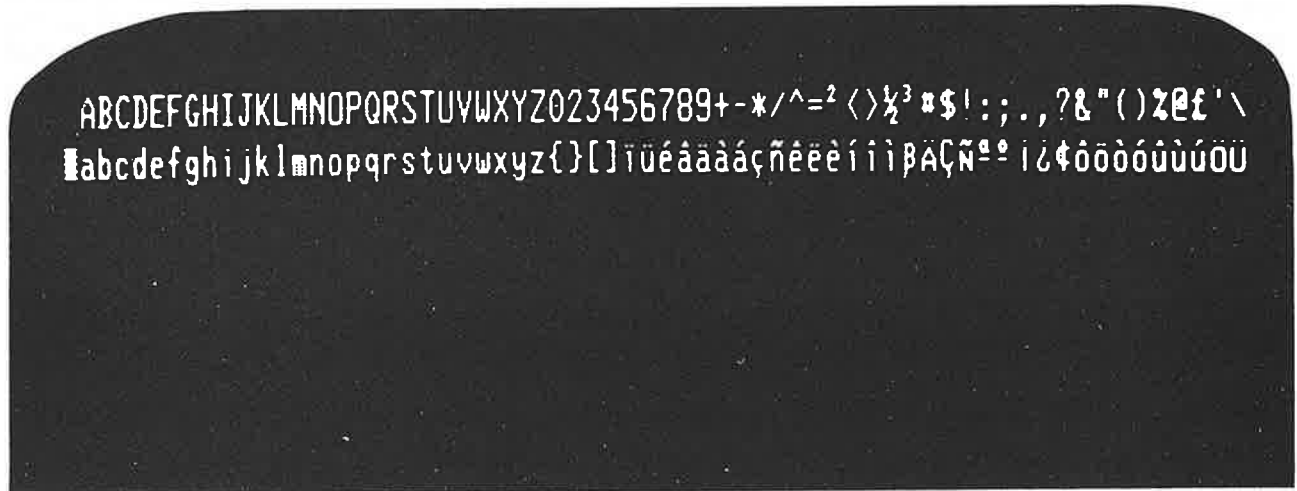
Character set 7 (Japan/Katakana)
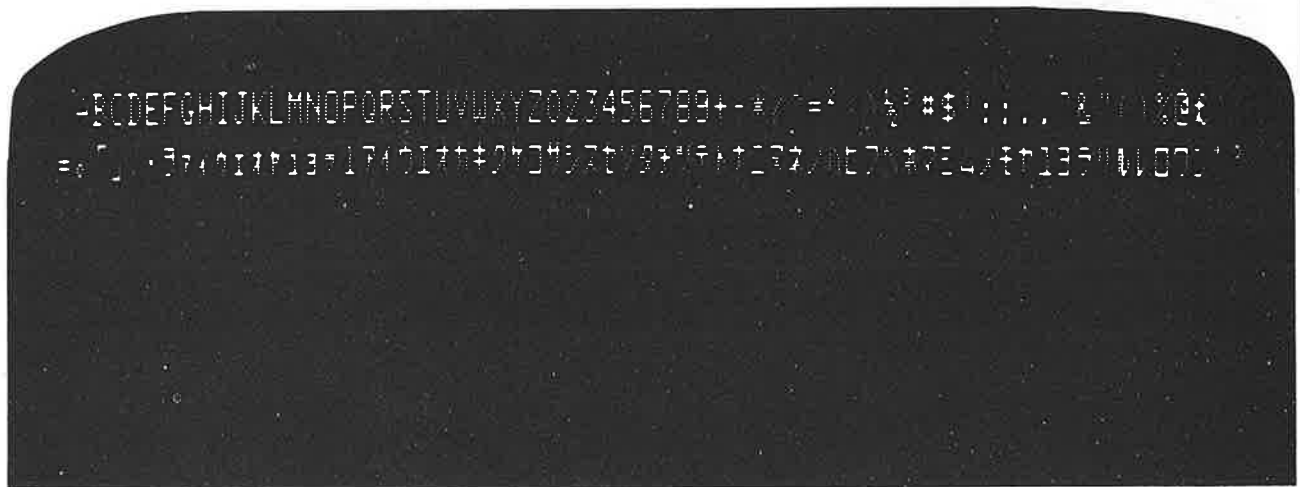
CRT display unit

Theory of operation introduction

The CRT display unit of the 5324 computer is used to display data, program information, and system status. The display screen size is 305 mm (12 in.) measured diagonally. A total of 1920 characters (24 rows of 80 characters) can be displayed in the display image area.

The display unit is a field replaceable unit (FRU). The parts of the display unit are not replaceable. Adjustments for the display unit are in "1440 Display unit adjustments" in the maintenance section of this chapter.

Operator's brightness control

The only operator control for the display unit is the brightness control, which is located at the right of the display screen. Turning this control clockwise increases the brightness of the images on the display screen. Do not leave the control in the fully clockwise position for long periods of time because this can damage the screen.

Display screen
305 mm (12 in.)

Brightness
control

5324 Display unit
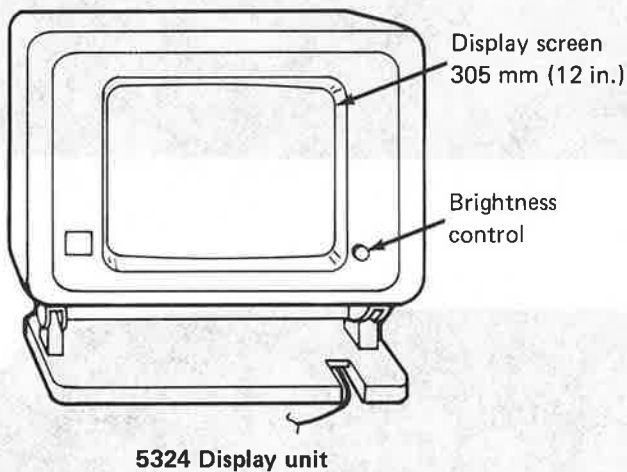
Functional description

Display screen

Images are generated on the display screen by increasing the energy of the electron beam as it moves across the face of the screen. When the energy is increased, it causes the phosphor on the inside of the screen to activate and form a dot or line at the position of the electron beam. The path of the electron beam, as it moves horizontally and vertically across the screen, can be seen if the operator's brightness control is turned fully clockwise. This pattern is the screen *raster*. For Germany only, the path of the beam should not be visible.

The raster is evenly spaced and rectangular as shown in the diagram. The pattern is made by varying the magnetic field generated by the horizontal and vertical deflection coils. The changing polarity of these magnetic fields causes the electron beam to move.

The effective starting point for the electron beam is at **A**. As the vertical and horizontal deflection coils are activated, the electron beam follows the path from **A** to **B**. The beam then retraces to the left **C**, where it starts the next line. This scanning action of the electron beam continues until the beam reaches the bottom of the screen **D**. The beam then retraces to **A** to generate the raster again by the same method. During normal display operations, blanking of the electron beam occurs for the retrace intervals.
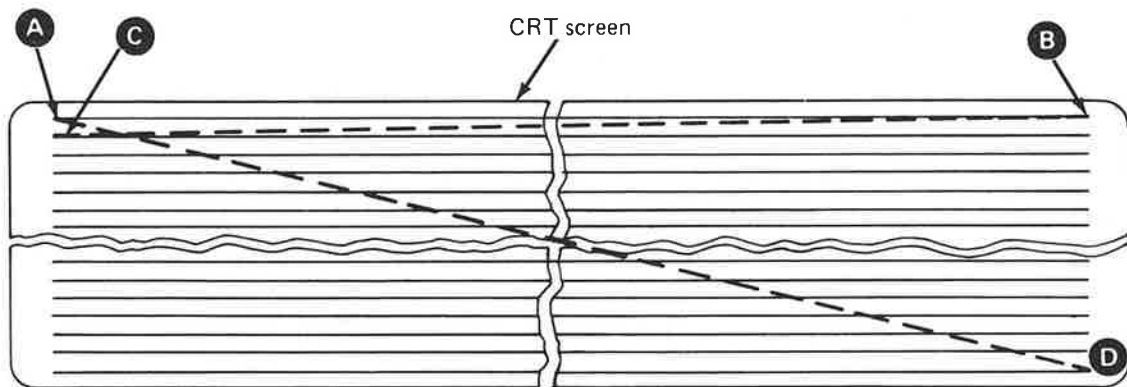
Note: Dotted lines represent blanking.
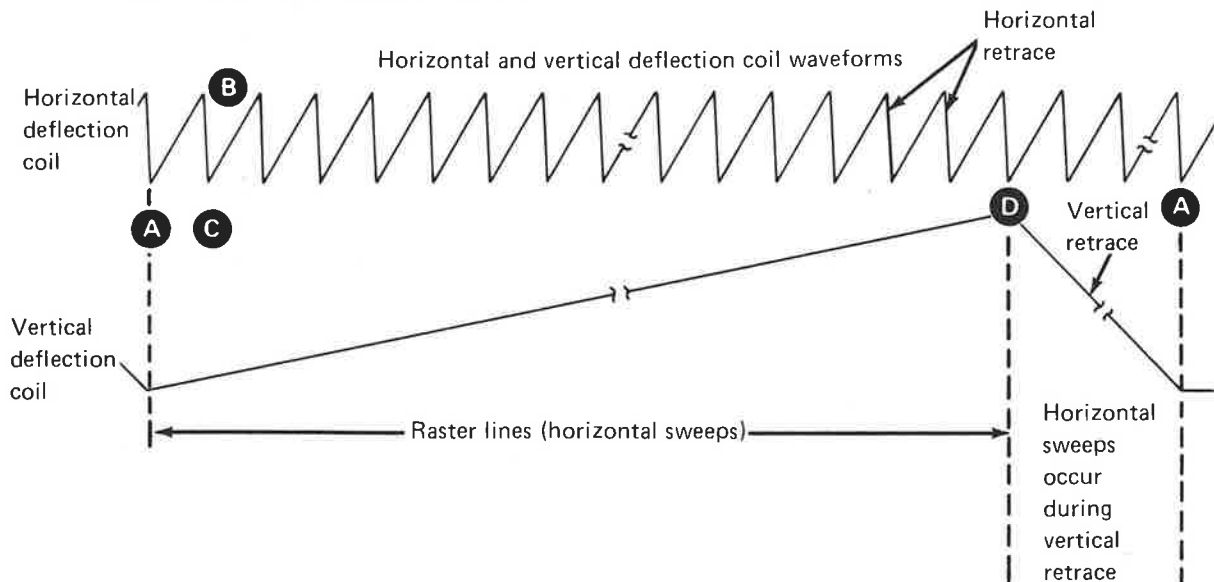
CRT display unit

Functional description (continued)

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Screen and character formats

Screen format. The screen image area has 24 character rows. Each of these character rows is made up of 14 horizontal lines. Eighty characters can be displayed in a character row.

Character format. Each of the 24 character rows is divided into 80 character boxes. A character box is a dot matrix, 10 dots wide by 14 dots high. The characters are displayed by a dot matrix, 7 dots wide by 9 dots high, in the character box. The remaining space in the character box is used to display character ascenders, descenders, and the cursor.

The following diagram shows how the lines, rows, and characters are generated on the display screen.
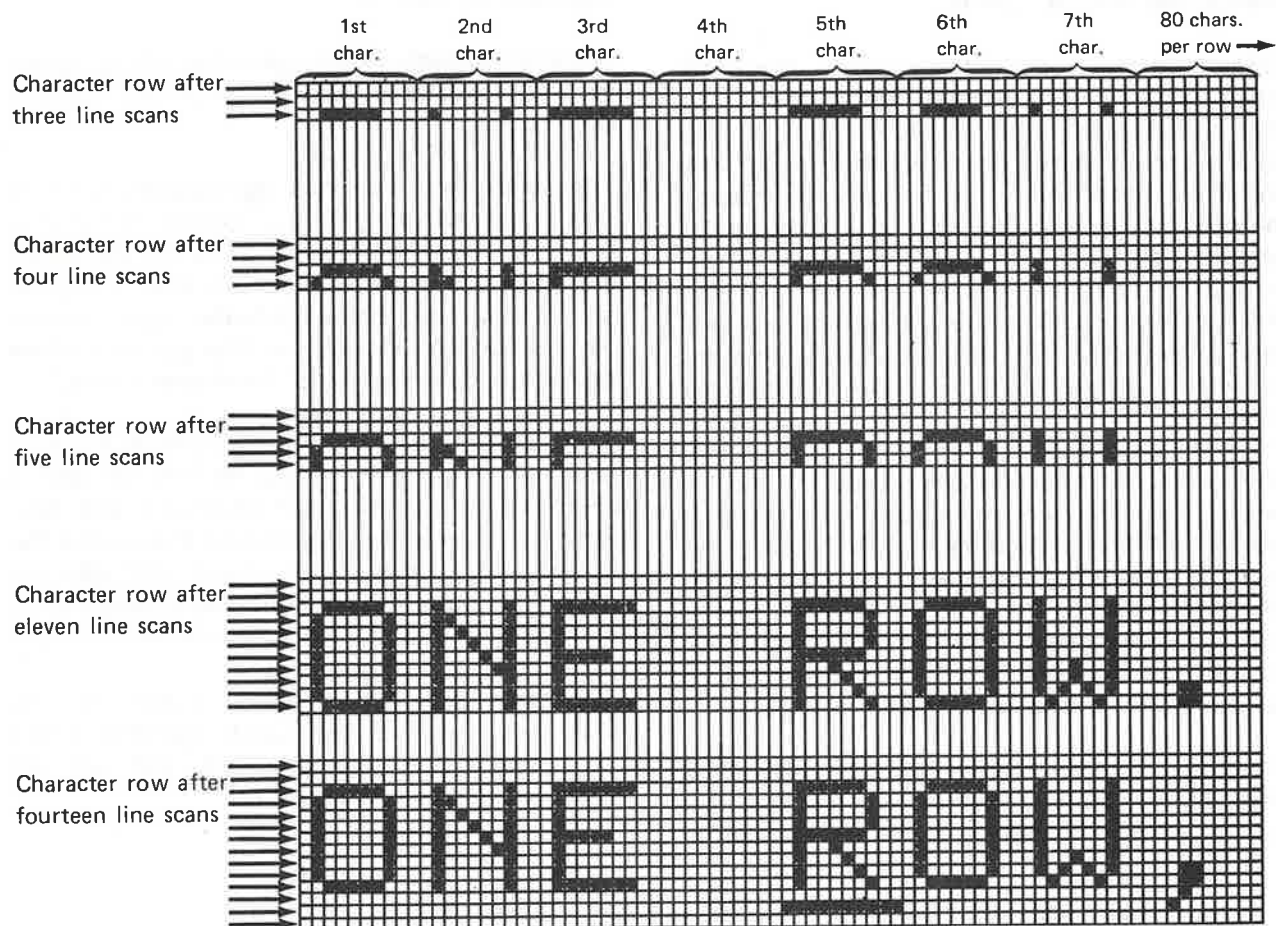
CRT display unit

Functional description (continued)

Data flow (Models 1XX)

The display data is read from the 5324 read/write storage **A** and displayed row by row on the display screen. The display attachment, which is located on the 5324 CPU planar board, has two row buffers **C** and **D**. While one row buffer is being used for display, the other is being filled with the display data for the next display row. The attachment uses direct memory access (DMA) cycles to read the data from the 5324 storage into the row buffers.

Before the start of a display frame, the DMA controller **F** requests DMA cycles to fill one row buffer. When the first horizontal line on the display screen starts, the characters in the row buffer are addressed sequentially by the character counter **K** and are sent to the character generator **H**. The character generator is an 8K read-only storage (ROS) unit that contains the dot patterns for each of the display language sets used in the 5324. (The language set is selected by feature jumpers on the 5324 CPU planar board.)

As the electron beam moves across the display screen, the characters in the row buffer and the value in the line counter **L** are used to address specific bytes of the character generator ROS, which contains the dot patterns for each line of the display characters. This dot pattern is sent to the video control circuits **I** and is displayed on the screen of the display unit **E**.

When the character counter has addressed all 80 character positions of the display line, the line counter is incremented by 1. The characters in the row buffer and the new value in the line counter are used to address the character generator ROS, and the second line of character dot patterns is displayed on the screen.

The line counter is incremented by 1 until all 14 lines of the character row are displayed. The row counter **M** is then incremented by 1, and the row buffer that was filled while the preceding character row was being displayed is used for the next character row. Up to 24 character rows can be displayed on the screen.

The clock generator **J** supplies the timing signals for the character counter and the video control circuits.

The buffer input controller **B** inspects the data that is loaded into the row buffers for special character codes that control the operation of the display unit. For example, an end-of-screen stop-DMA code causes the buffer input controller to stop DMA requests and to suppress video output for the remainder of the display frame.

The buffer output controller **G** inspects the data from the output of the row buffers for special character codes, character attributes, and field attributes that control the displayed image on the screen. For example, a highlight-field attribute causes the buffer output controller to activate the highlight output of the video control circuits.

The commands and character codes that are used to control the operation of the display unit are part of the microprograms and are not described in this service manual.

Simplified data flow diagram.
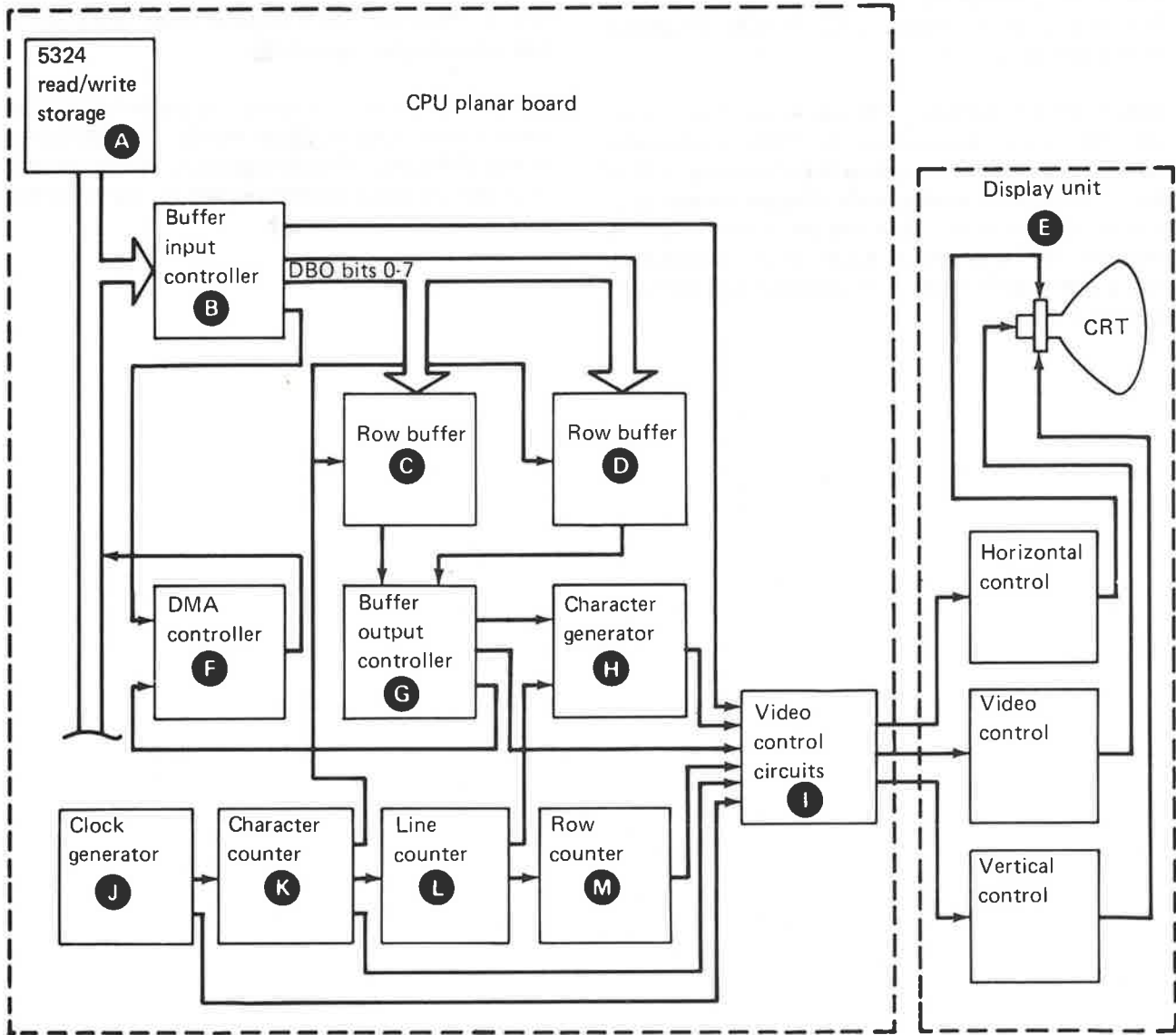
CRT display unit

Functional description (continued)

Data flow (Models 4XX)

The word processing data flow is in addition to the data flow for models 1XX already described in this chapter.

When word processing (WP) is active, two separate areas are reserved in the 5324 read/write storage **A**. The first area is the character buffer that normally contains only display characters. The second area is called the attribute buffer. It contains attribute control data. Each character in the display buffer has a corresponding attribute control code.

Each time the 5324 enters the WP mode the attribute sync circuit **E** syncronizes the attribute data path with the character data path. The data flow is then the same through both paths up to the video control circuits **D**.

The character dot patterns are cabled from the video control circuits **B** on the CPU planar board to the WP card. The dot patterns are combined with the attribute control signals on the card and sent to the display unit **C**.

Word processing data flow diagram.

- A — 5324 read/write storage
- From clock generator
- From DMA controller
- B — From video control circuits on planar
- To vertical control in display unit
- To video control in display unit
- To horizontal control in display unit
- C

Word processing card

- Buffer input controller
- Row buffer
- Row buffer
- Buffer output controller
- Attribute generator
- Video control circuits — D
- E — Attribute sync
- Character counter
- Line counter
- Row counter

CRT display unit

CRT display unit

Display unit diagnostics

Power-on diagnostic

The power-on diagnostic is located in the 5324 read-only storage (ROS) and executes (1) at every system power-on, (2) when the ROS resi-. dent diskette diagnostic is ended by a "9" key command, or (3) when the diagnostic control program (DCP) is ended.

The display unit section of the power-on diagnostic performs an initialization and synchronization test of the display unit controller circuits located on the 5324 CPU planar board. The display unit interface lines (horizontal, vertical, and video) are tested at the planar board. The display unit interface lines that leave the planar board are not checked by the diagnostic, but can be verified by probing the display unit signal cable connector with the CE logic probe.

CE diskette resident diagnostics

The CE diskette resident diagnostics for the display unit are located on the CE diskette and execute under control of the diagnostic control program (DCP). These tests permit you to verify the attribute functions (video highlight, reverse video, underline, blink, and blank field), and to display the language sets and the alignment pattern.

A complete description of the CE diskette resident diagnostics is located in the diagnostic user guide.

Chapter 5. Diskette drive

Contents

Diskette
drive

Diskette drive

Contents (continued)

Maintenance preface

Electromagnetic devices such as television sets or other display terminals can cause interference in the operation of the diskette drives. To ensure that the diskette drives will operate correctly, do not install any electromagnetic devices in a radius of 0.61 meter (2 feet) of the 5324 computer.

There is no preventive maintenance for the diskette drive. Repair the diskette drive by adjusting the internal assemblies or installing the field replaceable units (FRUs) as instructed by the maintenance analysis procedures (MAPs). Always use the machine diagnostics to verify machine repairs.

All procedures assume that two diskette drives are installed in the 5324 computer. All procedures also assume that the diskette drives have been removed from the 5324 and are fully accessible on a work surface. Ensure that the diskette drive casting does not damage or scratch the work surface.

The head/carriage assembly and the drive hub and pulley assembly are adjusted and tested at the factory. The drive hub and pulley assembly are not field replaceable. If either the track 40 adjustment surface or the drive hub and pulley assembly is damaged, replace the complete disk-ette drive assembly. The head/carriage assembly is replaceable in the field. However, do not repair or clean any part of this assembly.

The only differences between the 31SD diskette drive (one read/write head) and the 51TD disk-ette drive (two read/write heads) are in the head/carriage assembly and the arrangement of the diskette drive control card. Maintenance procedures that are affected by such differences are indicated by two distinct sets of instructions in the affected step. These differences are indicated as (31SD) and (51TD), as in the following example:

1. Disconnect the cables.

2. (31SD) Remove the head/carriage assembly.

    (51TD) Insert a clean strip of paper between the read/write heads and remove the head/carriage assembly.

Where a figure is not affected by the differences between the drives, the 51TD drive will be used.

The internal diskette drives are not in 5324 Models 110, 120, 130, or 140.

Diskette drive

1500 Service Position
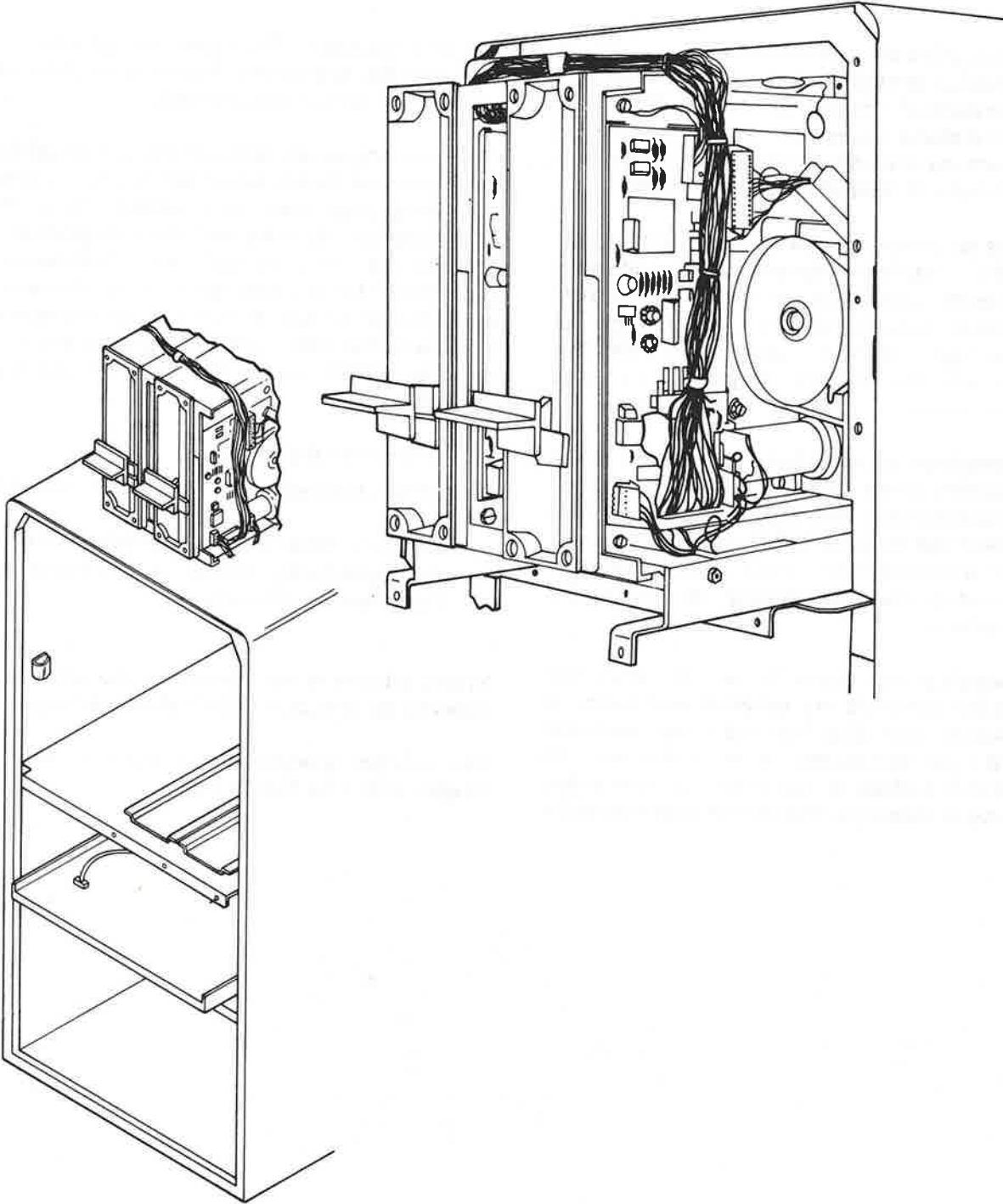
1501 Locations

Diskette drive (right side)

(A) Stepper motor

(B) Cable guide

(C) AC drive pulley/fan

(D) AC drive belt

(E) Solenoid idler

(F) Head load solenoid

(G) Spindle pulley

(H) Solenoid cable

(I) LED cable

(J) Attachment cable

(K) PTX cable

(L) Diskette latch

(M) Diskette drive control card

(N) Stepper motor cable

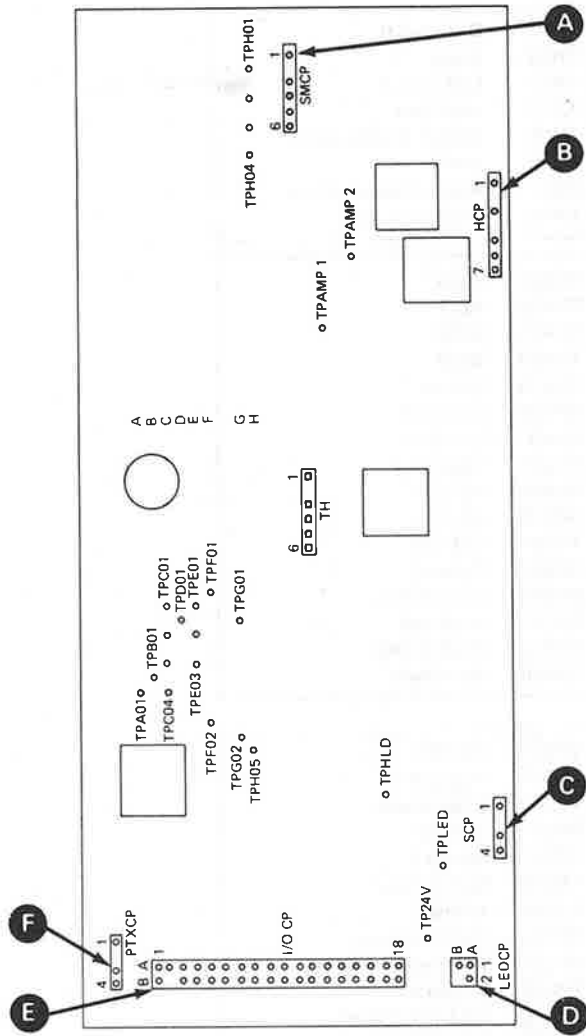(O) Head cable
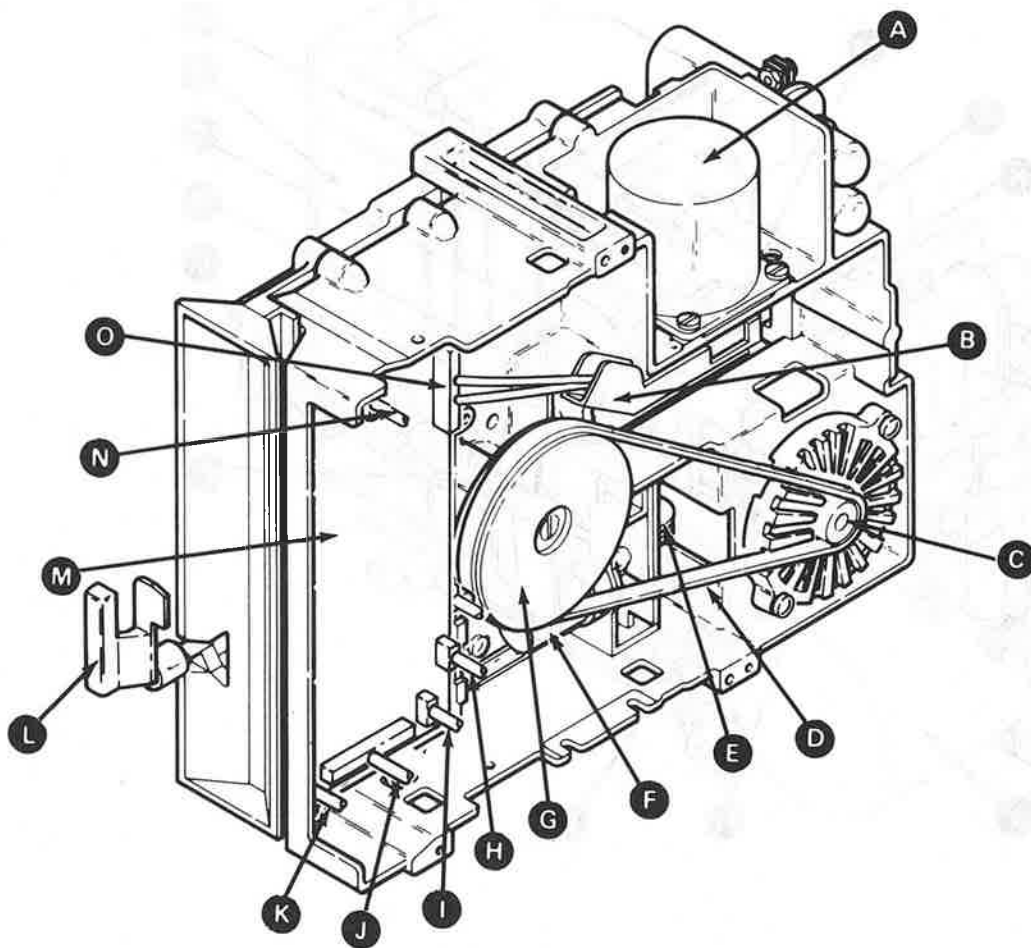
Diskette drive

1501 Locations (continued)

Diskette drive (left side)

- **A** Carriage pressure spring (tool)
- **B** Diskette guide
- **C** Collet flat spring
- **D** Collet
- **E** Diskette latch
- **F** Pressure roll
- **G** Head load bail
- **H** Head/carriage assembly
- **I** AC drive motor
- **J** AC capacitor
- **K** Timing pin (tool)
- **L** Stepper motor
- **M** Retaining clip (tool)

1501 Locations

Diskette drive control card (31SD)

TPH01
SMCP
TPH04
TPAMP 2
HCP
TPAMP 1
TPAMP
A B C D E F G H
TH
TPC01
TPD01
TPE01
TPF01
TPB01
TPG01
TPA01
TPC04
TPE03
TPF02
TPG02
TPH05
TPHLD
TPLED
SCP
TP24V
PTXCP
I/O CP
LEOCP

TPG01	File data
TPG02	Erase gate
TPH01	MC 3
TPH02	MC 2
TPH04	MC 0
TPH05	+Write gate
TPAMP1	Preamp TP1
TPAMP2	Preamp TP2
TPHLD	Head load
TP24V	+24 Vdc
TPLED	31SD LED voltage

TH01	Diff read B
TH02	Blank
TH03	Diff read A
TH04	Blank
TH05	Disable stepper motor
TH06	+18V

TPA01	+5 Vdc *
TPB01	−5 Vdc
TPC01	Access 1
TPC02	D1PTX
TPC03	Write data
TPC04	Ground*
TPD01	Inner tracks
TPE01	Access 0
TPE02	Head engage
TPE03	+ Index
TPF01	Ground*
TPF02	Write/erase enabled

*Connection for general
 logic probe power pin

A Stepper motor connector

A01	+24 Vdc common
A02	Blank (key)
A03	MC-3
A04	MC-2
A05	MC-1
A06	MC-0

B Head connector

A01	Not used
A02	Blank (key)
A03	Erase coil
A04	Blank
A05	Read/write coil
A06	Read/write coil
A07	Ground

C Solenoid connector

A01	Not used
A02	Blank (key)
A03	+24 Vdc
A04	Head load

D LED connector

A01	Ground
A02	Not used
B01	LED anode
B02	Blank (key)

E Attachment cable connector

A01	−5 Vdc
A02	Power supply ground
A03 to A18 ground	
B01	+5 Vdc
B02	Blank (key)
B03	+24 Vdc
B04	+ Index
B05	Diskette sense
B06	Write/erase enabled
B07	File data
B08	Inner tracks
B09	Erase gate
B10	Access 0
B11	Not used
B12	Not used
B13	Access 1
B14	Write gate
B15	Head engage
B16	Not used
B17	Write data
B18	Not used

F PTX connector

A01	PTX collector (+5 Vdc)
A02	Blank (key)
A03	PTX emitter
A04	Not used

Diskette drive

1503 Locations

Diskette drive control card (51TD)
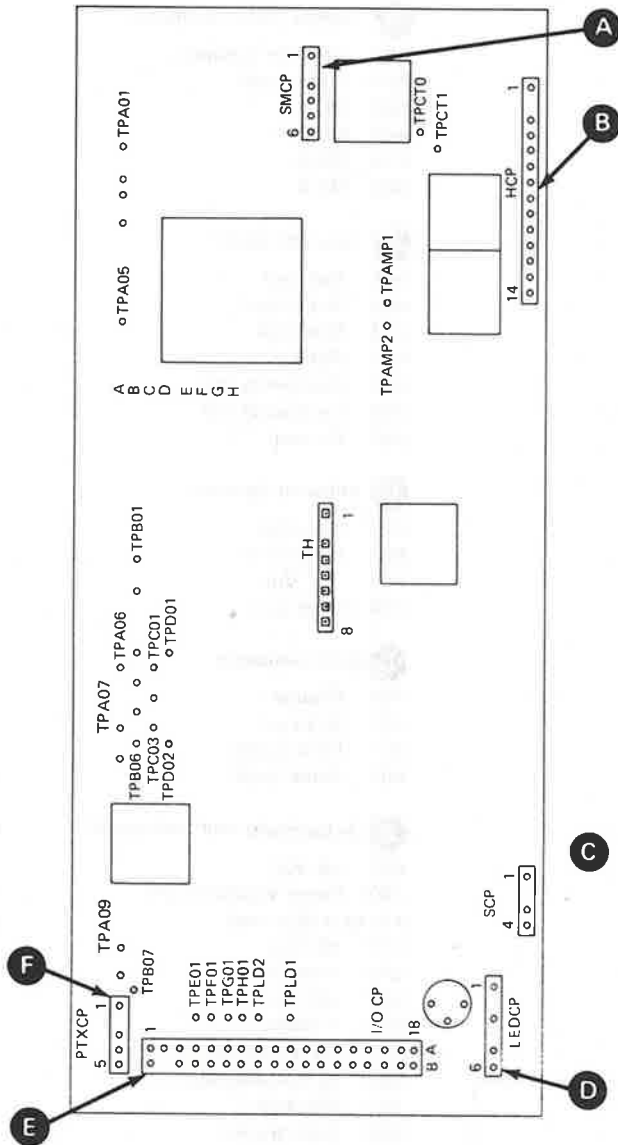
TH01	Diff read B
TH02	Blank
TH03	Diff read A
TH04	High gain
TH05	Disable stepper motor
TH06	+14V
TH07	Access clamp voltage
TH08	Oscillator

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
TPCT0	Center tap head 0
TPCT1	Center tap head 1

*Connection for general
logic probe power pin

A Stepper motor connector

A01   +24 Vdc common
A02   Blank (key)
A03   MC-3
A04   MC-2
A05   MC-1
A06   MC-0

B Head connector

A01   Not used
A02   Blank (key)
A03   Head 0 read/write coil
A04   Head 0 center tap
A05   Head 0 read/write coil
A06   Head 0 erase
A07   Head 0 erase common
A08   Ground
A09   Ground
A10   Head 1 erase common
A11   Head 1 erase
A12   Head 1 read/write coil
A13   Head 1 center tap
A14   Head 1 read/write coil

C Solenoid connector

A01   Not used
A02   Blank (key)
A03   +Head load
A04   −Head load

D LED connector

A01   Diskette 2, 2D ground
A02   Blank (key)
A03   Diskette 2, 2D anode
A04   Not used
A05   Diskette 1 ground
A06   Diskette 1 anode

E Attachment cable connector

A01   −5 Vdc
A02   Power supply ground
A03 to A18 ground
B01   +5 Vdc
B02   Blank (key)
B03   +24 Vdc
B04   Index
B05   Diskette sense
B06   Write/erase enabled
B07   File data
B08   Inner tracks
B09   Erase gate
B10   Access 0
B11   Select head 1
B12   Not used
B13   Access 1
B14   Write gate
B15   Head engage
B16   Switch filter
B17   Write data
B18   Not used

F PTX connector

A01   Diskette 1 collector (+5 Vdc)
A02   Blank (key)
A03   Diskette 1 PTX emitter
A04   Diskette 2, 2D PTX emitter
A05   Diskette 2, 2D collector (+5 Vdc)

Diskette drive

Diskette drive

1505 Locations

Diskette attachment cable
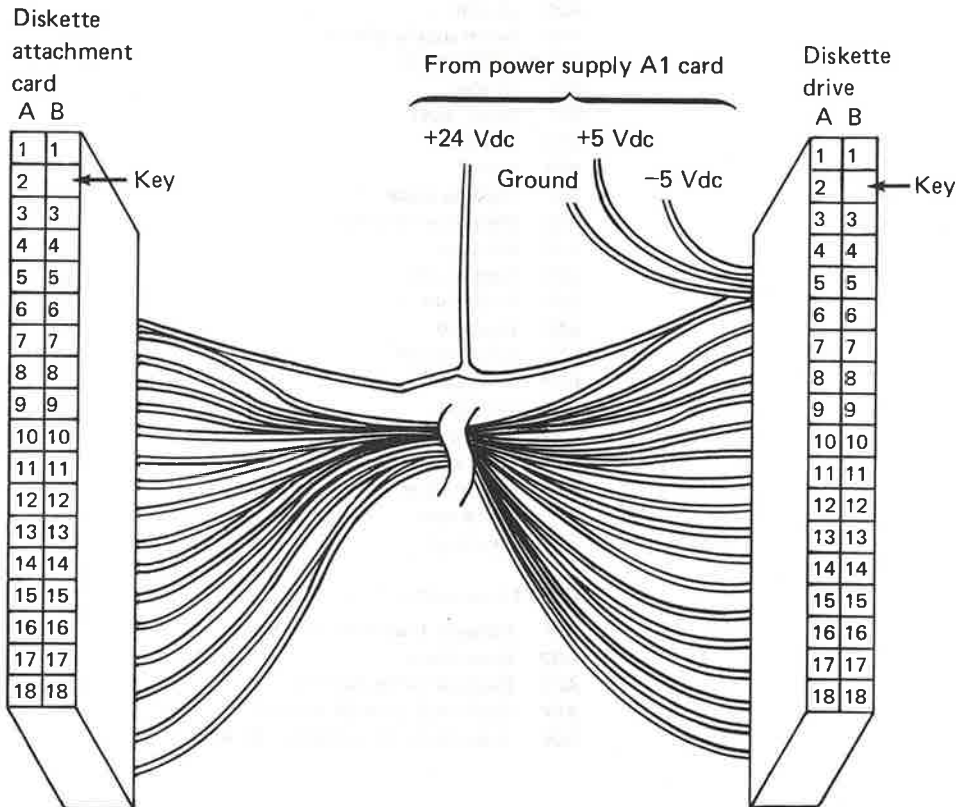
Pin	Line name	Pin
Not used	−5 Vdc	A01
Not used	Ground	A02
Not used	+5 Vdc	B01
B03	+24 Vdc	B03
A03 through A17	Ground (twisted pair)	A03 through A17
A18	Sense ground	A18
B04	Index	B04
B05	Diskette sense*	B05
B06	Write/erase enabled	B06
B07	File data	B07
B08	Inner tracks	B08
B09	Erase gate	B09
B10	Access 0	B10
B11	Select head 1†	B11
B13	Access 1	B13
B14	Write gate	B14
B15	Head engage	B15
B16	Switch filter†	B16
B17	Write data	B17

*Signal is + (51TD) or − (31SD)

†Wire is in the cable; used only with 51TD

1510 Diskette drive

Removal

1. Switch off the 5324 power.
2. Remove the front cover (1220).

   Note: Remove the reusable cable tie.

   Warning: Before removing the covers from the 5324, close the diskette latches to prevent damaging the latches and the front of the 5324. Protect the work surface so it will not be damaged or scratched.

3. Remove the two screws **E**; slide the diskette drives out to the service position (1500).
4. Disconnect the signal cable from the cable clamp **B** and pull the spare cable.
5. Tilt the drives up to remove them from the rails **C** and turn them 90 degrees to allow the cable to reach.

   Warning: If the drive is removed for testing, do not place the drive near the CRT, power supply, or any electromagnetic source.

6. Remove the four screws **D** from the two side brackets and remove the side brackets.

CAUTION
To avoid injury, do not let the clips fly up when you remove them.

7. Remove the three clips **A** to separate the diskette drives.

Replacement

1. Install the three clips **A** to hold the diskette drives together.
2. Install the two side brackets with the four screws **D**.

   Warning: Before installing the diskette drives in the 5324, close the diskette latches to prevent damaging the latches.

3. Slide the drives onto the rails **C** and reinstall the screws **E**.
4. Install the signal cables in the cable clamps **B**.
5. Replace the front cover (1220).

Cable clamp **B**

A Clip

C Rails

E Screws

D Screws (4)

A Clips (3)
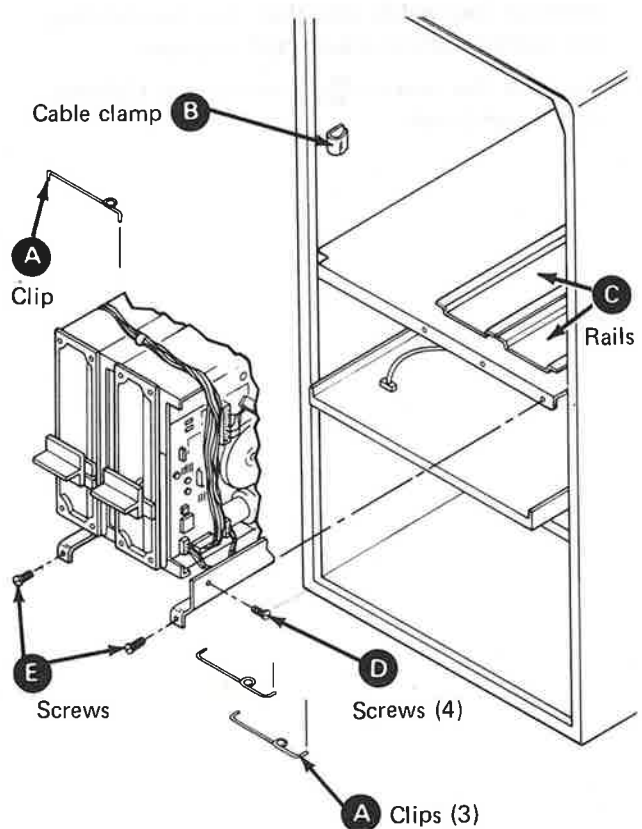
Diskette drive

1511 Diskette attachment cable

Removal

To remove the diskette attachment cable:

1. Switch off the 5324 power; disconnect the ac power cable.
2. Remove the front cover (1220).
3. Put the drives in service position (1500).
4. Disconnect the wires (+24 Vdc, +5 Vdc, -5 Vdc, and ground) from the power supply A1 board (1211).
5. Place the CPU planar board **E** in the service position (1230).
6. Disconnect diskette attachment cable 1 **A** or cable 2 **B** from the diskette attachment card **C** and from the diskette drive.
7. Remove any cable ties that may be holding the diskette attachment cable in place.
8. Remove the screw **D**; remove the diskette attachment card.

Replacement

1. Install the diskette attachment cable **A** or cable **B** in the 5324. (Ensure that the cable path through the 5324 frame is correct.) Connect the wires (+24 Vdc, +5 Vdc, -5 Vdc, ground) to the power supply A1 card (see 1211).
2. Pull out the CPU planar board drawer **E**.
3. Plug in the diskette attachment card **C**; replace the screw **D**.
4. Connect the diskette attachment cable **A** or **B** to the diskette attachment card **C**.
5. Place the CPU planar board in the operating position (1230).
6. Connect the diskette attachment cable to the diskette drive control card.
7. If the diskette drives were removed from the 5324, install the drives (1510).
8. Install any cable ties that were removed from the diskette attachment cable.
9. Install the front cover (1220).
10. Connect the ac power cable.

- **A** Diskette attachment cable 1
- **B** Diskette attachment cable 2
- **C** Diskette attachment card
- **D** Screw
- **E** CPU planar board
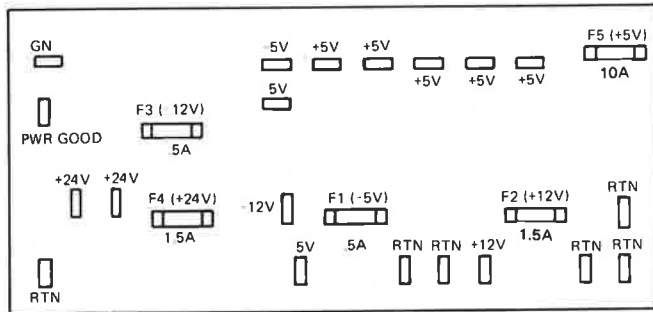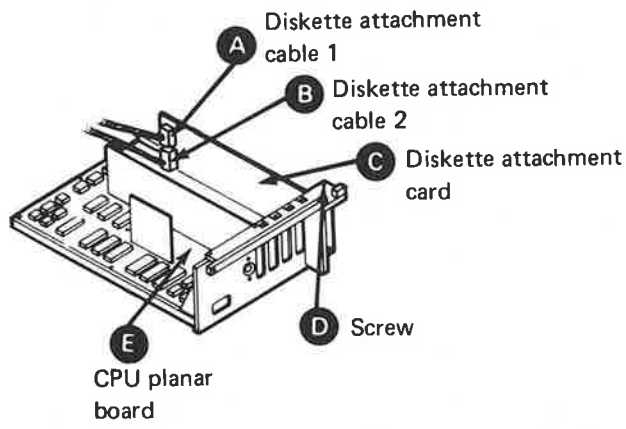
Power supply A1 card
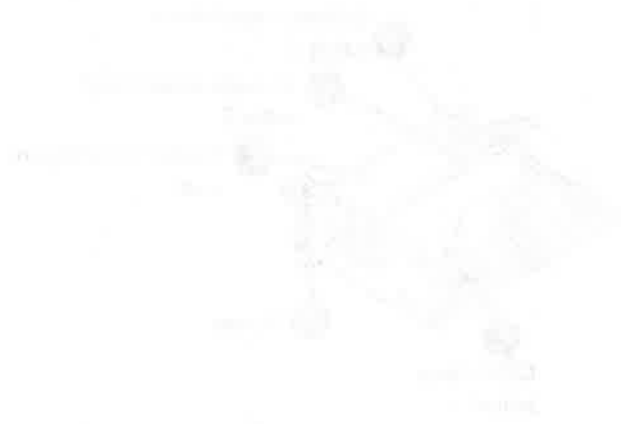
Diskette drive

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1512 Diskette latch

Removal

1. Switch off the 5324 power.
2. Remove the diskette drives from the 5324 (1510).
3. Remove the screw **B** and nut **C** from the diskette latch **A**; remove the diskette latch.

Replacement

1. Install the diskette latch **A** with screw **B** and nut **C**. Adjust the diskette latch for a maximum gap of 0.1 mm (0.004 in.) between the latch and the front surface of the diskette guide.
2. Install the diskette drives in the 5324 (1510).

A Diskette latch

B Screw

C Nut
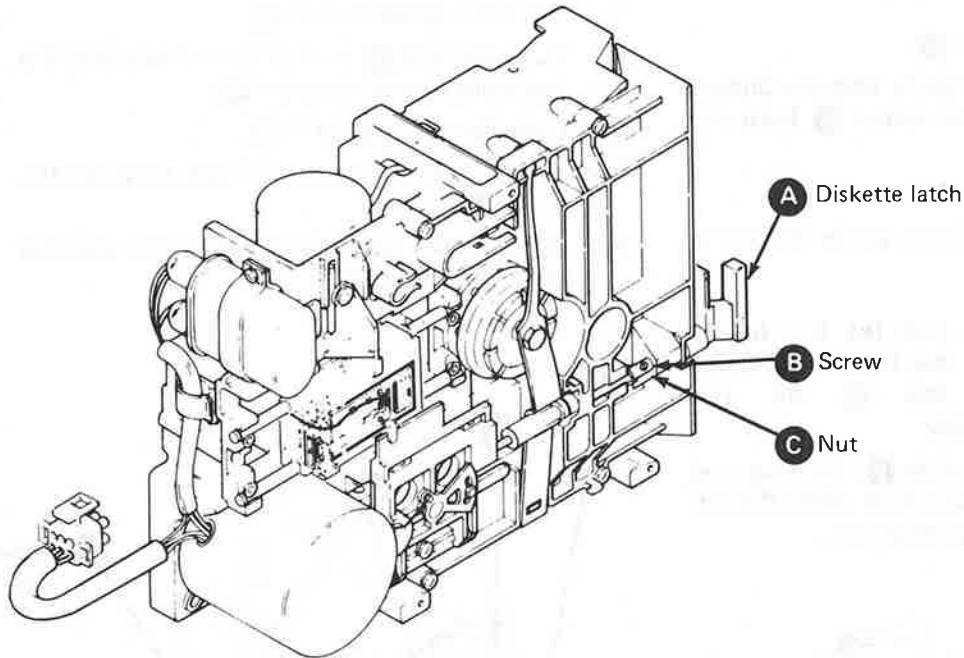
Diskette drive

1520 Diskette guide

Removal

1. Switch off the 5324 power; move the head/carriage to the rear of the machine.
2. Disconnect the LED cable **I** from the diskette drive control card **H**; note the cable path for the replacement.
3. (51TD) Insert a clean strip of paper between the heads **A**.
4. Close the diskette latch **D**.
5. Push the bail **G** in slightly and disconnect the bail actuating cable eyelet **F** from the bail.
6. Open the diskette latch **D**.
7. Remove the four diskette guide mounting screws **E**.

   Warning: (51TD) Do not let the heads snap together when the bail is removed from under the tab **B on the head/carriage assembly.**

8. Remove the diskette guide **C**; lift it up and carefully slide the bail out from under the tab **B** on the head/carriage assembly.

Replacement

1. Open the diskette latch **D**.
2. Install the diskette guide **C**; carefully slide the bail **G** under the tab **B** on the head/carriage assembly.
3. Install the four diskette guide mounting screws **E**.
4. Close the diskette latch **D**.
5. Push the bail **G** in slightly and connect the bail actuating cable eyelet **F**.
6. Open the diskette latch **D**.
7. (51TD) Remove the paper from between the heads **A**.
8. Connect the LED cable **I** to the diskette drive control card **H**.

A Read/write heads

B Head/carriage

E Screws

H Diskette drive control card

C Diskette guide

D Diskette latch

I LED cable

G Bail **F** Cable eyelet

E Screws
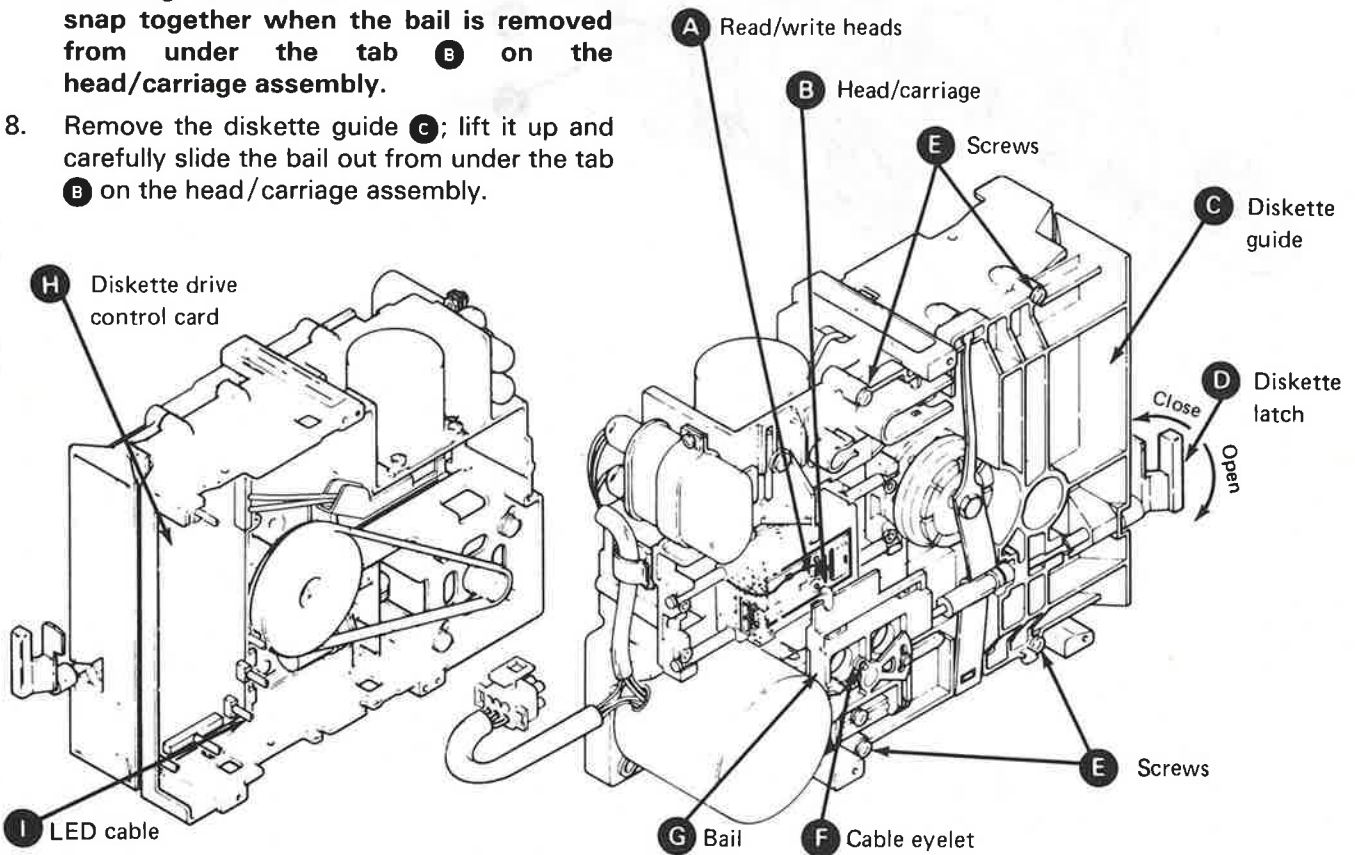
1521 Collet and spring assembly

Removal

1. Remove the diskette latch (1512).
2. Remove the head load bail (1541).
3. Remove the collet and spring assembly **B** from the diskette guide **A**.

   Note: If the collet and spring assembly is damaged, exchange the assembly.

Replacement

1. Install the collet and spring assembly **B** on the diskette guide **A**.
2. Install the head load bail (1541).
3. Install the diskette latch (1512).

A Diskette guide

B Collet and spring assembly
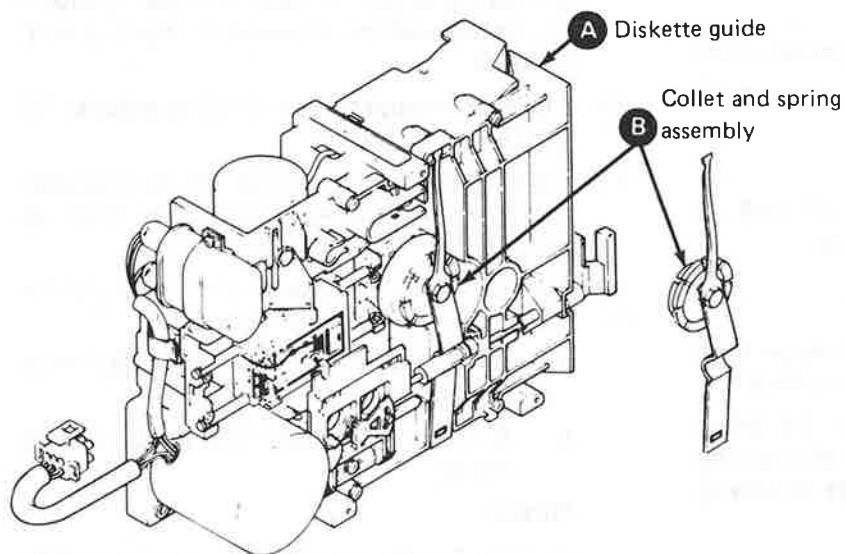
Diskette drive

1530 Head/carriage assembly

Service check (using PID 1500)

Note: This procedure uses PID 1500 of the ROS resident diskette diagnostics to move the head/carriage between cylinders 39 and 40.

Warning: Perform the head/carriage service check with the diskette drive installed (or in the same position as when installed) or the service check may not be accurate.

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **D**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

3. Switch on the 5324 power.
4. Select the "MAP chart support" option from PID 1500 (see the diagnostic user guide).
5. Move the head/carriage to align the timing pointer with the timing block on the casting (use option 7); the head/carriage is now at cylinder 40.

```
ENTER  KEY(S)          FUNCTION
---------------        --------
0                      RECAL.
1 (AND) FIELD +        SEEK IN ONE TRACK
4 (AND) FIELD +        SEEK IN FOUR TRACKS
4 (AND) FIELD -        SEEK OUT FOUR TRACKS
1 (AND) FIELD -        SEEK OUT ONE TRACK
7                      HEAD ALIGN (TRK 40,39,40)
9                      END, GO TO POWER-ON DIAGNOSTICS
```

6. Check that the timing pin **A** passes freely through the stepper motor pulley into the timing slot in the casting. If it does not, remove the timing pin and perform the head/carriage adjustment, starting with Step 3.

7. If the timing pin passes freely through the stepper motor pulley into the slot in the casting, remove the timing pin.

8. Move the stepper motor to cylinder 39 (use option 1, Field−).

9. Verify that this is cylinder 39 by checking for no gap **B** between the timing pointer and the timing block. If there is a gap, perform the head/carriage adjustment, starting with Step 12.

10. Move the stepper motor back to cylinder 40 (use option 1, Field+).

11. Verify that this is cylinder 40 by checking that the timing hole in the pulley lines up with the timing slot in the casting.

12. Check the gap **B** between the timing pointer and the timing block as follows:
    a. A 0.51-mm (0.020-in.) gauge **C** should fit tightly.
    b. A 0.53-mm (0.021-in.) gauge should not fit.

   **Notes:**
    a. To ensure an accurate measurement, remove the gauges from the holder.
    b. Because of the torque characteristics of the stepper motor, if Step 12 must be repeated, start the sequence with Step 8 of this service check.

13. If the gap **B** between the timing pointer and the timing block is correct, switch off the 5324 power and connect the ac drive motor power cable **D**.
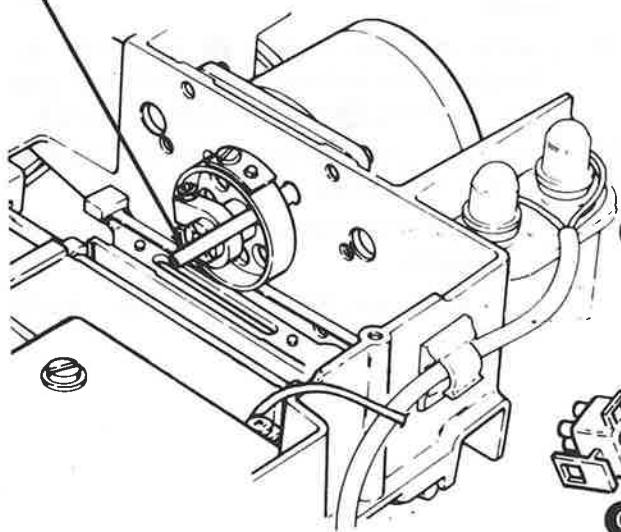
A Timing pin

B Gap

D Drive motor power cable

C Gauge
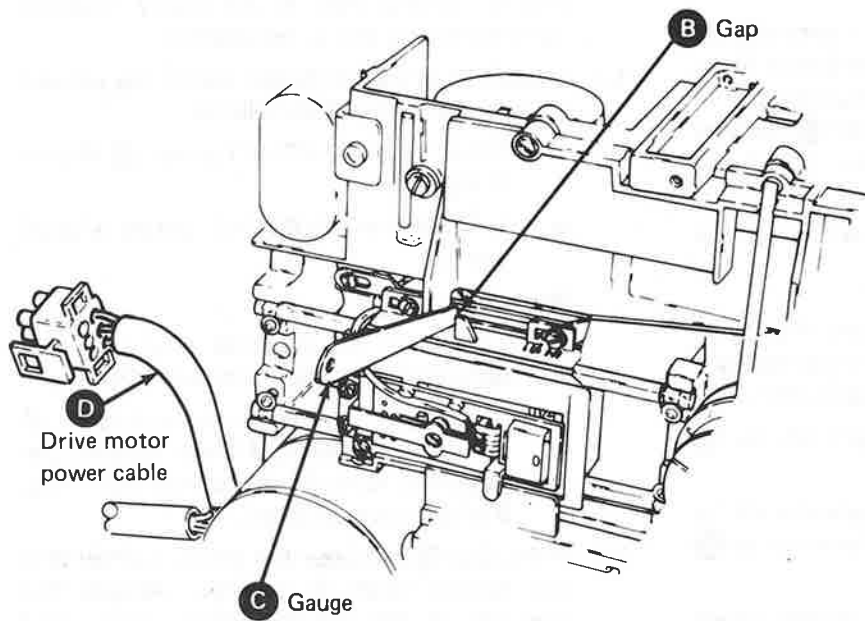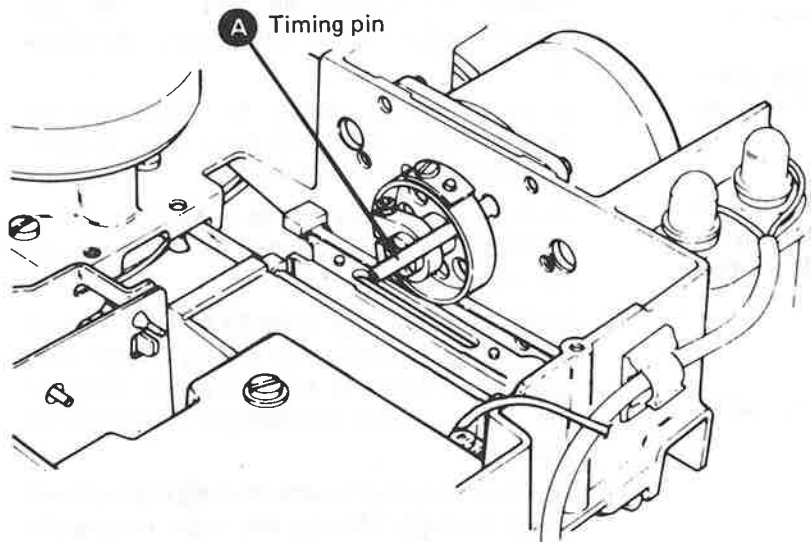
Diskette drive

Diskette drive

1530 Head/carriage assembly (continued)

Service check (using jumpers)

Note: This procedure uses jumpers on the diskette drive control card to move the head/carriage between cylinders 39 and 40.

Warning: Perform the head/carriage service check with the diskette drive installed (or in the same position as when installed) or the service check may not be accurate.

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **G**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

3. Move the head/carriage to approximately align the timing pointer with the timing block on the casting; the head/carriage is now at cylinder 40. Insert the timing pin **F**; ensure that the timing pin goes into the slot in the casting.
4. Remove the timing pin **F**; switch on the 5324 power.

    Warning: To prevent damaging the card, the jumpers to be inserted in the following steps must be on the correct pins.

5. Connect a jumper from **D** (ground) to **C** (disable stepper motor).
6. Detent the stepper motor at cylinder 40 by connecting a jumper from **E** (ground) to **B** (MC-0).
7. Check that the timing pin **F** passes freely through the stepper motor pulley into the timing slot in the casting. If it does not,

remove the timing pin and perform the head/carriage adjustment, starting with Step 3.

8. If the timing pin passes freely through the stepper motor pulley into the slot in the casting, remove the timing pin **F**.
9. Remove the jumper end from **B** (MC-0) and install it on **A** (MC-3); this moves the stepper motor to cylinder 39.
10. Verify that this is cylinder 39 by checking for no gap **I** between the timing pointer and the timing block. If there is a gap, perform the head/carriage adjustment, starting with Step 12.
11. Remove the jumper end from **A** (MC-3) and install it on **B** (MC-0); this again moves the stepper motor to cylinder 40.
12. Verify that this is cylinder 40 by checking that the timing hole in the pulley lines up with the timing slot in the casting.
13. Check the gap **I** between the timing pointer and the timing block as follows:
    a. A 0.51-mm (0.020-in.) gauge **H** should fit tightly.
    b. A 0.53-mm (0.021-in.) gauge should not fit.
    Notes:
    a. To ensure an accurate measurement, remove the gauges from the holder.
    b. Because of the torque characteristics of the stepper motor, if Step 13 must be repeated, start the sequence with Step 9 of this service check.
14. If the gap **I** between the timing pointer and the timing block is correct, remove the jumpers, switch off the 5324 power, and connect the ac drive motor power cable **G**.

Diskette drive control card - 51TD
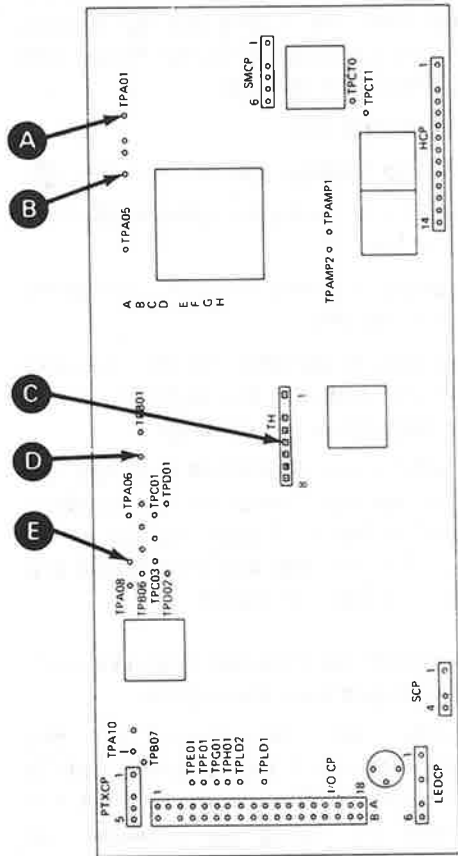
Diskette drive control card - 31SD
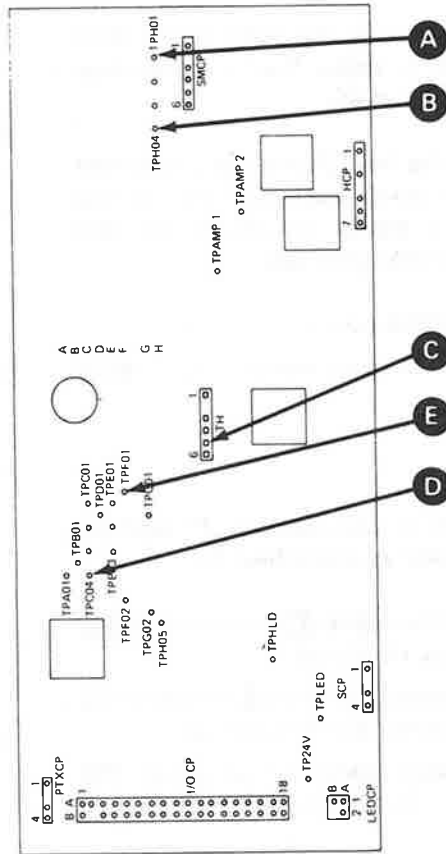
F Timing pin

H Gauge

I Gap

G Drive motor power cable
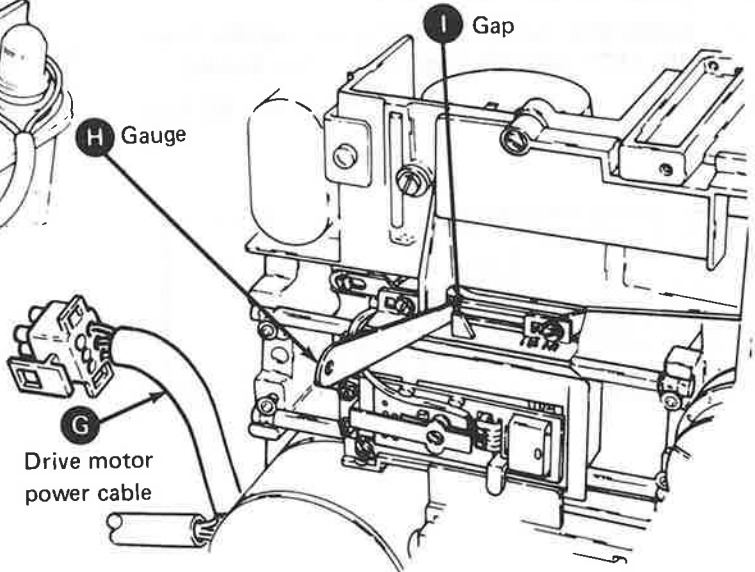
Diskette drive

Diskette drive

1530 Head/carriage assembly (continued)

Adjustment (using PID 1500)

Note: This procedure uses PID 1500 of the ROS resident diagnostics to move the head/carriage between cylinders 39 and 40.

Warning: Adjust the head/carriage assembly with the diskette drive installed (or in the same position as when installed) or the adjustment may not be accurate.

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **J**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

3. Remove the cable guide **B** (squeeze at **A**; push the cable guide down).
4. Measure and record the gap **E** between the stepper motor pulley and the casting.
5. Loosen the pulley clamp screw **C** so the stepper motor shaft can turn inside the pulley.
6. Move the head/carriage, by hand, to approximately align the timing pointer with the timing block on the casting; the head/carriage is now at cylinder 40. Insert the timing pin **D**.
7. Switch on the 5324 power.
8. Select the "MAP chart support" option from PID 1500 (see the Diagnostic User Guide).
9. Detent the stepper motor at cylinder 40 (use option 7).

```
ENTER  KEY(S)          FUNCTION
-------------          --------
0                      RECAL.
1 (AND) FIELD +        SEEK IN ONE TRACK
4 (AND) FIELD +        SEEK IN FOUR TRACKS
4 (AND) FIELD -        SEEK OUT FOUR TRACKS
1 (AND) FIELD -        SEEK OUT ONE TRACK
7                      HEAD ALIGN (TRK 40,39,40)
9                      END, GO TO POWER-ON DIAGNOSTICS
```

10. Maintain the gap **E** at the casting (recorded in Step 4); tighten the pulley clamp screw **C**. Ensure that the timing pin **D** passes freely through the stepper motor pulley into the timing slot in the casting.
11. Remove the timing pin.
12. Loosen the two carriage clamping screws **F**.
13. Move the stepper motor to cylinder 39 (use option 1, Field-).
14. Move the stepper motor back to cylinder 40 (use option 1, Field+).
15. Verify that this is cylinder 40 by checking that the timing hole in the pulley lines up with the timing slot in the casting.
16. Insert a 0.51-mm (0.020-in.) gauge **K** between the timing pointer on the carriage and the timing block. Fasten the gauge to the casting with the retaining clip **I** (the clip is stored on the diskette guide).

    Note: To ensure an accurate measurement, remove the gauges from the holder.

17. Press lightly at the front of the head/carriage **H** so it just touches, but is not forced against, the gauge. Insert the carriage pressure spring **G** between the casting and carriage to hold the head/carriage assembly against the gauge (the pressure spring is stored on the diskette guide).
18. Tighten the two screws **F** that hold the carriage to the bracket; remove the carriage pressure spring **G** and the retaining clip **I**.
19. Verify the gap between the timing pointer and the timing block as follows:
    a. A 0.51-mm (0.020-in.) gauge **K** should fit tightly.
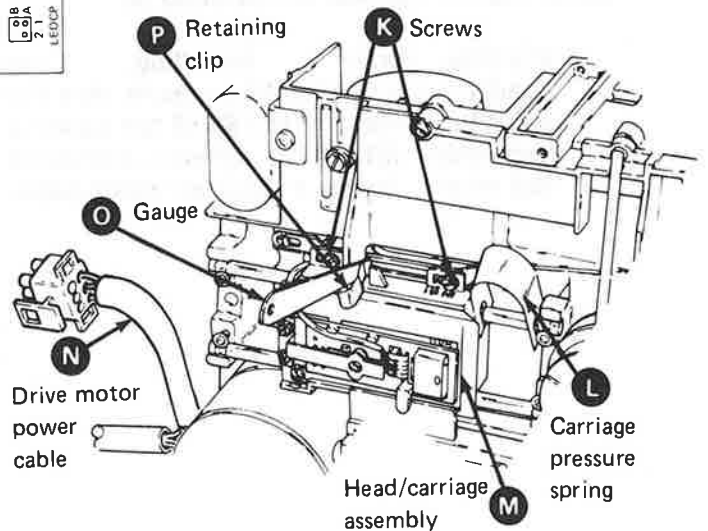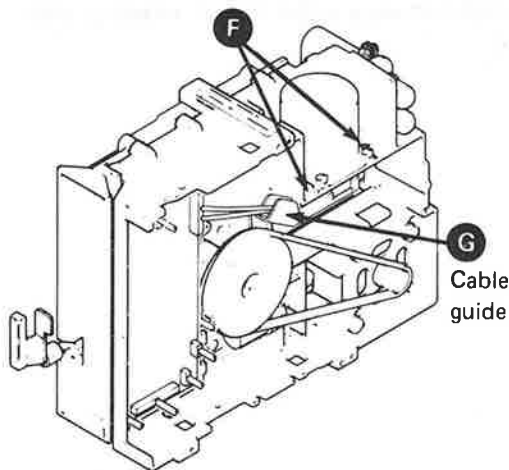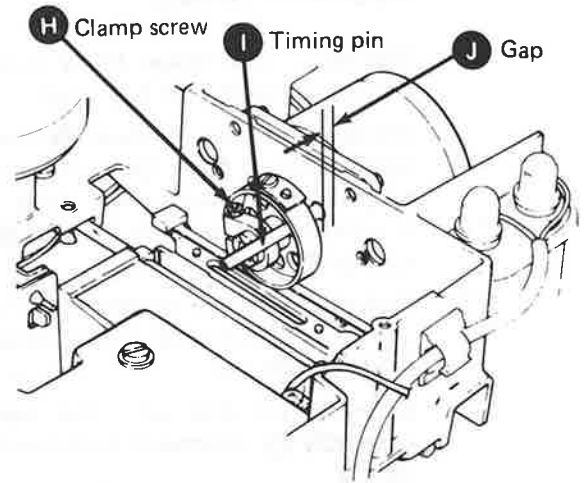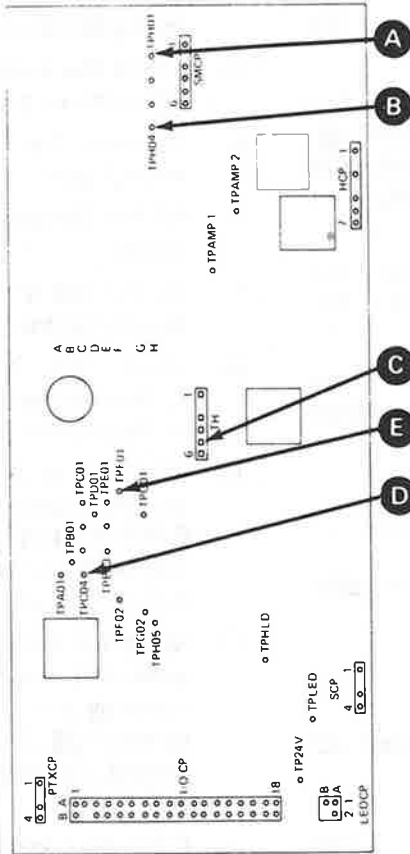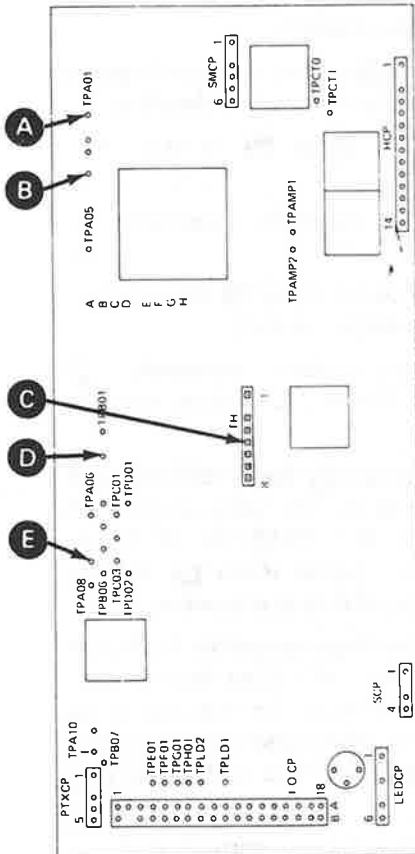   b. A 0.53-mm (0.021-in.) gauge should not fit.

Note: Because of the torque characteristics of the stepper motor, if Step 19 must be repeated, start the sequence with Step 13.

20. Switch off the 5324 power; remove the jumpers.

21. Snap the cable guide **B** into the holes in the casting.

22. Connect the ac drive motor power cable **J**.

23. Store the retaining clip **I**, the carriage pressure spring **G**, and the timing pin **D** on the diskette guide.

24. Verify head alignment by loading the diagnostic control program (DCP).
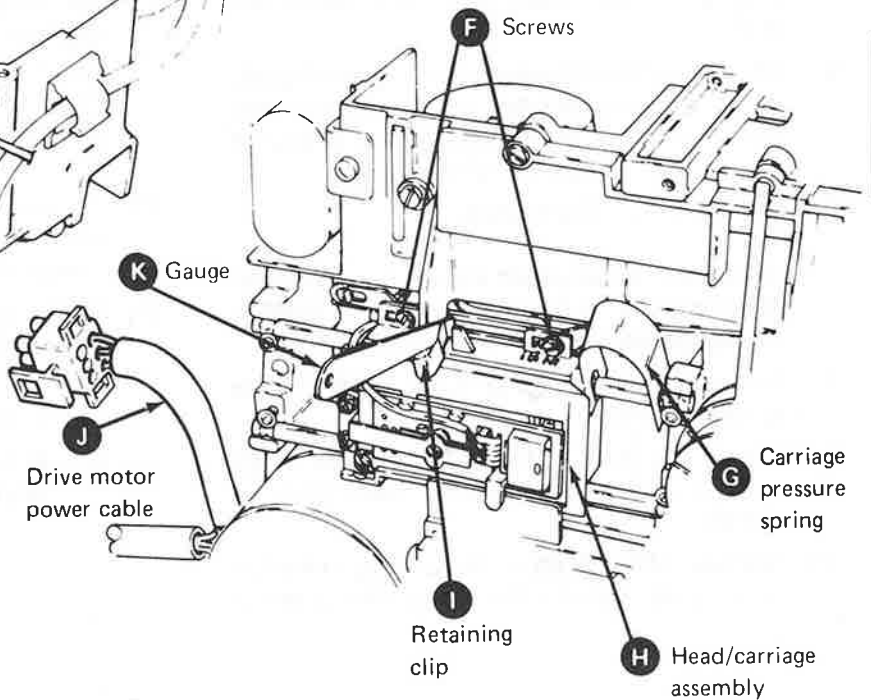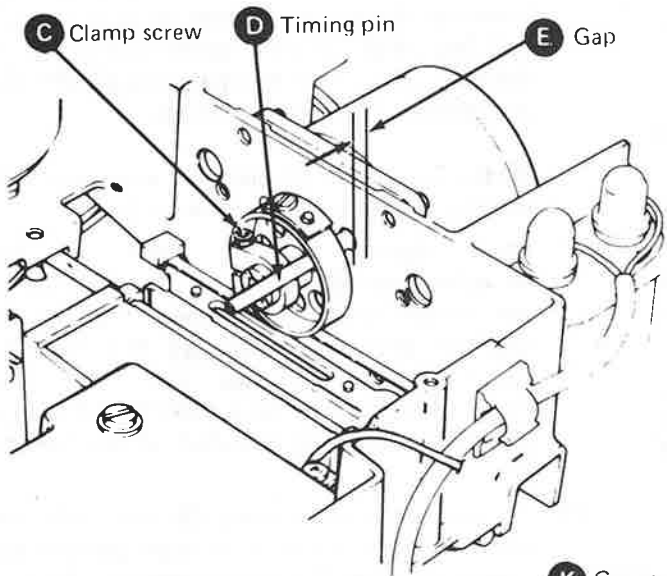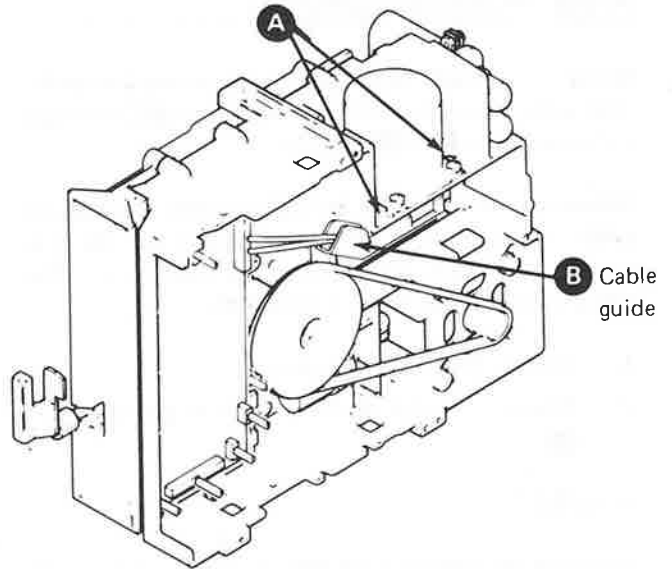
Diskette drive

1530 Head/carriage assembly (continued)

Adjustment (using jumpers)

Note: This procedure uses jumpers on the disk-ette drive control card to move the head/carriage between cylinders 39 and 40.

Warning: Adjust the head/carriage assembly with the diskette drive installed (or in the same position as when installed) or the adjustment may not be accurate.

1. Switch off the 5324 power.
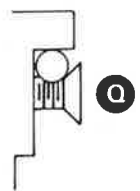2. Disconnect the ac drive motor power cable **N**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

3. Remove the cable guide **G** (squeeze at **F**; push the cable guide down).
4. Measure and record the gap **J** between the stepper motor pulley and the casting.
5. Loosen the pulley clamp screw **H** so the stepper motor shaft can turn inside the pulley.
6. Move the head/carriage to approximately align the timing pointer with the timing block on the casting; the head/carriage is now at cylinder 40. Insert the timing pin **I**.
7. Switch on the 5324 power.

    Warning: To prevent damaging the card, the jumpers to be inserted in the following steps must be on the correct pins.

8. Connect a jumper **D** (ground) to **C** (disable stepper motor).
9. Connect a jumper from **E** (ground) to **B** (MC-0) to detent the stepper motor at cylinder 40.
10. Maintain the gap **J** at the casting (recorded in Step 4); tighten the pulley clamp screw

H. Ensure that the timing pin **I** passes freely through the stepper motor pulley into the timing slot in the casting.

11. Remove the timing pin **I**.
12. Loosen the two carriage clamping screws **K**.
13. Remove the jumper end from **B** (MC-0); install it on **A** (MC-3) to move the stepper motor to cylinder 39.
14. Remove the jumper end from **A** (MC-3); install it on **B** (MC-0). This moves the stepper motor back to cylinder 40.
15. Verify that this is cylinder 40 by checking that the timing hole in the pulley lines up with the timing slot in the casting.
16. Insert a 0.51-mm (0.020-in.) gauge **O** between the timing pointer on the carriage and the timing block. Fasten the gauge to the casting with the retaining clip **P** (the clip is stored on the diskette guide).

    Note: To ensure an accurate measurement, remove the gauges from the holder.

17. Press lightly at the front of the head/carriage **M** so it just touches, but is not forced against, the gauge. Insert the carriage pressure spring **L** between the casting and carriage to hold the head/carriage assembly against the gauge (the pressure spring is stored on the diskette guide).
18. Tighten the two screws **K** that hold the carriage to the bracket; remove the carriage pressure spring **L** and the retaining clip **P**.
19. Verify the gap between the timing pointer and the timing block as follows:
    a. A 0.51-mm (0.020-in.) gauge **O** should fit tightly.
    b. A 0.53-mm (0.021-in.) gauge should not fit.

Note: Because of the torque characteristics of the stepper motor, if Step 19 must be repeated, start the sequence with Step 13.

20. Switch off the 5324 power; remove the jumpers.

21. Snap the cable guide **G** into the holes in the casting.

22. Connect the ac drive motor power cable **N**.

23. Store the retaining clip **P**, the carriage pressure spring **L** and the timing pin **I** on the diskette guide.

24. Verify head alignment by loading the diagnostic control program (DCP).

Diskette drive control card - 51TD   Diskette drive control card - 31SD

H Clamp screw   **I** Timing pin   **J** Gap

P Retaining clip

K Screws

O Gauge

N Drive motor power cable

Head/carriage assembly   **M**

L Carriage pressure spring

G Cable guide

Diskette drive

1530 Head/carriage assembly (continued)

Removal

1. Switch off the 5324 power.
2. (51TD) Insert a clean strip of paper between the heads.
3. Remove the cable guide **C** from the casting (squeeze at **B** and push the guide down); carefully disconnect the head cable **A** from the drive control card.

   Warning: The drive band must not be bent or damaged in any way.

4. Remove the two screws **I** that hold the head/carriage **K** to the carriage bracket **F**. to prevent damaging the drive band, give support to the carriage bracket **F** when the screws **I** are removed.
5. Remove the allen screws **M** (one at each end of the upper guide rod); slide the upper guide rod **G** out.
6. Carefully lift and turn the head/carriage assembly **K**; remove it from the lower guide rod **H**.

Replacement

1. Disconnect the ac drive motor power cable **O**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

   Warning: When installing the head/carriage assembly, ensure that the bail **N is under the tab **J** of the carriage assembly. (51TD) To prevent damaging the heads, insert a strip of clean paper between the head surfaces during installation.**

2. Carefully install the head/carriage assembly **K** on the lower guide rod **H**.
3. Install the upper guide rod **G**; tighten the two screws **M**. Ensure that the guide rod notch **L** is aligned with the screw and is seated as shown in **Q**.
4. Move the head/carriage assembly to approximately align the timing pointer with the timing block on the casting.
5. Install the screws **I** in the carriage bracket **F** so the screws are centered in the slots.
6. Connect the head cable **A** to the drive control card.
7. (51TD) Remove the paper from between the heads.
8. Loosen the drive band screw **E** (at the slotted end of the carriage bracket).
9. Block the head/carriage assembly **K** approximately 25.0 mm (1.0 in) from the rear of the casting.
10. With the force gauge **D** (part 460870), pull on the slotted end of the drive band with 0.907 ±0.113 kg (2.5 ±0.25 lb) of force; tighten the band clamping screw **E**. Ensure that the band is parallel to the bracket.
11. Move the head/carriage assembly back and forth and ensure that the drive band tracks correctly and that there is not movement up or down **P**. If the drive band tracking is not correct, adjust the drive band (1562), starting with Step 3.
12. If the drive band tracking is correct, perform the head/carriage adjustment, starting with Step 4.

A Head cable

B

C Cable guide

F Carriage bracket

E Screw

Paper clip

D Force gauge

O Drive motor power cable

N Bail

25.0 mm (1.0 in)

M Guide rod screws

G Upper guide rod

H Lower guide rod

I Carriage bracket screws

L Notch

J Tab

K Head/carriage assembly

Side view of pulley

P

No movement up or down

No movement up or down

Drive band must be parallel to pulley edge

Q
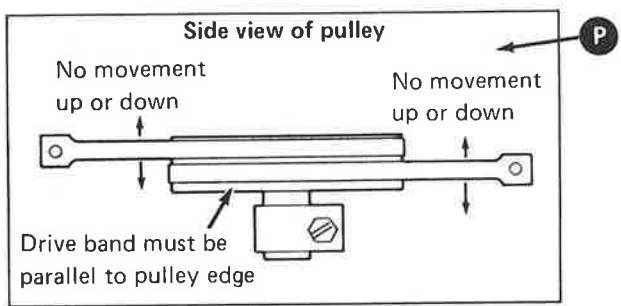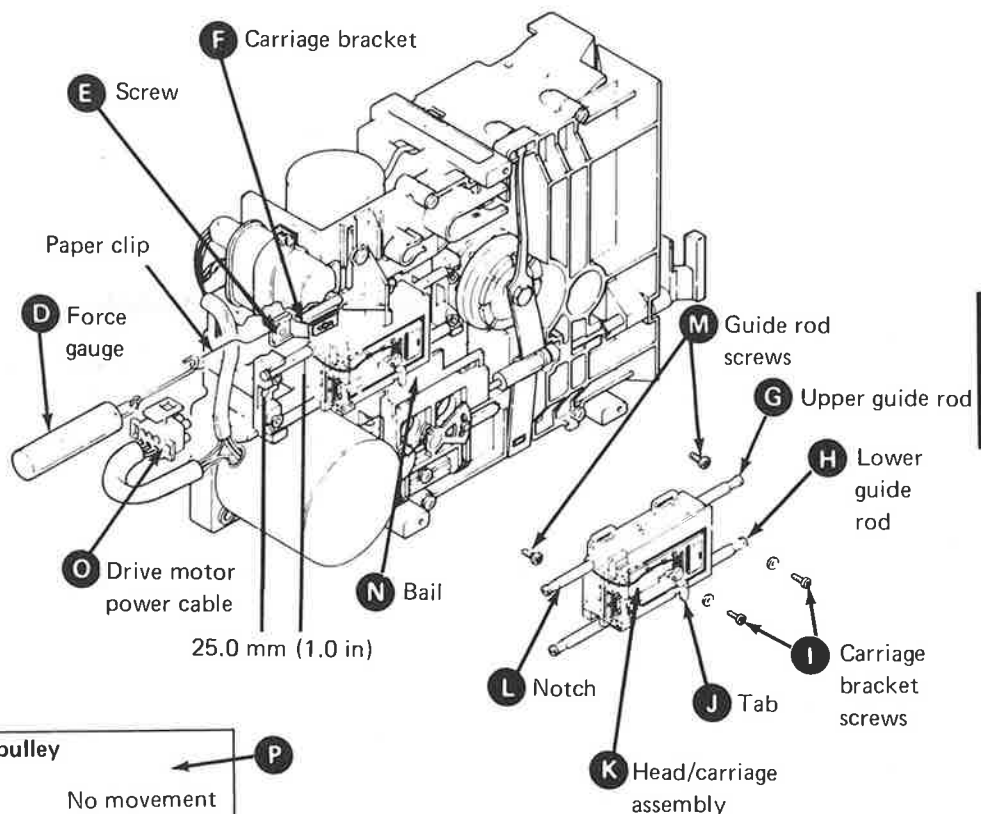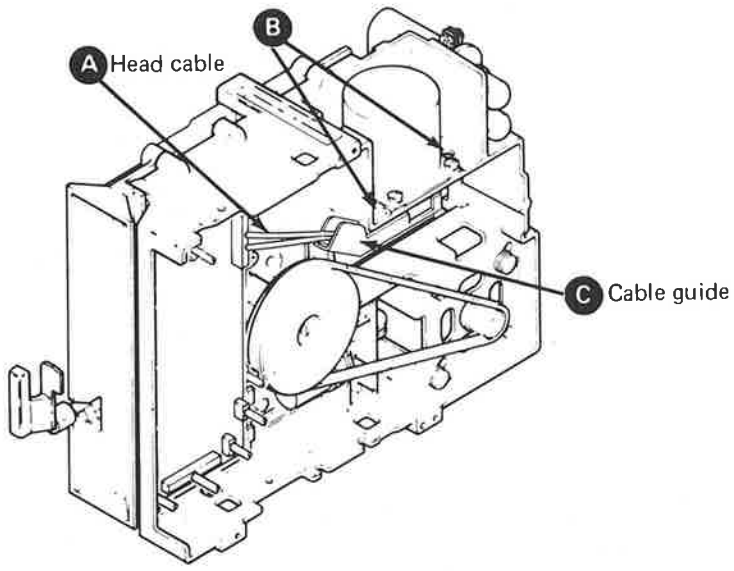
Diskette drive

Diskette drive

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1531 Head/carriage pressure pad (31SD only)

If the pressure pad is worn so it is even with the surface of the head load arm, exchange the pad. Use the pad replacement kit (part 2200751), which includes the pressure pad tool (part 2200750).

Warning: The head area can be easily damaged or contaminated. Ensure that your tools are clean; do not touch the pressure pad with your fingers or let the adhesive touch the pad surface that will contact the diskette. Do not use damaged pads or let the head load arm hit the read/write head.

Removal

1. Move the head load arm **C** away from the read/write head **A**.

2. Use the scissor clamp (part 9900233) to pull the worn pressure pad **B** off the head load arm.

3. Carefully remove any adhesive that remains on the pressure pad mounting surface; use

tissue (part 2162567) moistened with isopropyl alcohol (part 2200200) or an alcohol pad (part 9900679). If the surface is not completely clean, the new pad may not seat correctly.

Replacement

1. Lift off the paper cover that protects the adhesive layer on the new pad.

2. Use the scissor clamp to remove the new pressure pad from the other new pads.

3. Place the new pressure pad **B** in the center of its location on the head load arm **C**.

4. Use the small end of the pressure pad tool **D** (part 2200750); press the pressure pad into the head load arm.

5. Turn the tool one revolution in one direction only.

6. Carefully move the head load arm back to its operational position.
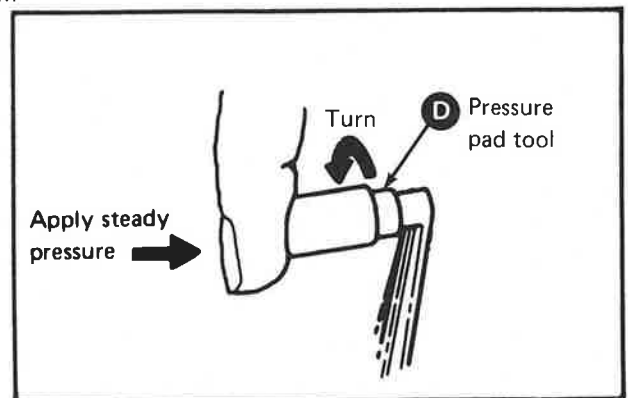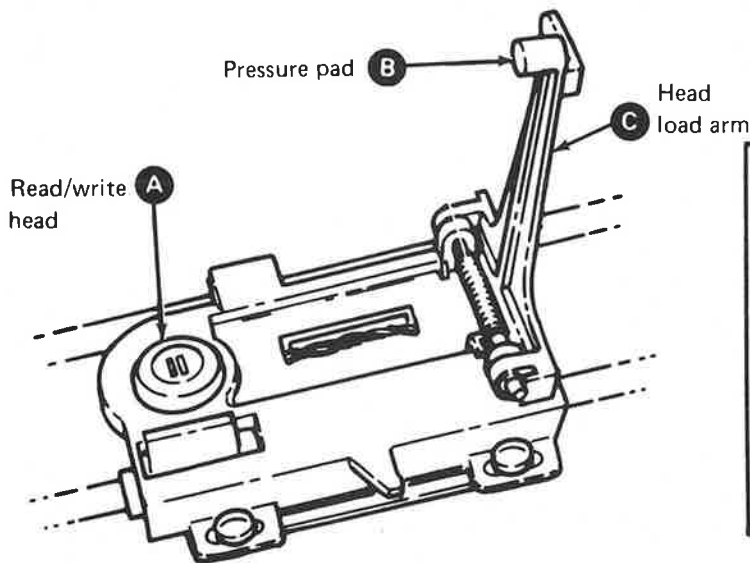
Pressure pad **B**

Head load arm **C**

Read/write head **A**

Turn — Pressure pad tool **D**

Apply steady pressure →

Diskette drive

1540 Head load solenoid and bail

Service check

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **F**.
3. Insert a diskette; close the diskette latch.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

4. Switch on the 5324 power.

   Warning: To prevent damaging the card, the jumpers to be inserted in the following steps must be on the correct pins.
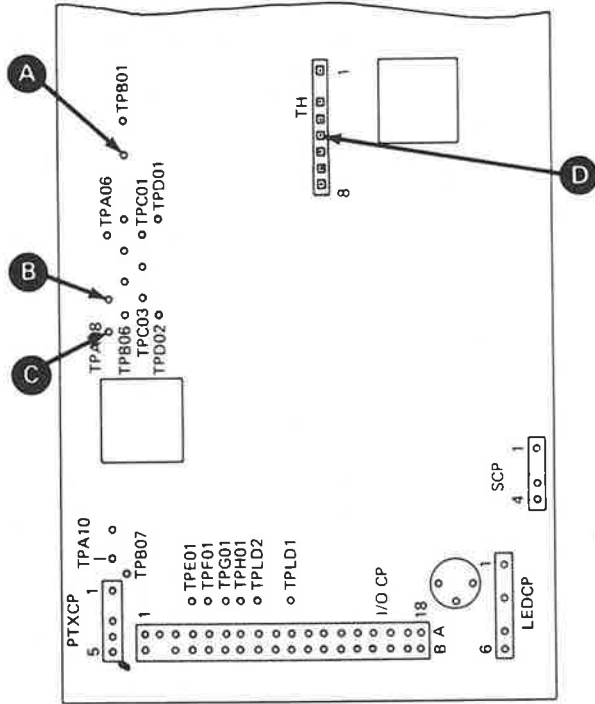
5. Connect a jumper from **B** (ground) to **C** (head load); the head load solenoid should be activated.
6. Connect a jumper from **A** (ground) to **D** (disable stepper motor).

CAUTION
The solenoid case becomes hot after continuous use.

7. Check for a 0.3 to 0.7-mm (0.012 to 0.028-in.) gap **E** between the bail and the tab on the carriage assembly for all of the carriage movement (cylinder 00 to cylinder 76).
8. Remove the jumpers installed in Steps 5 and 6; remove the diskette.
9. Switch off the 5324 power.
10. With the head load solenoid de-activated and the diskette latch closed:

    0(31SD) Visually check for a gap **G** of 3.0 to 4.0 mm (0.118 to 0.157 in.) between the head and the head load arm.

    0(51TD) Visually check for gap **G** of 2.0 to 3.0 mm (0.079 to 0.118 in.) between the head surfaces.

11. Connect the ac drive motor power cable **F**.
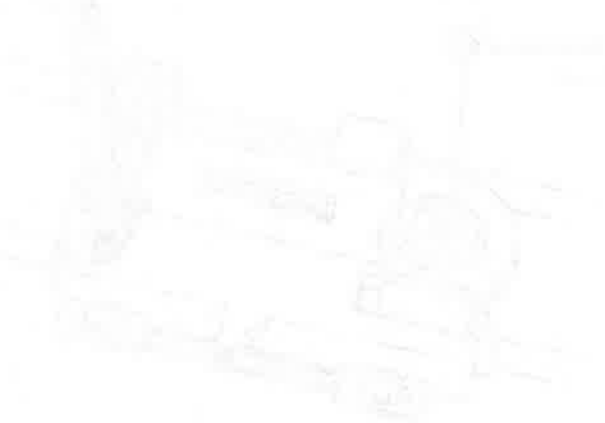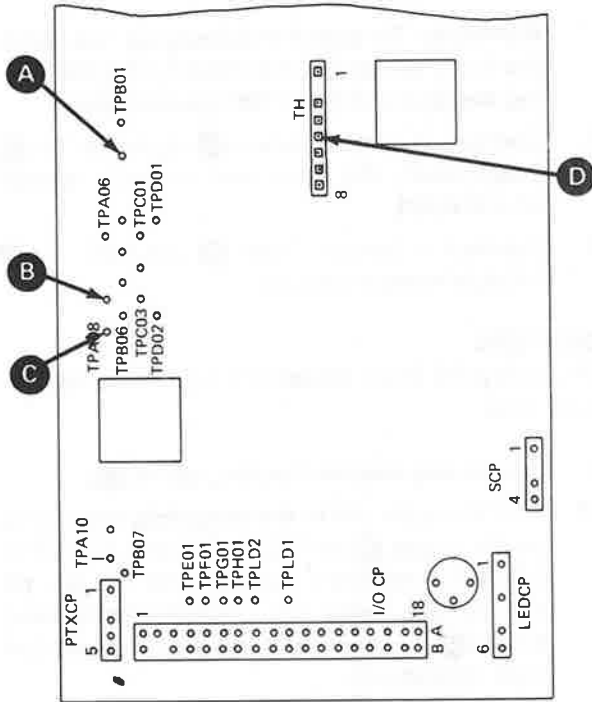
Diskette drive control card - 51TD

TPB01

A

TPA06
TPC01
TPD01

TH

1

8

D

B

TPA08
TPB06
TPC03
TPD02

C

SCP

1

4

PTXCP
TPA10
TPB07

TPE01
TPF01
TPG01
TPH01
TPLD2
TPLD1

I/O CP

5

1

1

B A

18

LEDCP

6

1

Diskette drive control card - 31SD

A

TPC04
TPD01
TPE01
TPF01
TPG01

TH

1

6

D

B

TPB01

TPA01
TPC04
TPE03

TPF02
TPG02
TPH05

TPHLD

C

TPLED

SCP

1

4

TP24V

PTXCP

4

1

I/O CP

B A

1

18

B A
2 1
LEDCP

F Drive motor
power cable

Close

Open

E Gap

G Gap
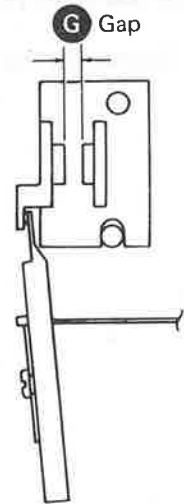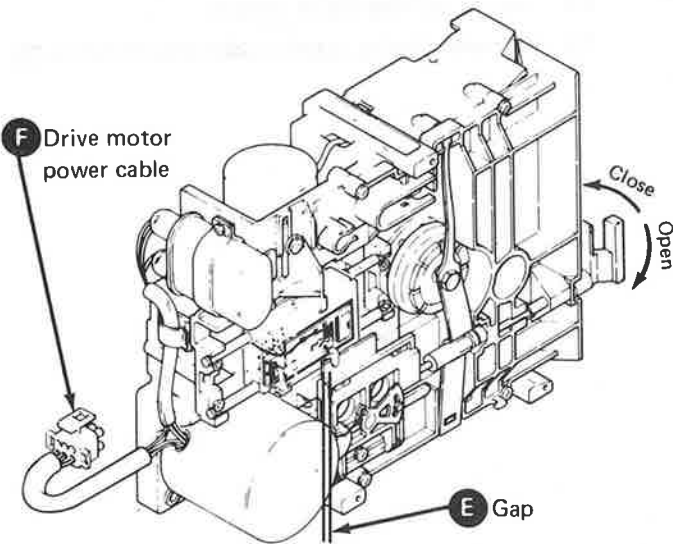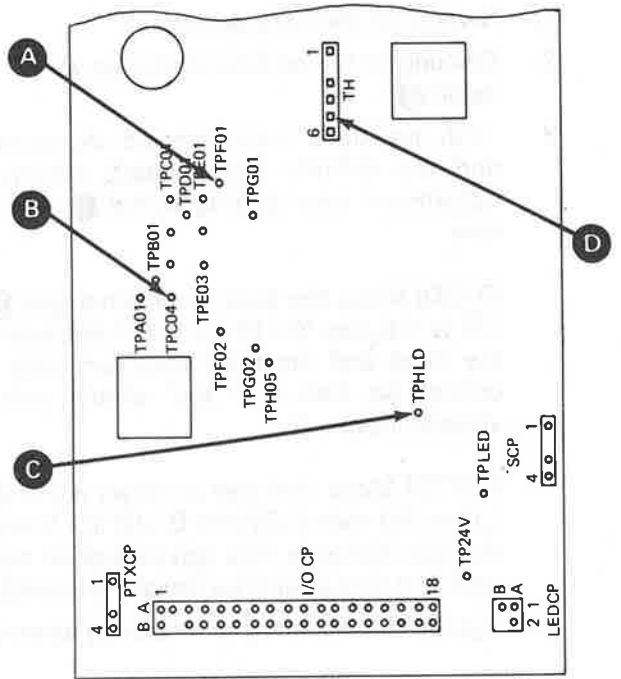
Diskette
drive

Diskette drive

1540 Head load solenoid and bail (continued)

Adjustment

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **G**.
3. With the head load solenoid de-activated and the diskette latch closed, loosen the adjustment lever locking screw **F** one-half turn.

   (31SD) Move the lever to obtain a gap **I** of 3.0 to 4.0 mm (0.118 to 0.157 in.) between the head and the head load arm (this gap cannot be measured and should only be visually checked).

   0(51TD) Move the lever to obtain a gap **I** of 2.0 to 3.0 mm (0.079 to 0.118 in.) between the head surfaces (this gap cannot be measured and should only be visually checked).

4. Tighten the adjusting lever locking screw **F**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

5. Switch on the 5324 power.

6. Insert a diskette; close the diskette latch.

   Warning: To prevent damaging the card, the jumpers to be installed in the following steps must be on the correct pins.

7. Connect a jumper from **B** (ground) to **C** (head load); the head load solenoid should be activated.

8. Connect a jumper from **A** (ground) to **D** (disable stepper motor).

CAUTION
The solenoid case becomes hot after continuous use.

9. Loosen the solenoid locking screw **H**.

10. Turn the solenoid in the mounting bracket to obtain a gap **E** of 0.3 to 0.7 mm (0.012 to 0.028 in.) between the bail and the tab on the carriage assembly. Tighten the locking screw **H**. Check the gap **E** at each end of head movement.

11. Remove the jumpers installed in Steps 7 and 8; remove the diskette.

12. Switch off the 5324 power.

13. Connect the ac drive motor power cable **G**.

Diskette drive control card - 51TD

Diskette drive control card - 31SD

G Drive motor power cable

Close
Open

F Locking screw

E Gap

H Locking screw

I Gap
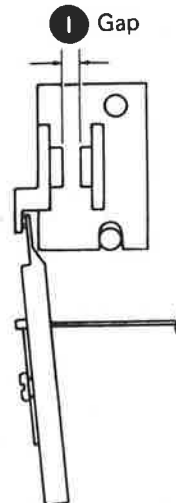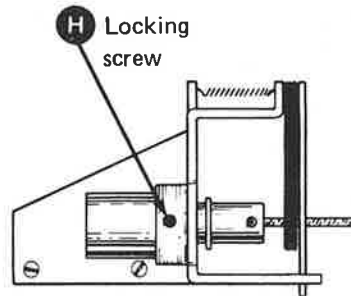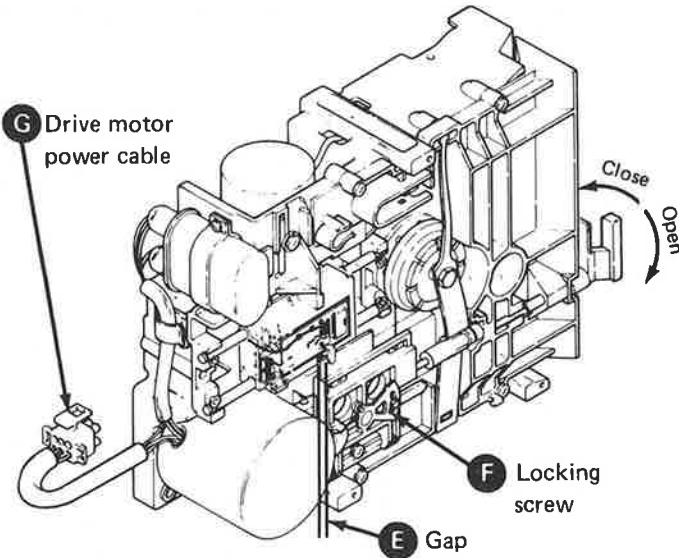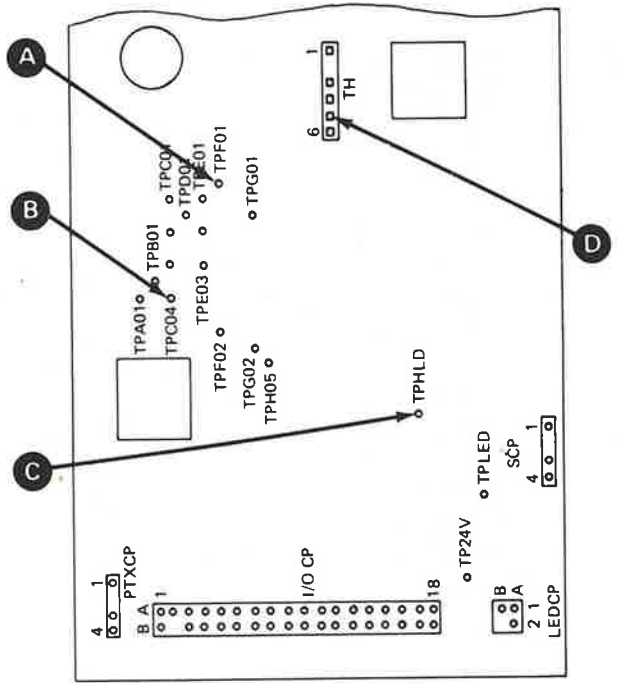
Diskette drive

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1541 Head load bail

Removal

1. Switch off the 5324 power; move the head/carriage to the rear of the machine.

2. (51TD) Insert a clean strip of paper between the heads.

3. Close the diskette latch.

4. Push the head load bail **C** in slightly, and disconnect the bail actuating cable eyelet **F** from the bail.

   Warning: Do not let the bail return spring E, located between the head load bail and the diskette guide A, fall out. (51TD) Do not let the heads snap together when the bail is removed from under the tab G on the head/carriage assembly.

5. Remove the mounting screw **B** and washer; remove the head load bail **C**, with the pivot

rod **D**, from under the tab **G** on the head/carriage assembly.

Replacement

1. Install the head load bail **C** and the pivot rod **D** under the tab **G** on the head/carriage assembly. Ensure that the bail return spring **E** is placed correctly between the bail and the diskette guide.

2. Push the head load bail in slightly and connect the bail actuating cable eyelet **F**.

3. (51TD) Remove the paper from between the heads.

4. Perform the head load solenoid and bail service check (1540).

A Diskette guide

Close

Open

B Mounting screw

C Bail

F Cable eyelet

G Head/carriage assembly

E Spring

D Pivot rod
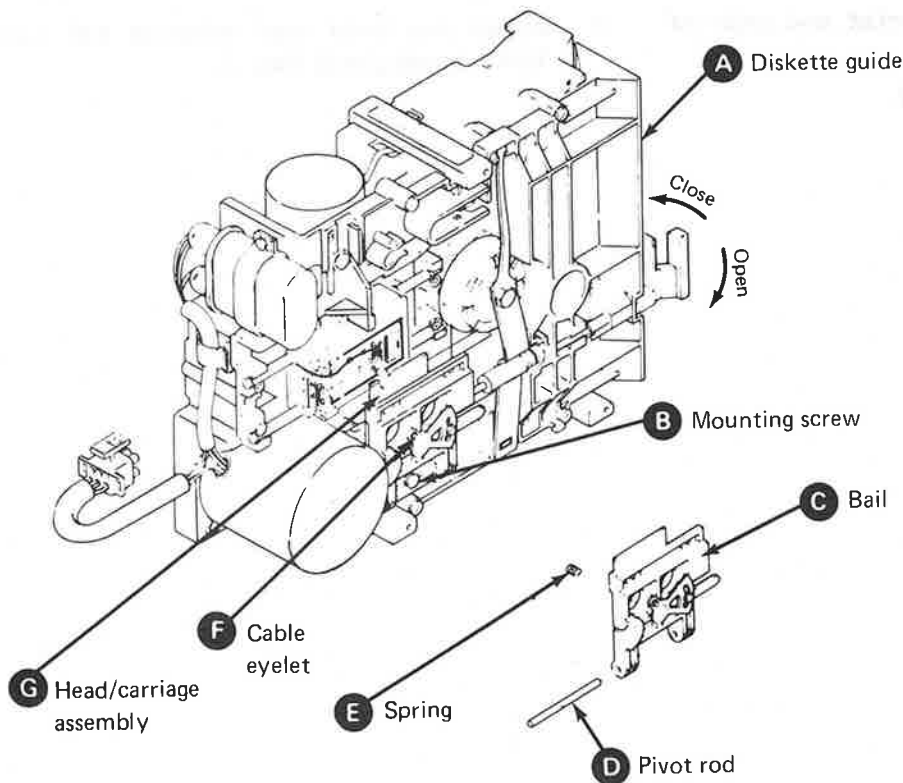
Diskette drive

1542 Head load solenoid and idler

Removal

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **C**.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

3. Close the diskette latch.
4. (51TD) Insert a clean strip of paper between the heads.
5. Push the bail **B** in slightly and disconnect the bail actuating cable eyelet from the bail.
6. Open the diskette latch.
7. Remove the ac drive motor belt **D**.
8. Disconnect the solenoid cable **A** from the diskette drive control card.
9. Remove the solenoid, bracket, and cable as a unit **G**.
10. Remove the idler pulley **E**.

11. Loosen the solenoid locking screw **F**; unscrew the solenoid **H** from the bracket (the solenoid and bail actuating cable are one unit).

Replacement

1. Install the solenoid idler **E**.
2. Install the solenoid and bail actuating cable **H** on the bracket.
3. Install the solenoid, bracket, and cable as a unit **G**.
4. Connect the solenoid cable **A** to the diskette drive control card.
5. Install the ac drive motor belt **D**.
6. Close the diskette latch.
7. Push the bail in slightly and connect the bail actuating cable eyelet to the bail **B**; ensure that the cable is around the solenoid idler pulley.
8. Adjust the head load solenoid and bail 1540), starting with Step 2.

A Solenoid cable

D Drive belt

E Idler pulley

F Locking screw

H Solenoid

G Assembly

C Drive motor power cable

Close

Open

B Bail
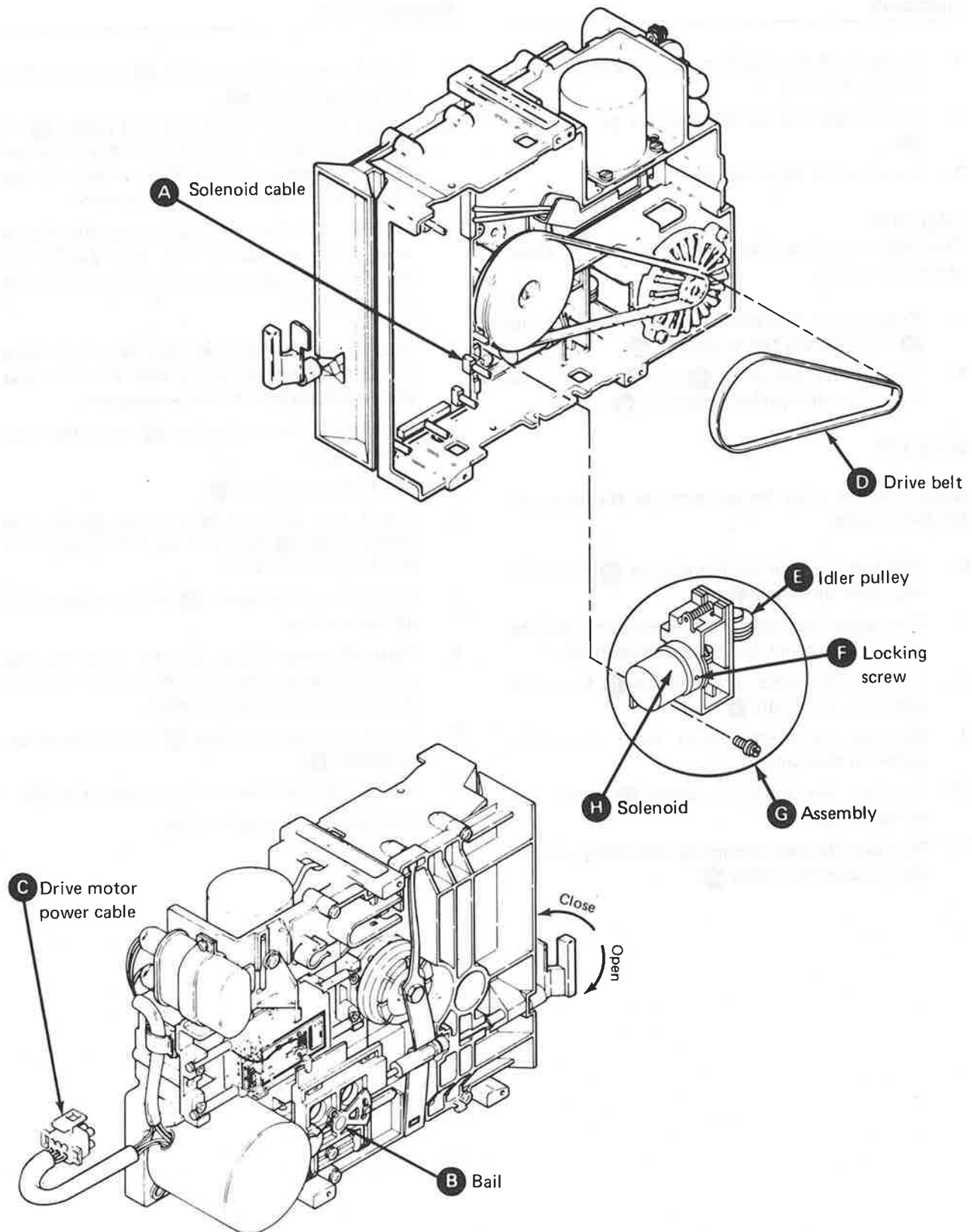
Diskette drive

1550 AC drive motor

Removal

1. Switch off the 5324 power; disconnect the ac power cable.
2. Disconnect the ac drive motor power cable **B**.
3. Remove the drive belt **I**.

CAUTION
The drive motor case becomes hot after continuous use.

4. Remove the two enclosure mounting screws **J**; remove the fan enclosure **H**.
5. Loosen the setscrew **F**; remove the drive motor fan and pulley assembly **G**.

DANGER

High voltage may be present at the capacitor terminals.

6. Remove the two insulator caps **D** from the capacitor terminals **C**.
7. Discharge the capacitor by shorting out its terminals with an insulated screwdriver.
8. Remove the drive motor leads **E** from the capacitor terminals **C**.
9. Remove the motor leads from the cable guide on the casting.
10. Remove the insulator caps **D** from the motor leads.
11. Remove the two remaining mounting screws **K**; remove the motor **A**.

Replacement

1. Install the ac drive motor **A** with the two mounting screws **K**.
2. Install the drive motor fan and pulley **G** on the motor shaft. Ensure that the setscrew **F** is centered on the flat surface of the motor shaft; leave the setscrew loose.
3. Position the fan and pulley on the motor shaft with a gap of 0.5 mm (0.020 in.) between the motor and the fan hub; tighten the setscrew.

Warning: Ensure that the fan enclosure is installed so the drive belt fits into the recessed portion of the enclosure.

4. Install the fan enclosure **H** with the two screws **J**.
5. Install the drive belt **I**.
6. Install the two insulator caps **D** on the motor leads **E** (one cap on lead 1 and one cap on leads 2 and 3).
7. Install the motor leads **E** in the cable guide on the casting.
8. Connect motor leads 2 and 3 to the top capacitor terminals; connect motor lead 1 to the bottom capacitor terminal.
9. Install the insulator caps **D** on the capacitor terminals **C**.
10. Connect the ac drive motor power cable **B**.
11. Connect the ac power cable.

3 2 1

B Drive motor power cable

C Capacitor terminals

D Insulator caps

3 2 1

A AC drive motor

E Motor leads

F Setscrew

G Fan and pulley

H Fan enclosure

I Drive belt

J Screws

K Screws
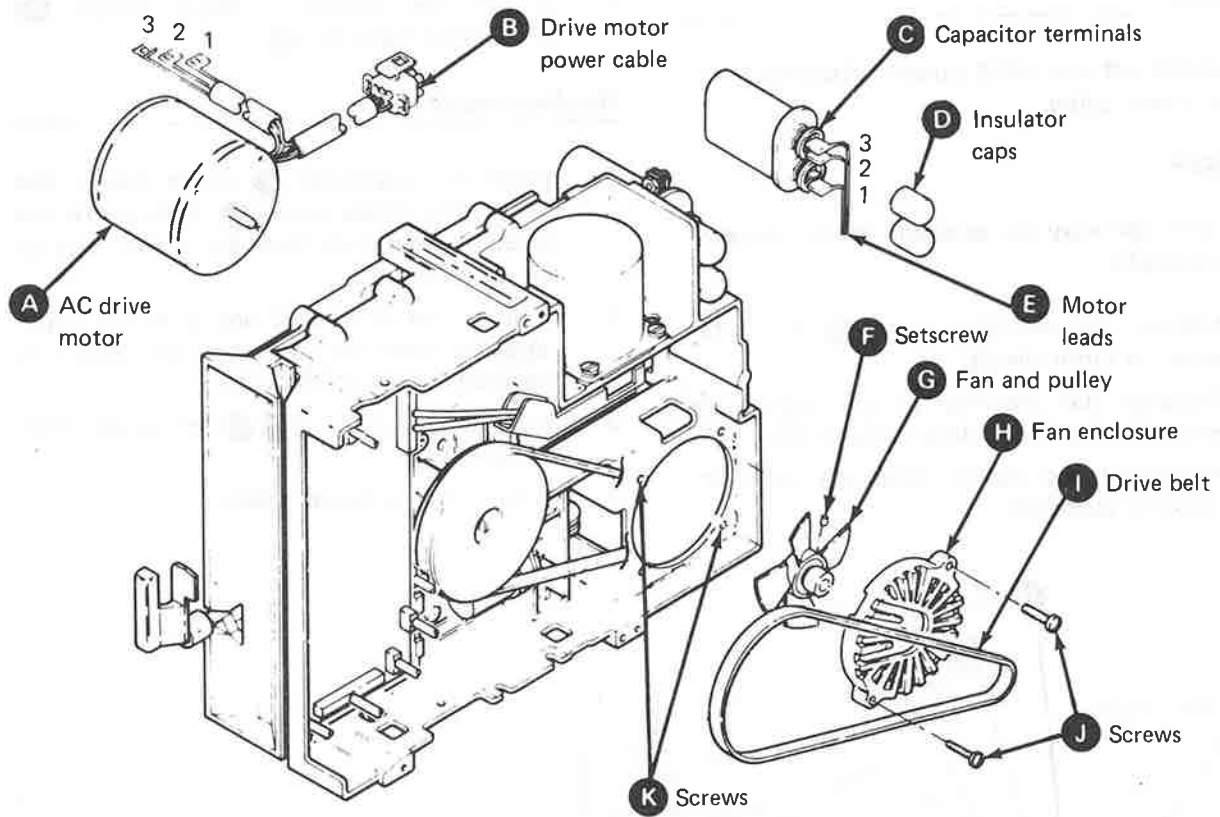
Diskette drive

1551 Capacitor

Removal

1. Switch off the 5324 power; disconnect the ac power cable.

DANGER

High voltage may be present at the capacitor terminals.

2. Remove the insulator caps **A** from the capacitor terminals **B**.

3. Discharge the capacitor by shorting out its terminals with an insulated screwdriver.

4. Disconnect the motor leads **E** from the capacitor terminals.

5. Loosen the capacitor clamp screw **D**; remove the capacitor **C**.

Replacement

1. Install the capacitor **C** in its clamp and tighten the clamp screw **D**; ensure that the capacitor terminals face the pulley side of the diskette drive.

2. Connect motor leads 2 and 3 to the upper capacitor terminal; connect motor lead 1 to the lower capacitor terminal.

3. Install the insulator caps **A** on the capacitor terminals **B**.

4. Connect the ac power cable.

B Capacitor terminals

C Capacitor

A Insulator caps   **D** Clamp screw

3
2
1

E Motor leads
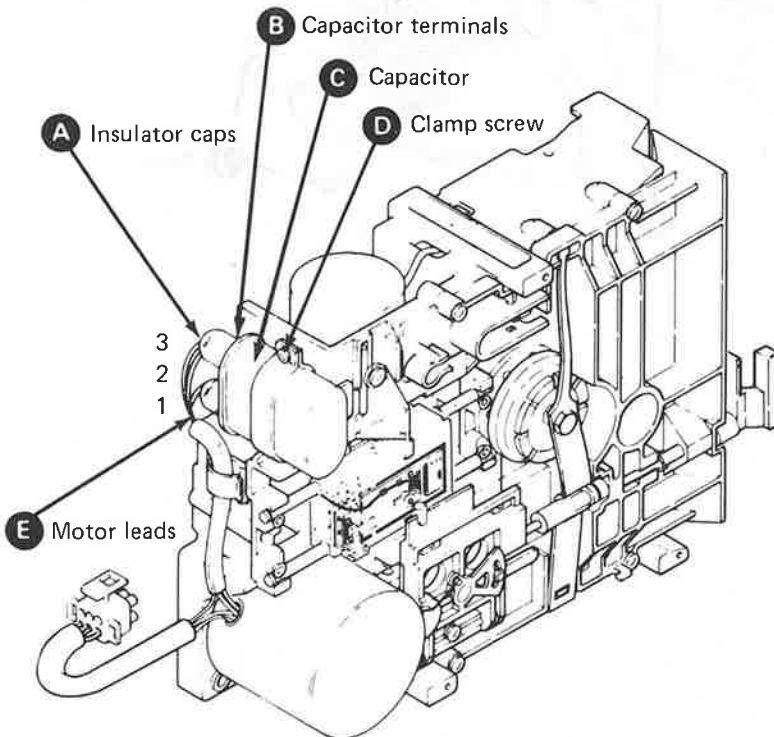
1552 AC drive belt and pulley

Removal

1. Switch off the 5324 power.
2. Remove the drive belt **D**.
3. Remove the two enclosure mounting screws **E**; remove the fan enclosure **C**.
4. Loosen the setscrew **A**; remove the drive motor fan and pulley assembly **B**.

Replacement

1. Install the drive motor pulley and fan **B** on the motor shaft, with the setscrew **A** centered on the flat surface of the shaft (leave the setscrew loose).
2. Position the fan and pulley on the motor shaft with a gap of 0.5 mm (0.020 in.) between the motor and the fan hub; tighten the setscrew.

   Warning: Ensure that the fan enclosure is installed so the drive belt fits into the recessed portion of the enclosure.

3. Install the fan enclosure **C** with the two screws **E**.
4. Install the drive belt **D**.

A Setscrew

B Fan and pulley

C Fan enclosure

D Drive belt

E Screws
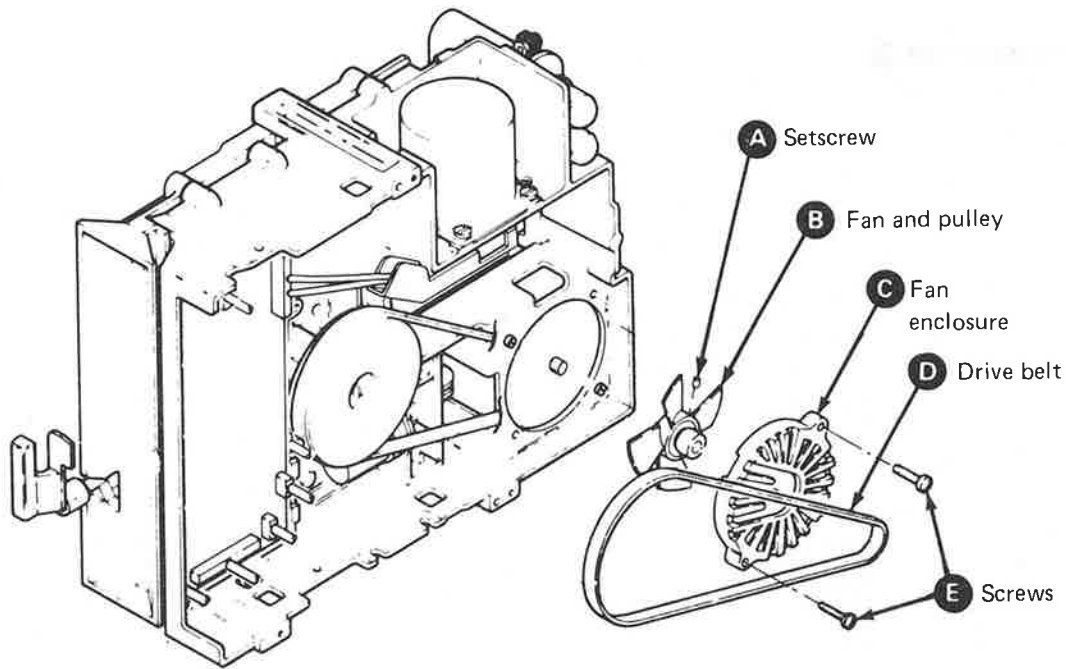
Diskette drive

1560 Stepper drive motor

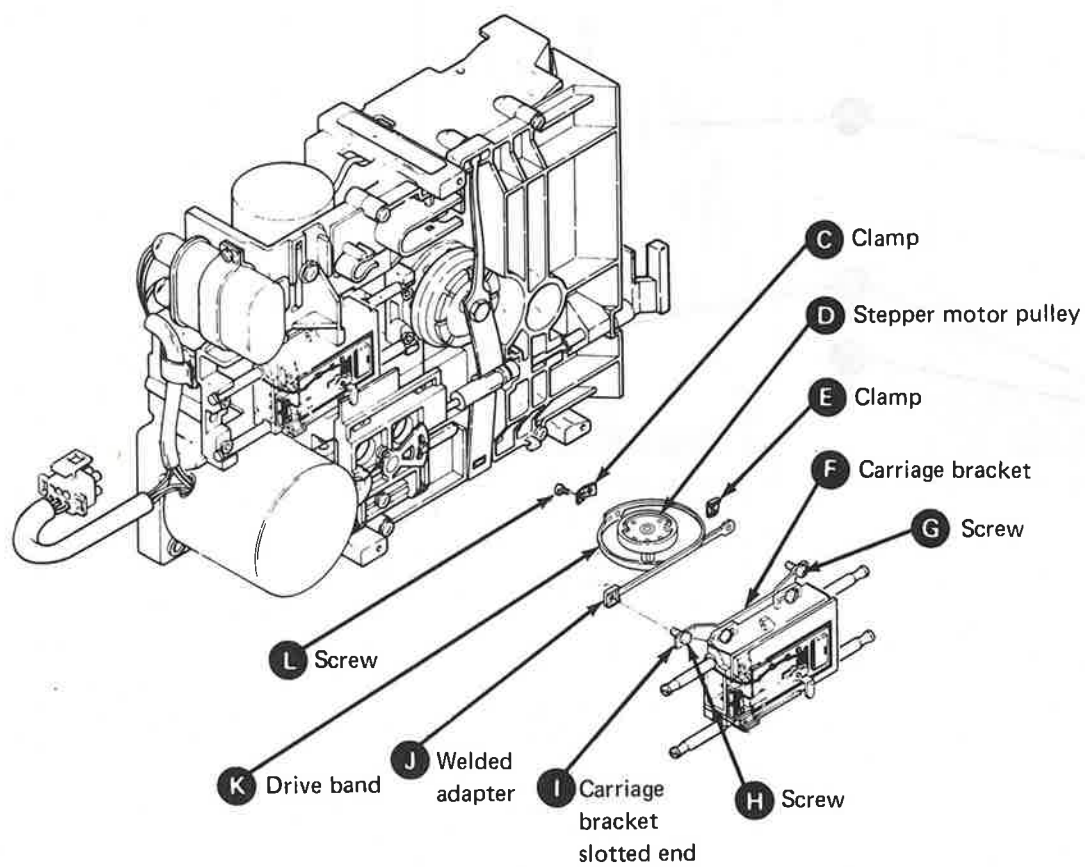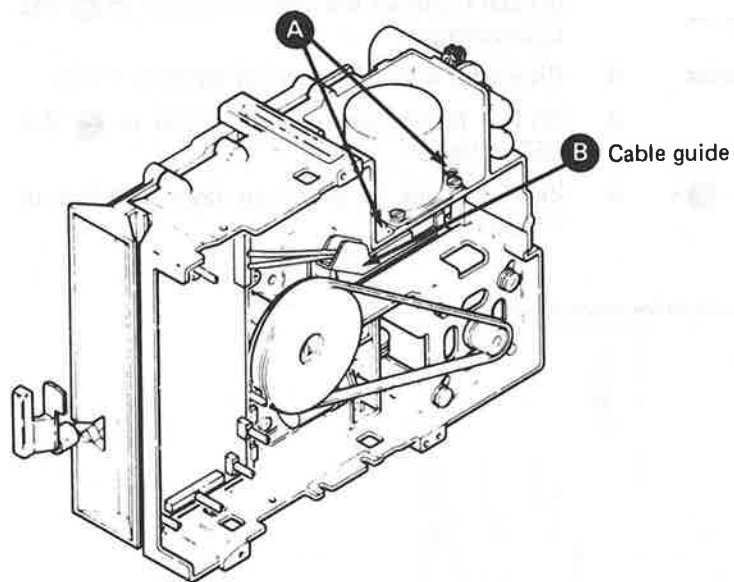### Removal

Warning: The drive band assembly can be easily damaged. Be careful not to bend the drive band.

1. Switch off the 5324 power.
2. Disconnect the stepper motor cable **A** from the diskette drive control card.
3. Remove the cable guide **E**; squeeze at **C** and push the cable guide down.
4. Measure and record the gap **G** between the stepper motor pulley **H** and the casting.
5. Loosen the clamp screw **F**. To prevent damaging the drive band, give support to the pulley **H** before removing the stepper motor.
6. Remove the four stepper motor mounting screws **D**.
7. Remove the stepper motor **B**.

Replacement

1. Install the stepper motor **B** with the four mounting screws **D**; position the motor cable toward the diskette drive control card.
2. Connect the stepper motor cable **A** to the diskette drive control card.
3. Set the gap **G** (recorded in step 4 of the removal procedure) and tighten the clamp screw **F**.
4. Snap the cable guide **E** into the casting.
5. Perform the head/carriage assembly service check (1530).

B Stepper motor

A Stepper
motor cable

C

D Screws (4)

E Cable guide

F Clamp screw   G Gap

H Pulley

I Timing pin
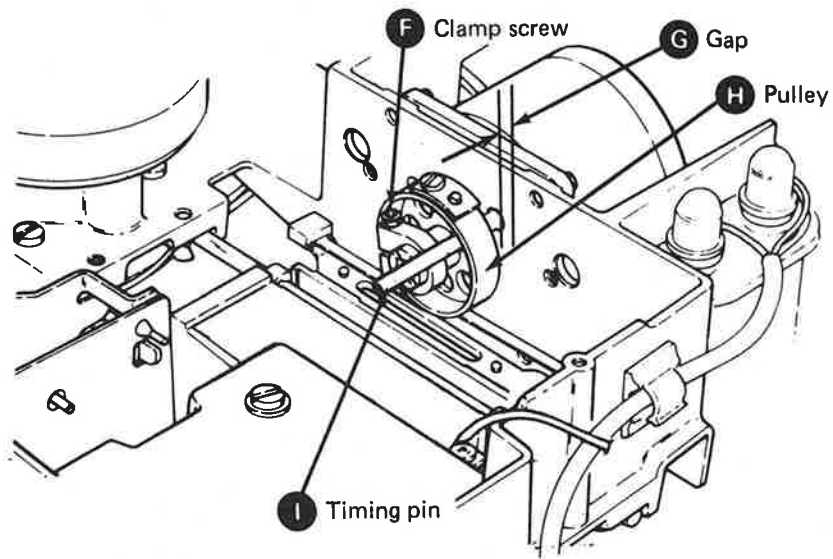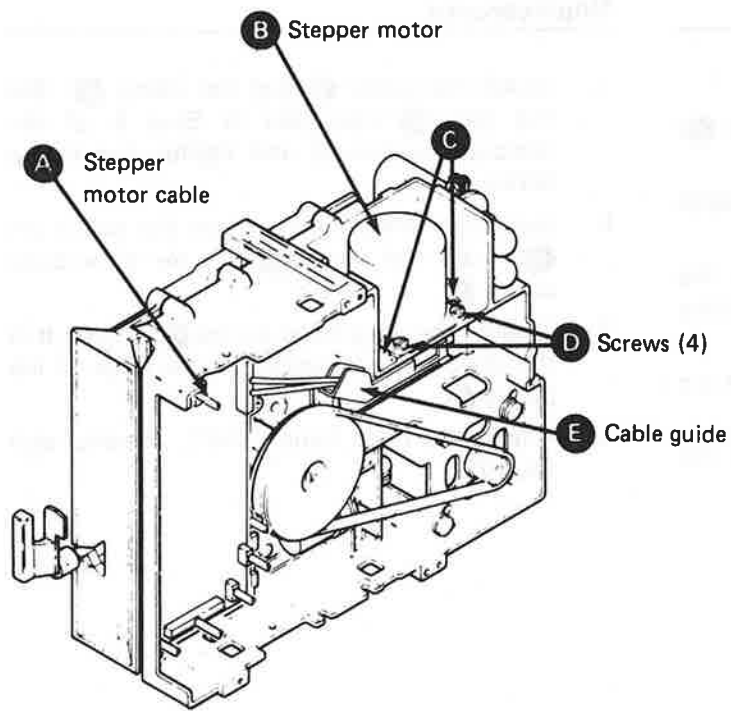
Diskette drive

1561 Stepper motor pulley and clamp

Removal

1. Switch off the 5324 power.
2. Remove the cable guide **L** (squeeze at **K**; push the cable guide down).
3. Remove the drive bank screw **C** and clamp **D**.
4. Loosen the drive band screw **I**; (leave the drive band end **J** loose to release the drive band tension on the pulley pin **G**).
5. Measure and record the gap **E** between the stepper motor pulley **F** and the casting.
6. Loosen the clamp screw **A**; remove the clamp **B** and the pulley **F**.

Replacement

1. Install the pulley **F** and the clamp **B**. Set the gap **E** (recorded in Step 5 of the removal procedure) and tighten the clamp screw **A**.
2. Install the drive band end on the pulley pin **G**; install the clamp **D** and the drive band screw **C**.
3. Tighten the drive band screw **C**; ensure that the drive band is parallel to the edge of the pulley **F**.
4. Adjust the drive band (1562), starting with Step 7.

A Clamp screw

B Pulley clamp

C Drive band screw

D Drive band clamp

E Gap

F Pulley

G Pulley pin

H Timing pin

K

L Cable guide

J Drive band end

I Screw
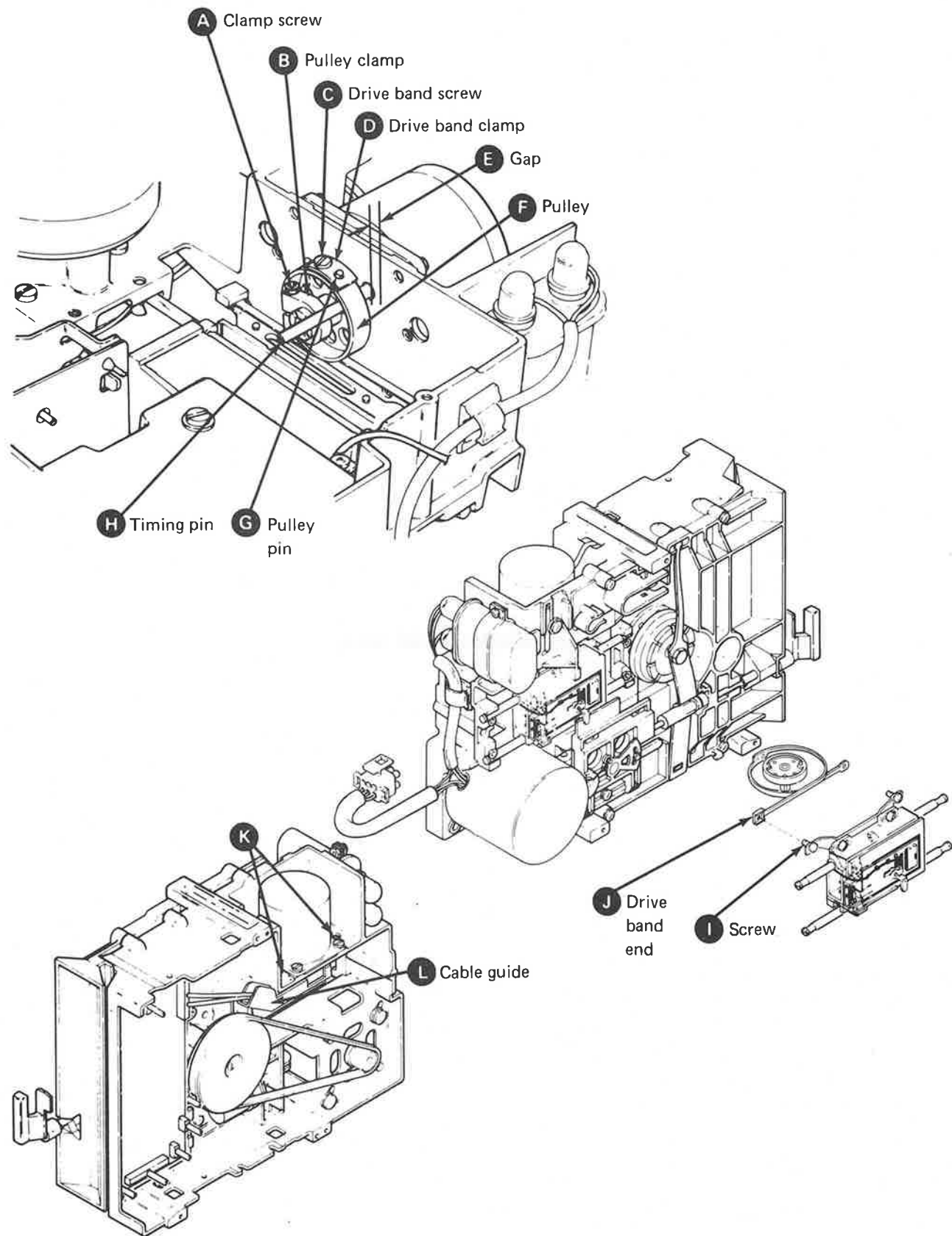
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1562 Drive band

Service check

1. Switch off the 5324 power.

2. Move the head/carriage assembly by hand between cylinders 00 and 76. The drive band should track without moving up or down on the pulley **B** as shown in **A**.

3. If the drive band does not track correctly, adjust the drive band.

4. Exchange the drive band if it is damaged.
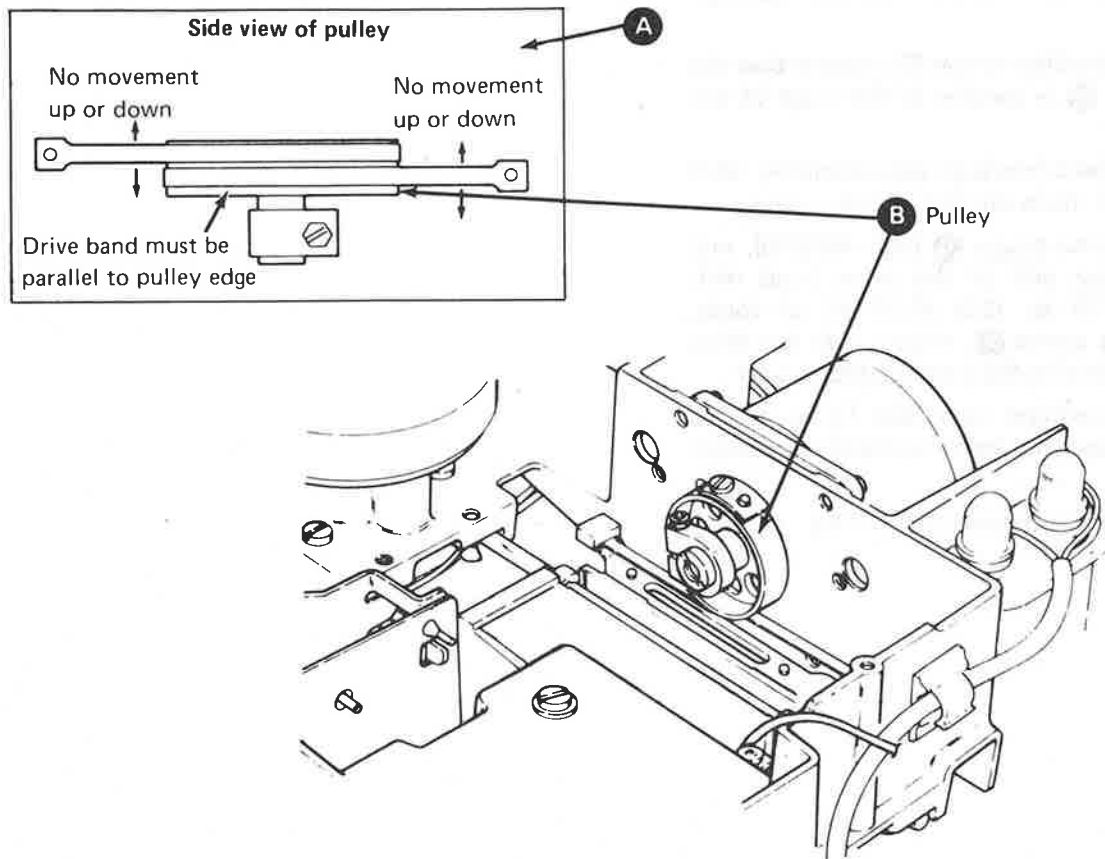
Diskette drive

1562 Drive band (continued)

Adjustment

1. Switch off the 5324 power.
2. Remove the cable guide **B** (squeeze at **A**; push the guide down).
3. Move the head/carriage assembly **E** to approximately align the timing pointer with the timing block on the casting (cylinder 40).
4. Loosen the two carriage bracket mounting screws **D** and **F** and the pulley screw **H**.
5. Tighten the mounting screw **D**; ensure that the drive band is parallel to the carriage bracket **C**.
6. Tighten the pulley screw **H**; ensure that the drive band **I** is parallel to the edge of the pulley **J**.
7. Block the head/carriage approximately 25.0 mm (1.0 in.) from the rear of the casting.
8. With the force gauge **G** (part 460870), pull on the loose end of the drive band with 0.907 ±0.113 kg (2.5 ±0.25 lb) of force. Tighten the screw **F**; ensure that the drive band is parallel to the carriage bracket **C**.
9. Move the carriage back and forth; ensure that the drive band tracks correctly as shown in **L**.
10. Adjust the head/carriage (1530), starting with Step 4.

A

B Cable guide

C Carriage bracket

Paper clip

G Force gauge

D Bracket mounting screw

E Head/carriage assembly

F Bracket mounting screw

25.0 mm (1.0 in)

H Screw

I Drive band

J Pulley

K Timing pin

Side view of pulley

No movement up or down

No movement up or down

L

Drive band must be parallel to pulley edge
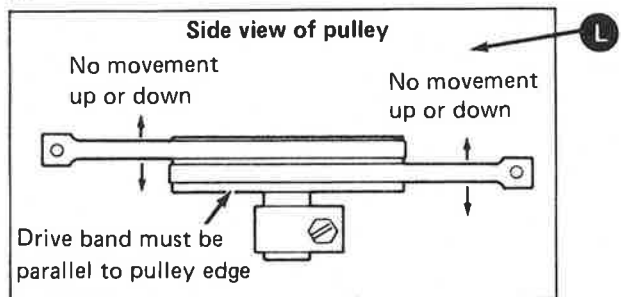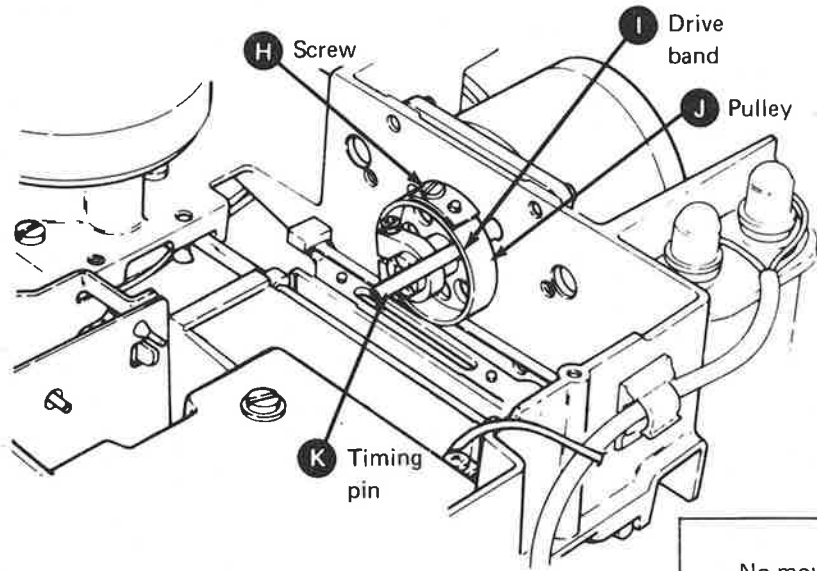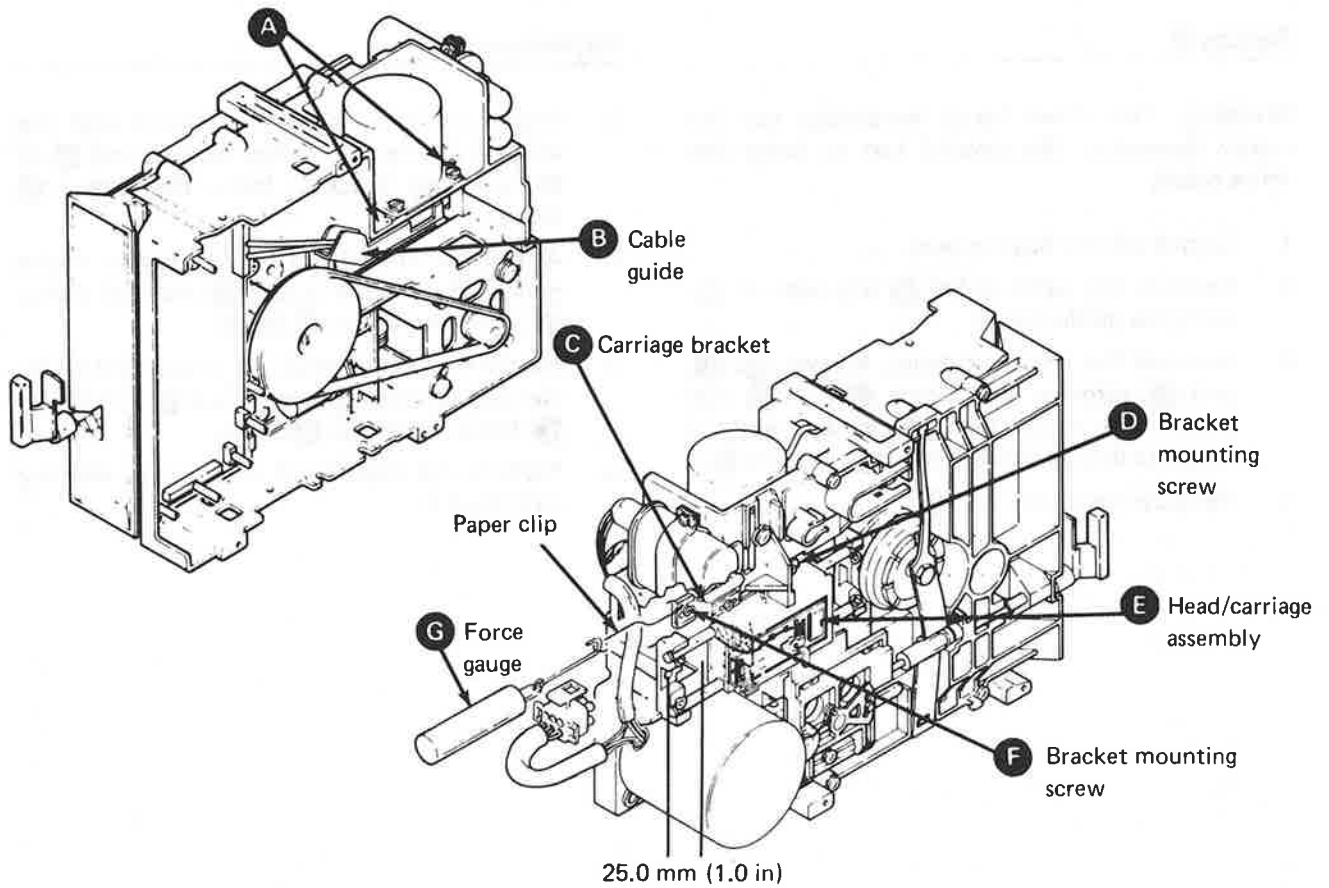
Diskette drive

Diskette drive

1562 Drive band (continued)

Removal

Warning: The drive band assembly can be easily damaged. Be careful not to bend the drive band.

1. Switch off the 5324 power.
2. Remove the cable guide **B** (squeeze at **A**; push the guide down).
3. Remove the three mounting screws **G**, **L**, and **H**; remove the clamps **C** and **E** that attach the drive band **K** to the stepper motor pulley **D** and the carriage bracket **F**.
4. Remove the drive band **K**.

Replacement

1. Attach the end of the drive band with the welded adapter **J** to the slotted end **I** of the carriage bracket; leave the screw **H** loose.
2. Attach the drive band to the stepper motor pulley **D** with the screw **L** and the clamp **C**; leave the screw **L** loose.
3. Attach the other end of the drive band to the carriage bracket **F** with screw **G** and clamp **E**; leave the screw **G** loose.
4. Perform the drive band adjustment, starting with Step 5.

B Cable guide

C Clamp

D Stepper motor pulley

E Clamp

F Carriage bracket

G Screw

L Screw

K Drive band

J Welded adapter

I Carriage bracket slotted end

H Screw

Diskette drive

1570 LED assembly

Output service check

1. Connect the negative probe of the CE meter to Ⓐ (ground).

2. Set the CE meter scale to 5 Vdc.

3. (31SD) Connect the positive probe to Ⓑ (31SD LED voltage).

(51TD) Connect the positive probe to Ⓑ (D2 LED voltage).

4. Check for a voltage level of 1Vdc to 2 Vdc.

5. (51TD) Move the positive probe to Ⓒ (D1 LED voltage).

6. (51TD) Check for a voltage level of 1 Vdc to 2 Vdc.

Diskette drive control card - 51TD
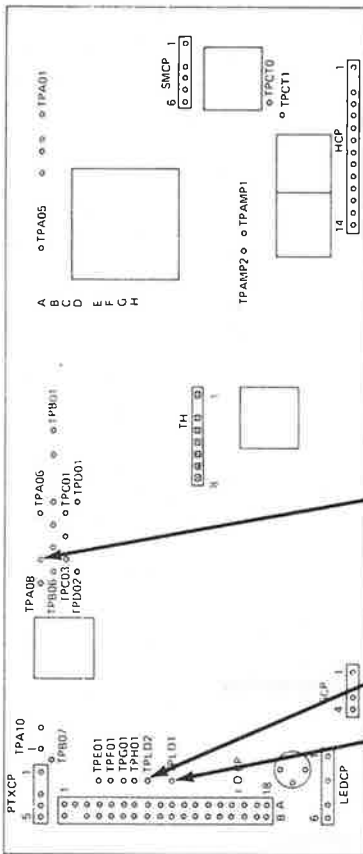
Diskette drive control card - 31SD
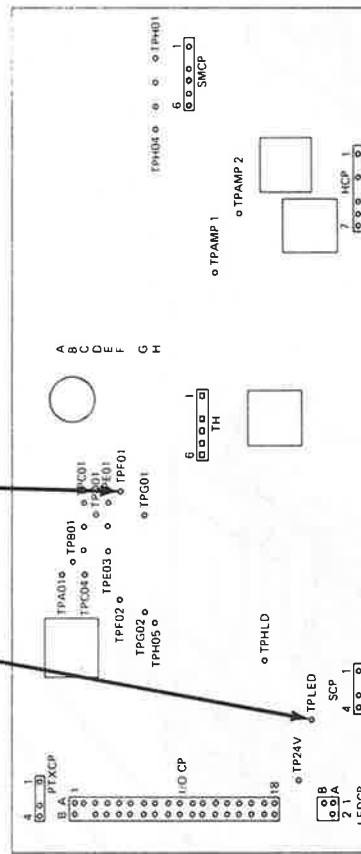
Removal

1. Switch off the 5324 power.
2. Remove the LED cable **C** from the diskette drive control card.
3. Remove the LED mounting screw **B**.
4. Remove the LED assembly **A** and the cable (note the cable path to make the replacement easier).

Replacement

1. Install the LED cable in the diskette guide; install the LED assembly **A** and the mounting screw **B**.
2. Connect the LED cable **C** to the diskette drive control card.

A LED assembly

B Mounting screw

C LED cable
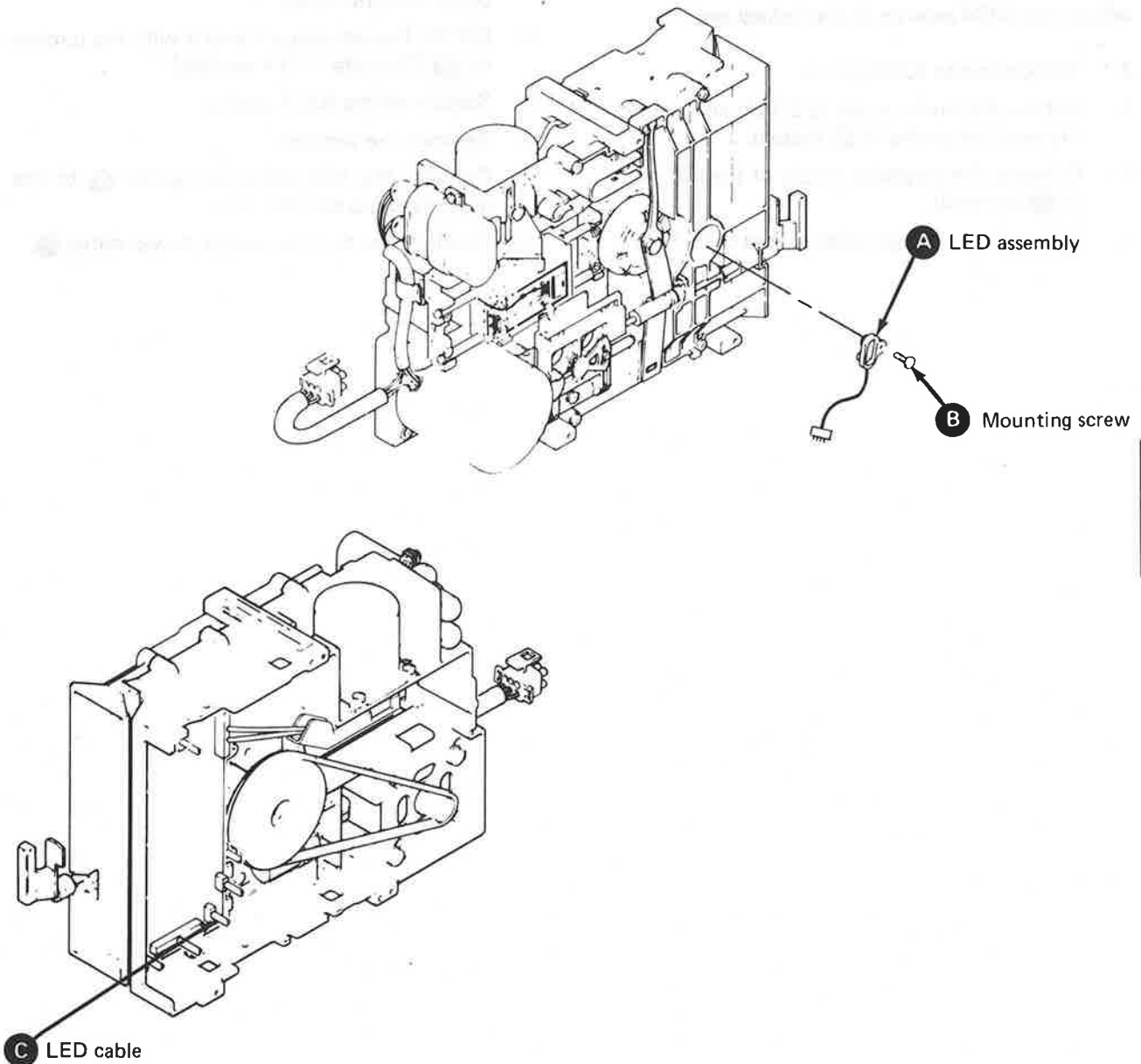
Diskette drive

Diskette drive

1571 PTX assembly

Output service check

1. Switch off the 5324 power.
2. Disconnect the ac drive motor power cable **F**.
3. Disconnect the PTX cable connector **G** from the diskette drive control card.

DANGER

Voltage is present at connectors J1 and J2 when the 5324 power is switched on.

4. Switch on the 5324 power.
5. Set the CE meter scale to 5 Vdc and connect the positive probe to **C** (index).
6. Connect the negative probe of the CE meter to **A** (ground).
7. Check for a voltage level of less than 1 Vdc.

8. (31SD) Connect one end of a jumper to **E** (PTX emitter); do not connect the other end.

   (51TD) Connect one end of a jumper to **E** (Diskette 2, 2D PTX emitter), do not connect the other end.

9. Watch the CE meter; touch the other end of the jumper to **B** Diskette 1 collector (51TD) or **B** PTX collector (31SD) several times. The CE meter should read 2.5 Vdc or more when **B** is touched (a false reading can occur the first time).

10. (51TD) Repeat steps 8 and 9 with the jumper on **D** (Diskette 1 PTX emitter).

11. Switch off the 5324 power.

12. Remove the jumper.

13. Connect the PIX cable connector **B** to the diskette drive control card.

14. Connect the ac drive motor power cable **F**.

Diskette drive control card - 51TD

Diskette drive control card - 31SD

A B C D E F G H

o TPB01

TH

A

TPA06 o
TPC01 o
TPD01 o

A

TPC01 o
TPD01 o
TPE01 o
TPF0; o
TPG01 o

C

TPB01 o
TPE03 o

TPA08 o
TPB06 o
TPC03 o
TPD02 o

TPA01 o
TPC04 o

TPF02 o
TPG02 o
TPH05 o

o TPHLD

SCP

4   1

B
C
D
E

TPA10
TPB07
TPE01 o
TPF01 o
TPG01 o
TPH01 o
TPLD2 o
TPLD1 o

PTXCP

I/O CP

B A
1   18

LEDCP

6   1

SCP

o TPLED

o TP24V

4   1

B

PTXCP

I/O CP

B A
1   18

E

B A
4   1

2 1

LEDCP

F Drive motor
power cable

G
PTX cable
connector
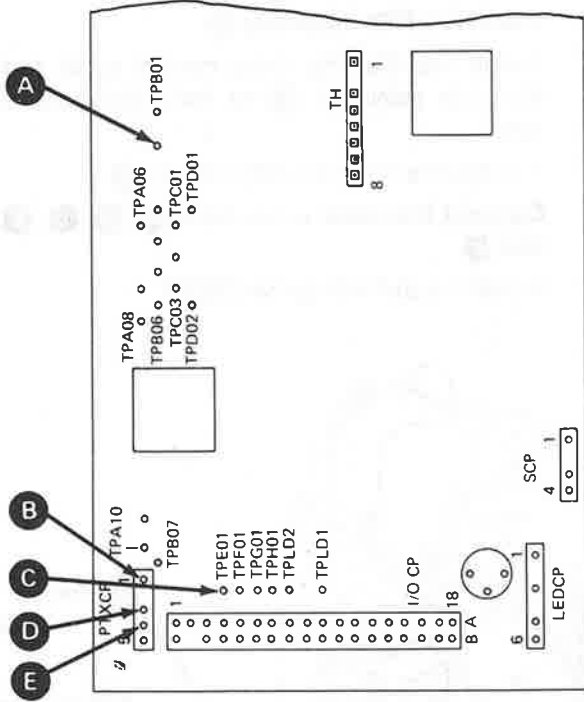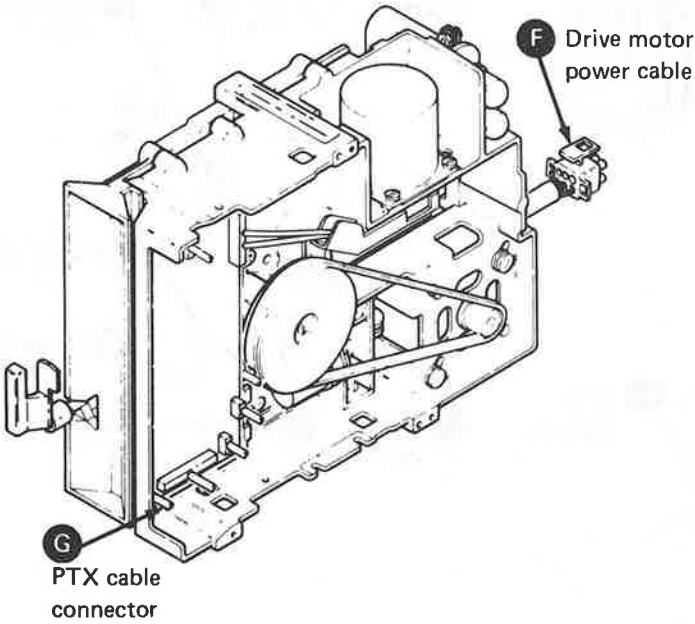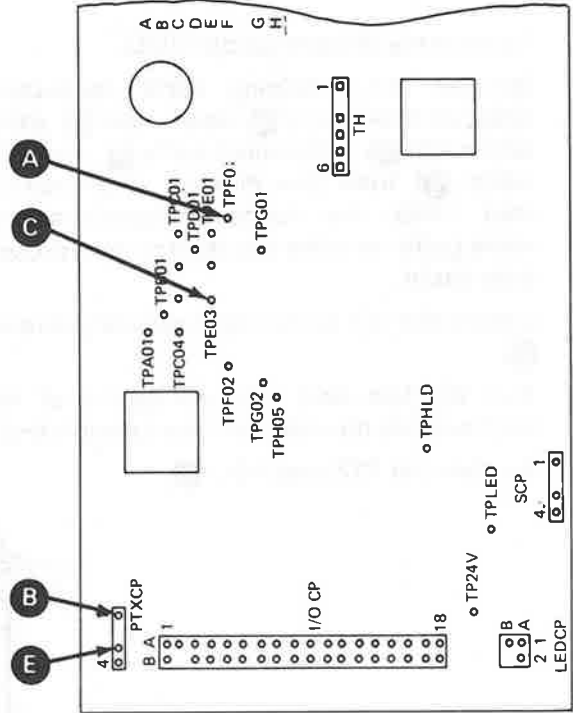
Diskette drive

1571 PTX assembly (continued)

Removal

1. Remove the diskette guide (1520).

2. Remove the remaining cable connectors (stepper drive motor **A**, head cable **B**, solenoid cable **C**, attachment cable **F**, and PTX cable **G**) from the diskette drive control card. Note the connector locations and cable paths to make the replacement procedure easier.

3. Loosen the two control card retaining screws **E**.

4. Turn the two card retainers **D** out of the way; remove the diskette drive control card.

5. Remove the PTX assembly **H**.

Replacement

1. Install the PTX assembly **H**.

2. Install the diskette drive control card; turn the two retainers **D** to hold the card in place.

3. Tighten the two retaining screws **E**.

4. Connect the cable connectors **A**, **B**, **C**, **F**, and **G**.

5. Install the diskette guide (1520).

A Stepper motor cable

B Head cable

C Solenoid cable

D Retainer (2)

E Screw (2)

H PTX assembly

G PTX cable
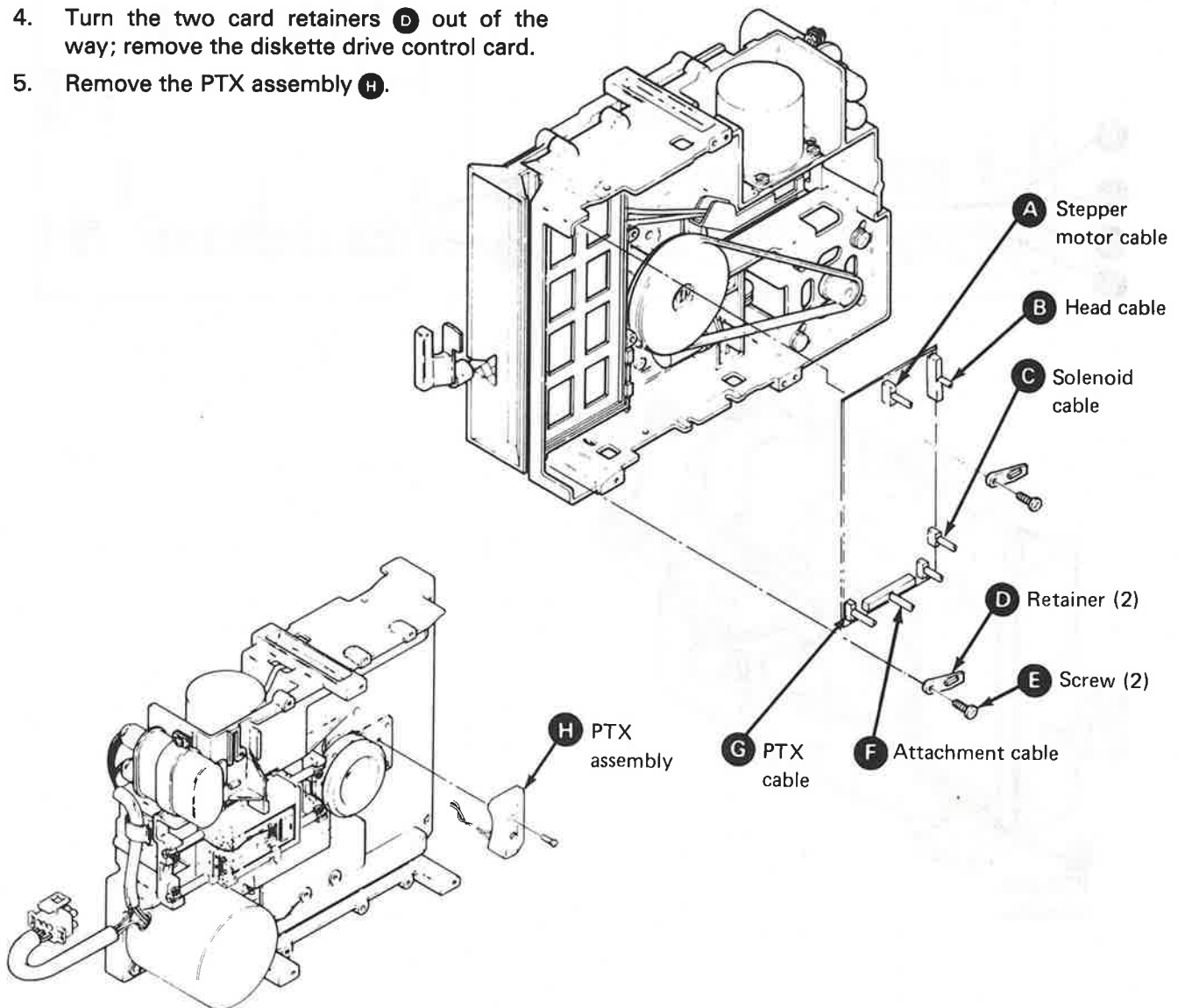
F Attachment cable

1572 Diskette drive control card

Removal

1. Switch off the 5324 power.

2. Remove the cable connectors (stepper drive motor cable **A**, head cable **B**, solenoid cable **C**, LED cable **F**, attachment cable **G**, and PTX cable **H**) from the control card. Note the connector locations and cable path to make the replacement procedure easier.

3. Loosen the two card retaining screws **E**.

4. Turn the two card retainers **D** out of the way; remove the diskette drive control card.

Replacement

1. Install the diskette drive control card; turn the two retainers **D** to hold the card in place.

2. Tighten the two retaining screws **E**.

3. Connect the cable connectors **A**, **B**, **C**, **F**, **G**, and **H**.

A Stepper motor cable

B Head cable

C Solenoid cable

D Retainer (2)

E Screw (2)

H PTX cable   **G** Attachment cable   **F** LED cable
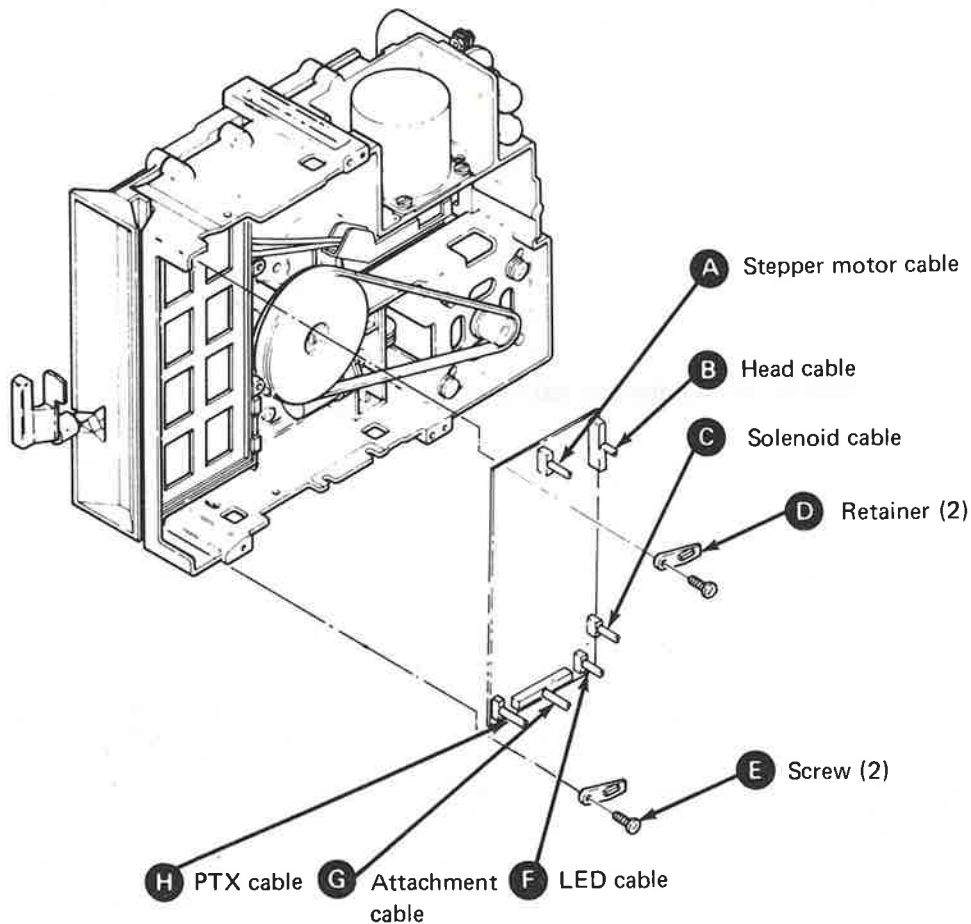
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Theory of operation introduction

Diskette drive

IBM diskette drives are direct-access, read/write, data-storage devices. These drives use the flexible magnetic diskette for data entry, data exchange, and data storage.

The 31SD diskette drive can only read from, and write to, a diskette 1. The 31SD diskette drive can read and write in Frequency modulated (FM) only. If a diskette 2 or a diskette 2D is inserted into a 31SD diskette drive, the drive will not be activated.

The 51TD diskette drive can read from and write to one side of a diskette 1, and both sides of a diskette 2 or diskette 2D. The 51TD diskette drive can read and write in either Frequency modulated (FM) or Modified frequency modulated (MFM).

31SD diskette drive
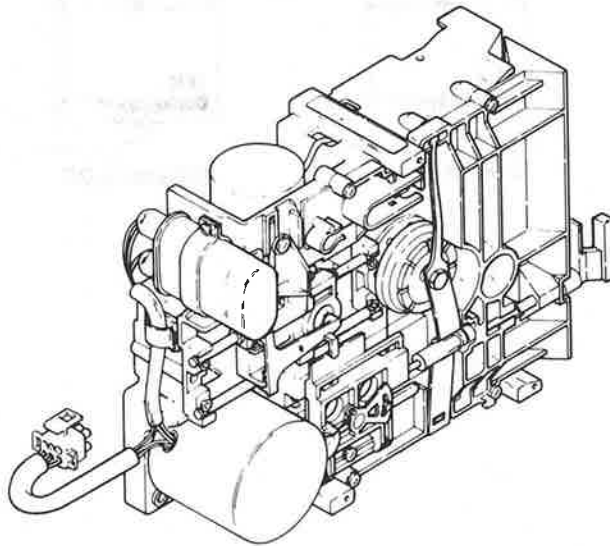
51TD diskette drive
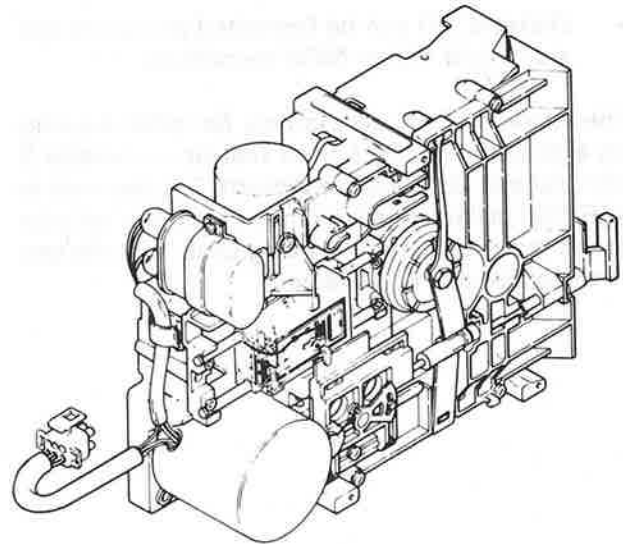
Diskette drive

Diskette

The IBM diskette is a thin, flexible disk housed in a protective jacket. Information is stored magnetically on the diskette surface, which is coated with magnetic oxide. The diskette is free to rotate inside the jacket. As the diskette rotates, the inner surface of the jacket cleans the diskette. The jacket has access holes for rotating the diskette, for read/write head contact, and for index hole sensing.

There are three types of diskettes on which data can be recorded and retrieved:

- Diskette 1 can be formatted on side 0 only.

- Diskette 2 can be formatted on side 0 and side 1.

- Diskette 2D can be formatted on side 0 and side 1 with FM or MFM recordings.

The location of the access hole for index sensing on a diskette 1 differs from that on a diskette 2 and diskette 2D. When a diskette 1 is inserted in a 51TD diskette drive, index sensing circuits sense that a diskette 1 is being used, and the use of the blank side is prevented.

Access hole for index sensing

Access hole for rotating the diskette

Access hole for read/write head contact

Diskette 1
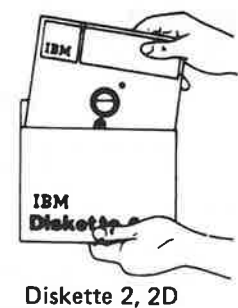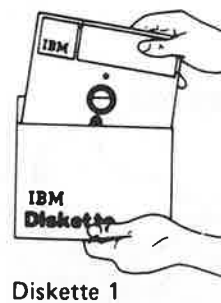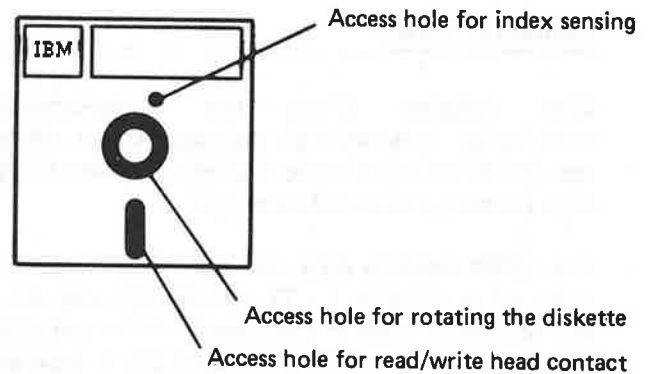
Diskette 2, 2D

Diskette format

Information is written on the diskette in tracks. A *track* is a circular path on the diskette surface. A *sector*, determined during diskette initialization, is a division of each track of the diskette. Each sector is used to write one record. As the diskette rotates, information is magnetically written to and read from a track by a read/write head.

There are 77 tracks on each side of a diskette. Track 00, which is the outside track, is reserved as a label track and cannot be used for data. Tracks 75 and 76, which are the two innermost tracks, are reserved as replacement tracks and can be used for data only if another track becomes damaged.

The diskette 1 has 74 tracks available for recording data. The diskette 2 or diskette 2D has 74 tracks available on each side of the diskette, resulting in a total of 148 tracks of data. When data is recorded on only one side of a diskette, each addressed circle of data is called a track. When data is recorded on both sides of a diskette, however, each pair of tracks (one upper and one lower) is referred to as a *cylinder*. For example, cylinder 0, the outside cylinder, is made up of upper and lower track 00.

When a diskette 1 is used, the most data that can be read or written on a track without moving the read/write head is the data on that track over which the read/write head is positioned. When a diskette 2 or 2D is used, the most data that can be read or written on two tracks (one on each side of the diskette), without moving the read/write head assembly, is the data on the two tracks over which the read/write head is positioned. When two tracks are used, the total amount of area that can be accessed is referred to as a cylinder.
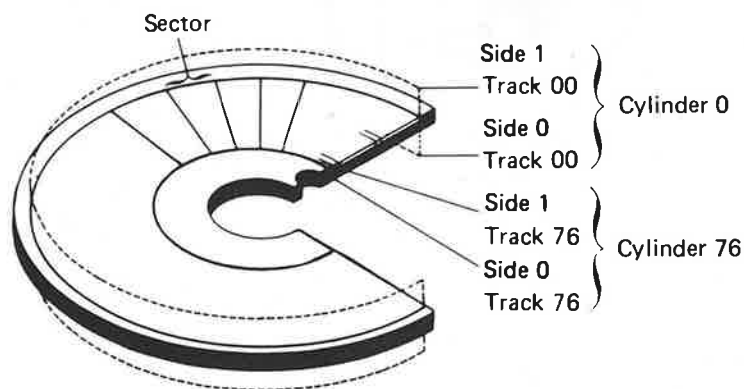
Diskette drive

Diskette handling

Diskette insertion

1. Open the diskette latch.
2. Remove the diskette from its protective envelope.
3. Switch on the 5324 power.
4. Place the diskette squarely into the diskette drive (with the label facing the latch).
5. Close the diskette latch.

Diskette removal

1. Open the diskette latch.
2. Remove the diskette.
3. Insert the diskette into its protective envelope.

Diskette
latch in
closed
position

Diskette loaded

Diskette latch
in open
position

IBM
Diskette
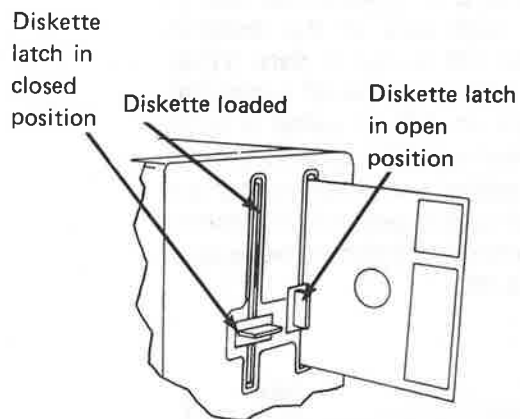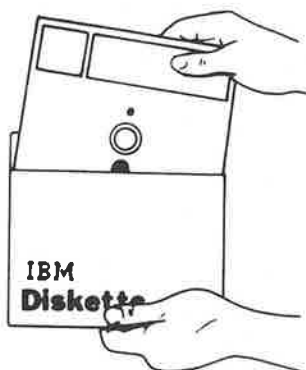
Environment

Temperature: 10C to 51C (50F to 125F)

Relative humidity: 8% to 80%

Maximum wet bulb temperature: 29C (85F)

Short-term storage

Store often-used diskettes flat in their envelopes, in stacks of up to 10. If storing vertically, give support to the diskettes so they do not lean or sag.

Long-term storage

Store seldom-used diskettes in their original shipping cartons. Put each diskette in its protective envelope. Shipping cartons can be stored either vertically or horizontally.

Shipping and receiving

Ship diskettes only in shipping cartons. Additional shipping cartons are available at IBM branch offices. With the diskette in place, the package weighs 280 grams (10 ounces). Be sure to label the package: DO NOT EXPOSE TO HEAT OR SUNLIGHT. Save the carton for diskette storage or for later shipment.

Diskette drive

Diskette handling (continued)
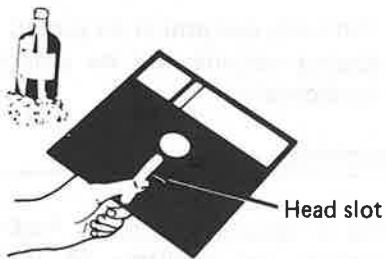
Head slot

DO NOT touch the head slot or any other unprotected surface of the diskette. Body oils and perspiration cause diskette damage.

DO NOT try to clean the surface of the diskette. Contaminated diskettes should no longer be used.
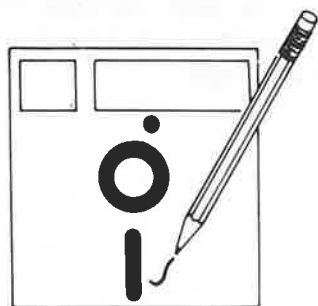
DO NOT write on the diskette outside the label area.

DO NOT write on the diskette label with pencil. It is best to mark the diskette label with a fiber-tip pen or ballpoint pen before attaching it to the diskette.
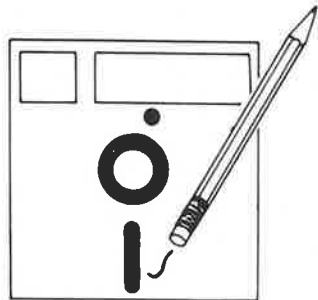
DO NOT erase labels on the diskette, or make erasures on or near the diskette. Eraser crumbs on the diskette surface will make the diskette unusable.

DO NOT place heavy objects on the diskette. The weight can seriously damage the surface.

DO NOT use clips or rubber bands on the diskette or bend it in any way.
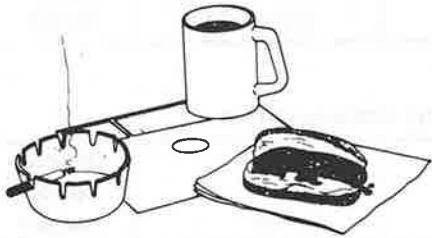
DO NOT lay a diskette near food, drinks, or ashtrays where foreign materials can contaminate the diskette surface.
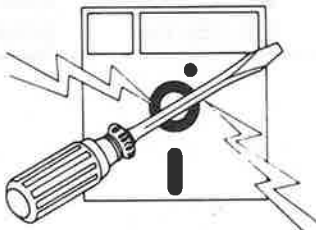
DO NOT allow the diskette to be near anything that might be magnetized. A magnetic field can cause data loss. Magnetic fields can be found near fluorescent lights, electronic calculators, dictation equipment, and especially telephones.

DO NOT expose the diskette to heat greater than 51° C (125° F) or to direct sunlight.

Note: If a diskette has been exposed to temperatures outside the range of 10° C to 51° C (50° F to 125° F), keep the diskette at room temperature for approximately five minutes before inserting it into a diskette drive.

Diskette drive

Functional description

Physical characteristics

- Weight: 5.0 kg (11.0 lb)
- Diskette speed: 360 revolutions per minute (rpm)

Electrical characteristics

The 5324 supplies all the power needed to operate the diskette drives:

DC voltage

Voltage	Tolerance (see note 1)	Maximum operating current
+5 Vdc	+4.6 Vdc to +5.5 Vdc	0.50A
−5 Vdc	−4.6 Vdc to −5.5 Vdc	0.08A
+24 Vdc	+22.0 Vdc to 26.4 Vdc	0.50A

Note 1: The voltage tolerances in this chart are for voltages measured at the power supply A1 card.

60–Hz, single phase ac voltage

Voltage	Range	Average operating current
100 Vac	90–110 Vac	0.30A
110 Vac	96.5–119 Vac	0.30A
120 Vac	104–127 Vac	0.30A
127 Vac	111–137 Vac	0.30A
200 Vac	180–220 Vac	0.20A
208 Vac	180–220 Vac	0.20A
220 Vac	193–238 Vac	0.20A
240 Vac	208–254 Vac	0.20A

50–Hz, single phase ac voltage

Voltage	Range	Average operating current
100 Vac	90–110 Vac	0.30 A
110 Vac	96.5–119 Vac	0.30A
200 Vac	180–220 Vac	0.25A
220 Vac	193–238 Vac	0.20A
230 Vac	202–249 Vac	0.20A
240 Vac	210–259 Vac	0.20A

Environmental characteristics

The diskette drives can be operated or stored in the following temperatures and humidity ranges:

	Temperature		Relative
	Celsius	Fahrenheit	humidity
Operated (power on)	10° to 40.6°	50° to 105°	8% to 80%
Stored (power off)	10° to 51.7°	50° to 125°	8% to 80%

The format of the data on a diskette is changed when the number of bytes written in a sector is changed. Diskettes are used with the following formats:

Sectors per track		Bytes per sector
FM	MFM	
26	—	128
15	26	256
8	15	512
—	8	1,024

Specifications

- Data capacity: The following chart shows the capacity in formatted data bytes for the three diskette types.

Bytes per sector	Diskette 1	Diskette 2	Diskette 2D
128	246,272	492,544	—
256	284,160	568,320	985,088
512	303,104	606,208	1,136,640
1,024	—	—	1,212,416

- Data rate: 250,000 bits (31,250 bytes) per second for FM recordings and 500,000 bits (62,500 bytes) per second for MFM recordings.

- Cylinder-to-cylinder seek time: 5 milliseconds, plus 35 milliseconds for the head/carriage assembly to stop. The total seek time is the number of cylinders the heads move across multiplied by 5 milliseconds, plus 35 milliseconds settle time.

- Tracks per diskette side: 77 (cylinder 00 is the label cylinder; cylinders 01 through 74 are for data; cylinders 75 and 76 are reserved as replacement tracks).

Diskette drive

Diskette drive

Frequency modulated (FM) format principles

FM format is a method of recording data on a diskette surface. The frequency of pulses is changed (modulated) to represent data.

When no data is present (all 0 bits), only clock pulses are present. These pulses occur at a frequency of every 4 microseconds.

When data is present, the pulse frequency changes. Each 1-bit pulse is inserted halfway between adjacent clock pulses so there is double the pulse frequency. If a 0 bit is recorded, no pulse is between the clock pulses; therefore, the pulse frequency is not changed.

The raw data rate in FM format is 250,000 bits (31,250 bytes) per second.

Read data

Each clock pulse or 1-bit pulse is recorded on the diskette surface as a change in magnetic direction (flux) from the bit immediately preceding it. As this change in flux passes the read/write heads, the current in the read/write heads changes direction. This change in current direction is recognized by the attachment as either a clock pulse or a 1-bit pulse. If there is no change in the direction of the current between two adjacent clock pulses, the attachment recognizes that a 0 bit is present.
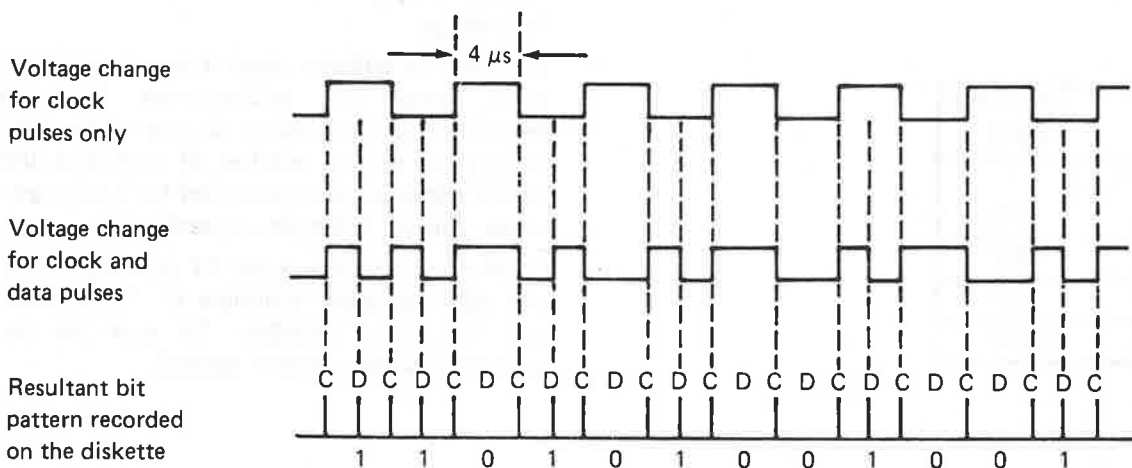
The C and D above the line show the clock and data bit times.

The numbers under the line show whether a 1 bit or a 0 bit is recorded.

Modified frequency modulated (MFM) format principles (51TD only)

MFM format is another method of recording data on a diskette surface. The frequency of pulses is changed (modulated) to represent data.

With no data present (all 0 bits), the only pulses present are clock pulses. These pulses occur at a frequency of every 2 microseconds.

When data is present, the pulse frequency changes. Each 1-bit pulse is inserted halfway between adjacent clock times. The clock pulses are suppressed, however, so the frequency remains the same. All clock pulses will be suppressed unless two 0 bits (no pulse) occur next to each other. When this happens, the clock pulse that would normally occur at the clock time between the 0 bits is not suppressed. (For that particular time, the pulse frequency changes.)

Therefore, a pulse appears between any consecutive 0 bits (the clock pulses) and for each 1 bit.

The raw data rate in MFM format is 500,000 bits (62,500 bytes) per second.

MFM format can record twice as much data on a diskette surface as FM format.

Read data

Each clock pulse or 1 bit is recorded on the diskette surface as a change in magnetic direction (flux) from the bit immediately preceding it. As a change in flux passes the read/write heads, the current in the read/write heads changes direction. This change in current direction is recognized by the attachment as either a clock pulse or a 1-bit pulse. If there is no change in the direction of current at data time, the attachment recognizes that a 0 bit is present.
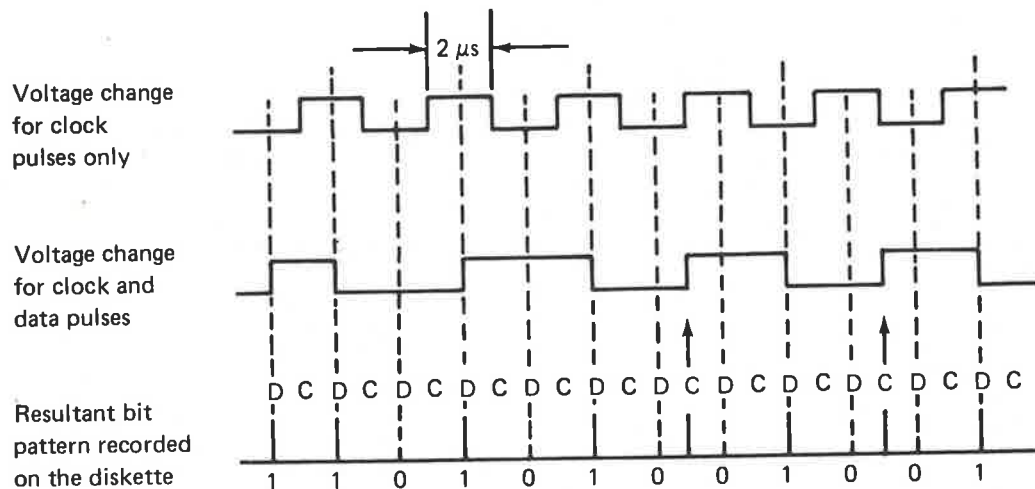
Voltage change for clock pulses only

Voltage change for clock and data pulses

Resultant bit pattern recorded on the diskette

The C and D above the line show the clock and data bit times.

The numbers under the line show whether a 1 bit or a 0 bit is recorded.

Diskette drive

Stepper motor

Stepper motor description

The dc stepper motor consists of a permanent-magnet rotor and pairs of two-phase stator windings. The motor is a sealed unit that has no gears or commutators and requires no maintenance. Do NOT disassemble the stepper motor.

When current flows through a pair of stator windings, a magnetic field that is set up in the stator poles provides torque to the rotor shaft. This torque turns the rotor shaft only a part of a revolution. The direct current in the stator windings, acting on the permanent-magnet rotor, then holds the shaft in an electrically detented position. Shaft rotation is continuous only if the stepper motor is continuously pulsed.

You cannot turn the rotor easily turned by hand with the machine power switched on. When the power is switched off, you may hear a clicking sound as you turn the shaft.

Stepper motor operation

For ease of understanding, the motor used in this example turns 9 per step; the actual motor turns 1.8 per step.

This simplified stepper motor consists of eight coil-wound stator poles and a ten-pole permanent-magnet rotor.
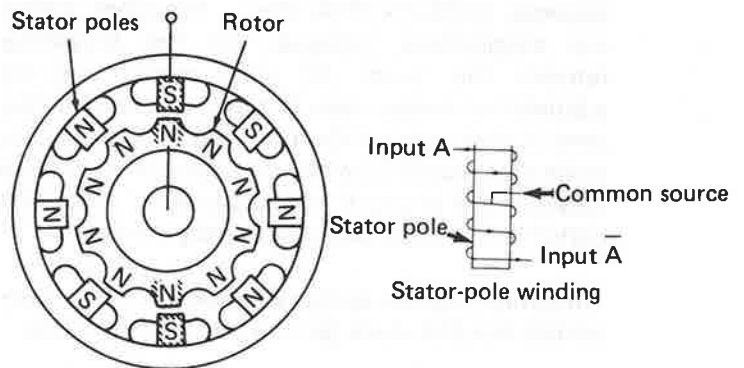
If the stator is rotated in either direction, the rotor maintains its detented position and follows the stator as shown. Both the stator poles and the rotor are shown rotated 45 clockwise.
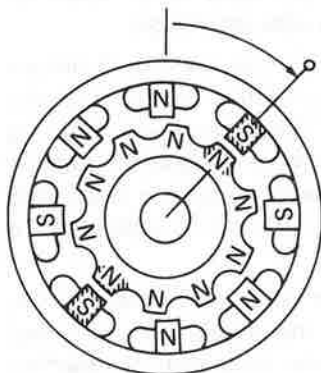
Note: Current flows only in one-half of the winding at a time. Polarity of the stator poles is determined by the half of the winding that has current flow.

When the stepper motor operates, the stator's magnetic field is electrically rotated by switching the current to the next stator winding. The rotor turns until the closest opposite-polarity (shaded) magnetic poles are attracted into alignment. Note that the polarity of the poles has rotated one position clockwise from that shown in the first figure. The logic circuits provide the sequence of phase pulses that determine the direction of rotation.
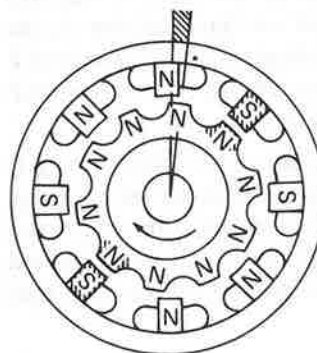
In the diskette drive, the stepper motor drive band is attached to the head/carriage assembly. As the motor turns, the drive band moves the head/carriage assembly. A clockwise movement of the rotor moves the assembly toward the hub of the diskette.

Diskette drive

Diskette drive operation

To operate the internal diskette drive, insert a diskette into the diskette drive and close the diskette latch. With the system power on, the following occurs (see "Timing sequence" in this chapter.

1. The diskette begins to turn; in approximately 10 seconds, the diskette reaches operating speed (360 rpm).

2. Index pulses are sensed every revolution (166.7 milliseconds) by the LED/PTX. For the 51TD diskette drive, the type of diskette inserted is identified on the diskette sense line. An up level indicates that a diskette 2 or a diskette 2D has been inserted; a down level indicates a diskette

3. To seek to the selected track, access line 0 and access line 1 are activated alternately. The stepper motor turns, moving the read/write heads across the diskette surface a distance of one track. The access line that

is activated at the time the read/write heads reach the desired track remains activated as long as the heads remain at that track. It takes 40 milliseconds for the heads to settle to a complete stop after a seek operation. Therefore, data is not valid for at least 40 milliseconds after a seek operation.

4. A head load command can be issued before or during a seek operation to activate the head load solenoid. Because of head settling time, the read or write operation cannot begin until 80 milliseconds after a head load operation, or until 40 milliseconds after a seek operation.

5. To reduce the wear on the diskette and the read/write heads, the heads are unloaded after the read/write operation if another command is not issued by the computer within two revolutions of the diskette.

Timing sequence

This timing sequence shows a typical seek operation from cylinder 00 to cylinder 05. Cylinder 05 is the cylinder that is to be read from or written to.
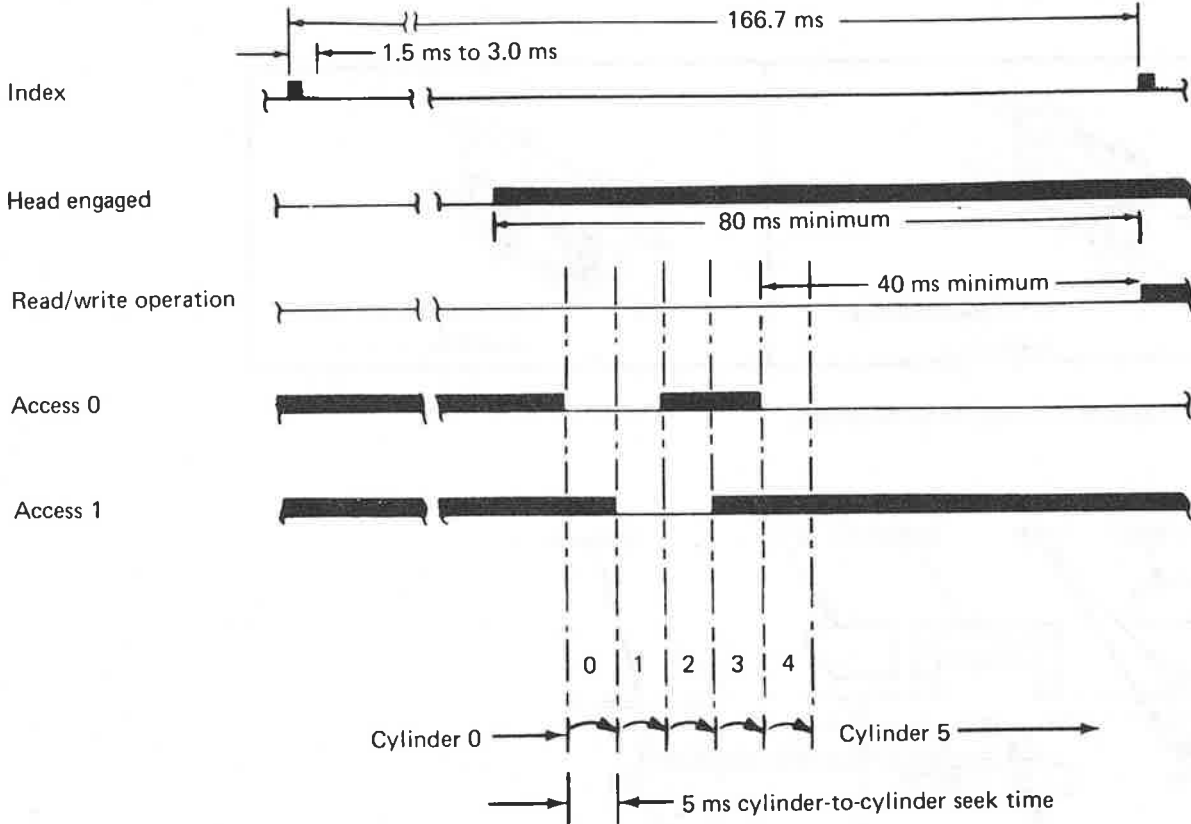
Note: Seeking and head loading are not timed to the index.

Diskette drive

Diskette drive operation (continued)

Mechanical sequence

The mechanical sequence is shown for the 51TD drive, which has two read/write heads. The operation of the 31SD is the same, except that the 31SD has a pressure pad instead of the second read/write head.

31SD Head/carriage assembly

51TD Head/carriage assembly
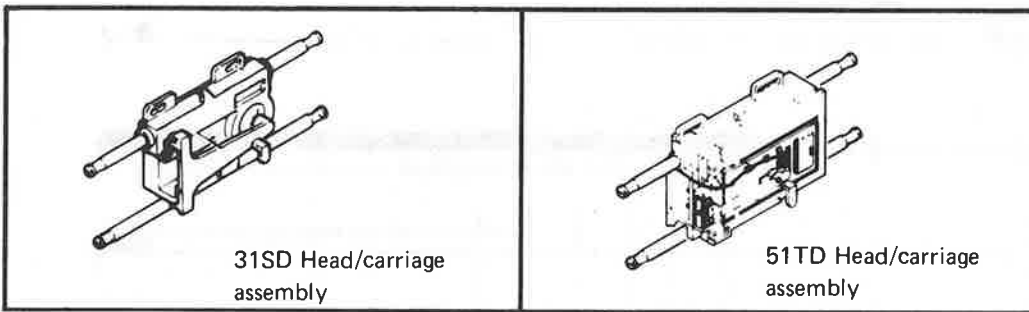
1. The diskette is ready to be inserted.
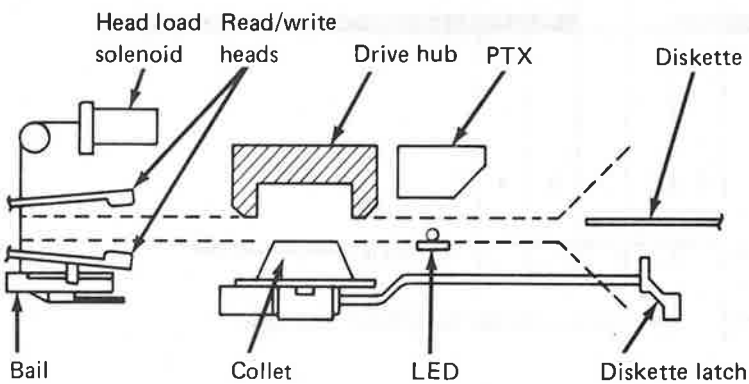
2. The operator inserts the diskette into the diskette guide and closes the diskette latch. The collet is clamped (the read/write heads are now much closer to the diskette).
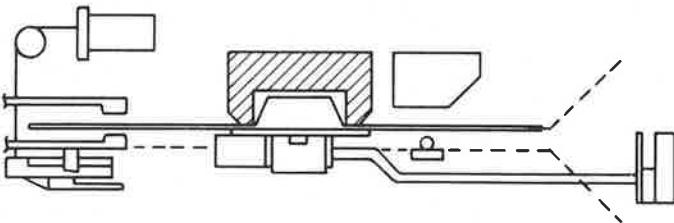
3. The head load solenoid is activated and the cable pulls the head load bail, thereby loading the read/write heads. The heads now touch the surface of the diskette.
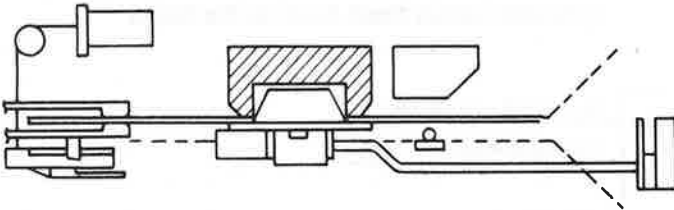
4. The read/write operation takes place. The heads are moved to the desired cylinder on the diskette by activating the two stepper motor access lines in a specific sequence.

5. The heads are released (the solenoid is de-activated).
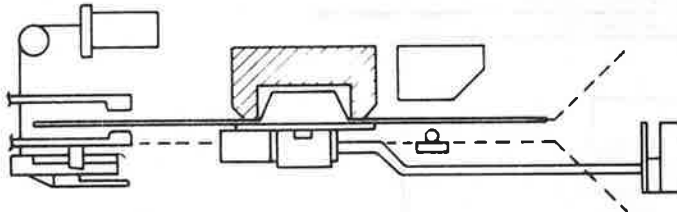
6. The operator opens the diskette latch and removes the diskette from the diskette drive.
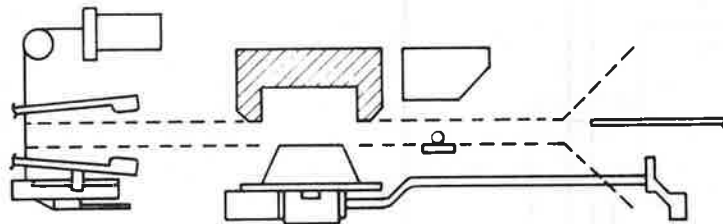
Diskette drive

Diskette attachment

Diskette attachment card

The diskette attachment is packaged on one card. This 2-drive diskette attachment card plugs into the diskette attachment card slot in the 5324 planar board.

The diskette attachment provides an interface between the 5324 and the diskette drives. The attachment accepts access, read, and write commands from the 5324 and activates the proper control lines to the diskette drive. The attachment assembles the sense information and data and sends them back to the 5324.
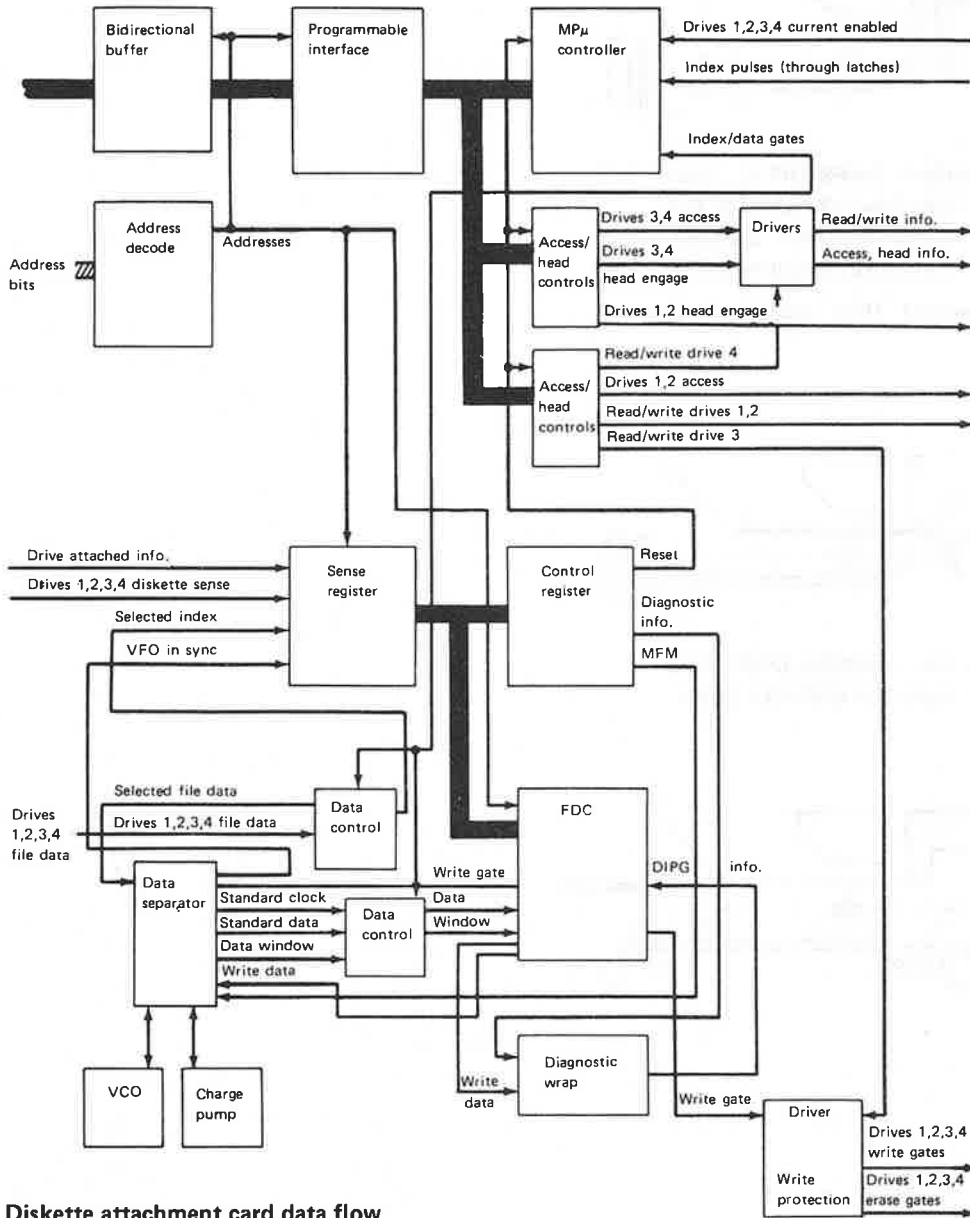
Diskette attachment card data flow

Diskette drive control card

The diskette drive control card, mounted on the diskette drive, is connected to the diskette attachment card with the diskette attachment cable. The dc voltages (+5, -5, and +24 volts) and ground are supplied by the 5324 power supply. These four wires are tied to the attachment cable, and are connected to the power supply A1 card.

The following figures show the differences between the 31SD and 51TD diskette drive control card circuits.

Diskette drive control card circuit (31SD)
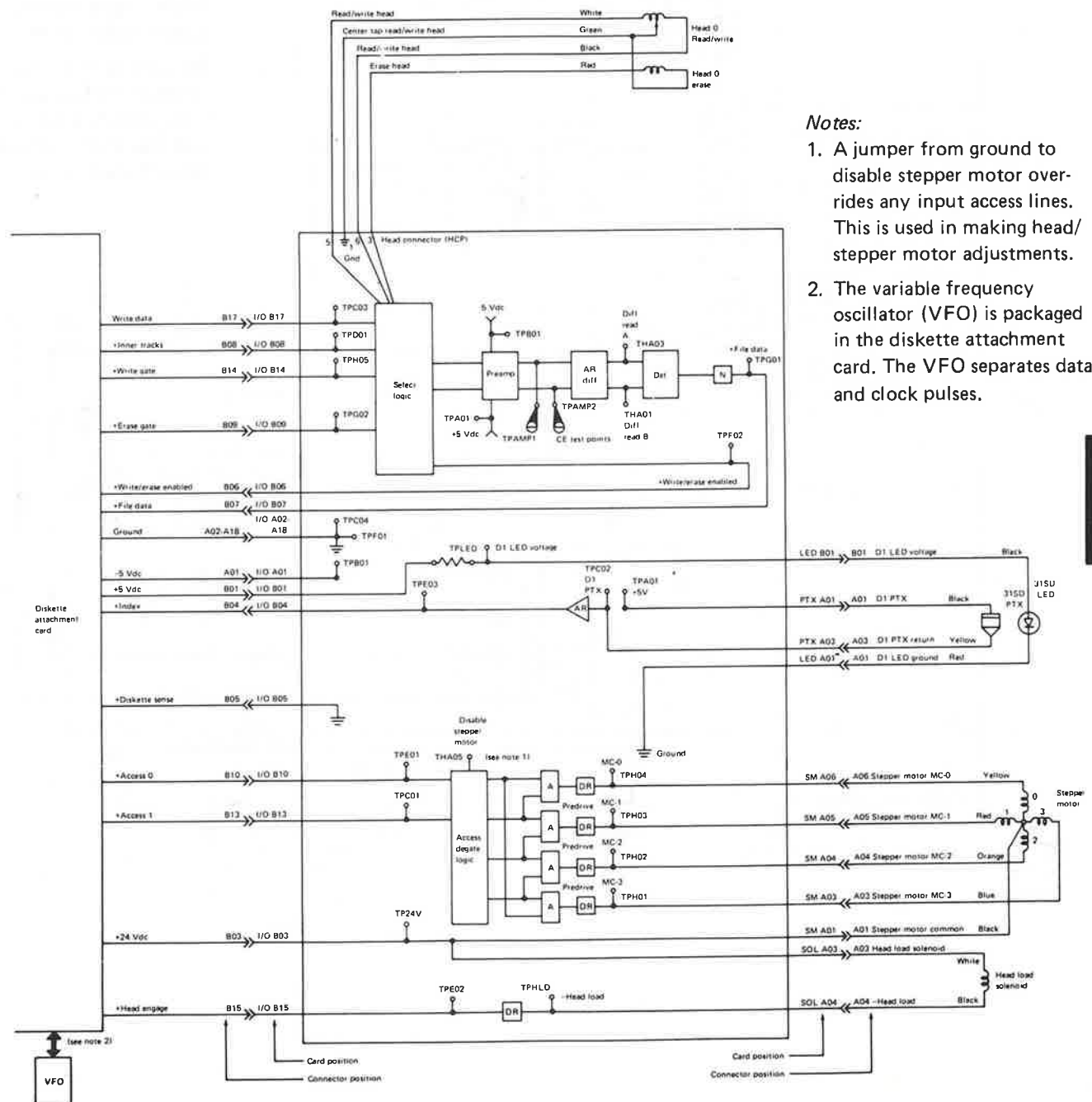
Notes:

1. A jumper from ground to disable stepper motor over-rides any input access lines. This is used in making head/stepper motor adjustments.

2. The variable frequency oscillator (VFO) is packaged in the diskette attachment card. The VFO separates data and clock pulses.

Diskette drive

Diskette drive control card (continued)

Diskette drive control card circuit (51TD)
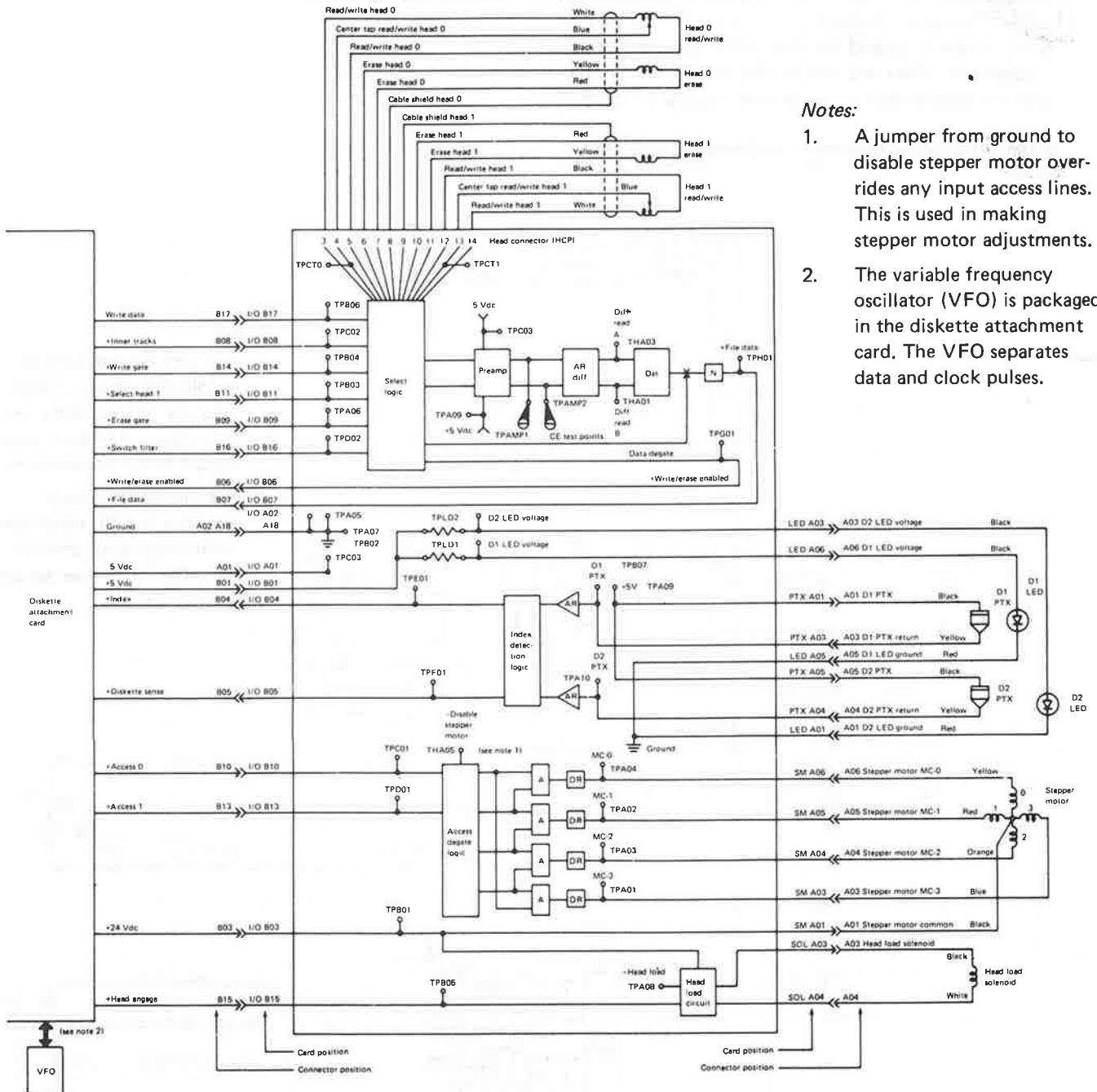
Notes:

1. A jumper from ground to disable stepper motor overrides any input access lines. This is used in making stepper motor adjustments.

2. The variable frequency oscillator (VFO) is packaged in the diskette attachment card. The VFO separates data and clock pulses.

Signal lines

The following is a description of the signal lines between the diskette attachment card and the diskette drive control card. The direction of each signal is also given.

Write data (output from the attachment). For each change of the 'write data' signal, the current switches in the read/write head. This current switching records the data on the diskette.

+Inner tracks (output from the attachment). On a write operation beyond the middle cylinders, this line is used to reduce the amount of recording current. On a read operation beyond the middle cylinders, this line is used to compensate for bit shifting. The '+inner tracks' line is active from track 43 through track 76.

+Write gate (output from the attachment). The 'write gate' line activates the write circuits and de-activates the read circuits for a write operation.

+Select head 1 (output from the attachment-51TD). When this line is active, head 1 is selected. When it is inactive, head 0 is selected.

+Erase gate (output from the attachment). The 'erase gate' line activates the erase circuits during a write operation to erase the edges of the track just recorded. This erasing prevents crosstalk between tracks during later read operations.

+Switch filter (output from the attachment-51TD). The 'switch filter' line is used, beyond cylinder 60, with the 'inner tracks' line to further compensate for bit shifting for MFM encoding. This line is used only during a read operation.

+Write/erase enabled (input to the attachment). When this line is active, current is present in the write/erase windings of the diskette drive. This line is used by the attachment for error detection.

File data (input to the attachment). The 'file data' line is a series of clock and data pulses that represents the data read from the diskette surface. The VFO circuits separate the clock pulses from the data pulses.

+Index (input to the attachment). This line indicates the start of a track. This 1.5 to 3.0-millisecond pulse occurs every 166.7 milliseconds.

Diskette sense (input to the attachment-31SD). This line is tied to ground to always indicate a diskette 1.

Diskette sense (input to the attachment-51TD). An active level on this line indicates that a diskette 2 or 2D is being used. This line is not activated by a diskette 1.

+Access lines 0 and 1 (output from the attachment). The read/write heads are moved from one cylinder to the next by sequentially activating the access lines.

As shown in the following chart, the sequence for activating the access lines is repeated every four cylinders. The drive control card decodes 'access 0' and 'access 1' into four motor control (MC) pulses (MC-0 through MC-3) for the four stepper motor poles. Refer also to the diskette drive control card circuit for the representation of MC-0 through MC-3.

Cylinder location	In → 0 1 2 3 4 5						·· 40 ··	← Out 74 75 76		
Access 0	1	0	0	1	1	0	1	0	1	1
Access 1	1	1	0	0	1	1	1	0	0	1
MC-0	1	0	0	1	1	0	1	0	1	1
MC-1	1	1	0	0	1	1	1	0	0	1
MC-2	0	1	1	0	0	1	0	1	0	0
MC-3	0	0	1	1	0	0	0	1	1	0

+Head engage (output from the attachment). When this line is active, it loads the read/write heads.

Diskette drive

Read/write principles

FM encoding

The data bits are written 4 microseconds apart. They are recorded on the diskette as follows:

Data bit to be recorded	Recorded as: Clock bit	Data bit
1	1	1
0	1	0

Data bits 0101 appear as follows:
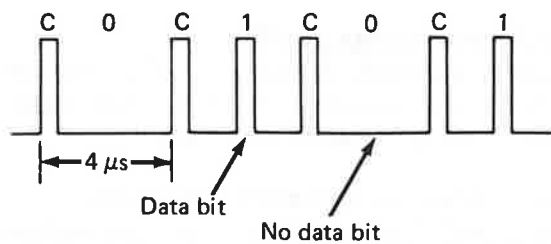
Read data. 'Read data' is the encoded read head signal (FM or MFM) that can be observed at TPAMP1 and TPAMP2 on the diskette drive control card.

Typical measurements for FM encoding are:

125 kHz: 120 to 300 mV (all 0's)

250 kHz: 100 to 250 mV (all 1's)

The voltage is higher at the outer tracks because of the higher track speeds and lower bit density.

An all 0's pattern has a higher voltage amplitude and it is half the frequency of an all 1's pattern.

File data. The 'file data' signal is a series of clock and data pulses that represent the read data. These pulses can be observed at TPG01 (31SD) or TPH01 (51TD) on the diskette drive control card. These pulses are from 150 to 500 nanoseconds long. The VFO circuits (on the diskette attachment card) separate the clock pulses from the data pulses.
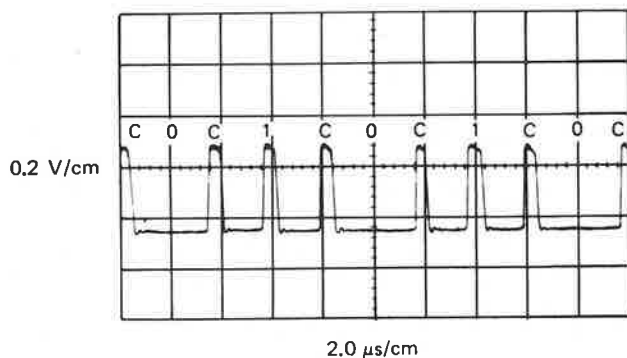
Read data: FM encoded

Read head signal at TPAMP1 and TPAMP2 on the diskette drive control card

0.05 V/cm

One record

ID field

Beginning of data

2.0 ms/cm

0.05 V/cm

All 1's

All 0's

10 μs/cm

File data signal at TPH01 (51TD) or TPG01 (31SD) on the diskette drive control card
Example: 01010

C O C 1 C O C 1 C O C

0.2 V/cm

2.0 μs/cm

Note: Use a Tektronix 453, 454, or similar oscilloscope with x10 probes.

Channel A sweep mode	Normal
Channel A level	+
Channel A coupling	DC
Channel A slope	+
Channel A source	External
Trigger	Normal
Mode	Add
Channel 1 volts/division	0.05 V/cm
Channel 2 volts/division	0.05 V/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	2 ms/cm
Connect channel 1 to	TPAMP1
Connect channel 2 to	TPAMP2
Connect trigger to	+Index test pin
Observe: The amplitude of the read signal should be between 6.5 to 560 mV.	

Scope setup

Note: Use a Tektronix 453, 454, or similar oscilloscope with x10 probes.

Channel A sweep mode	Normal
Channel A level	+
Channel A coupling	DC
Channel A slope	+
Channel A source	Internal
Trigger	Normal
Mode	Channel 1
Channel 1 volts/division	0.2 V/cm
Channel 1 input	DC
Times per division	2 μs/cm
Connect channel 1 to	+File data
Observe: Clock pulses every 4 μs. Pulse duration should be between 100 and 500 ns. Pulse amplitude should be between 2.4 and 4.2 volts.	

Diskette drive

Diskette drive 5-81

Diskette drive

Read/write principles (continued)

MFM encoding (51TD only)

The constant clock pulse is removed. A clock bit is recorded only when a 0 (no-data bit) is followed by another 0. Therefore, the time between data bits is only 2 microseconds. Either a data bit for a 1 or a no-data bit for a 0 is recorded in this 2-microsecond period. They are recorded on the diskette as follows:

Data bit to be recorded	Recorded as:	
	Clock bit	Data bit
1	0	1
0	(X)	0

Note: (X) is a 0 bit if the preceding bit is a 0 bit, or a 1 bit if the preceding bit is a 1 bit.

Data bits 10110011 appear as follows:
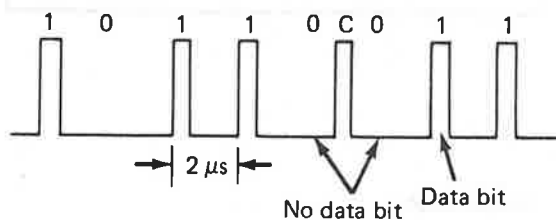
Read data. 'Read data' is the encoded read head signal that can be observed at TPAMP1 and TPAMP2 on the diskette drive control card.. Typical measurements for MFM encoding are:

125 kHz: 120 to 300 mV (alternating 0's and 1's)

250 kHz: 100 to 250 mV (all 0's or all 1's)

For MFM, an alternating 0's and 1's pattern has a higher voltage amplitude and is half the frequency of an all 0's or an all 1's pattern.

File data. The 'file data' signal is a series of clock and data pulses that represent the read data. These pulses can be observed at TPG01 (31SD) or TPH01 (51TD). These pulses are from 150 to 500 nanoseconds long. The VFO circuits (on the diskette attachment card) separate the clock pulses from the data pulses.

Read data: MFM encoded (51TD only)

Read head signal at TPAMP1 and TPAMP2 on the diskette drive control card

0.05 V/cm

One record

ID field   Beginning of data field

2.0 ms/cm

One record

ID field   Data field

0.05 V/cm

Gap   Sync   Gap   Sync   Address mark

200.0 μs/cm
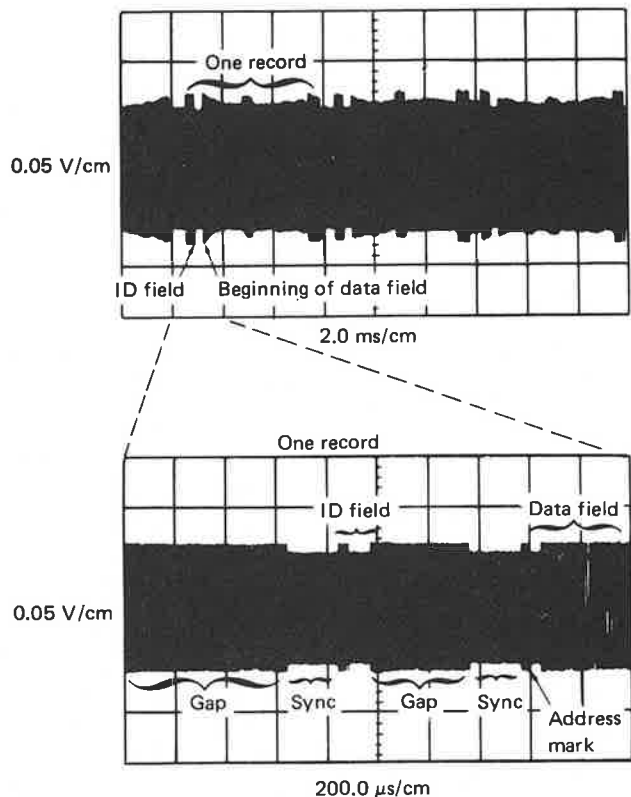
MFM file data at TPH01 (51TD only) on the diskette drive control card

Example: 0101111001

0.2 V/cm

C 0 C 1 C 0 C 1 C 0 C

2.0 μs/cm

Scope setup

Note: Use a Tektronix 453, 454, or similar oscilloscope with x10 probes.

Channel A sweep mode	Normal
Channel A level	+
Channel A coupling	DC
Channel A slope	+
Channel A source	External
Trigger	Normal
Mode	Add
Channel 1 volts/division	0.05 V/cm
Channel 2 volts/division	0.05 V/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	2 ms/cm
Connect channel 1 to	TPAMP1
Connect channel 2 to	TPAMP2
Connect trigger to	+Index test pin

Observe: The amplitude of the read signal should be between 6.5 to 560 mV.

Scope setup

Note: Use a Tektronix 453, 454, or similar oscilloscope with x10 probes.

Channel A sweep mode	Normal
Channel A level	+
Channel A coupling	DC
Channel A slope	+
Channel A source	External
Trigger	Normal
Mode	Channel 1
Channel 1 volts/division	0.2 V/cm
Channel 1 input	DC
Times per division	2 μs/cm
Connect channel 1 to	+File data
Connect trigger to	+Index test pin

Observe: Clock or data pulses every 2 to 4 μs. Pulse duration should be between 100 and 500 ns. Pulse amplitude should be between 2.4 and 4.2 volts.

Diskette drive

Appendix A. Parts catalog

Contents

Parts catalog

How to use a parts catalog

How to Use a Parts Catalog

PARTS CATALOG STRUCTURE

To find parts quickly, you should have a general understanding of the three major sections of this catalog:

1   Visual Index   (machine assembly illustrations and page locations within the Catalog Section)

2   Catalog Section   (assembly illustrations with accompanying parts lists)

3   Numerical Index   (parts listed in numerical order with cross-references to applicable figure and index numbers within the Catalog Section)

1   VISUAL INDEX   This is a starting point for locating a part in the Catalog Section

MAIN ASSEMBLY
FIGURE 2
PAGE 14

DISK STORAGE DRIVE ASSEMBLY
FIGURE 16
PAGE 48
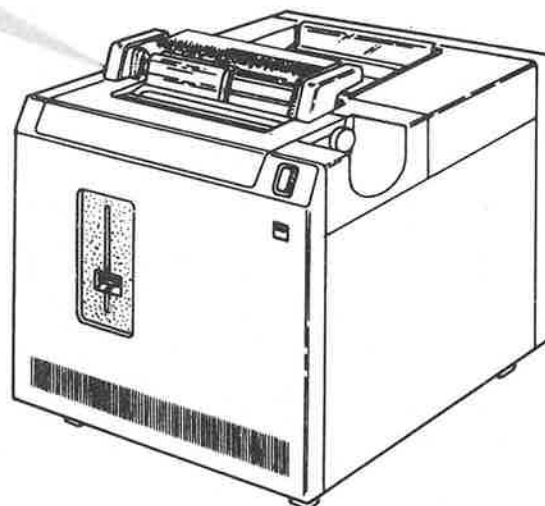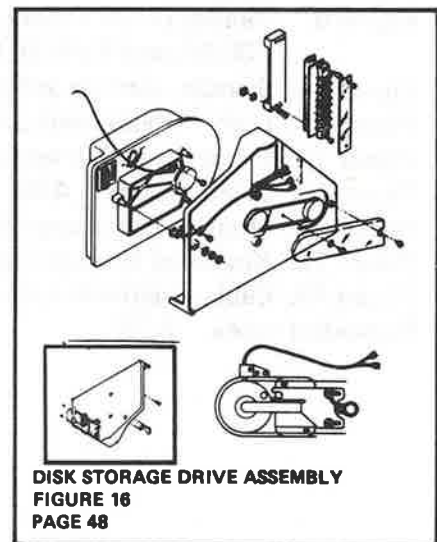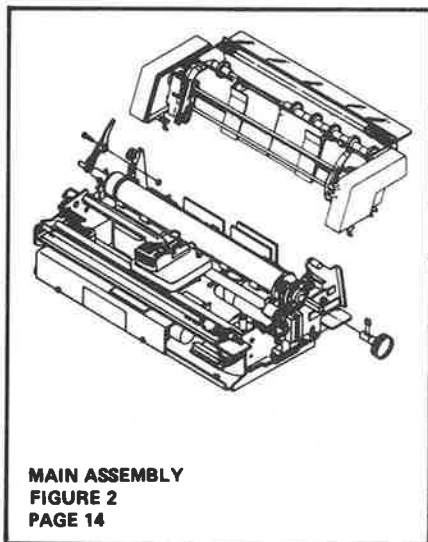
Note: If assembly name is known, locate page
reference in catalog "Contents."

Higher or Lower assembly reference.

SEE FIG. 13

Stacked index numbers show part and attaching hardware.

53
54
55
56

Index numbers corresponding to parts list accompanying each figure.

4

5

6

7

8

9

Circled letter indicates that part is shown separately and broken down within detail drawing ("Detail B") and ("Detail C").

Circled letter with arrow is a key to an assembly that cannot be seen because of the perspective of the figure. The assembly is shown separately ("View A").

Circled index number indicates that the item is broken down within the parts list.

3

C

B

A

13

14

15

16

VIEW A

19

17

18

20

21

DETAIL B

23

25

24

26

18

27

28

DETAIL C

D

24

25

18

28

26

27

DETAIL D

Parts catalog

Parts catalog

How to use a parts catalog (continued)

2 CATALOG SECTION (parts list)

POWER SUPPLY ASM

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
3 - 5	5892856 ◄1	REF	POWER SUPPLY ASM,NO.1-110V 50 AND 60 HZ
-	5892858	REF	POWER SUPPLY ASM,NO.1-208V 50 AND 60 HZ
-	1553193	REF 7	POWER SUPPLY ASM,NO.1 AND 3-60 HZ LV
-	1553194	REF	POWER SUPPLY ASM,NO.1 AND 3-60 HZ HV
-	1553195 NP ◄2	REF	POWER SUPPLY ASM,NO.1 AND 3-50 HZ LV
-	1553196 NP	REF	POWER SUPPLY ASM,NO.1 AND 3-50 HZ HV
-	1631389	REF	PWR SPLY ASM,NO.1 AND 3-50 HZ LV-UK ONLY
-	1631390	REF	PWR SPLY ASM,NO.1 AND 3-50 HZ HV-UK ONLY
			FOR NEXT BIGGER ASM SEE LIST 2-21 AND 23
	3		AND FOR ILLUSTRATION FIG.3
- 1	NO NO. ◄4	1	. LABEL
- 2	645762	1	. LABEL
- 3	5651299	1	. COVER
- 4	6841935	4	. SCREW,MACH BIND HD 8-32X.250 LG ATT PT
- 5	1632336	1	. FUSE,7A-USED ON 208V POWER SUPPLY NO.1
			NO FUSE REQUIRED ON 110V POWER SUPPLY
- 6	512137	1	. FUSE,5A-USED ON 110V POWER SUPPLY NO.1
- 6	1632336	1	. FUSE,7A-USED ON 208V POWER SUPPLY NO.1
- 7	5130278 NR ◄6	1	. LABEL-USED ON 208V POWER SUPPLY NO.1
- 8	5130277	1	. LABEL-USED ON 110V POWER SUPPLY NO.1
- 8	5130278	1	. LABEL-USED ON 208V POWER SUPPLY NO.1
- 9	1553738	1	. POWER INPUT ASM
			FOR DETAIL BREAKDOWN SEE LIST 4
10 - 10	5E207 9	AR	. SCREW,MACH BIND HD 8-32 NC-2A X.250 LG ATT PT ◄8
- 11	5130276	1	. BRACKET
- 12	5E207	1	. SCREW, MACH BIND HD 8-32 NC-2A X.250 LG ATT PT
- 13	2546652	1	. TIE,CABLE
- 14	2100264	2	. RELIEF,CABLE STRAIN
- 15	55901	3	. WASHER,LOCK EXT .176DIA
- 16	5E207	3	. SCREW,MACH BIND HD 8-32 NC-2A X .250 LG

ITEM		MEANING
1	Similar Assemblies	Multiple assemblies having majority of identical parts are broken down on same list (common parts have same index number).
2	NP	Nonprocurable—parts not available separately; order next higher assembly.
3	Indenture	Shows the relationship of a part to its next higher assembly. For example:
		1 2 3 4
		MAIN ASSEMBLY
		• Detail parts of main assembly
		or
		• Assembly within main assembly
		• • Detail part of one-dot assembly
		or
		• • Assembly within one-dot assembly
		• • • Detail parts of two-dot assembly
4	NO NO.	No number—order detail parts separately or see defective part for part number.
5	Figure Number	Number of illustration for this index listing.
6	NR	Not recommended—not recommended for field replacement; order next higher assembly.
7	REF	Reference—Multiple assemblies on same list and figure called out and illustrated.
8	ATT PT	Attaching parts—listed following part to be attached.
9	AR	As required—use quantity as required.
10	Index Number	Numbers on figure correspond to part numbers on figure index number page.

NUMERICAL INDEX

The numerical index follows the catalog section. Use it to locate a part when you know the part number only. The index lists part numbers in numerical order along with all applicable figures and parts lists.

Part numbers in numerical order   References to figure, parts list, and part index number

PART NO.	LIST AND INDEX NO.		PART NO.	LIST AND INDEX NO.		PART NO.	LIST AND INDEX NO.		PART NO.	LIST AND INDEX NO.
10170	5 - 9		475124	5 - 1		1631369	3 - REF		5130276	3 - 7
55901	3 - 15		512137	3 - 6		1631390	3 - REF			3 - 8
56079	5 - 7		526376	5 - 4		1632336	3 - 5		5130347	5 - 5
58207	3 - 10		845762	3 - 2			3 - 6		5252607	5 - 3
	3 - 12		1553193	3 - REF		2100264	3 - 14		5691299	3 - 3
	3 - 16		1553194	3 - REF		2548652	3 - 13		5691860	5 - REF
	5 - 2		1553195	3 - REF		2701001	5 - 5		5692646	5 - REF
236849	5 - 6		1553196	3 - REF		2701011	5 - 5		5692856	3 - REF
322766	5 - 10		1553738	3 - 9		5130276	3 - 11		5692856	3 - REF
351237	5 - 8		1631386	5 - REF		5130277	3 - 8		6641539	3 - 4

ORDERING PARTS

Refer to the Catalog Section when ordering parts. The example shown here should help guide you through a typical situation.

POWER SUPPLY

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
5 -	5691860 Ⓐ	REF	POWER SUPPLY,NO.3 60 HZ
-	5692846	REF	POWER SUPPLY,NO.3 50 HZ
-	1631386	REF	POWER SUPPLY,NO.3 50 HZ-UK ONLY
			FOR NEXT HIGHER ASM SEE LIST 3-25
			AND FOR ILLUSTRATION FIG.5
- 1	475124 NR	1	. CLAMP,CAPACITOR
- 2	58207	2	. . SCREW,MACH BIND RD 8-32 NC-2A X .250 LG ATT PT
- 3	5252607	1	. CAPACITOR,C3
- 4	526378 NR	2	. COVER
- 5	2701001	1	. TRANSFORMER,60 HZ
- 5	2701011	1	. TRANSFORMER,50 HZ
- 5	5130347 Ⓑ	1	. TRANSFORMER,50 HZ-UK ONLY
- 6	236849	4	. SCREW,MACH BIND RD 10-32 X.250 LG ATT PT
- 7	56079	1	. WASHER, LOCK EXT .204ID .204OD
- 8	351237	1	. . SHIELD
- 9	10170	2	. . SCREW,MACH-BIND RD 6-32 X1/4 LG
- 10	322766	1	. . TERMINAL BOARD,8 DBL SCREW TERMINAL

If, for example, you need the *power supply, no. 3, 60 HZ*, order part number 5891860 Ⓐ (all one-dot items will also be received). See the explanation of the Catalog Section for information on how the leading dots are used in the parts listings. If you need the *transformer, 50 HZ-UK only*, order part number 5130347 Ⓑ (all two-dot items will also be received except attaching parts). Each part may also be ordered separately except in the following cases:

- Many detail parts are unavailable if they are part of an inseparable assembly or if they are part of an assembly that is ordered as a unit. In such cases they are noted NR or Not Recommended.

- Parts found on purchased assemblies may not have IBM part numbers. These parts are noted NP or Nonprocurable.

In either case, order the assembly rather than the detail parts.

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Visual index I

ATTACHMENT FEATURES
FIGURE 3 (SHEET 1 OF 2)
PAGE A-20

MECHANICAL ASSEMBLY
FIGURE 2
PAGE A-18

FRONT COVER ASSEMBLY
FIGURE 4
PAGE A-24

ATTACHMENT FEATURES
FIGURE 3 (SHEET 2 OF 2)
PAGE A-22

FINAL ASSEMBLY
FIGURE 1 (SHEETS 1 & 2 OF 3)
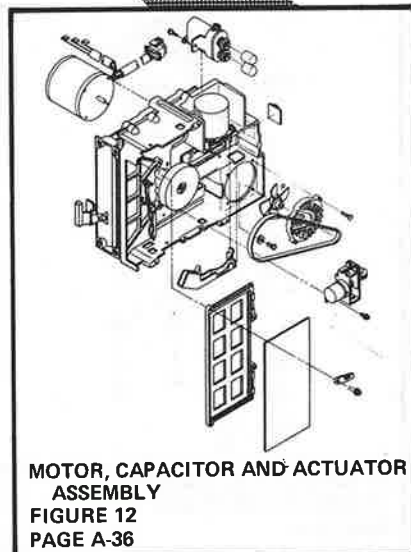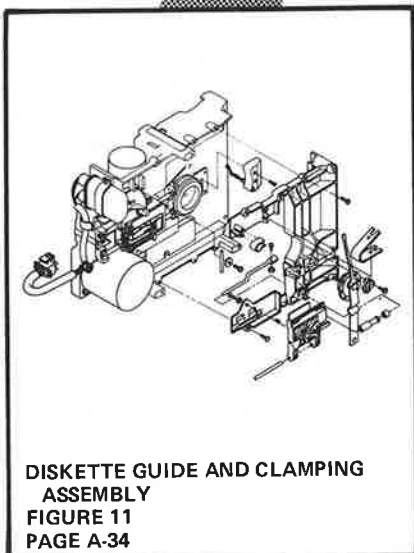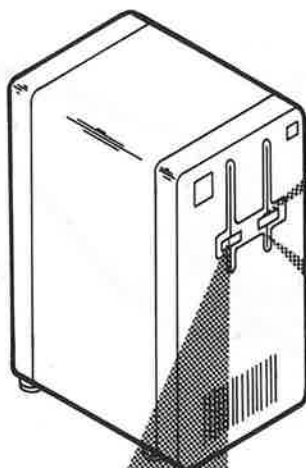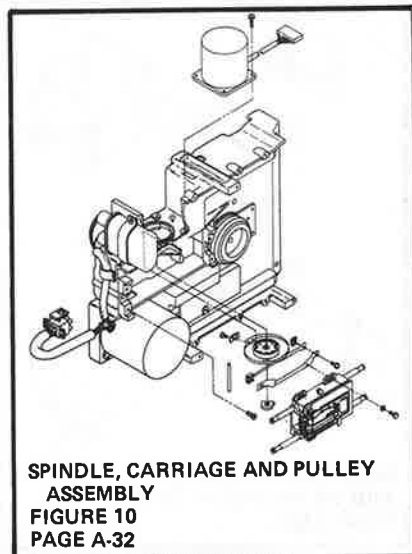PAGES A-12 & A-14

FINAL ASSEMBLY
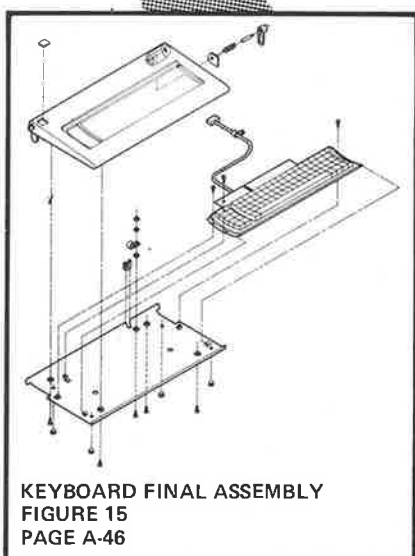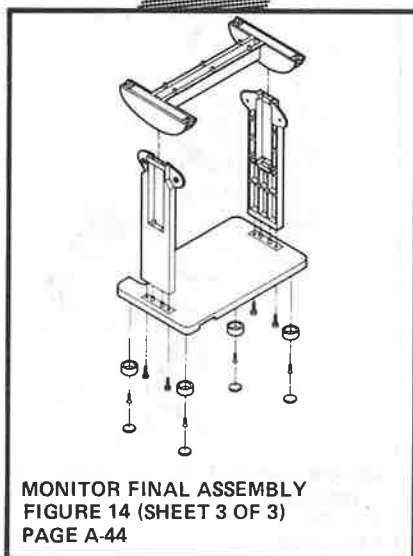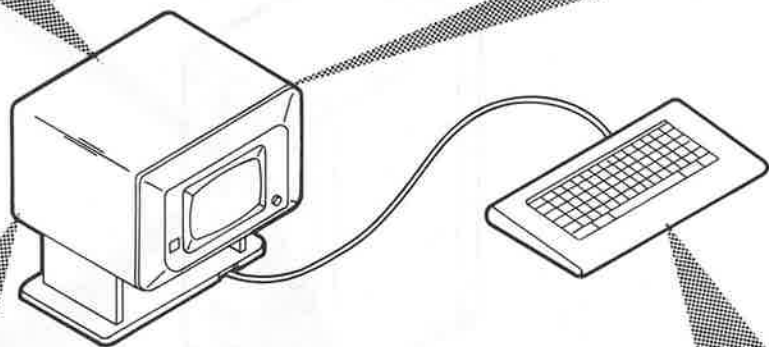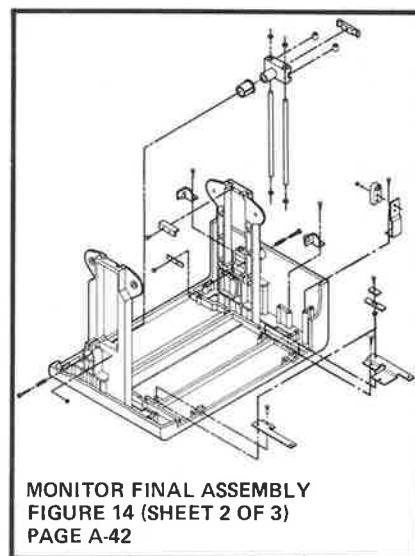FIGURE 1 (SHEET 3 OF 3)
PAGE A-16

Parts
catalog

Parts catalog

Visual index II

FAN ASSEMBLY
FIGURE 5
PAGE A-25

POWER SUPPLY ASSEMBLY, 73 W
60 HZ - U.S./CANADA
FIGURE 6
PAGE A-26

POWER SUPPLY ASSEMBLY, 73 W 60
HZ - GBG/I AND 73 W 50 HZ -
GBG/I, EMEA
FIGURE 7
PAGE A-28

CABLE ROUTING
FIGURE 13
PAGE A-38

VENDOR POWER SUPPLY ASSEMBLY,
73 W 60 HZ - U.S./CANADA
FIGURE 8
PAGE A-30

VENDOR POWER SUPPLY ASSEMBLY,
73 W 50/60 HZ - GBG/I AND 73 W
50 HZ - EMEA
FIGURE 9
PAGE A-31

SPINDLE, CARRIAGE AND PULLEY
ASSEMBLY
FIGURE 10
PAGE A-32

DISKETTE GUIDE AND CLAMPING
ASSEMBLY
FIGURE 11
PAGE A-34

MOTOR, CAPACITOR AND ACTUATOR
ASSEMBLY
FIGURE 12
PAGE A-36

Parts
catalog

Parts catalog

Visual index IV

MONITOR FINAL ASSEMBLY
FIGURE 14 (SHEET 1 OF 3)
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MONITOR FINAL ASSEMBLY
FIGURE 14 (SHEET 2 OF 3)
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MONITOR FINAL ASSEMBLY
FIGURE 14 (SHEET 3 OF 3)
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KEYBOARD FINAL ASSEMBLY
FIGURE 15
PAGE A-46

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Parts catalog

Figure 1. Final assembly

FIGURE 1. FINAL ASSEMBLY. SHEET 1 OF 3. INDEX NOS. 1-17. SEE LIST 1.

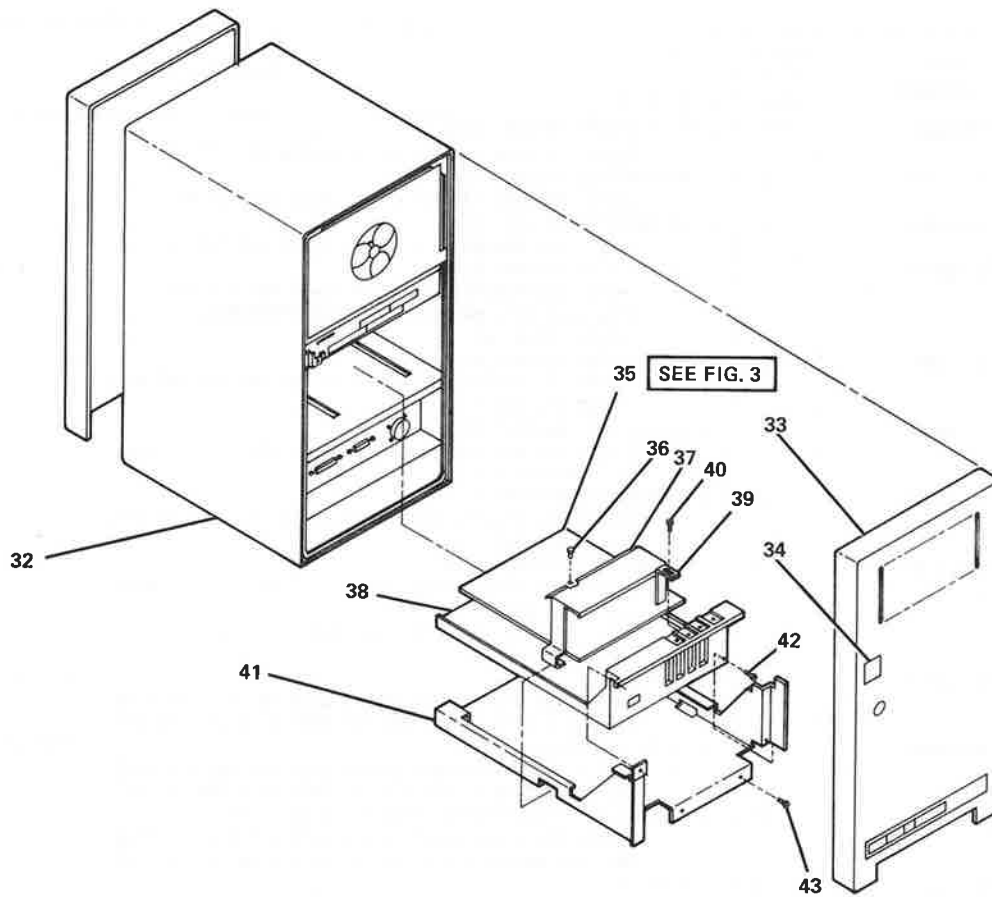| FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION
			1 2 3 4
1 -	NO NO.		FINAL ASSEMBLY
			FOR ILLUSTRATION SEE FIGURE 1
- 1	8257842	1	. MECHANICAL ASSEMBLY
			FOR DETAIL BREAKDOWN SEE FIGURE 2
- 2	8257868	1	. COVER ASM,REAR
- 3	8257880	1	. . KNOB ASM
- 4	6195578	1	. . SPRING,COMPRESSION
- 5	1126831	1	. . C-RING
- 6	8257843	1	. POWER SUPPLY ASM,73 W 60 HZ-U.S./CANADA
			FOR DETAIL BREAKDOWN SEE FIGURE 6
- 6	8257844	1	. POWER SUPPLY ASM,73 W 60 HZ-GBG/I
- 6	8257845	1	. POWER SUPPLY ASM,73 W 50 HZ-GBG/I,EMEA
			FOR DETAIL BREAKDOWN SEE FIGURE 7
- 6	6081757	1	. VENDOR POWER SUPPLY ASM,73 W 60 HZ-
			U.S./CANADA
			FOR DETAIL BREAKDOWN SEE FIGURE 8
- 6	6081759	1	. VENDOR POWER SUPPLY ASM,73 W 50/60 HZ-
			GBG/I
- 6	6081761	1	. VENDOR POWER SUPPLY ASM,73 W 50 HZ-EMEA
			FOR DETAIL BREAKDOWN SEE FIGURE 9
- 7	1621812	2	. SCREW ATT PT
- 8	1622346	2	. WSHR.LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 9	6844683	1	. RESISTOR ASM
			USED ON MACHINES WITH NO DRIVE
- 10	8257867	1	. COVER ASM,FRONT
			FOR DETAIL BREAKDOWN SEE FIGURE 4
- 11	6838235	1	. INSERT,BEZEL
			USED ON MACHINES WITH NO DRIVE,0.25 MB
			60 HZ,1.0 MB 60 HZ,0.25 MB 50 HZ AND
			1.0 MB 50 HZ
- 12	2451197	2	. SCREW,THD FORM HEX WSHR HD- 6-19 X .312L ATT PT
			USED ON MACHINES WITH NO DRIVE,0.25 MB
			60 HZ,1.0 MB 60 HZ,0.25 MB 50 HZ AND
			1.0 MB 50 HZ
- 13	6841471	2	. MOUNTING PLATE,BEZEL INSERT ATT PT
			USED ON MACHINES WITH NO DRIVE,0.25 MB
			60 HZ,1.0 MB 60 HZ,0.25 MB 50 HZ AND
			1.0 MB 50 HZ
- 14	6838235	1	. INSERT,BEZEL
			USED ON MACHINES WITH NO DRIVE
- 15	2451197	2	. SCREW,THD FORM HEX WSHR HD- 6-19 X .312L ATT PT
			USED ON MACHINES WITH NO DRIVE
- 16	6841471	2	. MOUNTING PLATE,BEZEL INSERT ATT PT
			USED ON MACHINES WITH NO DRIVE
- 17	6081621	1	. NAMEPLATE,5324

Figure 1. Final assembly (continued)
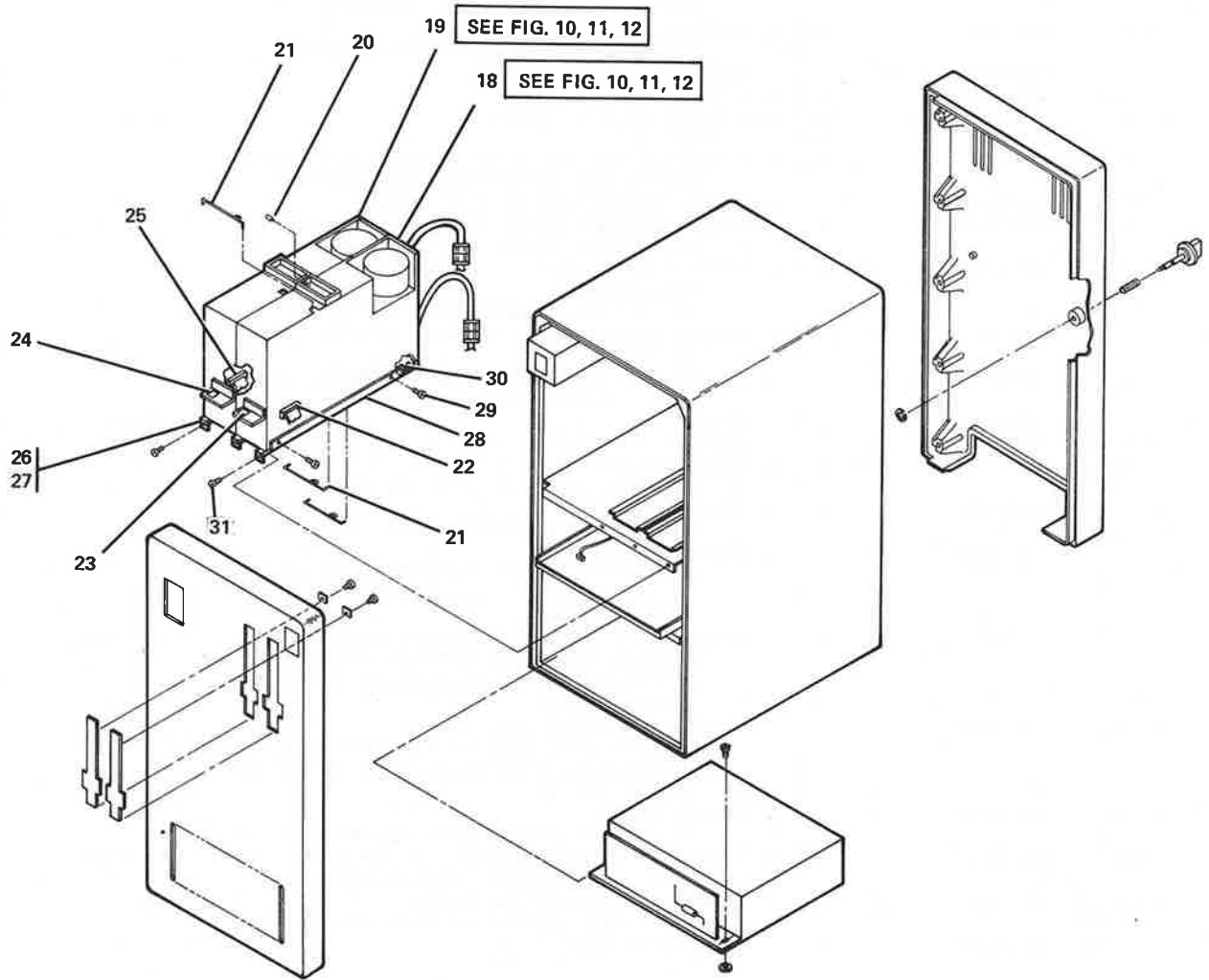
FIGURE 1. FINAL ASSEMBLY. SHEET 2 OF 3. INDEX NOS. 18-31. SEE LIST 1.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
1 - 18	6838201	1	• DISKETTE DRIVE ASM USED ON MACHINES WITH 0.50 MB 60 HZ
- 18	6838203	1	• DISKETTE DRIVE ASM USED ON MACHINES WITH 2.0 MB 60 HZ
- 18	6838200	1	• DISKETTE DRIVE ASM USED ON MACHINES WITH 0.50 MB 50 HZ
- 18	6838202	1	• DISKETTE DRIVE ASM USED ON MACHINES WITH 2.0 MB 50 HZ FOR DETAIL BREAKDOWN SEE FIGURES 10,11 AND 12
- 19	6838201	2	• DISKETTE DRIVE ASM USED ON MACHINES WITH 0.25 MB 60 HZ AND 0.50 MB 60 HZ
- 19	6838203	2	• DISKETTE DRIVE ASM USED ON MACHINES WITH 1.0 MB 60 HZ AND 2.0 MB 60 HZ
- 19	6838200	2	• DISKETTE DRIVE ASM USED ON MACHINES WITH 0.25 MB 50 HZ AND 0.50 MB 50 HZ
- 19	6838202	2	• DISKETTE DRIVE ASM USED ON MACHINES WITH 1.0 MB 50 HZ AND 2.0 MB 50 HZ FOR DETAIL BREAKDOWN SEE FIGURES 10,11 AND 12
- 20	4240585	2	• PIN ATT PT USED ON MACHINES WITH 0.5 MB 60 HZ,2.0 MB 60 HZ,0.5 MB 50 HZ AND 2.0 MB 50 HZ
- 21	4240586	3	• CLIP,SPRING ATT PT USED ON MACHINES WITH 0.5 MB 60 HZ,2.0 MB 60 HZ,0.5 MB 50 HZ AND 2.0 MB 50 HZ
- 22	8257834	1	• CABLE ASM,DISKETTE SIGNAL AND POWER USED ON MACHINES WITH 0.5 MB 60 HZ,2.0 MB 60 HZ,0.5 MB 50 HZ AND 2.0 MB 50 HZ
- 23	8258007	1	• LABEL USED ON MACHINES WITH 0.50 MB 60 HZ AND 0.50 MB 50 HZ
- 23	4499244	1	• LABEL USED ON MACHINES WITH 2.0 MB 60 HZ AND 2.0 MB 50 HZ
- 24	8258006	1	• LABEL USED ON MACHINES WITH 0.25 MB 60 HZ, 0.50 MB 60 HZ,0.25 MB 50 HZ AND 0.50 MB 50 HZ
- 24	4499243	1	• LABEL USED ON MACHINES WITH 1.0 MB 60 HZ, 2.0 MB 60 HZ,1.0 MB 50 HZ AND 2.0 MB 50 HZ
			NOTE THE FOLLOWING PARTS ARE USED ON MACHINES WITH 0.25 MB 60 HZ,0.50 MB 60 HZ,1.0 MB 60 HZ,2.0 MB 60 HZ,0.25 MB 50 HZ,0.50 MB 50 HZ,1.0 MB 50 HZ AND 2.0 MB 50 HZ
- 25	8257834	1	• CABLE ASM,DISKETTE SIGNAL AND POWER
- 26	4498576	1	• BRACKET
- 27	1621509	2	• SCREW,SOC HD- M4 X 8 LG ATT PT
- 28	4498577	1	• BRACKET
- 29	1621509	2	• SCREW,SOC HD- M4 X 8 LG ATT PT
- 30	4498578	2	• BOLT,SHOULDER ATT PT
- 31	1621190	2	• BOLT,PAN HD- M4 X 8 LG ATT PT

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Figure 1. Final assembly (continued)

FIGURE 1. FINAL ASSEMBLY. SHEET 3 OF 3. INDEX NOS. 32-43. SEE LIST 1.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
1 - 32	8257846	REF	• ENCLOSURE ASM	
- 33	8257868	REF	• COVER ASM,REAR	
- 34	6081621	1	• NAMEPLATE	
- 35	NO NO.	1	• PLANAR BOARD	
			FOR ATTACHMENT FEATURES SEE FIGURE 3	
- 36	2632773	1	• CLIP	ATT PT
- 37	6060940	1	• STRAP ASM,LOGIC	
- 38	6841570	1	• STIFFENER ASM	
- 39	6840707	3	• PLATE,BLANK	
- 40	6846445	3	• SCREW	ATT PT
- 41	6060937	1	• STIFFENER,LOGIC	
- 42	1621510	2	• BOLT,SOC HD- M4 X 10 LG	ATT PT
- 43	1621812	2	• SCREW	ATT PT

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Figure 2. Mechanical assembly
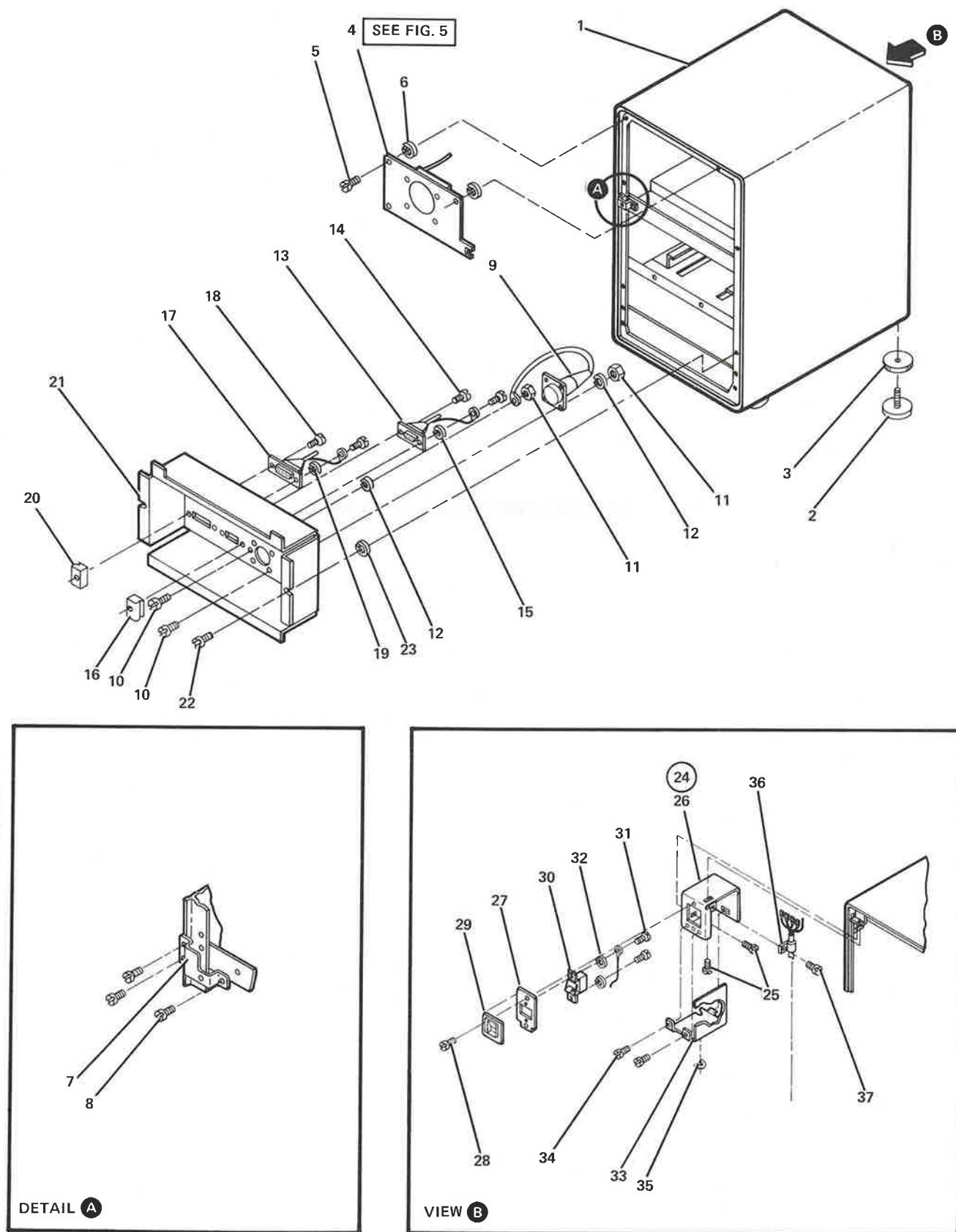
FIGURE 2. MECHANICAL ASSEMBLY. SEE LIST 2.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
2 -	NO NO.	REF	MECHANICAL ASM
			FOR NEXT HIGHER ASM SEE FIGURE 1-1
			AND FOR ILLUSTRATION FIGURE 2
- 1	8257846	REF	. ENCLOSURE ASM
- 2	6081612	4	. GLIDE ASM,ADJUSTABLE
- 3	6081613	4	. NUT,ADJUSTABLE GLIDE ATT PT
- 4	8257859	1	. FAN AND BRACKET ASM
			FOR DETAIL BREAKDOWN SEE FIGURE 5
- 5	1621812	4	. SCREW ATT PT
- 6	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 7	8257854	1	. LATCH ASM,BRACKET
- 8	1621812	3	. SCREW ATT PT
- 9	8257841	1	. CABLE ASM
- 10	1621171	5	. SCREW,MACH PAN HD- M3 X 8 LG ATT PT
- 11	1622401	5	. NUT,HEX- M3 X 5.5 ATT PT
- 12	1622344	5	. WASHER,LOCK EXT T- 3.8 ID X 6 OD ATT PT
- 13	6031062	1	. CABLE ASM
- 14	1621170	2	. SCREW,MACH PAN HD- M3 X 6 LG ATT PT
- 15	1622344	1	. WASHER,LOCK EXT T- 3.8 ID X 6 OD ATT PT
- 16	6031052	2	. BLOCK,LATCHING
- 17	6195582	1	. CABLE ASM,KEYBOARD INTERNAL
- 18	1621170	2	. SCREW,MACH PAN HD- M3 X 6 LG ATT PT
- 19	1622344	1	. WASHER,LOCK EXT T- 3.8 ID X 6 OD ATT PT
- 20	6031052	2	. BLOCK,LATCHING
- 21	8257847	1	. BOX,CONNECTOR
- 22	1621812	2	. SCREW ATT PT
- 23	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 24	NO NO.	1	. SWITCH ASM
- 25	1621197	2	. SCREW,MACH PAN HD- M4 X 6 LG ATT PT
- 26	8257850	1	. . BOX,SWITCH
- 27	8257849	1	. . PLATE,SWITCH MOUNTING
- 28	6845240	2	. . SCREW ATT PT
- 29	6837729	1	. . BEZEL,SWITCH
- 30	6842984	1	. . SWITCH
- 31	6841070	2	. . SCREW ATT PT
- 32	1622346	2	. . WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 33	8257851	1	. . COVER,SWITCH BOX
- 34	1621197	2	. . SCREW,MACH PAN HD- M4 X 6 LG ATT PT
- 35	1550666	1	. . GROMMET
- 36	533289	1	. CLAMP
- 37	1621197	1	. SCREW,MACH PAN HD- M4 X 6 LG ATT PT

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Figure 3. Attachment features

EXTENDED 5246 CONTROLLER RPQ (I/O POSITION 5)

WORD PROCESSING (I/O POSITION 2 OR 3)

INTEGRATED DISKETTE CONTROLLER (I/O POSITION 5)

5246 DISKETTE UNIT CONTROLLER (I/O POSITION 5)
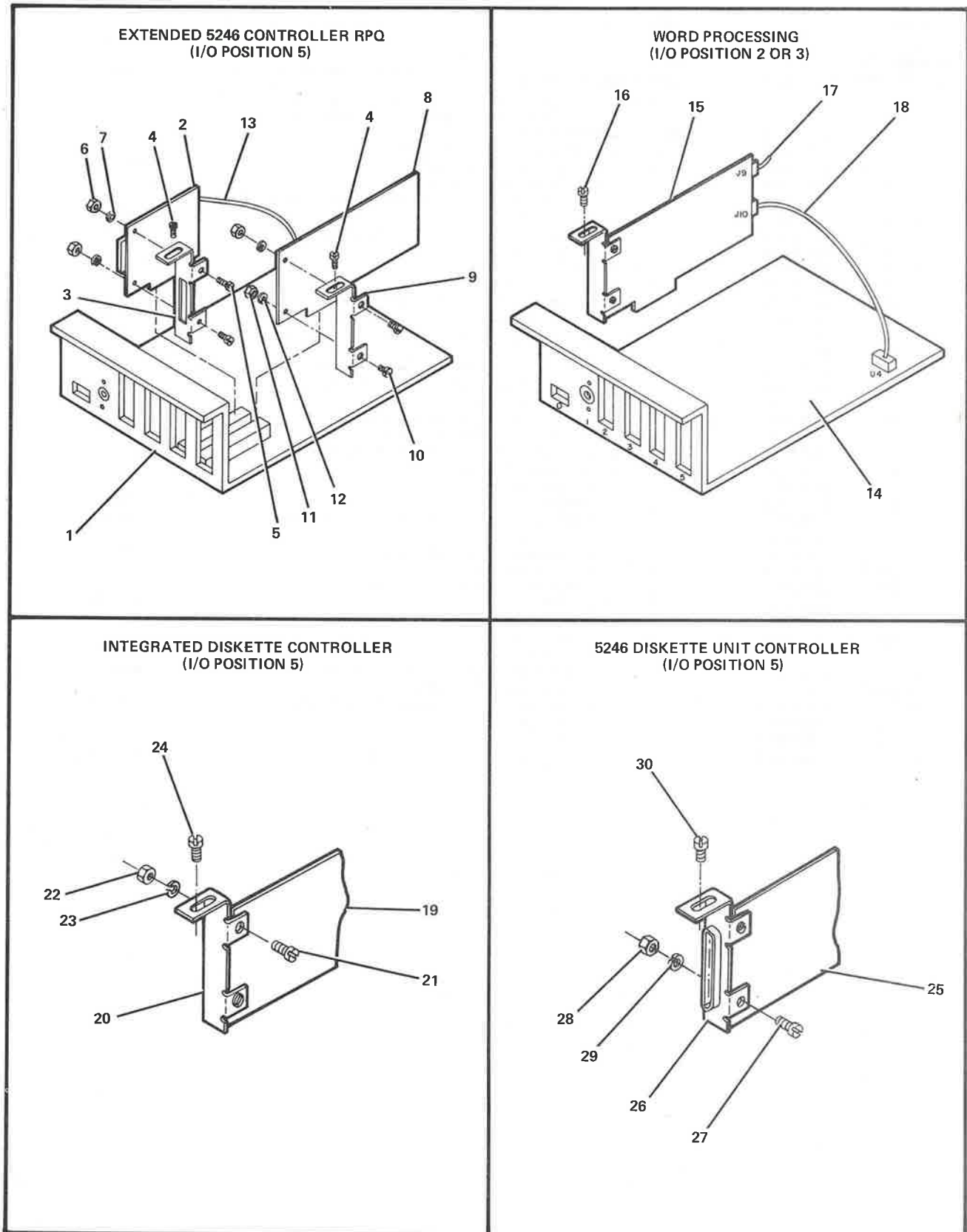
FIGURE 3. ATTACHMENT FEATURES. SHEET 1 OF 2. INDEX NOS. 1-30. SEE LIST 3.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
3 –	NO NO.	REF	ATTACHMENT FEATURES
			FOR NEXT HIGHER ASM SEE FIGURE 1-35
			AND FOR ILLUSTRATION SEE FIGURE 3
– 1	6841570	REF	. STIFFENER ASM
– 2	NO NO.	REF	. CARD ASM,DR/RCR,FOR PART NUMBER SEE CARD
– 3	6841609	1	. BRACKET,MCUNTING
– 4	6846445	2	. SCREW ATT PT
– 5	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG ATT PT
– 6	1622401	2	. NUT,HEX- M3 X 5.5 ATT PT
– 7	1622316	2	. WASHER,LOCK SPRING- 3.1 ID X 6.2 OD ATT PT
– 8	NO NO.	REF	. CARD ASM,REMOTE
			FOR PART NUMBER SEE CARD
– 9	6846471	1	. BRACKET,MOUNTING
– 10	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG ATT PT
– 11	1622401	2	. NUT,HEX- M3 X 5.5 ATT PT
– 12	1622316	2	. WASHER,LOCK SPRING- 3.1 ID X 6.2 OD ATT PT
– 13	6846795	1	. CABLE ASM,REMOTE ATTACHMENT
– 14	NO NO.	1	. PLANAR BOARD
			FOR PART NUMBER SEE BOARD
– 15	NO NO.	REF	. CARD ASM,WORD PROCESSING
			FOR PART NUMBER SEE CARD
– 16	6846445	1	. SCREW ATT PT
– 17	6031062	REF	. CABLE ASM,MONITOR INTERNAL
– 18	6844251	REF	. CABLE ASM
– 19	NO NO.	REF	. CARD ASM,INTEGRATED DISKETTE CONROLLER
			FOR PART NUMBER SEE CARD
– 20	6846471	1	. BRACKET
– 21	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG ATT PT
– 22	1622401	2	. NUT,HEX- M3 X 5.5 ATT PT
– 23	1622316	2	. WASHER,LOCK SPRING- 3.1 ID X 6.2 OD ATT PT
– 24	6846445	1	. SCREW ATT PT
– 25	NO NO.	REF	. CARD ASM,5246 DISKETTE UNIT CONTROLLER
			FOR PART NUMBER SEE CARD
– 26	6841609	1	. BRACKET/STANDOFF ASM
– 27	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG ATT PT
– 28	1622401	2	. NUT,HEX- M3 X 5.5 ATT PT
– 29	1622316	2	. WASHER,LOCK SPRING- 3.1 ID X 6.2 OD ATT PT
– 30	6846445	1	. SCREW

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Figure 3. Attachment features(continued)

LARGE SCREEN ATTACHMENT RPQ
(I/O POSITION 1)

COMMUNICATION ADAPTER
(I/O POSITION 2/3 OR 4)

SECOND PRINTER ATTACHMENT
(I/O POSITION 2/3 OR 4)

PLANAR BOARD CONFIGURATION
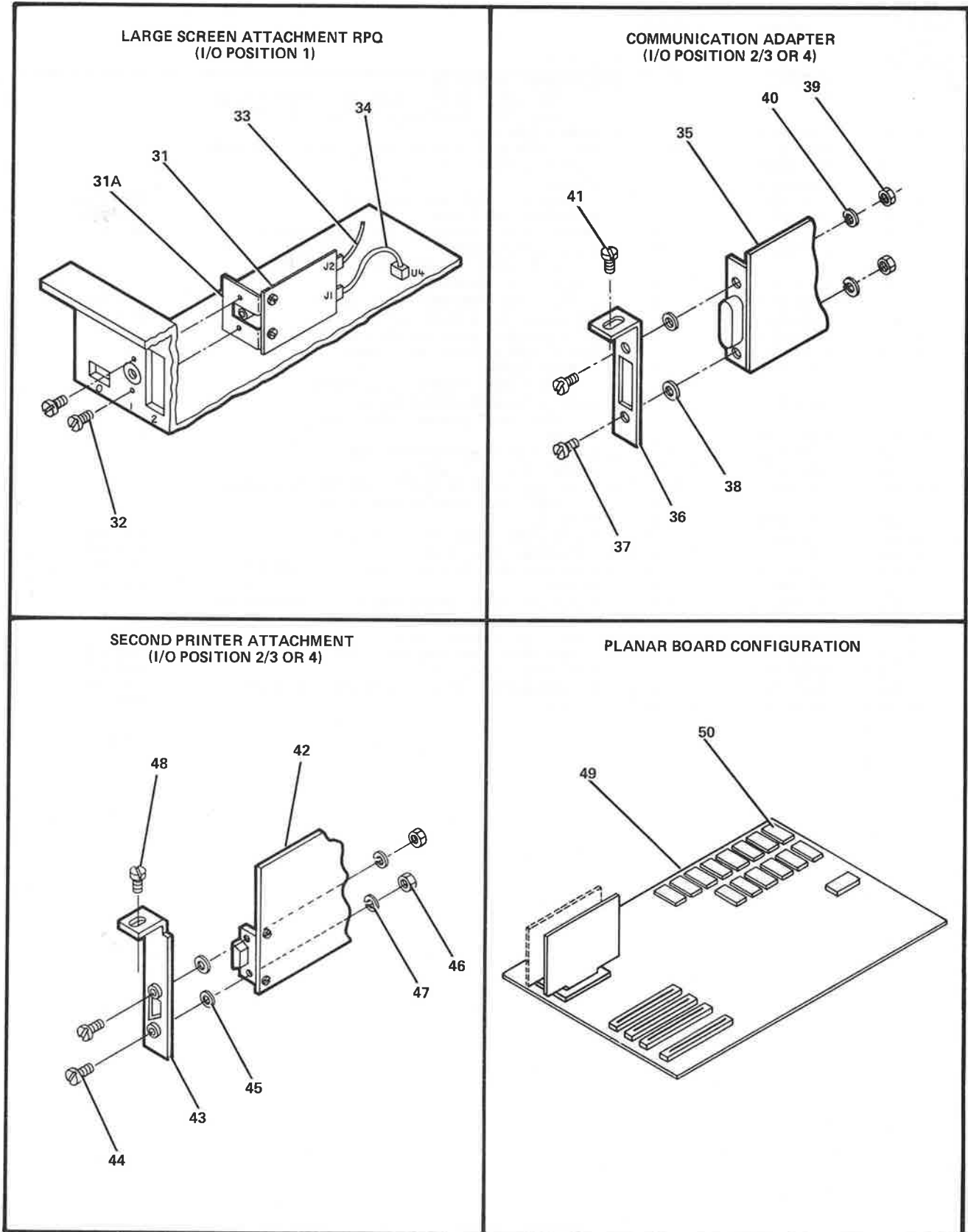
FIGURE 3. ATTACHMENT FEATURES. SHEET 2 OF 2. INDEX NOS. 31-50. SEE LIST 3.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
3 - 31	NO NO.	REF	• CARD ASM,LARGE SCREEN ATTACHMENT FOR PART NUMBER SEE CARD	
- 31A	NO NO.	1	• BRACKET	
- 32	1621182	2	• SCREW,MACH PAN HD- M3.5 X 8 LG	ATT PT
- 33	6031062	REF	• CABLE ASM,MONITOR INTERNAL	
- 34	8258012	REF	• CABLE ASM,COMP VIDEO	
- 35	NO NO.	REF	• CARD ASM,COMMUNICATION ADAPTER FOR PART NUMBER SEE CARD	
- 36	6841610	1	• BRACKET,MOUNTING	
- 37	1621172	2	• SCREW,MACH PAN HD- M3 X 10 LG	ATT PT
- 38	1622302	2	• WASHER,FLAT- M7 OD X 3.2 ID	ATT PT
- 39	1622401	2	• NUT,HEX- M3 X 5.5	ATT PT
- 40	1622316	2	• WASHER,LOCK SPRING- 3.1 ID X 6.2 OD	ATT PT
- 41	6846445	1	• SCREW	ATT PT
- 42	NO NO.	REF	• CARD ASM,SECOND PRINTER ATTACHMENT FOR PART NUMBER SEE CARD	
- 43	6841611	1	• BRACKET/STANDOFF ASM	
- 44	1621172	2	• SCREW,MACH PAN HD- M3 X 10 LG	ATT PT
- 45	1622302	2	• WASHER,FLAT- M7 OD X 3.2 ID	ATT PT
- 46	1622401	2	• NUT,HEX- M3 X 5.5	ATT PT
- 47	1622316	2	• WASHER,LOCK SPRING- 3.1 ID X 6.2 OD	ATT PT
- 48	6846445	1	• SCREW	ATT PT
- 49	NO NO.	REF	• PLANAR BOARD FOR PART NUMBER SEE CARD	
- 50	NO NO.	REF	• MODULE FOR PART NUMBER OF REPLACEABLE MODULES SEE INDIVIDUAL MODULE	

Figure 4. Front cover assembly
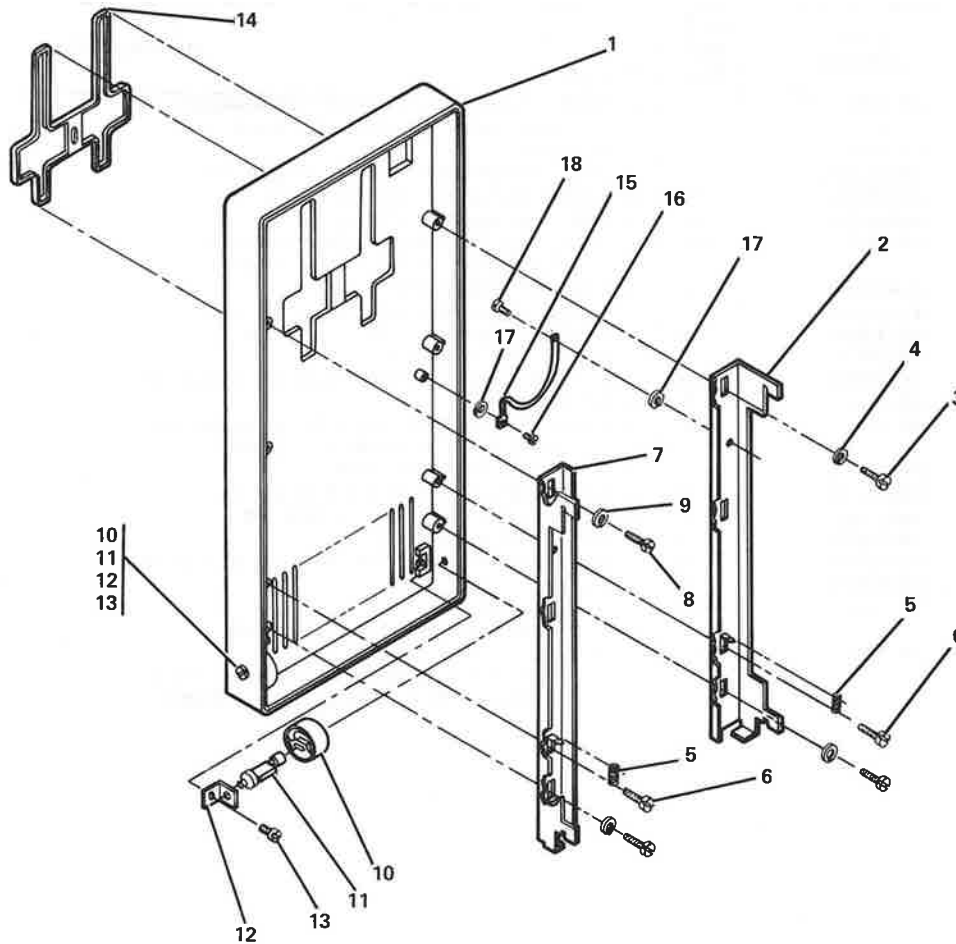
FIGURE 4. FRONT COVER ASSEMBLY. SEE LIST 4.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
4 —	8257867	REF	FRONT COVER ASM	
			FOR NEXT HIGHER ASM SEE FIGURE 1-10	
			AND FOR ILLUSTRATION FIGURE 4	
— 1	8257869	1	. COVER,FRONT	
— 2	8257874	1	. LATCH,LEFT FRONT	
— 3	2549526	2	. SCREW	ATT PT
— 4	1622305	2	. WASHER,FLAT- M10 OD X 5.5 ID	ATT PT
— 5	8257871	1	. SPRING,EXTENSION	
— 6	2549526	1	. SCREW	ATT PT
— 7	8257873	1	. LATCH,RIGHT FRONT	
— 8	2549526	2	. SCREW	ATT PT
— 9	1622305	2	. WASHER,FLAT- M10 OD X 5.5 ID	ATT PT
— 10	6081623	2	. CAM,COVER LATCH	
— 11	6195579	2	. SHAFT,CAM	
— 12	6081622	2	. BRACKET,CAM MOUNTING	
— 13	1608277	2	. SCREW,THD FORM HEX WSHR HD- 6-19 X 3/8 L	ATT PT
— 14	6841071	1	. BEZEL,DISKETTE DRIVE	
— 15	523022	1	. JUMPER ASM,GROUND	
— 16	1608427	1	. SCREW,THD FORM HEX WSHR HD- 6-19 X 1/2 L	ATT PT
— 17	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T	ATT PT
— 18	7362385	1	. SCREW,THD FORM HEX WSHR HD- M4 X 8 LG	ATT PT

Figure 5. Fan assembly
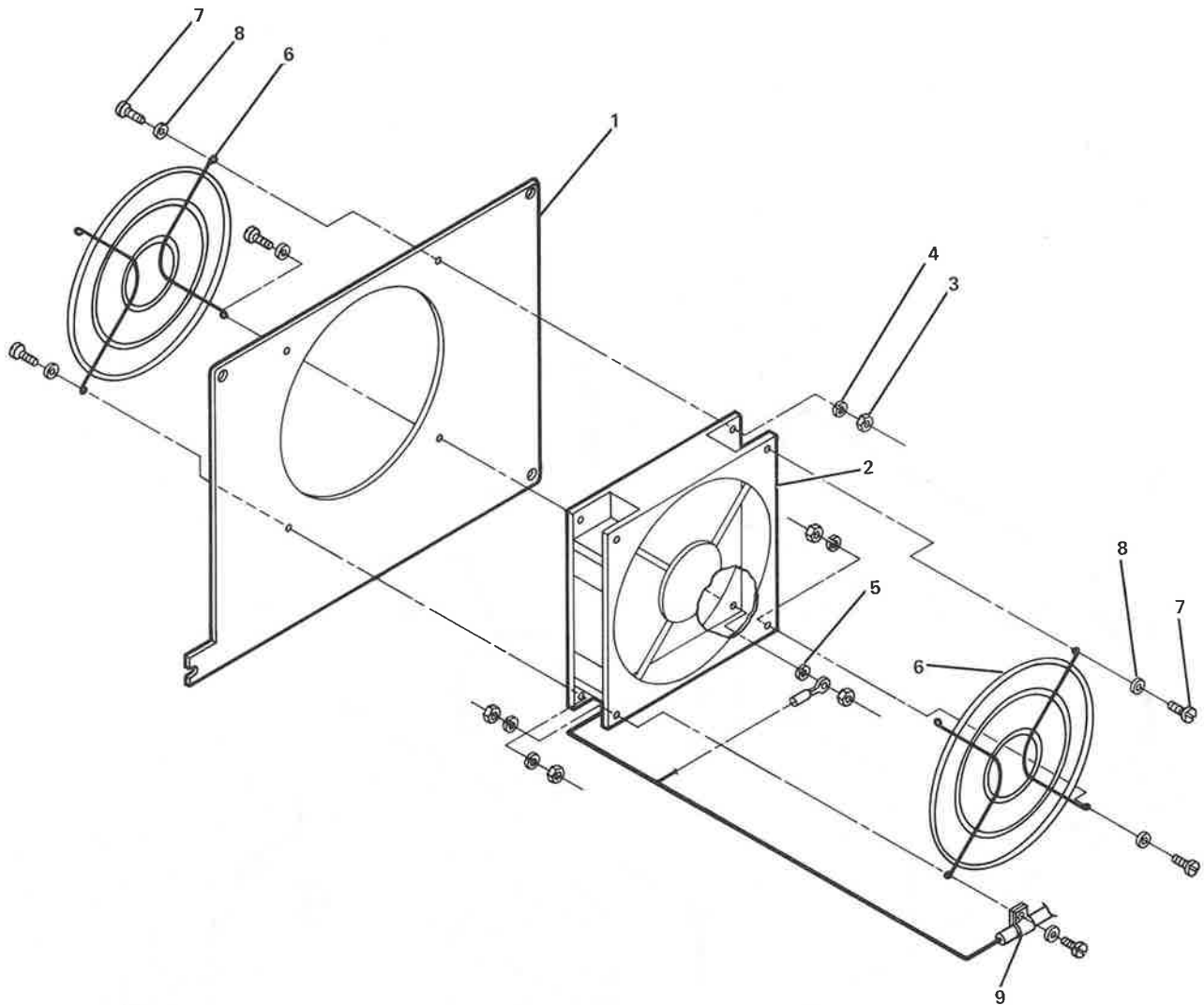
FIGURE 5. FAN ASSEMBLY. SEE LIST 5.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
5 -	8257859	1	FAN ASM	
			FOR NEXT HIGHER ASM SEE FIGURE 2-4	
			AND FOR ILLUSTRATION FIGURE 5	
- 1	8257855	1	. PLATE	
- 2	8257858	1	. FAN ASM	
- 3	1622401	8	. NUT,HEX- M3 X 5.5	ATT PT
- 4	1622344	7	. WASHER,LOCK EXT T- 3.8 ID X 6 OD	ATT PT
- 5	1622332	1	. WASHER,LOCK INT T- 3.2 ID X 6 OD	ATT PT
- 6	6195581	2	. GUARD,FAN	
- 7	1621174	8	. SCREW,MACH PAN HD- M3 X 16 LG	ATT PT
- 8	1622302	8	. WASHER,FLAT- M7 OD X 3.2 ID	ATT PT
- 9	356742	1	. CLAMP	

Figure 6. Power supply assembly, 73 W 60 Hz - U.S./Canada
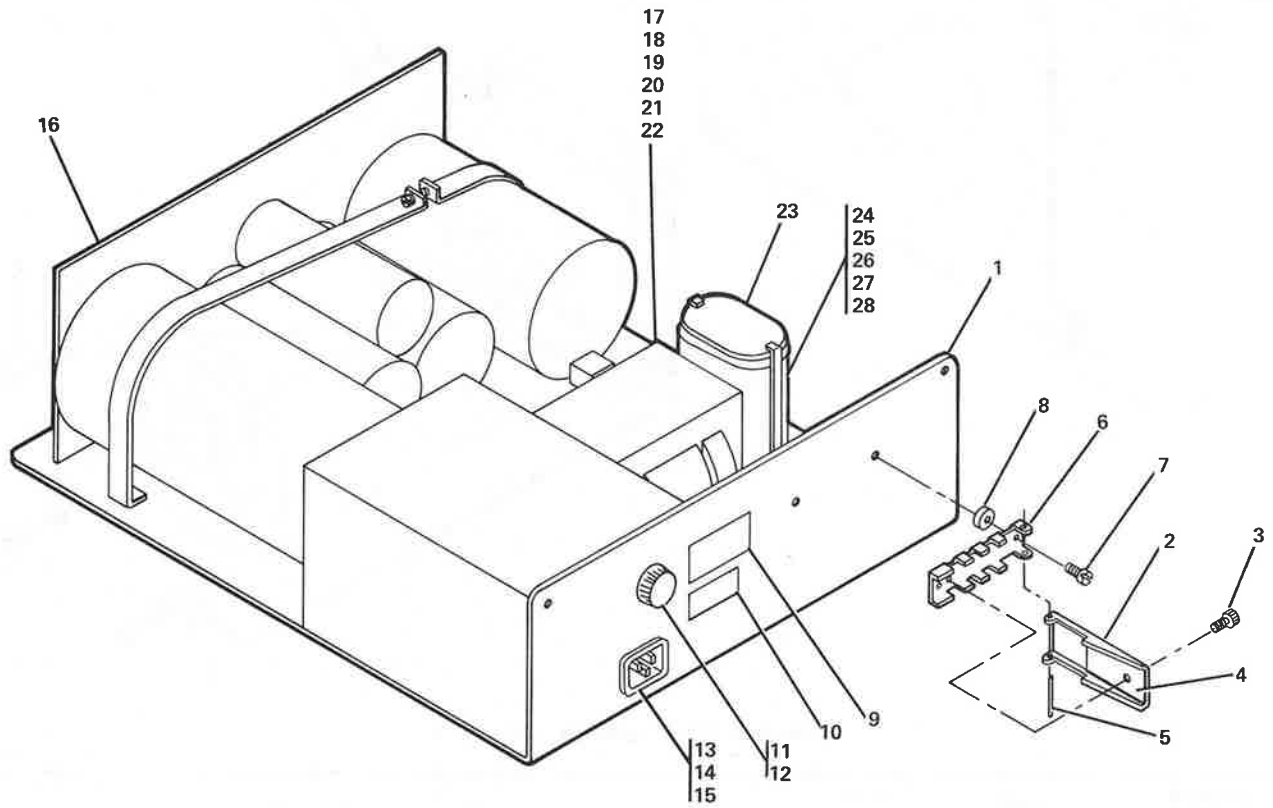
FIGURE 6. POWER SUPPLY ASSEMBLY, 73 W 60 HZ - U.S./CANADA. SEE LIST 6.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
6 -	8257843	REF	POWER SUPPLY ASM,73 W 60 HZ-U.S./CANADA
			FOR NEXT HIGHER ASM SEE FIGURE 1-6
			AND FOR ILLUSTRATION FIGURE 6
- 1	8257835	1	. CHASSIS
- 2	6846466	1	. COVER
- 3	6846463	1	. SCREW ATT PT
- 4	4499245	1	. RUBBER
- 5	1611083	1	. PIN,ROLL
- 6	6846467	1	. BRACKET
- 7	1621320	2	. BOLT,FLAT HD- M5 X 10 LG ATT PT
- 8	6846464	2	. STANDOFF
- 9	5892077	1	. LABEL
- 10	5130277	1	. LABEL
- 11	4412938	1	. FUSEHOLDER
- 12	512137	1	. FUSE,SLO BLO 5 A 125 V
- 13	6838259	1	. RECEPTACLE,AC POWER
- 14	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG ATT PT
- 15	1622401	2	. NUT,HEX- M3 X 5.5 ATT PT
- 16	6841577	1	. CARD ASM
- 17	6838240	1	. FERRO
- 18	1621310	4	. SCREW,MACH FLAT HD- M4 X 12 LG ATT PT
- 19	1622304	4	. WASHER,FLAT- M9 OD X 4.3 ID ATT PT
- 20	1622318	4	. WASHER,LOCK SPRING- 4.1 ID X 7.5 OD ATT PT
- 21	1622403	4	. NUT,HEX- M4 X 7 ATT PT
- 22	1622346	4	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 23	526378	2	. COVER
- 24	5252850	1	. CAPACITOR
- 25	6842663	2	. CLAMP,60 HZ
- 26	1621312	2	. SCREW,MACH FLAT HD- M4 X 20 LG ATT PT
- 27	1622403	2	. NUT,HEX- M4 X 7 ATT PT
- 28	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT

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FIGURE 7. POWER SUPPLY ASSEMBLY, 73 W 60 HZ - GBG/I AND 73 W 50 HZ - GBG/I, EMEA. SEE LIST 7.

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FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
7 -	8257844	REF	POWER SUPPLY ASM,73 W 60 HZ-GBG/I	
-	8257845	REF	POWER SUPPLY ASM,73 W 50 HZ-GBG/I,EMEA	
			FOR NEXT HIGHER ASM SEE FIGURE 1-6	
			AND FOR ILLUSTRATION FIGURE 7	
- 1	8257836	1	. CHASSIS,GBG/I	
- 2	6846466	1	. COVER	
- 3	6846463	1	. SCREW	ATT PT
- 4	4499245	1	. RUBBER	
- 5	1611083	1	. PIN,ROLL	
- 6	6846467	1	. BRACKET	
- 7	1621320	2	. BOLT,FLAT HD- M5 X 10 LG	ATT PT
- 8	6846464	2	. STANDOFF	
- 9	1821987	1	. CIRCUIT BREAKER	
- 10	10170	4	. SCREW,MACH BIND HD- 6-32 X 1/4 LG	ATT PT
- 11	6838259	1	. RECEPTACLE,AC POWER	
- 12	1621172	2	. SCREW,MACH PAN HD- M3 X 10 LG	ATT PT
- 13	1622401	2	. NUT,HEX- M3 X 5.5	ATT PT
- 14	6841577	1	. CARD ASM	
- 15	6838242	1	. FERRO	
			60 HZ-GBG/I	
- 15	6838241	1	. FERRO	
			50 HZ-GBG/I,EMEA	
- 16	1621310	4	. SCREW,MACH FLAT HD- M4 X 12 LG	ATT PT
- 17	1622304	4	. WASHER,FLAT- M9 OD X 4.3 ID	ATT PT
- 18	1622318	4	. WASHER,LOCK SPRING- 4.1 ID X 7.5 OD	ATT PT
- 19	1622403	4	. NUT,HEX- M4 X 7	ATT PT
- 20	1622346	4	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T	ATT PT
- 21	2426489	1	. TERMINAL,SUB 53	
			50 HZ-GBG/I,EMEA ONLY	
- 22	361537	1	. SHIELD	
- 23	1621181	2	. SCREW,MACH PAN HD- M3.5 X 6 LG	ATT PT
- 24	526378	2	. SHIELD	
- 25	5252850	1	. CAPACITOR	
			60 HZ-GBG/I	
- 25	5252839	1	. CAPACITOR	
			50 HZ-GBG/I,EMEA	
- 26	6842663	2	. BRACKET	
			60 HZ-GBG/I	
- 26	524928	2	. BRACKET	
			50 HZ-GBG/I,EMEA	
- 27	1621312	2	. SCREW,MACH FLAT HD- M4 X 20 LG	ATT PT
- 28	1622403	2	. NUT,HEX- M4 X 7	ATT PT
- 29	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T	ATT PT

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Figure 8. Vendor power supply assembly, 73 W 60 Hz - U.S./Canada
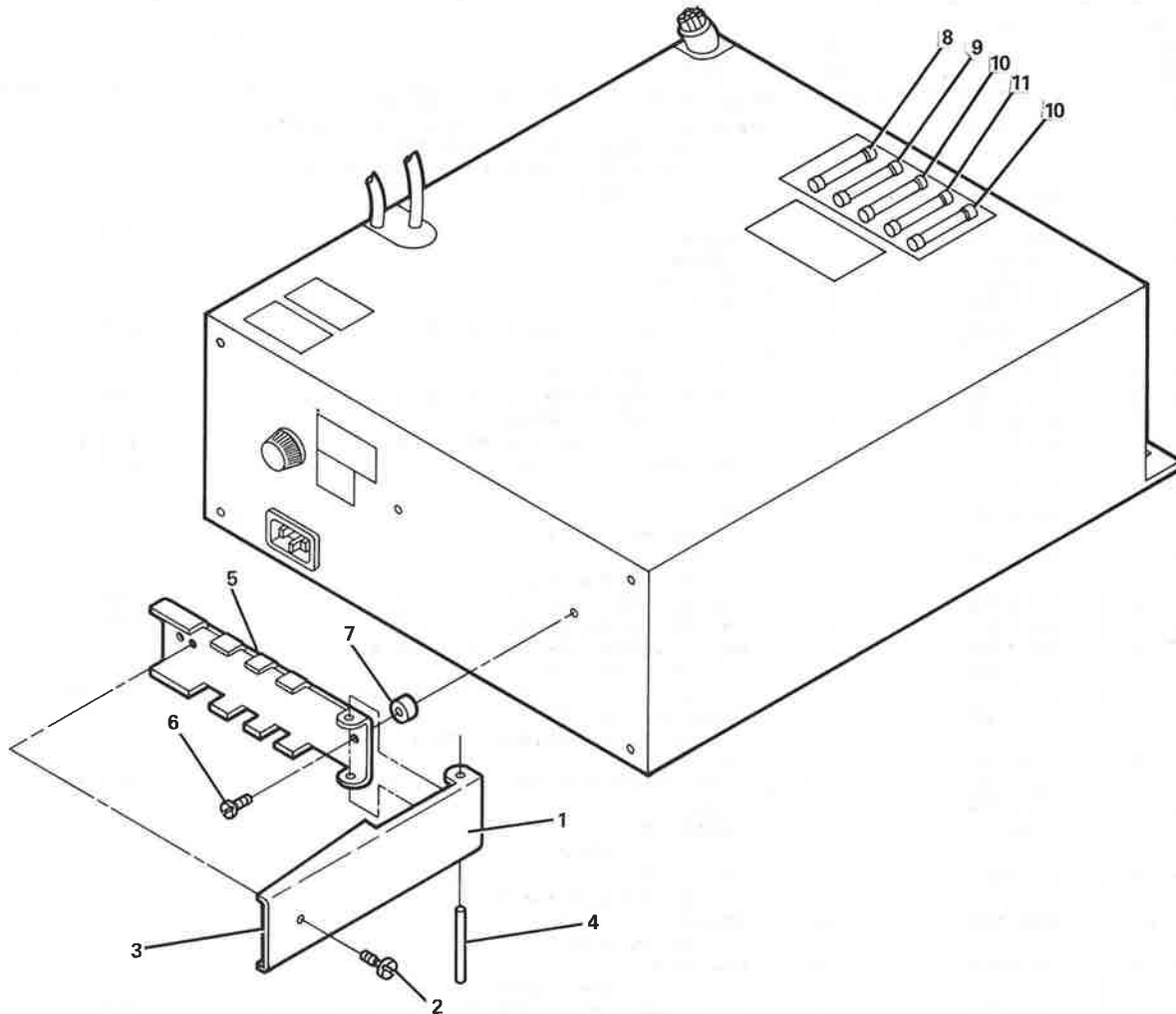
FIGURE 8. VENDOR POWER SUPPLY ASSEMBLY, 73 W 60 HZ - U.S./CANADA. SEE LIST 8.

FIGURE-INDEX NUMBER	PART NUMBER		UNITS PER ASM.	DESCRIPTION 1 2 3 4
8 -	6081757		REF	VENDOR POWER SUPPLY ASM
				73 W 60 HZ-U.S./CANADA
				FOR NEXT HIGHER ASM SEE FIGURE 1-6
				AND FOR ILLUSTRATION FIGURE 8
- 1	6846466	NP	1	. COVER
- 2	6846463	NP	1	. SCREW ATT PT
- 3	4499245	NP	1	. RUBBER
- 4	1611083	NP	1	. PIN,ROLL
- 5	6846467	NP	1	. BRACKET
- 6	1621320	NP	2	. BOLT,FLAT HD- M5 X 10 LG ATT PT
- 7	6846464	NP	2	. STANDOFF
- 8	6069233	NP	1	. FUSE,CARTRIDGE
- 9	1176668	NP	1	. FUSE,1.5 A
- 10	3577	NP	2	. FUSE,0.5 A
- 11	111256	NP	1	. FUSE,1.5 A

Figure 9. Vendor power supply assembly, 73 W 50/60 Hz - GBG/I and 73 W 50 Hz - EMEA
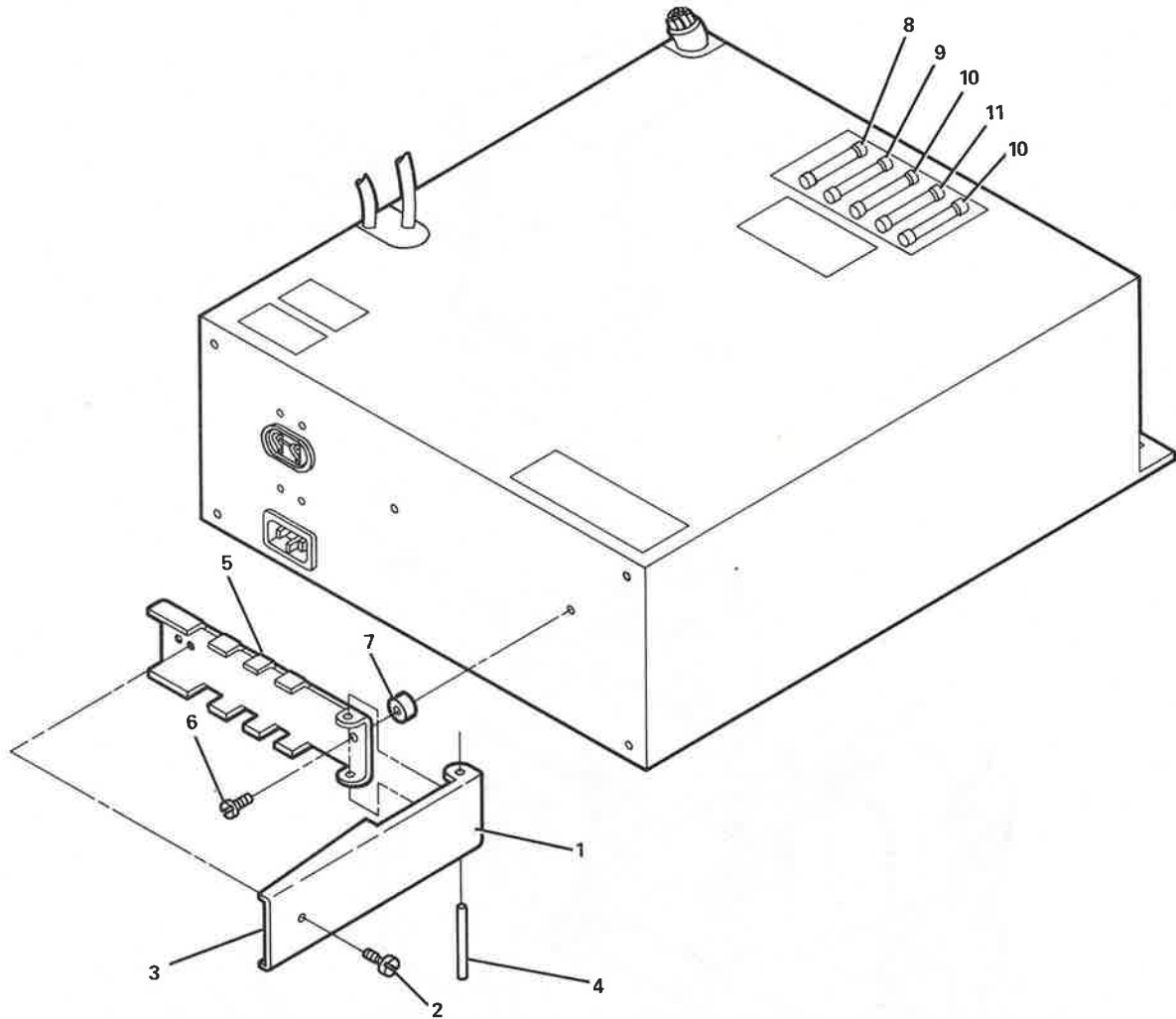
FIGURE 9. VENDOR POWER SUPPLY ASSEMBLY, 73 W 50/60 HZ - GBG/I AND 73 W 50 HZ - EMEA. SEE LIST 9.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
9 -	6081759	REF	VENDOR POWER SUPPLY ASM
			73 W 50/60 HZ-GBG/I
-	6081761	REF	VENDOR POWER SUPPLY ASM
			73 W 50 HZ-EMEA
			FOR NEXT HIGHER ASM SEE FIGURE 1-6
			AND FOR ILLUSTRATION FIGURE 9
- 1	6846466 NP	1	. COVER
- 2	6846463 NP	1	. SCREW ATT PT
- 3	4499245 NP	1	. RUBBER
- 4	1611083 NP	1	. PIN,ROLL
- 5	6846467 NP	1	. BRACKET
- 6	1621320 NP	2	. BOLT,FLAT HD- M5 X 10 LG ATT PT
- 7	6846464 NP	2	. STANDOFF
- 8	6069233 NP	1	. FUSE,CARTRIDGE
- 9	1176668 NP	1	. FUSE,1.5 A
- 10	3577 NP	2	. FUSE,0.5 A
- 11	111256 NP	1	. FUSE,1.5 A

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Figure 10. Spindle, carriage and pulley assembly
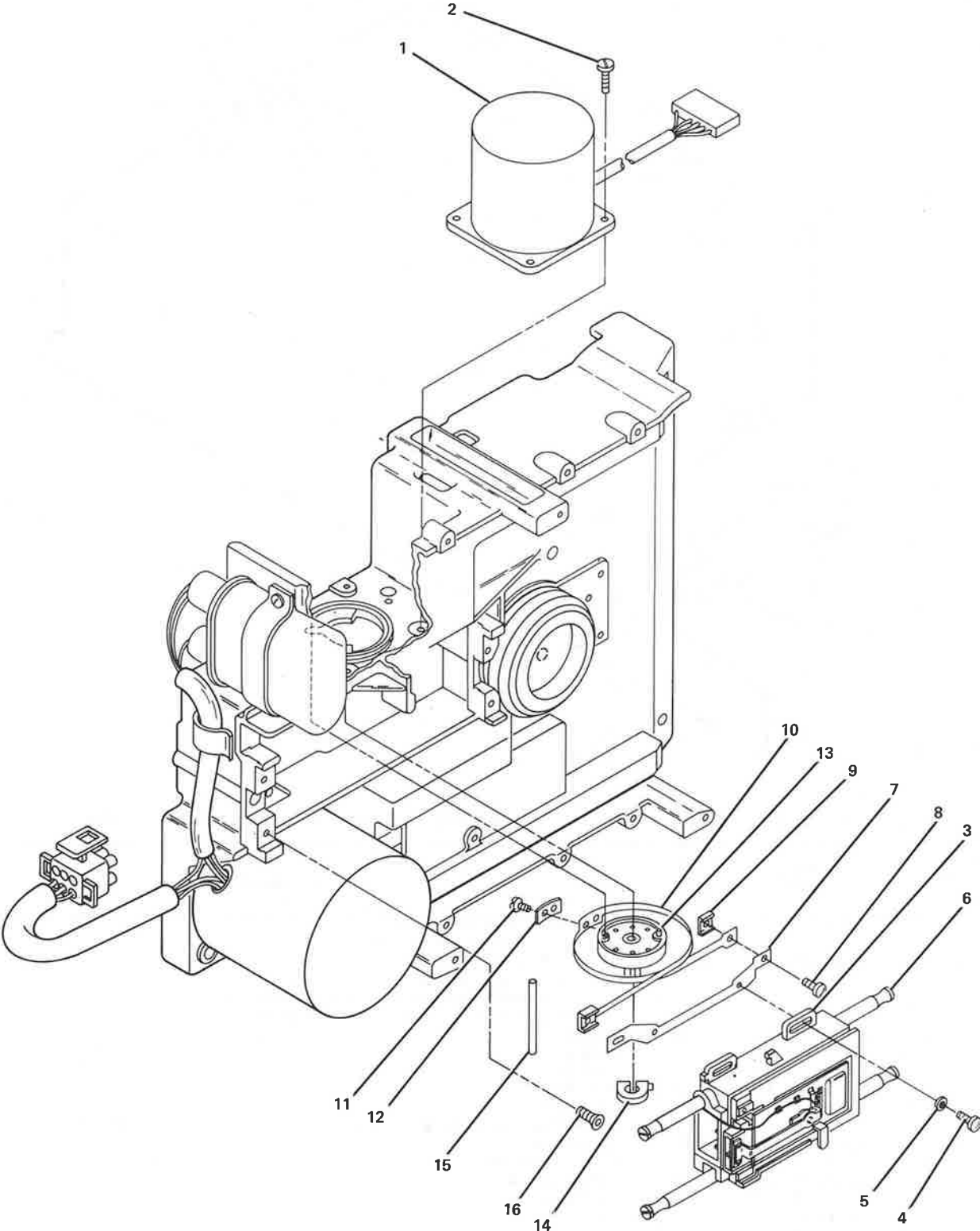
FIGURE 10. SPINDLE, CARRIAGE AND PULLEY ASSEMBLY. SEE LIST 10.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
10 -	NO NO.	1	SPINDLE,CARRIAGE AND PULLEY ASM
			FOR NEXT HIGHER ASM SEE FIGURES 1-18 AND
			1-19
			AND FOR ILLUSTRATION FIGURE 10
- 1	4240593	1	. MOTOR,STEPPER
- 2	2462685	4	. SCREW,THD FORM- M4 X .7 X 10 LG ATT PT
- 3	4240615	1	. CARRIAGE,HEAD(31 SD)
- 3	4240620	1	. CARRIAGE,HEAD(51TD)
- 4	1621170	2	. SCREW,MACH PAN HD- M3 X 6 LG ATT PT
- 5	1622302	2	. WASHER,FLAT- M7 OD X 3.2 ID ATT PT
- 6	4240573	2	. ROD,GUIDE
- 7	4240600	1	. BRACKET,MOUNTING
- 8	1621170	2	. SCREW,MACH PAN HD- M3 X 6 LG ATT PT
- 9	4240601	2	. CLAMP ATT PT
- 10	4240596	1	. BAND,DRIVE
- 11	1621170	1	. SCREW,MACH PAN HD- M3 X 6 LG ATT PT
- 12	4240599	1	. CLAMP ATT PT
- 13	4240594	1	. PULLEY ASM
- 14	2305493	1	. CLAMP ATT PT
- 15	5562019	1	. PIN,TIMING
- 16	4240642	4	. SCREW,FL HD- M4 X .7 X 12 LG

Figure 11. Diskette Guide and clamping assembly
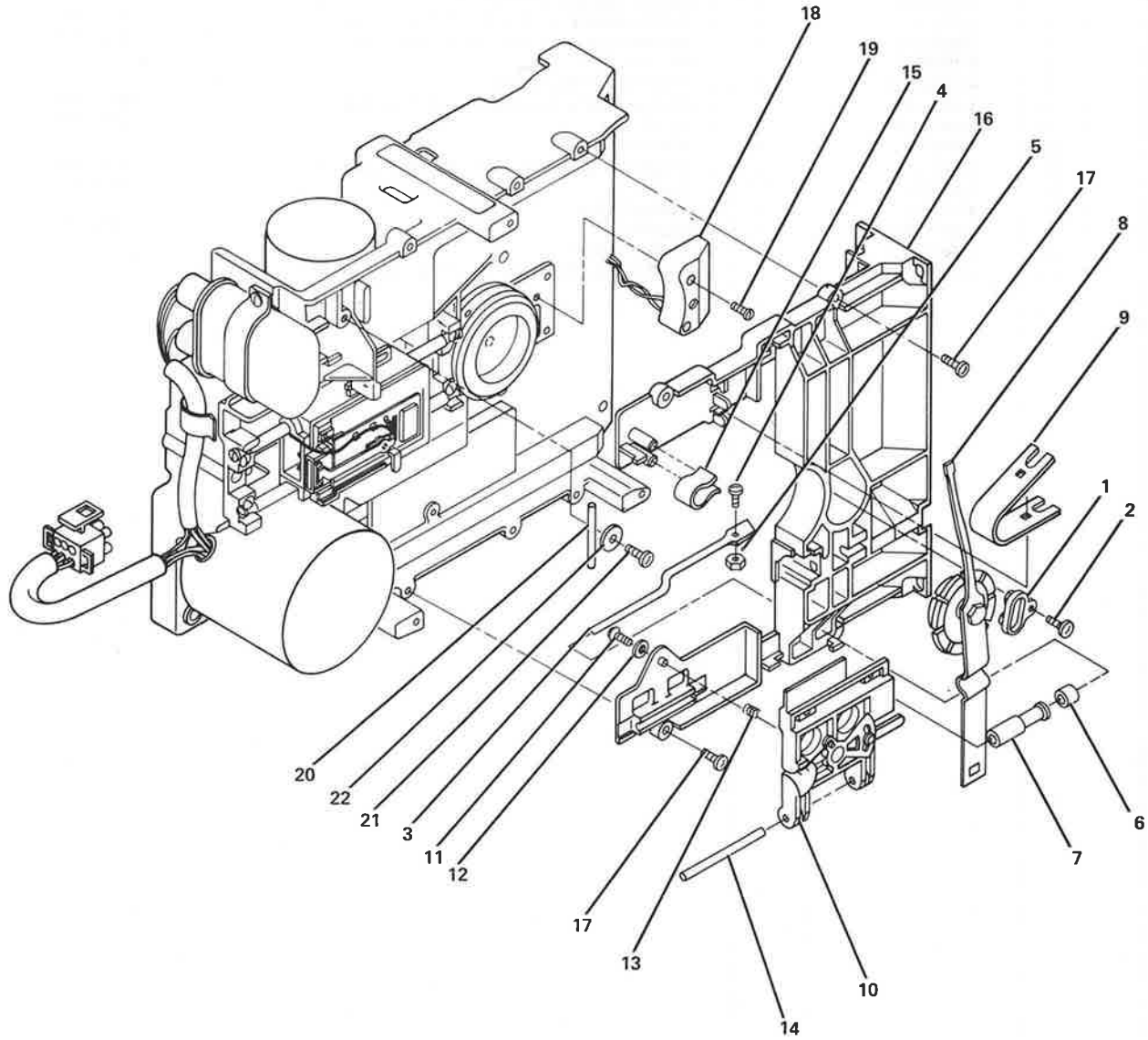
FIGURE 11. DISKETTE GUIDE AND CLAMPING ASSEMBLY. SEE LIST 11.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
11 -	NO NO.	1	DISKETTE GUIDE AND CLAMPING ASM
			FOR NEXT HIGHER ASM SEE FIGURES 1-18 AND
			1-19
			AND FOR ILLUSTRATION FIGURE 11
- 1	4240662	1	. LED ASM(31SD)
- 1	4240661	1	. LED ASM(51TD)
- 2	1621672	1	. SCREW,THD FORM- M4 X .7 X 12 LG ATT PT
- 3	4240592	1	. LEVER
- 4	1621182	1	. SCREW,MACH PAN HD- M3.5 X 8 LG ATT PT
- 5	1622402	1	. NUT,HEX- M3.5 X 6 ATT PT
- 6	4240644	1	. ROLL
- 7	4240614	1	. ROLLER
- 8	4240589	1	. COLLET ASM
- 9	4240631	1	. SPRING,TENSION
- 10	4240580	1	. BAIL ASM
- 11	1621672	1	. SCREW,THD FORM- M4 X .7 X 12 LG ATT PT
- 12	49374	1	. WASHER,FLAT NO. 10- .53 OD X .08 THK ATT PT
- 13	4240582	1	. SPRING(31 SD)
- 13	4240583	1	. SPRING(51 TD)
- 14	2462574	1	. PIN
- 15	4240632	1	. CLIP,RETAINER
- 16	4240663	1	. GUIDE
- 17	1621193	4	. SCREW,MACH PAN HD- M4 X 16 LG ATT PT
- 18	4240574	1	. PIX ASM(31SD)
- 18	4240576	1	. PIX ASM(51TD)
- 19	2462686	1	. SCREW,THD FORM- M4 X .7 X 16 LG ATT PT
- 20	5562019	1	. PIN,TIMING
- 21	2462685	1	. SCREW,THD FORM- M4 X .7 X 10 LG ATT PT
- 22	35229	1	. WASHER,11/64 ID X 7/16 OD ATT PT

Figure 12. Motor, capacitor and actuator assembly
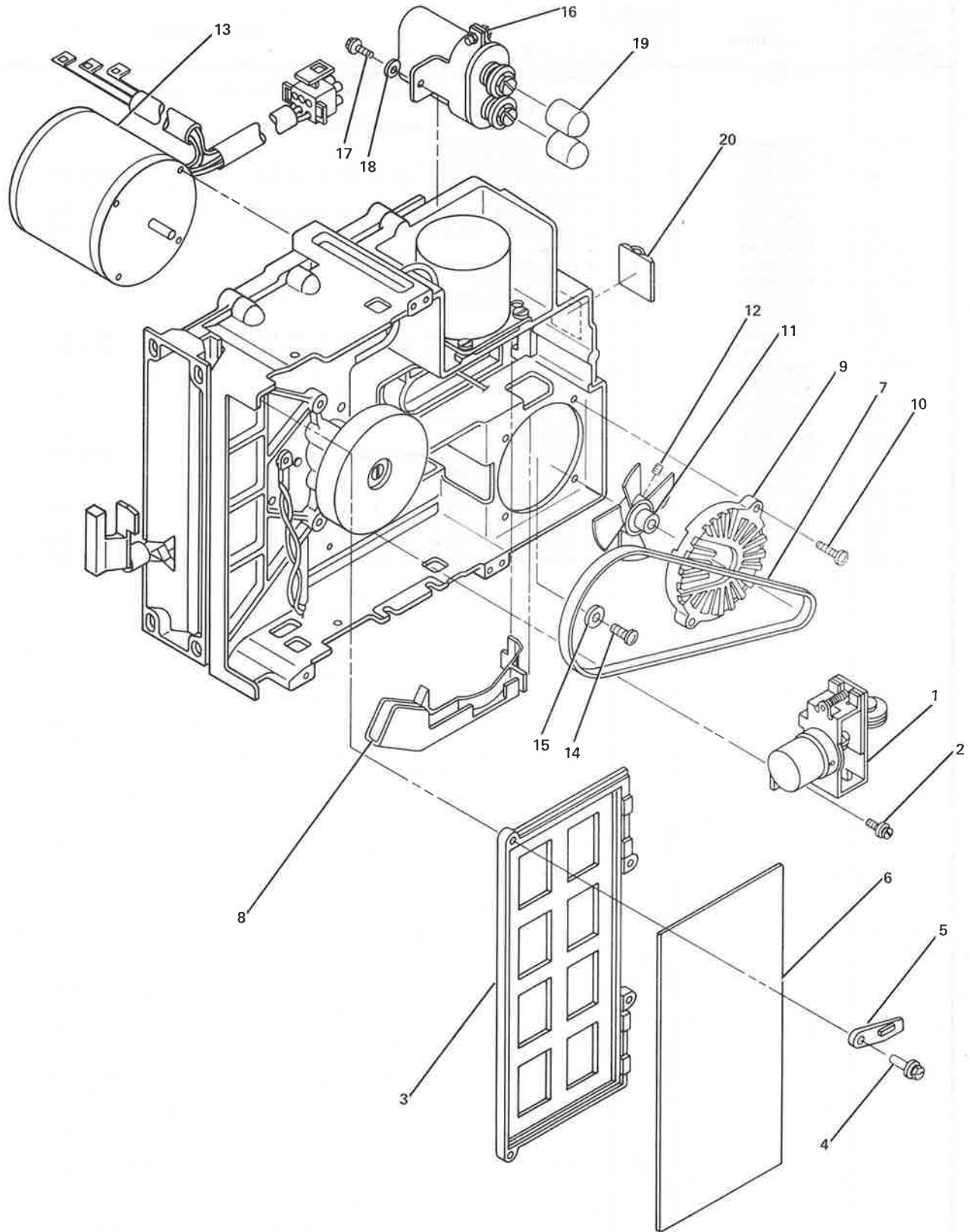
FIGURE 12. MOTOR, CAPACITOR AND ACTUATOR ASSEMBLY. SEE LIST 12.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
12 -	NO NO.	1	MOTOR,CAPACITOR AND ACTUATOR ASM
			FOR NEXT HIGHER ASM SEE FIGURES 1-18 AND
			1-19
			AND FOR ILLUSTRATION FIGURE 12
- 1	4240667	1	. ACTUATOR ASM(31SD)
- 1	4240666	1	. ACTUATOR ASM(51TD)
- 2	2462685	2	. SCREW,THD FORM- M4 X .7 X 10 LG ATT PT
- 3	4240638	1	. HOLDER,CARD
- 4	2462686	4	. SCREW,THD FORM- M4 X .7 X 16 LG ATT PT
- 5	4240584	2	. RETAINER,CARD
- 6	4240724	1	. CARD,FILE CONTROL(51TD)
- 6	4240722	1	. CARD,FILE CONTROL(31SD)
- 7	4240605	1	. BELT
			USED ON 60 HZ MACHINES
- 7	4240604	1	. BELT
			USED ON 50 HZ MACHINES
- 8	4240610	1	. GUIDE,HD LEAD
- 9	4240671	1	. ENCLOSURE
- 10	1621194	2	. SCREW,MACH PAN HD- M4 X 20 LG ATT PT
- 11	4240675	1	. PULLEY
- 11	4240673	1	. PULLEY
- 12	1621719	1	. SETSCREW,6 FLUTE DR CUP PT- M4 X 5 LG ATT PT
- 13	4240677	1	. MOTOR ASM
- 13	4240679	1	. MOTOR ASM
- 14	1621192	2	. SCREW,MACH PAN HD- M4 X 12 LG ATT PT
- 15	22478	2	. WASHER,FLAT- 0.170 ID X 0.375 OD X 0.032 ATT PT
- 16	4240681	1	. CAPACITOR ASM
- 17	2462685	1	. SCREW,THD FORM- M4 X .7 X 10 LG ATT PT
- 18	35229	1	. WASHER,11/64 ID X 7/16 OD ATT PT
- 19	526378	2	. COVER
- 20	2596291	1	. CLAMP

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Figure 13. Cable routing
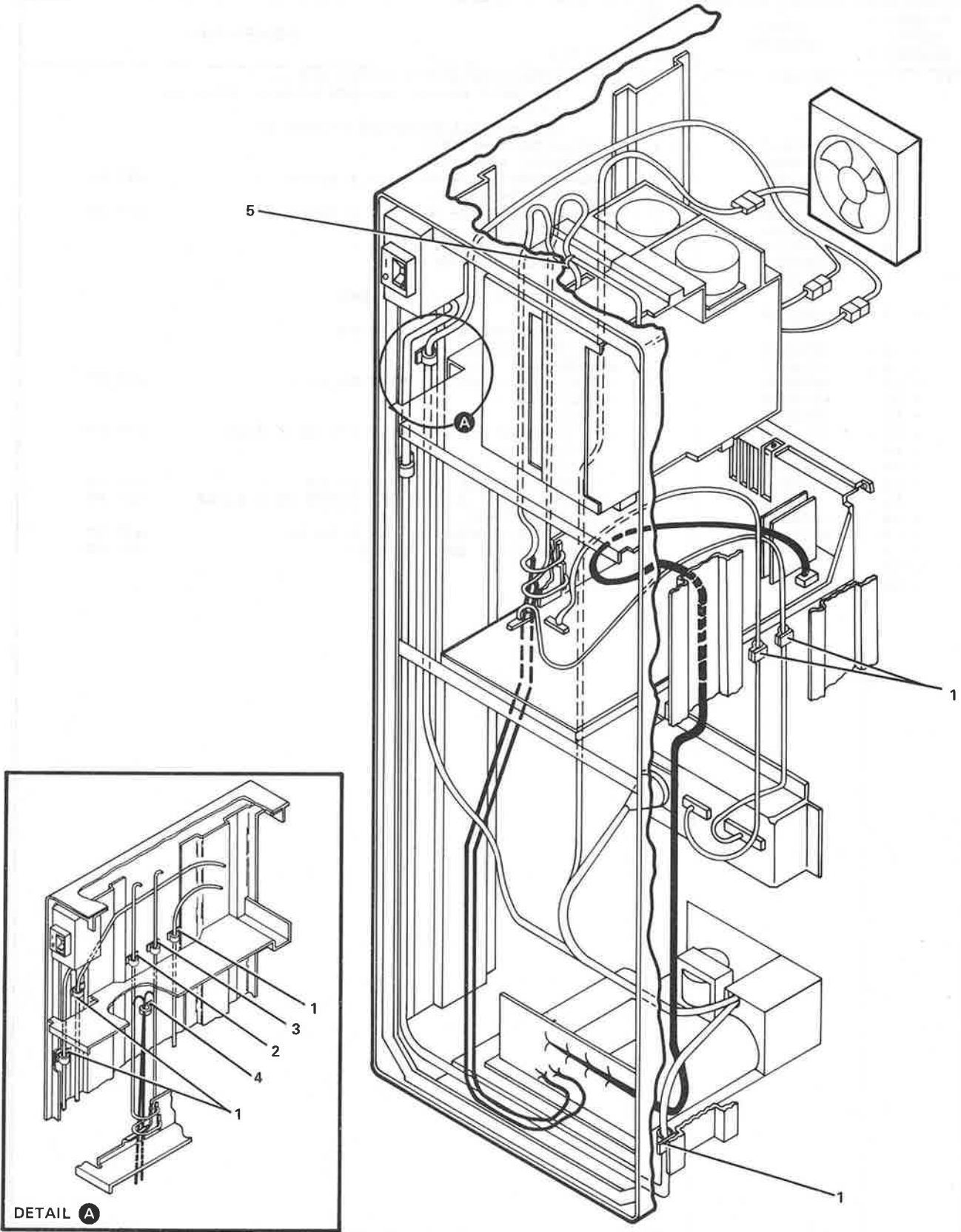
FIGURE 13. CABLE ROUTING. SEE LIST 13.

DETAIL A

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
13 -	NO NO.		CABLE ROUTING
			FOR ILLUSTRATION SEE FIGURE 13
- 1	2596291	6	. CLAMP,60 HZ-U.S./CANADA,60 HZ GBG/I AND
			50 HZ GBG/I
- 2	2596291	1	. CLAMP
			USED ON MACHINES WITH
			0.25 MB 60 HZ,0.50 MB 60 HZ,
			1.0 MB 60 HZ,2.0 MB 60 HZ,
			0.25 MB 50 HZ,0.50 MB 50 HZ,
			1.0 MB 50 HZ AND 2.0 MB 50 HZ
- 3	2596291	1	. CLAMP
			USED CN MACHINES WITH
			0.50 MB 60 HZ,2.0 MB 60 HZ,
			0.50 MB 50 HZ AND 2.0 MB 50 HZ
- 4	2596293	1	. CLAMP,60 HZ-U.S./CANADA,60 HZ GBG/I AND
			50 HZ GBG/I
- 5	6846793	1	. CLAMP
			USED CN MACHINES WITH
			0.25 MB 60 HZ,0.50 MB 60 HZ,
			1.0 MB 60 HZ,2.0 MB 60 HZ,
			0.25 MB 50 HZ,0.50 MB 50 HZ,
			1.0 MB 50 HZ AND 2.0 MB 50 HZ

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Figure 14. Monitor final assembly
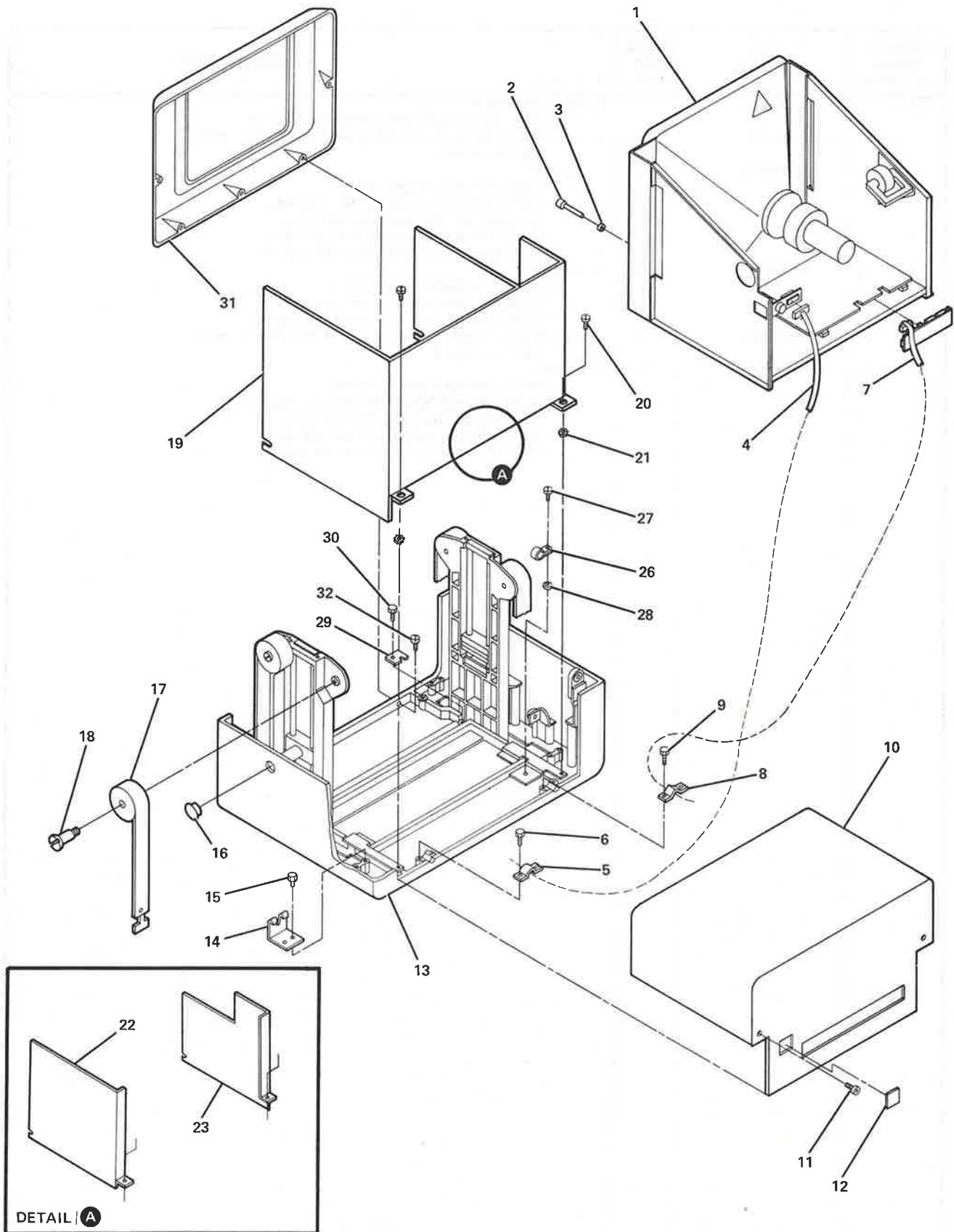
FIGURE 14. MONITOR FINAL ASSEMBLY. SHEET 1 OF 3. INDEX NOS. 1-32. SEE LIST 14.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
14 -	NO NO.	REF	MONITOR FINAL ASM
			FOR ILLUSTRATION SEE FIGURE 14
- 1	6837718	1	. MONITOR ASM
- 1	2426474	1	. MONITOR ASM,50/60 HZ LOW VOLTAGE-GBG/I
- 2	6838236	1	. KNOB,MONITOR BRIGHTNESS
- 3	6841539	1	. CLIP,FASTENER
- 4	6031049	REF	. CABLE ASM,MONITOR EXTERNAL AC
- 5	8529371	1	. CLAMP,STRAIN RELIEF-RIGHT HAND
- 6	2451224	2	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L ATT PT
- 7	6031070	REF	. CABLE ASM,MONITOR EXTERNAL
- 8	8529366	1	. CLAMP,STRAIN RELIEF-LEFT HAND
- 9	2451224	2	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L ATT PT
- 10	8529344	1	. COVER ASM,TOP
- 11	9395349	2	. SCREW ATT PT
- 12	4412518	1	. LOGO
- 13	8529348	1	. LOWER STRUCTURE ASM
- 14	8529389	4	. RETAINER,SPRING
- 15	2451224	8	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L ATT PT
- 16	8257815	2	. PLUG
- 17	8529370	4	. HUB ASM
- 18	8529374	4	. BOLT,SHOULDER,HUB ASM MTG ATT PT
- 19	8257818	1	. SHIELD,U.S. AND AFE
- 20	1621191	2	. SCREW,MACH PAN HD- M4 X 10 LG ATT PT
- 21	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 22	8529360	1	. SHIELD,RIGHT HAND-EMEA ONLY
- 23	8529361	1	. SHIELD,LEFT HAND-EMEA ONLY
- 26	4411359	1	. CLAMP,CABLE
- 27	1621190	1	. BOLT,PAN HD- M4 X 8 LG ATT PT
- 28	1622346	1	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT
- 29	8529364	2	. BRACKET,SHIELD
- 30	2451224	2	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L ATT PT
- 31	8529346	1	. BEZEL ASM
- 32	5552875	5	. SCREW,THD FORM HEX WSHR HD- 8-16 X 9/16L ATT PT

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Figure 14. Monitor final assembly (continued)
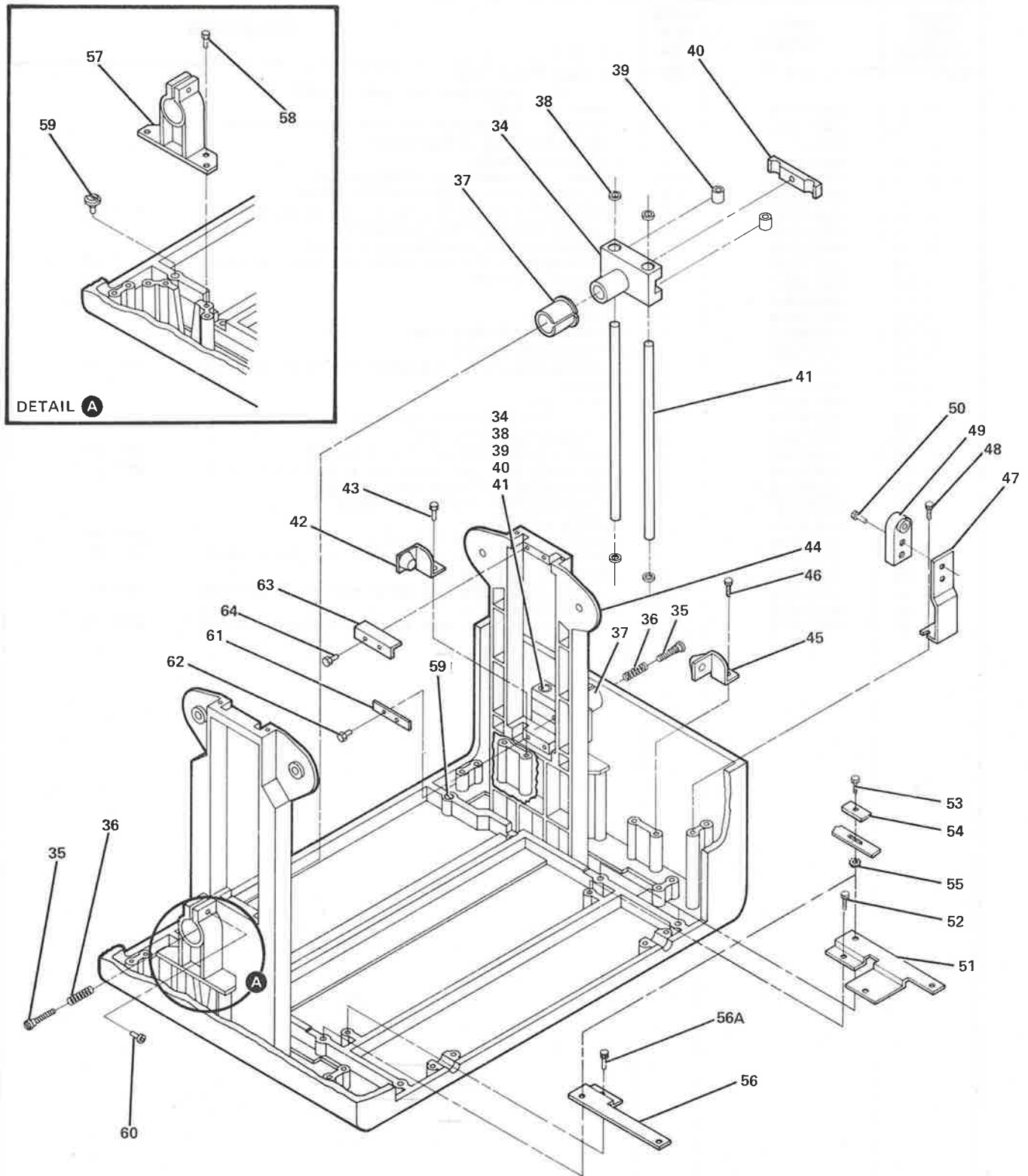
FIGURE 14. MONITOR FINAL ASSEMBLY. SHEET 2 OF 3. INDEX NOS. 34-64. SEE LIST 14.

A-42   SY34-0241-0

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
14 - 34	8257797	2	. BEARING ASM,HOUSING	
- 35	8257813	2	. SCREW,SHOULDER	ATT PT
- 36	8257814	2	. SPRING,COMPRESSION	ATT PT
- 37	8529359	1	. . SLEEVE,TILT	
- 38	355392	4	. . O-RING	
- 39	8529358	2	. . BRAKE,SLEEVE	
- 40	8529362	1	. . BAR,BRAKE-RIGHT HAND	
- 41	8529355	2	. . SHAFT	
- 42	8529378	1	. BRACKET ASM,TILT STOP-FRONT	
- 43	2451224	2	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L	ATT PT
- 44	8529351	REF	. BASE/UPRIGHT ASM	
- 45	8529377	1	. BRACKET ASM,TILT STOP-REAR	
- 46	2451224	2	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L	ATT PT
- 47	8529381	2	. BRACKET,BLOCK ASM MTG	
- 48	5552875	4	. SCREW,THD FORM HEX WSHR HD- 8-16 X 9/16L	ATT PT
- 49	8257810	2	. BLOCK ASM,TOP COVER MOUNTING	
- 50	1621190	4	. BOLT,PAN HD- M4 X 8 LG	ATT PT
- 51	8529367	1	. BRACKET,GROUNDING-LEFT HAND	
- 52	2451224	1	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L	ATT PT
- 53	1621190	2	. BOLT,PAN HD- M4 X 8 LG	ATT PT
- 54	6846850	2	. WASHER,CRT MOUNTING	ATT PT
- 55	1622346	2	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T	ATT PT
- 56	8529393	1	. BRACKET,GROUNDING-RIGHT HAND	
- 56A	2451224	1	. SCREW,THD FORM HEX WSHR HD- 8-16 X 7/16L	ATT PT
- 57	8529368	2	. FITTING,SUPPORT	ATT PT
- 58	5552875	8	. SCREW,THD FORM HEX WSHR HD- 8-16 X 9/16L	ATT PT
- 59	8529376	2	. BOLT,SHOULDER,CRT LOCATOR	
- 60	1621510	2	. BOLT,SOC HD- M4 X 10 LG	
- 61	8529399	2	. BRACKET,RCD CAP-LOWER	
- 62	1621170	4	. SCREW,MACH PAN HD- M3 X 6 LG	ATT PT
- 63	8529365	2	. BRACKET,RCD CAP-TOP	
- 64	1621170	4	. SCREW,MACH PAN HD- M3 X 6 LG	ATT PT

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Figure 14. Monitor final assembly (continued)
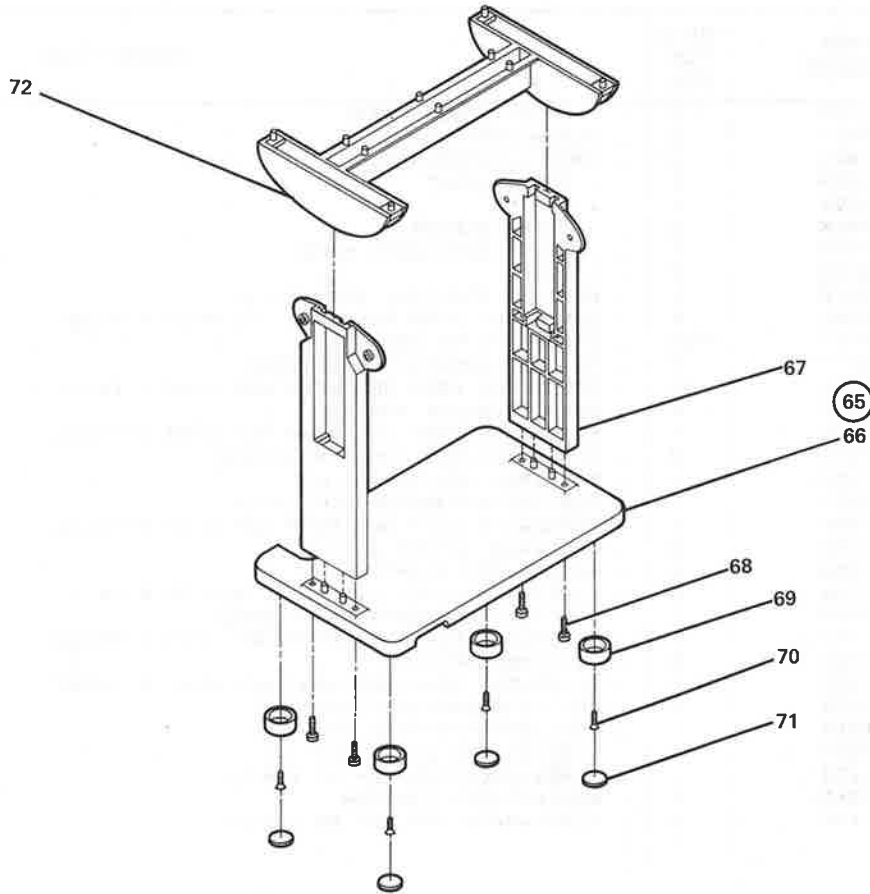
FIGURE 14. MONITOR FINAL ASSEMBLY. SHEET 3 OF 3. INDEX NOS. 65-72. SEE LIST 14.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4	
14 - 65	8529351	1	• BASE/UPRIGHT ASM	
- 66	8529353	1	• • BASE,CRT MOUNTING	
- 67	8529354	2	• • UPRIGHT,CRT MOUNTING	
- 68	1621595	4	• • SCREW	ATT PT
- 69	8529352	4	• • CUP,BASE PAD	
- 70	7362385	4	• • SCREW,THD FORM HEX WSHR HD- M4 X 8 LG	ATT PT
- 71	8529398	4	• • PAD,FOOT,BASE	
- 72	8529350	1	• SKIRT	

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Figure 15. Keyboard final assembly
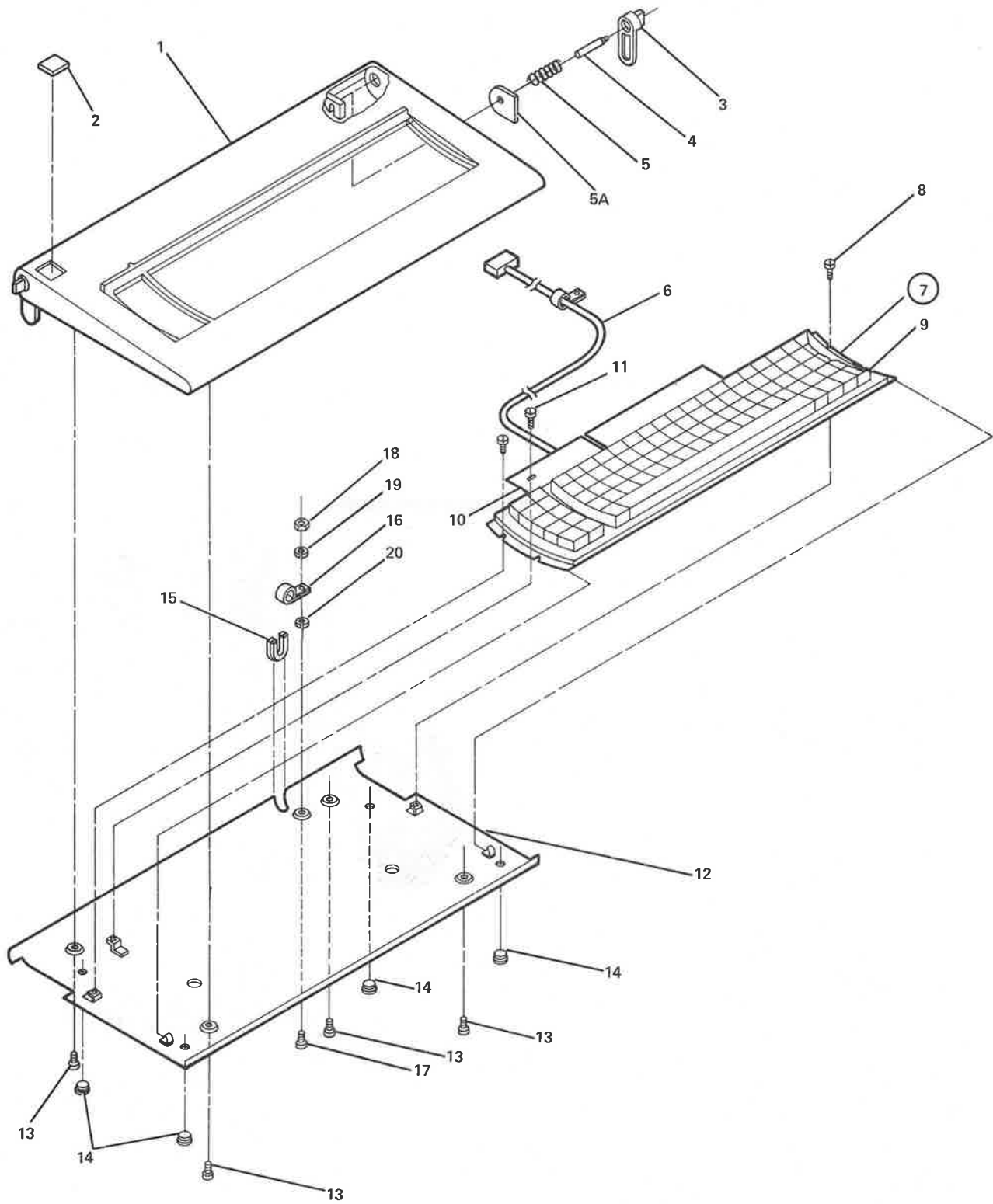
FIGURE 15. KEYBOARD FINAL ASSEMBLY. SEE LIST 15.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
15 -	8529382	1	KEYBOARD FINAL ASM
			FOR ILLUSTRATION SEE FIGURE 15
- 1	8529383	1	. COVER ASM,KEYBOARD-PAINTED
- 2	4412518	1	. LOGO
- 3	8529387	2	. LEG,ADJUSTABLE
- 4	8529390	2	. SHAFT,SPRING
- 5	8529388	2	. SPRING,ADJUSTABLE LEG
- 5A	8257817	2	. WASHER,RETAINER
- 6	6031069	REF	. CABLE ASM,KEYBOARD EXTERNAL
- 7	8529402	1	. KEYBOARD ASM-UNITED STATES
- 7	8257796	1	. KEYBOARD ASM-AUSTRIA/GERMAN
- 7	8257794	1	. KEYBOARD ASM-BELGIUM
- 7	8529428	1	. KEYBOARD ASM-CANADA/FRENCH
- 7	8529422	1	. KEYBOARD ASM-FRENCH/AZERTY
- 7	8529424	1	. KEYBOARD ASM-FRENCH/QWERTY
- 7	8529426	1	. KEYBOARD ASM-DENMARK
- 7	8529410	1	. KEYBOARD ASM-FINLAND/SWEDEN
- 7	8529420	1	. KEYBOARD ASM-INTERNATIONAL
- 7	8529418	1	. KEYBOARD ASM-ITALY
- 7	8529416	1	. KEYBOARD ASM-JAPAN
- 7	8529414	1	. KEYBOARD ASM-NORWAY
- 7	8529412	1	. KEYBOARD ASM-SPAIN/SPANISH
- 7	8529408	1	. KEYBOARD ASM-SWITZERLAND/FRENCH
- 7	8529406	1	. KEYBOARD ASM-SWITZERLAND/GERMAN
- 7	8529404	1	. KEYBOARD ASM-UNITED KINGDOM
- 8	1621197	2	. BOLT,PAN HD- M4 X 8 LG ATT PT
- 9	1643374	1	. . KEYBOARD-UNITED STATES
- 9	1643383	1	. . KEYBOARD-AUSTRIA/GERMANY
- 9	1643386	1	. . KEYBOARD-BELGIUM
- 9	1643377	1	. . KEYBOARD-CANADA/FRENCH
- 9	1860765	1	. . KEYBOARD-FRENCH/AZERTY
- 9	1643395	1	. . KEYBOARD-FRENCH/QWERTY
- 9	1643389	1	. . KEYBOARD-DENMARK
- 9	1643392	1	. . KEYBOARD-FINLAND/SWEDEN
- 9	1860771	1	. . KEYBOARD-INTERNATIONAL
- 9	1860768	1	. . KEYBOARD-ITALY
- 9	1643380	1	. . KEYBOARD-JAPAN
- 9	1860774	1	. . KEYBOARD-NORWAY
- 9	1860777	1	. . KEYBOARD-SPAIN/SPANISH
- 9	1860786	1	. . KEYBOARD-SWITZERLAND/FRENCH
- 9	1860789	1	. . KEYBOARD-SWITZERLAND/GERMAN
- 9	1860783	1	. . KEYBOARD-UNITED KINGDOM
- 10	NO NO.	1	. DRIVE CARD
			FOR PART NUMBER SEE CARD
- 11	1621197	1	. SCREW,MACH PAN HD- M4 X 6 LG ATT PT
- 12	8529386	1	. BASE PLATE,KEYBOARD
- 13	1621510	4	. BOLT,SOC HD- M4 X 10 LG ATT PT
- 14	8529392	4	. PAD,FOOT
- 15	8529391	1	. GROMMET,HORSESHOE
- 16	4411360	1	. CLAMP,CABLE
- 17	1621510	1	. BOLT,SOC HD- M4 X 10 LG ATT PT
- 18	1622403	1	. NUT,HEX- M4 X 7 ATT PT
- 19	1622318	1	. WASHER,LOCK SPRING- 4.1 ID X 7.5 OD ATT PT
- 20	1622346	1	. WSHR,LK EXT TH- 4.15 ID X 9.0 OD X .4 T ATT PT

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Figure 16. Cable assemblies with component parts
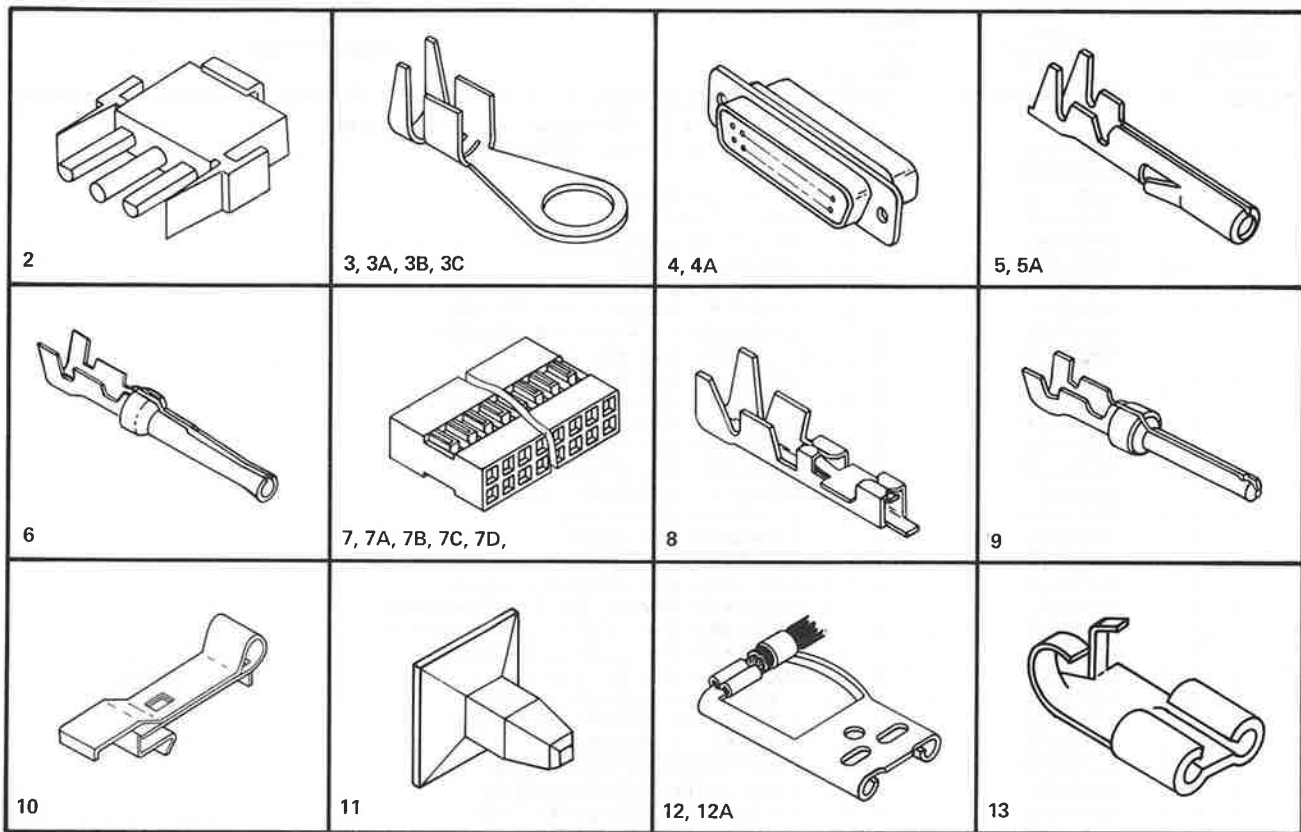
FIGURE 16. CABLE ASSEMBLIES WITH COMPONENT PARTS. SEE LIST 16.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
16 - 2	1847526	AR	. PLUG,3 CIRCUIT
- 3	483676	AR	. TERMINAL,RING NO. 6 STUD- 22-26 AWG
- 3A	483677	AR	. TERMINAL,RING NO. 6 STUD- 18-20 AWG
- 3B	483681	AR	. TERMINAL,RING NO. 8 STUD- 18-20 AWG
- 3C	483678	AR	. TERMINAL,RING NO. 6 STUD- 14-16 AWG
- 4	6031044	AR	. CONNECTOR,15 POSITION-RECEP
- 4A	6031046	AR	. CONNECTOR,25 POSITION-RECEP
- 5	1847523	AR	. PIN,TERMINAL
- 5A	1471019	AR	. TERMINAL-LEAD
- 6	1655337	AR	. SOCKET CONTACT 20-24 AWG
- 7	8324648	AR	. HOUSING
- 7A	2731844	AR	. HOUSING,2 X 8-POLARIZED
- 7B	2731845	AR	. HOUSING,2 X 12-POLARIZED
- 7C	2731847	AR	. HOUSING,2 X 16-POLARIZED
- 7D	2731848	AR	. HOUSING,2 X 20-POLARIZED
- 8	2637682	AR	. PIN,CONTACT
- 9	1655339	AR	. PIN,CONTACT- 20-24 AWG
- 10	6031050	AR	. LATCH,SPRING
- 11	2637689	AR	. INSERT,POLARIZATION
- 12	517913	AR	. CLIP,TERMINAL
- 12A	2162590	AR	. TERMINAL
- 13	5761553	AR	. TERMINAL,SLIP-ON 12-14 AWG

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
16 -	NO NO.	REF	CABLE ASSEMBLIES WITH COMPONENT PARTS FOR ILLUSTRATION SEE FIGURE 16
- 1	6031042		CABLE,14 AWG
- 1	6031043		CABLE,24 AWG,13 TWISTED PAIR,SHIELDED
- 1	6031048		CABLE,24 AWG,5 TWISTED PAIR,SHIELDED
- 1	6031049		CABLE ASM,MONITOR EXTERNAL AC FOR COMPONENT PARTS SEE INDEX NOS. 2, 5,21,21A,22,24
- 1	6031051		CABLE ASM,KEYBOARD INTERNAL FOR COMPONENT PARTS SEE INDEX NOS. 3,4A, 6,7C,8
- 1	6031062		CABLE ASM,MONITOR INTERNAL FOR COMPONENT PARTS SEE INDEX NOS. 4,6, 7B,8
- 1	6031063		CABLE,24 AWG,13 TWISTED PAIR,SHIELDED
- 1	6031064		CABLE,24 AWG,5 TWISTED PAIR,SHIELDED
- 1	6031065		CABLE,24 AWG,15 CONDUCTOR SHIELDED
- 1	6031066		CABLE ASM,PLANAR TO KYB ADAPTOR CARD FOR COMPONENT PARTS SEE INDEX NOS. 7A, 8,27
- 1	6031069		CABLE ASM,KEYBOARD EXTERNAL FOR COMPONENT PARTS SEE INDEX NOS. 7C,8, 9,10,19A,28
- 1	6031070		CABLE ASM,MONITOR EXTERNAL FOR COMPONENT PARTS SEE INDEX NOS. 8,9, 10,18,19,28A
- 1	6195582		CABLE ASM,KEYBOARD INTERNAL FOR COMPONENT PARTS SEE INDEX NOS. 3,4A, 6,7A,8
- 1	6844251		CABLE ASM
- 1	6846795		CABLE ASM,REMOTE ATTACHMENT FOR COMPONENT PARTS SEE INDEX NOS. 7D,8
- 1	8257834		CABLE ASM,DISKETTE SIGNAL AND POWER FOR COMPONENT PARTS SEE INDEX NOS. 7,8, 11,12A
- 1	8257838		CABLE ASM,DC DIST P4 TO CARD ASM A1 FOR COMPONENT PARTS SEE INDEX NOS. 5, 12,13,26
- 1	8257839		CABLE ASM,DCM AC PWR SUP TB,FUSE,ON/OFF FOR COMPONENT PARTS SEE INDEX NOS. 3A, 3B,14
- 1	8257840		CABLE ASM,AC DIST WT PWR BOX FOR COMPONENT PARTS SEE INDEX NOS. 3A, 3B,14,20,21
- 1	8257841		CABLE ASM,AC DIST TR/SL,1,2 FAN,CRT CON FOR COMPONENT PARTS SEE INDEX NOS. 2,3A, 3E,5,15,16A,23,25
- 1	8257857		CABLE ASM,FAN FOR COMPONENT PARTS SEE INDEX NOS. 3B, 5A,16,17
- 1	8258012		CABLE ASM,CCMP VIDEO FOR COMPONENT PARTS SEE INDEX NOS. 7B, 7C,8
- 1	8258013		CABLE,24 AWG,9 TWISTED PAIR,SHIELDED

Parts catalog

Figure 16. Cable assemblies with component parts (continued)
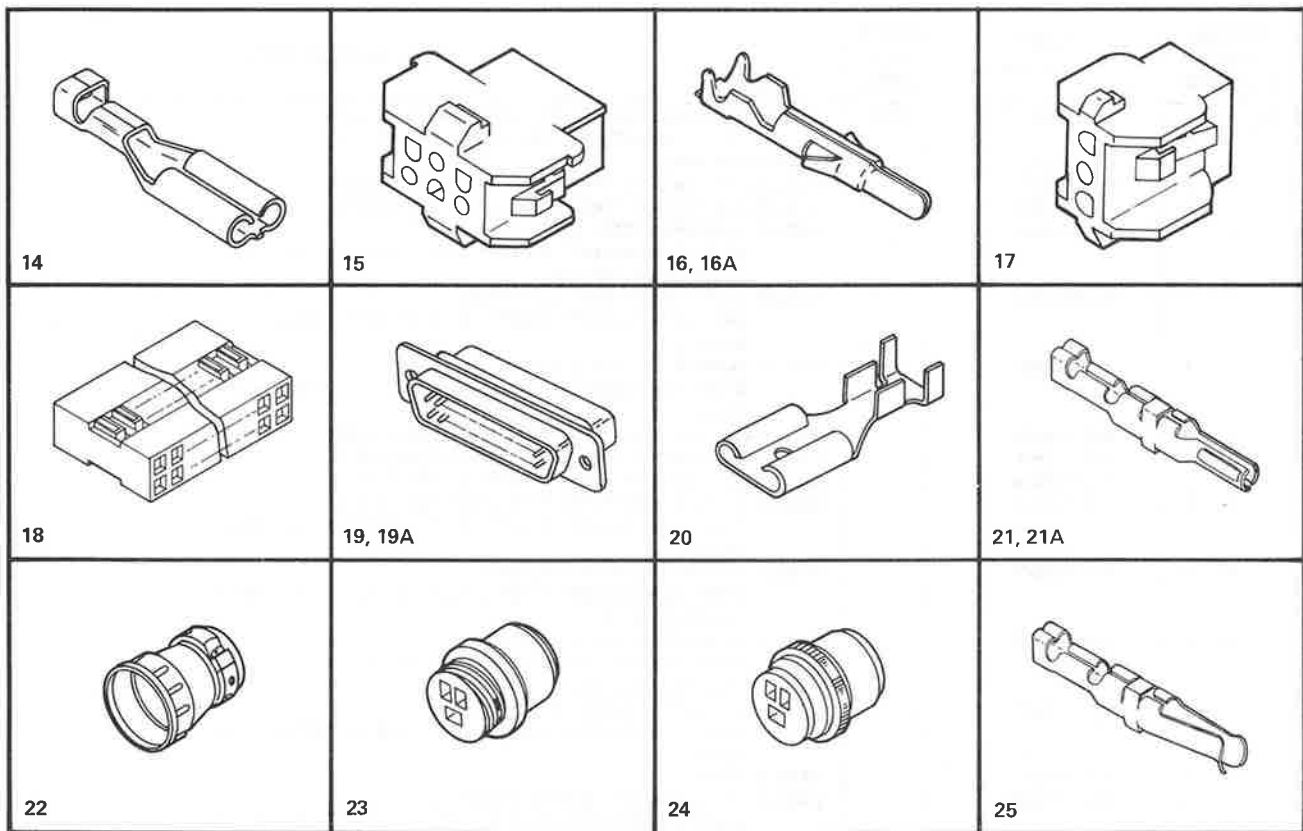
FIGURE 16. CABLE ASSEMBLIES WITH COMPONENT PARTS. SEE LIST 16.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
16 – 14	236915	AR	• TERMINAL,CONTACT FEMALE- 18-20 AWG
– 15	1 847531	AR	• HOUSING,6 CIRCUIT
– 16	1471018	AR	• PIN,TERMINAL
– 16A	2451131	AR	• PIN,UNIVERSAL
– 17	1 847527	AR	• CONNECTOR,3 CIRCUIT
– 18	6031053	AR	• HOUSING ASM,POLARIZED-2X6
– 19	6031045	AR	• CONNECTOR,15 POSITION-PLUG
– 19A	6031047	AR	• CONNECTOR,25 POSITION-PLUG
– 20	430799	AR	• TERMINAL,SLIP-ON- 18-24 AWG
– 21	738254	AR	• TERMINAL,STRAIGHT PIN- 12-14 AWG
– 21A	2192507	AR	• TERMINAL,STRAIGHT PIN-14-12 AWG LONG
– 22	2462055	AR	• CLAMP,CABLE
– 23	4146529	AR	• CONN,FLANGE RECEP SHELL-SOCKET CONTACTS·
– 24	4146530	AR	• CONN,PLUG SHELL-PIN CONTACTS
– 25	738255	AR	• TERMINAL ASM,FEMALE

Figure 16. Cable assemblies with component parts (continued)

26	27	28, 28A	

FIGURE 16. CABLE ASSEMBLIES WITH COMPONENT PARTS. SEE LIST 16.

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
16 - 26	1847534	AR	. HOUSING,P4 CONNECTOR
- 27	2731854	AR	. HOUSING,1X16
- 28	6031056	AR	. CLAMP,CABLE
- 28A	6031060	AR	. CLAMP,CABLE

Parts
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Parts catalog

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Appendix B. Tools and test equipment

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Tools/test
equipment

Tools and test equipment

Shipping group tools

Retaining clip (part 4240632)

The retaining clip is shipped with the diskette unit and is located on the diskette guide. The clip is used to hold the thickness gauge during head alignment adjustments.

Carriage pressure spring (part 4240631)

The carriage pressure spring is shipped with the diskette unit and is located on the diskette guide. The pressure spring is used during head alignment adjustments.

Timing pin (part 5562019)

The timing pin is shipped with the diskette unit and is located on the diskette unit casting. The timing pin is used during head alignment adjustments.

Carriage pressure spring
(part 4240631)

Retaining clip
(part 4240632)

Timing pin
(part 5562019)
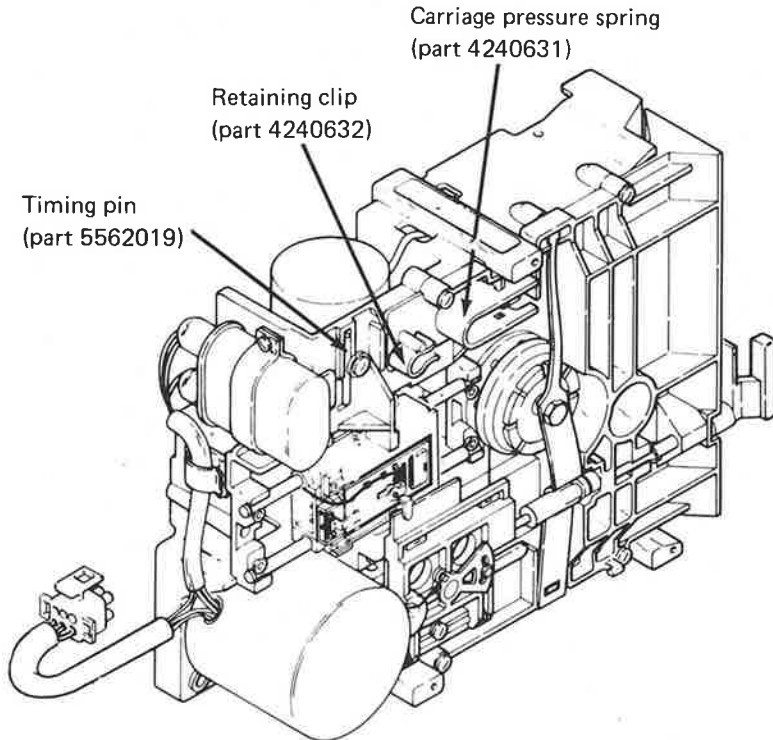
CE tool kit tools

Display unit adjustment tool (part 460811)

The display unit adjustment tool is a non-metallic fiber screwdriver. It is used to make the display unit adjustments.

Metric tool supplement (BM 1749235)

The metric tool supplement (not shown) contains the metric tools needed to repair the 5324 computer.

CE meter (part 1749231)

The CE meter is used to measure the ac and dc voltages and to perform continuity checks.
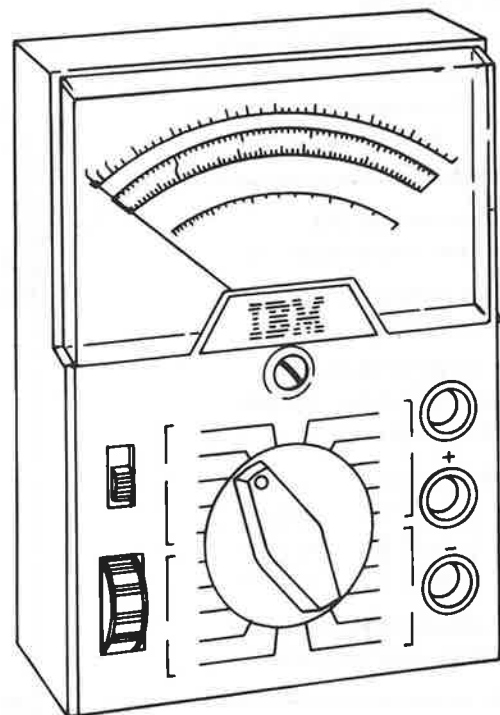
Tools and test equipment

CE tool kit tools (continued)

General logic probe (part 453212)

The general logic probe provides a visual indication of a line level. The probe can also be used to detect pulses and to serve as a babysitter. (Refer to the handbook that comes with the probe.)

The probe UP and DOWN lights will momentarily flash on during power-on if the probe is connected to its machine power source. Ignore these indications.

Indicator lights

UP indicates an up level (+).
DOWN indicates a down level (−).

A pulsing line is indicated by both lights being on.

Both lights are off if the line level is from +1.0 Vdc to +2.0 Vdc for the MULTI logic setting.

Safe operating ranges:

Logic Selector }
MULTI	+60.0V
MST 2/4	+14.0V
MST 1	+14.0V

Voltages greater than the above ranges will damage the probe.

Power leads

CAUTION
Improper connection of the power lead might cause the probe to malfunction.

Connect the probe power leads as follows:

- When probing on the CPU planar board, use the logic probe power pins on the CPU planar board (1230).

- When probing on the diskette drive control card, use the logic probe power pins on the drive control card (1502, 1503).
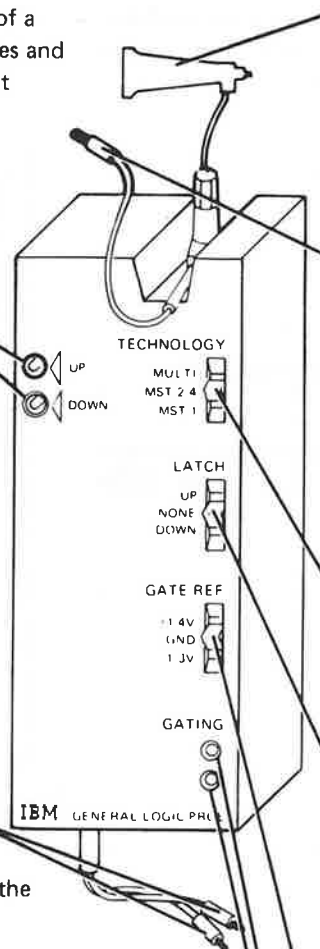
Test terminal

The line being probed is connected to this terminal. (Various probes may be attached, other than the one shown, to aid in probing.) Do not use a tip longer than 76.2 mm (3 in)

Ground lead

Connect this lead to any signal ground near the probe point. Do not use frame ground.

CAUTION
Improper indications result if this lead is not connected to signal ground. A maximum length of 101.6 mm (4 in) can be used.

Logic selector (TECHNOLOGY)

- MULTI

Selects the type of logic to be probed. Circuits probed in the System/23 require the MULTI setting.

LATCH switch

- NONE

Allows the probe to be used as a babysitter. The up position allows latching the UP light on a positive pulse. The down position allows latching the DOWN light on a negative pulse. The NONE position resets the lights and prevents any latching action.

GATE REF volts switch

- GND

This switch affects only the gating terminals and is not needed to probe the System/23.

GATING terminals

These terminals are not needed to probe the System/23.

Branch office tools

Force gauge (part 460870)

The force gauge is used to make the drive band adjustments in the diskette units.
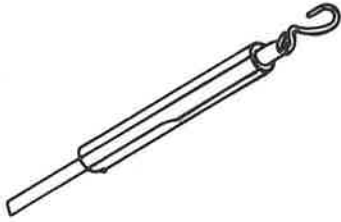
Miniprobe (part 453718)

The miniprobe is a probe tip that attaches to the test leads of the CE meter and is used to probe connectors.

Tools/test equipment
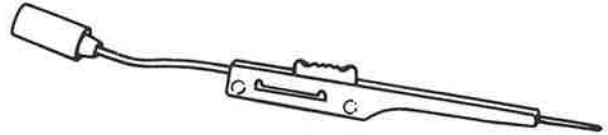
Appendix C. Glossary

Definitions of abbreviations, acronyms, and words

This glossary defines the abbreviations, acronyms, and words that are used in this service manual and not defined in the *IBM Limited Vocabulary*, ZC28-2510.

Sources of the definitions

The primary source for the definitions is the *IBM Data Processing Glossary*, GC20-1699, which includes definitions from the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). ANSI definitions are preceded by an asterisk (*) to indicate that the entry is reprinted from the *American National Dictionary for Information Processing*.

The symbol "(ISO)" at the beginning of a definition indicates that the definition has been discussed and agreed upon at meetings of the International Organization for Standardization, and has been approved by ANSI for inclusion in the *American National Dictionary for Information Processing*.

If you do not find the term you are looking for, refer to the Index of this service manual or to the *IBM Data Processing Glossary*.

Acknowledgment

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, New York 10018.

Tools/test equipment

Glossary

Definitions of abbreviations, acronyms, and words (continued)

A

A: The logic block symbol for the AND function.

access lines: These lines cause the stepper motor in the diskette drive to turn.

*accumulator: (ISO) A register in which the result of an operation is formed.

alcohol pad: A pad soaked with isopropyl alcohol.

*alphameric: Pertaining to a character set that contains letters, digits, and usually other characters, such as punctuation marks.

alternate cylinder: A cylinder on a diskette that can be assigned in place of a primary cylinder that has failed.

alternate track: A track on a diskette that can be assigned in place of a primary track that has failed.

amplifier (AR): An electronic device that produces an increased level of voltage, current, or power.

anode: The electron collecting element of an electron tube or cathode-ray tube.

ANSI: American National Standards Institute.

AR: See *amplifier*.

AR-DIFF: See *differentiator-amplifier*.

ascender: The part of a character or letter that rises above the main body of the character or letter.

Attn: The abbreviation used on the attention key on the 5324 keyboard.

*attribute: A characteristic of a unit of data such as length, value, or method of presentation.

B

bail assembly: A mechanical arm that operates under control of the head load solenoid to load or release the read/write head load arm.

band: See *drive band*.

BASIC: The acronym for Beginner's All-purpose Symbolic Instruction Code, a standardized language for programming.

baud: See *baud-rate*.

baud-rate: The rate of data transmission speed on a communications circuit (usually equal to one bit-per-second).

bezel: The plastic enclosure around the face of the cathode-ray tube of the display unit.

buffer: A storage unit for storing data during an input/output operation.

*byte: A sequence of eight adjacent binary digits that are operated upon as a unit and that constitute the smallest addressable unit in the system.

C

carriage: The part that carries the read/write head and is controlled by the stepper motor drive.

cathode: The electron emitting element of an electron tube or cathode-ray tube.

cathode-ray tube (CRT): An electronic vacuum tube, such as a television picture tube, that can be used to display graphic images.

*central processing unit (CPU): (ISO) A unit of a computer that includes circuits controlling the interpretation and execution of instructions.

channel: A data path that connects the processing unit, storage, and input/output devices.

characteristics: Statements about the electrical, physical, or functional features of a machine that are not specifications.

clamp: A part used to lock another part.

clamped: Held tightly.

Cmd: The abbreviation used on the command key on the 5324 keyboard.

collet: The part of the diskette drive that centers and holds the diskette to the drive hub.

co-planar: A small planar board that mounts on the primary circuit board that supplies additional processor storage.

*computer: (ISO) A data processor that can perform substantial computation, including numerous arithmetic or logic operations, without intervention by a human operator during the run.

CPU: See *central processing unit.*

CRC: See *cyclic redundancy check.*

crosstalk: Data bits sensed from one diskette track while the read/write head is reading from another track.

CRT: See *cathode-ray tube.*

cyclic redundancy check (CRC): In the 5324 computer, a method of checking for errors in read-only storage (ROS) by accumulating a check character as the ROS module is read and then comparing that check character to a CRC count character that is contained in the ROS module.

D

data bus in (DBI): The data path used to move information from storage and input/output devices to the processing unit.

data bus out (DBO): The data path used to move information from the processing unit to storage and input/output devices.

DBI: See *data bus in.*

DBO: See *data bus out.*

DCP: See *diagnostic control program.*

decoder: In the 5324, the circuit (instruction decoder) that translates the programmed instruction into the function to be performed by the processing unit.

descender: The part of a character or letter that is below the main body of the character or letter.

DET: See *detector.*

detector (DET): An electronic device that is used to recognize valid data in an electronic circuit.

diagnostic control program (DCP): In the 5324, the control program that permits program selection and loading, message displays, keyboard input, and interrupt processing for the CE diskette-resident diagnostics.

differentiator-amplifier (AR-DIFF): An electronic device whose output signal is a function of the time rate of change of the input signal.

direct memory access (DMA).: In the 5324, a method of moving blocks of data, under control of the DMA controller and without processing unit intervention, between storage and the CRT display and diskette drive attachments.

diskette 1: A diskette used for storing data on only one surface.

diskette 2: A diskette used for storing data on both surfaces.

diskette 2D: A diskette used for storing data on both surfaces with twice the bit density used on a diskette 2.

DMA: See *direct memory access.*

DR: See *driver.*

drive band: A metal band connected to the stepper motor pulley and the head/carriage assembly.

Glossary

Definitions of abbreviations, acronyms, and words (continued)

drive hub: A continuously running part that turns the diskette at 360 rpm.

driver (DR): An electronic circuit that converts a low level logic voltage to the level needed to operate a stepper motor or a solenoid.

E

EC: See *engineering change*.

engineering change (EC): An IBM supplied alteration in the design or operation of a device or a program.

eyelet: A small diameter ring at the end of a cable that makes it possible for the cable to be connected to a fixed bolt.

F

fan enclosure: The safety cover that is installed on the diskette drive ac motor cooling fan

fault locating test (FLT).: In the System/23, a diagnostic program used to determine system failure conditions. FLTs are used with the MAPs and service manual procedures to determine, isolate, and solve system problems.

ferroresonant: Pertaining to a type or power supply used in the 5324 computer. The ferroresonant power supply contains an input transformer with a resonant primary winding that aids in voltage/current regulation.

field replaceable unit (FRU): An assembly that is replaced in its entirety when any one of its components fails.

FLT: See *fault locating test*.

FM: The abbreviation for frequency modulation. See *modulation*.

FRU: See *field replaceable unit*.

G

gain: In an amplifier, pertains to the ratio of increase of output over input.

GBG/I: See   *General   Business Group/International*.

General   Business   Group/International (GBG/I): A division of IBM's General Business Group that has responsibility for marketing, servicing, manufacturing, and overall performance responsibility for General Systems and Office Product operations in Europe, the Americas, and the Far East. In this service manual, GBG/I indicates machines built for sale and use outside of Canada and the U.S.A..

general logic probe (GLP)· A CE tool used during maintenance activity to verify the presence or absence of logic signals in the System/23.

GLP: See *general logic probe*.

H

head/carriage: The unit that contains the read/write head.

hex: See *hexadecimal*.

hexadecimal: Pertaining to a number system with a base of 16.

highlight: To increase the brightness of a displayed image on the CRT display screen.

hub: See *drive hub*.

I

ID: See *identifier*.

*identifier (ID): (ISO) A character or group of characters used to identify or name an item of data and possibly used to indicate certain properties of that data.

implode: To burst inward.

in: The abbreviation for inch. One inch equals 25.4 mm.

*input/output (I/O): (ISO) Pertaining to a device or to a channel that may be involved in an input process, and at a different time, in an output process.

INTA: Used as the abbreviation for the interrupt acknowledge signal in the 5324 computer.

interpreter: In the 5324, a microprogram stored in read-only storage that controls the operation of the BASIC instructions.

*interrupt: To stop a process in such a way that it can be resumed.

inverter (N): An electronic circuit that inverts a signal (to -, or- to +).

I/O: See *input/output*.

isopropyl alcohol: A fluid that can be used to clean some machine parts.

J

jacket: The permanently attached cover that protects the diskette surface.

K

K-bytes: 1,024 bytes; used in referring to storage capacity.

L

LED: See *light emitting diode*.

light emitting diode (LED): A device that emits light for detection purposes.

linearity: In the 5324 display unit adjustment procedures, refers to the equal spacing and size of the characters and images displayed on the CRT display screen.

loop: Within a program, a group or set of instructions that are executed repeatedly.

M

MAPs: The abbreviation for maintenance analysis procedures.

mask: A binary bit pattern that is used to control the selection or exclusion of specific data bits.

Mb: See *megabyte*.

megabyte (Mb): 1,048,576 bytes; used in referring to storage capacity.

memory: Used to indicate storage, as in direct memory access.

MFM: The abbreviation for modified frequency modulation. See *modulation*.

microinstruction: An instruction within a microprogram. See *microprogram*.

microprocessor (MPU): A processing unit, with microcode, contained on an integrated circuit chip.

microprogram: In the 5324, refers to the programs used to control the operation of the central processing unit.

miniprobe: A probe tip that attaches to a test lead of the CE meter and is used to probe connectors.

mm: The abbreviation for millimeter.

modulation: In the diskette drive, the process of changing the amplitude and frequency of the read and write signals.

millivolt (mV): Equal to 0.001 volt.

MPU: See *microprocessor*.

mV: See *millivolt*.

N

N: See *inverter*.

Glossary

Definitions of abbreviations, acronyms, and words (continued)

O

option: A selection choice, such as to select an option in a diagnostic program.

oscillator: An electronic circuit that generates alternating current.

overcurrent: A flow of electrical current that exceeds the normal rated flow for a device.

overvoltage: A level of voltage that exceeds the normal rated level for a device.

P

page register: In the 5324, a register used to extend the addressing capacity of the computer.

phototransistor (PTX): An electronic device used to sense the light from a light-emitting diode (LED).

PID: See *program identification.*

planar board: In the 5324, the primary printed-circuit board that contains the logic for the processing unit, the display attachment, and the keyboard attachment. Also contains the ROS control programs for the above devices and the diskette attachment.

PN: The abbreviation for part number.

port: An access point (for example, printer port) for data entry and exit to which an input/output device can be attached.

preamp: The abbreviation for preamplifier. See *preamplifier.*

preamplifier (preamp): An electronic circuit that, by enabling a received signal to control a source of power, can supply a larger copy of the necessary characteristics of the signal. Usually, a preamp is followed in the circuit by an amplifier.

processor: The processing unit of the 5324.

program identification (PID): The identifying number or name assigned to a program.

program temporary fix (PTF): A temporary solution or by-pass of a problem diagnosed by IBM field engineering as a result of a defect in a current, unaltered release of the program.

PTF: See *program temporary fix.*

PTX: See *phototransistor.*

R

raster: The rectangular pattern on the screen of a cathode-ray tube caused by the scanning of the video beam. On the display screen of the 5324, the raster is normally visible only when the operator's brightness control is in the full clockwise position.

read-only storage (ROS): Storage from which data can only be read, but not written.

read/write: In the diskette drive, pertains to reading data from and writing data to a diskette.

read/write storage: Storage where data can be written to and read from.

recess: In the diskette drive, the groove in the fan enclosure that permits the ac motor drive belt to turn without rubbing against the fan enclosure.

register: (ISO) A storage device, having a specified storage capacity such as a bit, a byte, or a computer word, and usually intended for a special purpose.

replace: In this service manual, pertains to removing a failing part and installing a new part.

ROS: See *read-only storage.*

R/W: The abbreviation for read/write.

R/W storage: See *read/write storage.*

S

scan code: In the 5324, the scan code is the 7-bit character that encodes the characters from the keyboard.

SM: The abbreviation used for service manual in the System/23 service library.

solenoid plunger: In the diskette drive, the moving part of the solenoid that operates the bail assembly to load or release the read/write head load arm.

spindle: The shaft in the diskette drive that engages the diskette and causes it to rotate.

stepper motor: In the diskette drive, the incremental motor that moves the head/carriage assembly from track to track.

T

translator: In the 5324, the program that translates the BASIC language instructions into machine operations.

TSR: The abbreviation used for transistor-switching-regulator power supply.

tunnel erase: The process used to erase the data along the edge of a diskette track during a write operation. This erasing prevents crosstalk between tracks during later read operations.

typamatic: A type of key on the 5324 keyboard that causes its input character to be input repeatedly as long as the key is pressed.

V

Vac: The abbreviation for volts of alternating current.

variable frequency oscillator (VFO): An electronic circuit used to synchronize the diskette drive reading circuits when the diskette drive is performing a read operation.

Vdc: The abbreviation for volts of direct current.

VFO: See *variable frequency oscillator.*

video: Pertaining to the visual images on the screen of the cathode-ray tube.

volume table of contents (VTOC): A table of contents that is written on a diskette to describe each data set stored on the diskette.

VTOC: See *volume table of contents.*

W

welded: Connected together using heat (as in metal parts).

word processing: A program that permits an operator to arrange data in a processor.

write/erase: Pertains to the writing of data to a diskette and erasing data from a diskette.

Y

yoke: Pertains to the assembly on a cathode-ray tube (CRT) that contains the horizontal and vertical deflection coils. The position of the yoke affects the size and alignment of the image on the screen of the CRT.

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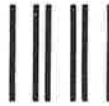
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