IBM

IBM System/34
5340 System Unit
Maintenance Manual

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Maintenance Manual

This manual contains maintenance information that will be used by the customer engineer who installs and maintains the IBM System/34. Most maintenance on System/34 is performed using this maintenance manual and the System/34 MAPs (maintenance analysis procedures). Additional information about this service method is in Section 01-100 *How to Use the System/34 MAPs and Maintenance Manual.*

Customer engineers using this manual are assumed to have been trained on System/34 as described in the 5340 Technical Service Letter (TSL).

The *5340 System Unit Theory Diagrams Manual* has a list of abbreviations and a glossary that gives the meaning of words and abbreviations used in this maintenance manual.

There are several DANGER and CAUTION messages in this manual. You can use the blank lines below each message to translate it into your own words.

Note: This manual follows the convention that *he* means *he* or *she*.

Related Publications

- *IBM System/34 Operator's Guide,* SC21-5158

- *IBM System/34 Functions Reference Manual,* SA21-9243

- *IBM System/34 5340 System Unit Theory Diagrams Manual,* SY31-0458

- *IBM System/34 5340 System Unit Parts Catalog,* S131-0632

- *IBM System/34 Installation and Modification Reference Manual: Program Products and Physical Setup,* SC21-7689

- *IBM System/34 System Data Areas and Diagnostic Aids Manual,* LY21-0049

- *IBM System/34 System Support Program Logic Manual: System,* LY21-0050

- *IBM System/34 1255 Attachment Feature Theory/Maintenance Manual,* SY31-0521

ELECTROMAGNETIC INTERFERENCE

United States Federal Communications Commission (FCC) rules require IBM to publish the following information, which applies to each unit (including modems and terminals) described in this manual (hereafter called *equipment*).

WARNING: *This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manuals, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.*

Instructions Pursuant to FCC Part 15, Subpart J

1. This equipment should not be installed less than 30 meters (98.5 feet) from radio or television receivers or their receiving antennas.

2. This equipment should not receive its power from branch circuits that also power radio or television receivers.

If this equipment cannot comply with the above distance limitation:

1. Turn the equipment and the receiver on. If no interference is apparent, no further action need be taken.

2. If interference occurs, reorient or relocate the equipment, the receiver, or both.

3. If interference still occurs, contact your IBM representative.

Contents

Ensure that you understand and observe the safety precautions printed in the CE Safety Practices card that is used in the country where you work. A copy of the card that is used by customer engineers who work in the U.S. follows.

CAUTION AND DANGER NOTICES

Throughout this manual, the word *DANGER* is used to inform you of an action that could cause you to receive an injury. The word *CAUTION* is used to inform you of an action that could damage the machine that you are working on, or affect the running of the customer program.

DANGER AREAS OF SYSTEM/34

Observe the following danger conditions when working on the System/34:

- Be especially careful when working in areas of System/34 that contain parts that become hot during normal machine operation, areas where high voltage is present, and areas that have moving parts.

- Do not touch the diskette drive belt while the diskette drive is running.

DANGER NOTICES

The following danger notices appear throughout this manual in the sections named:

05-100 Power Introduction: Set the circuit breaker (CB1) to Off if you want *all* voltages off. With the IPO switch turned off and CB1 on, AC line voltage is still present at the control supply and DC output voltages from the control supply are present at the A-A1 board, the operator panel, and the CE panel. Because of the charge on the capacitors in the arc-suppression networks across K1 and K2, a voltage is still present on all circuits supplied by the contactor points when K1 and K2 are de-activated (see paragraph 05-315).

05-315 Power AC Box: When K1 and K2 are de-activated, a voltage is still present in the circuits that are supplied by the points of the contactors. The voltage is present because of the charge on the capacitors in the arc-suppression networks across the points of the contactors.

05-500 Immediate Power Off: Set the circuit breaker (CB1) to Off if you want *all* voltages off. With the IPO switch turned off and CB1 on, AC line voltage is still present at the control supply and DC output voltages from the control supply are present at the A-A1 board, the operator panel, and the CE panel. Because of the charge on the capacitors in the arc-suppression networks across K1 and K2, a voltage is still present on all circuits supplied by the contactor points when K1 and K2 are de-activated (see paragraph 05-315).

09-020 62EH Disk Enclosure Removal: The disk enclosure weight is 12.5 kg (27 pounds). Clear a space for the disk enclosure before removing the disk enclosure from the machine.

09-030 62EH Drive Motor Removal and Replacement: CB1 must be off to remove AC voltage from ACTB3 and ACTB4.

09-035 62EH Motor Start Relay Removal: CB1 must be off to remove AC voltage from the motor start relay terminals.

09-050 62EH Brake Assembly Adjustment: Ensure that the disconnected wires are away from ACTB3 (lower drive) or ACTB4 (upper drive).

220 Vac is present on ACTB3 and ACTB4.

09-120 62EH Cable and Card Locations: 220 Vac is present on ACTB3 and ACTB4.

10-020 62PC Subframe Removal: The subframe/disk enclosure weight is 16 kg (35 pounds). Clear a space for the subframe/disk enclosure before removing the subframe/disk enclosure from the machine.

10-030 62PC Disk Enclosure Removal: The disk enclosure weight is 9 kg (20 pounds). Clear a space for the disk enclosure before removing the disk enclosure from the machine.

10-080 62PC Motor Assembly Terminal Block Removal: CB1 must be off to remove AC voltage from this circuit.

10-090 62PC Card Gate Fan Assembly Terminal Block Removal: CB1 must be off to remove AC voltage from this circuit.

10-100 62PC Drive Motor Assembly Removal: CB1 must be off to remove AC voltage from this circuit.

10-130 62PC Card Gate Fan Assembly Removal: CB1 must be off to remove AC voltage from this circuit.

23-060 33FD Safety: The drive motor case may be hot and may burn your hand. When the drive motor is operating, do not touch the drive motor case or the drive belt.

23-170 33FD Drive Motor Removal: The drive motor case may be hot and may burn your hand.

23-170 33FD Drive Motor Replacement: To prevent personal injury, position the two large square holes in the motor frame so the holes are under the bracket. The holes are large enough for a finger to go through.

25-020 53FD Safety:

1. The system supplies the alternating current and direct current power. Voltages are present on the connector terminals in the diskette drive when the drive motor is turning.

2. Motor and solenoid cases become hot after continuous use; wait enough time for parts to cool before servicing.

25-490 53FD Head/Carriage Adjustment: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

25-510 53FD Head/Carriage Replacement: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

25-520 53FD Diskette Drive Solenoid and Bail Service Check: Voltage is still present at the power connector when the diskette drive solenoid and bail are disconnected and power is on.

25-530 53FD Solenoid and Bail Adjustment: Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.

The solenoid case becomes hot after continuous use.

25-540 53FD Solenoid and Bail Removal (Machines with Taper Pin Block): Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.

25-550 53FD Solenoid and Bail Removal (Machines without Taper Pin Block: Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.

25-600 53FD Diskette Drive Motor Removal: The motor case becomes hot after continuous use.

25-610 53FD Drive Motor Replacement (60 Hz motors): To prevent personal injury, if your motor case has two large holes, position the two large holes in the motor frame so the holes are under the bracket. The holes are large enough for a finger to go through.

25-690 53FD Stepper Motor Replacement: Voltage is still present at the power connector when the stepper motor is disconnected and power is on.

25-710 53FD Pulley and Clamp Replacement: Voltage is still present at the power connector when the pulley and clamp are disconnected and power is on.

25-840 53FD Phototransistor Amplifier Service Check: Voltage is still present at the power connector when the phototransistor amplifier is disconnected and power is on.

27-020 72MD Safety:

1. The system supplies the alternating current and direct current power. Voltages are present on the connector terminals in the diskette drive when the drive motor is turning.

2. Motor and solenoid cases become hot after continuous use; wait enough time for parts to cool before servicing.

27-200 72MD Removal and Replacement: The 72MD unit weight is 18 kg (40 pounds).

27-295 72MD Carriage Bed Orient Adjustment: Voltage is still present at the power connector when the drive motor power cable is disconnected and power is on.

27-600 72MD Head/Carriage Service Check: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

27-605 72MD Head/Carriage Adjustment: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

27-610 72MD Head/Carriage Removal and Replacement: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

27-615 72MD Head/Carriage Stepper Motor Reinstallation: Voltage is still present at the power connector when the head/carriage stepper motor is disconnected and power is on.

27-620 72MD Head/Carriage Pulley and Clamp Reinstallation: Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

27-690 72MD Index Sense PTX Output Service Check: Voltage is still present at the power connector when the drive motor power cable is disconnected and power is on.

27-800 72MD Driver Board Output to Picker/Cam Stepper Motor Service Check: Parts of the driver board become hot after continuous use.

27-805 72MD Driver Board Output to Carriage Bed Stepper Motor Service Check: Parts of the driver board become hot after continuous use.

27-845 72MD Carriage Bed Stepper Motor Control Card Signal Output Check: Parts of the driver board become hot after continuous use.

27-850 72MD Picker/Cam Stepper Motor Control Card Signal Output Check: Parts of the driver board become hot after continuous use.

30-360 Line Plate Adjustment: Voltage is present on the line plate from the telephone lines.

31-320 Line Plate Adjustment: Voltage is present on the line plate from the telephone lines.

80-210 Power Distribution for ESD: Disconnect the line cord before checking the screws holding the line cord.

99-041 Diagnostic Supervisors; Concurrent Maintenance: If you are performing maintenance on the printer, have the operator take the printer offline to prevent the printer from being activated by an external source.

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 power 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

CONTENTS

01-005 INTRODUCTION

This section of the manual contains the following:

- A list of publications that you can use when performing maintenance on the System/34

- A short description of the types of information found in each publication

- Information on using the MAPs (maintenance analysis procedures) along with this maintenance manual when troubleshooting a system or device failure

01-010 SYSTEM/34 MAINTENANCE DOCUMENTS

The following maintenance documents are shipped with the system:

- *IBM System/34 Maintenance Analysis Procedures (MAPs) (Volume A)*

- *IBM System/34 5340 System Unit Maintenance Manual*, SY31-0457 (Volume B)

- *IBM System/34 5340 System Unit Parts Catalog*, S131-0632 (Volume B)

- *IBM System/34 5340 System Unit Theory Diagrams Manual*, SY31-0458 (Volume C)

- *IBM System/34 Field Service Logics* (Volume D)

01-020 Maintenance Analysis Procedures (Volume A)

Each MAP (maintenance analysis procedure) contains:

- A short description of its purpose

- A list of conditions under which it can be used

- A list of the logic cards that it tests

- Step-by-step procedures to follow when determining the cause of a failure

MAPs are described in more detail in sections 01-100 and 01-110.

01-030 Maintenance Manual and Parts Catalog (Volume B)

The maintenance manual contains information that you will need when using MAPs. This information includes:

- Service checks

- Adjustments

- Removal and replacement procedures

- Second-level logic diagrams

- Error recording information

- A diagnostic service guide

- System installation instructions

The parts catalog is divided into three major sections:

- The Visual Index, containing complete figures of the machine, with callouts that point to detailed figures.

- The Catalog Section, containing a visual detail figure of assemblies and subassemblies.

- The Numerical Index, which is a numerical list of all parts used in the machine, with references to other figure(s) on which the part is found.

01-032 Theory Diagrams Manual (Volume C)

The theory diagrams manual contains text and logic diagrams that show how the System/34 operates. You can also use this manual to analyze a machine failure that the MAPs fail to isolate.

The list of abbreviations at the front, and the glossary at the back of the theory diagrams manual give the meanings of terms used in both the theory diagrams manual and this maintenance manual.

01-034 Field Service Logics (Volume D)

The FSL (field service logics) contain wiring diagrams and pin, socket, board, and gate information that is used when troubleshooting machine failures.

01-070 MAP AND MAINTENANCE MANUAL SECTION NUMBERING

The MAPs and the maintenance manual use the same section numbers for each section. For example, MAPs and maintenance manual pages pertaining to power start with 05, while those pertaining to 62EH disk drives start with 09.

01-080 MAP Numbering

MAPs are numbered with a four-digit number. The first two digits identify the MAP section. The last two digits identify the MAP.

05 10

These two digits identify MAP number is in a section of MAPs.

These two digits identify section 05 (the power section of MAPs).
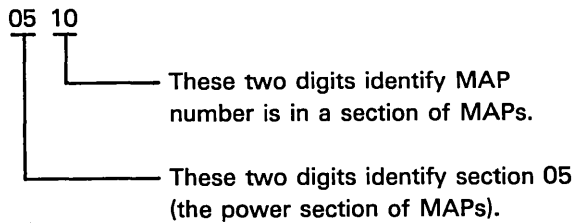
01-090 Maintenance Manual Numbering

Each unit in the maintenance manual is identified with a five-digit number. The first two digits identify the section. The last three digits identify the paragraph in the section. Most references from MAPs to the maintenance manual are written as in the following example: PERFORM THE DISK BRAKE SERVICE CHECK (09-050).

Example:

*09-050A

When used, this letter matches a letter on a figure.

These three digits (the paragraph number) identify the Brake Assembly Service Check and Adjustment Procedure.

These two digits identify this as section 09 (the 62EH disk drive section of the maintenance manual).

The letter C in this location would mean that the MAP is sending you to the *Theory-Diagrams Manual.* The letter D would mean that the MAP is sending you to the *Field Service Logics.*

The MAPs (Volume A) and the maintenance manual (Volume B) do not use this character position because most references are between these two volumes. When the reference is not easily understood, the volume identification letter is added.

Pages in each section of the maintenance manual are numbered consecutively, starting with 1. These numbers are used only when the manual is being printed; they are not used for any other purpose.

01-100   HOW TO USE THE SYSTEM/34 MAPS
AND MAINTENANCE MANUAL

MAPs contain procedures that let you follow symptoms, one step at a time, until you find the cause of the failure. Most MAPs contain a series of questions that can be answered *yes* or *no*. As these questions are answered, the MAP will identify the failing field-replaceable unit (FRU). The MAP may send you to the maintenance manual for instructions on adjusting a FRU, or removing the FRU and installing a new one.

Use MAPs to find the cause of errors recorded by system hardware or diagnostic program failures and to interpret error recording information. Each MAP is a stand-alone document so you can enter a MAP at any of its entry points.

System entry MAPs contain general questions that send you to the area MAP for the machine function that is failing. An area MAP contains specific questions that send you to a unit MAP. The unit MAP contains detailed questions that enable you to identify the failing FRU.

This maintenance manual contains instructions for removing, checking, adjusting, and reinstalling most field-replaceable units in the System/34. A MAP usually sends you there to perform a specific action. After completing the action, return to the MAP for additional instructions.

Also use the index of this manual to find repair procedures for observed machine failures, such as a broken part.

A short table of contents at the front of the maintenance manual lists the number and title of each section. Each section of the maintenance manual contains a detailed table of contents for that section.

System Entry
MAP 0101
Start

From Any
MAP NTF or
Intermittent
Path

From Any MAP

Power Area
MAP 0500

System Printer
Area MAP 0700

System Printer
Area MAP 0800

Work Stations
Area MAP 1100

Data Communi-
cation Area
MAP 3100
(not MLCA)

Error Recording
Index 80-000

Intermittent
Failure
Replacement
List 50XX

Power Unit
MAP 05XX

Printer Controller
Unit MAP 07XX

Printer Controller
Unit MAP 08XX

Work Station
Controller Unit
MAP 11XX

Data Communi-
cation Unit
MAPs 31XX—
39XX

Error Log
MAP 8XXX

IPL Function
Failure
MAP 03XX

5211
Maintenance
Library

3262
Maintenance
Library

5251, 5252,
5256, or 5225
Maintenance
Library

62PC
Disk Area
MAP 1000

Processor and
Miscellaneous
Area MAP 1500

62EH
Disk Area
MAP 0900

CE Panel Area
MAP 1300

Operator
Panel Area
MAP 2100

Diskette
Area
MAP 2300
(level 1)

Diskette
Area
MAP 2700
(level 2)

MLCA
MAPs 30XX,
1701-171E

62PC
Disk Attach-
ment Unit
MAP 10XX

Processor and
Miscellaneous
Unit MAPS
15XX—20XX

62EH
Disk Attach-
ment Unit
MAP 09XX

CE Panel Unit
MAP 13XX

Operator
Panel Unit
MAP 21XX

Diskette 33FD
Diskette
MAP
23XX (level 1)
27XX (level 2)

Diskette
53FD Unit
MAP
23XX (level 1)
27XX (level 2)

Diskette
72MD Unit
MAP 27XX

Introduction to Maintenance   5

01-110 RULES FOR USING MAPS

You will usually be using MAPs or MAP diagnostic integration (MDI) tests to diagnose a failure with symptoms that remain constant. MAPs and MDI tests used in this way should identify a failing field-replaceable unit (FRU).

If the failure symptoms do not remain constant, you should still use the MAPs and MDI tests when attempting to isolate the problem. If the MAPs and MDI tests fail to find the problem, perform the following:

- Reseat the cards and cables

- Use the error recording procedures (Section 80-000)

- Use the intermittent failure replacement list (MAP 5000)

When using a MAP or running an MDI test, the MAP or MDI test always describes how to prepare the machine or operate the switches needed to answer the MAP questions or run the tests. Additional information describing the purpose of the MAP or MDI test is also given.

You should observe the following procedures when using the System/34 MAPs or MDI tests:

1. Always analyze any unusual noise or distinct errors before going through the MAPs by using the table of contents or index to find information that pertains to the symptom, or, use the MAP for the specific part of the machine that is failing. If you cannot determine the cause of the failure from these sources of information, start at the system entry MAP for a detailed analysis of the symptom.

2. For other system failures, or failures reported by the customer, you should normally start at MAP 0101.

3. Always start using a device MAP or MDI test at entry point A unless you are instructed not to, and check to see that the START conditions are met.

4. Always power down before removing or installing a fuse, cable, or card, unless you are instructed not to.

5. When a MAP indicates that a card or cable is bad, do the following:
   a. Inspect the card and socket, then reseat the card and run the test that failed.
   b. Remove the bad card or cable, install a good one, and run the test that failed.
   c. If the card has top card connectors, reverse the connectors end for end and run the test that failed to see if the symptom changes.
   d. Swap cards in the system unit to see if the symptom changes. Card swapping information is in the *Field Service Logics* on page AC500.
   e. Install new cards for each card in the LOGIC CARDS TESTED list at the start of the MAP or MDI test.

6. Always probe all lines indicated, observing the status of each line, before answering the question that follows in the MAP or MDI test, unless you are instructed to perform some other action.

7. Names of all switches and indicators are shown in MAPs in the same way that they appear on the panel itself.

8. Hexadecimal numbers are shown as hex AB23 or X'AB23'.

9. An X inside single quotation marks indicates a don't care position. For example, the second X in X'X54B' could represent any hexadecimal number.

10. After you diagnose and repair a problem, run the failing MAP or MDI test again to verify that the problem is corrected.

01-120 PROBING INFORMATION WHEN USING MAPS

Use the General Logic Probe II tool, (IBM part 453212) to measure signal levels when the MAPs instruct you to. This probe is used instead of an oscilloscope for normal System/34 maintenance. Detailed information on using and maintaining the probe is in the *IBM General Logic Probe II Manual*, SY27-0127, and in paragraphs 02-015 through 02-045 of this manual.
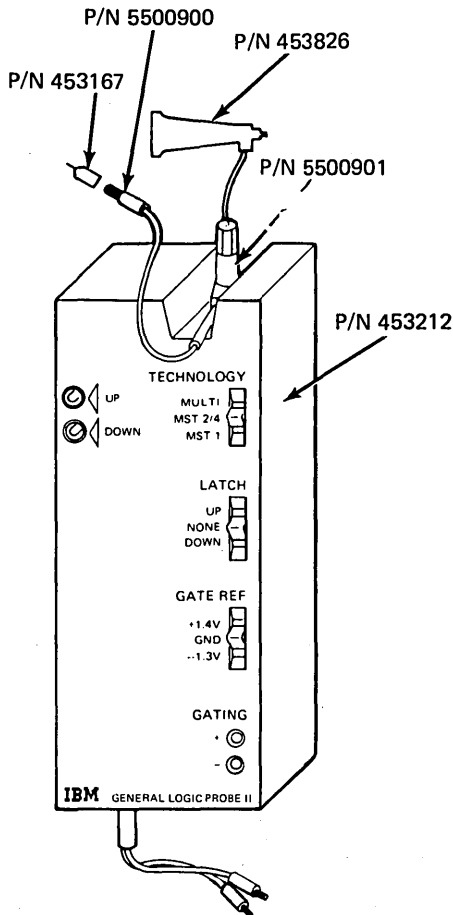
CONTENTS

02-010   INTRODUCTION

The general reference information in this section includes the following:

- Instructions on how to test and use the IBM General Logic Probe II.

- Signal levels used in System/34 logic circuits.

- Locations of optional features on the System/34.

- Additional information needed for servicing the System/34.

02-015   PROBING INFORMATION

When using the MAPs, use the General Logic Probe II (IBM part 453212) to determine if a signal level is Up or Down. Use this probe instead of an oscilloscope for most System/34 maintenance. Additional information about using and maintaining this probe is in the *IBM General Logic Probe II Manual*, SY27-0127.

P/N 5500900

P/N 453826

P/N 453167

P/N 5500901

P/N 453212

TECHNOLOGY

UP
DOWN

MULTI
MST 2/4
MST 1

LATCH

UP
NONE
DOWN

GATE REF

+1.4V
GND
–1.3V

GATING

+
–

IBM   GENERAL LOGIC PROBE II

02-020   How to Prepare the Probe for Use

To make the probe ready for use, do the following:

- Set the Technology switch to the Multi position.

- Set the Latch switch to the None position.

- Set the Gate Ref switch to +1.4V.

- Attach the red lead to any convenient +5V pin (D03).

- Attach the black lead to any convenient ground pin (D08).

02-025   Input Voltage Levels of the Probe

When you use the General Logic Probe II with the Technology switch set to Multi, you can probe voltage levels as shown in the figure that follows.

General Logic Probe II Input Voltage Ranges

MPUL (+60V) (most positive up level)

A

LPUL (+2.16V ± .180V) (least positive up level)

B

(most positive down level)

MPDL (+.95V ± .180V)

0V

(least positive down level)

C

LPDL (-60V)
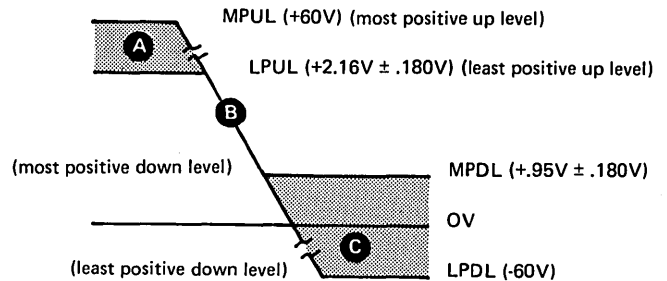
Indicating Lights

Region	Up	Down
A	ON	OFF
B	OFF	OFF
C	OFF	ON

VTL and Dutchess Input Voltage Ranges

02-035   What the Probe Lights Mean

The probe lights can have different meanings that rely on the condition of the lights. Some of the possible conditions and their meanings are shown in the table that follows.

2

What the Probe Lights Mean

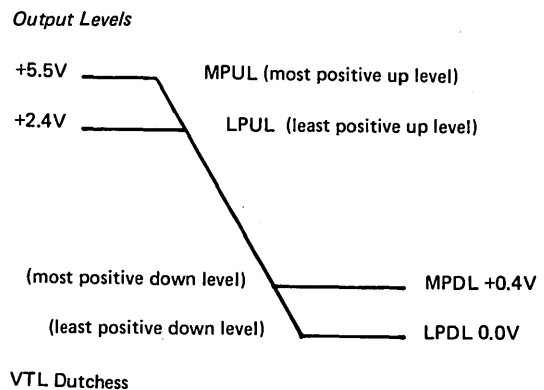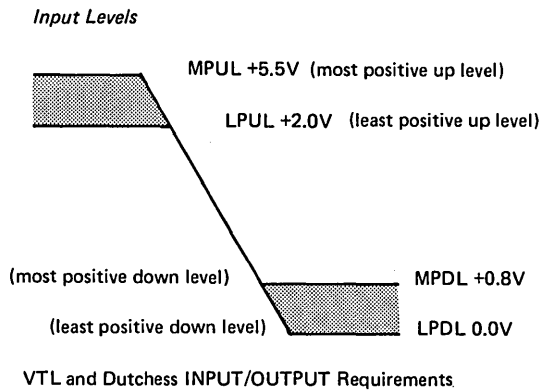| Condition		Meaning
UP light	OFF	The point being probed is not at either an up logic level or a down logic level, or the power cable of the General Logic Probe II is not connected correctly.
DOWN light	OFF	
UP light	ON	The point being probed is at the up level (1).
DOWN light	OFF	
UP light	OFF	The point being probed is at the down level (0).
DOWN light	ON	
UP light	ON	The point being probed is pulsing at a frequency of more than 30 pulses per second.
DOWN light	ON	
UP light	Flashing	The point being probed is pulsing at a frequency of less than 30 pulses per second.
DOWN light	Flashing	
UP light	Flashing	The point being probed has a series of narrow positive pulses with a frequency of less than 30 pulses per second.
DOWN light	ON	
UP light	ON	The point being probed has a series of narrow negative pulses with a frequency of less than 30 pulses per second.
DOWN light	Flashing	

02-040   Machine Voltage Levels

System/34 uses mainly Dutchess and VTL logic technology. Both of these technologies have the same input and output levels. The input and output voltage levels for these technologies range from 0.0V to +5.5V as shown.

Input Levels

MPUL +5.5V (most positive up level)
LPUL +2.0V (least positive up level)
(most positive down level)
(least positive down level)
MPDL +0.8V
LPDL 0.0V
VTL and Dutchess INPUT/OUTPUT Requirements

Output Levels

+5.5V — MPUL (most positive up level)
+2.4V — LPUL (least positive up level)
(most positive down level)
(least positive down level)
MPDL +0.4V
LPDL 0.0V
VTL Dutchess

SLT technology is also used when the data communications feature is installed. SLT input and output voltage levels are shown in the figure that follows.

Input Requirements

V = 12V, I = -10 μA ————   Maximum Up

   V = 3V, I = 0 ——————   Normal Up Level

      V = 1.2V, I = 100 μA. ———   Minimum Up Level

        V = 0.5V, I = 1.6 mA ——   Maximum Down Level

          V = 0.3V, I = 2.3 mA
              or ——   Normal Down Level
          V = 0.0V, I = 2.5 mA

             V = 3.12, I = 4 mA ——   Maximum Down

Output Specifications

V = 9V, I = -5 mA ———   Maximum Up

   V = 3V, I = 0 ——————   Normal Up Level

   V = 0.3V, I = -22 mA ——   Maximum Down (Saturation)

      V = 0, I = 0 ——   Maximum Down
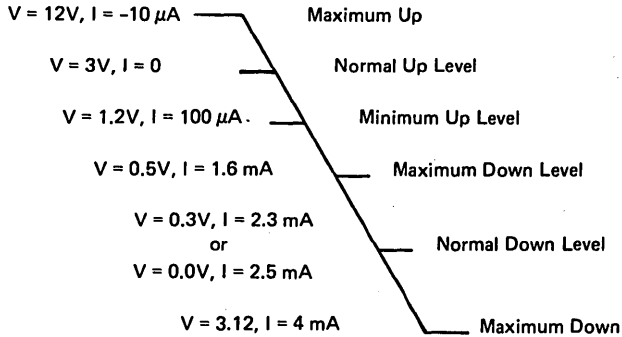
SLT I/O Voltage Levels Requirement

02-045   How to Check the Probe for Correct Operation

To verify that the General Logic Probe II is working correctly, use a CE multimeter (IBM part 1749231 or 452796) or a similar tool. For information on repairing the probe, see the *IBM General Logic Probe II Manual*, SY27-0127.

To check the probe, perform the following test using the 5340 logic gate:

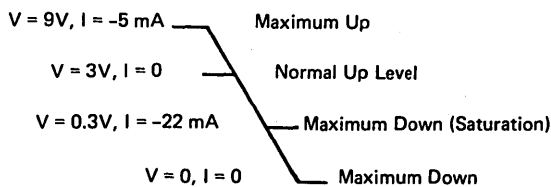1.   With system power on, attach the red probe lead to any convenient +5V pin (D03); attach the black probe lead to any convenient ground pin (D08).

2.   Using the multimeter, verify that the voltage measured from pin D03 (+) to pin D08 (-) is between 4.5 and 5.5 volts DC.

3.   Set the Latch switch on the probe to the None position.

4.   Set the Technology switch on the probe to the Multi position. Both lights should be off.

5.   Attach the probe tip to any D03 pin. Attach the probe ground to any D08 pin (ground). Only the Up light should be on.

6.   Attach the probe tip to any D08 pin. Attach the probe ground to any D08 pin (ground). Only the Down light should be on.

7.   Set the Gate Ref switch to +1.4V.

8.   Use a 12-inch jumper (IBM part 2588263) to connect the +Gating pin on the probe to any D08 pin (ground). The Up light and the Down light should both be off.

9.   Use the 12-inch jumper to connect the -Gating pin on the probe to any D03 pin. The Up light and the Down light should both be off.

10.   Remove the 12-inch jumper from the -Gating pin on the probe. Attach the probe tip to pin A-A1K2S02. Remove the 12 inch jumper from the +Gating pin and you should see a slow (1 second) pulse on the probe.

11.   Attach the probe tip to pin A-A1K2S13. You should see a fast (16 ms) pulse on the probe.

If this service check fails, see the General Logic Probe II manual for instructions on how to repair the probe.

4

02-070   FEATURES

The figures that follow show the features that are
available for System/34 and their locations in the 5340
system unit.

62EH
- 8.6 Mb Drive A
- 13.2 Mb Drive A
- 27.1 Mb Drives A and B
- When only one disk drive is
  installed, drive A could be
  on the top frame, or it
  could be on the bottom
  frame. When two drives are
  installed, drive A is on the
  top frame and drive B is on
  the bottom frame.

62PC
- 63.9 Mb Drive A
- 128.4 Mb Drives A and B
- Drive A is always on the top;
  Drive B is always on the
  bottom.

- 192.9 Mb Drives A, B,
  and C
- 257.4 Mb Drives A, B,
  C, and D
- Drive C is always on the
  bottom; Drive D is always
  on the top.

Operator
Panel

A1

B-gate
Data Communications
for 2400 bps Modem
(first or second
communications line
adapter only)

W1 Board

33FD, 53FD,
or 72MD

Cable Tower (D-gate)
- 3262 or 5211 Printer 01D
- Data Communications 01D
- 5251 Display Stations ⎫
- 5225 Printers   ⎬ Ports 0–3
- 5256 Printers   ⎭

Cover Latch
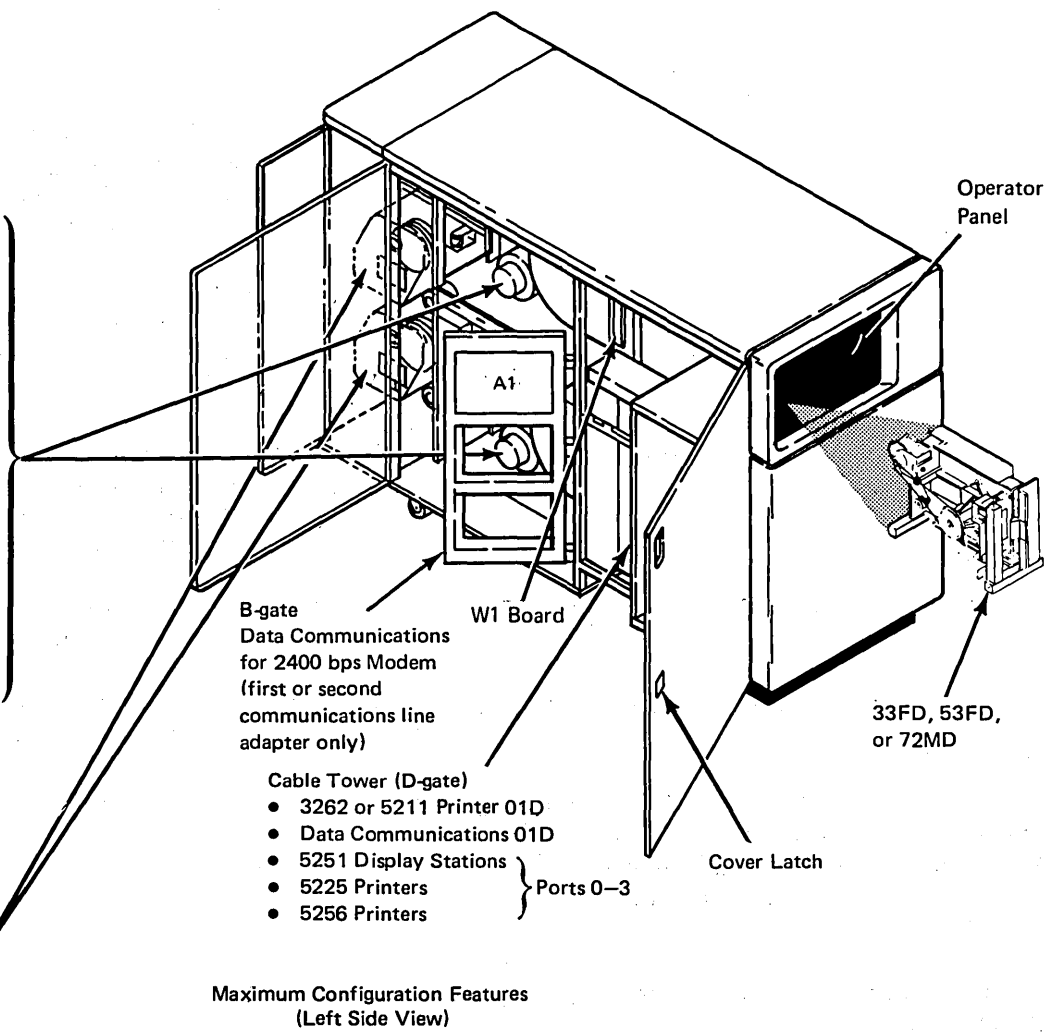
Maximum Configuration Features
(Left Side View)

Storage Area
for Diagnostic
Diskettes

A1	B1
A2	B2
A3	B3

CE Panel

CE Subpanel

C-gate

A-gate
A1   Processing Unit
A2   Input/Output Board
A3   Feature Input/Output Board
B1 }
B2 } Not used
B3   MLCA
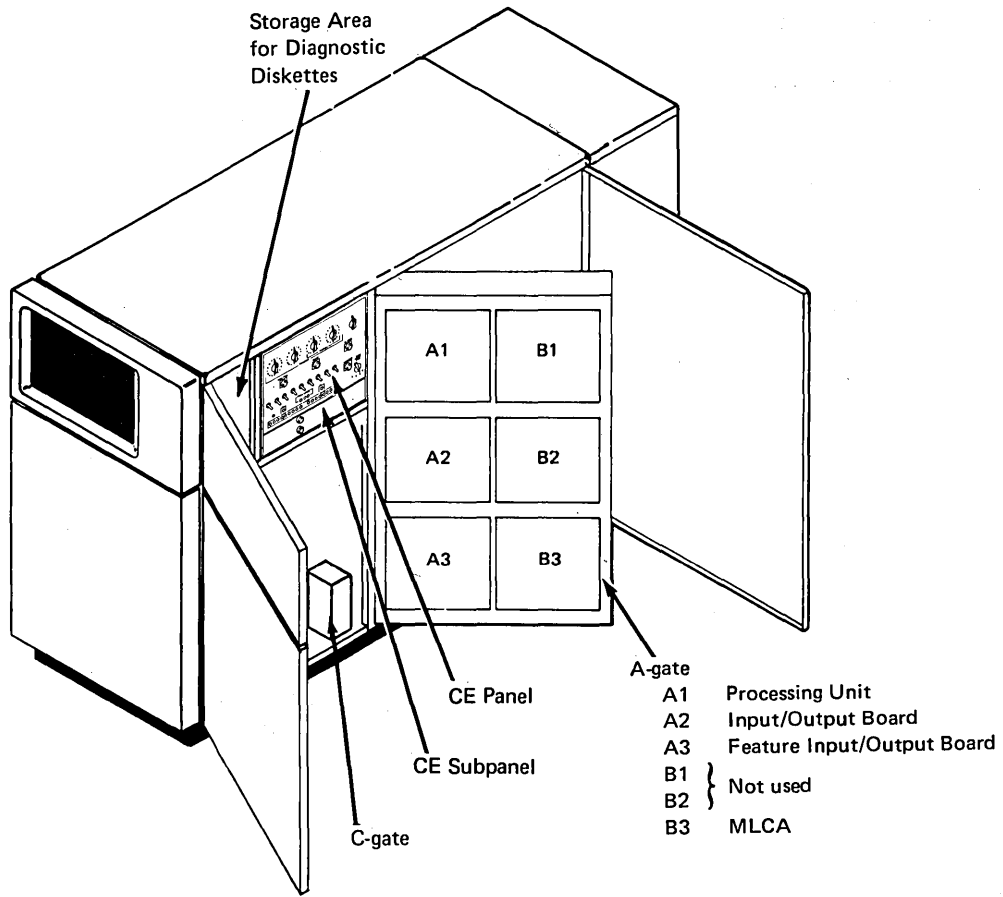
Maximum Configuration Features
(Right Side View)

02-080 SPECIAL TOOLS

In addition to the tools in the medium CE tool case, you will need the following tools when working on the System/34:

- Ten 6-inch red jumpers (IBM part 0829117)

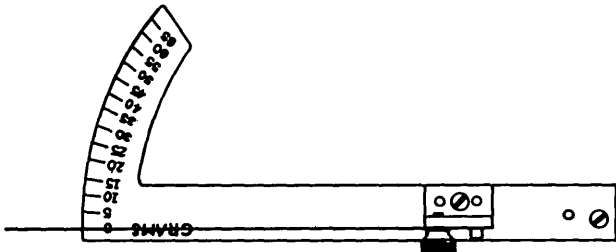- General Logic Probe II test lead extender (IBM part 453605)

- CE multimeter (IBM part 1749231) or a similar tool

- Metric bill of material (IBM part 1749235)

- Gram gauge (IBM part 450459)

- Times 10 (X10) gram scale (IBM part 451915)

You will need the following special tools only if the data communications feature is installed:

- Decibel meter (IBM part 453545) or dB adapter (IBM part 1749299) and head phone (IBM part 2728116). These tools, which are not shipped with the system, are used for the integrated modem transmit level adjustment.

  Note: You can use the dB adapter (IBM part 1749299) only with the CE multimeter (IBM part 1749231). If you do not have this combination, use decibel meter (IBM part 453545) to adjust the transmit level on 2400 bps integrated modems.

- Wrap plug (IBM part 2546708 for EIA/CCITT, first or second communications adapter; IBM part number 4236643 for the Digital Data Service Adapter; IBM part 5586825 for the Analog Wideband Adapter; or IBM part 4236975 for the Autocall Adapter and EIA) used for external wrap testing (shipped with specific feature).
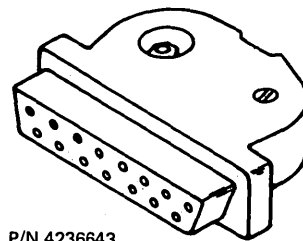
P/N 4236643
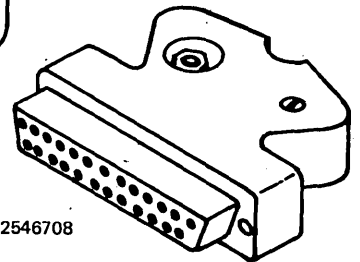
P/N 2546708
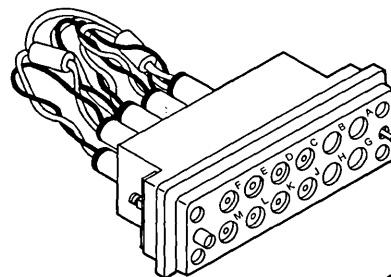
P/N 5586825
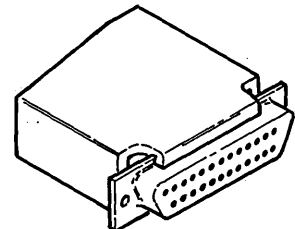
P/N 4236975

• Indicator card (IBM part 5801645) used for the switched 2400 bps modem equalizer test (not shipped with system).

• MLCA wrap card (IBM part 4236797) used for internal wrap testing of the MLCA logic board (shipped with the MLCA feature).

P/N 4236797

Use the following special tool only if your system has a 53FD diskette drive: Two timing pins (IBM part 5562019). These pins are inside the 53FD cover assembly.

If your system has a 33FD diskette drive, you will need the following special tools and supplies:

• 33FD alignment tool (IBM part 2200698, shipped with the system).

• Diskette head cleaning tools:
  – Brush (IBM part 2200106)
  – Isopropyl alcohol (IBM part 2200200)
  – Cloth (IBM part 2108930)

If your system has a 72MD diskette magazine drive, you will need the following special tools:

• 72MD adjusting tool (IBM part 2462583 for the old style picker or IBM part 2462612 for the new style picker).

• Two adjusting pins (IBM part 2462574). These pins are on the 72MD casting.

8   02-080

CONTENTS

05-100 INTRODUCTION

DANGER
Set the circuit breaker (CB1) to Off if you want *all* voltages off. With the IPO switch turned off and CB1 on, AC line voltage is still present at the control supply and DC output voltages from the control supply are present at the A-A1 board, the operator panel, and the CE panel. Because of the charge on the capacitors in the arc-suppression networks across K1, K2, and K4, a voltage is still present on all circuits supplied by the contactor points when K1 and K2 are de-activated (see paragraph 05-315).

_____
_____
_____
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_____

Input line voltage is supplied through the line filters, CB1, F302, and ACTB2 in the AC box to the control supply.

Plus and minus 5 Vdc, plus and minus 24 Vdc, and 48 Vac are supplied to the power logic board (C-A1) by the control supply. The control supply also supplies +24 Vdc to pick K1 and K2 in the AC box. When K1 picks, input line voltage is distributed to the following places:

- Base ferroresonant transformer and capacitor by way of F301

- Feature power supplies (if installed) by way of fuses F201, F202, F203, F204, and F207

- Feature AC box

- Diskette drive motor

- Gate and power fans

When K2 (and K4 for systems with 3 or 4 62PC disk drives) picks, input line voltage is sent to the disk drive motors.

Secondary AC outputs from the base ferroresonant transformer go to the +5V filter assembly, and to the multilevel filter assembly.

The DC outputs from the +5V and multilevel filter assemblies go to the DC distribution assembly.

The DC voltages from the DC distribution assembly go to the A-gate and the B-gate (if installed). The point-to-point wiring can be found on FSL pages YA4xx and YA5xx.

05-200   POWER LOCATIONS

05-210   Connector Pin Locations

CAUTION
The board connectors might not be installed as shown in these drawings.

Connectors J2, J7, and J8:
4-Position
Board Connector
Pin Side
P/N 1473910

Locator
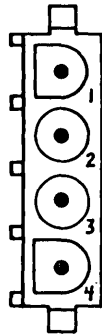
Connectors J2, J7, and J8:
4-Position
Cable Connector
Pin Side
P/N 1847528
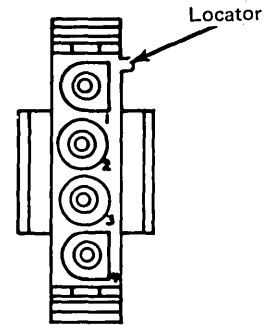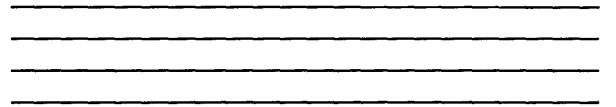
Connectors J4, J9, and C-B1J2
6-Position
Board Connector
Pin Side
P/N 1295112

Locator
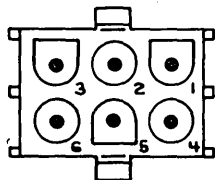
Connectors J4, J9, and C-B1J2
6-Position
Cable Connector
Pin Side
P/N 1847530
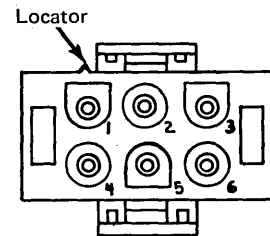
Connectors J10, J20, and C-B1J1
9-Position
Board Connector
Pin Side
P/N 1473911

Locator
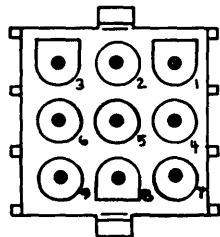
Connectors J10, J20, and C-B1J1
9-Position
Cable Connector
Pin Side
P/N 1847532
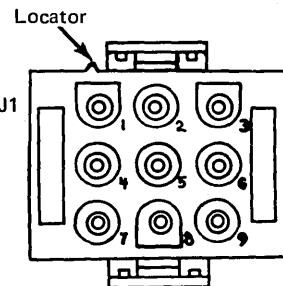
Connector J1
12-Position
Cable Connector
Pin Side
P/N 1847535

Connectors J13 and J14
12-Position
Board Connector (Pin configuration same as connector J1, above)
Pin Side
P/N 1295545

Locator

Connectors J1, J13, and J14
12-Position
Cable Connector
Pin Side
P/N 1847534

05-200

Power   3

Connector J19
2-Position
Board Connector
Pin Side
P/N 2731398

Connector J19
2-Position
Cable Connector
Pin Side
P/N 2731397

Connector J5
4-Position
Board Connector
Pin Side
P/N 2731815

1 3 4
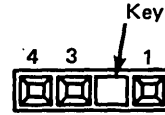
Key
4 3   1
Connector J5
4-Position
Cable Connector
Pin Side
P/N 2731850

Connector J12
8-Position
Board Connector
Pin Side
P/N 2731816

1   3 4 5 6 7 8
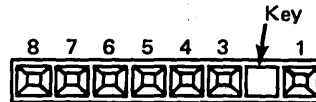
Key
8 7 6 5 4 3   1
Connector J12
8-Position
Cable Connector
Pin Side
P/N 2731836

1   3 4 5 6 7 8 9 10 11 12
Connector J24
12-Position
Board Connector
Pin Side
P/N 2731818

Key
12 11 10 9 8 7 6 5 4 3   1
Connector J24
12-Position
Cable Connector
Pin Side
P/N 2731838
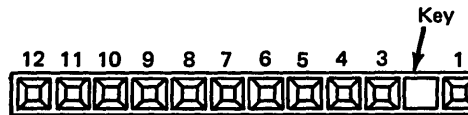
1   3 4 5 6 7 8 9 10 11 12 13 14 15 16
Connector J21
16-Position
Board Connector
Pin Side
P/N 2731820
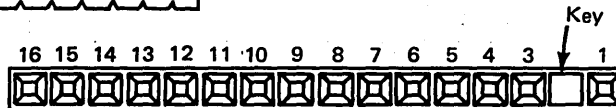
Key
16 15 14 13 12 11 10 9 8 7 6 5 4 3   1
Connector J21
16-Position
Cable Connector
Pin Side
P/N 2731839

1 2 3 4 5 6
Connector J23
6-Position
Board Connector
Pin Side
P/N 2777213
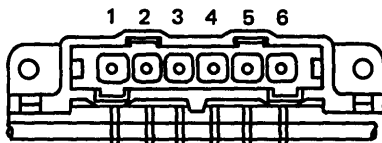
6 5 4 3 2 1
Connector J23
6-Position
Cable Connector
Pin Side
P/N 2777212

4

Connector C-B1J7
16-Position Dual Line
Board Connector
Pin Side
P/N 2731816
and
P/N 2637708

1 2
4
5 6
7 8
9 10
11 12
13 14
15 16

Key
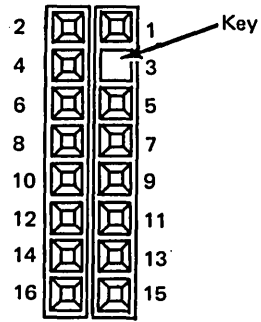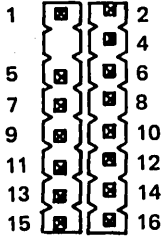
Connector C-B1J7
16-Position
Cable Connector
Pin Side
P/N 2731844

2 1
4 3
6 5
8 7
10 9
12 11
14 13
16 15

05

Connector J11,
C-B1J3, C-B1J4,
and C-B1J5
24-Position
Right Angle
Board Connector
Pin Side
P/N 818554

B   D
B02 ● ●) D02
B03 ● ●) D03
B04 ● ●) D04
B05 ● ●) D05
B06 ● ●) D06
B07 ● ●) D07
B08 ● ●) D08
B09 ● ●) D09
B10 ● ●) D10
B11 ● ●) D11
B12 ● ●) D12
B13 ● ●) D13

D   B
D02 B02
D03 B03
D04 B04
D05 B05
D06 B06
D07 B07
D08 B08
D09 B09
D10 B10
D11 B11
D12 B12
D13 B13
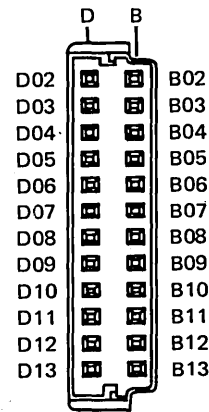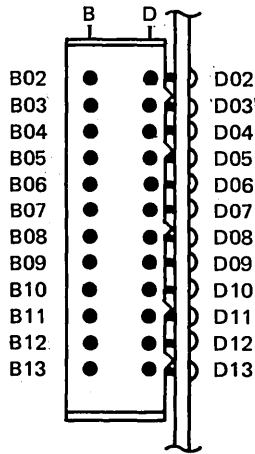
Connectors J6, J11,
C-B1J3, C-B1J4,
and C-B1J5
24-Position
Cable Connector
Pin Side
P/N 817329

Connector J6
24-Position
Board Connector
Pin Side
P/N 818869

B   D
B02 ● ● D02
B03 ● ● D03
B04 ● ● D04
B05 ● ● D05
B06 ● ● D06
B07 ● ● D07
B08 ● ● D08
B09 ● ● D09
B10 ● ● D10
B11 ● ● D11
B12 ● ● D12
B13 ● ● D13

B D
B02 D02
B03 D03
B04 D04
B05 D05
B06 D06
B07 D07
B08 D08
B09 D09
B10 D10
B11 D11
B12 D12
B13 D13
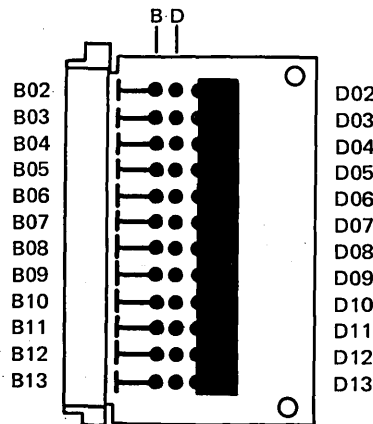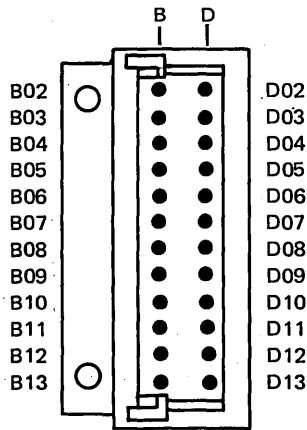
Connector J11,
C-B1J3, C-B1J4,
and C-B1J5
24-Position
Cable Connector
Probe Side
P/N 5800634

05-210

Power   5

Connector C-B1J6
48-Position
Dual Line
Board Connector
Pin Side
P/N 813329

B   D

B02 ● ● D02
B03 ● ● D03
B04 ● ● D04
B05 ● ● D05
B06 ● ● D06
B07 ● ● D07
B08 ● ● D08
B09 ● ● D09
B10 ● ● D10
B11 ● ● D11
B12 ● ● D12
B13 ● ● D13

G02 ● ● J02
G03 ● ● J03
G04 ● ● J04
G05 ● ● J05
G06 ● ● J06
G07 ● ● J07
G08 ● ● J08
G09 ● ● J09
G10 ● ● J10
G11 ● ● J11
G12 ● ● J12
G13 ● ● J13

6

05

Feature Power
Supply D

TB 8

Base Distribution
Assembly

E10

PDTB1

PDTB2

Control Power
Supply PCB

Feature Distribution Assembly

C-A1

Power Logic Board

E11

E12

E13

Control Supply
Status Indicator

Power Compartment
Thermal Sensor

Power Compartment
Fan

TB7

Feature Power
Supply C

Front

Line Filter Box

Multilevel Filter
Assembly

IPO Switch

Operator Panel

Power Check

Thermal Check

Processor Check

Console Check

System In Use

Load

Power

TB5

Feature Power
Supply A

TB6

Feature Power
Supply B

Cable Tower

AC Box

Base Ferroresonant
Transformer

E5

+5V Filter
Assembly

CR50

CR51

TB1

J1

Front

Base AC
Capacitor C-65

CB1

ACTB1

AC Frame
Ground Bus

8

05

J19, J23, J24
(see 05-640)

J7

J6

J8

J9

J10

J14

J13

J12

J11

J20

J21

J4

J5

J2

Front

J1

C-B1
Board

Feature Power Supply G
AC Capacitor

F207

Feature Power Supply G
Filter Assembly

Ground Bus

TB9

ACTB7

Feature Power Supply G
Ferroresonant Transformer

Feature AC Box

05

C-B1 Board

C-B1J5

C-B1J3

C-B1J6

C-B1J4

C-B1J1

C-B1J7

C-B1J2

05-310   AC Box

F201 (Feature Power Supply A)

F202 (Feature Power Supply B)

AC Frame Ground Bus

ACTB1

RC4
RC3

K2
(Alternative for
some countries)

Diode Assembly
(Alternative for
some counties)

RC4
RC3

(Alternative for
some countries)

K2

F203 (Feature Power Supply C)
F204 (Feature Power Supply D)

Diode Assembly

RC1
(Alternative for
some countries)

K1

RC2
(Alternative for
some countries)

ACTB2

RC2
RC1

CB1

F301 (Base Ferroresonant Transformer)

F302 (Control Supply)

Relay K3
(Mounted
Behind)

F401

CE Outlet
(50 Hz only)

Cover Assembly
(Alternative for
some countries)

200, 208, or 230 Vac ± 10% 60 Hz

See FSL page YA000.

05

Control Supply

F302

ACTB2

CBI 20A

200, 220, or 235 Vac ± 10% 50 Hz

ACTB1

Base Ferroresonant
Transformer

F301

*DANGER
When K1 and K2 are de-activated, a voltage
is still present in the circuits that are supplied
by the points of the contactors. The voltage
is still present because of the charge on the
capacitors in the arc-suppression networks
across the points of the contactors.

K1

Feature Power Supply A

F201

Feature Power Supply B

F202

Feature Power Supply C

F203

Feature Power Supply D

F204

Diskette Motor, Gate, Power
Fans, Feature AC Box and
A and B 62 PC Disk Fans

Disk A and B Motor(s)

K2

CE Outlet**

F401

K3

To Power Logic Board

Fuse Chart

Fuse	Size	P/N
CB-1	20A	5565214
F301	4.5A	2495471
F302	0.3A	254628
F201	1.25A	252592
F202	1.25A	252592
F203	2.0A	92734
F204	1.25A	252592
F401	7A	2495463

IPO Switch

Control Supply

+24 Vdc
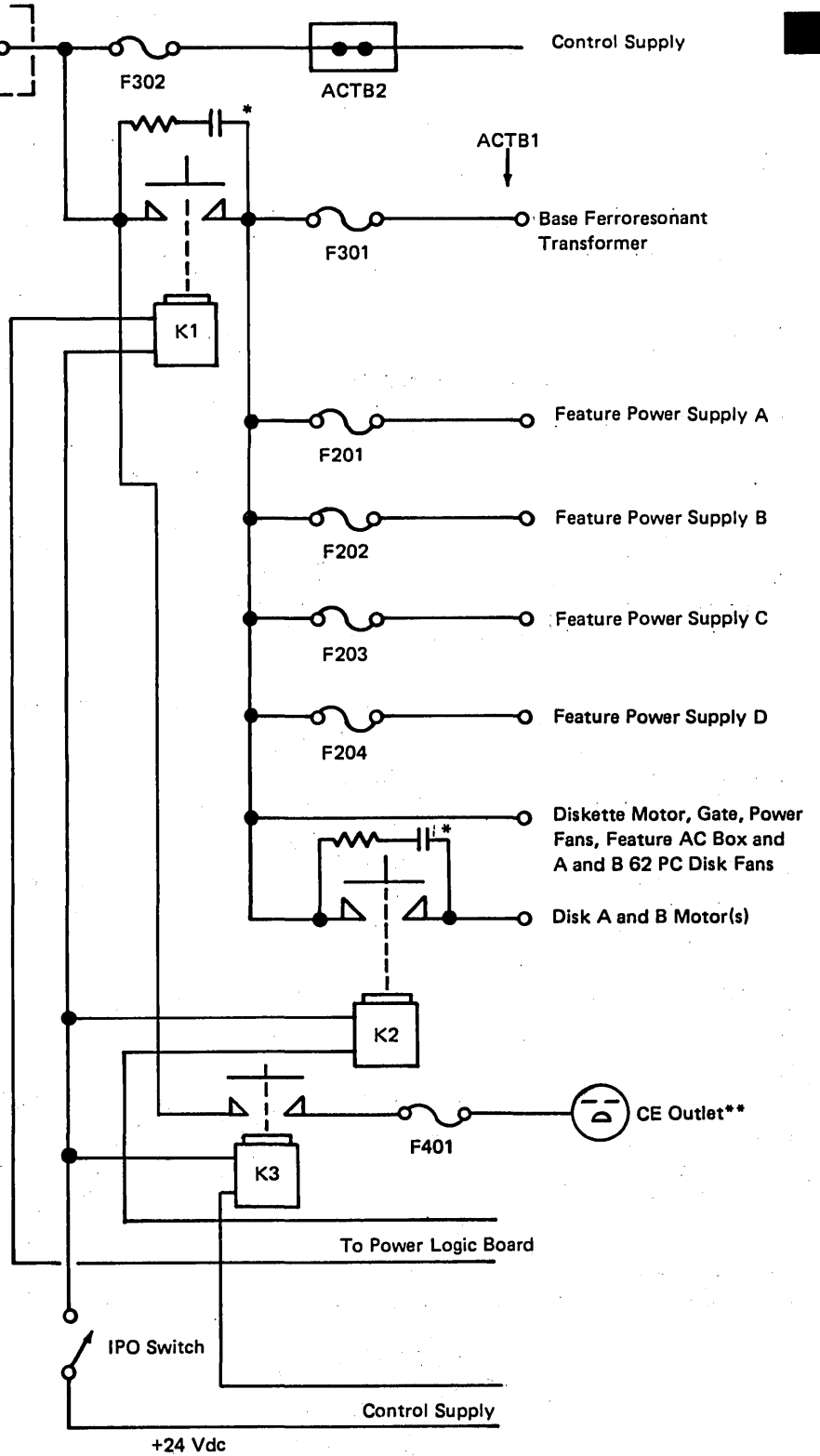
**Available only in some 50 Hz countries

PC Board

J20

F101

F104

J21

F103

F102

TB-10

1

16

Control Supply
Ferroresonant
Transformer

C-5
Control Supply
Ferroresonant
Capacitor

Fuse Chart

Fuse	Size	P/N
F101	1A	855253
F102	.3A	855229
F103	4A	111257
F104	1A	855253

Safety Cover

Note: For connector pin locations,
see 05-210.

05

See FSL page YA020.

C-5 Control Supply
Ferro Capacitor

J20

+24 Vdc
Filter

-24 Vdc
Filter

+5 Vdc
Filter

-5 Vdc
Filter

TB10

Ferro
Common

200V

208V
220V

230V

235V

T-10

J21-1

J21-3

J21-4

F101

J21-13

J21-12

F102

J21-9, 10 and 11

F103

J21 Goes to power logic board
and the AC box.

J21-8

F104

J21-5

J21-6

J21-7

To K1
and K2

IPO Switch

05-330 Base Power Supply and Base Distribution Assembly

The base ferroresonant transformer receives input AC line voltage through CB1, contactor K1 points, fuse 301 and ACTB1 on the AC box. See FSL page YA040.

The transformer has five secondary outputs:

- 5 Vac to the +5V filter assembly

- 8.5 Vac to the multilevel filter assembly for +8.5 Vdc

- 8.5 Vac to the multilevel filter assembly for -8.5 Vdc

- 24 Vac to the multilevel filter assembly for +24 Vdc

- 24 Vac to the multilevel filter assembly for -24 Vdc
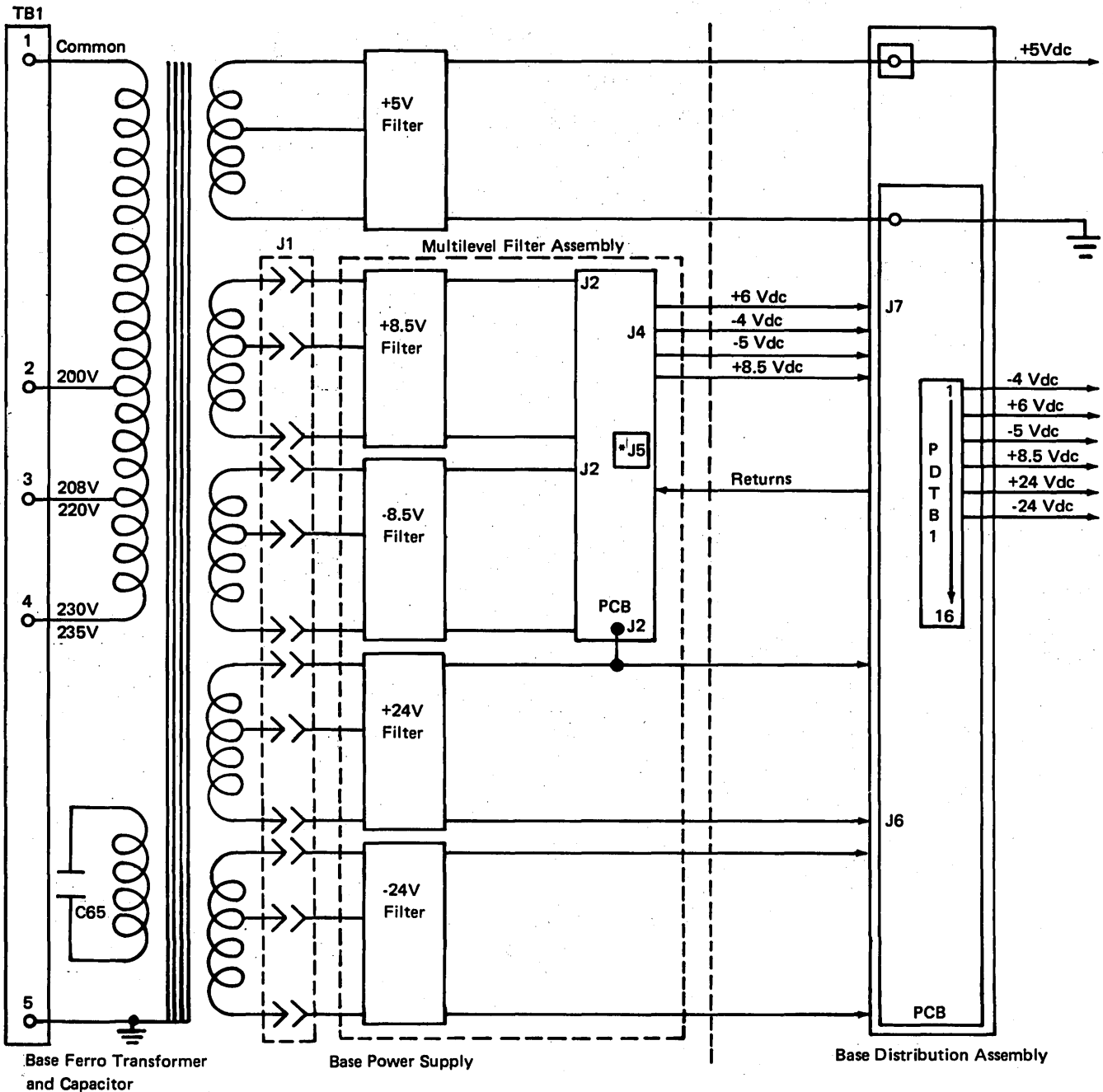
* J5 is used to send an overcurrent sense signal to the C-A1 board

16

The multilevel filter assembly supplies +6 Vdc, +8.5 Vdc, +24 Vdc, -24 Vdc, -4 Vdc, and -5 Vdc to the base distribution assembly. See FSL page YA040.

05

J9

J10

J4

J5

1   4

J2

Power Compartment
Thermal Sensor

PCB

J1
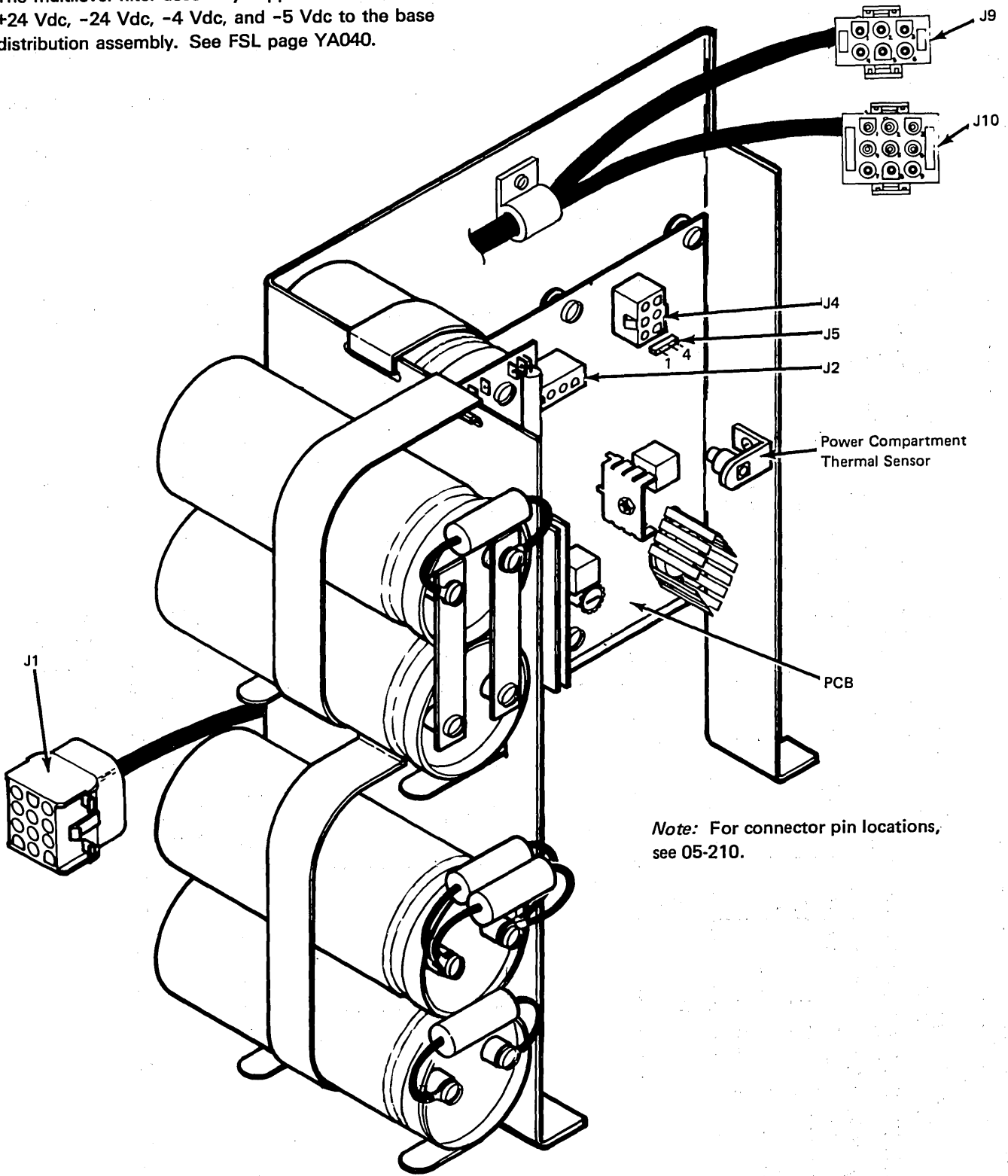
Note: For connector pin locations, see 05-210.

Multilevel Filter Assembly

See FSL page YA040.

CR50

CR51
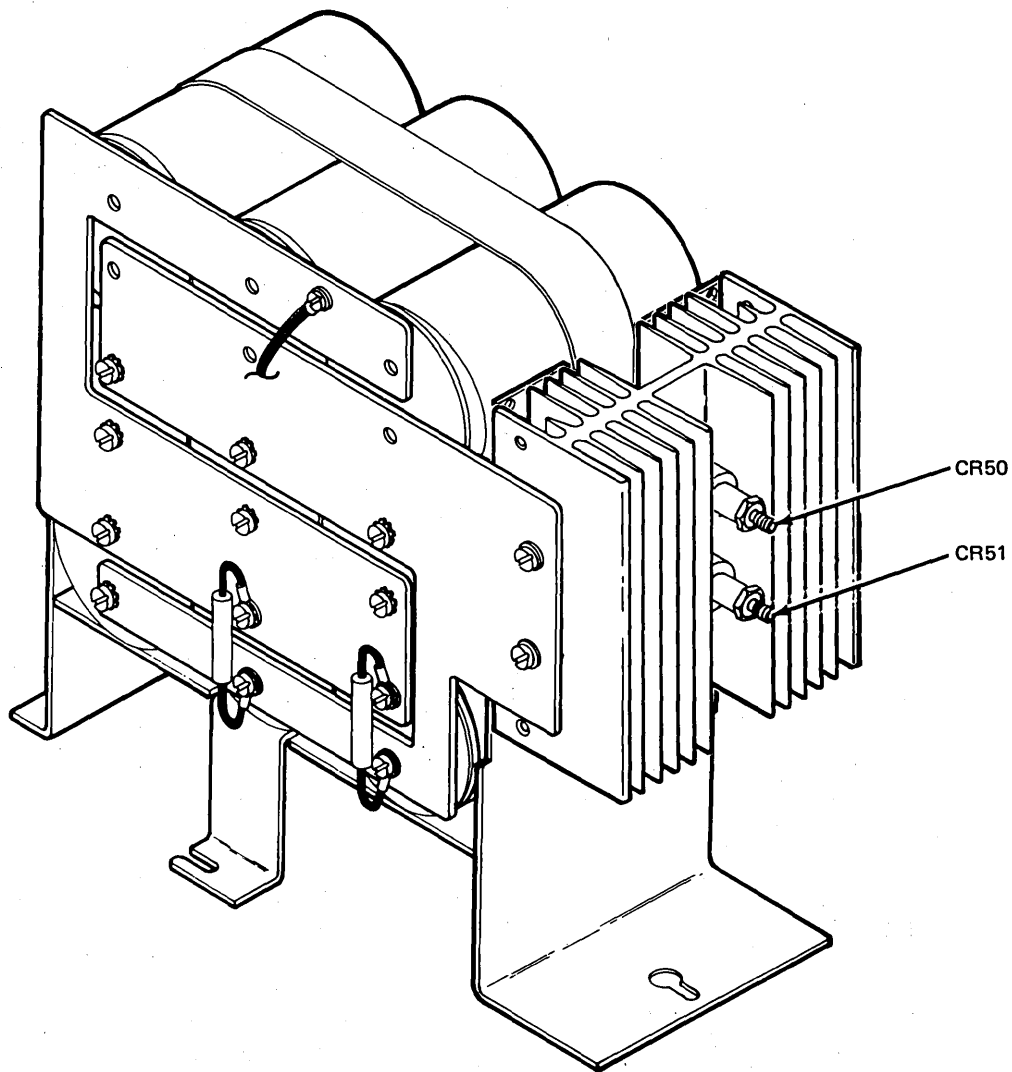
See FSL pages YA080 and YA090

Base Distribution Assembly

DC Ground

+5 V Plate

+5 Vdc Base

O/C
Sense
Plate

Note: For connector pin
locations, see 05-210.

PDTB1

E10

J7   B
       D

J6

J8

J9

PCB

J10

E11
E12

E13

1   +5 Vdc Feature Power Supply B
2   +12 Vdc Feature Power Supply A
3   +12 Vdc Feature Power Supply A
4   -12 Vdc Feature Power Supply A*
5   -12 Vdc Feature Power Supply A*
6   -4 Vdc Base
7   -4 Vdc Base
8   +6 Vdc Base
9   -5 Vdc Base
10   -5 Vdc Base
11   -5 Vdc Base
12   +8.5 Vdc Base
13   +8.5 Vdc Base
14   +24 Vdc Base
15   +24 Vdc Base
16   -24 Vdc Base

Feature Distribution Assembly

+5 Vdc Feature Power Supply C   1
+5 Vdc Feature Power Supply C   2
+8.5 Vdc Feature Power Supply C   3
+12 Vdc Feature Power Supply C   4
-5 Vdc Feature Power Supply C   5
-12 Vdc Feature Power Supply C   6
+5 Vdc Feature Power Supply D   7
+5 Vdc Feature Power Supply D   8

PDTB
(See 05-630 Feature
Power Supply C and
05-640 Feature
Power Supply D)

DC Ground

*Or regulator

The power logic board contains the following cards:

- *Protect card* C-A1B2 contains circuits for turning
  power on and off, registers for storing the causes of
  power failures, and circuits for turning on the Power
  Check light, Thermal Check light, and displaying the
  power fault registers in CE byte 0.

- *Base sense card* C-A1C2 contains circuits for sensing
  undervoltage, overvoltage, and overcurrent conditions
  for the base power system. Attached to this card is
  an LED (light-emitting diode) known as the Control
  Supply Status indicator. When the Lamp Test switch
  is pressed, the LED comes on only if none of the
  control supply fuses (F101 through F104) has failed.

Additional Cards for Optional Features

The 62PC Disk Drive feature or the 2400 BPS Integrated
Modem feature adds feature power supply A to the
System/34. Sensing the output of the added supply is
done by a sense card that goes into C-A1C4 on the
power logic board.

Note: If a first or second communications adapter uses
the 1200 BPS Integrated Modem feature or the
EIA/CCITT feature and the system does not include
feature power supply A, a feature regulator card
(C-A1C4) must be installed.

The MLCA feature adds feature power supply C to the
System/34.

The 1255 MICR Reader/Sorter attachment feature adds
feature power supply B to the System/34 if the
System/34 also contains either a 62PC disk drive or a
72MD magazine drive. Sensing the output of the added
supply is done by a sense card in C-A1C5 on the power
logic board.

C-A1Y1
Sense Cable

C-Gate

C-A1B2
Protect
Card

C-A1C2
Base Sense
Card

Control Supply
Status Indicator

C-A1C4
Feature Power
Supply A
Sense Card,
or Feature Regulator
Card

C-A1C5
Feature Power
Supply B
Sense Card

C-A1A2
CPU Cable

C-A1A3
Control
Supply Cable

C-A1A4T
Feature
Power Supply
C Interface
Cable

C-A1A4B
Feature Power
Supply D Interface
Cable

Connector Positions
on Backplane

C-A1Z1
Feature Power Supply G
Interface Cable

Power Logic Board C-A1 Locations
(card side)

05-400 POWER FAULT INDICATIONS

05-401 System Power-Off Conditions

The system powers off (or fails to power on) if any of the following conditions is present:

1. The temperature rises high enough to open the thermal switch in either the A-gate (117°-127°F) or the power compartment (129°-139°F).

2. The output voltage of any of the supplies is too high (overvoltage).

3. The load on any of the power supplies conducts more current from the power supply than is safe for the load (overcurrent).

4. The output voltage of any of the supplies is too low (undervoltage).

5. An AC input power failure occurs.

6. The IPO switch is turned off.

7. The cards at C-A1C4 or C-A1C5 (if installed) are either not seated correctly or are missing.

8. The cables to feature power supply C, D, or G (if installed) are either not seated correctly or are missing.

9. The Power switch on the operator panel is turned off.

A system power off caused by condition 1 lights the Thermal Check light on the operator panel. A system power off caused by conditions 2 through 7 lights the Power Check light on the operator panel.

05-410   Power Fault Registers

When a Power Check occurs on the System/34, power
fault codes that indicate the cause of the fault are
stored so that you can display the codes and isolate the
cause of the power check.

Power fault codes are divided into two groups: priority
fault codes and additional fault codes.

Priority fault codes indicate that some power supply was
overvoltage, undervoltage, overcurrent, or that a feature
sense card is missing. Priority fault codes all have bit 0
active.

Additional fault codes generally further specify the cause
of the priority fault by either indicating *which* power
supply has the wrong voltage, or by indicating that *all*
power supplies have the wrong voltage.

The protect card (C-A1B2) has three registers that store
power fault codes when a power check occurs.

1. The shift register:
    - Stores up to 43 fault codes.
    - Stores the priority fault code and any additional
      fault codes controlled by the sensing circuits on
      the base sense card, feature sense cards, or
      feature power supplies during 320
      microseconds after a power check.
    - Increments each time a search operation is
      performed.

2. The present register:
    - Stores one fault code at a time.
    - Stores the fault code each time the shift
      register increments.
    - Can be displayed by pressing the Dply Pwr Chk
      switch.

3. The previous register:
    - Stores one priority fault at a time.
    - Is loaded from the present register if the fault
      code in the present register is a priority fault
      code (bit 0 on) and either a power check occurs
      or a search operation is performed.
    - Can be displayed by pressing the Dply Pwr Chk
      switch and operating the Prev switch.
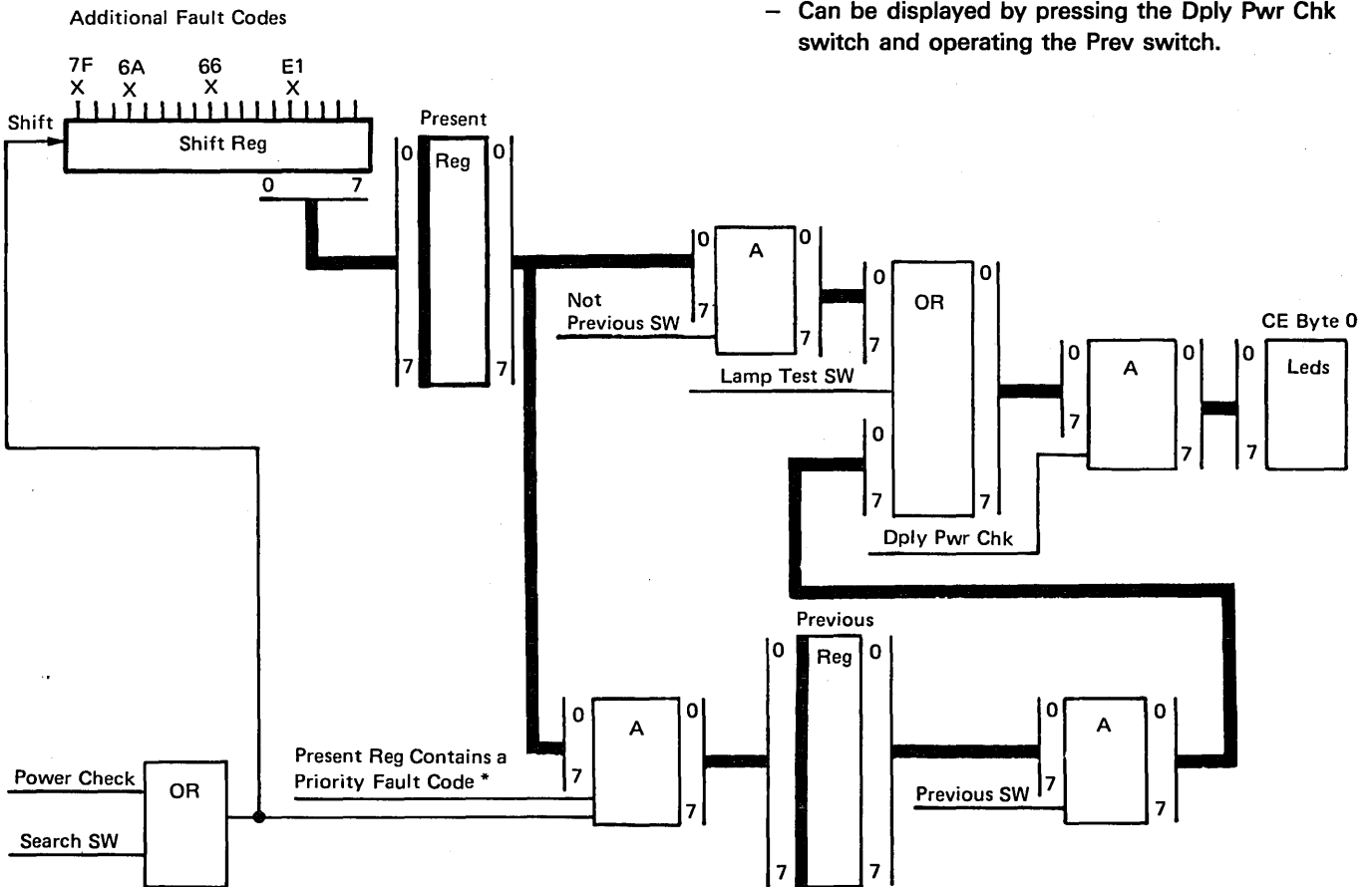
* Bit 0 On

Three CE panel switches are used to display this information in byte 0 of the CE panel display. The switches are:

- The Dply Pwr Chk switch

- The Pwr Fault Dply (two switches: Prev and Search)

CAUTION
Information concerning power supply failures that is stored in the power failure latches is lost if all system power is removed by turning off the circuit breaker (CB1).

05-420   Dply Pwr Chk Switch

CAUTION
Do not operate the Search switch until you have displayed and recorded the previous power fault register. Operating the Search switch moves the present power fault register data to the previous power fault register.

When a power check occurs, press Lamp Test and look at the Control Supply Status indicator on the card at C-A1C2 (see paragraph 05-370) to ensure that it lights with Lamp Test. If the indicator does not light, the indicators in CE byte 0 (when the Dply Pwr Chk switch is pressed) are not reliable. If the Control Supply Status indicator does not light when Lamp Test is pressed, the power check was probably caused by a fuse on the control supply. If the Control Supply Status indicator does light with Lamp Test, press Dply Pwr Chk to display the cause of the power check in CE byte 0.

1. Press Dply Pwr Chk and operate the Prev switch (see paragraph 05-431) to display the cause of the power check that occurred before the present power check.

2. Press Dply Pwr Chk and operate the Search switch (see paragraph 05-432) to display all of the additional fault conditions that caused the present power check (one display for each operation of the Search switch). When the CE byte 0 lights display hexadecimal 7F, the search is complete and all of the conditions have been displayed.

CE Panel

PROC RUN

INSN STEP/
DPLY LSR
ALTER STOR
ALTER MAR
IRPT
DPLY STOR
INSN STEP/
DPLY CHKS
INSN STEP/
DPLY PCR
SYS INSN STEP

MODE SELECTOR

ADDRESS/DATA
DISPLAY/DATA

DPLY PWR CHK   RESET   CE START

COMM
DPLY   FORCE
PWR FAULT DPLY   CHECK   CLOCK   MSIPL   CSIPL   STOR SEL   ADD COMP
ON   PREV   SEARCH   RUN   ON   DISKETTE   DISKETTE   CTL   STOP

OFF   STOP   OFF   DISK   DISK   MAIN   RUN

LAMP TEST

CLOCK   P0   PROC INTERRUPT   P1
                      4   2   1

BYTE 0 ——— DISPLAY LIGHTS ——— BYTE 1

0 1 2 3   4 5 6 7   0 1 2 3   4 5 6 7
8 4 2 1   8 4 2 1   8 4 2 1   8 4 2 1

STOP   STOP

MSP
RUNNING   START

CE Subpanel

OR

FIRST OR SECOND
COMMUNICATIONS
ADAPTER

MLCA

COMM
SELECT
1
2
3
4

COMM
1

COMM
2

05-430   Pwr Fault Dply Switches

05-431   Prev Switch

Pressing Dply Pwr Chk when the Prev switch is in the
normal (down) position displays the cause of the latest
power failure in CE byte 0. Bits in CE byte 0 have the
meanings shown in the following chart.

Pressing Dply Pwr Chk while holding the Prev switch in
the Prev position (up) displays the cause of the
preceding power failure in CE byte 0.

05-432   Search Switch

Hold Dply Pwr Chk while operating the Search switch to
the Search position (up) to display other power supply
failures that occurred during the 320 microsecond period
after the power check. A different failing condition is
displayed for each time the Search switch is operated.
When the search is complete, CE byte 0 contains 0111
1111 (hexadecimal 7F).

Note: The search function will not work unless the
system power is off because of a power fault.

When you have determined which power supply is
causing the power check, use the manual bring-up
procedure (see paragraph 05-550) to force power on
long enough to measure the output of the failing power
supply.

CE Panel

DPLY PWR CHK

COMM DPLY ON / OFF | PWR FAULT DPLY PREV / SEARCH | CHECK RUN / STOP | FOR CLO ON / OFF

CLOCK ○ ┌PO┐ ○ BYTE 0 PROC ○ 4 INTE ○ 2

CE Byte 0

0 1 2 3 | 4 5 6 7
○○○○ ○○○○
8 4 2 1 | 8 4 2 1
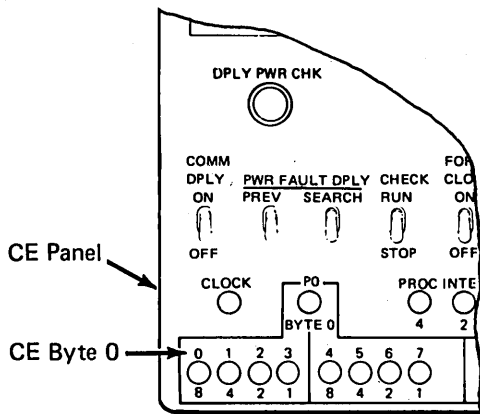
Type of Failure

					Type of Failure
Priority Fault Codes	1	0	0	1	Feature Sense Card or Cable Missing (hex 9)
	1	0	1	0	Over Voltage (hex A)
	1	1	0	0	Over Current (hex C)
	1	1	1	0	Under Voltage (hex E)
Additional Fault Codes	0	0	0	1	Feature Sense Card or Cable Missing (hex 1)
	0	0	1	0	Over Voltage (hex 2)
	0	1	0	0	Over Current (hex 4)
	0	1	1	0	Under Voltage (hex 6)

Failing Voltage Level or Supply

0	0	0	1	+5V Power Supply (hex 1)
0	0	1	0	+8.5V Power Supply (hex 2)
0	0	1	1	+24V Power Supply (hex 3)
0	1	0	0	-24V Power Supply (hex 4)
0	1	0	1	+6V Regulator (hex 5)
0	1	1	0	-4V Regulator (hex 6)
0	1	1	1	-5V Regulator (hex 7)
1	0	0	0	+12V Feature Power Supply A (hex 8)
1	0	0	1	-12V Feature Power Supply A or Feature Regulator Card (hex 9)
1	0	1	0	+5V Feature Power Supply B (hex A)
1	0	1	1	Feature Power Supply C or Cable (hex B)
1	1	0	0	Feature Power Supply D (hex C)
1	1	1	1	Feature Power Supply G (hex F)

Miscellaneous Power Fault Codes

0 0 0 0 0 0 0 0								No faults since the last time AC power was restored (hex 00)
0 1 1 1 1 1 1 1								Search Complete (hex 7F)

Thermal Check Codes (Thermal Check LED on)

1 1 1 0 0 0 0 1								Thermal Check when power was off (hex E1)
1 1 1 1 1 1 1 1								Thermal Check when power was on (hex FF)

05-500   IMMEDIATE POWER OFF (IPO)

Operating the IPO switch causes an undervoltage condition that turns on the Power Check light on the operator panel.

When the IPO switch is turned off, contactors K1, K2, and K3 (50 Hz only) de-activate. When the contactor points open, AC line voltage is removed from the following places:

- The gate and power fans

- The diskette motor

- The base ferroresonant transformer and capacitor

- Any optional feature power supplies that are installed

- The feature AC box and K4 (if installed)

- The disk motors

DANGER
Set the circuit breaker (CB1) to Off if you want *all* voltages off. With the IPO switch turned off and CB1 on, AC line voltage is still present at the control supply and DC output voltages from the control supply are present at the A-A1 board, the operator panel, and the CE panel. Because of the charge on the capacitors in the arc-suppression networks across K1, K2, and K4, voltage is still present on all circuits supplied by the contactor points when K1, K2, and K4 are de-activated (see paragraphs 05-315 and 05-670).

05-550   MANUAL BRING-UP PROCEDURE

Use the following procedure to measure the output voltage of power supplies that are causing power checks.

1. Set the IPO switch to O.

2. Attach the CE multimeter to the output of the failing power supply.

3. Attach a jumper from C-A1B2G13 to C-A1B2J08 on the power logic board.

4. Set the IPO switch to I only long enough to read the scale on the multimeter, and then set the IPO switch back to O.

5. Remove the jumper and set the IPO switch to I.

05-600   POWER SUPPLIES FOR OPTIONAL FEATURES

Some optional features that are added to the System/34 need additional power supplies or voltages that are not supplied by the base power supply. The following chart indicates which features need the extra power:

Optional Feature	Power Changes
2400 BPS Integrated Modem or 62PC Disk Drives, A or B	Add feature power supply A
1200 BPS Integrated Modem or Electronic Industries Association (EIA) (not MLCA) not installed	Add feature regulator card if feature power supply A is
1255 MICR Reader/Sorter and either the 72MD or 62PC	Add feature power supply B
MLCA A-B3 Board	Add feature power supply C
Expanded Memory 256K bytes	Add feature power supply D
3 or 4 62PC Disk Drives	Add feature power supply G

Feature power supply A is a +12 Vdc and -12 Vdc power supply. Its outputs are used by the 62PC disk drive and/or in the B-gate that is added to the system by the 2400 BPS Integrated Modem feature. The addition of feature power supply A to the System/34 also adds a feature sense card to C-A1C4 in the power logic board (C-gate). See FSL page YA100.

A1

C1

C2

J8

C3

T3

TB5

Note: For connector pin locations, see 05-210.

Base Distribution Assembly

TB-5

1 Common

2 200 Vac

3 208/220 Vac

4 230/235 Vac

C-3

5

T3

A1

+12 V Filter

J8

+ 12 Vdc

+12 V Return

A2

-12 V Filter

- 12 Vac

- 12 V Return
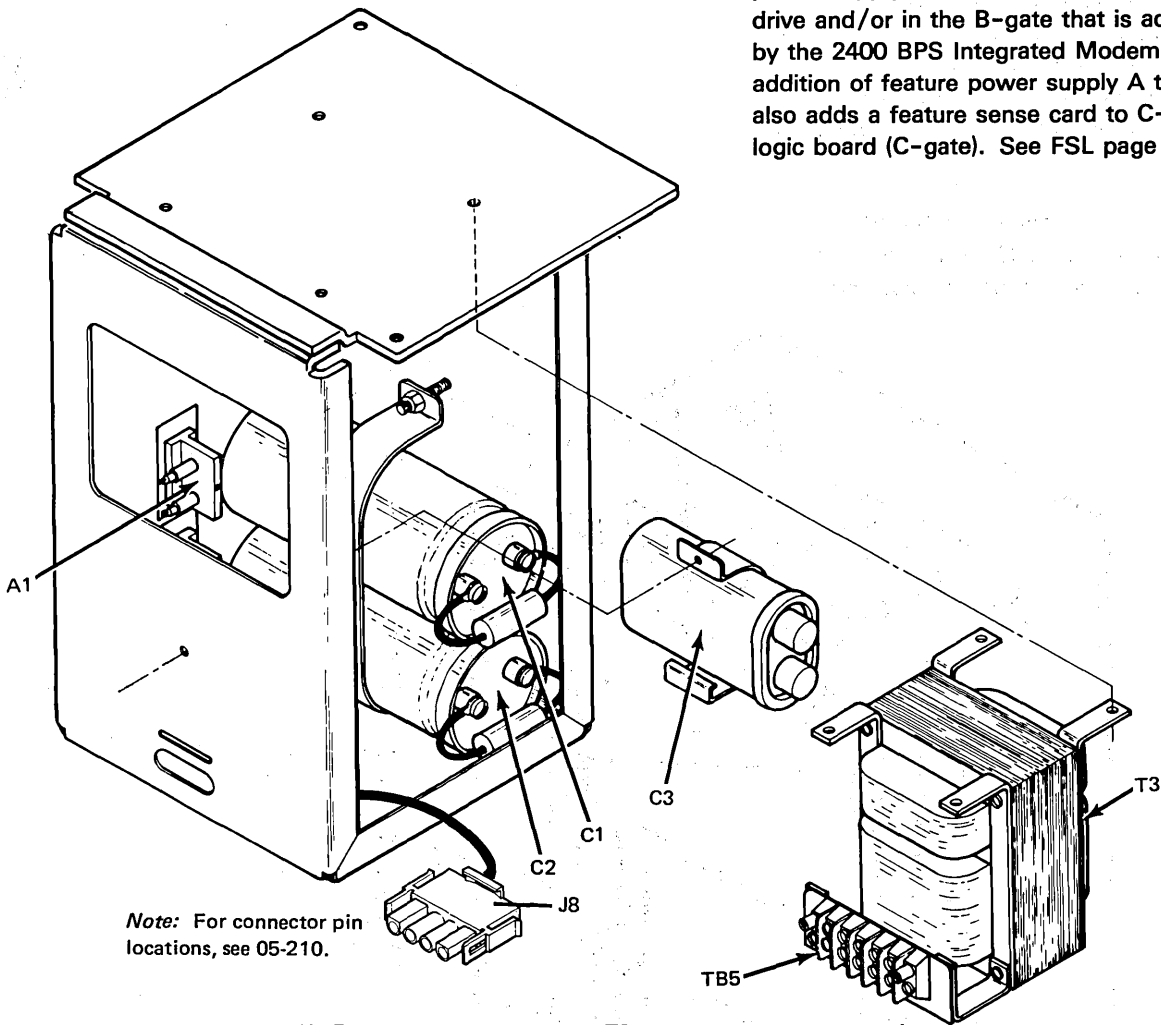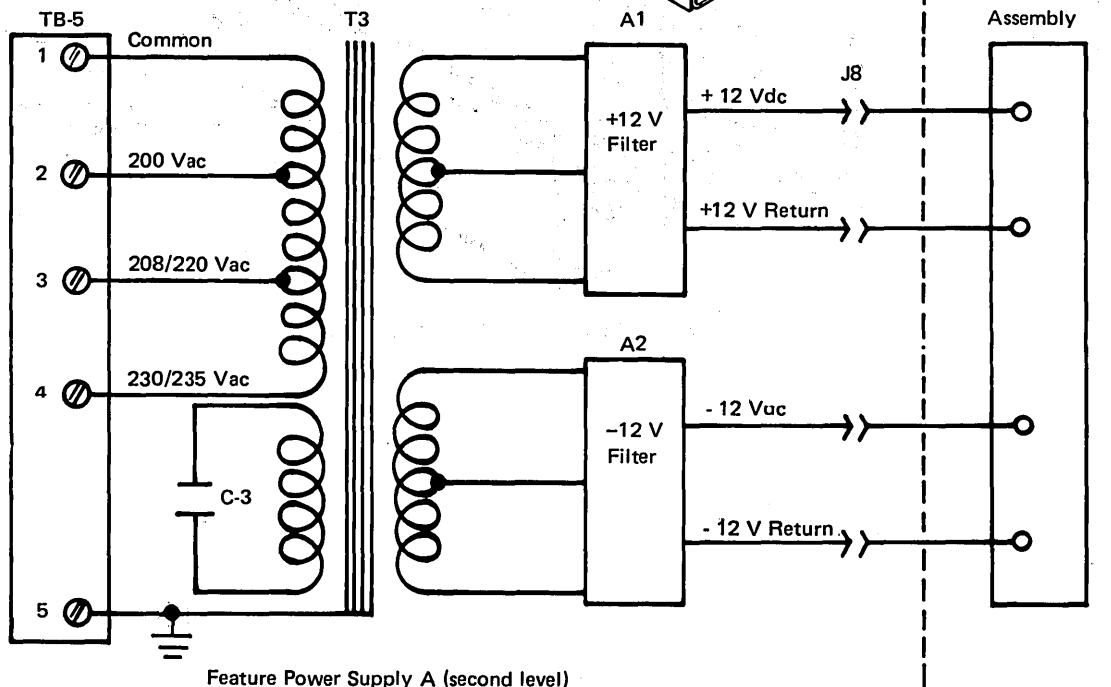
Feature Power Supply A (second level)

28   05-610

05-615   Feature Regulator Card

The feature regulator card is added to C-A1C4 and
generates a -12 Vdc by using the -24 Vdc from the base
power supply. When the first or second
communications adapter is installed, the -12 Vdc is used
by the card added to the System/34 by the 1200-bps or
EIA modems.

Only one of the following features (the 2400 BPS
Integrated Modem feature, the 1200 BPS Integrated
Modem feature or the EIA feature) can be installed.

C Gate

C-A1B2
Protect
Card

C-A1C2
Base Sense
Card

Control Supply
Status Indicator

C-A1C4
Feature Power
Supply A
Sense Card,
or Feature Regulator
Card

C-A1C5
Feature Power
Supply B
Sense Card
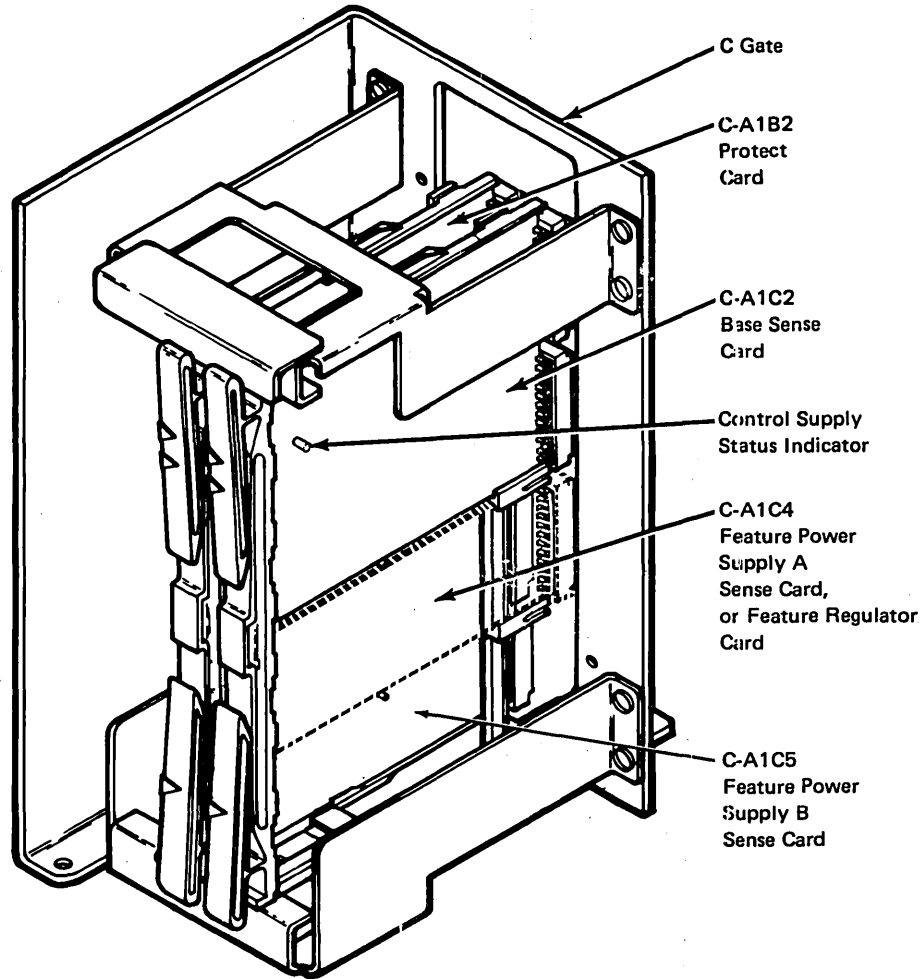
Power Logic Board C-A1 Locations
(card side)

05-620   Feature Power Supply B

Feature power supply B is a +5 Vdc power supply. Its
output is used in the A-A3 board when the 1255 MICR
Reader/Sorter attachment is added to the System/34.
Its output is also used by either the 72MD diskette
magazine drive or the 62PC disk drive. The addition of
feature power supply B also adds a sense card to
C-A1C5. See FSL page YA120.
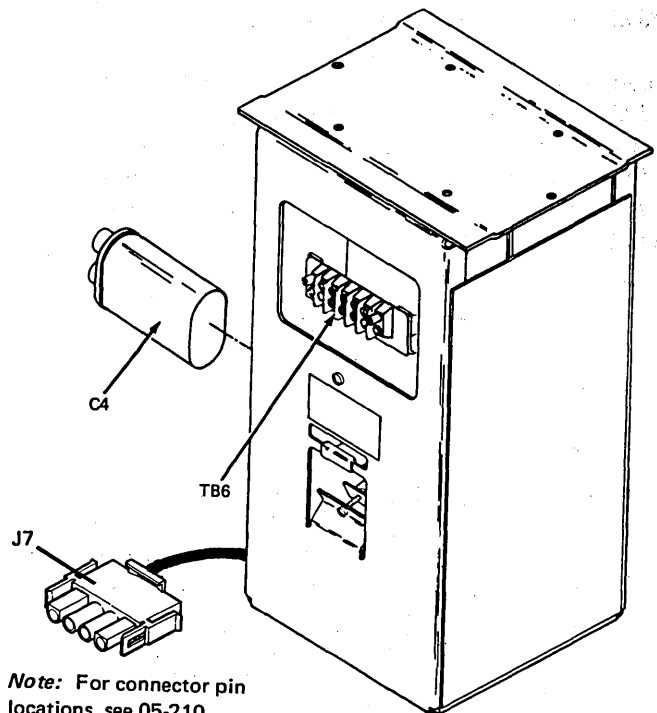
C4

TB6

J7

Note: For connector pin
locations, see 05-210.

Feature Power Supply B
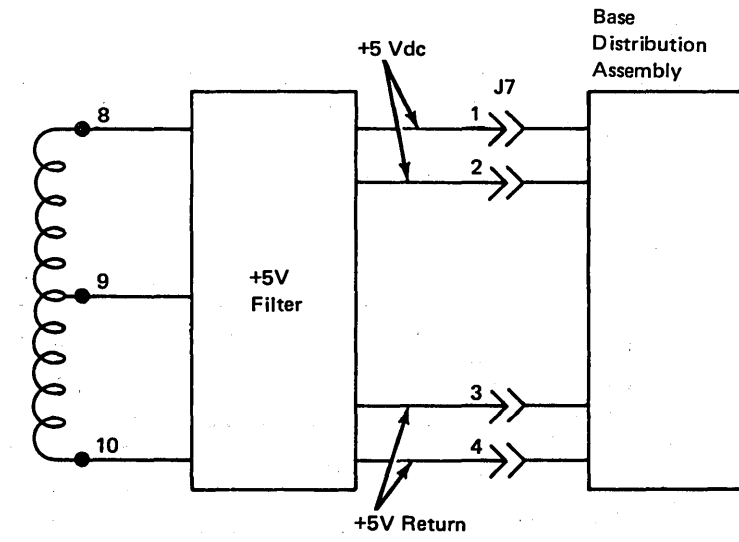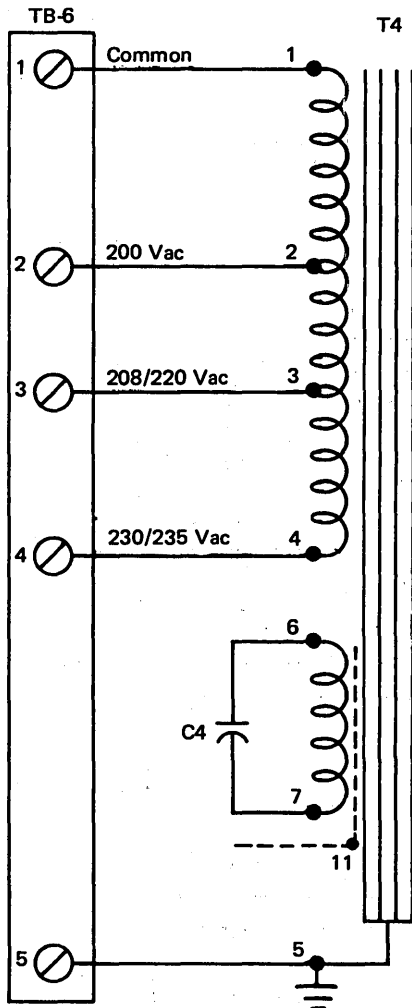
Feature Power Supply B (second level)

Feature power supply C is a +5 Vdc, +8.5 Vdc, +12 Vdc,
-5 Vdc, and -12 Vdc power supply. Its output is used at
the A-B3 board when added to the System/34. The
addition of feature power supply C also needs the
feature distribution assembly if not already installed.
See FSL page YA130.

05
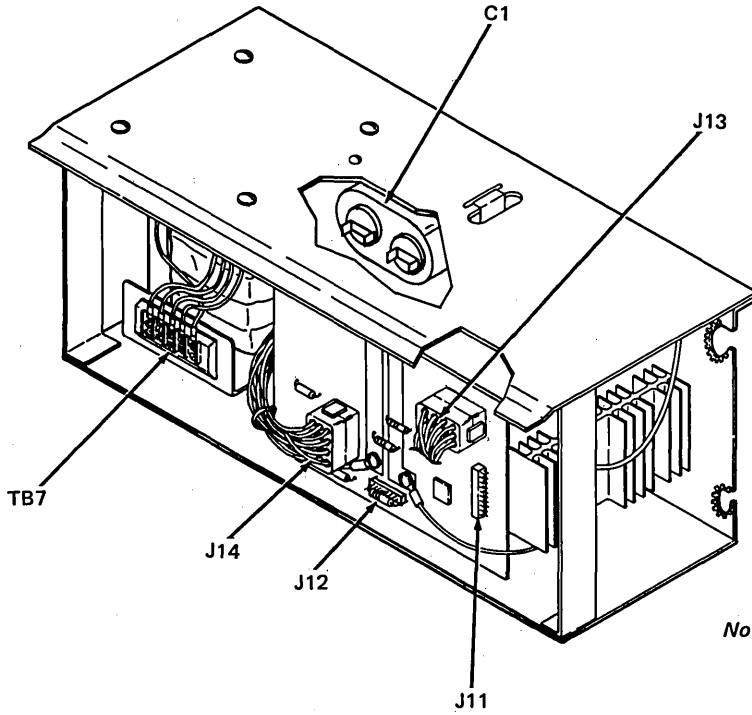
Note: For connector pin locations, see 05-210.
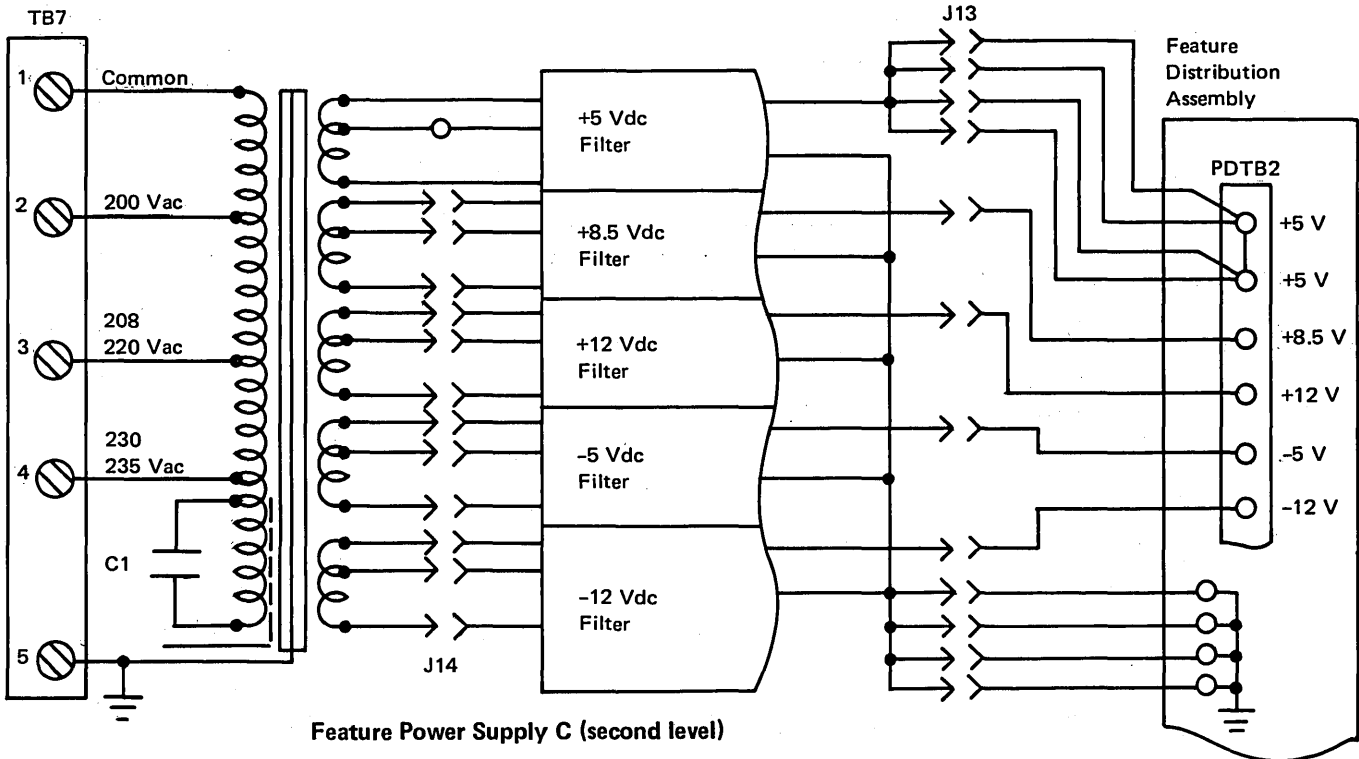
Feature Power Supply C (second level)

Feature power supply D is a +5 Vdc power supply. Its
output is used on the A-A1 board when memory is
expanded to be greater than 128K bytes. Feature power
supply D also requires adding the feature distribution
assembly if it is not already installed. See FSL page
YA140. The circuit board of feature power supply D
contains circuits for sensing undervoltage, overvoltage,
and overcurrent conditions.

Note: For connector pin locations,
see 05-210.

05

K4

F207
2.0 A
P/N 92734

ACTB7

GND BUS
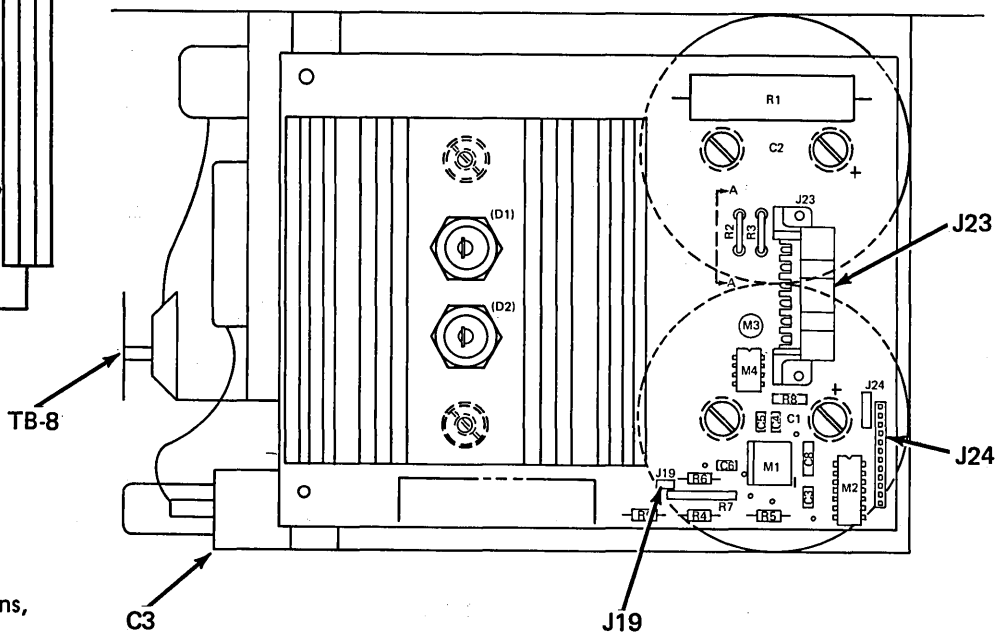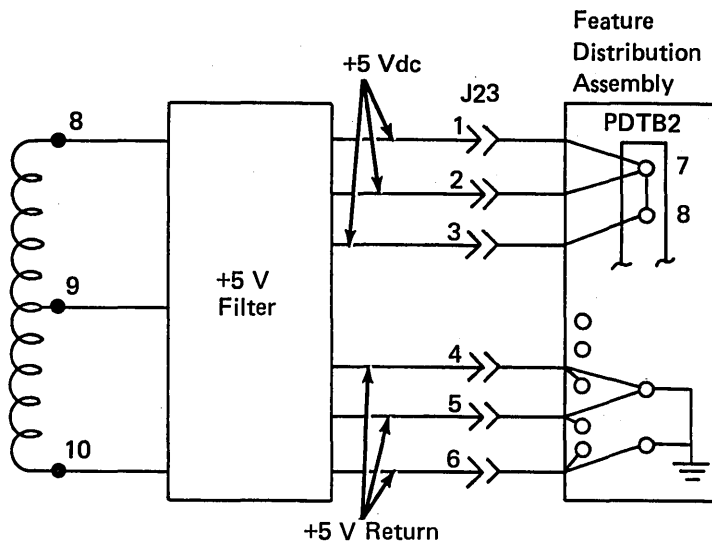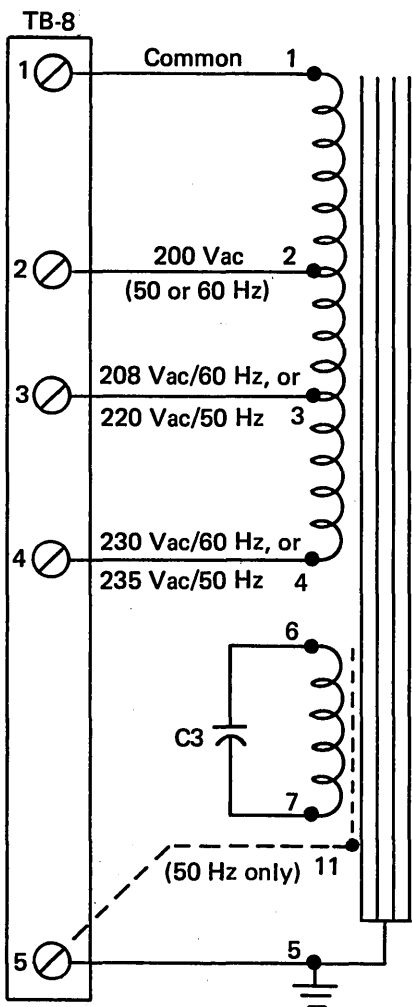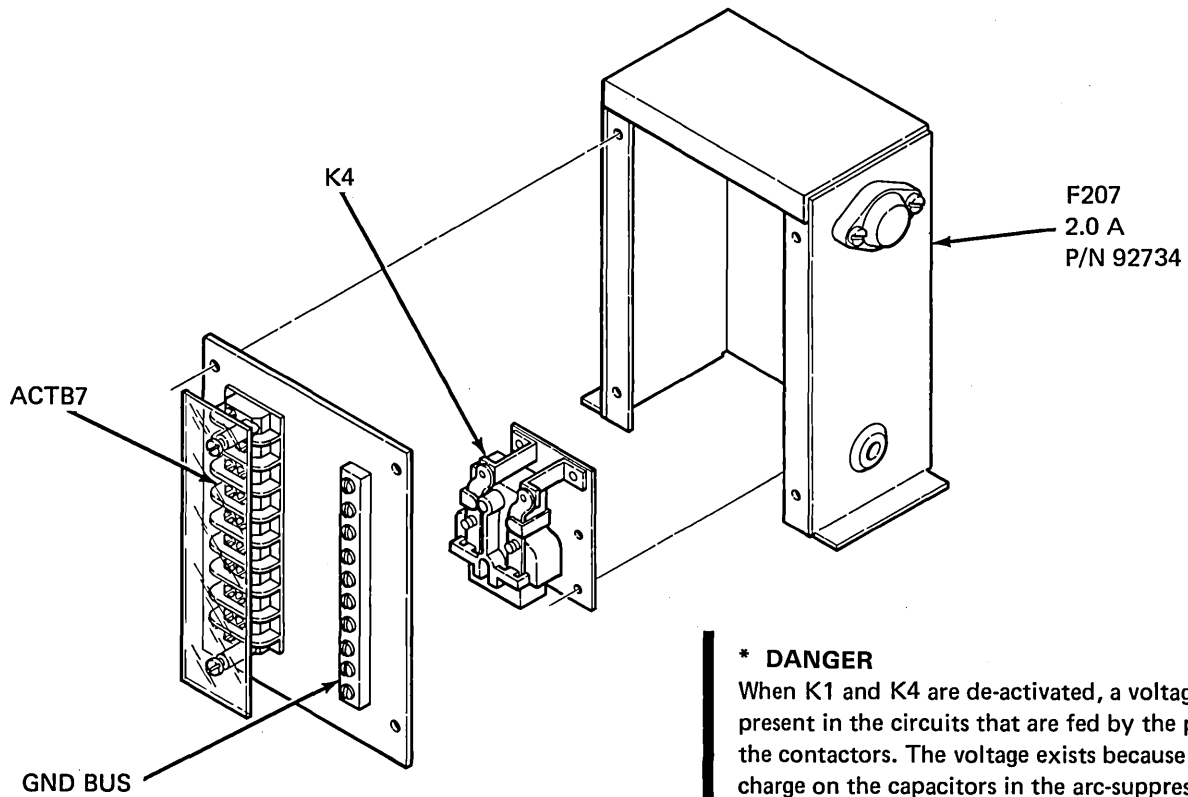
* **DANGER**
When K1 and K4 are de-activated, a voltage is still
present in the circuits that are fed by the points of
the contactors. The voltage exists because of the
charge on the capacitors in the arc-suppression
networks across the points of the contactors.

ACTB7   ACTB7

From K1   F207
In Base   O————————————————O⌇O————————————————O Feature Power Supply G Ferroresonant
AC Box

                                                        O 62 PC Disk C and D Fan(s)

                                    *

                                                        O Disk C and D Motor(s)

                              24 Vdc
                    K4   ———————————— Feature Power Supply G

                                        ———————————— To Feature Power Supply G Filter Assembly
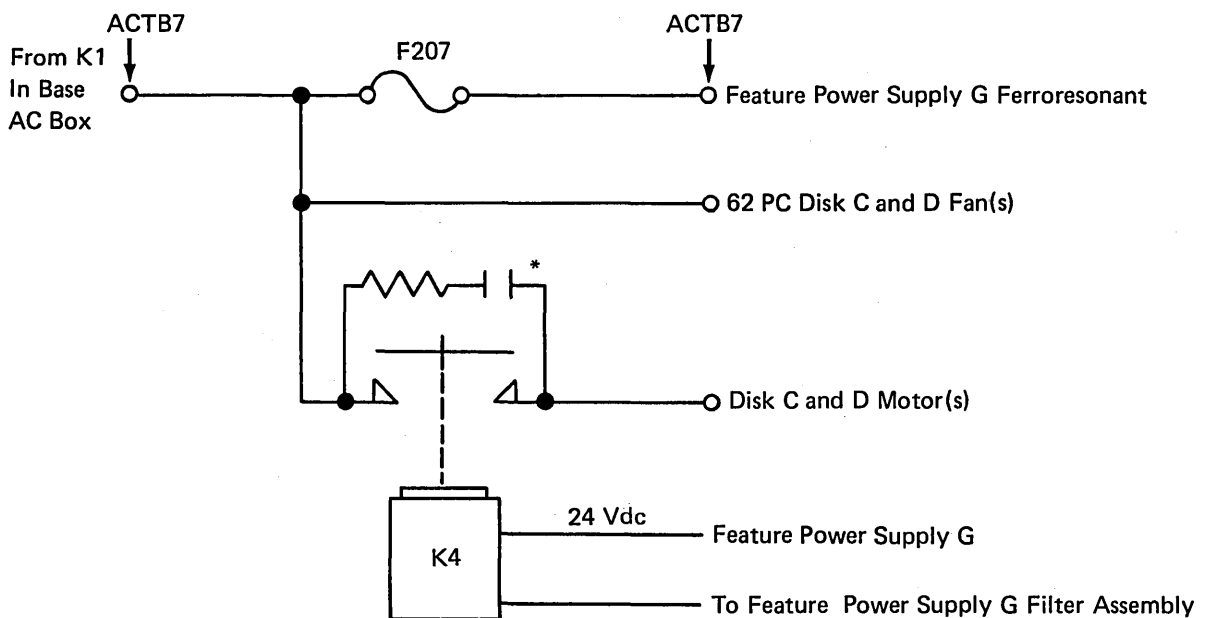
05-680 Feature Power Supply G

Feature power supply G produces +5 Vdc, +12 Vdc,
+24 Vdc, –4 Vdc, and –12 Vdc from the filter assembly.
These voltages are used by the third and fourth 62PC
disk drives when installed. See FSL YA180. Feature
power supply G requires a sense card in J6. See FSL
YA182 and YA184.
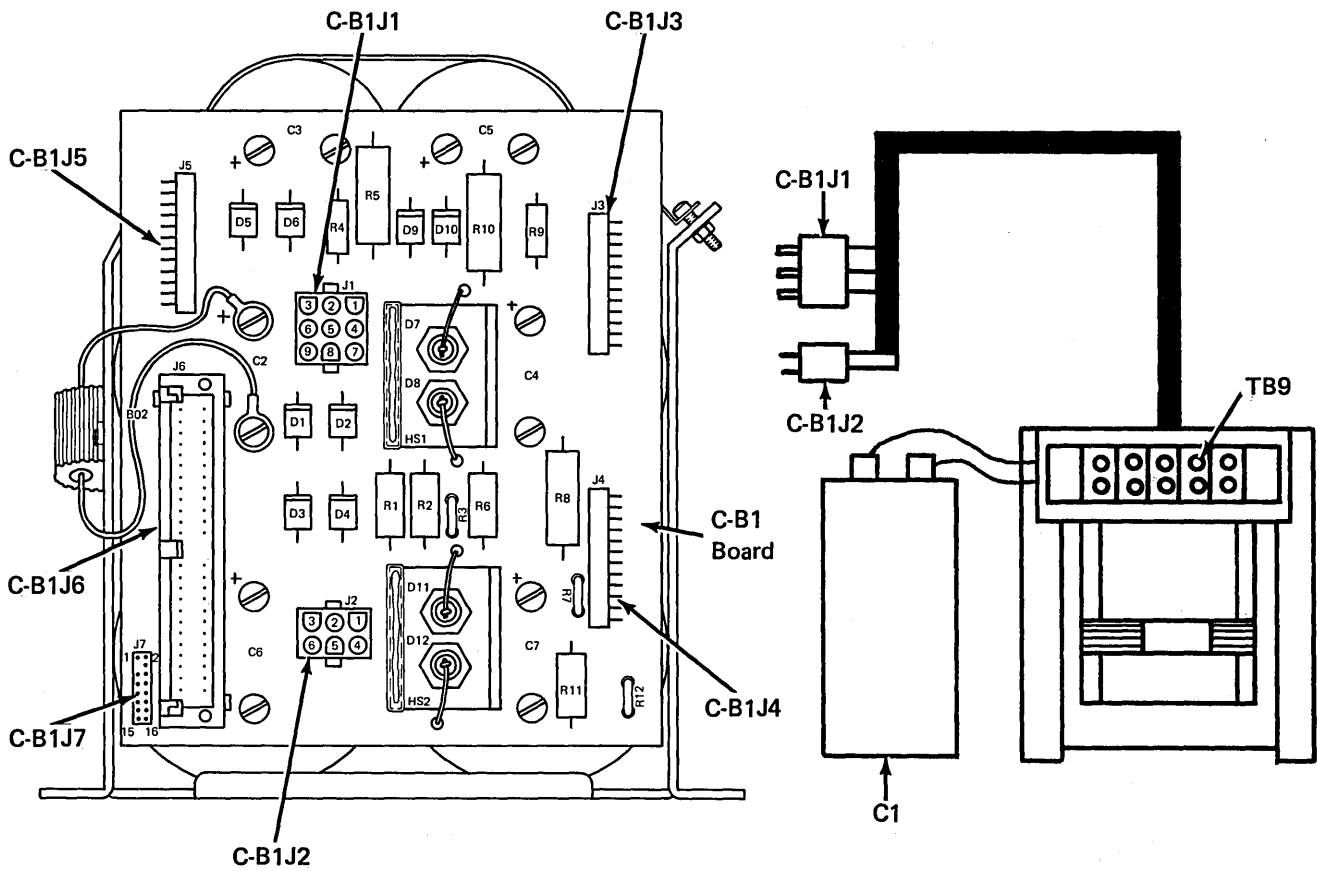
Note: For connector pin locations, see 05-210.

05

TB9

C-B1J1

C-B1J3/J4

1 — Common

+5 Vdc Filter → B03, B04, D03

2 — 200 Vac (50 or 60 Hz)

+12 Vdc Filter → B02

→ * B12, D12

3 — 208 Vac/60 Hz / 220 Vac/50 Hz

-12 Vdc Filter → D02

4 — 230 Vac/60 Hz / 235 Vac/50 Hz

C1

-4 Vdc Filter → B13, D13

50 Hz only

+24 Vdc Filter

+24 Vdc → B06, D06

Return* → B05, D05

5

C-B1J2
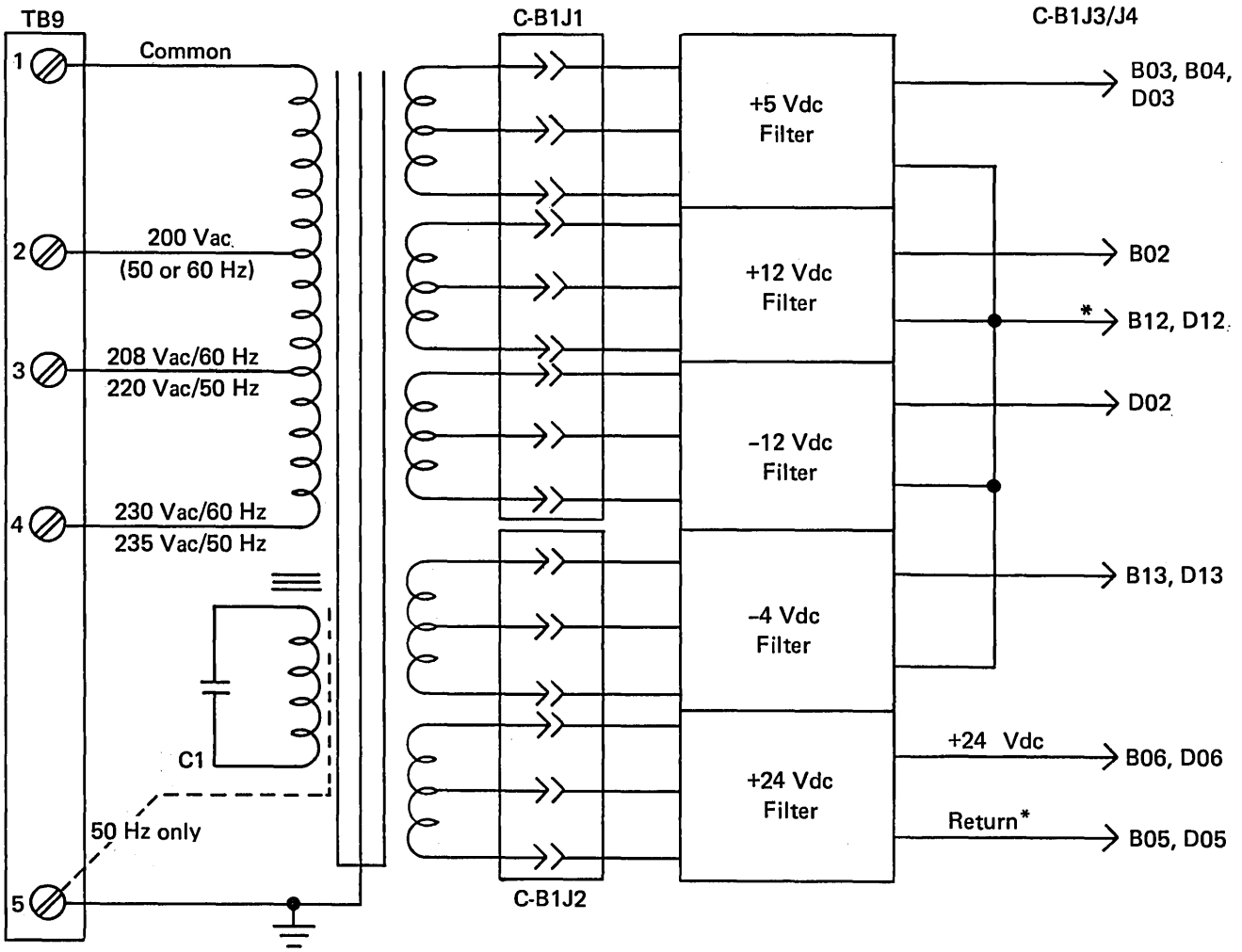
*Return line (B05, D05) for +24 Vdc is connected to other return line (B12, D12) within J4 connector.

05-700   SYSTEM VOLTAGE DISTRIBUTION

System voltage distribution is shown on FSL pages
AFxxx.

05-710   Power Supply Voltage Tolerance Chart

Power Supply Voltage Tolerance Chart*

Voltage	Voltage Tolerance Ranges						
	Base	Reg	Feature A	Feature B	Feature C	Feature D	Feature G
-4 Vdc	-3.92 -4.16						-3.74 -4.42
+5 VDC	4.69 5.52			4.65 5.52	4.65 5.50	4.70 5.52	4.68 5.52
-5 VDC	-4.70 -5.50				-4.625 -5.50		
+6 Vdc	5.64 6.60						
+8.5 Vdc	7.86 9.35				7.86 9.35		
+12 Vdc			11.10 13.20		11.10 13.20		11.04 13.20
-12 Vdc		-11.04 -13.20	-11.04 -13.20		-11.04 -13.20		-11.04 -13.20
+24 Vdc	22.08 26.40						22.56 26.40
-24 Vdc	-22.08 -26.40						
Ground							

*Measure at the CD distribution assemblies (base or feature)

Note: Over voltage is that voltage farthest from 0 V; under voltage is that
voltage nearest to 0 V.

CONTENTS

07-010   INTRODUCTION

The 5211 Printer attachment is used to attach either the
Model 1 or Model 2 5211 Printer to System/34. With
the 48-character set, the Model 1 has an operating
speed of 160 lines per minute and the Model 2 has an
operating speed of 300 lines per minute.

07-100   LOCATIONS

All parts for the printer attachment are located on the
A-gate, A2 board. These parts include two cards, four
top card connectors, and three flat cables. For a
description of the top card connectors, see paragraph
07-300. The two cards, their locations, and the
hardware on each card are:

- Printer controller card (A-A2S2)
  - 4-bit ALU
  - 4-bit A and B registers
  - 16 4-bit data address registers
  - 16 4-bit primary work registers
  - 16 4-bit auxiliary work registers
  - 16-bit storage address register (The SAR bits are
    numbered XSAR 0 through 3 and SAR 0 through
    11.)
  - 16-bit instruction address register
  - 2K bytes of random access storage
  - Control logic: Includes control lines between the
    controller card and the adapter card.

- Printer adapter card (A-A2T2)
  - System command decode
  - System/controller data registers
  - Printer/controller data registers
  - Printer controls:
      Fire tier generation
      Belt and carriage controls
      Hammer echo checking
      Control lines for printer indicators and switches
  - Controller data bus in assembler
  - System data bus in assembler

The three flat cables used for the printer attachment are
plugged into sockets V3, V4, and V5 on the A-A2
board. The other ends of the cables are plugged into
the cable tower. See paragraph 07-400 for a description
of these cables.

Figure 07-1. Printer Attachment Card Locations

07-200   MAINTENANCE

Because of the parts (cards, top card connectors, and cables) that make up the printer attachment, there are no adjustment, removal, or replacement procedures. Any maintenance performed on the attachment needs a failing part exchanged. For locations of all the parts, see Figures 07-1 through 07-3.

For maintenance information on the 5211 Printer, see the *5211 Printer Maintenance Information Manual*.

07-300   TOP CARD CONNECTORS

The four top card connectors on the printer attachment cards are marked (from top to bottom) W, X, Y, and Z. The pins that can be probed on each connector are numbered 02 through 13 (right side of connector) and 22 through 33 (left side of connector).

Using connector W as an example in Figure 07-2, notice that pins W02 through W13 of the T2 card, and pins W22 through W33 of the S2 card can be probed. Also notice that pin A-A2T2W22 cannot be probed with the top card connector installed; but this pin is connected to A-A2S2W22, which can be probed. All of the 02 through 13 pins of the S2 card and the 22 through 33 pins of the T2 card cannot be probed when the top card connector is installed.

As an aid to identifying pin locations on each card connector, at least one pin location is shown on each connector in Figure 07-2.

Figure 07-2. Printer Attachment Top Card Connectors

Three internal cables are used to attach the 5211 Printer
to System/34. These cables are connected from the
A-gate, A2 board to the cable tower. See Figure 07-3
for a description of each cable and for the cable
locations on the cable entry tower.

B and D pins of D-B4
are connected to A-A2V5
and contain the print
data and fire tier signals.

G and J pins of D-B4
are connected to A-A2V4
and contain the printer
control signals.

D-B4B02

D-B4J13

G and J pins of D-B5
are not used.

B and D pins of D-B5
are connected to A-A2V3
and contain the signals
for the printer indicators
and switches.

Figure 07-3. Cable Entry Tower

07-500   CARD JUMPERS

There are three jumper locations on the printer adapter
card located in A-A2T2. Attach the jumpers (IBM part
1675209) as shown in Figure 07-4.

A-A2T2   B02 Pin
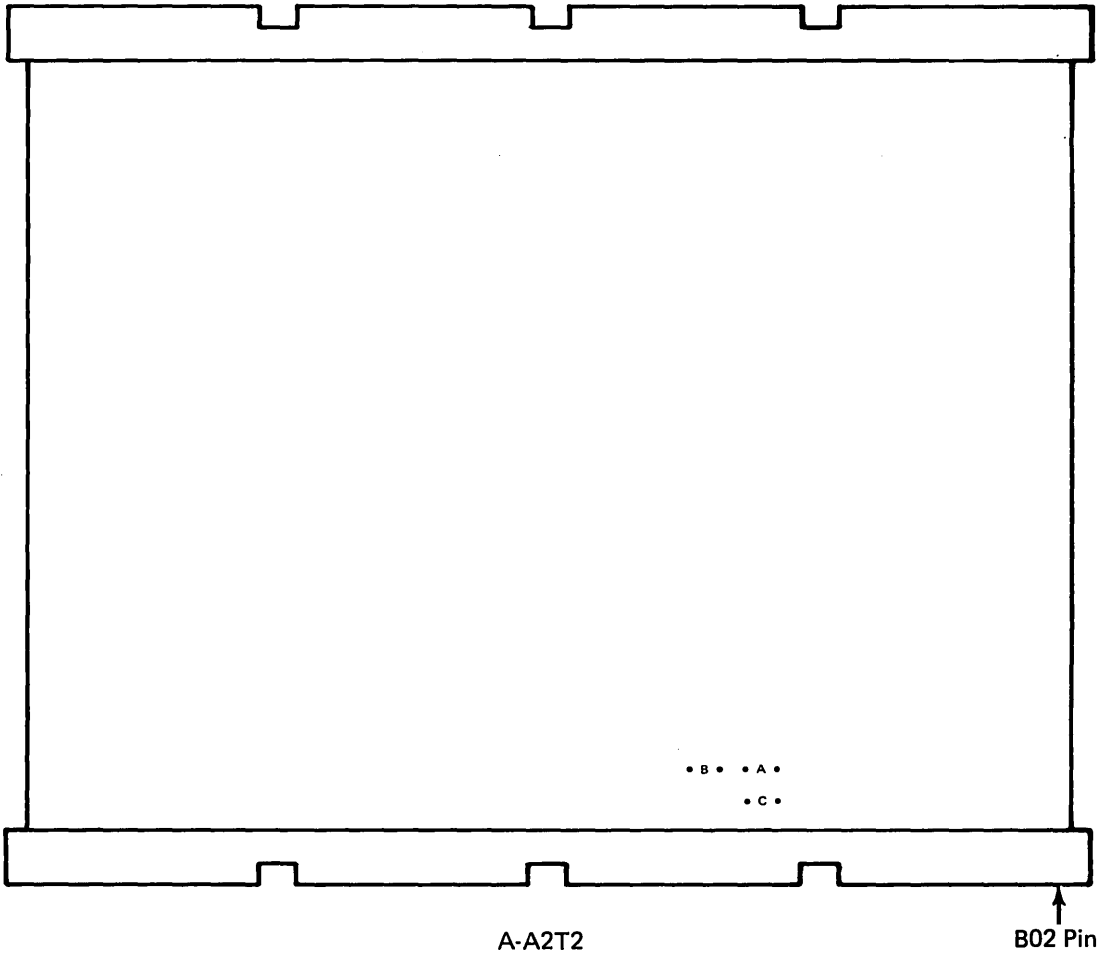
A — Must be removed for both the 5211 Model 1 (160 lines
      per minute) and the 5211 Model 2 (300 lines per minute)
      printers.

B — Needed for both printer models.

C — Needed for the 5211 Model 2 (300 lines per minute)
      printer; not needed for the 5211 Model 1 (160 lines
      per minute) printer.

Figure 07-4. Printer Adapter Card Jumpers

08

CONTENTS

08-010   INTRODUCTION

The 3262 Printer attachment is used to attach the 3262 Printer to System/34. With the 48-character set, the 3262 has an approximate operating speed of 650 lines per minute at a line spacing of 6 lines per inch.

08-100   LOCATIONS

All parts for the printer attachment are located on the A-gate, A2 board. These parts include three cards, four top card connectors, and three flat cables. For a description of the top card connectors, see paragraph 08-300. The three cards, their locations, and the hardware on each card are:

- Printer controller card (A-A2S2)
  - 4-bit ALU
  - 4-bit A and B registers
  - 16 4-bit data address registers
  - 16 4-bit primary work registers
  - 16 4-bit auxiliary work registers
  - 16-bit storage address register (The SAR bits are numbered XSAR 0 through 3 and SAR 0 through 11.)
  - 16-bit instruction address register
  - 2K bytes of random access storage
  - Control logic: Includes control lines between the controller card and the adapter card.

- Printer adapter card (A-A2T2)
  - System command decode
  - System/controller data registers
  - Printer/controller data registers
  - Printer controls:
       Fire tier generation
       Belt and carriage controls
       Hammer echo checking
       Control lines for printer indicators and switches
  - Controller data bus in assembler
  - System data bus in assembler

- Printer sequencer card (A-A2U2)
  - Belt/input buffer registers
  -Print position register
  - Hammer count register
  - State count/incrementer register
  - Register controls
  - Storage data register
  - 6K bytes of random access storage
  - Storage switching

The three flat cables used for the printer attachment are plugged into sockets V3, V4, and V5 on the A-A2 board. The other ends of the cables are plugged into the cable tower. See paragraph 08-400 for a description of these cables.
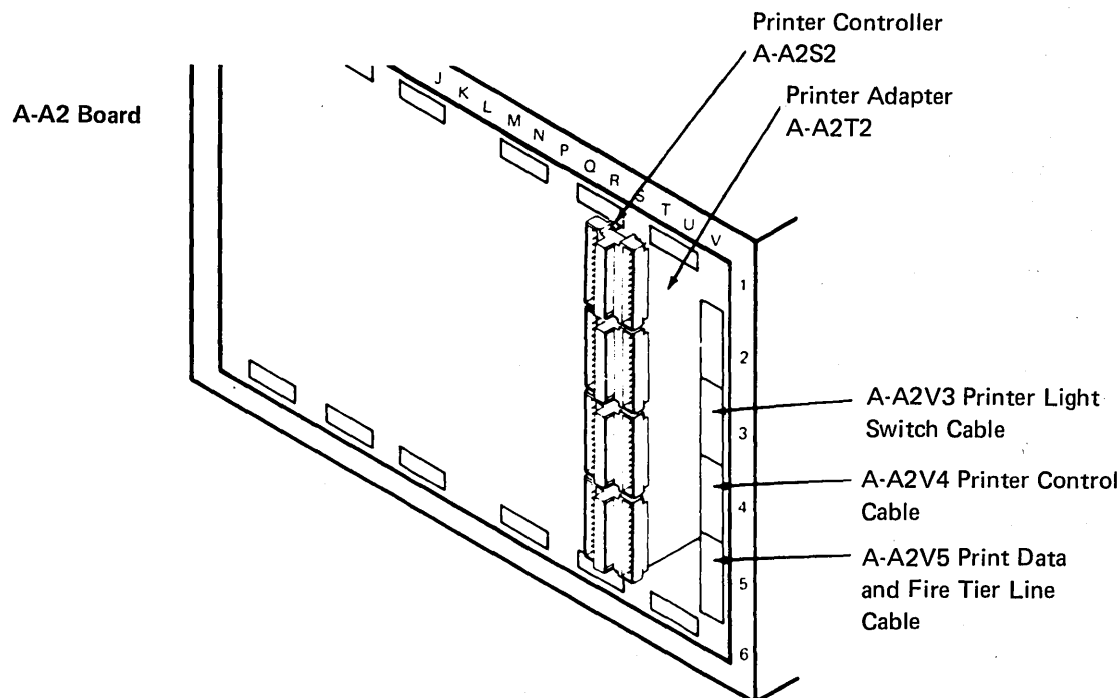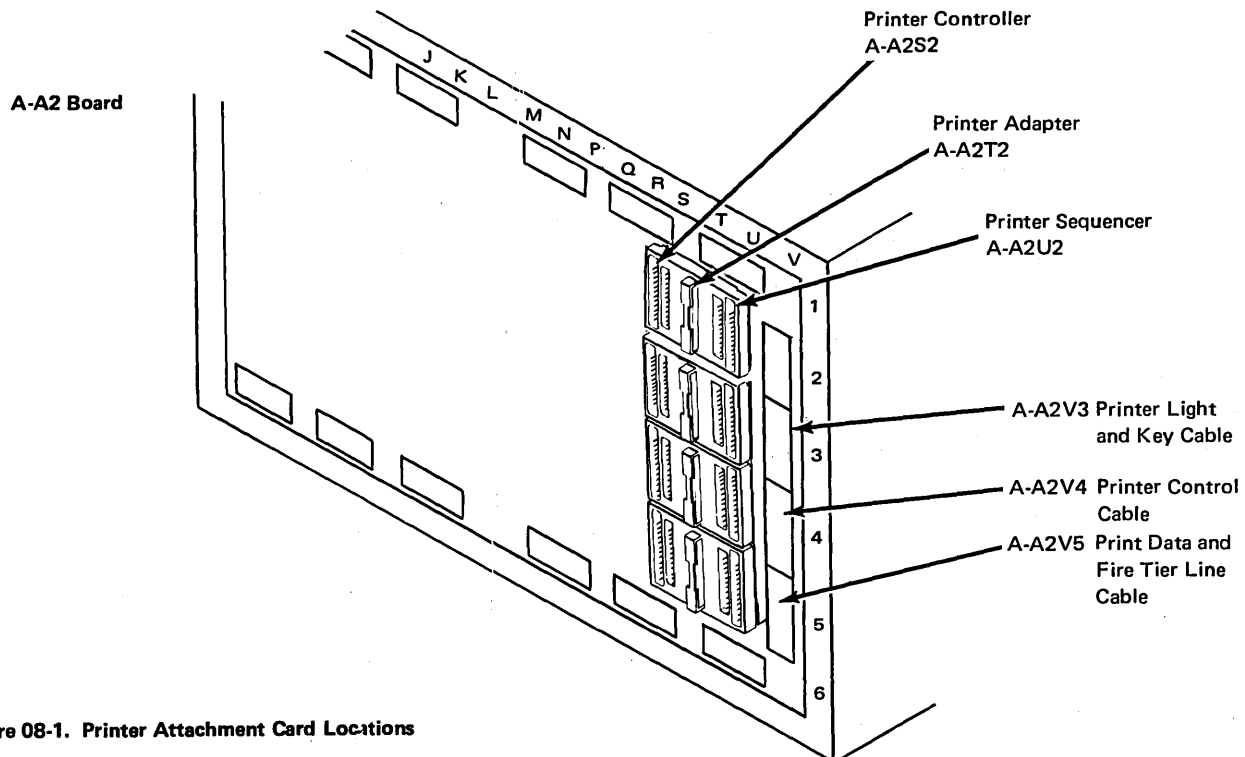

Figure 08-1. Printer Attachment Card Locations

Because of the parts (cards, top card connectors, and cables) that make up the printer attachment, there are no adjustment, removal, or replacement procedures. Any maintenance performed on the attachment needs a failing part exchanged. For locations of all the parts, see Figures 08-1 through 08-3.

For maintenance information on the 3262 Printer, see the *3262 Printer Maintenance Information Manual*.

The four top card connectors on the printer attachment cards are marked (from top to bottom) W, X, Y, and Z. The pins that can be probed on each connector are numbered 02 through 33 on the right side of the connector and 02 through 33 on the left side of the connector.

08

Using connector W as an example in Figure 08-2, notice that pins W02 through W33 of the U2 card, and pins W02 through W33 of the S2 card can be probed. Also notice that pin A-A2T2W22 cannot be probed with the top card connector installed; but this pin is connected to A-A2S2W22 and A-A2U2W22, which can be probed. All of the pins on the S2 and U2 cards can be probed directly. Pins on the T2 card can be probed from the S2 or the U2 pin.

As an aid to identifying pin locations on each card connector, at least one pin location is shown on each connector in Figure 08-2.
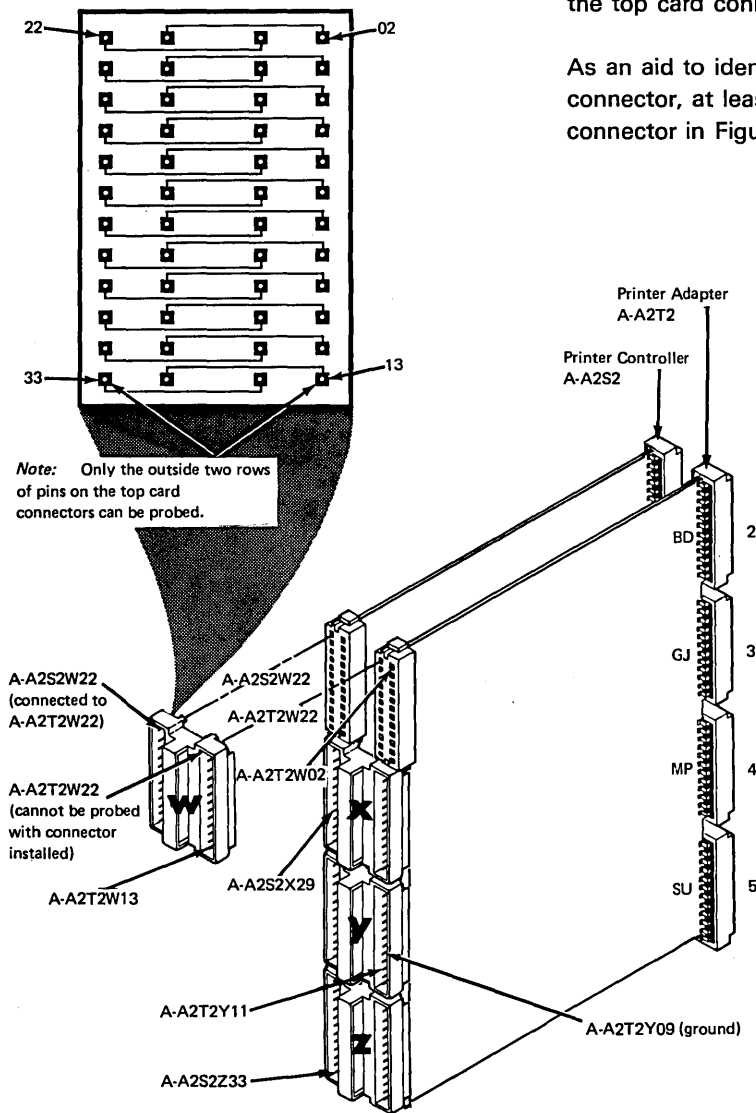

Figure 08-2. Printer Attachment Top Card Connectors
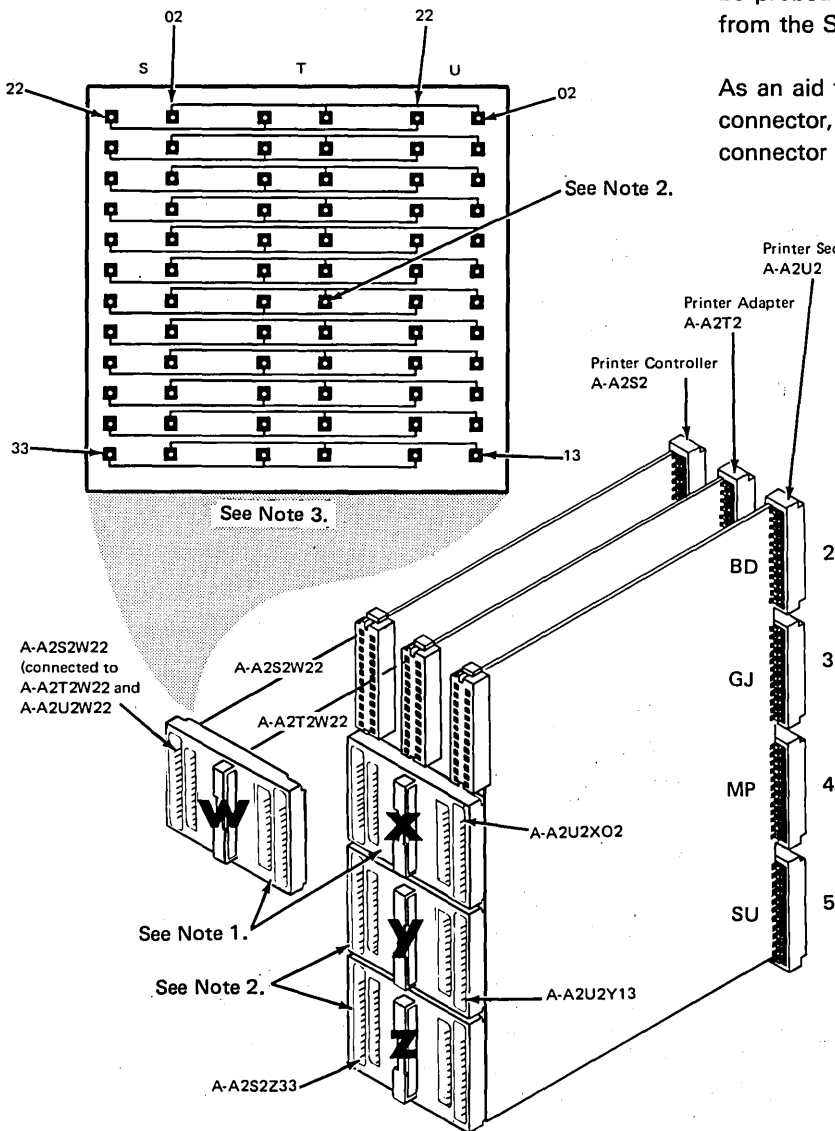
Notes:

1. Top card connectors W and X are the same (IBM part 4134831).
2. Top card connectors Y and Z are the same (IBM part 8265141) but are different from the connectors at W and X and must be installed right side up (see FSL page AC322). To aid in identifying connectors Y and Z, pin T2Y07 has been removed from connector Y, and pin T2Z07 has been removed from connector Z. To install connectors right side up, make sure the letters ASM appear in the upper right corner of the Y and Z connectors when viewed from pin side.
3. All of the pins on S2 and U2 can be probed directly. T2 pins on Y and Z top card connectors may not go to S2 or U2 pins. See FSL page AC322 to determine pins that can be probed on these two connectors.

3262 Printer Attachment   3

08-400   INTERNAL CABLES

Three internal cables are used to attach the 3262 Printer
to System/34. These cables are connected from the
A-gate, A2 board to the cable tower. See Figure 08-3
for a description of each cable and for the cable
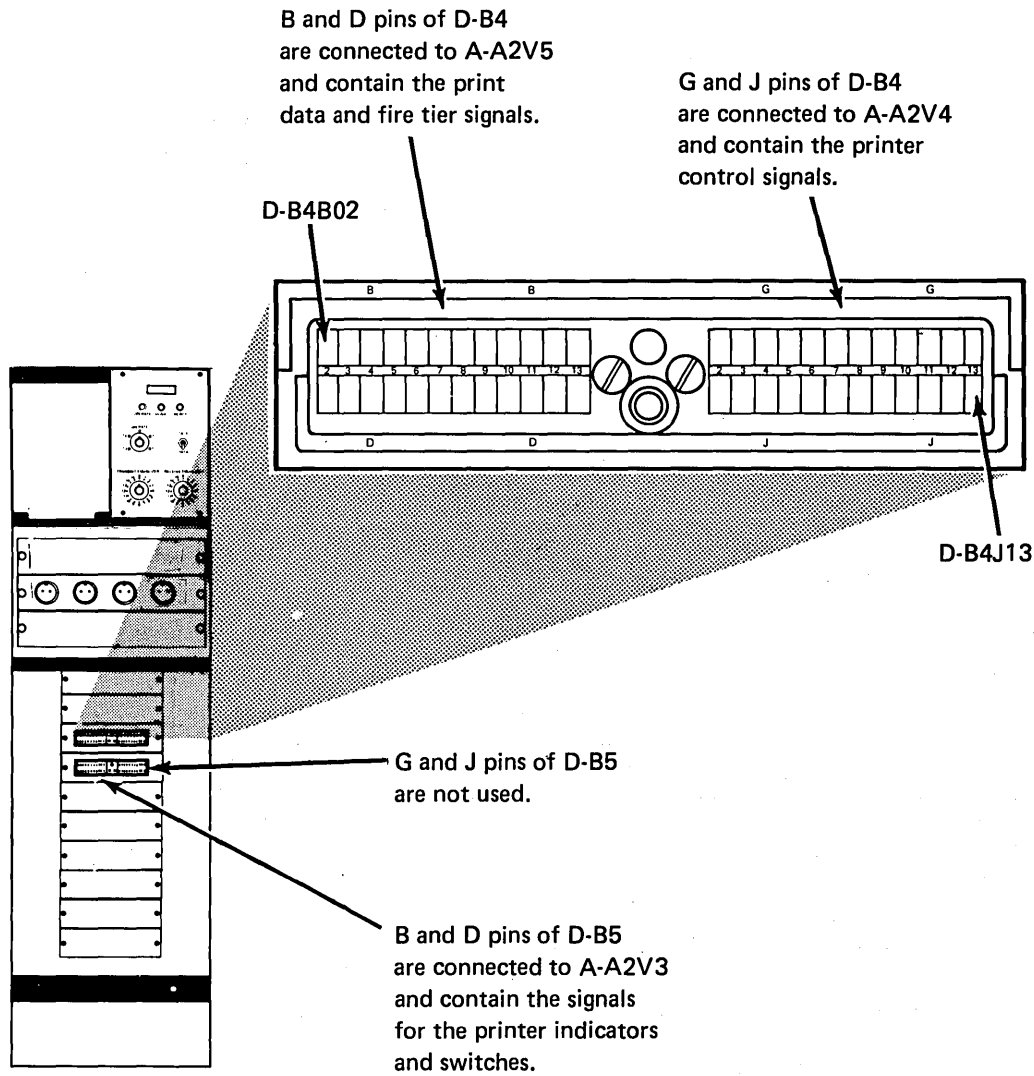locations on the cable entry tower.

B and D pins of D-B4
are connected to A-A2V5
and contain the print
data and fire tier signals.

G and J pins of D-B4
are connected to A-A2V4
and contain the printer
control signals.

D-B4B02

D-B4J13

G and J pins of D-B5
are not used.

B and D pins of D-B5
are connected to A-A2V3
and contain the signals
for the printer indicators
and switches.
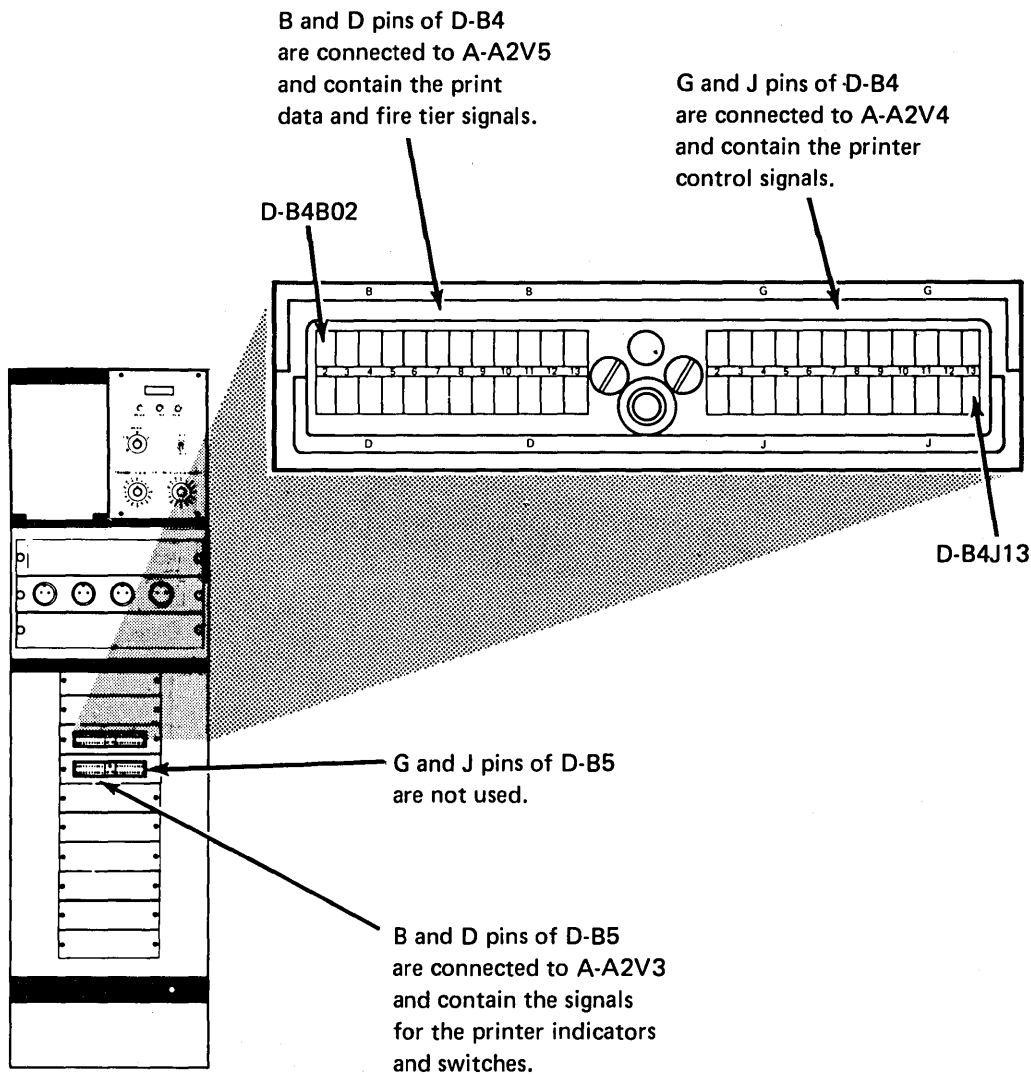
Figure 08-3. Cable Entry Tower

4

08-500   CARD JUMPERS

There are three jumper locations on the printer adapter
card located in A-A2T2. There are two jumper locations
on the printer sequencer card located in A-A2U2.
Attach the jumpers (IBM part 1675209) as shown in
Figure 08-4.
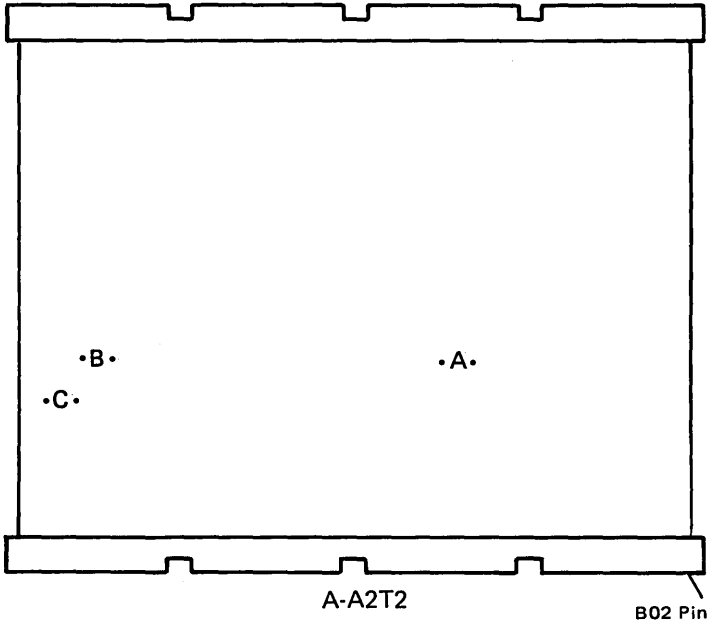
A — Needed for the 650 lines
per minute printer.
B — Must be removed for the 650
lines per minute printer.
C — Must be removed for the 650
lines per minute printer.
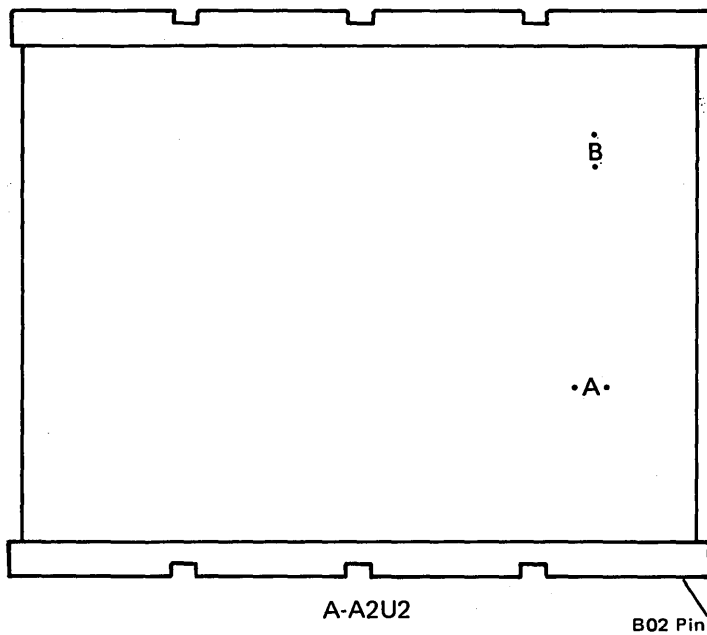
•B•
•C•   •A•

A-A2T2   B02 Pin

A — Needed for the 650 lines
per minute printer.
B — Must be removed for the 650
lines per minute printer.

B
•

•A•

A-A2U2   B02 Pin

Figure 08-4. Printer Adapter Cards Jumpering

09

CONTENTS

09-010 MAINTENANCE

No preventive maintenance is needed for the disk drive. However, it may be necessary to adjust or exchange field-replaceable units. To find a failing unit, use diagnostic programs and MAPs. Verify repairs by running diagnostic programs.

CAUTION
Do not turn the spindle unless specifically instructed to do so. Head damage can occur.

_____
_____
_____

09-020   DISK ENCLOSURE

Removal

Note: If possible, before removing the disk enclosure, have the customer remove his data from the disk, then initialize the disk to destroy customer data.

DANGER
The disk enclosure weight is 12.5 kg (27 pounds). Clear a space for the disk enclosure before removing the disk enclosure from the machine.

_____
_____
_____
_____

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____
_____
_____

1.   Set Power to O (operator panel).

2.   Set CB1 off (see paragraph 05-310 for the location of CB1).

3.   Remove the disk enclosure card socket cover **A** by pressing the top of the cover.

4.   Release the cable straps **C**.

5.   Note the sockets that the cards and cables are plugged into; and remove the cards and cables from the disk enclosure card sockets.

6.   Lock the actuator with the actuator lock **B** by moving the handle to ON.

7.   Remove the belt guard by loosening the two screws **H** and lifting it off.

8.   Loosen the two screws **L** that hold the spindle locking arm and slide the locking arm toward the disk spindle.

9.   Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

10.   Tighten the screws on the spindle locking arm.

11.   Lift the motor and pivot it toward the disk enclosure to release the tension on the belt, and remove the belt **F**.

12.   Remove the safety cover on TB1 **E**.

13.   Disconnect the disk speed transducer at TB1 **E** – terminal 7 (black wire) and terminal 8 (white wire).

14.   Unscrew the transducer cable clamp **M**.

15.   Disconnect the two wires from TB2 **D**.

16.   Disconnect the disk enclosure ground wire **N**.

17.   Ensure the disk enclosure holding clip **J** is engaged.

18.   Remove three nuts and spring washers **G**.

19.   Lift the disk enclosure holding clip. Note the three disk enclosure locating guides **K**; you must use them when you reinstall the disk enclosure.

20.   Slowly take the disk enclosure away from the subframe.

21.   Stand the disk enclosure on its three mounting studs.

Front

Front

Back View

Locked

Unlocked

Front
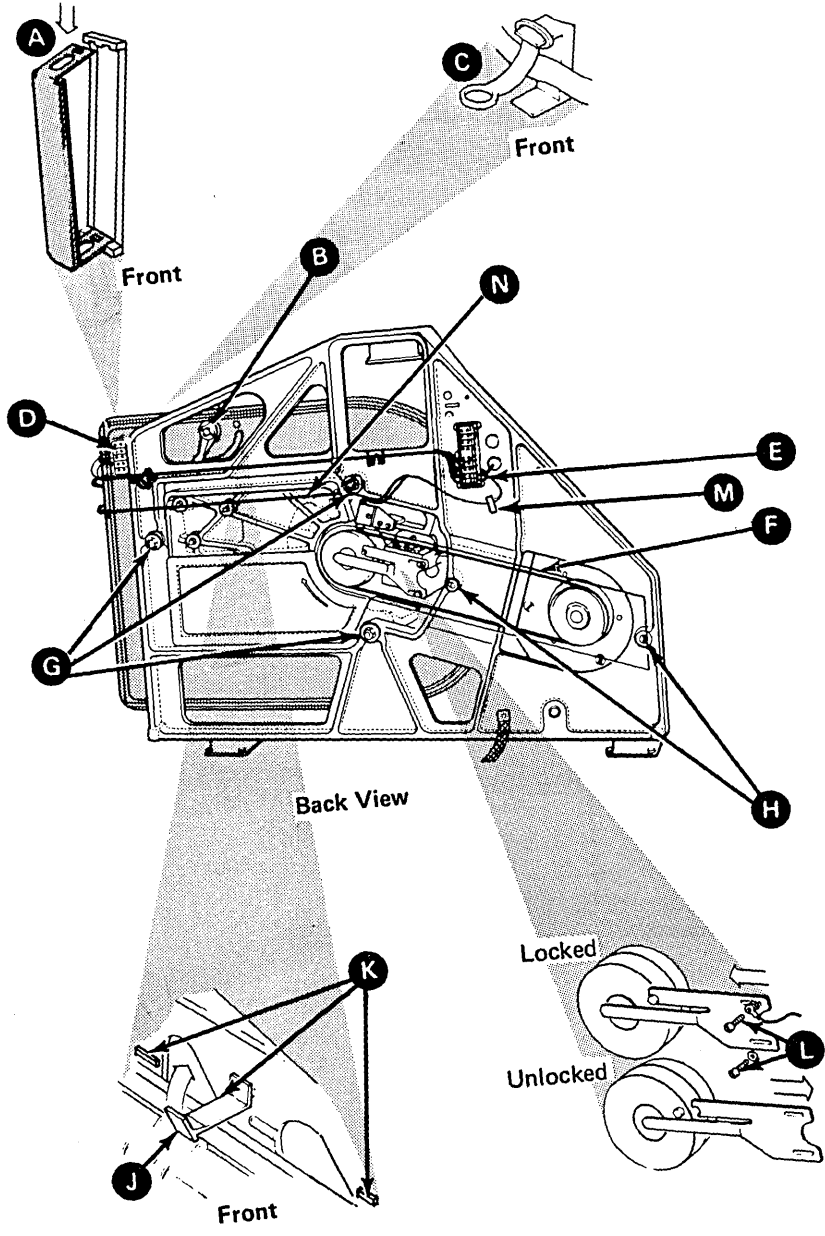
Replacement

1. Ensure the disk speed transducer and the disk enclosure ground wire are free. Place the disk enclosure on the subframe using the locating guides ⓛ to position the disk enclosure, and push the studs all the way into the nylon bushings. Check that the holding clip Ⓚ is in place.

2. Reinstall the three spring washers and nuts Ⓙ.

   CAUTION
   Do not overtighten. Overtightening can cause the washer to bind on the stud; overtightening can also cause the stud to unscrew from the subframe the next time the nut is loosened.

   When tightening the nuts, there is some resistance as pressure is put on the nylon bushing. Stop tightening when the spring washer is flat.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

3. Connect the disk enclosure ground wire Ⓟ (washer between the ground wire and the frame).

4. Reconnect the two wires to TB2 Ⓓ.

5. Connect the disk speed transducer at TB1 Ⓔ —terminal 7 (black wire) and terminal 8 (white wire).

6. Install the transducer cable clamp Ⓕ.

7. Install the safety cover on TB1 Ⓔ (holes to the left).

8. Check the disk speed transducer for a gap of 0.152 mm ± 0.0508 mm (0.006 inch ± 0.002 inch). See paragraph 09-080 _Disk Speed Transducer, Replacement and Adjustment._

CAUTION
Ensure that the belt does not touch the disk speed transducer.

_____
_____

9. Lift the motor and pivot it toward the disk enclosure and reinstall the belt Ⓖ (smooth side against the pulleys). Center the belt on the pulleys.

10. Loosen the two screws Ⓜ holding the spindle locking arm, and slide the locking arm away from the disk spindle.

11. Ensure that the antistatic brush and the center pin Ⓝ of the spindle touch.

    Note: If there is a worn spot on the spindle antistatic brush, put the spot back on the same place on the spindle.

12. Tighten the screws on the spindle locking arm.

13. Check that the antistatic brush has a pressure of approximately 60 (+25 to -20) grams on the center pin Ⓝ of the spindle. Adjust, if necessary, by removing and bending the brush.

14. Install the belt guard Ⓗ. Do not let the disk speed leads get under the belt guard. Slide the belt guard all the way to the left and tighten the screws.

    CAUTION
    Do not bend or break the pins when plugging in the cables and cards. Broken pins make it necessary to exchange the disk enclosure.

    _____
    _____
    _____

15. Connect the cables to the card sockets; reinstall the cards in the card sockets. See paragraph 09-120 for cable and card locations.

16. Strap the cables **B**.

17. Install the card socket cover **A**.

18. Unlock the actuator lock **C** by moving the handle to OFF.

CAUTION
Before operating the disk, wait 30 minutes for it to reach room temperature.

19. Do the actuator speed adjustment (see paragraph 09-140).

Before returning the system to the customer, identification, data, and other control information must be written on the new disk. See section *99-000 Diagnostic Service Guide* for instructions to initialize the disk.

09

Locked
Unlocked
Front
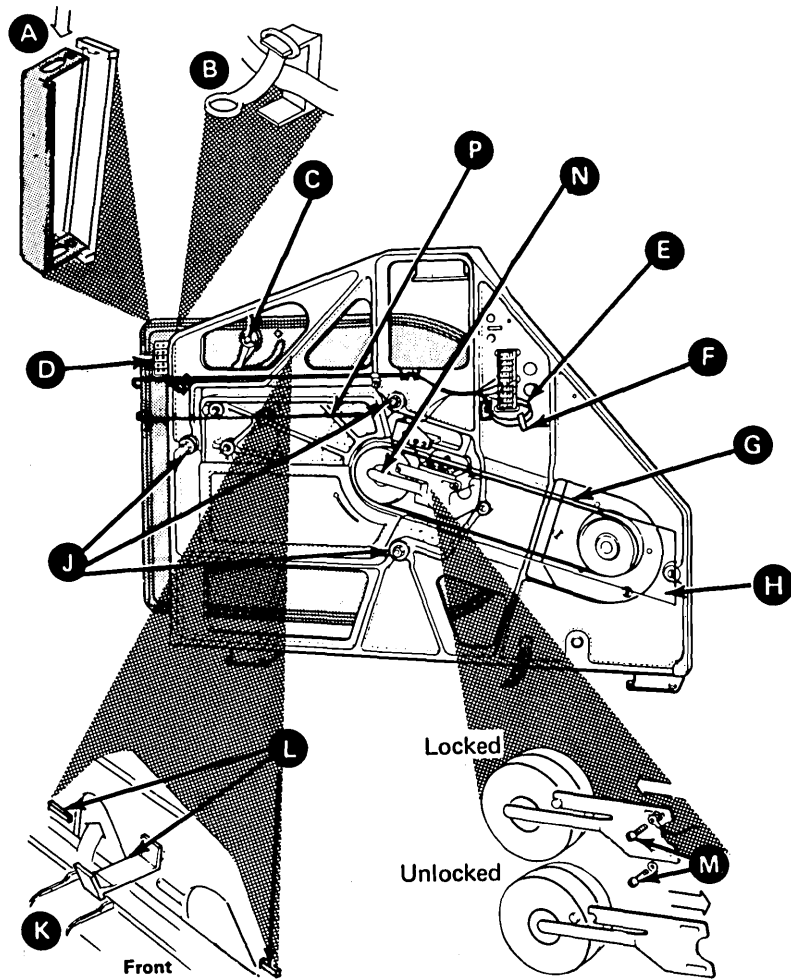
09-030   DISK DRIVE MOTOR

Note: This paragraph describes how to remove and reinstall the old style motor and the new style motor. See the figures to determine the style.

Old Style Motor Removal

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____

_____

_____

1.   Set Power to O (operator panel).

2.   Set CB1 off (see paragraph 05-310 for the location of CB1).

> **DANGER**
> CB1 must be off to remove AC voltage from ACTB3 and ACTB4.
>
> _____
>
> _____

3.   Lock the actuator with the actuator lock **A** by moving the handle to ON.

4.   Remove the belt guard by loosening the two screws **F** and lifting the belt guard off.

5.   Loosen the two screws **B** holding the spindle locking arm, and slide the locking arm toward the disk spindle.

6.   Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

7.   Tighten the screws on the spindle locking arm.

8.   Lift the motor and pivot it toward the disk enclosure to release tension on the belt, and remove the belt **D**.

9.   Remove the safety cover and remove the motor wires from ACTB3 lower drive, or ACTB4 upper drive **L** – terminal 1 (blue wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

10.   Remove the safety cover and remove the brake wires from TB1 **C** – terminal 5 (black wire) and terminal 6 (yellow wire).

11.   Remove the cable straps **J** that hold the brake cable.

12.   Release the motor tension spring by placing the blade of a screwdriver in the roller **K** and lift the roller and tension spring off the motor mounting bracket.

13.   Remove the clip and washer by turning the clip to the position shown in **G**; push the lugs into the groove of the pivot. Put the blade of a screwdriver on top of the clip **H**, and push the clip off.

14.   Pivot the motor toward the disk enclosure. Slide the motor away from the the main frame and lift the motor upward to clear the pivot and subframe.

15.   Remove the motor from its mounting bracket by removing the three screws **E**.

Locked

Unlocked

(B)

(A)

(C)

(J)

(D)

(E)

Old Style Motor

Front View

(K)

Back View

(F)

(L)

(G)

(H)

Pivot
Groove

Clip

Pivot

Lug

Old Style Motor Replacement

_____

_____

_____

_____

1. Install the motor in its mounting bracket. Ensure that the motor cool air holes face upward and the motor cable is at the bottom left. Install the three screws **D** that hold the motor in the mounting bracket.

2. Put a very thin layer of grease on the pivot points of the motor assembly.

3. Lift the motor assembly into position and slip the tapered pin on the mounting bracket into the hole in the subframe. At the same time, place the brake end of the motor assembly on the pivot.

4. Install the washer and clip **H**, and tighten the pivot **J**.

5. Place the blade of a screwdriver into the roller **F** and lift the roller and tension spring into the motor mounting bracket.

6. Pivot the motor against the tension springs to ensure correct position of the spring loop and roller.

7. Install the motor wires on ACTB3 lower drive, or ACTB4 upper drive **G** — terminal 1 (blue wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

8. Install the brake wires on TB1 **B** — terminal 5 (black wire) and terminal 6 (yellow wire).

9. Install the safety cover on TB1 (holes to the left).

10. Install the cable straps **L** that hold the brake cable.

CAUTION
Ensure that the belt does not touch the disk speed transducer.

_____

_____

_____

11. Lift the motor and pivot it toward the disk enclosure and reinstall the belt **K** (smooth side of the belt against the pulleys). Center the belt on the pulleys.

12. Loosen the two screws **C** that hold the spindle locking arm. Slide the locking arm away from the disk spindle.

13. Ensure that the antistatic brush is touching the center of the disk spindle.

    Note: If there is a worn spot on the spindle antistatic brush, put the spot back on the same place on the spindle.

14. Tighten the screws on the spindle locking arm.

15. Check that the spindle antistatic brush has a pressure of approximately 60 (+25 to -20) grams on the center of the disk spindle. Adjust, if necessary, by removing and bending the brush.

16. Install the belt guard **E**. Slide the belt guard all the way to the left and tighten the screws.

17. Unlock the actuator lock **A** by moving the handle to OFF.

Locked

Unlocked

C

A

B

L

D

E

G

K

F

D

J

H

Old Style
Motor

Front View
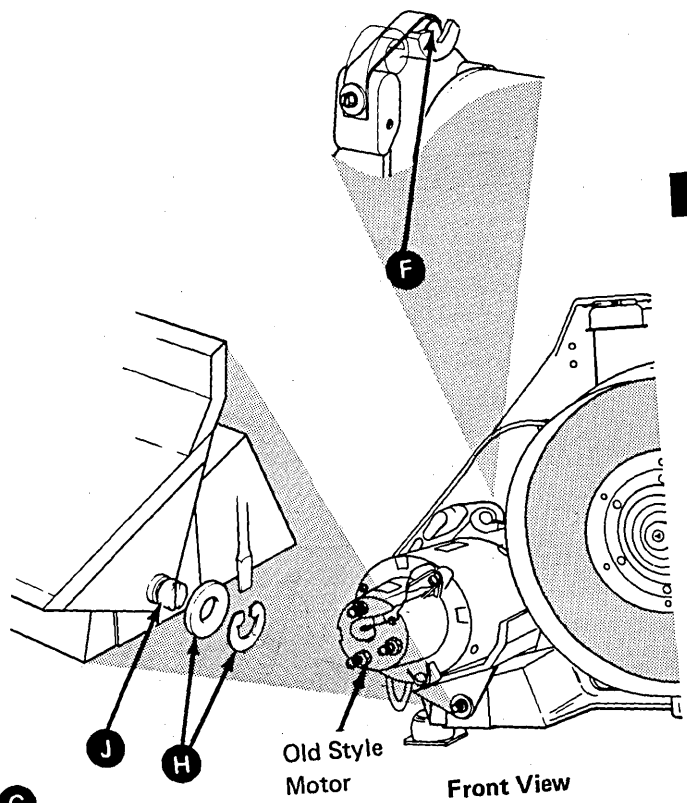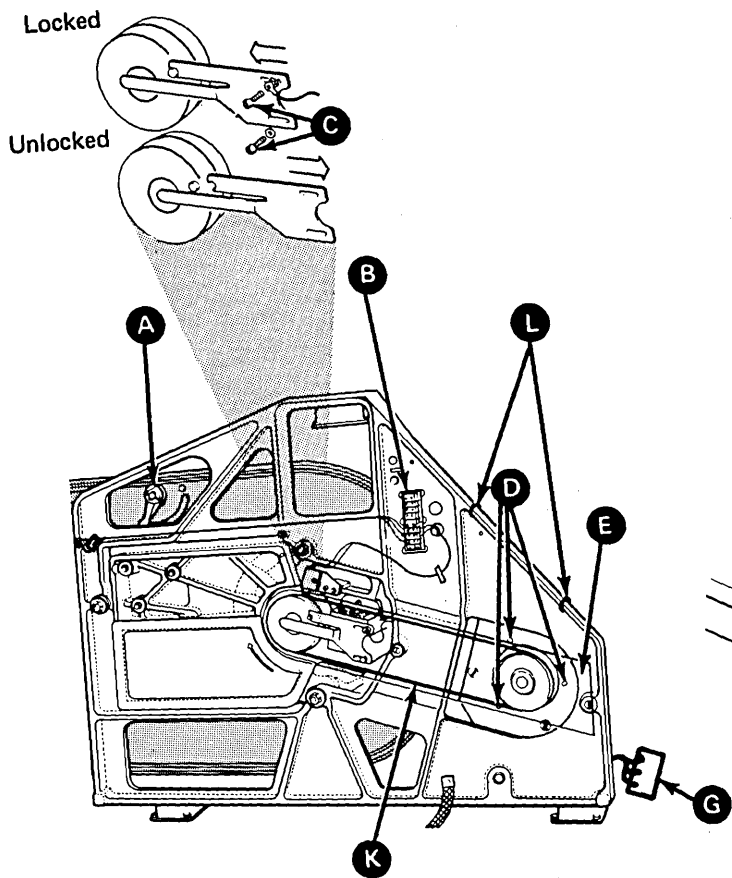
New Style Motor Removal

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.
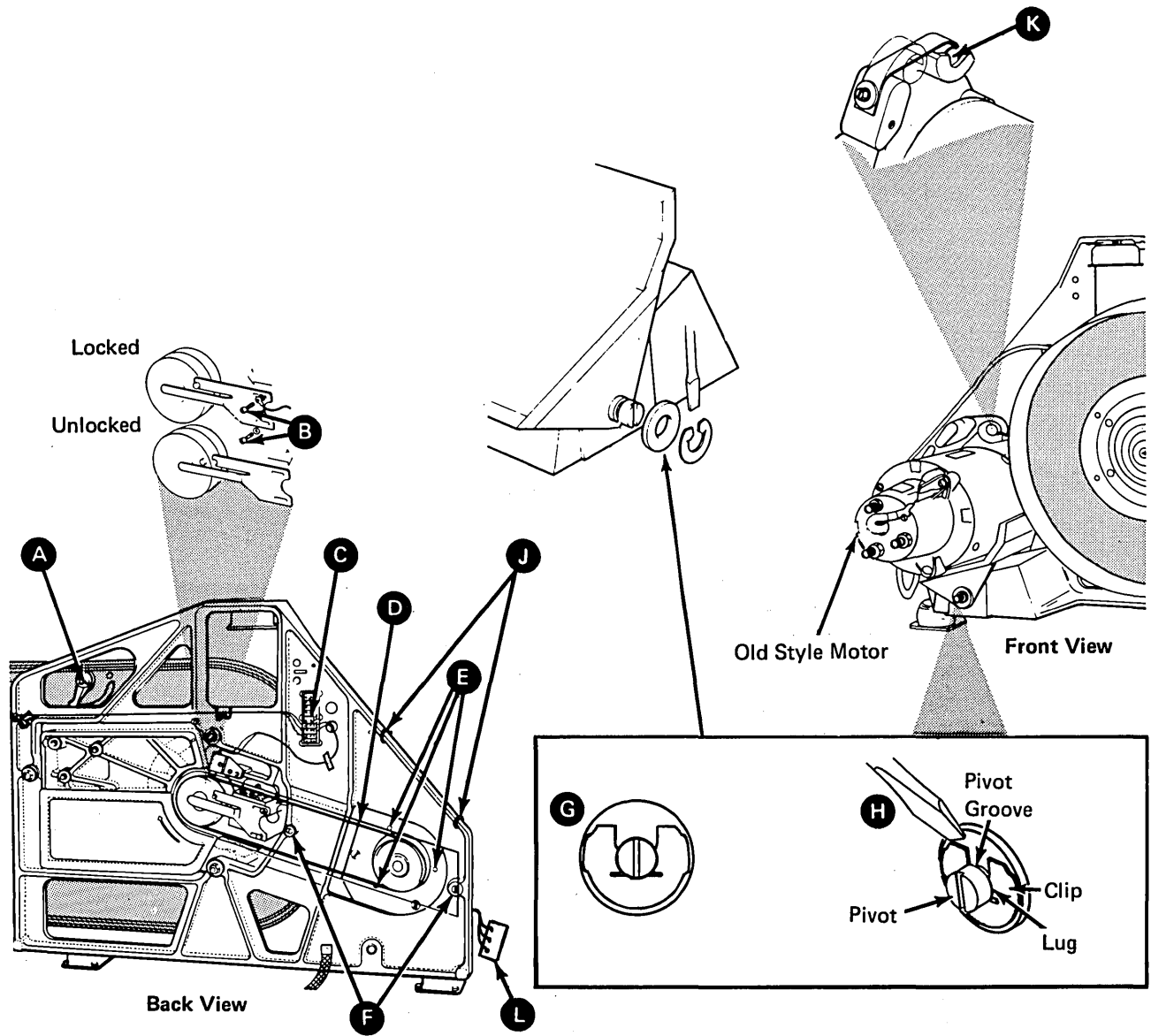
_____
_____
_____

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

   > **DANGER**
   > CB1 must be off to remove AC voltage from ACTB3 and ACTB4.
   >
   > _____
   > _____
   > _____
   > _____

3. Lock the actuator with the actuator lock **Ⓐ** by moving the handle to ON.

4. Remove the belt guard by loosening the two screws **Ⓔ** and lifting it off.

5. Loosen the two screws **Ⓑ** holding the spindle locking arm, and slide the locking arm toward the disk spindle.

6. Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

7. Tighten the screws on the spindle locking arm.

8. Lift the motor and pivot it toward the disk enclosure to release tension on the belt, and remove the belt **Ⓓ**.

9. Remove the safety cover and remove motor wires from ACTB3 lower drive or ACTB4 upper drive **Ⓕ** – terminal 1 (black wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

10. Remove the safety cover and remove the brake wires from TB1 **Ⓒ** – terminal 5 (black wire) and terminal 6 (yellow wire).

11. Remove the cable straps **Ⓖ** (if present) that hold the brake cable.

12. Release the motor tension spring **Ⓗ** by lifting it off the motor mounting bracket.

    Remove the nut, lock washer, flat washer, and insulating washer **Ⓙ** on the motor pivot at the back of the subframe.

13. Pivot the motor toward the disk enclosure. Slide the motor away from the main frame and lift it upward to clear the pivot and subframe.

Notes:
1. The motor mounting plates form part of the motor assembly and should not be removed.
2. Keep the two plastic bushings **Ⓚ** (one located in the motor pivot hole in the subframe, and one located in the motor mounting plate).

Locked

Unlocked

B

A

C

D

F

E

Back View

H

G

Subframe

J

K

Front View

New Style Motor

62EH Disk Drive 11
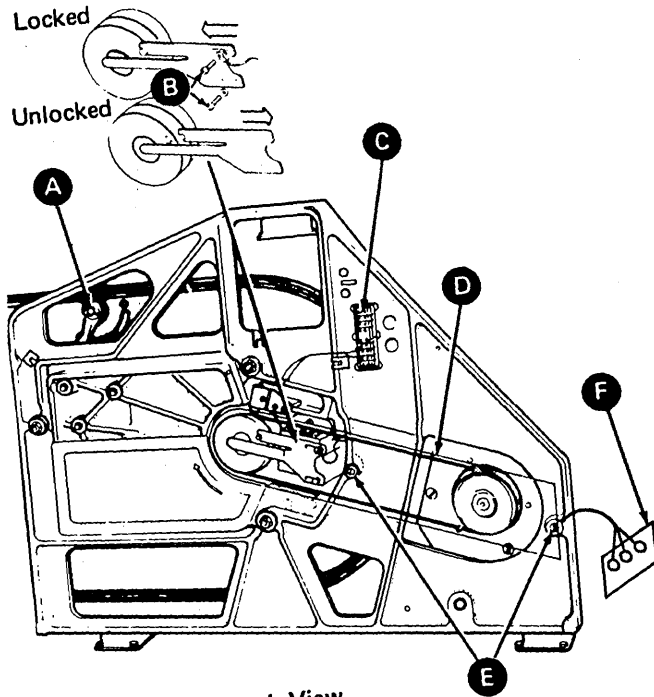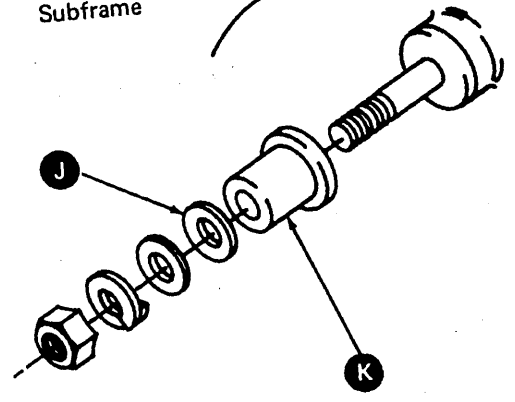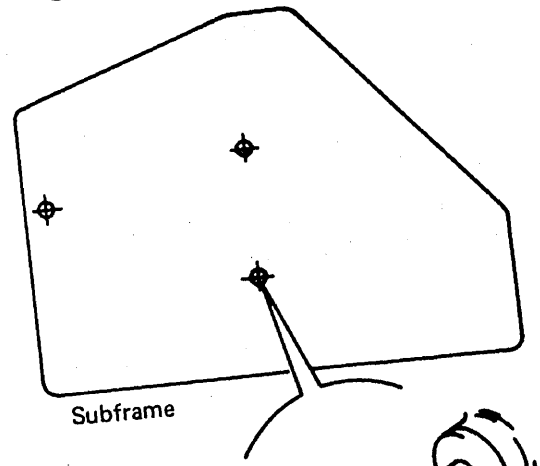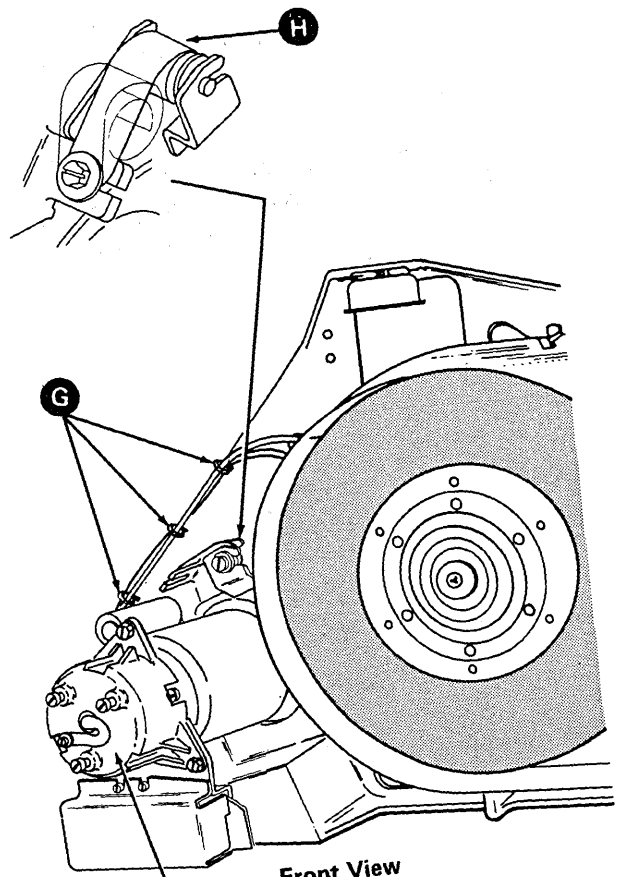
New Style Motor Replacement

Note: If a new style motor is installed in place of an old style motor, the motor pivot must be removed.

> **DANGER**
> CB1 must be off to remove AC voltage from ACTB3 and ACTB4.

_____
_____
_____
_____

1. Ensure that the two plastic insulating bushings 🅛 are installed in the motor pivot holes of the subframe casting and the motor mounting plate.

2. Set the motor on the pivot point and slide it into position.

3. Install the plastic insulating washer 🅚, flat washer, lock washer, and nut on the pivot at the back of the subframe. Tighten the nut until the lock washer is just flat, then unscrew the nut one-half turn.

    CAUTION
    New style and old style motor tension springs are not the same. The new style spring must be used with the new style motor. The old style spring must be used with the old style motor. The part number is on the new style spring.

_____
_____
_____
_____
_____
_____
_____

4. Lift the loop end of the tension spring into place on the motor mounting bracket 🅗.

5. Pivot the motor against the springs to ensure correct position of the spring loop and roller 🅙.

6. Install the motor wires on ACTB3 lower drive, or ACTB4 upper drive 🅕 – terminal 1 (black wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

7. Install the brake wires on TB1 🅒 – terminal 5 (black wire) and terminal 6 (yellow wire).

8. Install the safety cover on TB1 (holes to the left).

9. Install the cable straps 🅖 (if present) that hold the brake cable.

10. **CAUTION**
    Ensure that the belt does not touch the disk speed transducer.

_____
_____
_____

    Lift the motor and pivot it toward the disk enclosure and reinstall the belt 🅓 (smooth side of the belt against the pulleys). Center the belt on the pulleys.

11. Loosen the two screws 🅑 that hold the spindle locking arm. Slide the locking arm away from the disk spindle.

12. Ensure that the antistatic brush is touching the center of the disk spindle.

    Note: If there is a worn spot on the spindle antistatic brush, put the spot back on the same place on the spindle.

13. Tighten the screws on the spindle locking arm.

14. Check that the spindle antistatic brush has a pressure of 60 (+25 to -20) grams on the center of the disk spindle. Adjust, if necessary, by removing and bending the brush.

15. Install the belt guard and tighten the two screws 🅔. Slide the belt guard all the way to the left and tighten the screws.

16. Unlock the actuator lock 🅐 by moving the handle to OFF.

Locked

Unlocked

Ⓐ **Ⓑ** **Ⓒ** **Ⓓ** **Ⓕ** **Ⓔ**

Back View

Ⓗ **Ⓙ**

Ⓖ

Subframe

Ⓚ **Ⓛ**

Front View
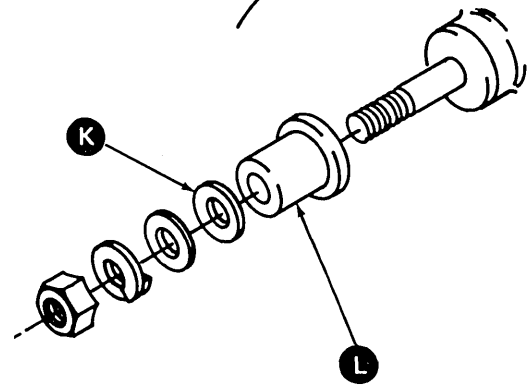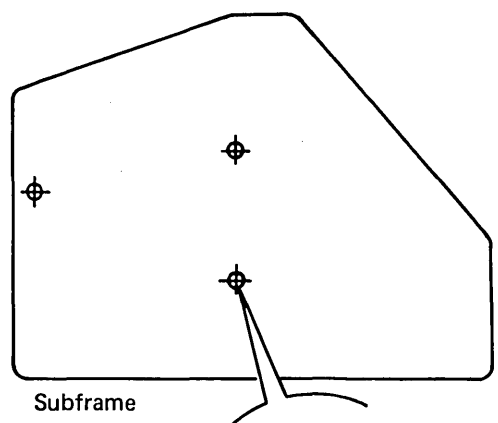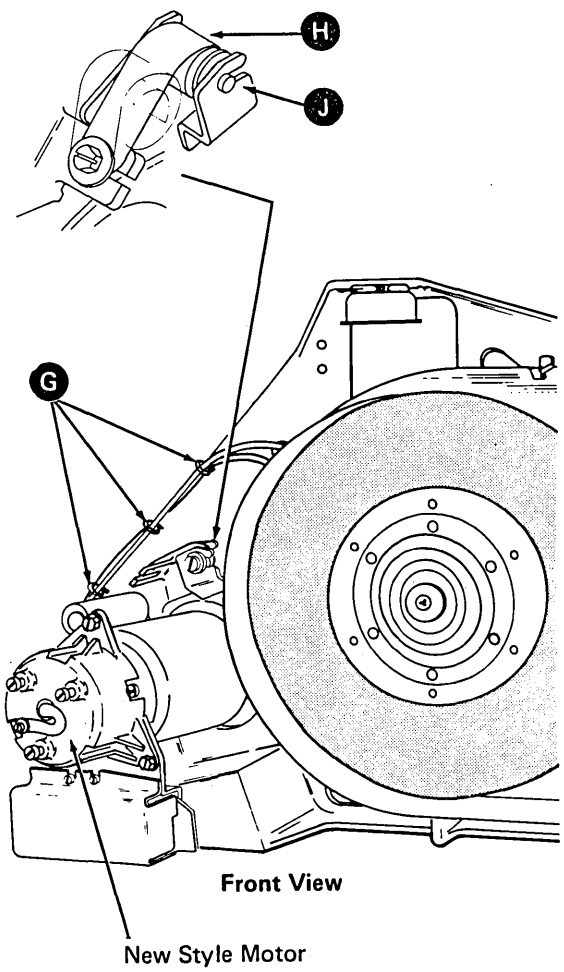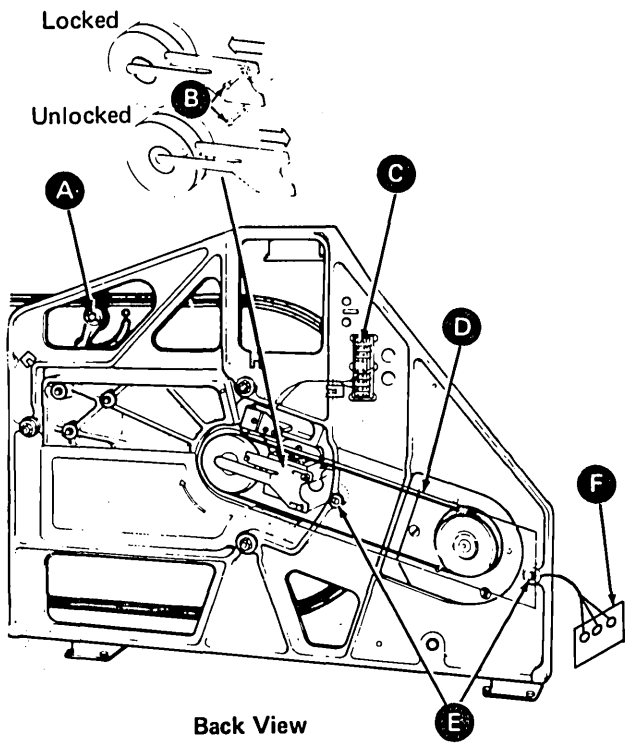
New Style Motor

09-035   MOTOR START RELAY

Removal

Note: The motor start relay is used only on the new style motor.

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

    DANGER
    CB1 must be off to remove AC voltage from the motor start relay terminals.

    _____
    _____
    _____
    _____

3. Loosen the two holding screws of the start relay cover and slide the cover down, disengaging it from the motor assembly.

4. Mark the wires, then disconnect them from the relay.

5. Remove the two relay holding screws, and lift out the relay.

Replacement

1. Install the motor start relay and holding screws.

2. Connect the wires to the relay.

3. Install the start relay cover and tighten the two holding screws.

Black Wire from TB1

Red Wire from Motor

Black Wire from Motor
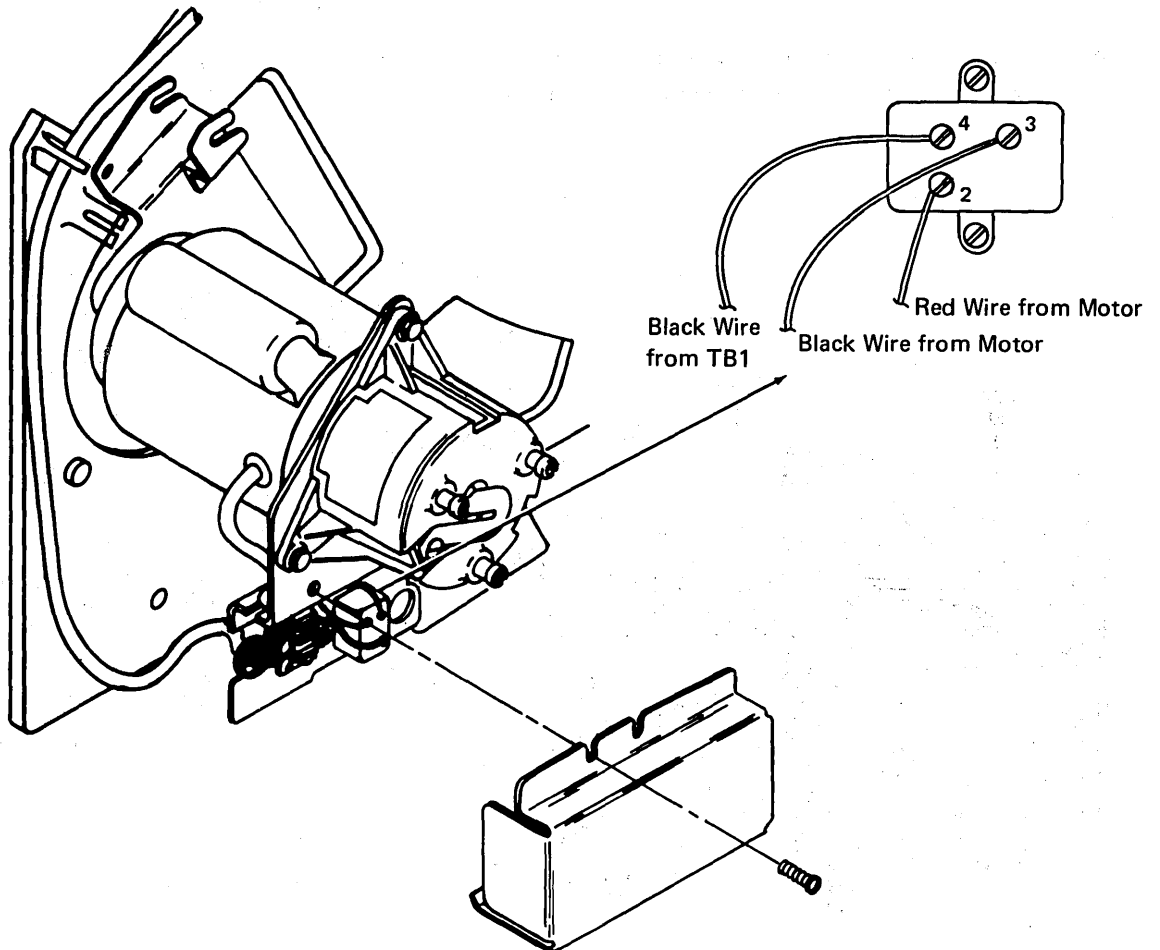
09-040   BRAKE COIL ASSEMBLY

Removal

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

---

1.   Set Power to O (operator panel).

2.   Set CB1 off (see paragraph 05-310 for the location of CB1).

3.   Lock the actuator with the actuator lock **A** by moving the handle to ON.

4.   Remove the belt guard by loosening the two screws **M** and lift the belt guard off.

5.   Loosen the screws **C** that hold the spindle locking arm, and slide the locking arm toward the disk spindle.

6.   Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

7.   Tighten the screws on the spindle locking arm.

8.   Lift the motor and pivot it toward the disk enclosure to release the tension on the belt, and remove the belt **N**.

9.   Remove the brake wires from the right side of TB1 **B** – terminal 5 (black wire) and terminal 6 (yellow wire).

10.   Remove the cable straps **D** that hold the brake cable.

11.   Remove the screw **J** that holds the brake antistatic brush to the brake frame.

12.   Remove the three screws **H** that hold the brake assembly to the motor.

13.   Remove the complete brake assembly, (including the brake pad **E** and spring **F**) from the back of the motor.

14.   To remove the brake coil assembly, remove the three brake adjustment locking screws **G**, and remove the brake coil assembly from the brake housing.

Locked

Unlocked
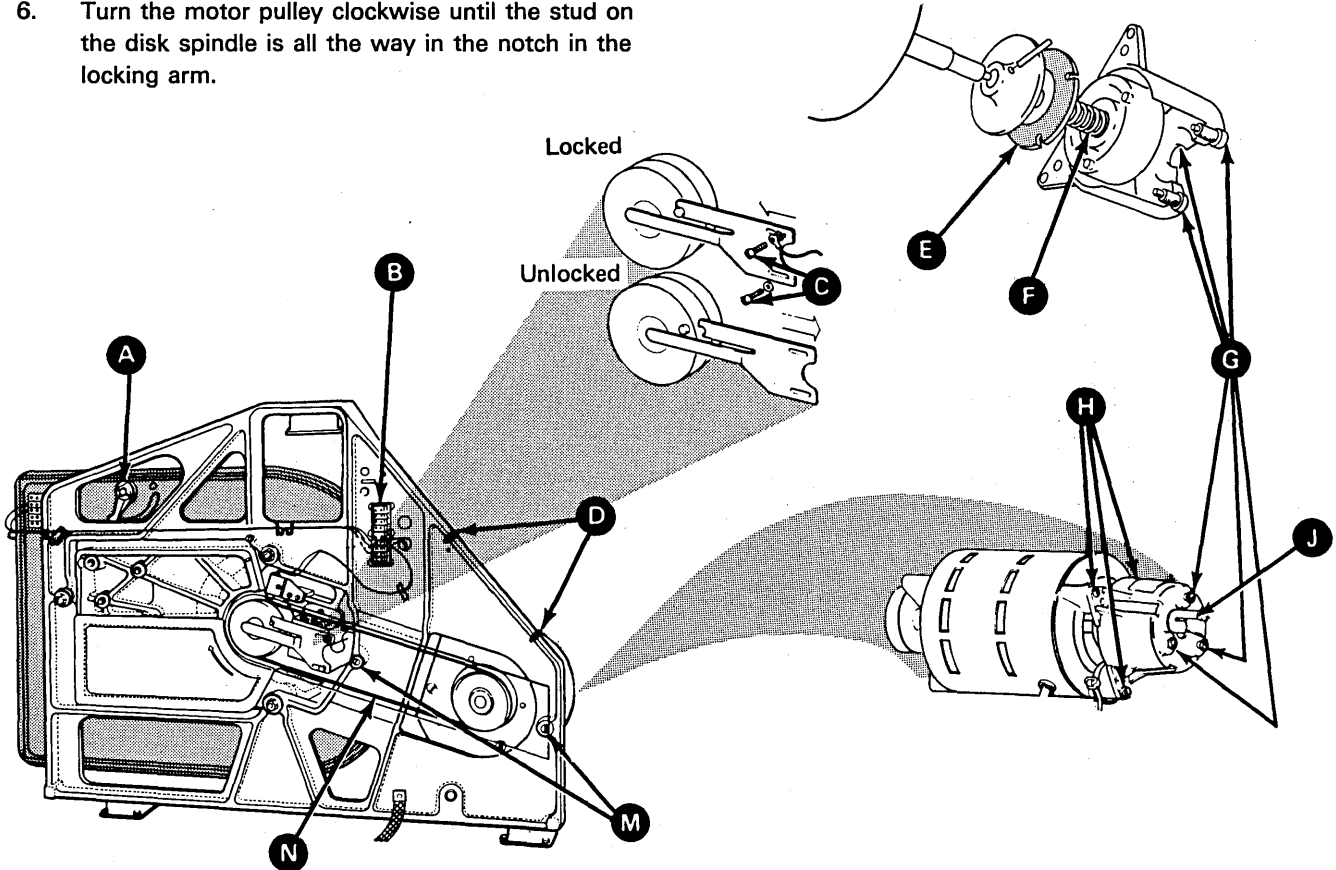
Replacement

1. If the brake coil assembly was removed, insert the brake coil **H** into the brake housing, and fasten the brake coil with the three brake adjustment locking screws **E**.

2. Loosen the brake adjustment locking screws **E**. Turn the brake adjusting studs **F** counterclockwise until the brake coil is against the brake housing **G**.

3. Check that the pin that holds the brake plate **C** to the motor shaft is not loose.

4. Check the brake pad **D** to see if it has deep scratches or if it is worn; exchange it, if needed.

5. Install the brake pad **D** and spring **N** on the motor shaft.

6. Install the brake assembly on the back of the motor. Ensure that the three notches **K** in the brake pad **D** are aligned with the three studs **J** on the brake coil.

   Note: The hazard label **P** should be up and to the right.

7. Install the three screws **L** that hold the brake housing to the motor, inserting the antistatic ground cable under the screw next to where the motor antistatic brush mounts. Before tightening the screws, the motor shaft must be located centrally in the brake housing.

8. Tighten the three screws that hold the brake housing to the motor.

9. Install the cable straps **B** that hold the brake and AC cable.

10. Install the brake wires from TB1 **A** – terminal 5 (black wire) and terminal 6 (yellow wire).

11. Install the motor antistatic brush **M**.

12. Do the brake assembly adjustment (see paragraph 09-050), starting with step 9.

09-050 BRAKE ASSEMBLY

Note: If a new motor brake assembly is installed, ensure that the hazard label on the new motor brake assembly is in the correct language. Two sets of labels are in the System/34 ship group. Label part numbers are in the *5340 System Unit Parts Catalog.*

Service Check

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____
_____
_____

1. Set Power to O (operator panel).

2. Check for 0.203 mm ± 0.127 mm (0.008 inch ± 0.005 inch) at gap (K).

Adjustment

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for location of CB1).

3. Lock the actuator with the actuator lock (A) by moving the handle to ON.

4. Remove the belt guard by loosening the two screws (E) and lift the belt guard off.

5. Loosen the two screws (B) holding the spindle locking arm, and slide the locking arm toward the disk spindle.

6. Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

7. Tighten the screws on the spindle locking arm.

8. Lift the motor and pivot it toward the disk enclosure to release tension on the belt, and remove the belt (D).

9. Remove the safety cover and remove the motor wires from ACTB3 (lower drive), or ACTB4 (upper drive) (M) – terminal 1 (blue or black wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

> **DANGER**
> Ensure that the disconnected wires are away from ACTB3 (lower drive) or ACTB4 (upper drive).
>
> _____
> _____
> _____
> _____

10. Loosen the brake adjustment locking screws (H).

11. Turn the adjusting studs (J) clockwise (one turn at a time, each time tightening the locking screws) until the brake pad (G) is tight against the brake plate (F).

12. Back off the studs as evenly as possible (keep locking screws tight), and adjust for a 0.203 mm ± 0.051 mm (0.008 inch ± 0.002 inch) gap (K) between the brake pad and the coil. Check the three gaps in the brake housing frame.

13. Tighten the locking screws (H) and check that the adjustment (K) is now 0.203 mm ± 0.051 mm (0.008 inch ± 0.002 inch).

14. Set CB1 on.

15. Set Power to I (operator panel).

> **DANGER**
> 220 Vac is present on ACTB3 and ACTB4.
>
> _____
> _____

16. With the brake coil activated, the gap (L) between the brake pad and the brake plate should be 0.203 mm ± 0.051 mm (0.008 inch ± 0.002 inch).

17. Turn the motor pulley to check if the motor is free from binds. Gap (L) should now be 0.203 mm ± 0.015 mm (0.008 inch ± 0.005 inch).

18. Set Power to O (operator panel).

19. Set CB1 off.

20. Install the motor wires from ACTB3 (lower drive) or ACTB4 (upper drive) **M** – terminal 1 (blue or black wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

21. Install the safety cover on ACTB3 (lower drive) or ACTB4 (upper drive) with the holes to the left.

    CAUTION
    Ensure the belt does not touch the disk speed transducer.

    _____
    _____
    _____
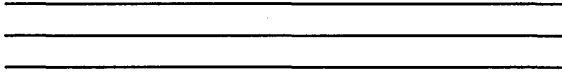
22. Lift the motor and pivot it toward the disk enclosure and reinstall the belt (smooth side of the belt against the pulleys). Center the belt on the pulleys.

23. Check that the motor tension spring is in place on the motor mounting bracket.

24. Adjust the motor antistatic brush.

    Note: If there is a worn spot on the motor antistatic brush, put the spot back on the same place on the motor shaft. Check for 60 (+25 to –20) grams. Adjust, if necessary, by removing and bending the brush.
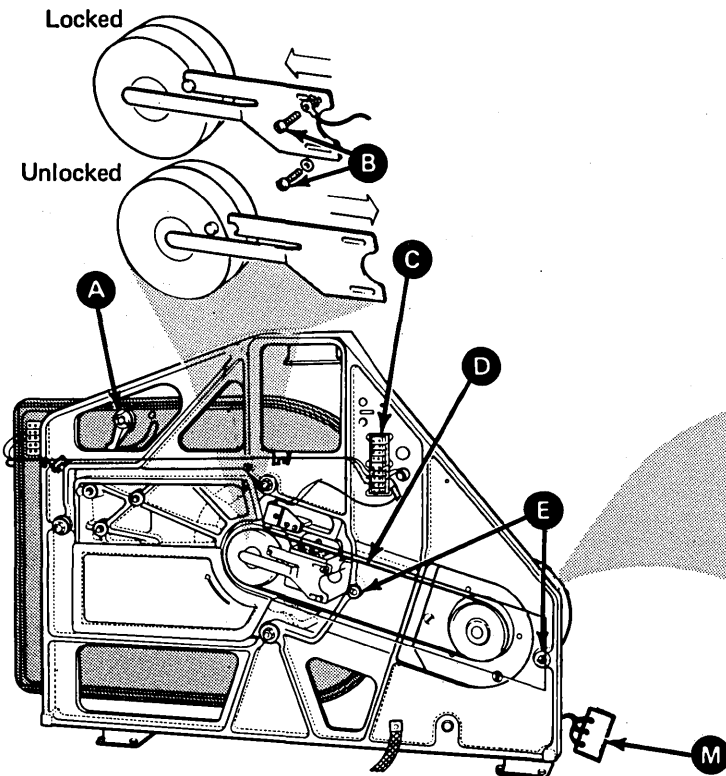
25. Loosen the two screws **B** that hold the spindle locking arm. Slide the locking arm away from the disk spindle.

26. Ensure the spindle antistatic brush is touching the center of the spindle.

    Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle.

27. Tighten the screws on the spindle locking arm.

28. Check that the spindle antistatic brush has a pressure of approximately 60 (+25 to –20) grams on the center of the spindle. Adjust, if necessary, by removing and bending the brush.

29. Install the belt guard. Slide the belt guard all the way to the left, and tighten the screws **E**.

30. Unlock the actuator by moving the handle **A** to OFF.
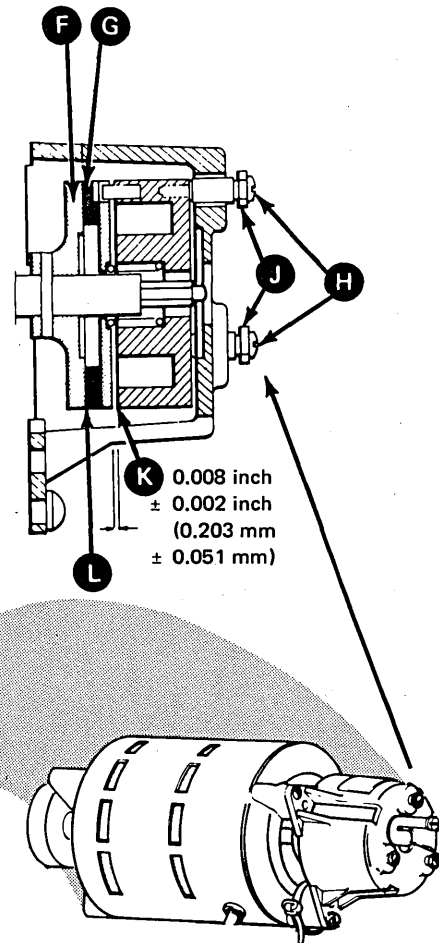
09

Locked

Unlocked

K 0.008 inch
± 0.002 inch
(0.203 mm
± 0.051 mm)

Removal

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

1.   Set Power to O (operator panel).

2.   Set CB1 off (see paragraph 05-310 for the location of CB1).

3.   Remove the motor antistatic brush by removing the screw **E** that holds the motor antistatic brush to the brake frame.

Replacement and Adjustment

1.   Install the motor antistatic brush **F**.

      Note: If there is a worn spot on the motor antistatic brush, put the spot back on the same place on the motor shaft.

2.   Check the motor antistatic brush **F** for 60 (+25 to -20) grams. Adjust, if necessary, by removing and bending the brush near the screw hole **E**.
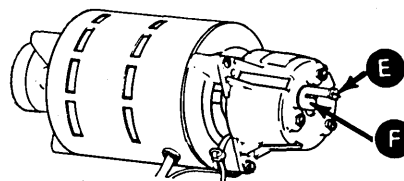
09-070 SPINDLE ANTISTATIC BRUSH

CAUTION
.Do not turn the disk spindle during the following procedures.
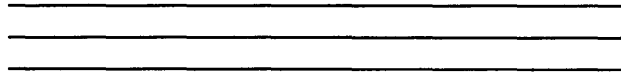
_____
_____
_____

Removal

1. Set Power to O (operator panel).

2. Lock the actuator with the actuator lock ⓒ by moving the handle to ON.

3. Remove the belt guard by loosening the two screws ⓓ and lifting it off.

4. Remove the two screws ⓑ that hold the spindle locking arm; at the same time, disconnect the ground wire from under one of the screws.

5. Lift off the spindle antistatic brush.

Replacement and Adjustment

1. Install the spindle locking arm with the spindle antistatic brush centered over the center ⓐ of the disk spindle pulley.

2. Install the two screws that hold the spindle locking arm. At the same time, connect the ground wire to the antistatic brush with one of the screws. Put the washer between the ground wire and the brush.

    Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle.

3. Check that the spindle antistatic brush has a pressure of 60 (+25 to −20) grams on the center of the spindle. Adjust, if necessary, by removing and bending the brush.

4. Install the belt guard. Slide the belt guard all the way to the left and tighten the screws ⓓ.

5. Unlock the actuator by moving the handle ⓒ to OFF.

Locked

Unlocked

Form here
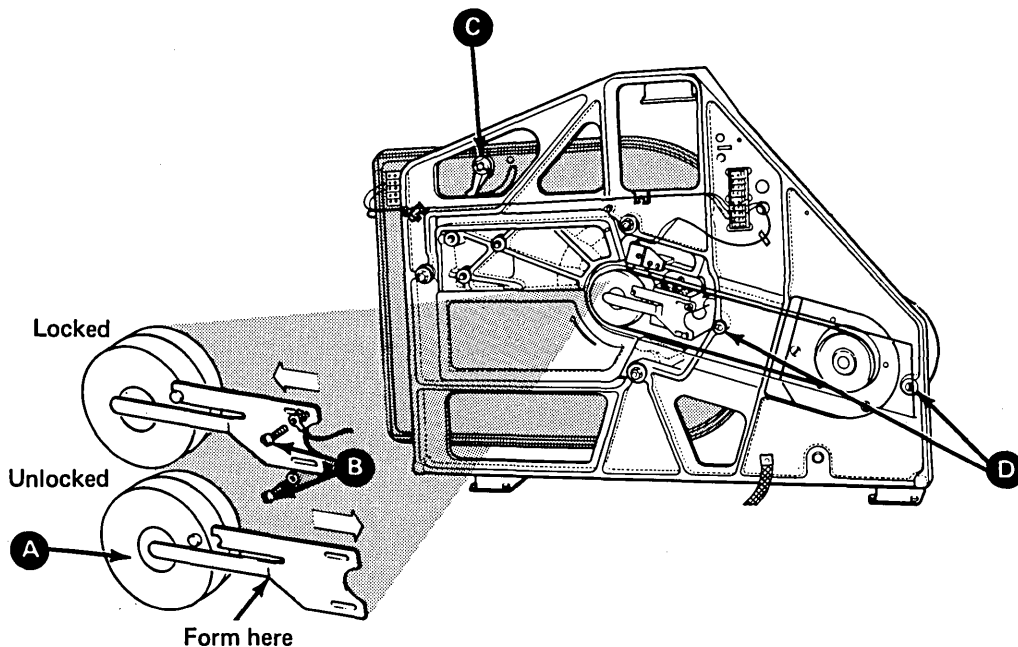
09-080 DISK SPEED TRANSDUCER

Removal

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____

_____

_____

Note: If the disk enclosure is being exchanged, you get a new speed transducer with a new disk enclosure.

1. Set Power to O (operator panel).

2. Lock the actuator with the actuator lock **D** by moving the handle to ON.

3. Remove the belt guard by loosening the two screws **H** and lift the belt guard off.

4. Loosen the two screws **G** holding the spindle locking arm, and slide the locking arm toward the disk spindle.

5. Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

6. Tighten the screws on the spindle locking arm.

7. Lift the motor and pivot it toward the disk enclosure to release tension on the belt, and remove the belt **J**.

8. Remove the safety cover and remove the disk speed transducer wires from TB1 **F** – terminal 7 (black wire) and terminal 8 (white wire).

9. Remove the disk speed transducer assembly by removing the two screws **C**.

Replacement and Adjustment

CAUTION
Be careful not to damage the disk speed transducer tip during replacement.

_____

_____

_____

1. Loosen the transducer clamp screw **B**. Ensure the tab on the transducer is in the notch in the bracket.

2. Install the transducer assembly with the two mounting screws **C**.

3. Adjust the transducer for a gap of 0.152 mm ± 0.051 mm (0.006 inch ± 0.002 inch) **A** by moving the transducer in the clamp.

4. Tighten the transducer clamp screw **B**.

5. Connect the transducer cable to TB1 **F** – terminal 7 (black wire) and terminal 8 (white wire).

6. Install the safety cover on TB1 (holes to the left).

   CAUTION
   Ensure that the belt does not touch the disk speed transducer.

   _____

   _____

   _____

7. Lift the motor and pivot it toward the disk enclosure and reinstall the belt (smooth side of the belt against the pulleys). Center the belt on the pulleys.

8. Loosen the two screws **G** that hold the spindle locking arm, and slide the locking arm away from the disk spindle.

9. Ensure that the antistatic brush is touching the center of the spindle.

   Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle.

10. Tighten the screws on the locking arm.

11. Check that the antistatic brush has a pressure of approximately 60 (+25 to -20) grams on the center of the spindle. Adjust, if necessary, by removing and bending the brush.

12. Install the belt guard. Slide the belt guard all the way to the left and tighten the two screws **H**.

13. Unlock the actuator lock **D** by moving the handle to OFF.

Locked

Unlocked

Form here

62EH Disk Drive   23
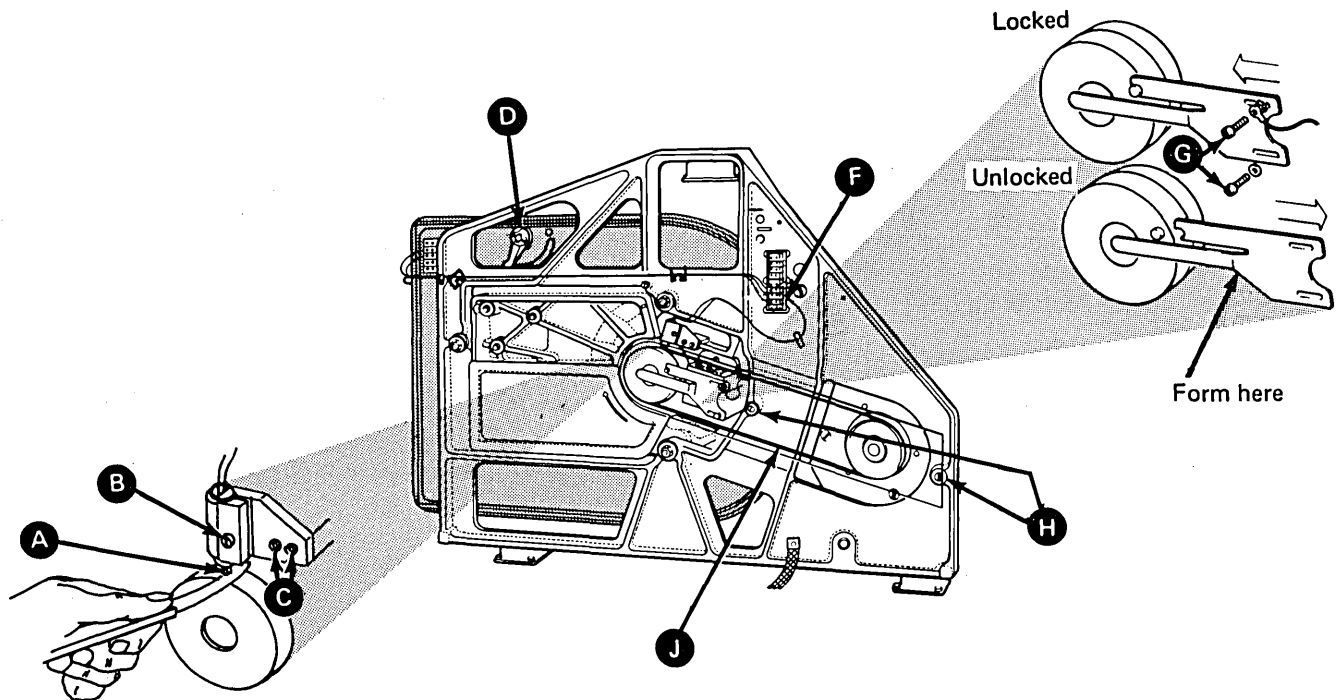
09-090   MOTOR TENSION SPRING

Removal

Note: New style and old style motor tension springs are not the same. The new style spring must be used with the new style motor. The old style spring must be used with the old style motor. The part number is on the new style spring.

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____

_____

_____

1.   Set Power to O (operator panel).

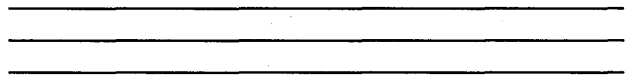2.   Set CB1 off (see paragraph 05-310 for the location of CB1).

3.   Place the blade of a screwdriver under the roller **C** and lift the roller and tension spring off the motor mounting bracket.

4.   For the old style motor tension spring only:

      Remove the roller.

      ### CAUTION
      Ensure that the nut and lock washer do not fall into the motor.

      _____

      _____

      _____

5.   Remove the nut and lock washer from screw **B**.

6.   Remove the screw and flat washer and tension spring by placing a screwdriver under the tension spring **D** and lift up.

7.   Open the tension spring a small amount and press the screw **A** with the flat washer out of the hole.

8.   For the new style motor tension springs only:

      Remove one of the washers from the roller end of the spring assembly and slide off the spring.

Replacement

1.   For the new style motor tension springs only:

      Place the spring on the roller, place the washer on the shaft, flat side first, and hand press into position.

2.   Open the tension spring a small amount and press the screw with the flat washer on it through the hole **A** in the spring.

3.   Press the screw into the hole **B**.

4.   Install the roller (old style), circular edge first, into the tension spring.

5.   Place the blade of a screwdriver under roller **C** and place the roller and tension spring on the motor mounting bracket. Install the lock washer and nut, and tighten the spring.

6.   Pivot the motor against the tension spring to ensure the spring loop and roller is in the correct place.

Old Style Motor Tension Spring

New Style Motor Tension Spring
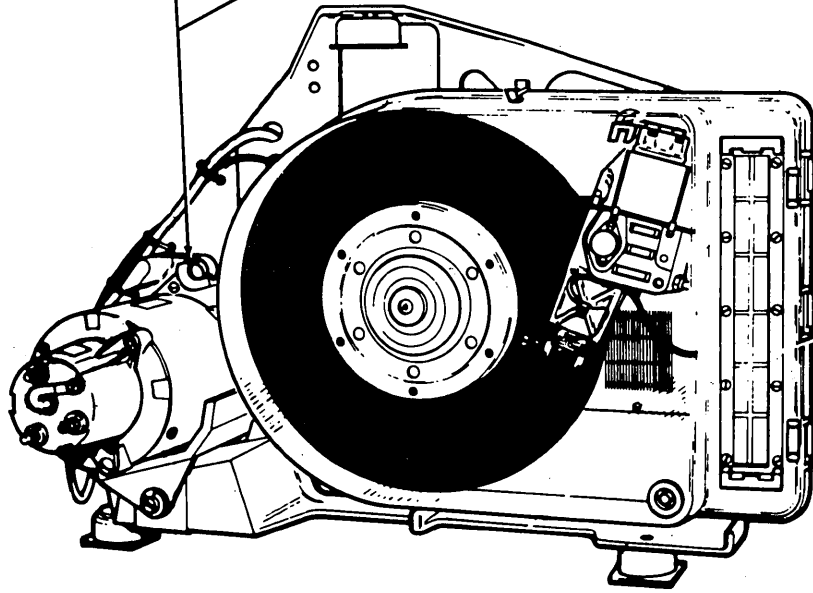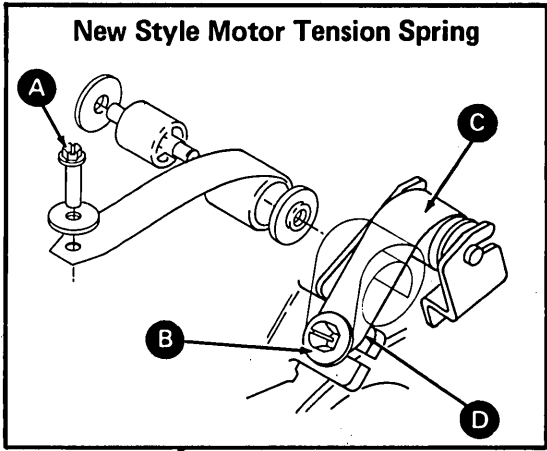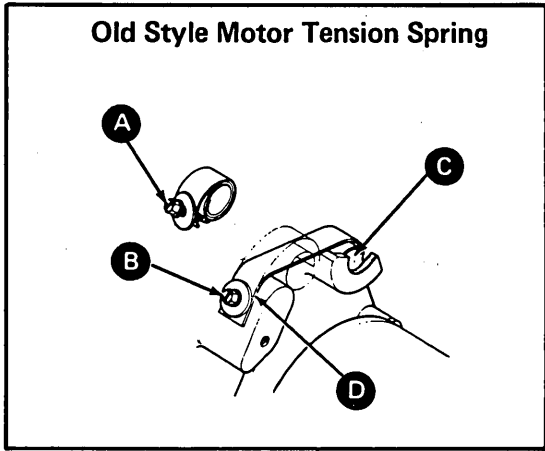
09-100 SHOCK MOUNT (TOP ONE)

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____
_____
_____

Removal

Note: Do not remove more than one shock mount at a time unless you are removing the subframe.

1. Set Power to O (operator panel).

2. Lock the actuator with the actuator lock by moving the handle Ⓐ to ON.

3. Remove the belt guard by loosening the two screws Ⓙ and lift the belt guard Ⓕ off.

4. Loosen the two screws Ⓚ holding the spindle locking arm, and slide the locking arm toward the disk spindle.

5. Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

6. Tighten the screws on the spindle locking arm.

    CAUTION
    Do not remove the four locating screws Ⓓ.

    _____
    _____

7. Remove the four bracket mounting screws Ⓔ (two on each side).

8. Remove the top screw Ⓒ.

9. Slide the bracket out and remove the four shock mount bolts, nuts, and washers Ⓑ.

Replacement

Note: The upper and lower shock mounts have different part numbers.

1. Install the bracket and the four shock mount bolts, nuts, and washers Ⓑ.

2. Install the top screw Ⓒ.

3. Position the shock mount bracket in the machine up against the locating brackets Ⓛ.

4. While holding the bracket to the top of the machine against the locating brackets Ⓛ, install the four bracket mounting screws Ⓔ.

5. Loosen the two screws Ⓚ that hold the spindle locking arm, and slide the locking arm away from the disk spindle.

6. Ensure that the antistatic brush is touching the center of the spindle.

    Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle.

7. Tighten the screws that hold the spindle locking arm.

8. Check that the antistatic brush has a pressure of approximately 60 (+25 to −20) grams on the center of the spindle. Adjust, if necessary, by removing and bending the brush.

9. Install the belt guard Ⓕ. Slide the belt guard all the way to the left and tighten the screws Ⓙ.

10. Unlock the actuator by moving the handle Ⓐ to OFF.

Locked

Unlocked
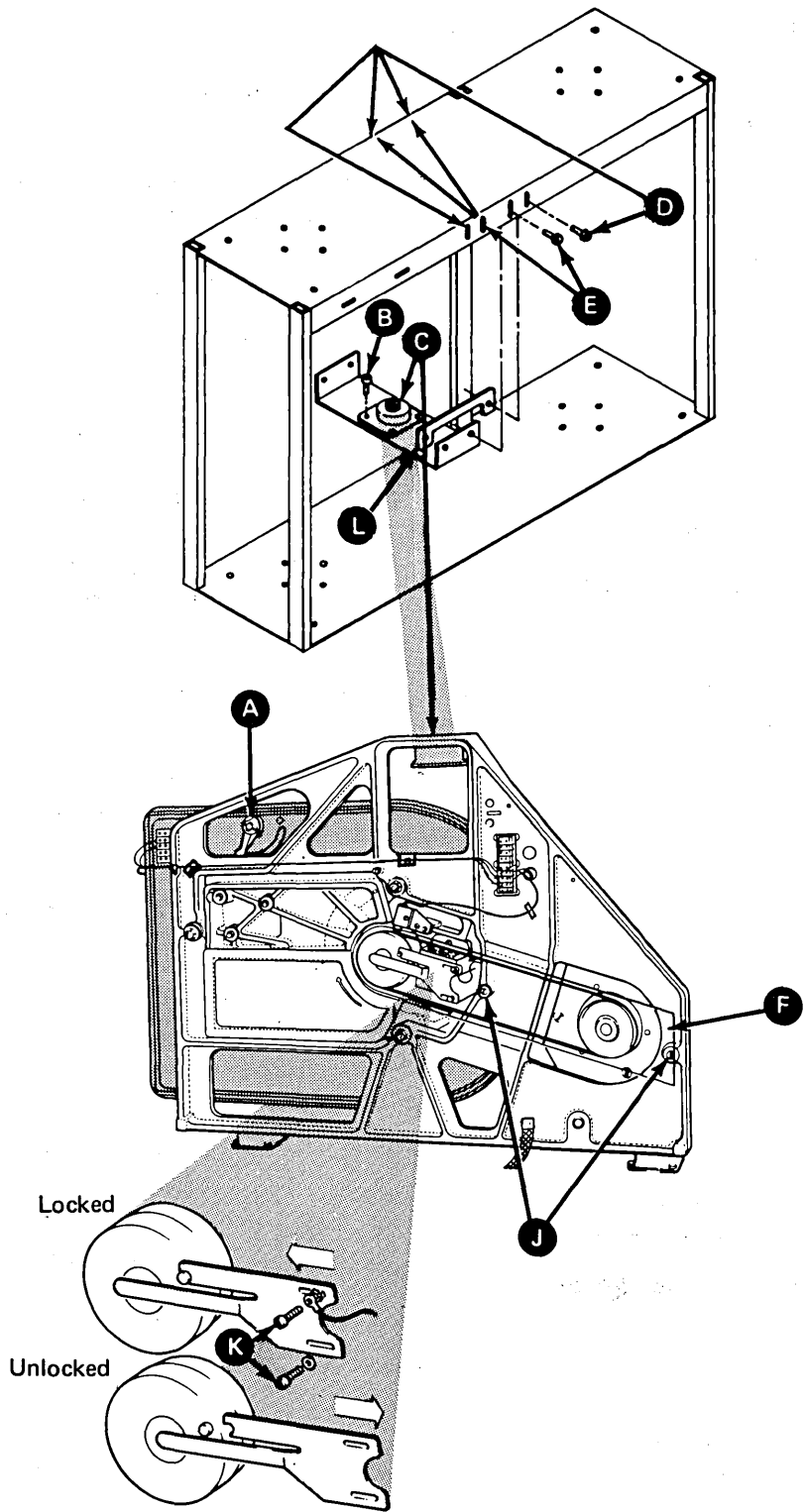
09-110   SHOCK MOUNTS (BOTTOM TWO)

CAUTION
Do not turn the disk spindle counterclockwise; head damage can occur.

_____
_____
_____

Removal

Note: Do not remove more than one shock mount at a time unless you are removing the subframe.

1. Set Power to O (operator panel).

2. Lock the actuator with the actuator lock Ⓐ by moving the handle to ON.

3. Remove the belt guard Ⓕ by loosening the two screws Ⓙ and lift the belt guard off.

4. Loosen the two screws Ⓚ that hold the spindle locking arm, and slide the locking arm toward the disk spindle.

5. Turn the motor pulley clockwise until the stud on the disk spindle is all the way in the notch in the locking arm.

6. Tighten the screws on the locking arm.

7. Remove the four screws and washers Ⓗ that hold the shock mount to the machine frame.

8. Remove the top screw Ⓖ from the shock mount.

9. Remove the shock mount.

Replacement

CAUTION
Ensure that the shock mount has the correct part number (the disk drive uses two types of shock mounts).

_____
_____
_____

1. Install the replacement shock mount on the disk subframe using the top screws Ⓖ.

2. Install the screws and washers Ⓗ that hold the shock mount to the machine frame.

3. Loosen the two screws Ⓚ that hold the spindle locking arm, and slide the locking arm away from the disk spindle.

4. Ensure the spindle antistatic brush is touching the center of the spindle.

   Note: If there is a worn spot on the spindle antistatic brush, put the spot back on the same place on the spindle.

5. Tighten the two screws that hold the locking arm.

6. Check that the spindle antistatic brush has a pressure of approximately 60 (+25 to −20) grams on the center of the spindle. Adjust, if necessary, by removing and bending the brush.

7. Install the belt guard Ⓕ. Slide the belt guard all the way to the left and tighten the screws Ⓙ.

8. Unlock the actuator by moving the handle Ⓐ to OFF.

Locked

Unlocked

DANGER
220 Vac is present on
ACTB3 and ACTB4.

Read Preamplifier and Write Driver
D-W1B3

Base Setting Resistor
Brake
Speed transducer
Speed transducer
+24V line 2
In coil drive
Out coil drive
-8.7V
+24V line 1

To A-A2A4

Ground

Speed
Transducer

Motor
Brake

In/Out Coils

TB2

Preamp servo signal A   Servo Head
Preamp servo signal B
To A-A2Y1

Motor

TB1

Data Heads
0 and 1

Servo head and data
head 2 are located on
back of disk.

-Write transitions
-One head selected
-4V supply
-4V supply
-Select head 2
-Select head 1
-Select head 0   To A-A2A5
-Read select
-24V   Tape Cable
-Write select
+Write gate 1
+Write current on
+6V
Card interlock line   Serial
-24V   Write Data
+Data transmission line
-Data transmission line
To A-A2Z1

A B
W1

Tape Cable

Test Socket D-W1A4

O 1
O 2
O 3

ACTB3—Lower Drive
ACTB4—Upper Drive

Card Side
A
B   D

B	D
+	+02
+	+03
+	+04
+	+05
+	+06
+	+07
+	+08
+	+09
+	+10
+	+11
+	+12
+	+13

Pins on other cards
are connected to
pins on D-W1A4,
for testing.

For example, ground
pin is D-W1A4D08.

W1A5
Read data automatic gain control
and data detector. Write data
trigger.

CAUTION
Do not use card extenders because they increase
noise pick-up and cause waveshape change on
the W1 cards.

A-A2Y1 (see *Note*)

A-A2B2 (see *Note*) Servo Head Position and Track Following Detect,
Phase Lock Oscillator

A-A2A4 (see *Note*)

A-A2C2 (see *Note*)
Read/Write
Data Separator

A-A2D2 (see *Note*)
Servo Control,
Data Unsafe Detection,
Phase Lock Oscillator Control

From D-W1A1
Servo Control and
24V Brake

A-A2E2 (see *Note*)
I/O Command Control
(between CPU and
attachment)

From D-W1B1
Servo Head

A-A2F2 (see *Note*)
Read/Write/Scan Data,
Cycle Steal Control

A-A2A5 (see *Note*)

A-A2G2 (see *Note*)
File Fast Access
Control

From D-W1B5

Tape Cable

A-A2C4 (see *Note*)
Servo Velocity Control,
Interlock Singleshots

A-A2Z1 (see *Note*)

A-A2B4 (see *Note*) Actuator
Coil Drivers, Current Sense,
Plus and Minus 12V Current
Regulators

Serial   Serial
Write Data   Read Data

From D-W1B6

Note: If file B is installed, the card locations are the
same, but they are located in A-A3.

See FSL page AC350 (disk drive A) and FSL page AC360 (disk drive B) for the correct card and cable part numbers.

09-130   CARD SOCKETS

CAUTION
Do not bend or break the pins when removing or
inserting cards. Broken pins make it necessary to
exchange the disk enclosure.

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_____

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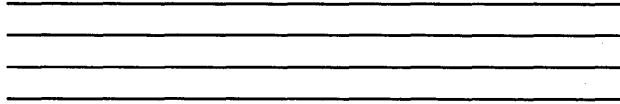
The card sockets are located on the front right of the
disk enclosure. To remove or reinstall cards, remove the
card socket cover **Ⓐ**.

D-W1

	A	B
1	Speed Transducer, Brake Sense, and Actuator Drive Coil Cable	Servo Preamp Cable (coaxial)
2	✕	✕
3	✕	Read Preamp and Write Select Card
4	✕	
5	Data AGC and Detector Card	Read/write Logic Cable (tape)
6		Read/write Data Cable (coaxial)
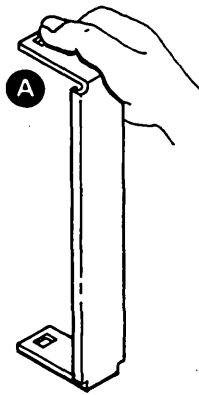
R/W = Read/write
AGC = Automatic Gain Control

See FSL page AC350 (disk drive A) and FSL page AC360
(disk drive B) for the correct card and cable part numbers.

09-140   ACTUATOR (ACCESS) SPEED ADJUSTMENT

Adjustment

Note: To verify a present adjustment, go to step 8. If
the G2 card has been changed, start at step 1.

1.   Locate the actuator control card (A2G2 disk drive
     A, A3G2 disk drive B) in the logic gate assembly.
     Note the 10 turn potentiometer and the two red
     light emitting diodes on the top half of the card
     (looking toward the end of the card opposite the
     board pin contacts). See paragraph 09-120 for
     cable and card locations.

2.   To ensure a center range setting of the
     potentiometer adjust 10 turns clockwise, then five
     turns counterclockwise. This sets the actuator
     speed high enough to let the actuator seek home.

3.   Load DIAGB1 and select Exercisers.

4.   Select device:
        Disk drive A or disk drive B.

     Note: Only the devices specified in the machine
     configuration are in the menu. Disk drive B can be
     selected in step 5 if it is not in the machine
     configuration.

5.   Select command.'Access Timing Module' (access
     speed adjustment test).

     Note: Command option 1 may be used to select
     disk drive A or disk drive B if they were not
     selected during step 4.

6.   Select 'E'.

7. Adjustment:

Note: The correct potentiometer setting is with the top light-emitting diode flashing continuously for 15 seconds and off for 2 seconds, and the bottom light-emitting diode flashing from 1 to 3 times during the 15 seconds.

a. If both the light-emitting diodes are flashing, turn the potentiometer clockwise until the top light-emitting diode is flashing continuously for 15 seconds and off for 2 seconds, and the bottom light-emitting diode flashes 1 to 3 times during the 15 seconds.

b. If both of the light-emitting diodes are off, turn the potentiometer counterclockwise until the top light-emitting diode is flashing continuously for 15 seconds and off for 2 seconds, and the bottom light-emitting diode flashes 1 to 3 times during the 15 seconds.

8. To verify correct seek operation after an adjustment has been completed, run the disk MDI MAPs for the disk drive that was adjusted (TA030 tests this function). If the adjustment is wrong, return to step 1.

09-150   DISK CONFIGURATION CHANGE

If it is necessary to change the machine configuration to a single drive machine to verify which drive is failing, do the following:

1. Set CB1 off (see paragraph 05-310 for the location of CB1).

2. Remove all file cables from the A-A3 board.

3. Jumper A-A2E2S13 to ground (A-A2E2U08).

4. Jumper A-A2F2J12 to ground (A-A2F2J08).

5. Connect the four cables from either the top or bottom disk to the attachment in the A-A2 board.

6. Disconnect the AC power to the disk drive not being used (see paragraph 09-030). If AC power is not removed, the brake will stop the motor and trip the thermal overload or if the motor does not stop, the brake can be destroyed.

7. Ensure that the leads from the motor not being used cannot contact the terminal block.

You can change the machine configuration and run the system as a 13.2-megabyte system.

09

CONTENTS

10

10-010   MAINTENANCE

No preventive maintenance is needed for the 62PC disk drive. However, it may be necessary to adjust or exchange field-replaceable units. To find a failing unit, use diagnostic programs and MAPs. Verify repairs by running diagnostic programs.

CAUTION
Do not turn the disk spindle counterclockwise; head and disk damage can occur.

10-020   SUBFRAME

Removing the Subframe

CAUTION
Do not turn the disk spindle counterclockwise; head and disk damage can occur.

---

1.   Set Power to O (operator panel).

2.   Remove the card gate (see paragraph 10-180).

3.   Remove the drive motor assembly (see paragraph 10-100).

4.   Turn the actuator lock knob **J** clockwise (through 120 degrees until the actuator lock reaches its stop) to lock the actuator.

5.   Remove the DC power cable **C** from the cable ties on the subframe.

> **DANGER**
> The subframe/disk enclosure weight is 16 kg (35 pounds). Clear a space for the subframe/disk enclosure before removing the subframe/disk enclosure from the machine.
>
> ---

6.   For drives C and D only, remove screws, washers, star washers, and nuts **K**. Remove drive assembly from rear of machine and set in clear area.

7.   Loosen the three single screws (two on the upper shock mounts **A** and one on the lower shock mount **G**) that attach the subframe **E** to the shock mounts. Slide the subframe off the screws. Set the subframe on the transparent disk enclosure cover.

8.   Disconnect the wires from the brake assembly **F** and the trimmer board **D**.

9.   Remove the lower (long) disk enclosure mounting nut **H** and the two upper nuts **B**.

10.   Lift the subframe **E** from the disk enclosure.

Reinstalling the Subframe

1.   Set the disk enclosure on its transparent cover.

2.   Place the subframe **E** on the disk enclosure. Be careful not to damage the bushings.

3.   Fasten the disk enclosure with the lower (long) nut **H** and the two upper nuts **B**.

4.   Connect the wires to the brake assembly **F** and the trimmer board **D**.

5.   Slide the subframe **E** on the three single screws (two on the upper shock mounts **A** and one on the lower shock mount **G**) that attach the subframe to the shock mounts and tighten the three screws **A** and **G**.

6.   For drives C and D only, lift and insert drive assembly into system from rear of machine. Install four screws, eight washers, two star washers, and four nuts **K**.

7.   Attach the DC power cable **C** to the subframe.

8.   Turn the actuator lock knob **J** counterclockwise (through 120 degrees) until the actuator lock reaches its stop.

9.   Reinstall the drive motor assembly (see paragraph 10-100).

10.   Reinstall the card gate (see paragraph 10-180).
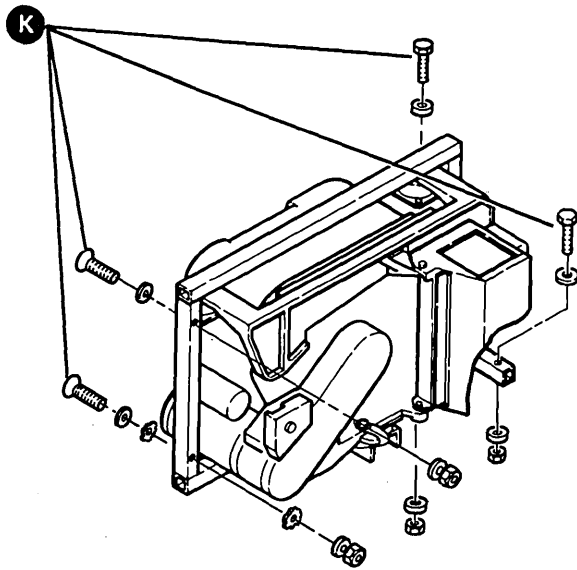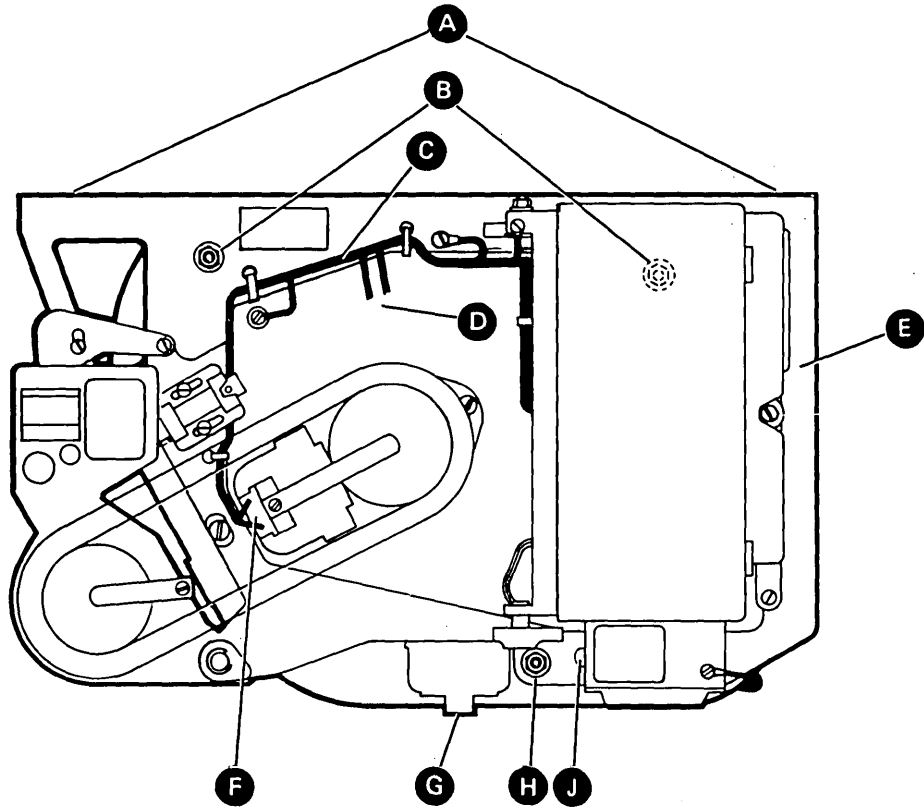
Drives C and D
only.

10-030   DISK ENCLOSURE

Removing the Disk Enclosure

If possible, before removing the disk enclosure, have the customer remove the customer data, then initialize the disk to destroy customer data.

CAUTION
Do not turn the disk spindle counterclockwise; head and disk damage can occur.

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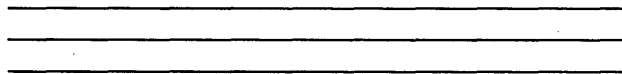
1.   Set Power to O (operator panel).

2.   Turn the screw **H** counterclockwise and open the card gate.

3.   Turn the actuator lock knob **M** clockwise (through 120 degrees until the actuator lock reaches its stop) to lock the actuator.

4.   Remove the two cable clamp screws **E** and remove the cable clamp and the attached card gate cover **J**. Keep the clamp, cover, and screws.

5.   For drives C and D only, remove disk drive assemblies (see paragraph 10-220) and then return to step 6 of this procedure. For drives A and B, continue with step 6.

6.   Disconnect the A2 cable **F**.

7.   Loosen the two screws (one for each board retainer) in the board retainers **P** and slide the board retainers up to release the actuator cable **N** from the card gate.

8.   Disconnect voltage connector VC9 **Q**.

9.   Loosen the two screws **T** and **V** and remove the belt guard **W**.

10. Lift the motor **U** against the force of the belt tensioner **R**, remove the belt **S**; then lower the motor until it is on its stop.

11. Disconnect the brake coil **K**, trimmer board **D**, and ground **A** connectors.

DANGER
The disk enclosure weight is 9 kg (20 pounds). Clear a space for the disk enclosure before removing the disk enclosure from the machine.

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_____

_____
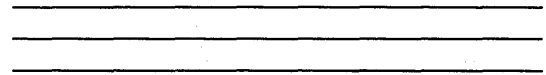
12. Remove the lower (long) **L** and two upper disk enclosure mounting nuts **C** and **G**.

13. Remove the disk enclosure **B** by sliding it away from the subframe. Place the disk enclosure on its transparent cover.

Reinstalling the Disk Enclosure

1.   Check the disk enclosure locating bushings. If they are damaged, install new bushings.

2.   Locate the disk enclosure **B** on the system frame, pass the cables through the subframe and tighten the three mounting nuts **C**, **G**, and **L** (long nut on the lower bolt).

CAUTION
Brake coil wires 1 and 2 must be connected to terminals 1 and 2 or the driver card may be damaged.

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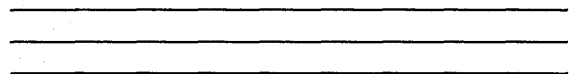
3.   Connect the brake coil **K**, trimmer board **D**, and ground **A** connectors.

4.   Lift the motor **U** against the force of the belt tensioner **R**, reinstall the belt **S** on the pulleys; then lower the motor until the belt is tight.

     Note: Reinstall the smooth side of the belt against the pulleys and center the belt.

5.   Reinstall the belt guard **W** and tighten the two screws **T** and **V**.

6.   Connect voltage connector VC9 **Q**.

7. Place the cable **N** under the two board retainers **P** to attach the actuator cable **N** to the card gate; then tighten the screws.

8. Plug in the A2 cable **F**.

9. For drives C and D only, reinstall disk drive assemblies (see paragraph 10-220), and then return to step 10 of this procedure. For drives A and B, continue with step 10.

   Note: Steps 10, 11, and 12 may already be done.

10. With the cable in position, use the two screws **E** to reinstall the cable clamp and the attached card gate cover **J**.

11. Turn the actuator lock knob **M** counterclockwise (through 120 degrees) until the actuator lock reaches its stop.

12. Close the card gate and tighten the screw **H**.

13. Adjust the drive belt tension and brake assembly (see paragraph 10-190).

14. Run the disk MDI MAPs to verify correct operation of the 62PC disk drive.

15. Do not initialize disk enclosures that are being used for diagnostic purposes only.

   If this replacement disk enclosure is to remain installed, or if this disk enclosure has not been initialized in this system, run the disk initialize program.

   Select the Organize option to build the A0 diskette and initialize the disk. (Identification and control data must be written on the new disk before returning the system to the customer. See section 99-000 *Diagnostic Service Guide.*)

10

Push
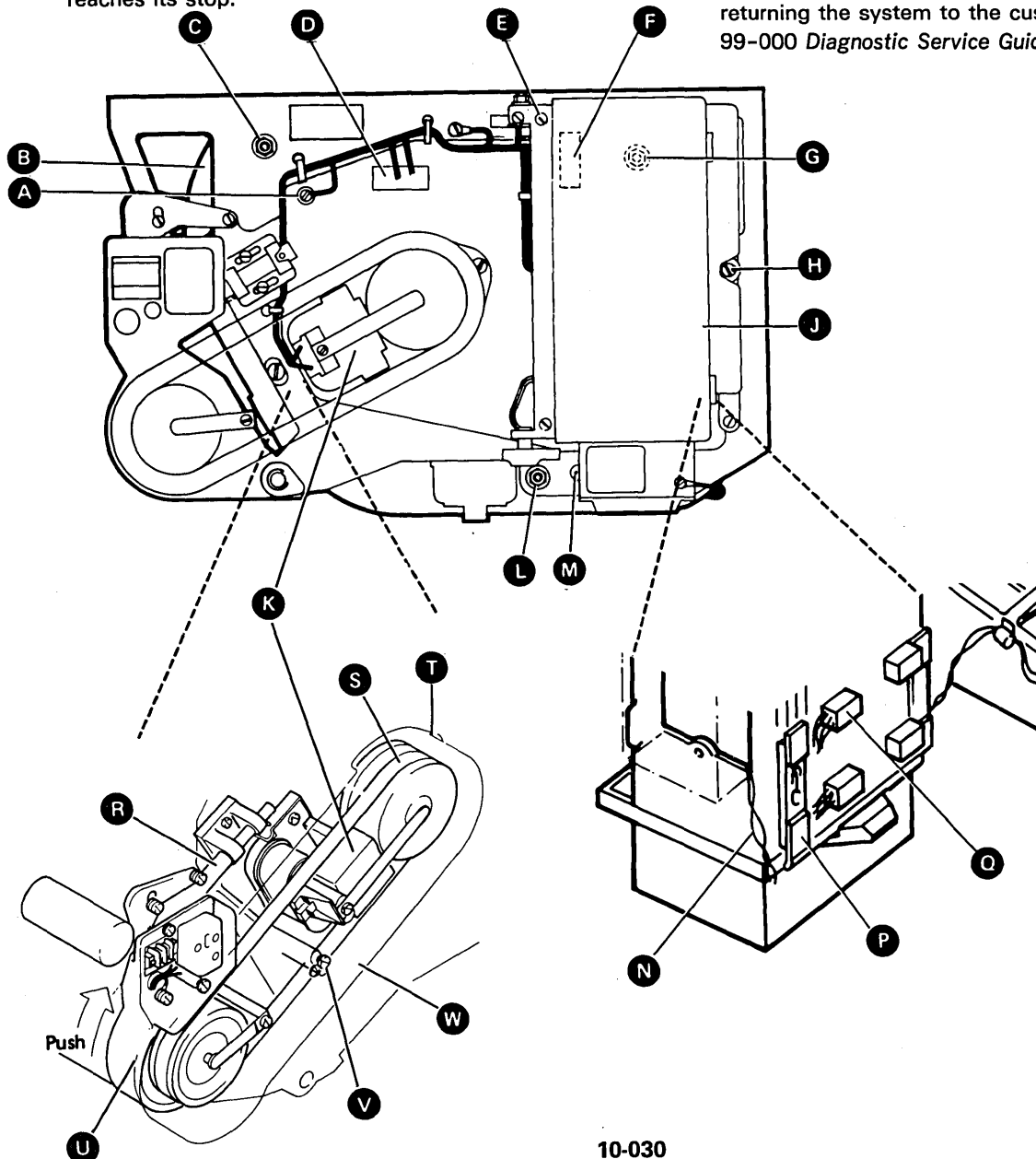
10-040 DRIVE BELT

CAUTION
Do not turn the disk spindle counterclockwise; head and disk damage can occur.

_____

_____

_____

Removing the Drive Belt

1. Set Power to O (operator panel).

2. Loosen the two screws (C) and (F) and remove the belt guard (E).

3. Lift the motor (D) against the force of the belt tensioner (A), and remove the belt (B); then lower the motor until it is on its stop.

Reinstalling the Drive Belt

1. Ensure that the belt is clean, dry, and not damaged.

2. Lift the motor (D) against the force of the belt tensioner (A), reinstall the belt (B) on the pulleys; then lower the motor until the belt is tight.

   Note: Reinstall the smooth side of the belt against the pulleys and center the belt.

3. Reinstall the drive belt guard (E) and tighten the two screws (C) and (F).

4. Adjust the belt tensioner.
   a. Lift the motor against the belt tensioner spring (N). When the pin (K) in the shaft (P) is free of the opening (J), turn the shaft 90 degrees to hold the spring. Lower the motor.
   b. Loosen the two screws (H) and locate the belt tensioner with no gap at (M) and tighten the screws (H).
   c. Lift the motor against the belt tensioner spring and turn the shaft 90 degrees to place the pin in the opening. Lower the motor.

   Note: The belt tensioner bracket (G) must overlap the motor bracket (L).

See Detail

Push

Detail

10
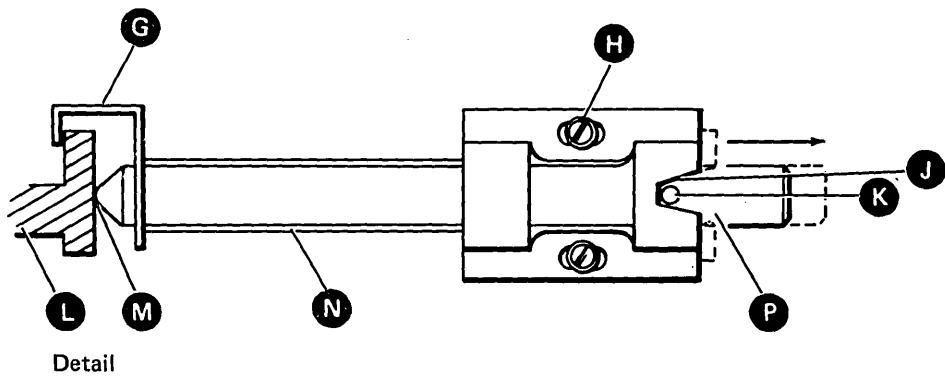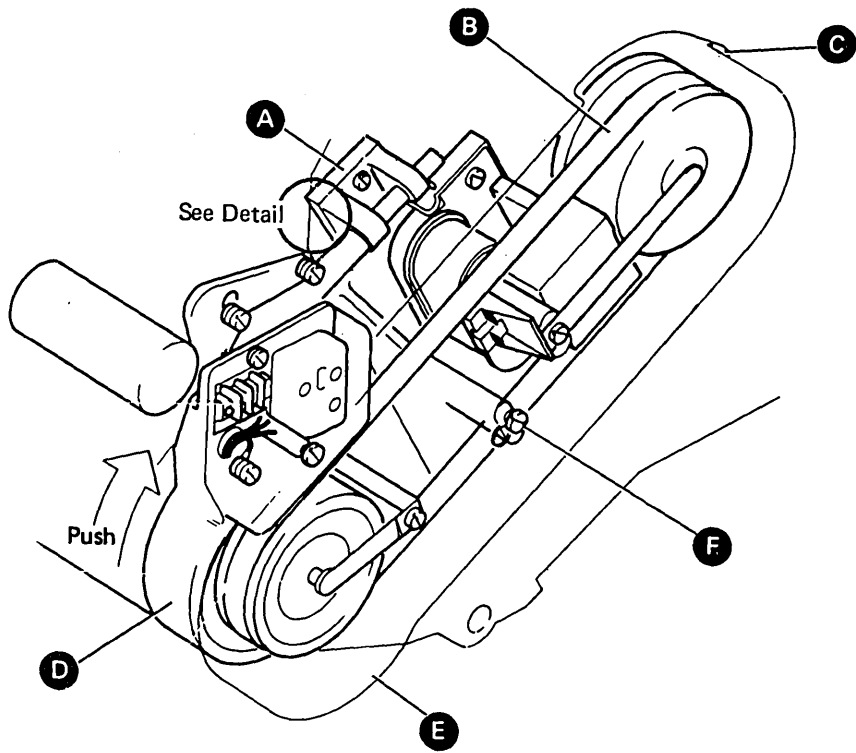
10-050   DRIVE BELT TENSIONER

Removing the Drive Belt Tensioner

1. Set Power to O (operator panel).

2. Lift the motor against the belt tensioner spring **G**. When the pin **D** in the shaft **H** is free of the opening **C**, turn the shaft 90 degrees to hold the spring, and lower the motor.

3. Remove the two screws **B** and the belt tensioner.

Reinstalling the Drive Belt Tensioner

1. Ensure that the pin in the shaft is holding the belt tensioner spring **G** (see step 2 of *Removing the Drive Belt Tensioner*).

2. Locate the two screws **B** in the belt tensioner assembly but do not tighten.

3. Locate the belt tensioner with no gap at **F** and tighten the two screws.

4. Lift the motor against the belt tensioner spring **G**, turn the shaft **H** 90 degrees to place the pin **D** in the opening **C**, and lower the motor.

Note: The belt tensioner bracket **A** must overlap the motor bracket **E**.
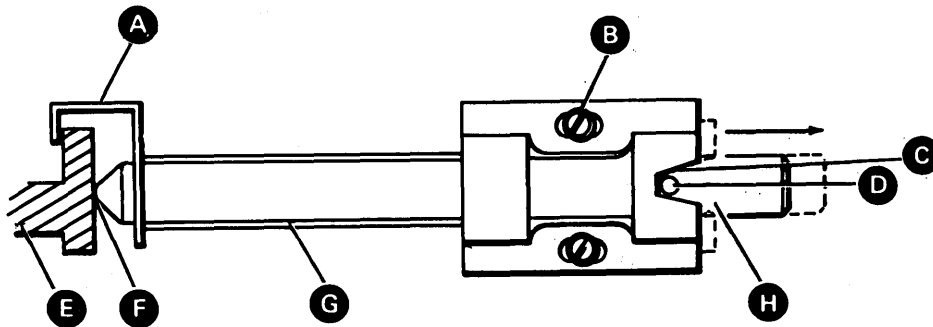
10-060   DRIVE MOTOR ANTISTATIC BRUSH

Removing the Motor Antistatic Brush

1. Set Power to O (operator panel).

2. Loosen the two screws Ⓐ and Ⓑ and remove the belt guard Ⓓ.

3. Remove the screw and the motor antistatic brush Ⓒ.

Reinstalling the Motor Antistatic Brush

1. Locate the screw through the antistatic brush Ⓒ, center the antistatic brush on the motor shaft, and tighten the screw.

   Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the motor shaft.

2. Reinstall the belt guard Ⓓ and tighten the two screws Ⓐ and Ⓑ.

10

10-070   SPINDLE ANTISTATIC BRUSH

Removing the Spindle Antistatic Brush

1.   Set Power to O (operator panel).

2.   Loosen the two screws (A) and (C) and remove the belt guard (D).

3.   Remove the screw and the spindle antistatic brush (B).

Reinstalling the Spindle Antistatic Brush

1.   Locate the screw through the antistatic brush (B), center the antistatic brush (B) on the spindle shaft, and tighten the screw.

Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle shaft.

2.   Reinstall the belt guard (D) and tighten the two screws (A) and (C).
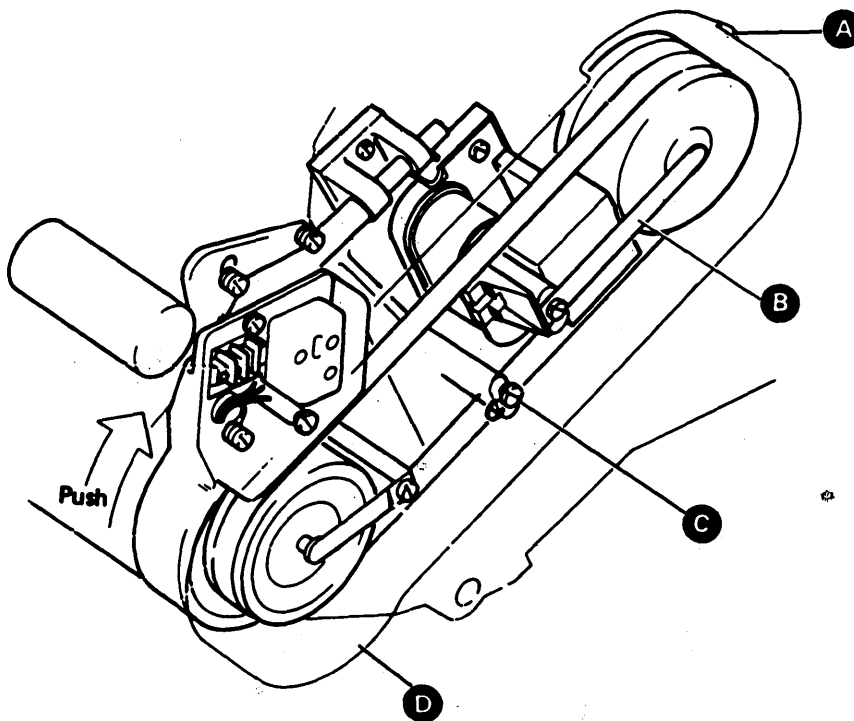
10-080 MOTOR ASSEMBLY TERMINAL BLOCK (TB1)

Removing TB1

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

   > **DANGER**
   > CB1 must be off to remove AC voltage from this circuit.
   >
   > _____
   > _____
   > _____
   > _____

3. Remove the screw **F** and the cover **E**.

4. Disconnect the two system wires **D** and the two motor wires **A**.

5. Remove the two screws **C** and the terminal block **B**.

Reinstalling TB1

1. Locate the two screws **C** through the terminal block **B** and tighten.

2. Connect the two system wires **D** and the two motor wires **A**.

3. Locate the screw **F** through the cover **E** and tighten.

10
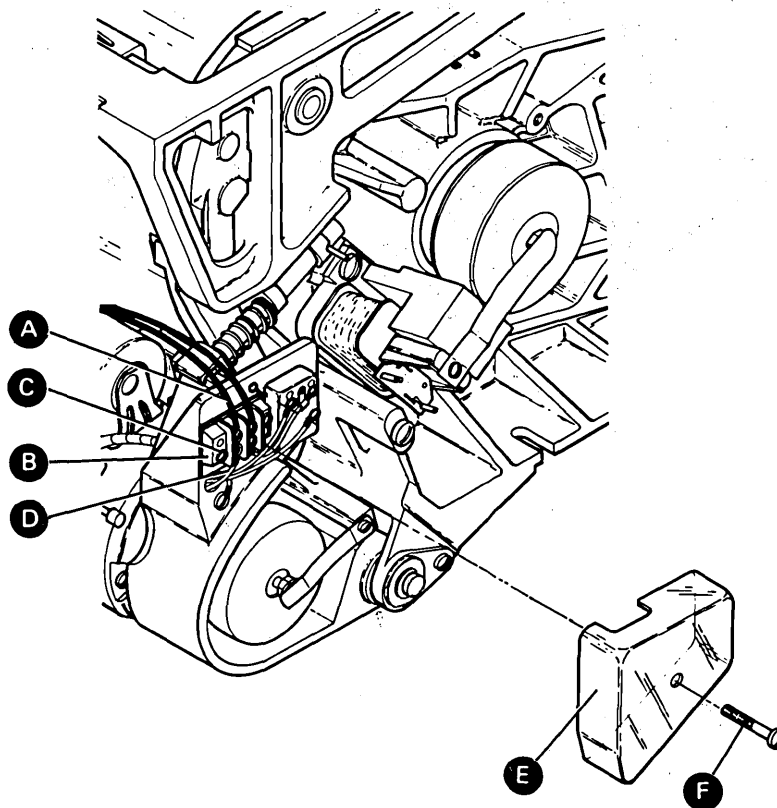
10-090 CARD GATE FAN ASSEMBLY TERMINAL BLOCK (TB2)

Removing TB2

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

   > **DANGER**
   > CB1 must be off to remove AC voltage from this circuit.
   > _____
   > _____
   > _____
   > _____
   > _____
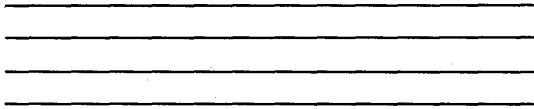
3. Remove the two screws **A** and the cover **B**.

4. Disconnect the fan wires **C** and supply wires **F**.

5. Remove the two screws **E** and the terminal block **D**.

Reinstalling TB2

1. Locate the two screws **E** through the terminal block **D** and tighten.

2. Connect the fan wires **C** and supply wires **F**.

3. Locate the screws **A** through the cover **B** and tighten.
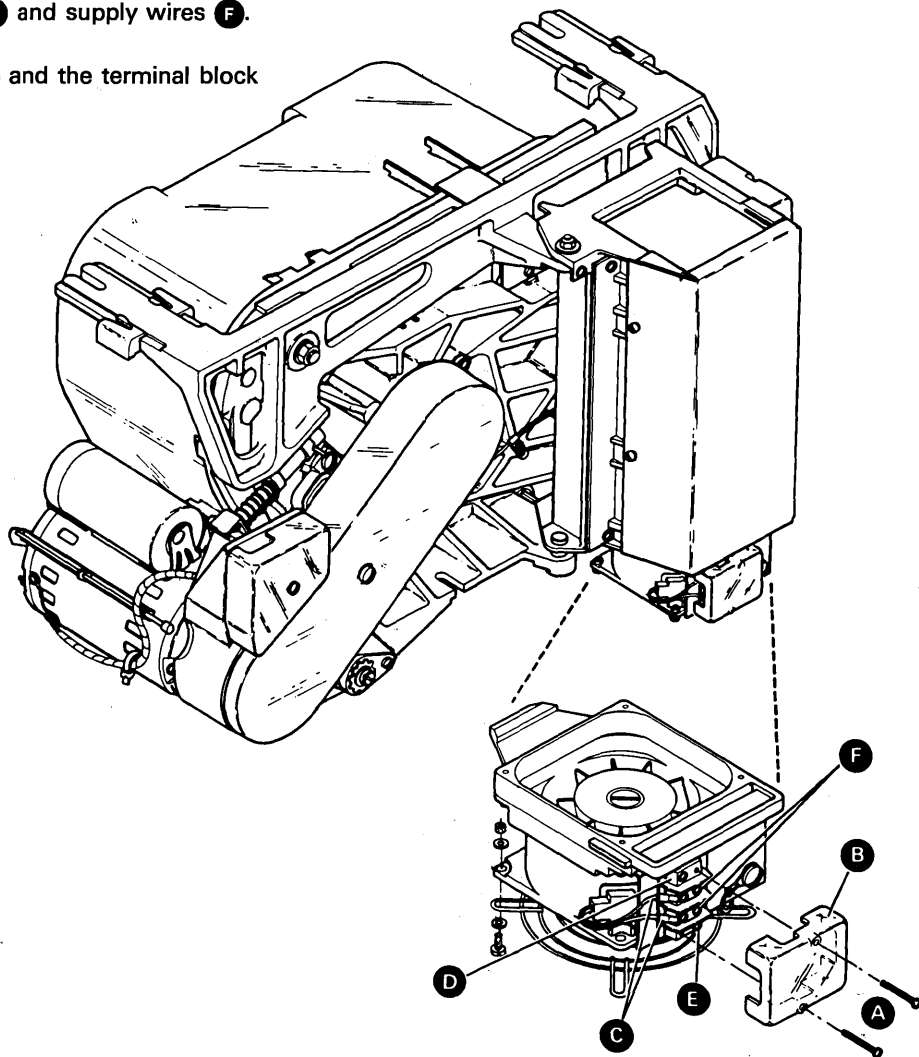
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10-100 DRIVE MOTOR ASSEMBLY

Removing the Drive Motor Assembly

The drive motor assembly includes the following field-replaceable units; the motor, the pulley, and the motor mounting bracket.

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

   > **DANGER**
   > CB1 must be off to remove AC voltage from this circuit.
   > _____
   > _____
   > _____
   > _____

3. Loosen the two screws **D** and **G** and remove the belt guard **F**.

4. Lift the motor **H** against the belt tensioner spring **U**. When the pin **R** in the shaft **V** is free of the opening **Q**, turn the shaft 90 degrees to hold the spring. Lower the motor until the belt supports it.

5. Remove the two screws **P** and the belt tensioner.

6. Remove the screw **J** and the cover **C** from TB1.

7. Disconnect the two system wires **B** and the AC ground wire **A**.

8. Remove the pivot pin clip **M** from the motor bracket pivot pin.

9. Take the weight of the drive motor in your left hand, remove the belt **E**, and push the motor toward the disk enclosure until the pivot pins **K** are free of their holes. Lift out the motor assembly.

   Note: The motor pivot bushings **L** could fall off as the motor is removed.

10. Remove and inspect the motor bushings **L**. If they are damaged, install new bushings.

Reinstalling the Drive Motor Assembly

1. Check that the motor pivot bushings **L** are not damaged and are in the pivot holes.

2. Guide the motor assembly pivot pins **K** into their holes and slide the assembly away from the disk enclosure.

3. Reinstall the pivot pin clip **M**.

4. Lift the motor **H** against the force of the belt tensioner spring **U**, reinstall the belt **E** on the pulleys, and lower the motor until the belt is tight.

   Note: Reinstall the smooth side of the belt against the pulleys and center the belt.

5. Ensure that the pin in the shaft is holding the belt tensioner spring (see step 4 of *Removing the Drive Motor Assembly*).

6. Locate the two screws **P** in the belt tensioner assembly but do not tighten.

7. Adjust the belt tension.

   a. Locate the belt tensioner with no gap at **T** and tighten the screws **P**.
   b. Lift the motor against the belt tensioner spring **U** and turn the shaft **V** 90 degrees to place the pin **R** in the opening **Q**.
   c. Lower the motor.

   Note: The belt tensioner bracket **N** must overlap the motor bracket **S**.

8. Connect the two system wires **B** and the AC ground wire **A**.

9. Locate the screw **J** through the TB1 cover **C** and tighten the screw.

10. Reinstall the belt guard **F** and tighten the screws **D** and **G**.
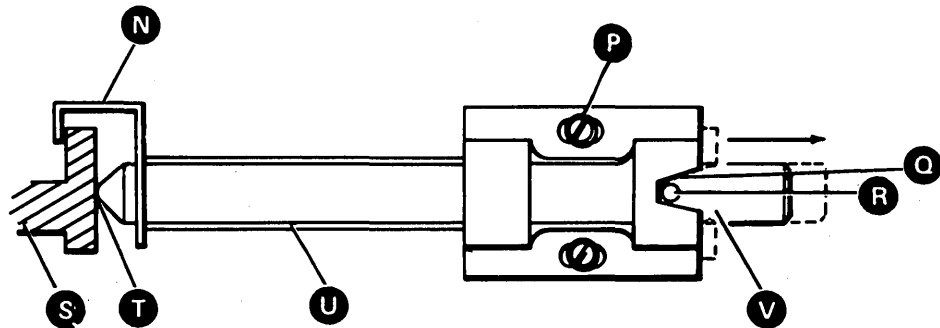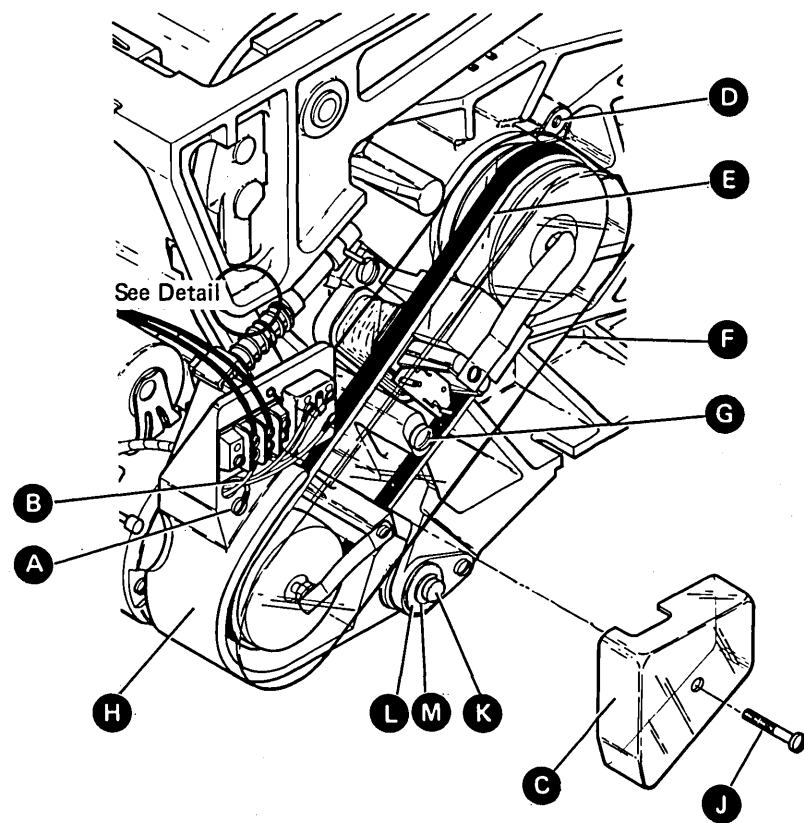
Detail

10-110   BRAKE ASSEMBLY AND COIL

Removing the Brake Assembly and Coil

CAUTION
Do not turn the disk spindle pulley **Q** counterclockwise; head and disk damage can occur.

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_____

1.   Set Power to 0 (operator panel).

2.   Loosen the two screws **A** and **H** and remove the belt guard **F**.

3.   Lift the motor **J** against the force of the belt tensioner **E**, remove the belt **D**; then lower the motor until it is on its stop.

4.   Disconnect wires 1 and 2 **G** from the brake coil **C**.

5.   Remove the two screws **B** and the brake assembly with the antistatic brush still attached to the assembly.

Reinstalling the Brake Assembly and Coil

1.   Insert the two screws **B** through the brake assembly and locate the brake assembly on the disk enclosure but do not tighten the screws.

CAUTION
Wires 1 and 2 must be connected to terminals 1 and 2 or the driver card will be damaged. (The terminals on the new coil may not be located in the same place as on the old coil.)

_____
_____
_____
_____
_____
_____

2.   Connect wires 1 and 2 **G** to terminals 1 and 2 on the coil **C**.

3.   Adjust the brake.
      a. Place a 0.25 millimeter (0.010 inch) gauge **M** between the armature casting **L** and the solenoid **N**, slide the brake assembly toward the disk enclosure spindle pulley **P**, and tighten the two holding screws **B**.
      b. Remove the gauge **M**.

4.   Loosen the screw **K**, center the antistatic brush **O** on the spindle **P** and tighten the screw **K**.

      Note: If there is a worn spot on the antistatic brush, put the spot back on the same place on the spindle shaft.

5.   Lift the motor **J** against the force of the belt tensioner **E**, reinstall the belt **D** on the pulleys; then lower the motor until the belt is tight.

      Note: Reinstall the smooth side of the belt against the pulleys and center the belt.

6.   Reinstall the drive belt guard **F** and tighten the two screws **A** and **H**.

Push
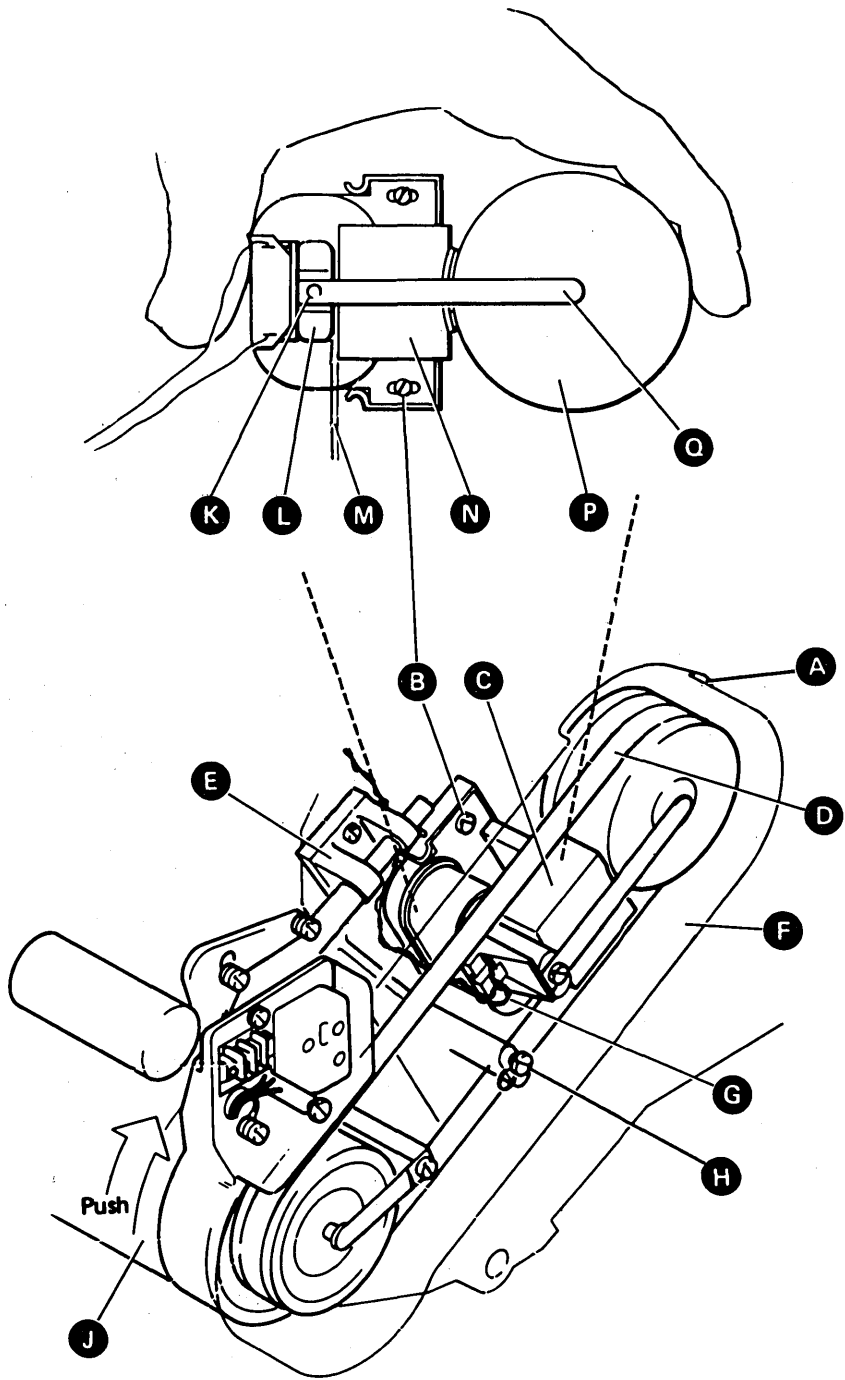
10-120 SHOCK MOUNTS

Removing the Shock Mounts

CAUTION
Do not remove more than one shock mount at a time unless the disk enclosure has been removed.

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_____

1. Set Power to O (operator panel).

2. Turn screw **G** counterclockwise and open the card gate.

3. Turn the actuator lock knob **H** clockwise (through 120 degrees) until the actuator lock reaches its stop.

4. Remove the four sets of screws **C**, washers **D**, and nuts **E** and remove the single screw **A** and washer **B**.

5. Remove the shock mount **F**.

Reinstalling the Shock Mounts

1. Slide the shock mount **F** into position.

2. Reinstall and tighten the single screw **A** and washer **B** and the four sets of screws **C**, washers **D**, and nuts **E**.

3. Turn the actuator lock knob **H** counterclockwise (through 120 degrees) until the actuator lock reaches its stop.

4. Close the card gate and tighten the screw **G**.

A
B
C
D
E
F

G

F
E
D
C
B
A

H
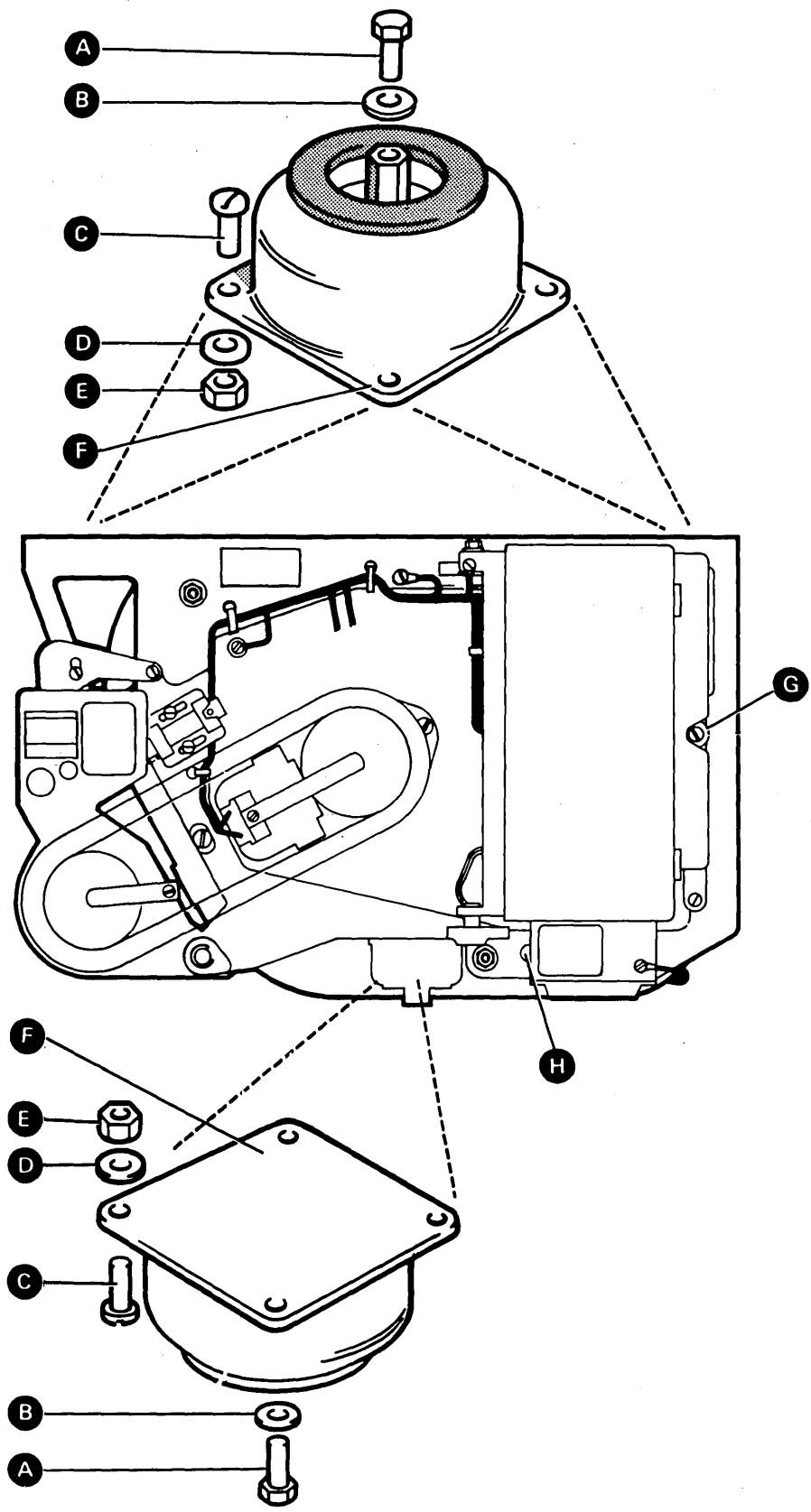
10-130 CARD GATE FAN ASSEMBLY

CAUTION
Before removing the fan, note the label indicating the air flow direction to ensure the fan is reinstalled correctly.

_____
_____
_____

Removing the Card Gate Fan Assembly

1. Set Power to O (operator panel).

2. Set CB1 off (see paragraph 05-310 for the location of CB1).

    > **DANGER**
    > CB1 must be off to remove AC voltage from this circuit.
    >
    > _____
    > _____
    > _____

3. Remove the two screws Ⓐ and the card gate cover Ⓑ.

4. Remove the two screws Ⓓ and the cover Ⓔ from TB2.

5. Disconnect the fan supply wires Ⓖ.

6. Remove the ground screw Ⓕ and ground wire.

7. Turn the screw Ⓒ counterclockwise and open the card gate.

8. Press down on the fan retainer Ⓙ at the rear of the card gate and slide the fan assembly Ⓗ from the card gate.

Reinstalling the Card Gate Fan Assembly

1. Align the fan assembly Ⓗ on the bottom of the card gate and slide together until the fan retainer Ⓙ latches on the rear of the card gate.

2. Close the card gate and tighten the screw Ⓒ.

3. Reinstall the ground wire with its screw Ⓕ.

4. Connect the fan wires Ⓖ.

5. Locate the screws Ⓓ through the cover Ⓔ and tighten.

6. Reinstall the card gate cover Ⓑ using the two screws Ⓐ.
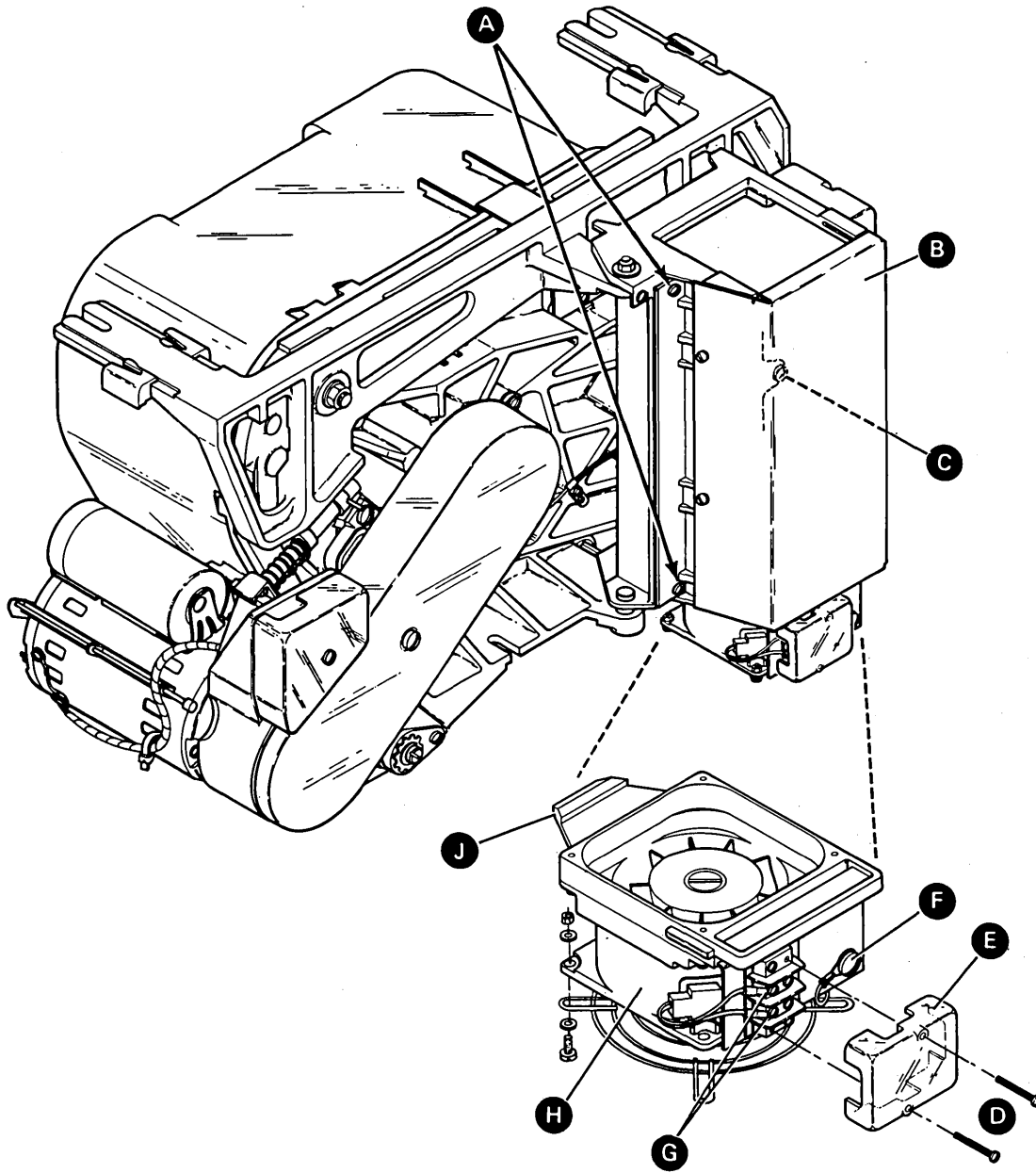
10-140   TERMINATOR CARD

Note: On systems with more than one disk, the terminator card is located in the last drive.

Removing the Terminator Card

1. Set Power to 0 (operator panel).

2. Remove the two cable clamp screws **A** and remove the cable clamp and the attached card gate cover **B**.

3. Remove the terminator card from A4.

Reinstalling the Terminator Card

1. Plug the terminator card into A4.

2. With the cables in position, use the two screws **A** to reinstall the cable clamp and the attached cover **B**.
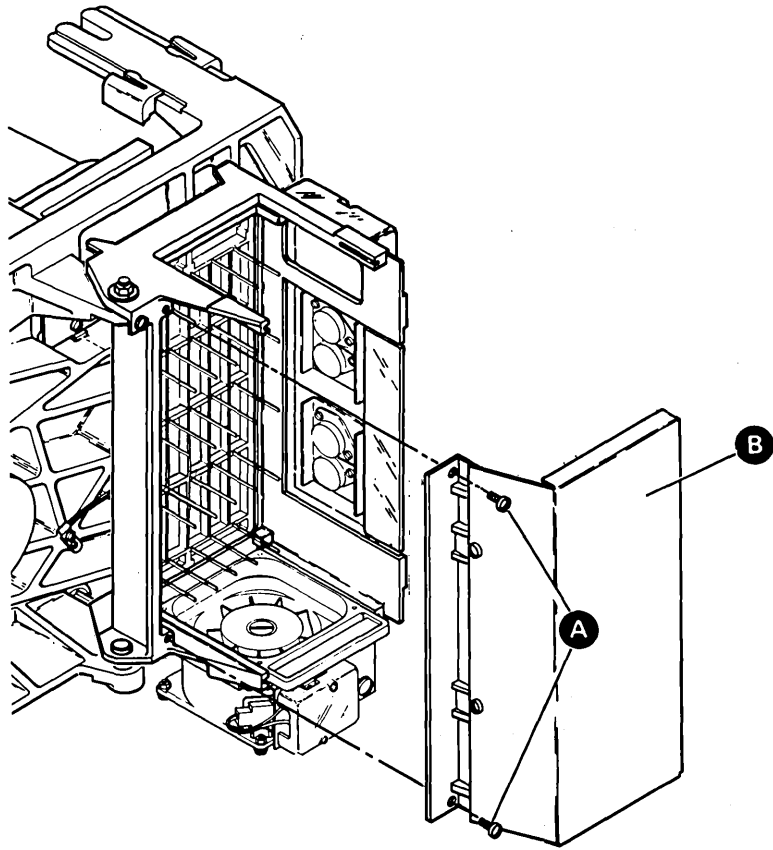
Disconnecting the Flat Cables and Connectors

1.   Set Power to O (operator panel).

2.   Remove the two cable clamp screws Ⓐ and remove the cable clamp and the attached card gate cover Ⓑ.

3.   Disconnect the cables Ⓒ (A3, A4, and A5). If this is the only or last disk drive, A4 contains a terminator card.

      Note: For drives C and D, the procedure is done; for drives A and B only, continue with steps 4, 5, and 6.

4.   Turn the screw Ⓓ counterclockwise and open the card gate.

5.   Remove the cable strap Ⓕ from the cable guide Ⓔ.

6.   Remove the flat cables from the disk enclosure.

Connecting the Flat Cables and Connectors

Note: For drives A and B only, begin with step 1. For drives C and D, begin with step 3 (skip steps 1 and 2).

1.   Place the flat cables into the cable guide Ⓔ and reinstall the cable strap Ⓕ.

2.   Close the card gate and tighten the screw Ⓓ.

3.   Plug in the cables Ⓒ (A3, A4, and A5). If this is the only or last disk drive, A4 contains a terminator card.

4.   With the cables in position, use the two screws Ⓐ to reinstall the cable clamp and the attached card gate cover Ⓑ.
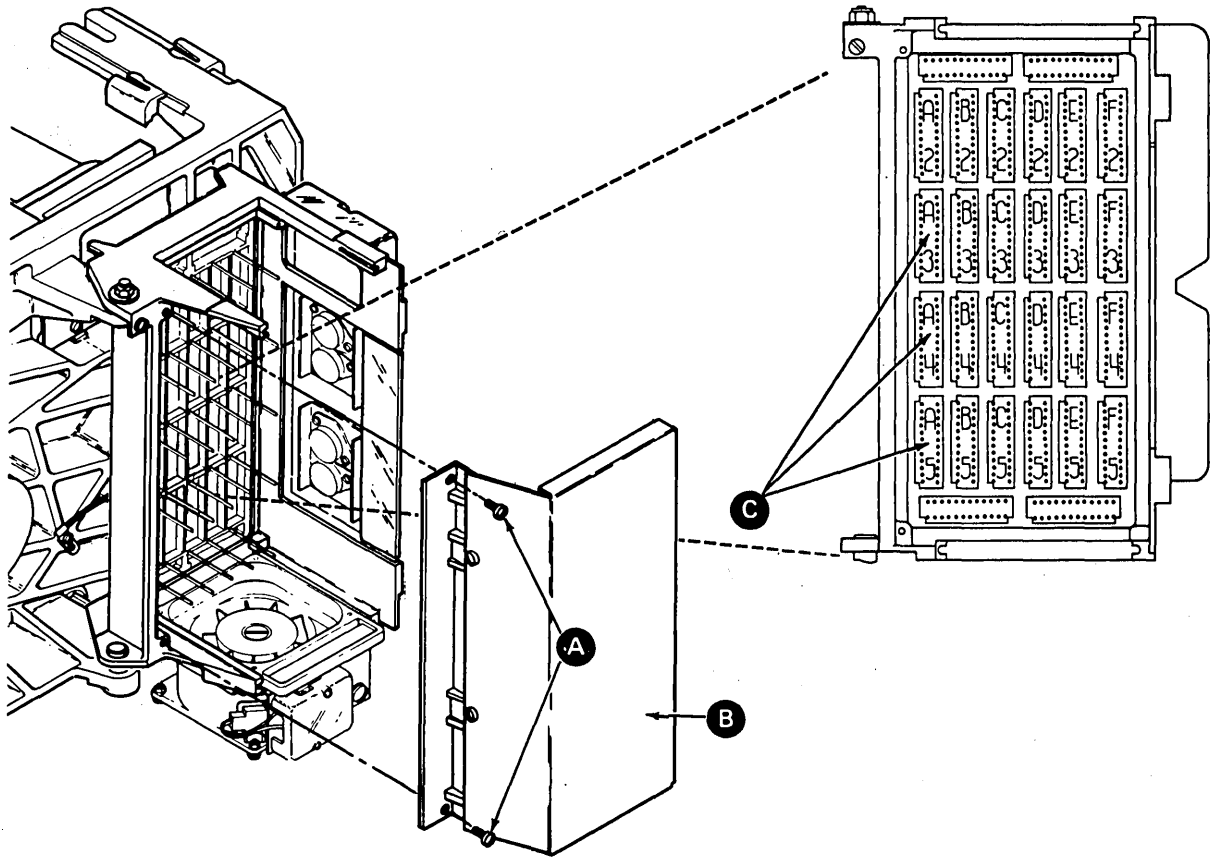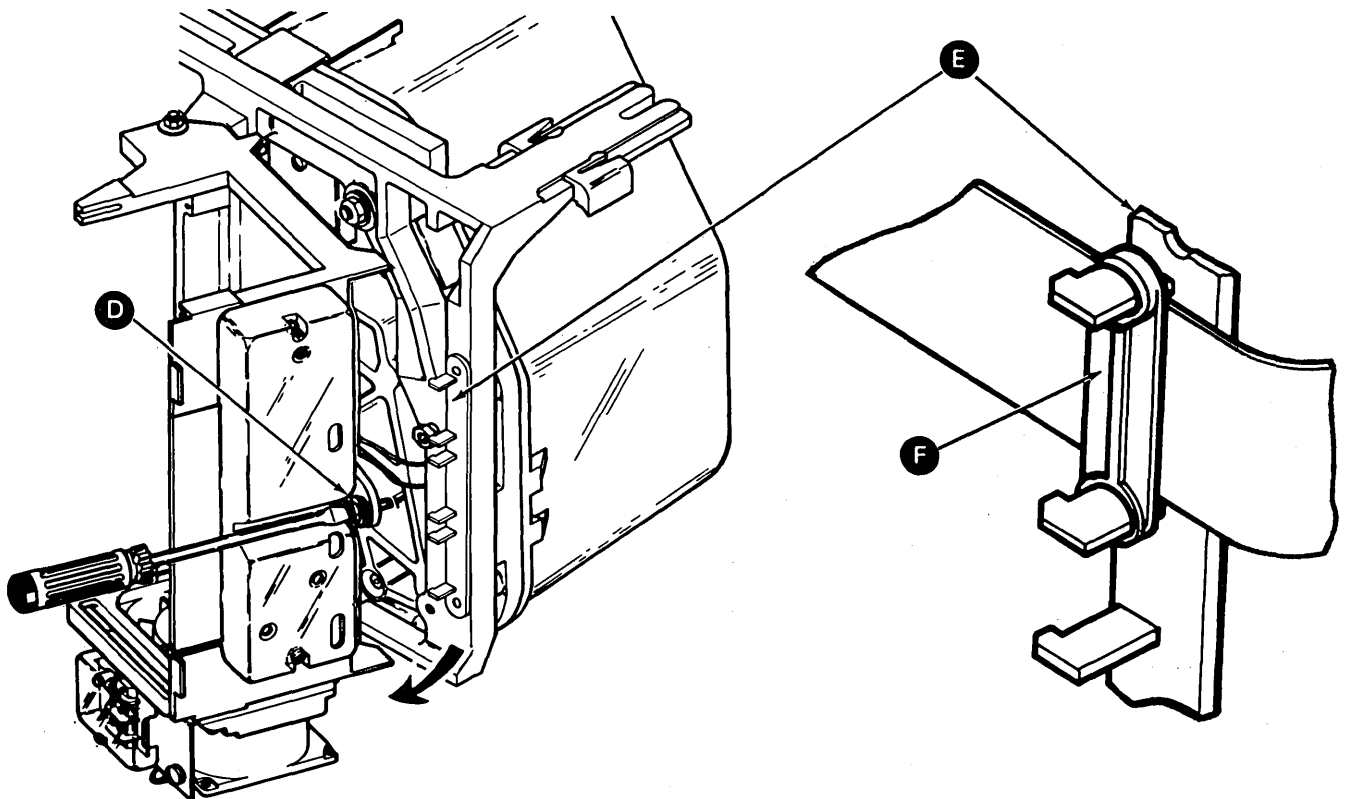
10-160   DISK CARDS

Note: Jumpers are installed on the disk drive C2, D2, and E2 cards at the factory. All jumper positions on a card must have a jumper installed in order for the card to function correctly. Before installing a new card, ensure that all jumpers are on the card, and that they are seated correctly.

Removing Cards from the Card Gate

1. Set Power to 0 (operator panel).

2. Remove the two screws **A** and the card gate cover **B**.

3. Remove the selected card.

Reinstalling Cards in the Card Gate

1. Plug the card into the selected position.

2. Locate the card gate cover **B**, reinstall the two screws **A** through the cover, and tighten the screws.

Removing the Actuator Coil Driver Card

1. Set Power to 0 (operator panel).

2. Turn the screw **C** counterclockwise and open the card gate.

3. Disconnect voltage connectors **G** (VC7, VC8, and VC10).

4. Remove the two screws **D** and **F** and the transparent cover **E**.

   Note: The actuator coil driver card is attached to the transparent cover **E** and the cable attached to the card will limit the movement of the cover.

5. Remove the three holding screws to remove the actuator coil driver card from the transparent cover **E**.

Reinstalling the Actuator Coil Driver Card

1. Place the card in the transparent cover **E**, install and tighten the three holding screws for the actuator coil driver card.

2. Position the transparent cover **E** on the card gate, reinstall the two screws **D** and **F**, and tighten the screws.

3. Connect voltage connectors **G** (VC7, VC8, and VC10).

4. Set Power to I (operator panel).

5. Check the voltage on pins C and D of VC10 **G** (see paragraph 27-190).

6. Close the card gate and tighten the screw **C**.
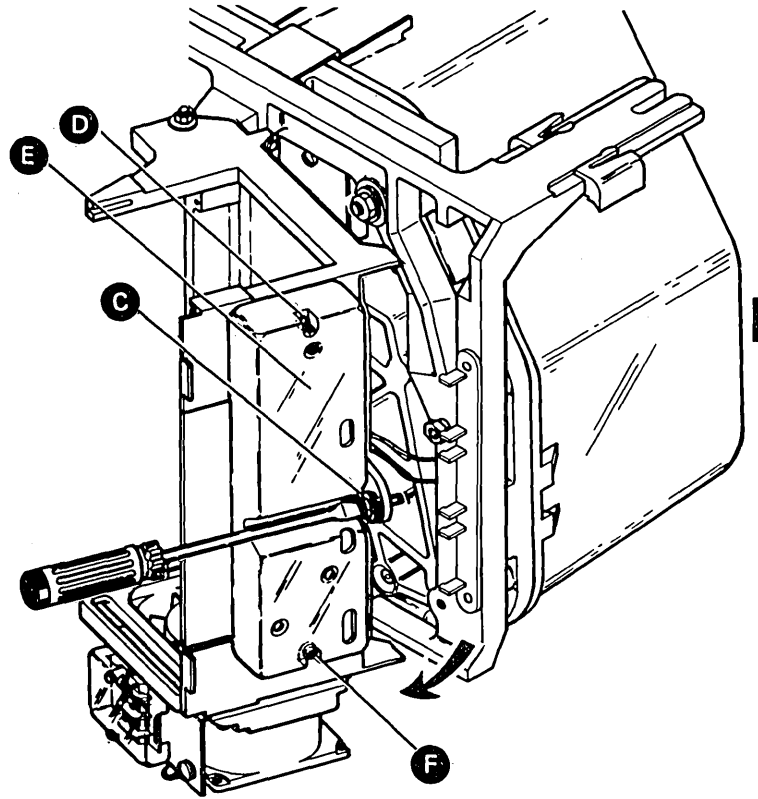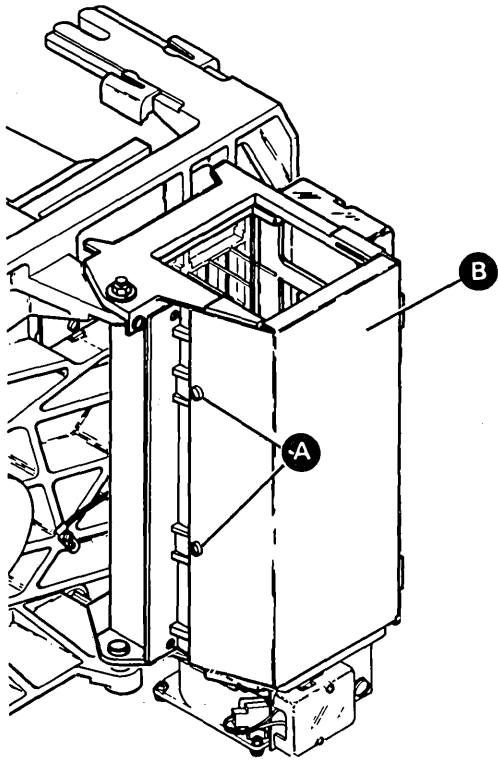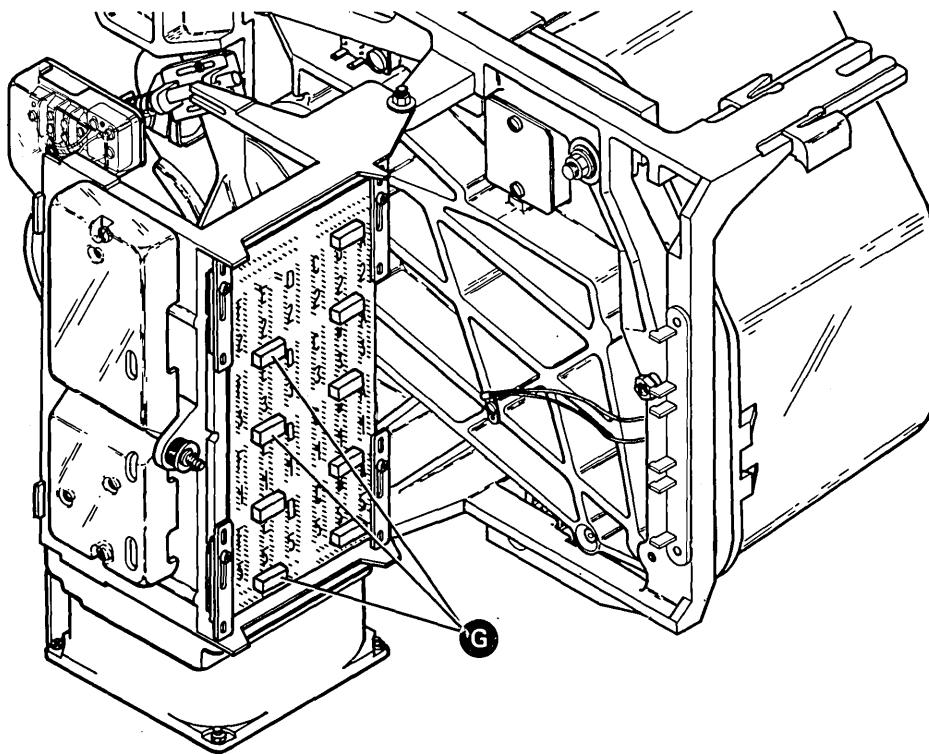
10-170 DISK BOARD

Removing the Disk Board

1. Set Power to 0 (operator panel).

2. Remove the two cable clamp screws **A** and remove the cable clamp and the attached card gate cover **B**.

3. Note the position of the cards and cables and then remove the cards and cables.

4. Turn the screw **C** counterclockwise and open the card gate.

5. Disconnect the voltage connectors **D**.

6. Loosen the screws in the four board retainers **E** and remove the board.

Reinstalling the Disk Board

1. Locate the board and tighten the screws in the four board retainers **E**.

2. Connect the voltage connectors **D**.

3. Carefully close the card gate. Be careful not to pinch the cables. Tighten the screw **C**.

4. Plug the cards and cables into the correct positions.

5. With the cables in position, use the two screws **A** to reinstall the cable clamp and the attached card gate cover **B**.
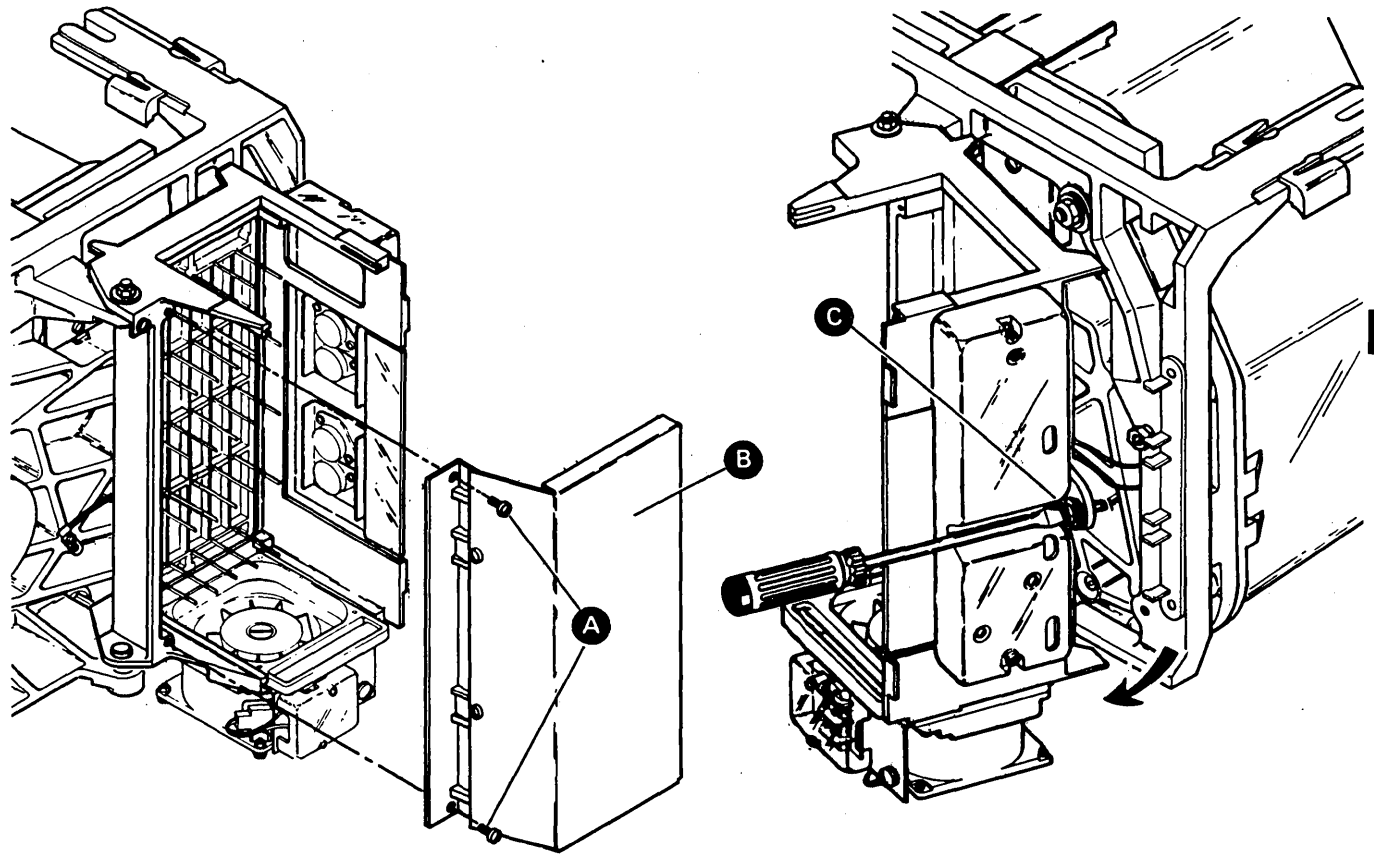
Removing the Card Gate

1. Set Power to O (operator panel).

2. Remove the two cable clamp screws **B** and remove the cable clamp and the attached card gate cover **C**.

3. Turn the screw **D** counterclockwise and open the card gate.

4. Disconnect the cables (A2, A3, A4, and A5). If this is the only or last disk drive, A4 contains a terminator card.

5. Remove the screw **A** and disconnect the ground wire from the card gate.

6. Loosen the screws in the board retainers **J** to release the actuator cable.

7. Disconnect the voltage connectors **H** (VC1, VC2, VC3, VC4, VC5, and VC9).

8. Remove the two screws **E** and the cover **F** from TB2 and disconnect the AC supply wires.

9. Remove the top pivot nut **G** and lift the card gate off the disk enclosure.

Reinstalling the Card Gate

1. Locate the card gate on its pivots (top pivot first) and lower into place.

2. Reinstall the top pivot nut **G** and tighten.

3. Connect the voltage connectors **H** (VC1, VC2, VC3, VC4, VC5, and VC9).

4. Place the actuator cable under the two board retainers **J** and tighten the screws.

5. Attach the ground wire to the card gate and tighten the screw **A**.

6. Plug in the cables (A2, A3, A4, and A5). If this is the only or last disk drive, A4 contains a terminator card.

7. Close the card gate and tighten the screw **D**.

8. With the cables in position, use the two screws **B** to reinstall the cable clamp and the attached card gate cover **C**.

9. Connect the AC supply wires to TB2, reinstall the two screws **E** through the cover **F**, and tighten the screws.

10-180
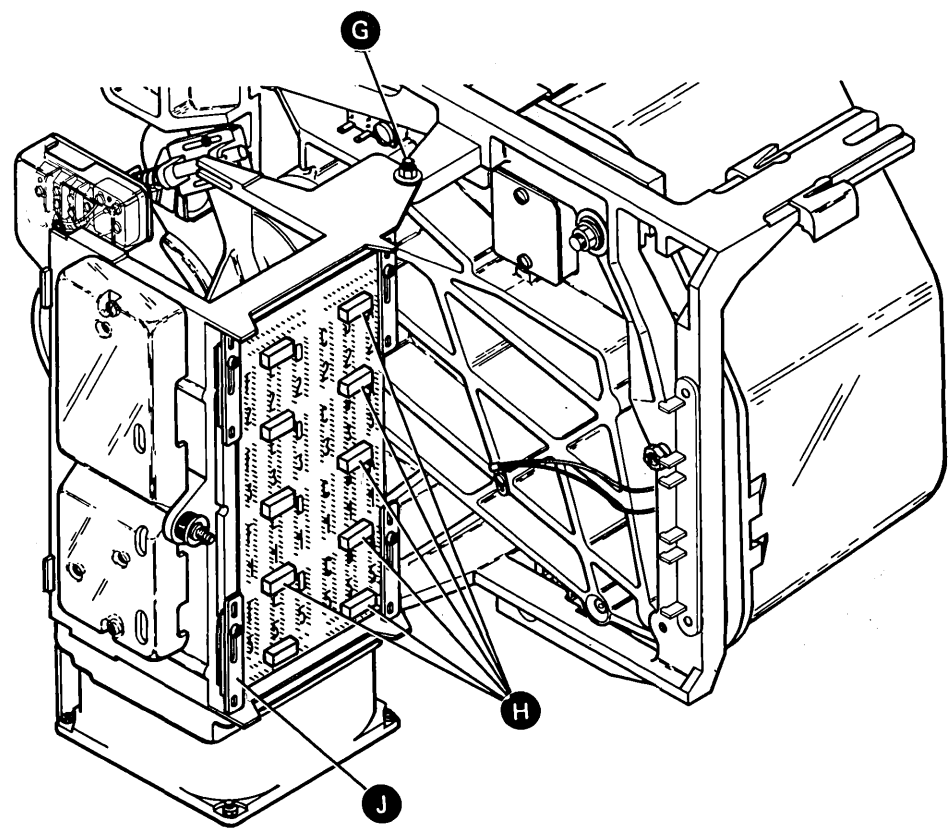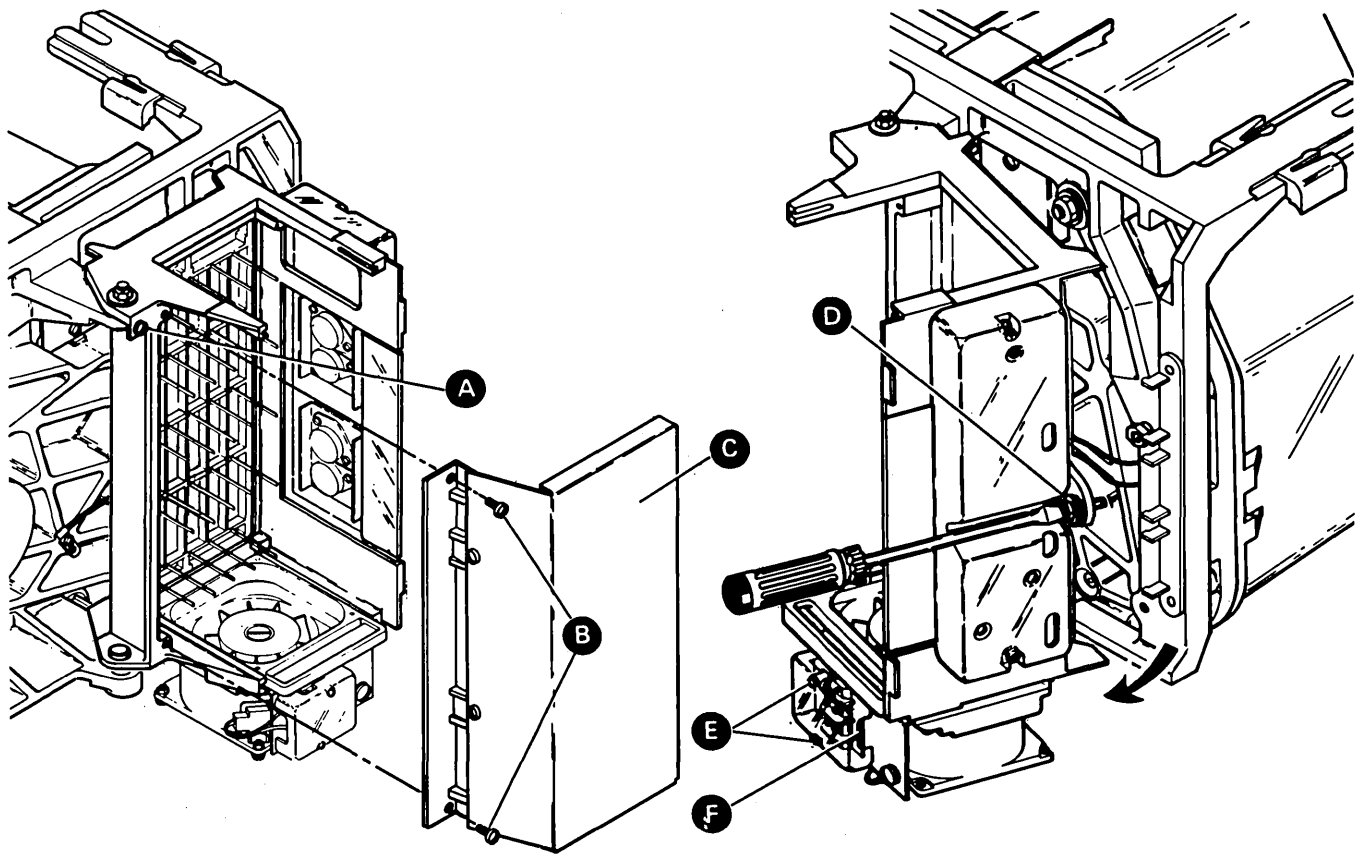
10-190   CHECKS AND ADJUSTMENTS

The following are the check and adjustment procedures for the 62PC disk drive:

- Brake Assembly

- Drive Belt Tension

- Drive Motor Thermal (50 and 60 Hz)

- Voltages

Brake Assembly

1. Set Power to 0 (operator panel).

2. Loosen the two screws **D** and **F** and remove the belt guard **E**.

3. Check for a 0.25 millimeter (0.010 inch) gap **B** between the armature casting and the solenoid.

4. Adjust the brake if necessary.
   a. Loosen the two holding screws **A**.
   b. Place a 0.25 millimeter (0.010 inch) gauge **B** between the armature casting and the solenoid, slide the brake assembly toward the disk enclosure spindle pulley **C**, and tighten the two holding screws **A**.
   c. Remove the gauge **B**.
   d. Reinstall the belt guard **E** and tighten the two screws **D** and **F**.
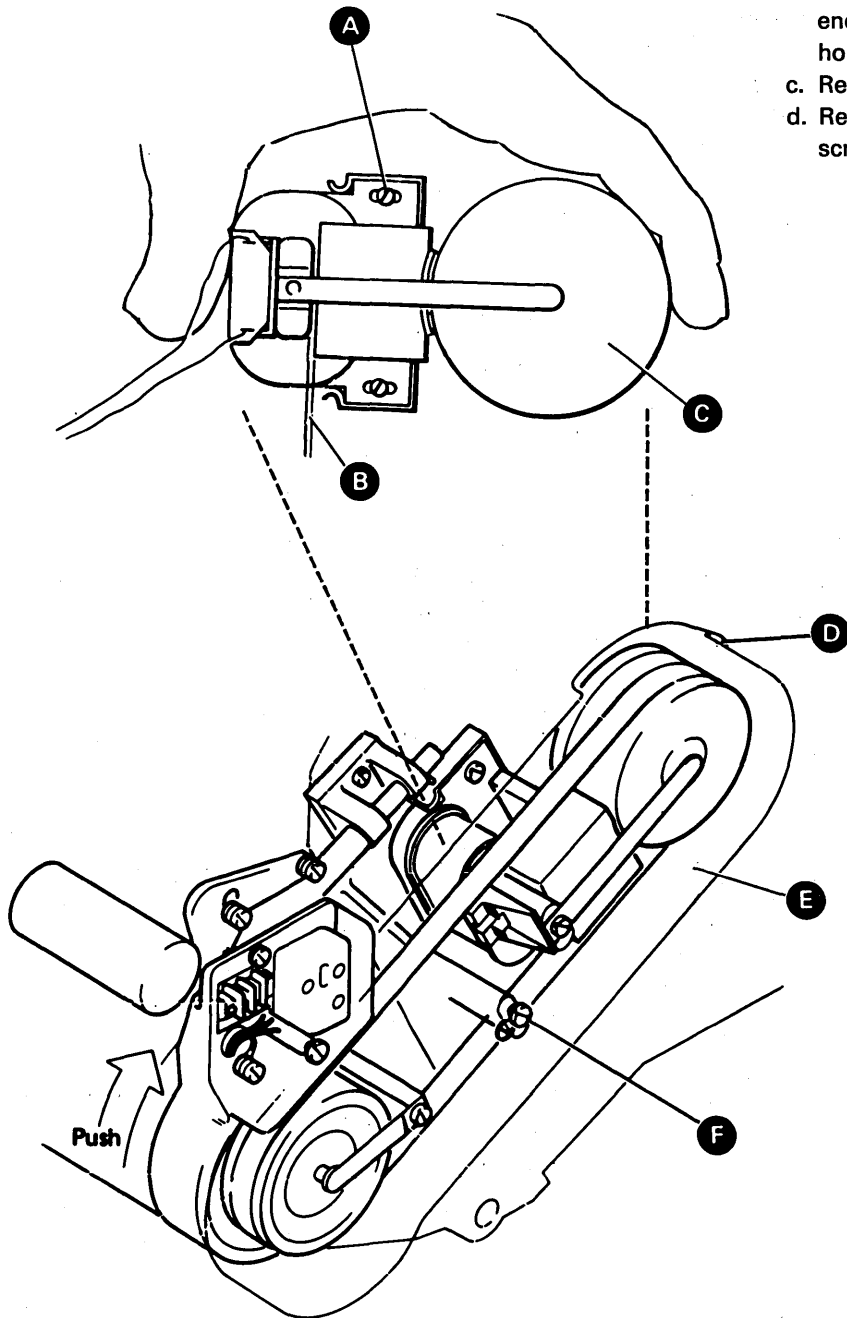
Push

Drive Belt Tensioner

1. Set Power to O (operator panel).

2. Lift the motor against the belt tensioner spring **G**. When the pin **D** in the shaft **H** is free of the opening **C**, turn the shaft 90 degrees to hold the spring, and lower the motor.

3. Check for no gap at **F**.

4. Adjust the belt tensioner if necessary.
   a. With the pin in the shaft holding the belt tensioner spring, (step 2 above), loosen the two screws **B**.
   b. Locate the belt tensioner with no gap at **F** and tighten the two screws **B**.
   c. Lift the motor against the belt tensioner spring **G**, turn the shaft **H** 90 degrees to place the pin **D** in the opening **C**, and lower the motor.

   Note: The belt tensioner bracket **A** must overlap the motor bracket **E** as shown.
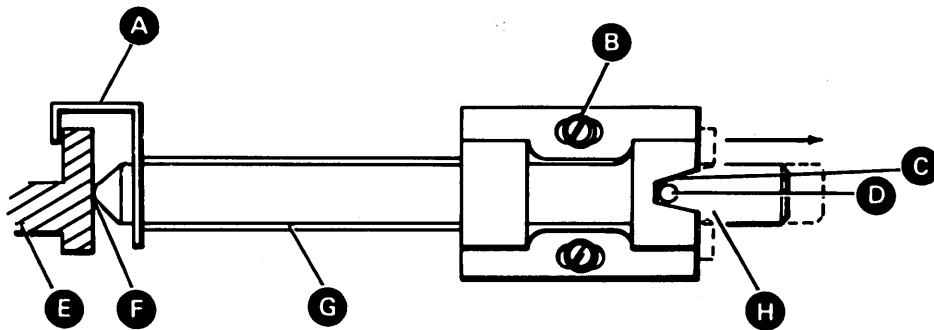
Drive Motor Thermal

The disk drive motor has a thermal to prevent
overheating.

CAUTION
Set Power to O (operator panel) before pressing the
thermal reset.

Press the thermal reset **(A)** to reset the motor.

60 Hz Motor
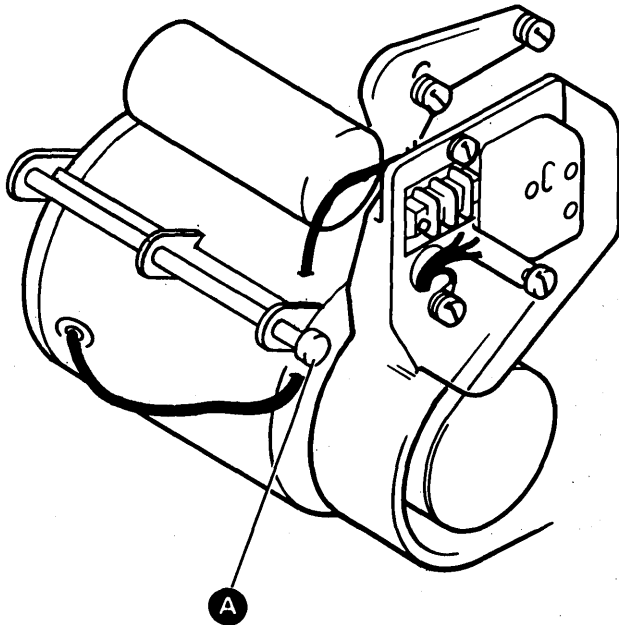
50 Hz Motor
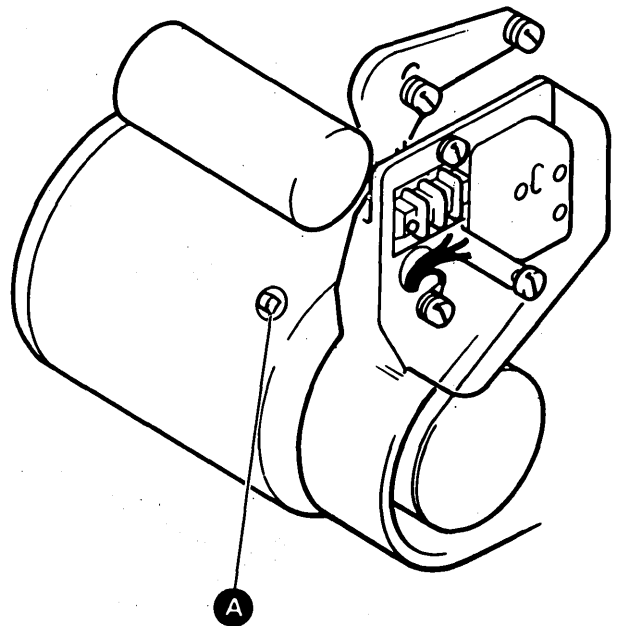
Voltages

1. Set Power to O (operator panel).

2. Turn the screw **Ⓐ** counterclockwise and open the card gate.

3. Set Power to I (operator panel).

4. Use the following charts for the locations to check the voltages.

5. Set Power to O (operator panel).

6. Close the card gate and tighten the screw **Ⓐ**.
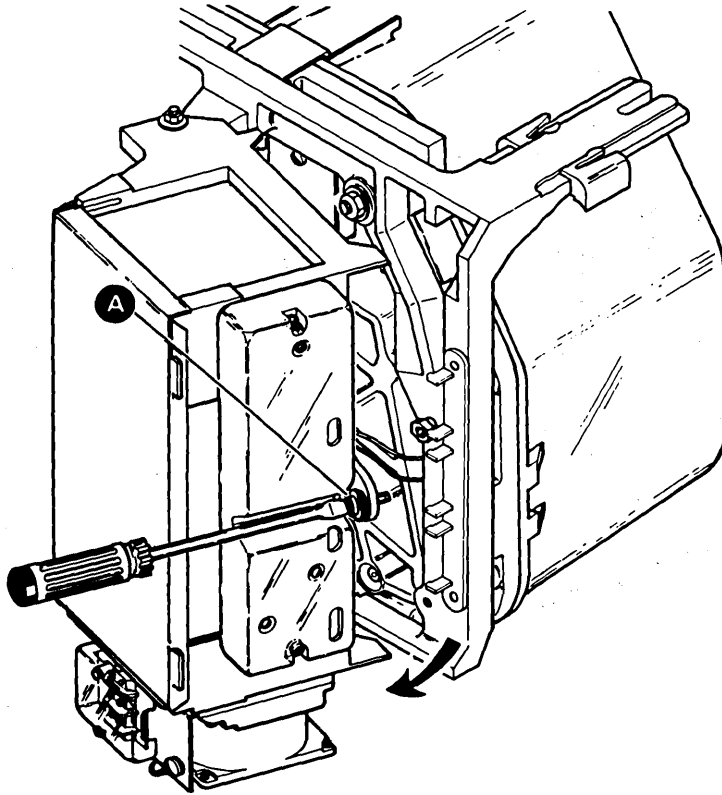
62PC Voltages Supplied by the System/34

Card Name	Card Plug Position	Voltage (±10%)**						
		-12	-4	+5	+12	+24	+24 Gnd	+24 Brake Applied
Data Channel	B2	D12	B06 G06 M06 S06	D03 J03 P03 U03	B11			F14
Logic 1	C2	D12		D03 J03 P03 U03	B11			
Logic 2	D2	D12		D03 J03 P03 U03	B11			
Servo 1	E2	D12 P12 U12	B06 G06 M06 S06	D03 J03 P03 U03	B11 M11 S11			
Servo 2	F2	D12 J12 P12 U12	B06 G06 M06 S06	D03 J03 P03 U03	B05 G11 M11 B11 S11	G02	S09	

Cable Name	Card Plug Position	Voltage (±10%)**						
		-12	-4	+5	+12	+24	+24 Gnd	+24 Brake Applied
Actuator	A2		D06					
Bus In	A3							
Bus Out*	A4			D03				
Dedicated	A5							

*Contains a terminator card if this is the only or last disk drive.

**Voltages on this chart are measured on the disk drive boards (E-A1 for disk drive A, E-B1 for disk drive B, E-C1 for disk drive C, and E-D1 for disk drive D).

62PC Voltages Supplied by the 62PC

Card Name	Card Plug Position	Voltage (±10%)**		
		-8	-7	+6
Data Channel	B2			B12
Logic 1	C2			
Logic 2	D2			
Servo 1	E2		D10	
Servo 2	F2	S04	D10 J10 P10 U10	

Card Name	Card Plug Position	Voltage (±10%)**		
		-8	-7	+6
Actuator	A2	B10 B12 D09 D13		D03
Bus In	A3			
Bus Out*	A4			
Dedicated	A5			

*Contains a terminator card if this is the only or last disk drive.
**Voltages on this chart are measured on the disk drive boards
 (E-A1 for disk drive A, E-B1 for disk drive B, E-C1 for disk drive
 C, and E-D1 for disk drive D).

Voltage Cross-Over Cable Locations
(Pin Side)

Note: All four jumpers may not be present.

62PC Disk Drive Board (E-A1, E-B1, E-C1, or E-D1)
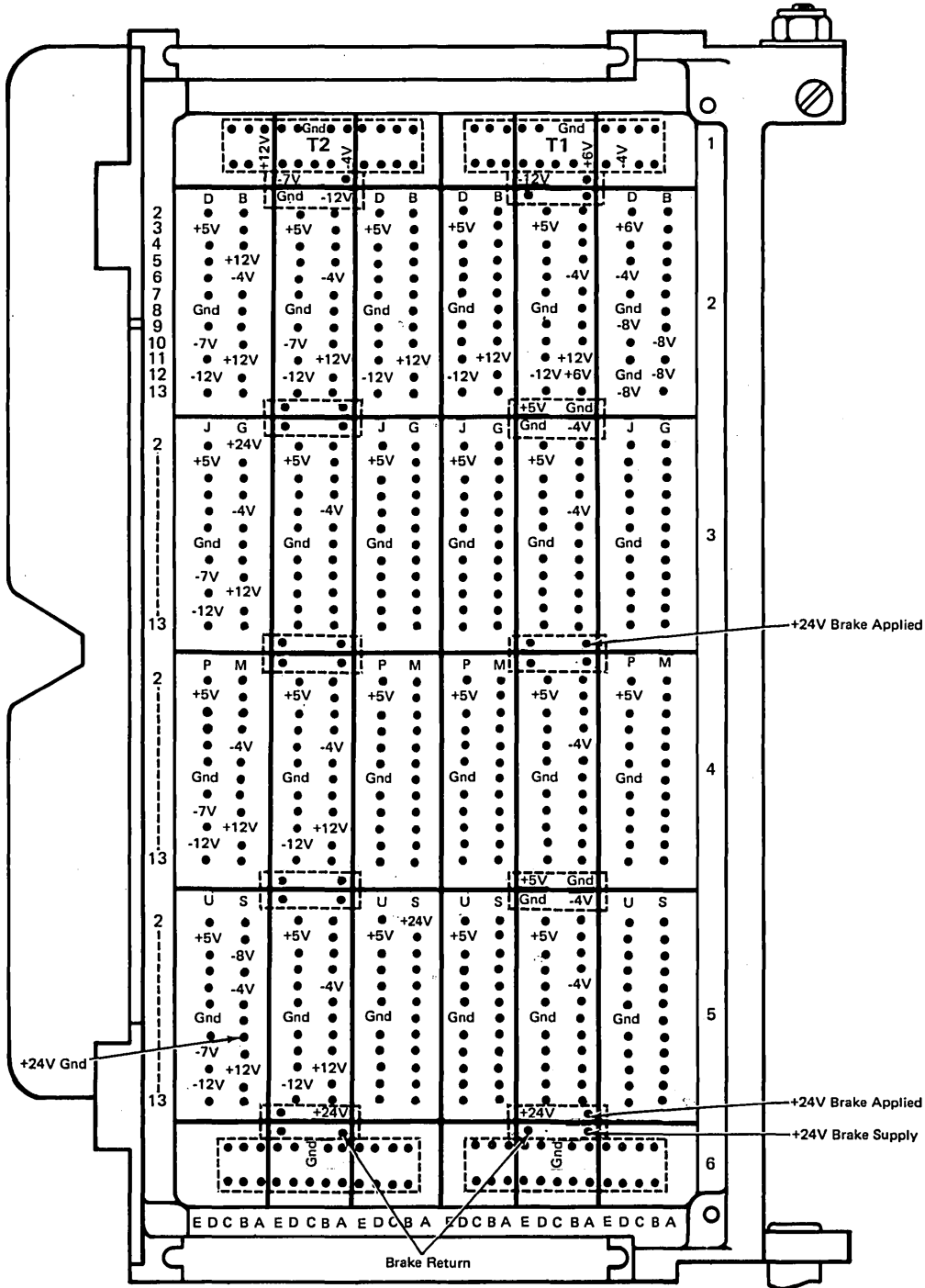
Voltage Pin Locations
(Pin Side)

+24V Brake Applied

+24V Gnd

+24V Brake Applied
+24V Brake Supply

Brake Return

EDCBA EDCBA EDCBA EDCBA EDCBA EDCBA

Brake Cable
+24V
+24V
+12V   } From Power Supplies
+5V
-4V
-12V

—Power Good—From power supply logic
Ground—From power supply logic
—Brake Applied—To power supply logic

TB1

AC Cable
to the
Drive Motor

AC Cable to the
Cooling Fan
The AC voltage to the fan is present even when
the drive motor is off. This provides cooling for
the cards.

Card Gate Assembly

Card Position	Card Name
B2	Data Channel
C2	Logic 1
D2	Logic 2
E2	Servo 1
F2	Servo 2

Bus Cable

Drive	From
A	A-A2A5
B	E-A1A4
C	E-B1A4
D	E-C1A4

Bus Cable

Bus Cable: This cable goes to the next drive.
If there is no next drive, A4 connector of
last drive contains a terminator card.

Dedicated Cable

Dedicated Cable

Drive	From		Last Drive	Terminator
A	A-A2A4		A	E-A1A4
B	A-A2Z1		B	E-B1A4
C	A-A2B4		C	E-C1A4
D	A-A2B5		D	E-D1A4

Line Name

	Line Name
B02	—Chip Select 3
B03	Head Select A
B04	Head Select B
B05	—Chip Select 2
B06	Chip Select 1
B07	Mars Safety
B08	Center Taps
B09	Not Used
B10	Servo Center Tap
B11	—8 Volt (Servo Write Current)*
B12	—8 Volt (Servo Write Data A)*
B13	+ Data Select Gated
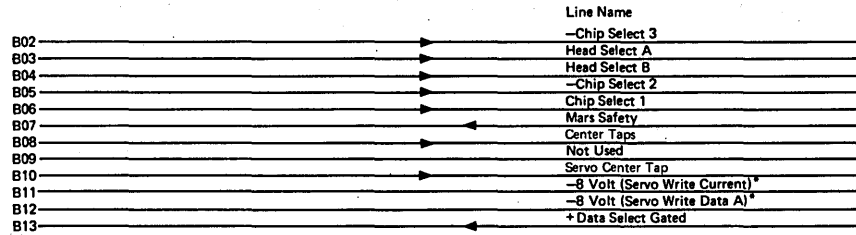
Disk Enclosure Cable
E-A1A2
(see Note)

A2

2
13
D B

To Disk Enclosure
(through base casting)

Line Name

	Line Name
D02	+ Data Select Gated
D03	+6 Volts
D04	Actuator I/O Line A
D05	Actuator I/O Line B
D06	—4 Volts
D07	Write Current
D08	Ground
D09	—8 Volts
D10	+Servo Preamp Out
D11	—Servo Preamp Out
D12	Ground
D13	—8 Volts (Servo Write Data B)*
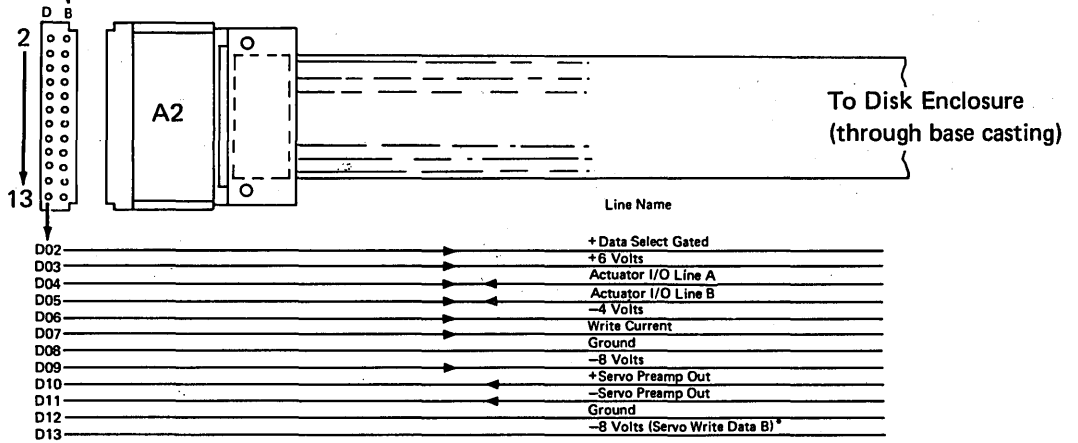
*Plant use only

Note: If drives B, C, or D are installed, the
line names are the same, but the board loca-
tions are E-B1, E-C1, and E-D1.

A-A2C2 and A-A2D2 (common adapter)
These cards are connected by four top
card connectors (see Note).

A-A2E2 (channel adapter)

Dedicated Cable to Drive A
—Missing Sector Pulse   To Adapter
—Control Sample   From Adapter
—Interface Driver De-gate   From Adapter
—Index   To Adapter
—Sector   To Adapter
—Data Select   From Adapter
—Write   From Adapter
—Read   From Adapter
—Write Data   From Adapter
—Fast Sync   From Adapter
—Reset Error   From Adapter
—Write Clock   To Adapter
—Read Clock   To Adapter
—Interrupt   To Adapter
+NRZ Data   To Adapter

Bus Cable to Drive A
—Tag Bus   3 lines   From Adapter
—Tag Parity   1 line   From Adapter
—Control Bus   8 lines   From and to Adapter
—Control Parity   1 line   From and to Adapter
—Control Sample   1 line   To Adapter
  Received

A

B

or

B
Dedicated Cable to Drive B (if attached)

B
Dedicated Cable to Drive C (if attached)

B
Dedicated Cable to Drive D (if attached)

B

A-A2

10

22   02

33   13

W

X

Y

Z

Top Card Connector

Note: The top card connectors on the common adapter
are not interchangeable with the top card connectors
on the line printer, work station, or 1255 magnetic
character reader attachments.

10-200

62PC Disk Drive   41

Top Card Connectors
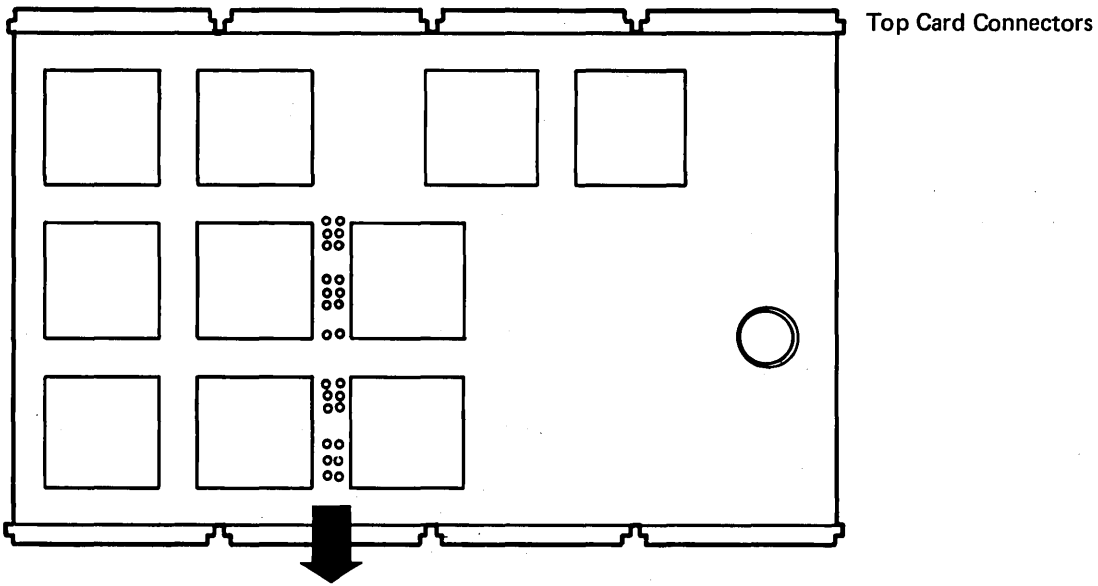
Install the jumpers as shown below:

For a 65-megabyte system:

For a 130-megabyte system:

For a 195-megabyte system:

For a 260-megabyte system:
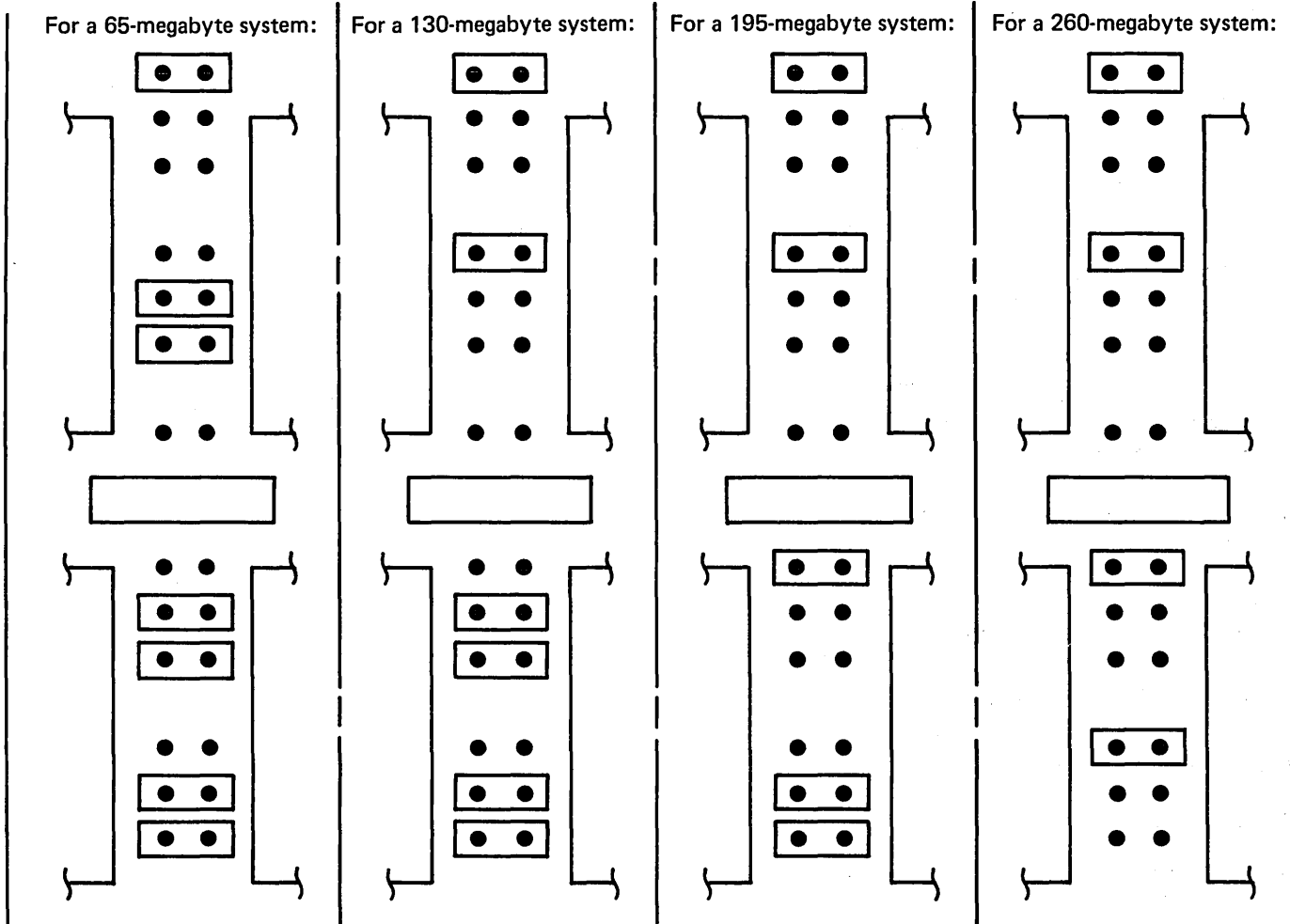
10-220 DRIVE ASSEMBLIES C AND D

Removal

CAUTION
Do not turn the disk spindle counterclockwise; you may damage the disk and head.

_____

_____

_____

1. Set Power to O (operator panel).

    Note: Steps 2, 3, and 4 may already have been completed.

2. Turn the screw **A** counterclockwise and open the card gate.

3. Turn the actuator lock knob **B** clockwise (through 120 degrees) until the actuator lock reaches its stop to lock the actuator.
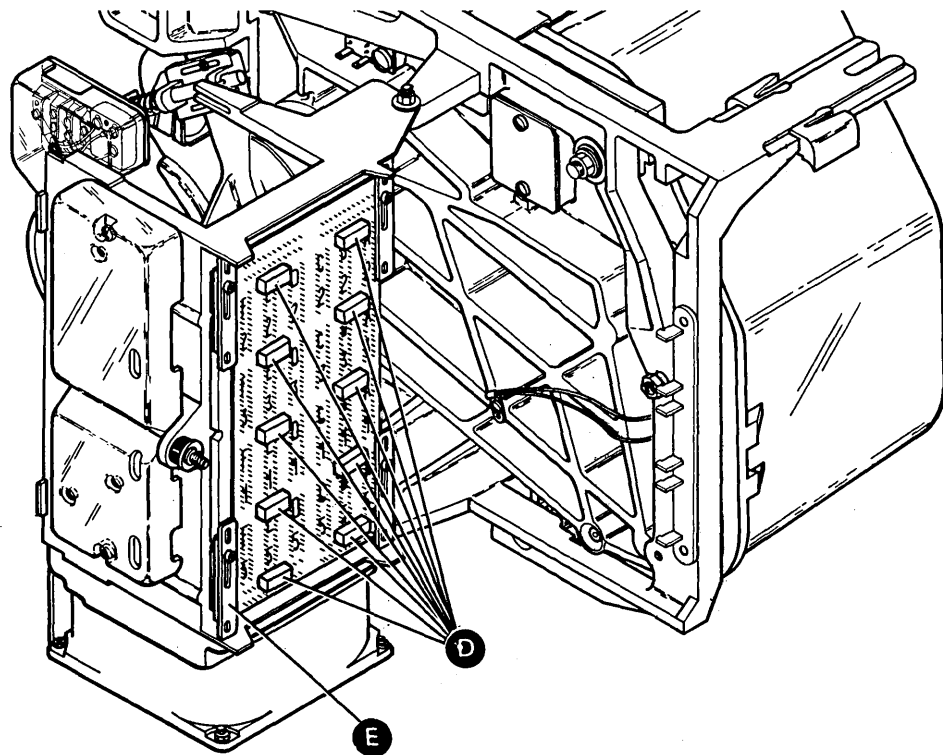
4. Remove the two cable clamp screws **C** and remove the cable clamp and the attached card gate cover **D**. Keep the clamp, cover, and screws.

5. Disconnect the cables (A3, A4, and A5). If this is the only drive or the last drive, A4 contains a terminator card.

6. Remove two screws **E** and the cover **F** from TB2 and disconnect the AC supply wires. Disconnect ground lead from screw **G**.

7. Remove screw **H** and cover **J** from TB1. Disconnect system AC wires from TB1 and ground wire from screw **K**.

8. Remove screws, washers, star washers, and nuts **L**.

    DANGER*
    The disk drive assembly weighs 16 Kg (35 pounds). Clear a space for the disk drive assembly before removing it from the machine.

    _____

    _____

    _____

    _____

9. Remove disk drive assembly from rear of machine and set in a clear area.

Replacement

1. Lift and insert disk drive assembly from rear of machine.

2. Reinstall four screws, eight washers, two star washers, and four nuts **L**.

3. Connect ground wire to screw **K** and two system AC wires to TB1.

4. Reinstall cover **J** over TB1 with screw **H**.

5. Connect ground wire to screw **G** and two system AC wires to TB2.

6. Reinstall cover **F** to TB2 with two screws **E**.

7. Connect cables (A3, A4, and A5). If this is the only drive or the last drive, A4 contains a terminator card.

8. Put the cables in position and reinstall cable clamp and attached card gate cover **D** with two screws **C**.

9. Turn actuator lock knob **B** counterclockwise (through 120 degrees) until the actuator lock reaches its stop.

10. Close the card gate and tighten screw **A**.

10

For Drives C and D Only

10-220
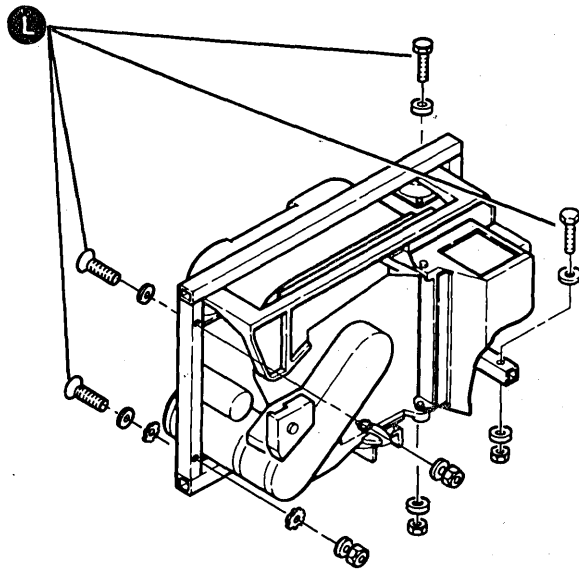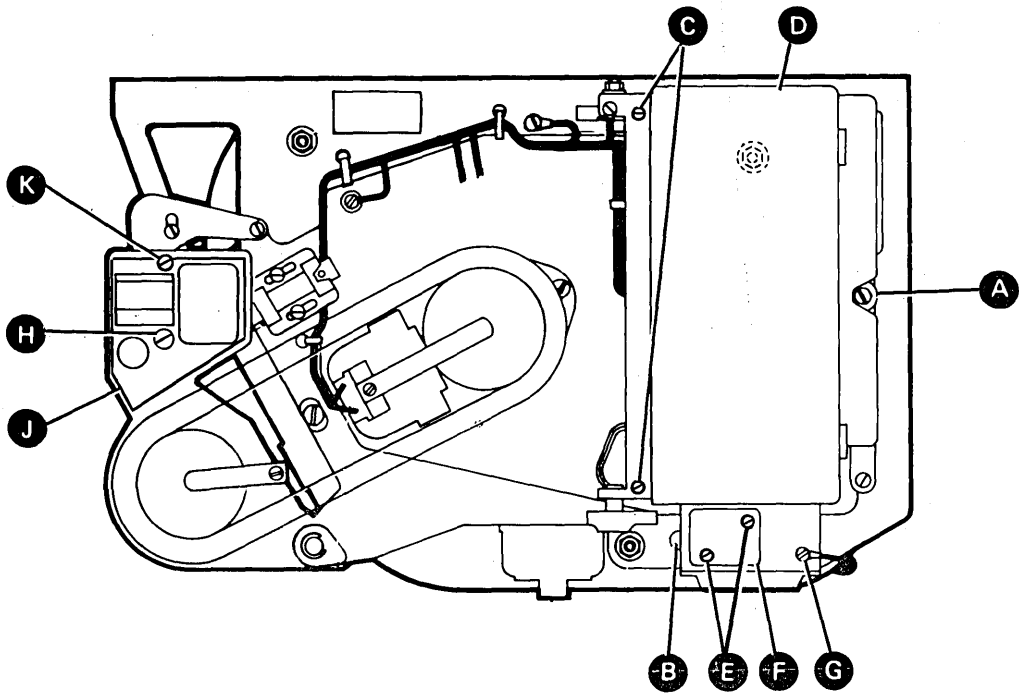
10-400   MAP SCOPE PICTURE 1
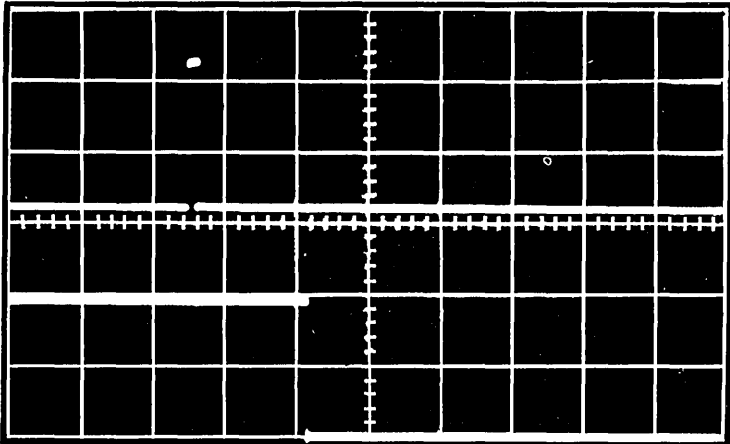
D2J09 + Shift Reg Clock

D2J10 + Enable Sample Servo

10

10-410   MAP SCOPE PICTURE 2
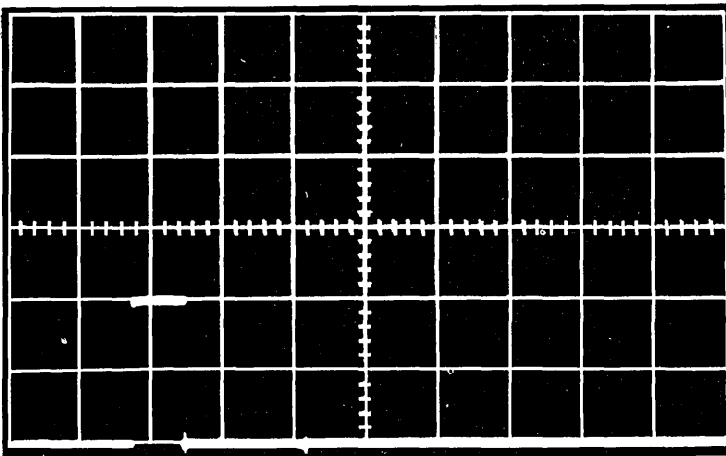
D2U13 + Enable Mark Detect

10-420   MAP SCOPE PICTURE 3
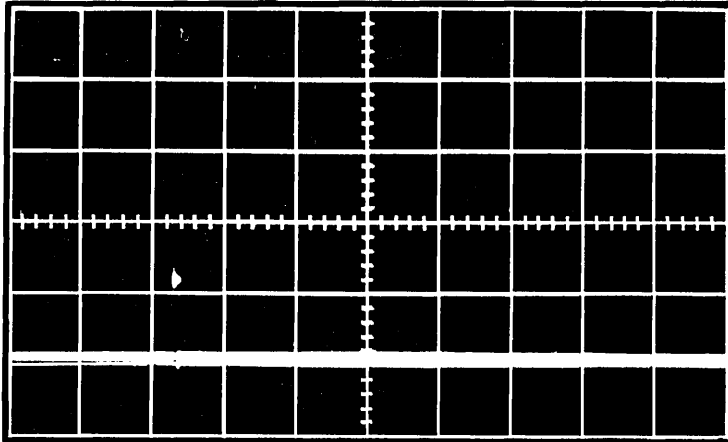
E2G03 + Servo Inhibit VCO

10-430   MAP SCOPE PICTURE 4
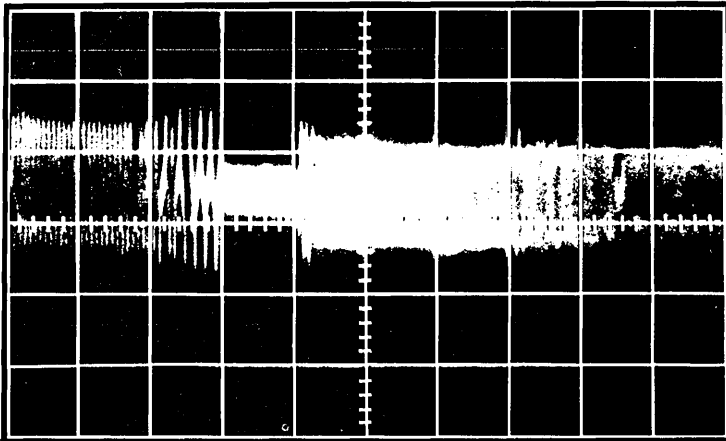
E2B03 Buffered Analog Data A

10-440   MAP SCOPE PICTURE 5
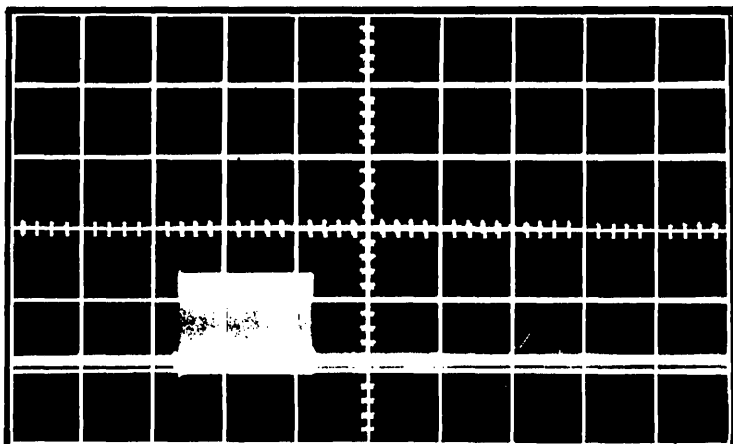
E2G08 + Data Servo 2F Burst

10-450   MAP SCOPE PICTURE 6
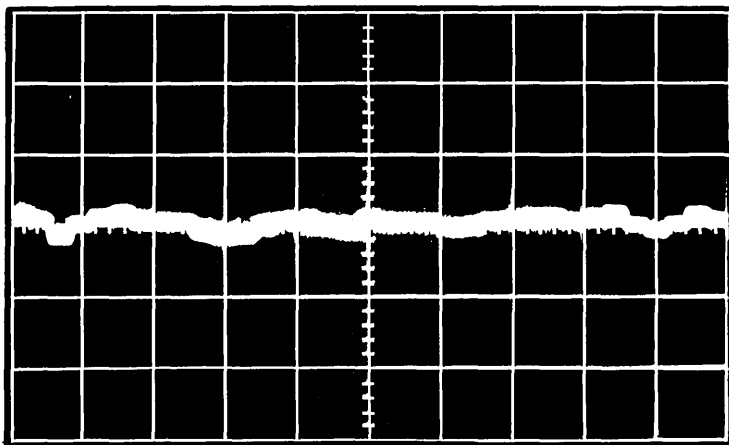
E2B13 Data PES
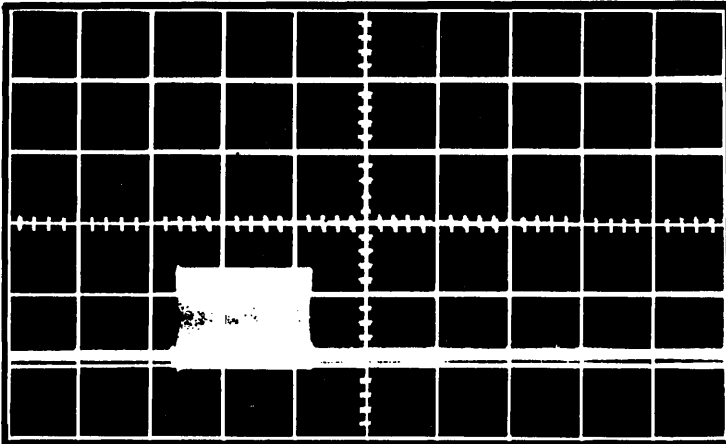
E2G03 + Servo Inhibit VCO

10-470   MAP SCOPE PICTURE 8
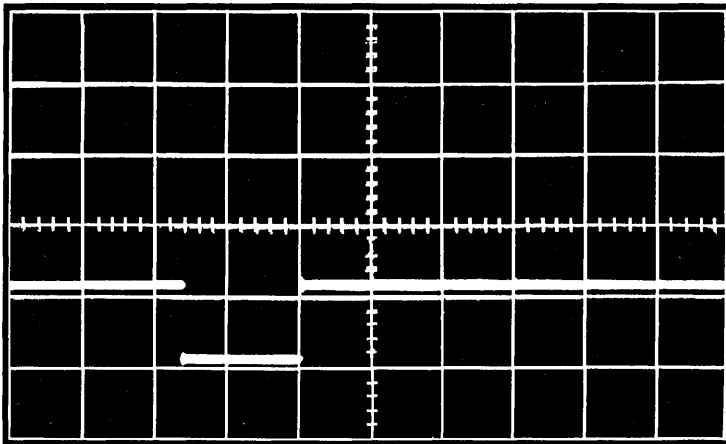
E2J05 — Counter Run

CONTENTS

10

11-010   INTRODUCTION

The work station attachment on each System/34 controls up to eight work stations; a work station being either a 5251 (Model 1 or 11) or 5252 Display Station or a 40, 80, or 120 character per second 5256 Printer. The primary work station for each System/34 must be a 5251 Display Station; it is the system console. See Figure 11-4 for several examples on how work stations can be attached to System/34.

11-100   LOCATIONS

All parts for the work station attachment are located on the A-gate, A2 board. As Figure 11-1 shows, the parts include six cards (A-A2R4 is optional), four top card connectors, and one cable. For a description of the top card connectors, see paragraph 11-300.
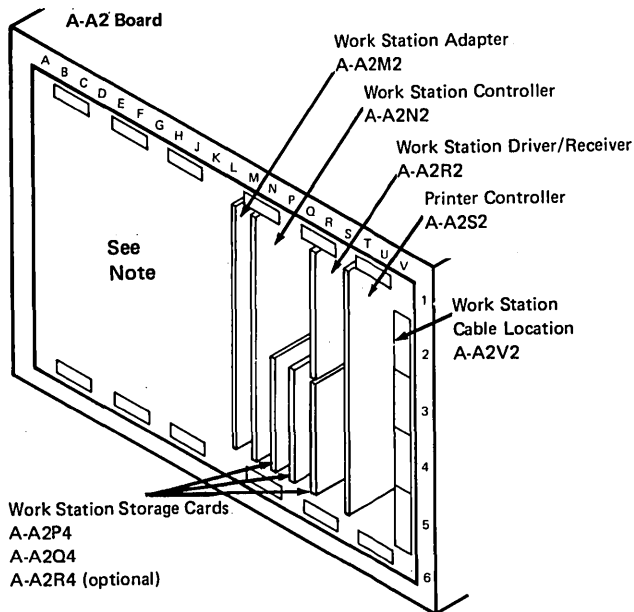
Note: The top card connectors are not shown.

Figure 11-1. Work Station Attachment Card Locations

The location of the six cards and the hardware on each card are:

- Work Station Controller Card (A-A2N2)
  - 4-bit ALU
  - 4-bit A and B registers
  - 16 4-bit data address registers
  - 16 4-bit primary work registers
  - 16 4-bit auxiliary work registers
  - 16-bit op register
  - 16-bit storage address register (The SAR bits are numbered XSAR 0 through 3 and SAR 0 through 11.)
  - 16-bit instruction address register
  - 2K bytes of controller random access storage
  - Control logic: Includes controller load logic, controller interrupt logic, and miscellaneous control lines between the controller and adapter cards.

- Work Station Adapter Card (A-A2M2)

  Since all commands and data must pass through the adapter card, there are three important functions to the adapter card. These functions and the hardware for each are:
  - Channel
      Data bus out (DBO), data bus in (DBI), command bus out (CBO), command bus in (CBI)
      Base cycle steal
      Interrupt level 4 generation
      I/O instruction decode
  - Controller
      Controller data bus out (CDBO), controller data bus in (CDBI), and controller command bus out (CCBO)
      Controller status and control latches
      Controller I/O instruction decode
  - Driver/receiver controls
      SERDES and SERDES controls
      Modulator/demodulator
      Cable address register
        (driver/receiver selection)

- Driver/receiver card (A-A2R2)
  The driver/receiver card can drive up to eight work stations. This card has the following functions:
  - Driver/receiver circuits
  - Driver/receiver activity register
  - Cable selection decode
  - Controller 16-MHz oscillator
  - Receive clock generation

- Storage cards (A-A2P4 and A-A2Q4)
  These cards are needed on each system; they contain additional controller storage. An optional type A-A2Q4 card is available; it contains additional storage.

- Feature storage card (A-A2R4)
  This card is needed on systems having any work station controller features.

11-200   MAINTENANCE

Because of the parts (cards, top card connectors, and cable) that make up the work station attachment, there are no adjustment, removal, or replacement procedures. Any maintenance performed on the attachment needs a failing part exchanged. For locations of all the parts, see Figures 11-1 through 11-3.

Line Quality

There is a service check that should be performed if the quality of the line signal is in question. To perform this service check, see *Cable Quality Check*, paragraph 11-500.

Work Stations

For maintenance information on the work stations, see the *IBM 5251 Display Station Maintenance Information Manual*, SY31-0461 and the *IBM 5256 Printer Maintenance Information Manual*, SY31-0462.

11-300   TOP CARD CONNECTORS

Figure 11-2 shows the location of all top card connectors on the work station attachment cards. Notice that the 3-wide connectors (on the N2, P4, and Q4 cards) are marked W and X on the P4 and Q4 cards but the same connectors are marked Y and Z, respectively, on the N2 card. (Card connectors are always marked W, X, Y, and Z for 4-wide cards; they are marked W and X for 2-wide cards.)

Also notice that only some of the pins on the top card connectors are accessible for scope probing. These pins are on the outside two rows of the 2-wide and 3-wide connectors. The row of pins on the right side of the connector is numbered 02 through 13; the pins on the left side of the connector are numbered 22 through 33.

As an aid for identifying pin locations on each card connector, several pin locations are shown in Figure 11-2.

11
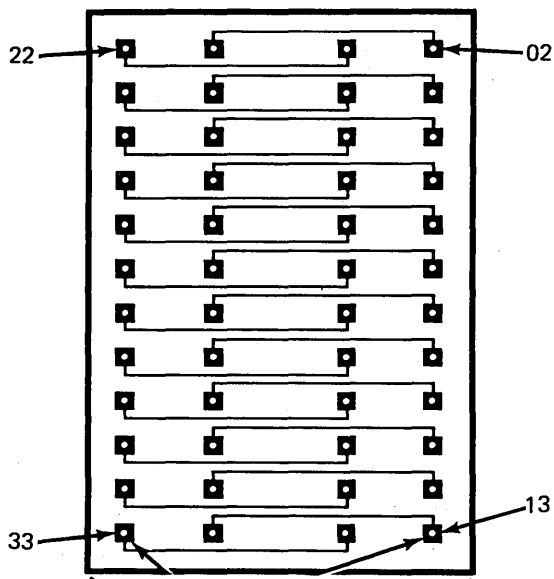
Note: The optional feature storage card in A-A2R4 is not shown in this figure. If this card is installed, the two 3-wide top card connectors are exchanged with two 4-wide top card connectors.

Note: Only the outside two rows of pins on the top card connectors can be probed.

Adapter Card
A-A2M2

Controller Card
A-A2N2

Storage Card
A-A2P4

Storage Card
A-A2Q4

Work Station Control
Expansion A or B
(feature) A-A2R4

A-A2M2W22

A-A2N2W02

A-A2M2W22

A-A2N2W11
    Connected to
A-A2M2W11

A-A2N2Y33
    Connected to
A-A2P4W33
    Connected to
A-A2Q4W33
    Connected to
A-A2R4Y33

A-A2R4X04
    Connected to
A-A2Q4X04
    Connected to
A-A2P4X04
    Connected to
A-A2N2Z04
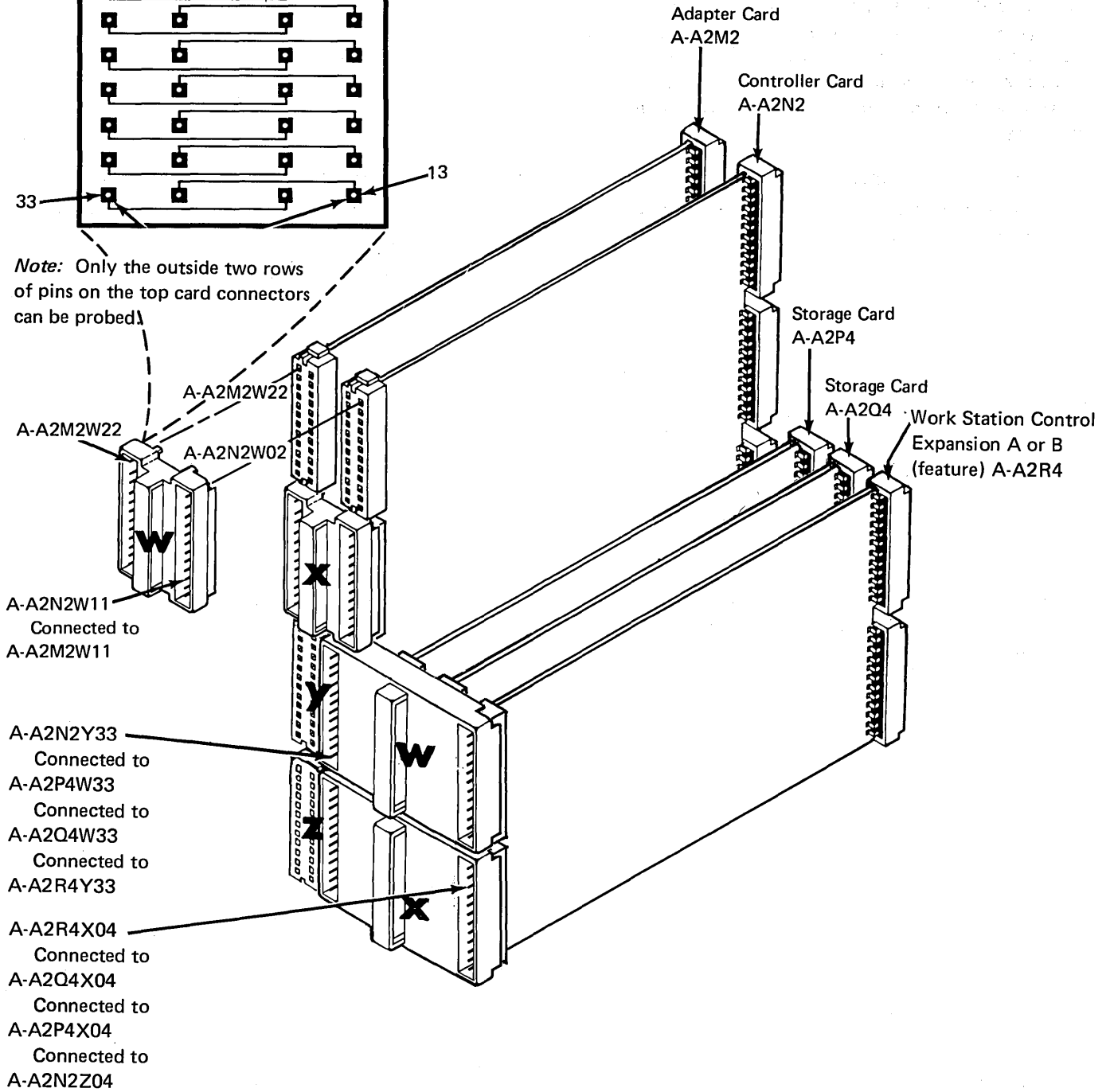
Figure 11-2. Work Station Attachment Top Card Connectors

4

11-400   CABLES

A cable is needed to attach the work stations to the
A-A2 board on System/34; it is connected from the
A-A2V2 socket to the work station cable entry tower.
Another cable (twinaxial cable) is connected from the
cable entry tower to the work stations. The ports on the
cable entry tower are numbered 0 through 3. Port 0 is
always used for the system console *only*. Ports 1
through 3 are used to attach a total of seven (a total of
15 if work station control expansion B is installed)
additional work stations to System/34. Figure 11-4
shows two ways in which work stations can be attached
to the system.

Note: Seven work stations can be attached to any of
the ports 1 through 3 for systems without work station
control expansion B.

The internal cable
to the four work
station connectors
is connected to
the A-A2V2
socket.

Port 0 (D-A1)
Cable Address is 0

Port 2 (D-A3)
Cable Address is 2

Port 1 (D-A2)
Cable Address is 1

Port 3 (D-A4)
Cable Address is 3
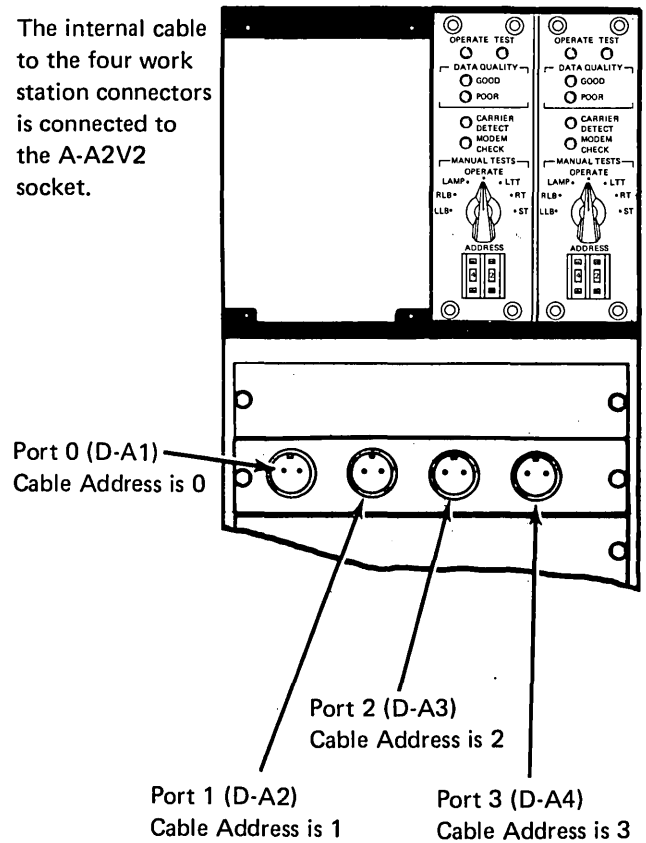
Figure 11-3. Cable Entry Tower

System
Console

Cable Positions on
Cable Entry Tower

System
Console

Cable Positions on
Cable Entry Tower
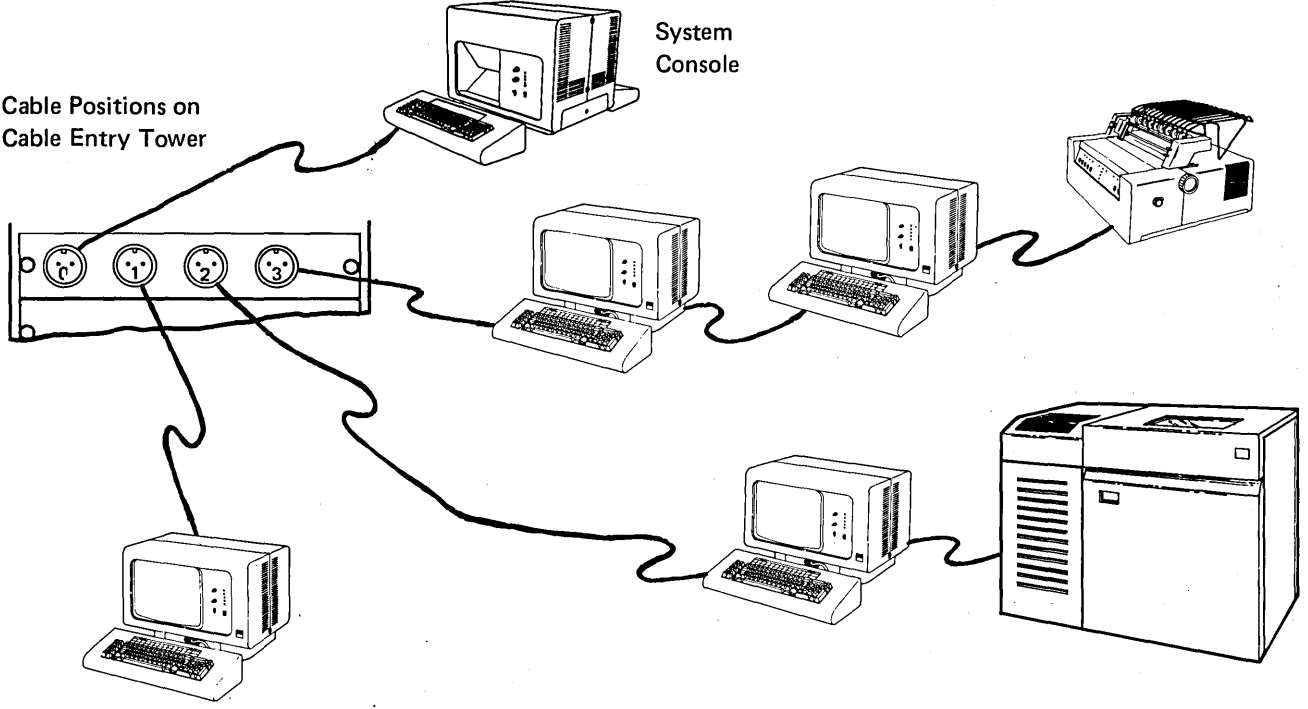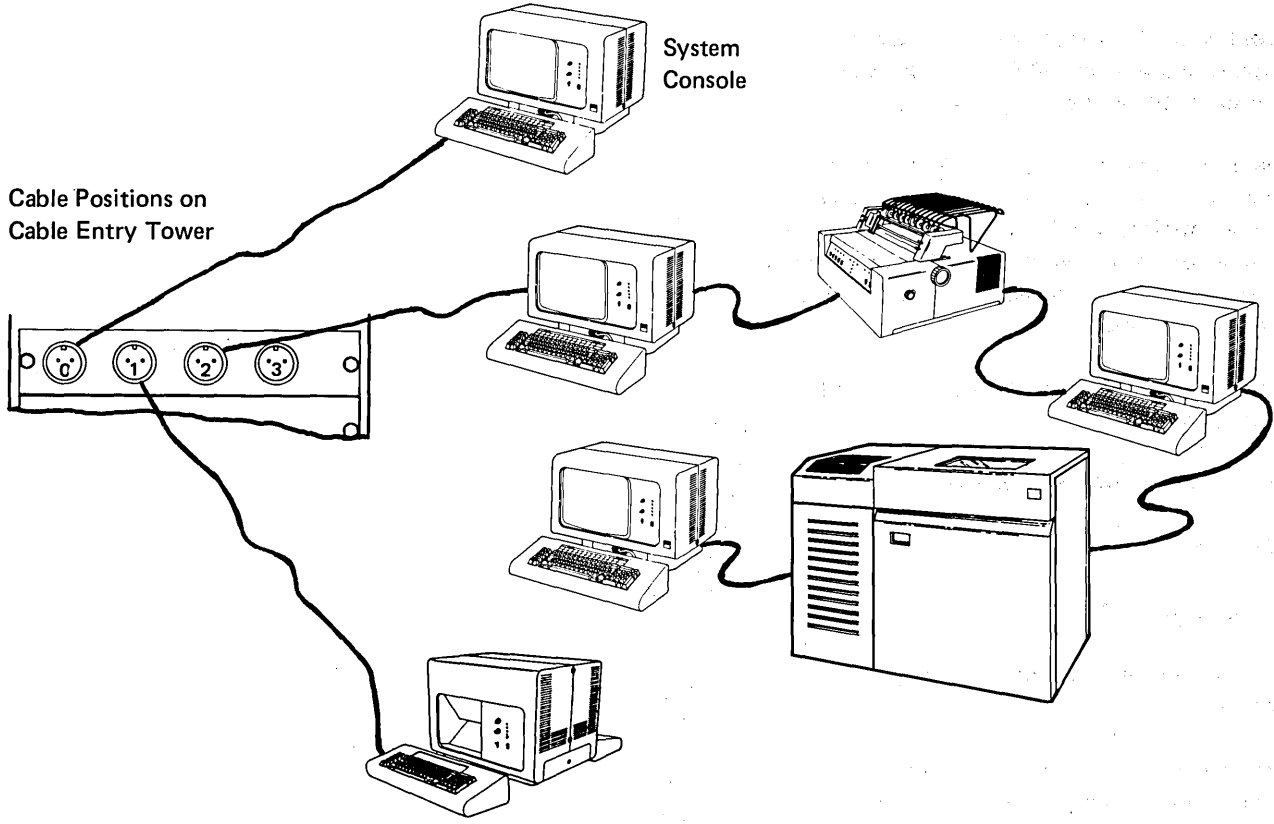
Figure 11-4. Work Station Configurations

11-500   CABLE QUALITY CHECK

A cable continuity check that does not need an
oscilloscope is available in MAPs 1181 through 1184.
Use these MAPs before using the cable quality check.

The following paragraphs aid you in determining if there
is a problem in a cable, a cable connection, or an
attached work station. The information will also help
you determine where the problem is. The most common
problems are open circuit cables, short circuit cables, or
poor cable connections.

To make this cable quality check, you will need the
following (or similar):

- Tektronix[1] 453 or 454 oscilloscope

- BNC T-connector

- Coaxial cable with BNC ends

- Times-1 (X1) probe with ground lead and two
  alligator clips

- Resistor assembly (part 7362344). This resistor
  assembly is needed only if the end of the cable being
  checked is not terminated at a work station.

Note: Do not use this test procedure to check the
quality of any work done by a customer.

11

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[1]Trademark of Tektronix, Inc.

11-510   Cable Checking Introduction

If you understand the cable quality check, go to
paragraph 11-520 and perform the check. However, if
you do not understand this check, it is important that
you carefully read all of the information through
paragraph 11-515. You can use this information as an
introduction to cable checking with the use of an
oscilloscope. Additional information can be found in *An
Oscilloscope Measurement Procedure for Twisted and
Coax Cables*, S226-3913.

11-513   Typical Signals

When you use the oscilloscope to make the cable
quality check, you will probably see a scope display
similar to the following figure. This figure shows the
transmitted signal for a normal cable, and the change in
signal level that occurs if a cable has an open or short
circuit.
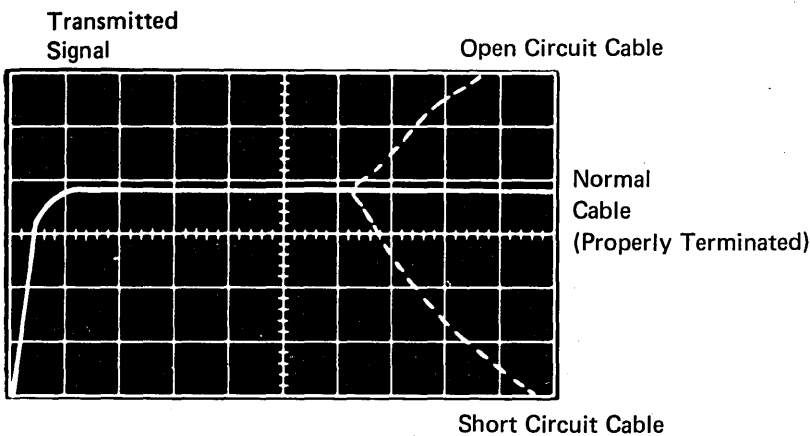
Notice that for an open circuit cable the transmitted
signal moves upward; for a shorted circuit cable the
transmitted signal moves downward. However, for a
good cable, there is usually a small change in the
transmitted signal level, or no change at all. Small
changes (less than 10 percent of the transmitted signal
level) are normal and they are probably caused by a
cable-to-cable connection or by a connector on a work
station.

Note: A change of more than 10 percent of the
transmitted signal level usually indicates a cable
problem.

Transmitted
Signal   Open Circuit Cable

Normal
Cable
(Properly Terminated)

Short Circuit Cable

11-515   *Calculating Distance to Cable Problem*

You can determine the distance to a cable problem from
the end of the cable that you are checking by using the
calculations as described in Figure 11-5.

In making the calculations, it is *important* that you:

- Calculate the distance accurately.

- Measure the time in microseconds as indicated by
  the pointer in Figure 11-5.

- Determine the time (t) by multiplying the B time base
  by the number of scope divisions.

Measure the time from the point
where the change in the signal level
just starts to change.
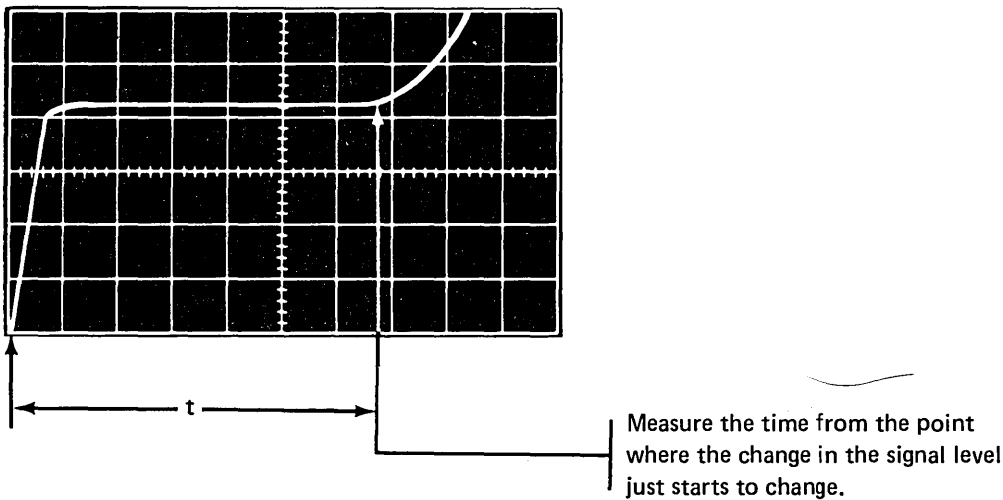
**Calculations for determining distance
in feet and meters are:**

D_f =   t (μs) X 324.7 feet D_f = distance in feet
D_m =   t (μs) X 99 meters D_m = distance in meters
                                          t = time in microseconds. To find
                                              t, multiply the B time base
                                              setting by the number of scope
                                              divisions.

The following calculation is set for the transmitted signal above (assuming
that the B time base is set for 0.2 μs).

   t = 6.8 divisions X 0.2 μs = 1.36 μs

1.36 μs X 324.7 feet = 441.6 feet

Figure 11-5. Calculating Distance to Bad Cable

11-520   Cable Quality Check Procedure

If you understand the information in paragraphs 11-500 through 11-515, you should now perform the cable quality check. Set the knobs and switches on the oscilloscope as shown in Figure 11-6. Then see Figure 11-7 and do the following:

1. Connect the T-connector to the B gate on the side panel of the oscilloscope. (The output of the B gate transmits a signal on the cable.)

2. Connect the coaxial cable from the channel 1 input to one side of the T-connector. If you have a probe-tip-to-BNC-adapter (part 453199), use a times-1 (X1) probe.

3. Connect a times-1 (X1) probe with a ground lead and alligator clips to the other side of the T-connector.

4. Connect the alligator clips to the end of the cable being checked as follows:

   • Ground lead to shield

   • Signal lead to phase Y

5. Ensure that the other end of the cable being checked is terminated. To do this do one of the following:

   • Verify that a work station without the Cable Thru feature is attached (cable is automatically terminated),
   or

   • Set the work station terminator switch to 1 on work stations with the Cable Thru feature,
   or

   • Terminate the end of the cable with a resistor assembly (part 7362344) as shown here:
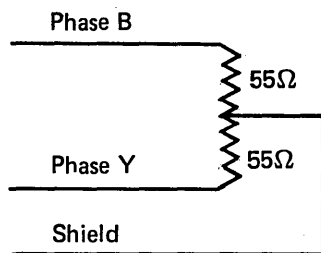
6. If the oscilloscope is connected as instructed, you should now see a signal. If the signal shows that the cable is good (no change in the signal level), you may be checking only the first 91 meters (300 feet) of a longer cable. Therefore, change the B time base from 0.1 microseconds to 0.2 microseconds, to 0.5 microseconds, and so on up to 2 microseconds. The 2 microsecond setting checks the maximum length cable of 1524 meters (5000 feet), so it is not necessary to increase the B time base to 5 microseconds.

   If the transmitted signal changes at any of the B time base settings, go to step 9.

7. If you see no change in the signal level when the B time base is set to 2 microseconds, leave the B time base on 2 microseconds and move the alligator clips as follows:

   • Ground lead to shield

   • Signal lead to phase B

   If the transmitted signal changes, go to step 9.

8. If you see no change in the signal level when the B time base is set to 2 microseconds, leave the B time base on 2 microseconds and move the alligator clips as follows:

   • Ground lead to phase Y

   • Signal lead to phase B

   If the transmitted signal changes, go to step 9. After you have checked all three possible combinations (shield to phase Y, shield to phase B, and phase Y to phase B) and there is still no change of the transmitted signal, the cable is good.

9. If there is a change of the transmitted signal, move the B time base to a setting that will let you calculate the distance to the bad cable. Use Figure 11-5 as an aid in calculating the distance, and Figure 11-8 as a reference.

   Note: If for some reason you want to check the length of a good cable, disconnect the cable from the other end. The transmitted signal will show an open circuit as shown in **C** or **D** of Figure 11-8.

Set A to 10 μs, then pull knob to unlock and set B to 0.1 μs.

Clockwise (9.5)

B starts after delay time.

TYPE 453 OSCILLOSCOPE

Delayed Sweep (B)

Off

Full

0.2 Volts

AC

CH1

Auto Trig

LEVEL to Full Counterclockwise
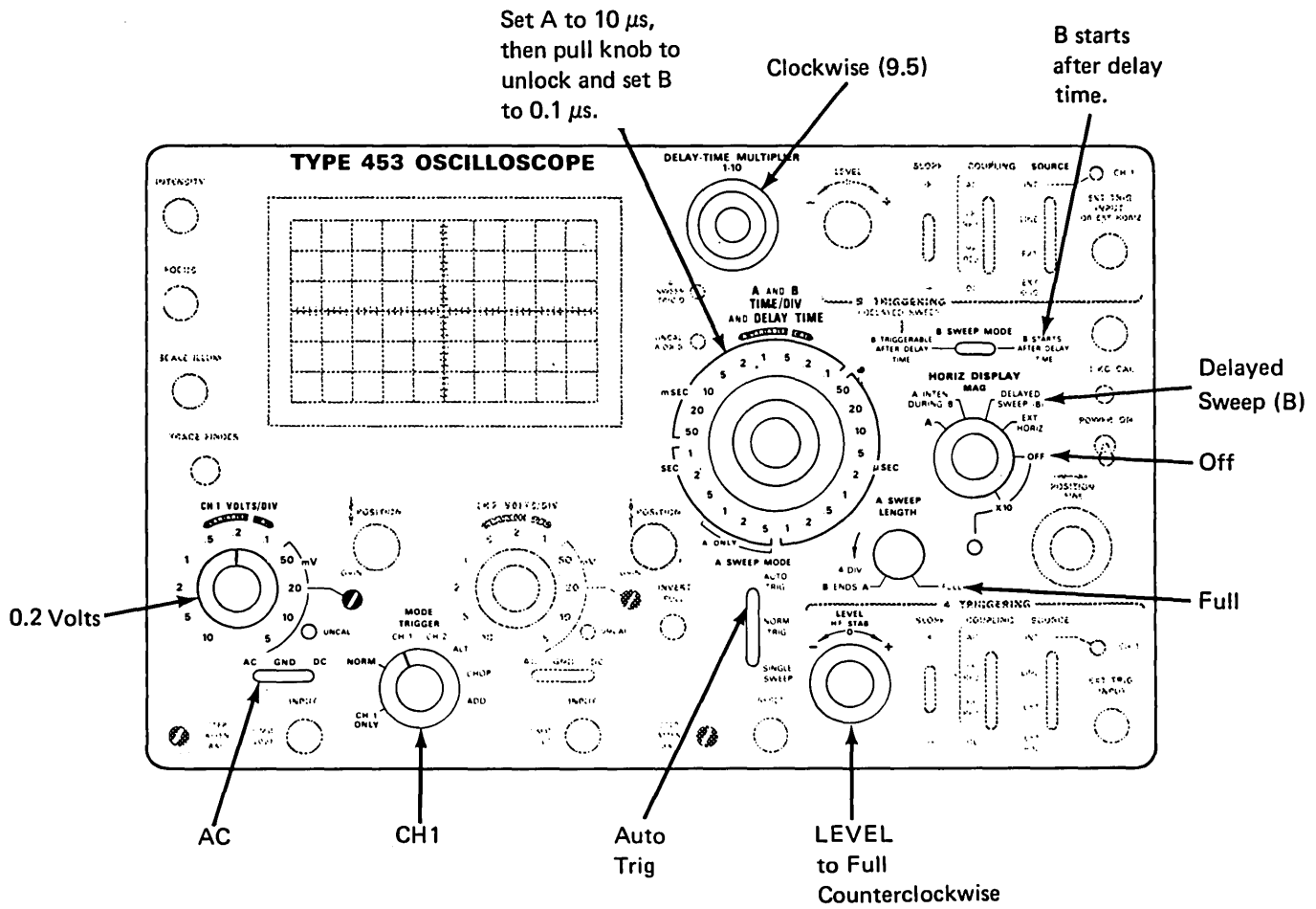
Figure 11-6. Setting Oscilloscope Switches

T-Connector on B Gate

T-Connector on B Gate

Times-1 Probe

Ground Lead

Signal Lead

Shield

Phase B

Phase Y

Coaxial Cable with BNC Ends
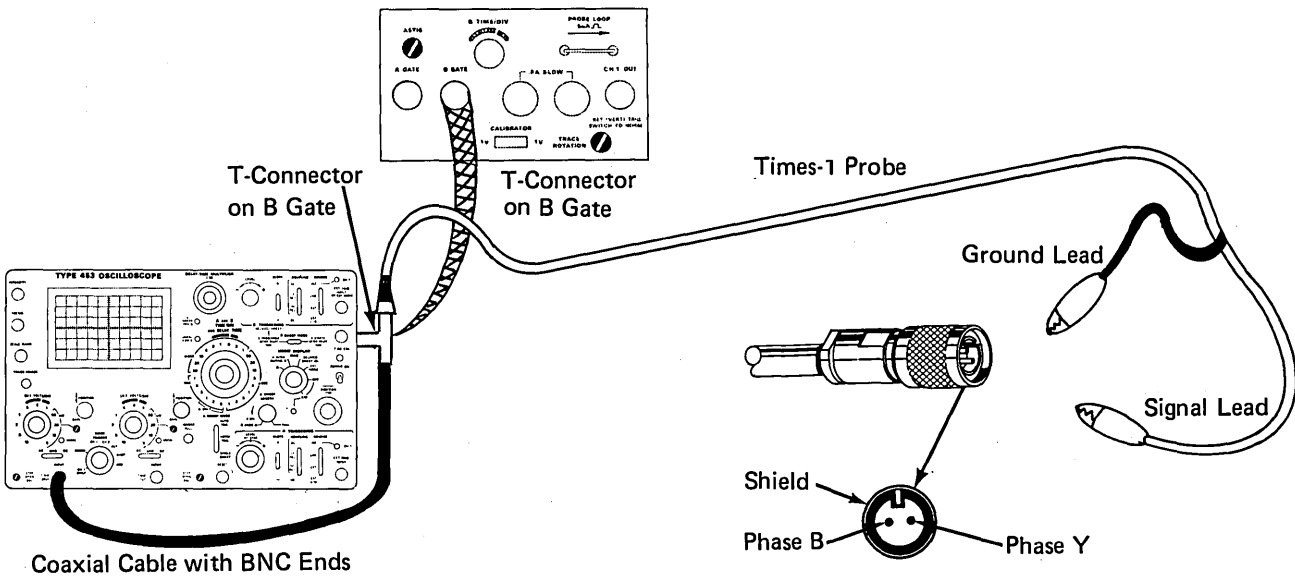
Figure 11-7. Connecting the Oscilloscope

(A) Normal Cable

B = 1 μs
(see Note 1)

(B) Short Circuit Cable

B = 0.2 μs
(see Note 1)

(C) Open Circuit Cable

B = 0.2 μs
(see Note 1)
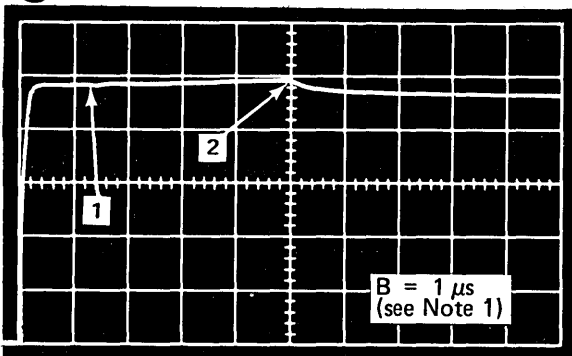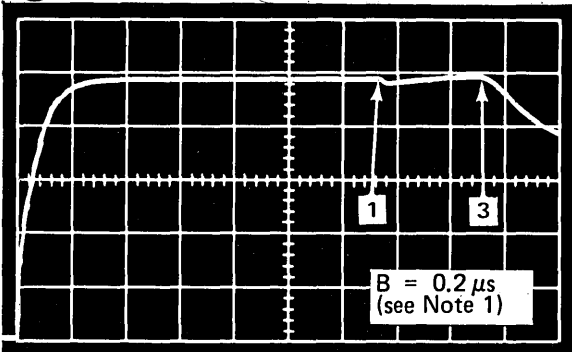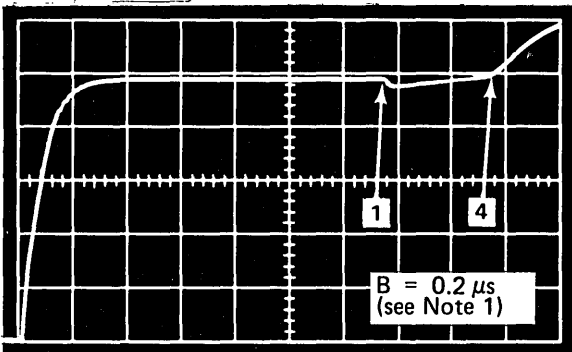
(D) Open Circuit Cable

B = 1 μs
(see Note 1)
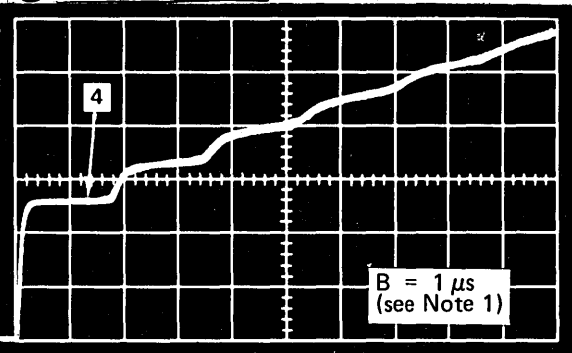
1 A small change in the signal level caused from a terminal (with the Cable Thru feature) 131 meters (430 feet) from the end of the cable being checked. The change at **1** is also shown in **(B)** and **(C)**.

2 A change in the signal level caused from the last terminal on the cable 495 meters (1625 feet) from the end of the cable being checked.

Note: A change in the signal level of more than 10 percent usually indicates a problem.

1 Same as **1** in **(A)** but with the B time base now set to 0.2 μs.

3 A change in the signal level caused by a short circuit cable 170 meters (560 feet) from the end of the cable being checked.

1.72 μs X 99 meters = 170 meters ⎫
⎬ (see Note 2)
1.72 μs X 324.7 feet = 560 feet ⎭

or

1 Same as **1** in **(B)**.

4 A change in the signal level caused by an open circuit cable 170 meters (560 feet) from the end of the cable being checked.

1.72 μs X 99 meters = 170 meters ⎫
⎬ (see Note 2)
1.72 μs X 324.7 feet = 560 feet ⎭

or

4 Same as **4** in **(C)** but with the B time base set at 1 μs.

Note: Always change the B time base to show only one change in the signal level so that you can more easily determine the time on your oscilloscope.

Notes:
1. The A time base is always set for 10 μs and Channel 1 is always set for 0.2 volts/division.
2. The reflection for the shorted cable and for the open cable occurs at 8.6 divisions.
   Therefore, t is equal to 1.72 μs (8.6 x 0.2).

Figure 11-8. Sample Oscilloscope Signals

CONTENTS

13

13-010   INTRODUCTION

Operation of the CE panel and CE subpanel switches and indicators is described in the *IBM System/34 5340 System Unit Theory Diagrams Manual*, SY31-0458. The locations of parts on the back of the CE panel and CE subpanel are shown in Volume D *(Field Service Logics)*. A list of the signal wire names and the connector pins to which they are connected is also given.

13-020   REMOVAL AND REPLACEMENT

To remove the CE panel:

1.   Set Power to O (operator panel).

2.   Remove the three hexagonal bolts **A** that hold the CE panel to the machine frame.

3.   While holding the CE panel in your hand, disconnect the three signal cables.

To reinstall the CE panel:

1.   Reconnect the signal cables to the same sockets they were disconnected from. See Volume D (FSL) page CE160 to identify the cable connectors on the CE panel.

2.   Reinstall the three hexagonal bolts **A** that hold the CE panel to the machine frame.

To remove the CE subpanel:

1.   Set Power to O (operator panel).

2.   Remove the two hexagonal bolts **B** that hold the CE subpanel to the machine frame.

To reinstall the CE subpanel:

Reinstall the two hexagonal bolts **B** that hold the CE subpanel to the machine frame.

CE Panel

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

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

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

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

—DISPLAY/DATA—

—ADDRESS/DATA—

PROC RUN
INSN STEP/
● DPLY LSR
  ● ALTER STOR
    ● ALTER MAR
    IRPT
  ● DPLY STOR
  ● INSN STEP/
    DPLY CHKS
  ● INSN STEP/
    DPLY PCR
└SYS INSN STEP

MODE SELECTOR

DPLY PWR CHK

RESET

CE START

13

COMM
DPLY
ON   FORCE
PWR FAULT DPLY CHECK CLOCK MSIPL   CSIPL   STOR SEL ADD COMP
PREV SEARCH RUN   ON   DISKETTE DISKETTE CTL   STOP

OFF
             STOP OFF DISK   DISK   MAIN   RUN

LAMP TEST

—PROC INTERRUPT—
CLOCK   ┌P0┐   4   2   1   ┌P1┐

— BYTE 0 —   DISPLAY LIGHTS   — BYTE 1 —
0 1 2 3   4 5 6 7   0 1 2 3   4 5 6 7
8 4 2 1   8 4 2 1   8 4 2 1   8 4 2 1

STOP
○   ○ STOP

MSP
RUNNING ○ START
○

CE Subpanel

OR

FIRST OR SECOND
COMMUNICATIONS
ADAPTER

MLCA

COMM
1

COMM
2

COMM
SELECT
1
2
3
4

EVENT INDICATOR (BYTE O)

LIGHT OFF
LOAD - DATA TRANSFER COMPLETE: NO DATA CHECK
- P   - ADAPTER RECEIVED IMPL SIGNAL AND INITIATED ACTION IN RESPONSE
- 0   - FIRST CYCLE STEAL REQUEST RECEIVED DATA TRANSFER HAS STARTED
- 1   - DATA TRANSFER OF 4096 BYTES HAS COMPLETED
- 2-7 - TURNED OFF WITH MICRO INSTRUCTIONS

LOCAL STORE REGISTERS

		0 ... 15	DATA SW 3-4
MAIN LEVEL OR MACH CHECK 0		WR0	00
		WR1	01
		WR2	02
		WR3	03
		WR4/CS0	04
		WR5/CS1	05
		WR6/CS2	06
		WR7/CS3	07
MAR/MAB STACK I		MAR	08
		MAB	09
		MAR (MC)	0A
		MAB (MC)	0B
		MAR − 1	0C
		MAB − 1	0D
		MAR − 2	0E
		MAB − 2	0F
INTERRUPT 1		WR0	10
		WR1	11
		WR2	12
		WR3	13
		WR4/CS0	14
		WR5/CS1	15
		WR6/CS2	16
		WR7/CS3	17
INTERRUPT 2		WR0	18
		WR1	19
		WR2	1A
		WR3	1B
		WR4/CS0	1C
		WR5/CS1	1D
		WR6/CS2	1E
		WR7/CS3	1F
INTERRUPT 3		WR0	20
		WR1	21
		WR2	22
		WR3	23
		WR4/CS0	24
		WR5/CS1	25
		WR6/CS2	26
		WR7/CS3	27
MAR/MAB STACK 2		MAR − 3	28
		MAB − 3	29
		Reserved	2A
		Reserved	2B
		MAR − 4	2C
		MAB − 4	2D
		MAR − 5	2E
		MAB − 5	2F
INTERRUPT 4		WR0	30
		WR1	31
		WR2	32
		WR3	33
		WR4/CS0	34
		WR5/CS1	35
		WR6/CS2	36
		WR7/CS3	37
INTERRUPT 5		WR0	38
		WR1	39
		WR2	3A
		WR3	3B
		WR4/CS0	3C
		WR5/CS1	3D
		WR6/CS2	3E
		WR7/CS3	3F

POWER FAULT DISPLAY (BYTE Ø)

0	1	2	3	4	5	6	7
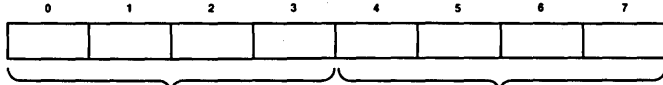
X'0' *
X'1' ADTL SENSE CD MISSING
X'2' OV — ADDITIONAL FAULT
X'3' NOT USED
X'4' OC — ADDITIONAL FAULT
X'5' NOT USED
X'6' UV — ADDITIONAL FAULT
X'7' *
X'8' NOT USED
X'9' SENSE CD MISSING
X'A' OV — PRIMARY FAULT
X'B' NOT USED
X'C' OC — PRIMARY FAULT
X'D' NOT USED
X'E' UV — PRIMARY FAULT
X'F' *

X'0' *
X'1' +5V BASE
X'2' +8.5V BASE
X'3' +24V BASE
X'4' -24V BASE
X'5' +6V BASE REGULATOR
X'6' -4V BASE REGULATOR
X'7' -5V BASE REGULATOR
X'8' +12V FEAT A
X'9' -12V FEAT A OR FEAT REG CARD
        OR SENSE CD MISSING
X'A' +5V FEAT B OR SENSE CD MISSING
X'B' FEATURE POWER SUPPLY C
X'C' FEATURE POWER SUPPLY D
X'D' RESERVED
X'E' RESERVED
X'F' FEATURE POWER SUPPLY G

* SPECIAL
X'00' IS NO FAULT SINCE AC RESTORED
X'7F' IS SEARCH COMPLETE
X'FF' DISPLAY W/THERMAL CHECK WHEN POWER WAS ON
X'EI' DISPLAY W/THERMAL CHECK WHEN POWER WAS OFF

- ADD COMP SYNC	(SYNC)	AA1-K2-D12
+ T3 AND PHASE A	(SYNC)	AA1-G2-S12
+ CARRY IN	(TIE DOWN)	AA1-G2-B11

PROCESSOR CONDITION REGISTER (DPLY PCR) (BYTE Ø)

0	1	2	3	4	5	6	7
FLAG LTH	POS	NEG	ZERO	CARRY	HIGH	LOW	EQUAL

COMM (BYTE O)

0	1	2	3	4	5	6	7
DATA TERM READY	DATA SET READY	REQ TO SEND	CLEAR TO SEND	SEND DATA SPACE	RECEIVE DATA SPACE		

PROC INTERRUPT

4	2	1

000 MAIN LEVEL
001 INTERRUPT LEVEL 1
010 INTERRUPT LEVEL 2
011 INTERRUPT LEVEL 3
100 INTERRUPT LEVEL 4
101 INTERRUPT LEVEL 5
111 MACHINE CHECK INTERRUPT

PROCESSOR CHECK DISPLAY (DPLY CHKS) (BYTE Ø)

0	1	2	3	4	5	6	7
SDR P-CHK	MOR P-CHK	STG GATE P-CHK	ALU GATE P-CHK	CSAR P-CHK / CS INV ADDR	TIMEOUT / CSAR P-CHK	MS INV ADDR / MSAR P-CHK	STG EXCEPT / MSAR P-CHK

PORT CHECK DISPLAY (DPLY CHKS) (BYTE 1)

8	9	10	11	12	13	14	15
DBO P-CHK	INV DEV ADDR	DBI P-CHK	I/O TIME OUT CHK	CBI/DBI NOT ZERO	SYS BUS P-CHK	CYCLE STEAL CHK	INV PORT ADDR.

CONTENTS

15

15-100   CONTROL PROCESSOR

The control processor is made up of eight cards (16K words of storage positions that can be addressed). Six cards are for the control processor logic and two 16K byte cards are for the control storage. The control processor does the following:

- Aids in controlling system input/output operations

- Moves data between the input/output devices and the main storage processor

- Handles some of the system control programming

Board A-A1 has two different board/card arrangements (level 1 and level 2). To determine if the level of the board/cards is level 1 or level 2, check card location B2. If a card is in this location, level 2 board/cards are installed.

The control processor cards and the hardware on each card are as follows for each of the two levels:

A-A1 (Level 1)

Control Processor

Power Status Cable

Operator Panel Cable

CE Panel Cables

Communications Crossover

Channel Crossovers

				E2	F2	G2	H2	J2	K2	L2		N2	P2	Q2	R2	S2	T2	U2	
				Ctrl Stor 0/16K Hi											Main Stor 0/16K	Main Stor 16/32K	Main Stor 32/48K Fea-ture	Main Stor 48/64K Fea-ture	
			D4		CP Stor Ctrl	CP Sys Ctrl	CP Data Flow	CP Status 1	CP Status 2	Port	MSP Sys Ctrl	MSP Data Flow	MSP Stor Ctrl	R4	S4	T4	U4	
				Ctrl Stor 0/16K Lo											Main Stor 64/80K Fea-ture	Main Stor 80/96K Fea-ture	Main Stor 96/ 112K Fea-ture	Main Stor 112/ 128K Fea-ture	

A-A1 (Level 2)

Control Processor

Power Status Cable

Operator Panel Cable

CE Panel Cables

Communications Crossover

	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	P2	Q2	R2	S2	T2	U2	V2
	Ctrl Stor 0/16K Hi										Main Stor 0/16K	Main Stor 16/32K	Main Stor 32/48K Fea-ture	Main Stor 48/64K Fea-ture	Main Stor 64/80K Fea-ture	Main Stor 80/96K Fea-ture	Main Stor 96/ 112K Fea-ture	Main Stor 112/ 128K Fea-ture	
	B4	CP Stor Ctrl	CP Sys Ctrl	CP Data Flow	CP Status 1	CP Status 2	Port	MSP Sys Ctrl	MSP Data Flow	MSP Stor Ctrl	M4	N4	P4	Q4	R4	S4	T4	U4	Stor Sel and Re-power
	Ctrl Stor 0/16K Lo										Main Stor 128-144K Fea-ture	Main Stor 144-160K Fea-ture	Main Stor 160-176K Fea-ture	Main Stor 176-192K Fea-ture	Main Stor 192-208K Fea-ture	Main Stor 208-224K Fea-ture	Main Stor 224-240K Fea-ture	Main Stor 240-256K Fea-ture	

Channel Crossovers

15

Control Storage Cards

Control Storage High and Low

- Each card contains 16K half words (bytes) of storage.

- Two cards are used to get the 2 bytes that make up the control processor word to be addressed.

- These cards have the same part number as those used in main storage.

Control Storage Control

- Storage address register (SAR)

- Not valid control storage address checking

- Control storage initial program load (CSIPL) sequence control

- System reset generation

- Control storage addressing and timing

- Display bits 8 through 11

- 100-nanosecond oscillator

- Main storage processor running indicator driver

Control Processor Cards

Control Processor Control

- Micro operation register (MOR)

- Control processor clock

- Local storage register (LSR) selection

- Local storage register (LSR) write pulses

- Clocks for X-register, Y-register, and storage address register (SAR)

- Storage gate selection

- Arithmetic logic unit (ALU) gate selection

- Arithmetic logic unit (ALU) function bits, carry in, and 16-bit arithmetic logic unit (ALU) operation

- Y-gate selection

- Storage selection and controls (main storage and control storage)

- Instruction decoding

- Mode selector switch decoding

- Cycle control for console and instruction

- Timing control for arithmetic logic unit (ALU) gate and storage gate check

- Cycle steal interrupt controls

- Micro operation register (MOR) parity check

Control Processor Data Flow

- Storage data register (SDR)

- Local storage register (LSR) (64 registers–8 bits wide plus 1 parity bit)

- Storage gates

- X-register and Y-register and reset for Y-register

- Arithmetic logic unit (ALU), parity predict and control bits

- Arithmetic logic unit (ALU) gates

- Checks for arithmetic logic unit (ALU), storage data register (SDR), and storage gates

Control Processor Status

- Address compare (high byte and compare logic)

- Branch on condition

- Storage data register (SDR) (bits 4 through 7)

- Decode logic

- Processor condition register (PCR) and controls

- Processor check register

- Display bits 0 through 7, P (high byte)

- Input/output immediate decodes (control processor)

- Assembly bus
  - Console switches 1 and 2
  - Event indicators
  - Processing unit checks
  - Processor condition register (PCR)
  - Control processor bus out high byte

Control Processor Status 2

- Input/output clocks

- Address compare (low byte and compare logic)

- Run latch

- Stop latch (main storage processor)

- Input/output immediate decodes (main storage processor)

- Display bits 12 through 15, P

- Assembly bus
  - Console switches 3 and 4
  - Console status
  - Input/output clock low byte
  - Input/output clock high byte

- Machine check latch and processor check trigger

- System in use indicator driver

- Stop indicator driver

Control Processor Channel

- Channel register

- Channel controls

- Channel clocks

- Channel checks

- Channel interrupt

- Channel status

- Cycle steal control

Processing Unit   5

15-200   MAIN STORAGE PROCESSOR

Level 1 A-A1 Board

The main storage processor is contained on five to eleven storage and processor logic cards. The number of cards is specified by the amount of main storage. Three cards are used for main storage processor and storage control logic, and the other two to eight cards contain storage. Various models are as follows:

- Axx = five cards for 32K bytes main storage and processor logic

- Bxx = six cards for 48K bytes main storage and processor logic

- Cxx = seven cards for 64K bytes main storage and processor logic

- Dxx = nine cards for 96K bytes main storage and processor logic

- Exx = eleven cards for 128K bytes main storage and processor logic

Level 2 A-A1 Board

The main storage processor is contained on six to twenty storage and processor logic cards. The number of cards is specified by the amount of main storage. Four cards are used for main storage processor and storage control logic, and the other two to sixteen cards contain storage. Various models are as follows:

- Axx = six cards for 32K bytes main storage and processor logic

- Bxx = seven cards for 48K bytes main storage and processor logic

- Cxx = eight cards for 64K bytes main storage and processor logic

- Dxx = ten cards for 96K bytes main storage and processor logic

- Exx = twelve cards for 128K bytes main storage and processor logic

- Fxx = twenty cards for 256K bytes main storage and processor logic

15-210   CARD LOCATIONS AND USES

The main storage processor cards and the logic on each card are as follows:

Main Storage Cards

Board A-A1 has two different board/card arrangements (level 1 and level 2). To determine if the level of the board/cards is level 1 or level 2, check card location B2. If a card is in this location, level 2 board/cards are installed.

The main storage processor cards and the hardware on each card are as follows for each of the two levels.

Main Storage

- Each card contains 16K bytes of storage

- Two to sixteen cards are used

- These cards all have the same part number as the cards used in control storage.

Main Storage Control

- Main storage address register (MSAR) high

- Not valid main storage address checking

- Main storage addressing and timing

- Address translation register (ATR)

- Program mode register (PMR)

- Main storage address compare

- Control mode register (CMR)

- Backup mode register (BMR)

- Mode sense gate

A-A1 (Level 1)

Main Storage Processor

Power Status Cable

Operator Panel Cable

CE Panel Cables

Communications Crossover

Channel Crossovers

Column labels: A B C D E F G H J K L M N P Q R S T U V

Y1 Y2 Y3 Y4 Y5 Y6

Row 2 labels: E2 F2 G2 H2 J2 K2 L2 N2 P2 Q2 R2 S2 T2 U2

Ctrl Stor 0/16K Hi

Main Stor 0/16K | Main Stor 16/32K | Main Stor 32/48K Feature | Main Stor 48/64K Feature

D4

CP Stor Ctrl | CP Sys Ctrl | CP Data Flow | CP Status 1 | CP Status 2 | Port | MSP Sys Ctrl | MSP Data Flow | MSP Stor Ctrl

R4 S4 T4 U4

Ctrl Stor 0/16K Lo

Main Stor 64/80K Feature | Main Stor 80/96K Feature | Main Stor 96/112K Feature | Main Stor 112/128K Feature

Z1 Z2 Z3 Z4 Z5 Z6

A-A1 (Level 2)

Main Storage Processor

Power Status Cable

Operator Panel Cable

CE Panel Cables

Communications Crossover

Channel Crossovers

Column labels: A B C D E F G H J K L M N P Q R S T U V

Y1 Y2 Y3 Y4 Y5 Y6

Row 2 labels: B2 C2 D2 E2 F2 G2 H2 J2 K2 L2 M2 N2 P2 Q2 R2 S2 T2 U2 V2

Ctrl Stor 0/16K Hi

Main Stor 0/16K | Main Stor 16/32K | Main Stor 32/48K Feature | Main Stor 48/64K Feature | Main Stor 64/80K Feature | Main Stor 80/96K Feature | Main Stor 96/112K Feature | Main Stor 112/128K Feature

B4

CP Stor Ctrl | CP Sys Ctrl | CP Data Flow | CP Status 1 | CP Status 2 | Port | MSP Sys Ctrl | MSP Data Flow | MSP Stor Ctrl

M4 N4 P4 Q4 R4 S4 T4 U4

Stor Sel and Re-power

Ctrl Stor 0/16K Lo

Main Stor 128-144K Feature | Main Stor 144-160K Feature | Main Stor 160-176K Feature | Main Stor 176-192K Feature | Main Stor 192-208K Feature | Main Stor 208-224K Feature | Main Stor 224-240K Feature | Main Stor 240-256K Feature

Z1 Z2 Z3 Z4 Z5 Z6

15

Main Storage Processor Cards

Main Storage Processor Data Flow

- Arithmetic logic unit (ALU) gate

- Local storage register (LSR) gate

- Local storage register (LSR)

- X-high register, Y register, main storage address register (MSAR), X-low register

- Arithmetic logic unit (ALU), parity predict and control bits

- Main storage gate

- Gating circuits

- Parity checks—LSR gate and main storage gate

Main Storage Processor Control

- Operation register

- Q register

- Q backup register

- Control gate

- Program status register (PSR)

- Status bytes

- Status gate

- Configuration control register (CCR)

- Data flow control
  - Control gate selection
  - Arithmetic logic unit (ALU) gate selection
  - Main storage gate selection
  - Gate selection
  - X-low register and Y register selection
  - Clock main storage processor X-high register, X-low register, Y register, and main storage address register (MSAR)
  - Local storage register (LSR) selection
  - Arithmetic logic unit (ALU) bits and carry in

- Decode system instructions

- Clocks

- Control for control gate, local storage register (LSR) gate, and main storage gate checks

- Main storage controls

- Interface to the control processor

Storage Select and Repower Card

The function of this card is to repower the control, address, and data lines between the main storage processor and the lower and upper 128K bytes of main storage. The following lines are repowered:

- Control
  - MS write pulse low and high
  - MS data strobe high
  - Write main storage

- MSAR address bits 10-15

- Data
  - Data in bits 8-15, P
  - Data out bits 8-15, P

CONTENTS

21

21-010   INTRODUCTION

Operation of the operator panel switches and indicators is described in Volume C (*5340 System Unit Theory Diagrams Manual*). Volume D (*Field Service Logics*) shows the locations of parts on the operator panel.

21-020   REMOVAL AND REPLACEMENT

To remove the operator panel assembly:

1. Set Power to O (operator panel).

2. Open the diskette drive (33FD or 53FD) cover.

3. Open the two system unit side covers and remove the two screws that hold the front cover to the machine frame. Carefully remove the front cover so as not to damage the indicators on the operator panel.

4. Mark the position of the panel assembly with a scribe to aid you later in reinstalling the assembly.

5. Remove the four hexagonal bolts that hold the panel assembly to the machine frame.

To reinstall the operator panel:

1. Place the panel assembly in the position that you marked during the removal procedure.

2. Reinstall the four hexagonal bolts that hold the panel assembly to the machine frame.

3. Carefully reinstall the the front cover using the two screws that hold the cover to the machine frame.

4. Ensure that all indicators are in position and that the Load switch does not bind.

Operator
Panel
Assembly

Front
Cover

Diskette Door

Power Check	O
Thermal Check	O
Processor Check	O
Console Check	O
System In Use	☐
Load	☐
Power O	☐

Operator Panel

CONTENTS

23

23-060   SAFETY

DANGER
The drive motor case may be hot and may burn your hand. When the drive motor is operating, do not touch the drive motor case or the drive belt.

_____
_____
_____
_____

CAUTIONS
1. The 33FD can be damaged if it is not operated or serviced correctly. Caution notices throughout this section indicate hazardous areas.
2. To prevent damage to the leadscrew and carriage, lubricate the leadscrew only with a very thin layer of IBM No. 6 oil when the head carriage is reinstalled. To prevent damage to the head, remove the diskette and clean the head only with isopropyl alcohol and a clean cloth (see paragraph 23-150).

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

23-070   TOOLS

CE Alignment Tool

The CE alignment tool (part 2200698) is used to do the following:

- Align the data head by adjusting the data head to track 0.

- Adjust the phototransistor assembly by mechanical alignment.

Head Cleaning Tools

- Brush (part 2200106)

- Isopropyl alcohol (part 2200200)

- Cloth (part 2108930)

Note: If the pressure arm pad needs replacement, order bill of material 2200751, 33FD pressure arm pad field replacement procedure. This bill of material contains parts and instructions.

23-090   DISKETTE PROTECTION

Damaged diskettes should not be inserted into the diskette drive. Diskettes that are physically damaged, (creased or bent) or contaminated with foreign materials (dust, marks from your fingers, cleaning fluid, etc.) can cause the head to lift from the diskette. This can cause operation errors, equipment errors, or head damage.

Placing a heavy item on a diskette can damage the diskette.

Long Term Storage

Place diskettes in their envelopes and store them in the following environment:

Temperature: 50 to 125 degrees F (10.0 to 51.1C)

Relative humidity: 8% to 80%

Maximum wet bulb: 85 degrees F (29.4C)

If a diskette is at a temperature outside of the machine operational range, wait 5 minutes before use. The diskette should be removed from its shipping container during this time, but should be kept in its envelope.

Shipping and Receiving

Send diskettes inside the original shipping container. A paper envelope does not give good enough protection. Ensure you label the container: DO NOT PLACE NEAR TOO MUCH HEAT (125 degrees F or 51.5 C) OR IN DIRECT LIGHT.

When you receive diskettes, check for container and diskette damage. Keep the container so you can store the diskettes or send them later.

Return a diskette to its envelope when it is removed from the diskette drive.
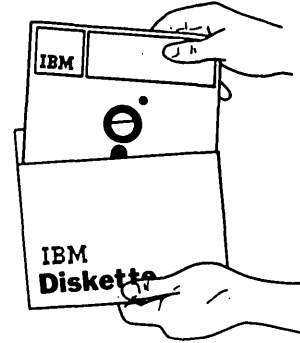
Do not lay diskettes near smoke or other things that can cause the diskette to be contaminated.

Do not use clips or rubber bands on a diskette.

Do not place heavy books on diskettes.

33FD Diskette Drive   3
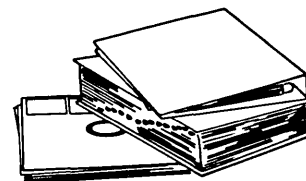
Do not touch or attempt to clean diskette surfaces.
Contaminated diskettes will not work correctly.
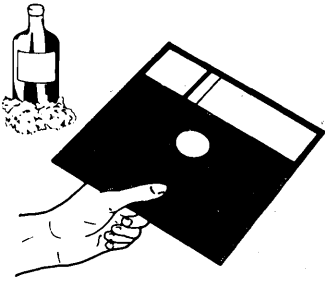
Do not place diskettes near magnetic materials.
Data can be lost from a diskette exposed to a
magnetic field.

Do not expose diskettes to heat greater than
51.5° C (125°F) or direct sunlight.
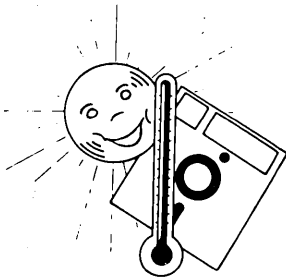
Do not write outside the label area on diskettes.
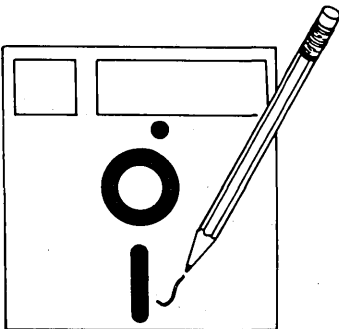
23-100   DISKETTE DRIVE ASSEMBLY

Removal and Replacement

The 33FD and its mounting frame should be removed from the machine when making adjustments, removals, and replacements.

1. Set Power to O (operator panel).

2. Open the diskette drive cover.

3. Open the front left side cover and remove screw Ⓐ, and open the front right side cover and remove screw Ⓑ. Remove the panel assembly.

4. Remove the ground wire Ⓒ.

5. Remove the 4 side panel screws Ⓓ and the side panel.

6. Turn the locks Ⓔ; remove the 33FD and mounting frame from the machine.

7. If power is not needed, disconnect the cables so the unit can be moved to a convenient location.

CAUTION
Ensure that the cables are clear of the bracket Ⓕ when the 33FD and mounting frame are reinstalled.

_____

_____

_____

8. To reinstall, reverse the above procedure.

23

Panel
Assembly
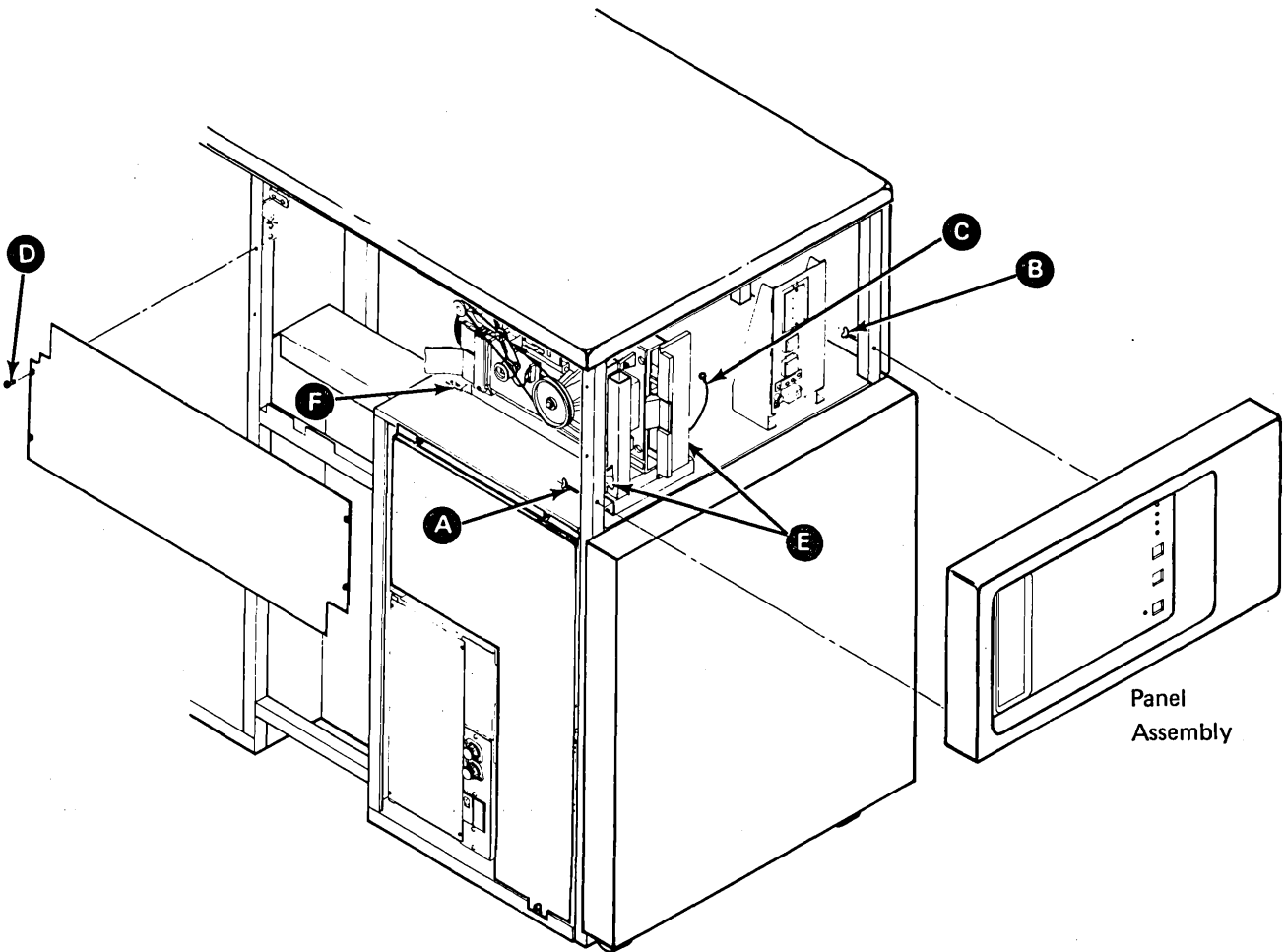
23-110   LATCH ASSEMBLY

Removal and Replacement

1. Remove the 33FD from the machine (see paragraph 23-100).

2. Loosen the top cover mounting screws **A**, and remove the cover.

3. Remove the two latch mounting screws **C**.

4. Pull latch **B** out toward the front of the cover.

5. To reinstall, reverse the above procedure.

23-120   COLLET

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the covers (see paragraph 23-130).

4. Remove mounting screw and washer **G**.

5. Remove collet assembly **E**, spring, and washer **D**.

6. Remove collet **F**.

7. To reinstall, reverse the above procedure.

23-130   COVER ASSEMBLY

Removal and Replacement

CAUTION
Do not let the pressure pad arm hit the head.

_____

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Loosen the top cover mounting screws **A** and remove the top cover.

4. Remove the two pivot screws while holding the side cover.

5. Remove the cover carefully to prevent damage to the wires.

6. Remove the wires from the light-emitting diode and actuator. (Yellow wire goes to the light-emitting diode terminal marked Y.)

7. Remove the wires from the clip on the cover.

CAUTION
Before the cover screws are reinstalled, position the actuator bail under the pressure pad arm **H**.

_____

8. To reinstall, reverse the above procedure.

CAUTION
Before reinstalling cover screws, put the actuator bail under the pressure pad arm **H**.

_____
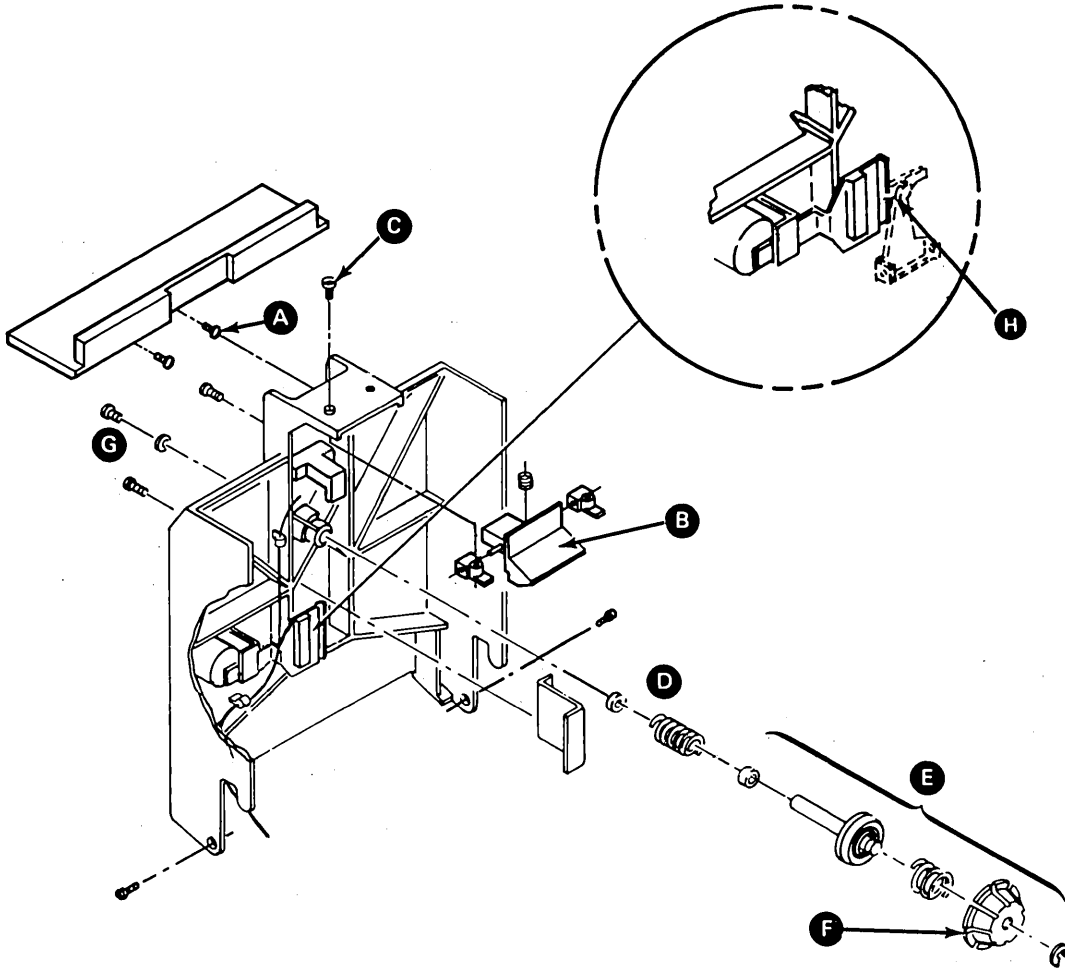
23-140 PRESSURE PAD ACTUATOR

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the covers (see paragraph 23-130).

4. Remove the two screws **A**.
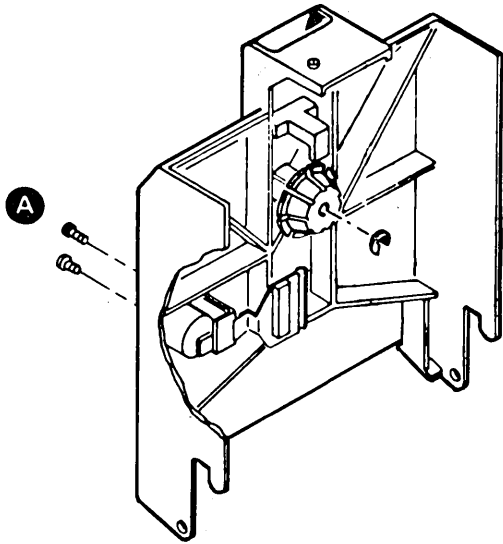
5. Remove the leads.

6. Remove the actuator.

7. Reinstall the actuator, leads, and cover, and do the adjustment.

CAUTION

Before reinstalling the cover screws, put the actuator bail **M**, located on the cover, under the pressure pad arm **N**.

Adjustment

Note: Run the head alignment exerciser before performing this adjustment. If the head alignment is good, go to the Diskette Quality Service Check (see paragraph 23-310). If the head alignment is bad, continue with this adjustment.

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100); then set Power to I (operator panel).

3. Insert a diskette.

4. Activate the head load coil by installing a jumper between the ground **C** and head load **B** test points on the file control card located on the 33FD.
   a. On the old type file control card (2 wide, 3 high), test points are located on the transistor side of the card.
   b. On the new type file control card (2 wide, 2 high), test points are the two rows of pins TPA and TPB.

5. Adjust the screw **E** until the pressure pad arm and the bail just touch **D**.

6. Turn the adjusting screw clockwise 1/2 to 3/4 turn; and check for a gap between the arm and the bail at all tracks **F**.

7. Install the 33FD in the machine.

Old Style File Control Card

- Erase Current
- +5 Vdc
- Preamp TP2
- —Head Load
- + Head Engage
- + Write Data
- MC-1
- MC-2
- MC-3
- MC-0
- Preamp TP1
- Ground
- LED Current
- + Access 0

B

C

New Style File Control Card

B

TPB4

TPB

TPA

C

TPA3

Diskette

D

E

F

23

23-150   HEAD AND PRESSURE PAD CLEANING

CAUTION
Use only the materials in the following list to clean the head and the pressure pad.

_____

_____

_____

Note: If the pressure pad needs replacement, order bill of material 2200751, 33FD pressure pad field replacement procedure.

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see paragraph 23-100).

3.   With the cover open, turn the stepper motor wheel by hand until the carriage assembly is at the upper limit stop.

   CAUTION
   Do not let the pressure pad arm hit the head.

_____

_____

4.   Pivot the pressure pad arm away from the head and check for dirt on the pad. If there is dirt on the pad, use a dry brush (part 2200106) to remove the dirt and to clean the pressure pad.

5.   A cloth with fluid on it should not touch the pressure pad. Hold the pressure pad arm out, clean the head surface with isopropyl alcohol (part 2200200) on a clean cloth (part 2108930). Any other cleaning fluid may damage the head assembly.

23

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23-160 LEADSCREW AND HEAD CARRIAGE ASSEMBLY

Removal

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100). Note the path of the head cable so it has the same path after replacement.

3. Remove the leads from the connector by pushing down with small screwdriver as shown:
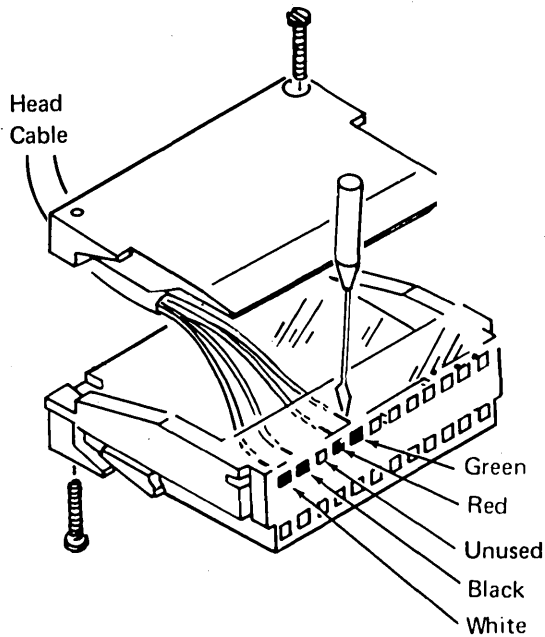
4. Center the head carriage on the leadscrew by turning the stepper motor wheel.

5. Remove the stepper motor **F** and leadscrew wheel **E**.

6. Remove the covers (see paragraph 23-130).

7. Loosen the clamping screws on the upper and lower stops **C**.

8. Remove the two screws and the bottom bearing **D**.

CAUTION
Do not lose the spring **A** when you remove the shaft. Note the bend in the spring, so you can reinstall it the same way.
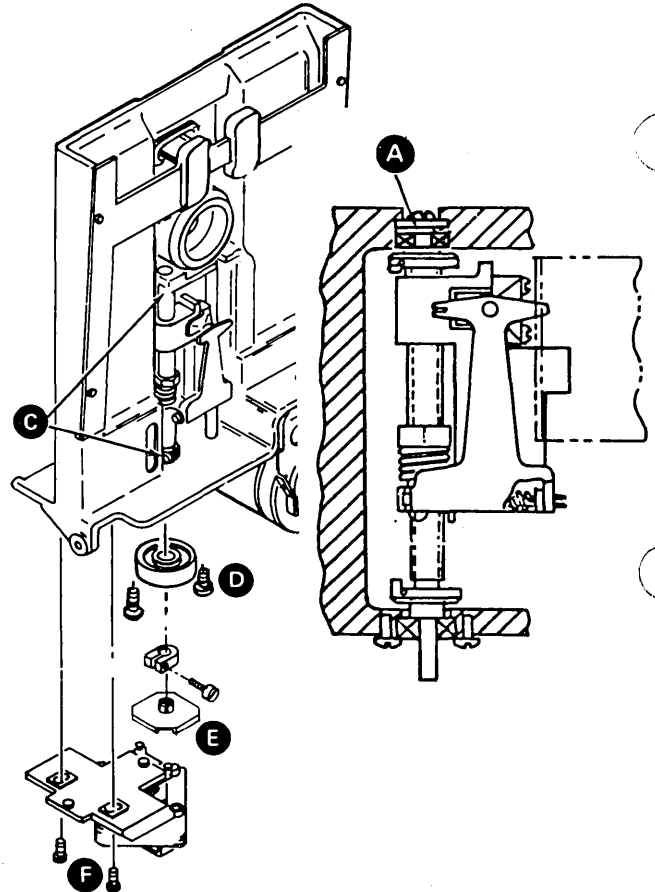
9. Slide the leadscrew assembly down until the top clears the baseplate, then slide the assembly out.

CAUTION
Do not let the pressure pad arm hit the head.

10. Remove the top bearing and both stops from the leadscrew.

Replacement

Note: If the leadscrew and the head carriage are disassembled, reinstall them by threading the leadscrew into the bottom of the head carriage assembly and into the carriage nut and spring. There should be approximately 0.51 mm (0.020 inch) gap **B**.

1. Center the head carriage assembly on the leadscrew and install the upper and lower limit stops.

2. Reinstall the top bearing spring **A** with the bend in the same position as when it was removed.

3. Reinstall the head carriage assembly into the baseplate (bottom end first).

4. Reinstall the two screws and the bottom bearing **D** and check for about 0.76 mm (0.030 inch) up and down movement of the leadscrew against the spring **A**.
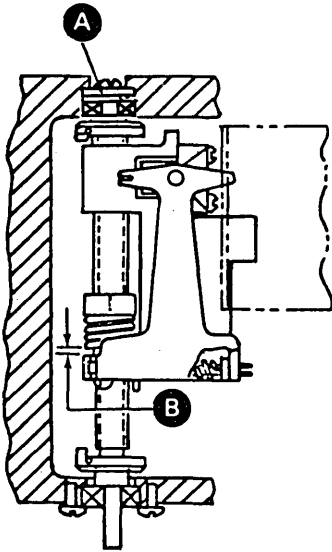
5. Reinstall the leadscrew wheel, leadscrew wheel clamp, and stepper motor.

   Note: Ensure that you use the same head cable path that you used during the removal.

6. Connect the wires (see *Removal* for wire locations). Check that the wire leads are in place and tightly fastened in the connector.

7. Do the stepper motor adjustment (see paragraph 23-260) and the data head adjustment (see paragraph 23-220).

8. Reinstall the connector.

9. Reinstall the covers (see paragraph 23-130).

10. Install the 33FD in the machine.
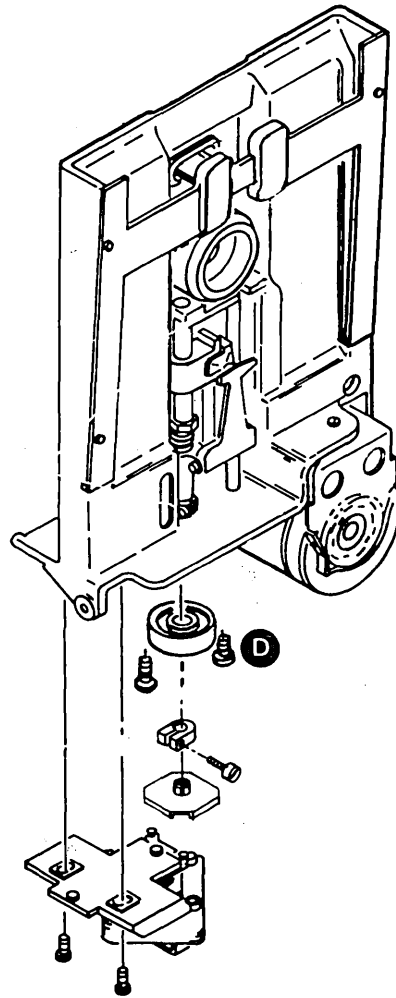
23-165   LEADSCREW CLEANING

CAUTION
Use only the indicated materials to clean the leadscrew.

_____
_____
_____

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see
      paragraph 23-100).

3.   With the cover open, turn the stepper motor wheel
      by hand until the carriage assembly is at the upper
      limit stop.

      CAUTION
      Do not let the pressure pad hit the head at any
      time.

      _____
      _____
      _____

4.   Clean the leadscrew with isopropyl alcohol (part
      2200200) on a clean cloth (part 2108930). Use of
      any other cleaning fluid may damage the head
      assembly.

5.   Evenly space about six drops of IBM No. 6 oil
      along the leadscrew and move the head down and
      up the leadscrew three or four times to distribute
      the oil.

23-170   DRIVE MOTOR

Removal

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see
      paragraph 23-100).

3.   Remove the belt.

4.   Remove the cable clamp on the back of the
      mounting frame.

> **DANGER**
> The drive motor case may be hot and may burn
> your hand.
>
> _____
> _____
> _____

5.   Loosen the two motor mounting clamps and
      remove the drive motor **B**.

6.   Remove the drive pulley **C**.

Replacement

1.   Reinstall the drive pulley. (Align the setscrew with
      flat surface on the shaft and tighten.)

> **DANGER**
> To prevent personal injury, position the two
> large square holes in the motor frame so the
> holes are under the bracket **A**. The holes are
> large enough for a finger to go through.
>
> _____
> _____
> _____
> _____
> _____
> _____
> _____

2.   Clamp the motor to the mounting bracket.

3.   Reinstall the belt.

4.   Connect the cables to the 33FD.

5.   Check the belt path. If necessary to adjust, see
      paragraph 23-200.

6.   Install the 33FD in the machine.

23
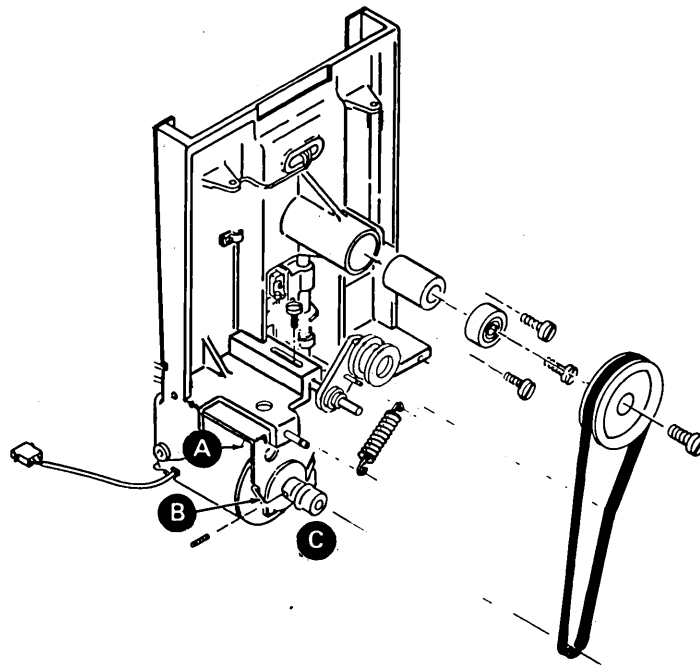
23-180   HUB ASSEMBLY

Removal and Replacement

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see paragraph 23-100).

3.   Remove the covers (see paragraph 23-130).

4.   Remove the drive belt.

5.   Remove the screw **F** and pulley.

6.   Remove the hub **A**.

7.   Remove the three screws, that hold the bearing, the back bearing, and the spacers **C**.

8.   Remove three bearing screws and bearing **B**.

9.   To reinstall, reverse above procedure. Check the belt path. If necessary to adjust, see paragraph 23-200.

    CAUTION
    The front bearing **B** must be even with the front surface of the baseplate. To do this, tighten the screws that hold the front bearing first. The seal on the bearings should face outside.

    _____
    _____
    _____
    _____
    _____

23-190   DRIVE PULLEY

Removal

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see paragraph 23-100).

3.   Remove the drive belt.

4.   Loosen the setscrew **J** and remove drive pulley **H**.

Replacement

1.   Position the pulley on the shaft.

2.   Align the setscrew with flat surface of the shaft and tighten.

3.   Reinstall the belt.

4.   Check the belt path. If necessary to adjust, see paragraph 23-200.

5.   Install the 33FD in the machine.

23-200   BELT PATH

The belt must be tracking in the center of the drive pulley and hub pulley.

Adjustment

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see paragraph 23-100).

3.   De-activate the idler by removing the spring **K**.

4.   Position the drive pulley so the belt path is on the center of the drive pulley and hub pulley.

5.   Activate the idler and adjust so it does not change the belt path. Loosen screw **D** and slide assembly in or out to adjust. Screw **D** must be tight to check the belt path.

6.   Install the 33FD in the machine.

23-210   IDLER ASSEMBLY

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the belt and spring **K**.

4. Remove the idler assembly **E**.

5. To reinstall the idler assembly spring and belt, reverse the above procedure and check the belt path. Loosen screw **D**. To adjust the assembly, slide the assembly in or out. Screw **D** must be tight to check the belt path.

CAUTION
Before reinstalling the cover screws **L**, put the actuator bail, located on the cover, under the pressure pad arm **M**.
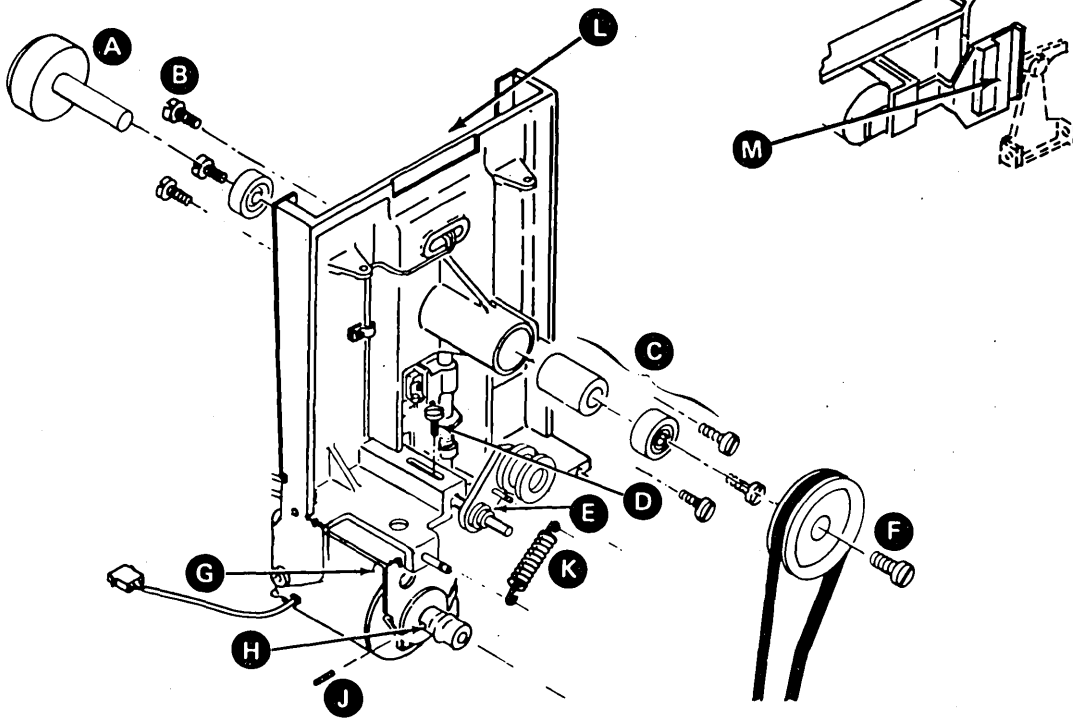
23-220   DATA HEAD

To adjust the data head, you must obtain three conditions at the same time:

- The correct gap from the data head to the 33FD alignment tool

- The correct position between the stepper motor wheel and the leadscrew wheel

- The correct space between the stepper motor and leadscrew wheels

Note: This procedure aligns the data head at track 00.

Adjustment

Note: Run the head alignment exerciser before performing this adjustment. If the head alignment is good, go to the *Diskette Quality Service Check* (see paragraph 23-310). If the head alignment is bad, continue with this adjustment.

1. Set Power to O (operator panel).

2. Remove the covers (see paragraph 23-130).

3. Turn the stepper motor wheel until the head carriage is against the lower stop ⓗ.

4. Loosen the mounting screw and move the phototransistor assembly ⓐ to the left.

   Note: If the phototransistor assembly is not moved, the head adjustment can be made wrong.

5. Loosen the clamping screws on the lower limit stop ⓗ and leadscrew wheel ⓙ.

6. With the stepper motor wheel and leadscrew wheel in position as in view ⓢ, insert a 0.51 mm (0.020 inch) thickness gauge between the wheels ⓛ in view ⓢ. Tighten screw ⓙ a small amount.

   Note: The purpose of this step is to let the stepper motor wheel pins go into the leadscrew wheel the maximum distance with no binds.

7. Locate the white spot label or the groove on the outer edge of the hub. If the hub has both, always use the white spot. Turn the hub to put this mark 180 degrees away from the data head.

   Note: This ensures that if the hub is eccentric, it is located in the same spot and that all head adjustments use the same reference point.

   CAUTION
   Do not let the 33FD alignment tool touch the shiny surface of the head.

   _____
   _____
   _____
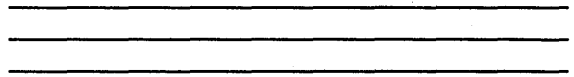
8. Install the 33FD alignment tool on the hub ⓑ. Clamp it into place with the thumbscrew and turn the CE tool so it touches surface ⓓ.

9. Turn the leadscrew by holding the upper limit stop ⓒ; adjust for gap ⓔ. This gap is a number on the front of the head assembly ⓕ. This number represents thousandths. Example: 3 is the same as 0.076 mm (0.003 inch). Adjust for a very light drag on a 0.003 inch gauge. A 0.002 inch gauge must be free.

   Note: Remove the thickness gauge from the pack to make this adjustment.

10. Ensure the stepper motor wheel and leadscrew wheel remain in position ⓢ; then tighten the leadscrew wheel clamping screw ⓙ. The top of the clamping collar should be approximately even with the top of the metal clamping surface of the leadscrew wheel ⓣ.

    CAUTION
    If the clamping collar is not tightened, machine operation causes the head to go out of adjustment. However, do not over tighten the clamping screw, because it can damage the screw or cause the screw to break.

    _____
    _____
    _____
    _____
    _____
    _____
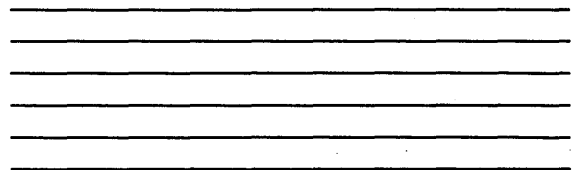
11. Verify gap **E** setting.

12. Adjust the phototransistor **A** so that the raised edge touches the 33FD alignment tool **B**, and tighten the mounting screw.

13. Remove the 33FD alignment tool and perform lower limit stop adjustment (see paragraph 23-240).

14. Turn the stepper motor wheel at least one complete revolution and check for binds.

15. Do the upper limit stop adjustment (see paragraph 23-250).

16. If a new leadscrew wheel was installed, fill the grooves in the leadscrew wheel from 25% to 40% with IBM No. 23 grease.

17. Reinstall the covers.

23

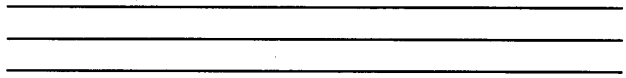18. Install the 33FD in the machine (see paragraph 23-100).

Removal and Replacement

1.   Set Power to O (operator panel).

2.   Remove the 33FD from the machine (see paragraph 23-100).

3.   Remove the stepper motor by removing the two screws **(K)**.

4.   Loosen the clamping screw and remove the leadscrew wheel **(J)**.

5.   To reinstall, reverse the above procedure. Do the stepper motor adjustment (see paragraph 23-260), and head adjustment (see paragraph 23-220).

CAUTION
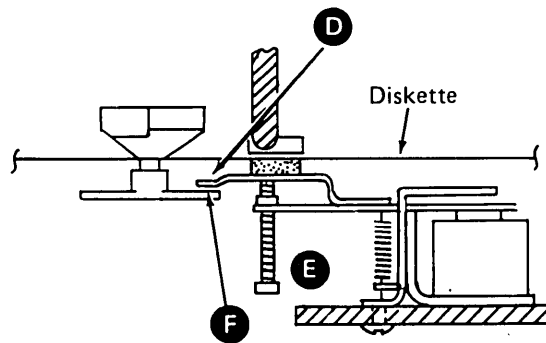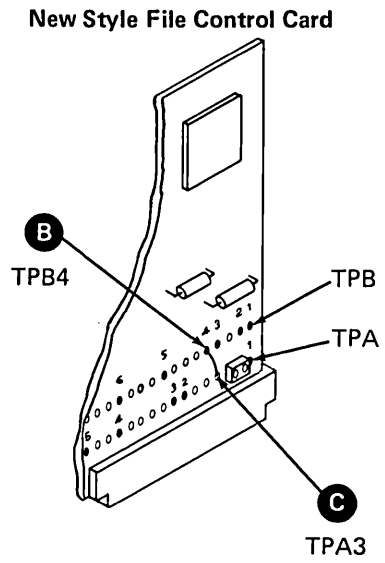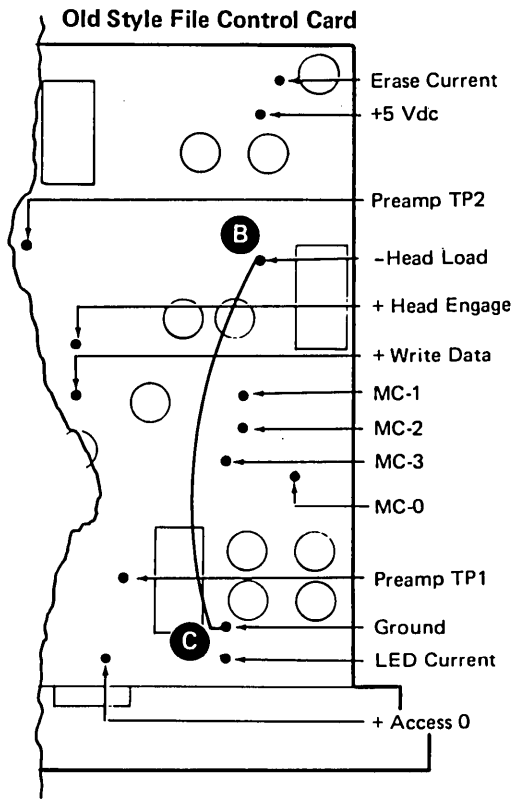Before reinstalling the cover screws, put the actuator bail **(M)**, located on the cover, under the pressure pad arm **(N)**.

6.   Install the 33FD in the machine.

Black ——
Steel Pin ——
White ——

—— 0.020 inch ± 0.005 inch
—— (0.508 mm ± 0.127 mm)
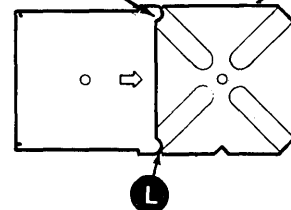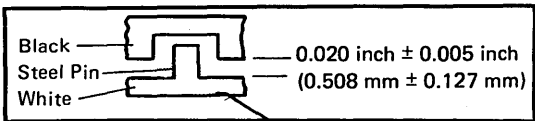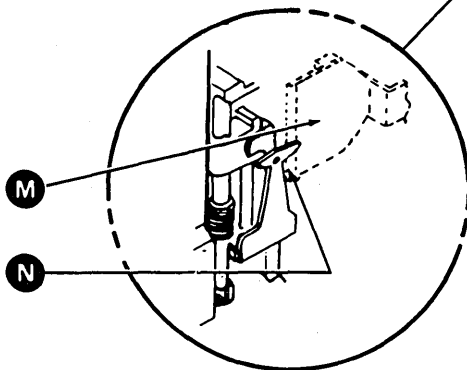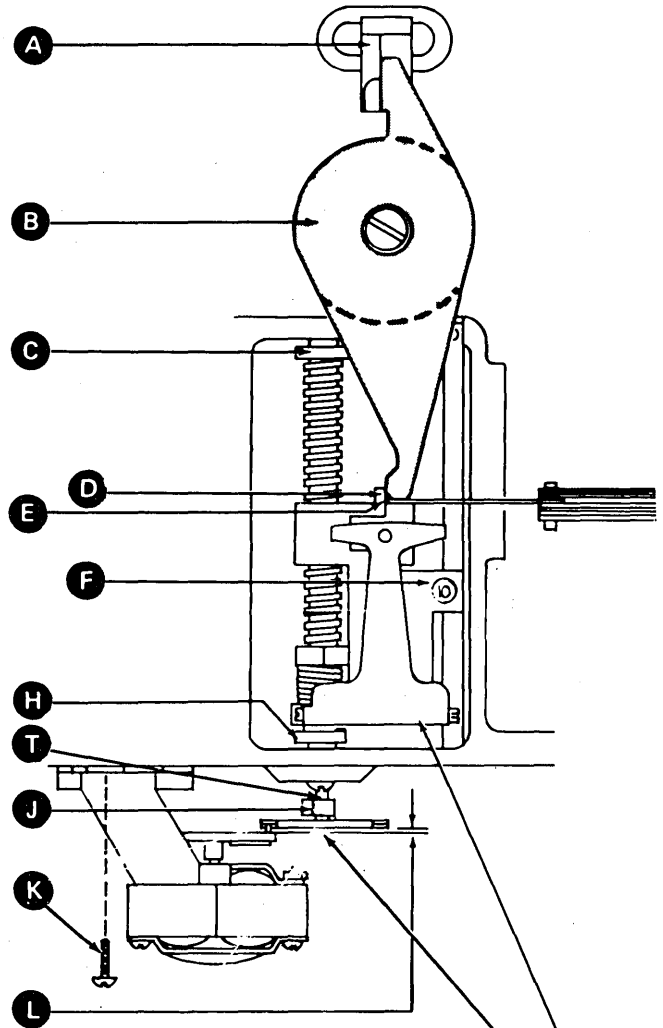
View
(S) Bottom View of Diskette Drive

23-240 LOWER LIMIT STOP

Adjustment

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Ensure that the head is adjusted for track 00 and the leadscrew **J** and stepper motor wheel **U** are in position for track 00 (see paragraph 23-220).

4. Loosen clamp screw **C**. Ensure that the leadscrew is 80 to 90 degrees past track 0 in a downward direction. The wheels must be in position **A**.

5. Place the limit stop so that **F** on the lower limit stop is in front of and against **G** on the carriage.

6. Adjust **H** for 0.3 mm to 0.46 mm (0.012 inch to 0.018 inch).

CAUTION
Do not overtighten the screw.
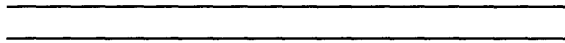
_____
_____

7. Install the 33FD in the machine (see paragraph 23-100).

CAUTION
Before reinstalling the cover screws, put the actuator bail **L**, located on the cover, under the pressure pad arm **M**.
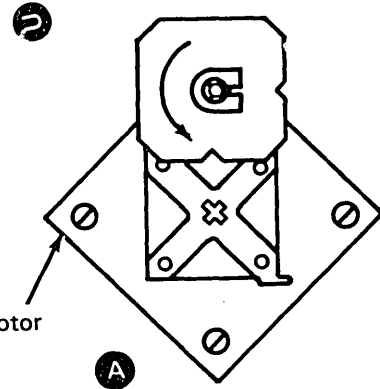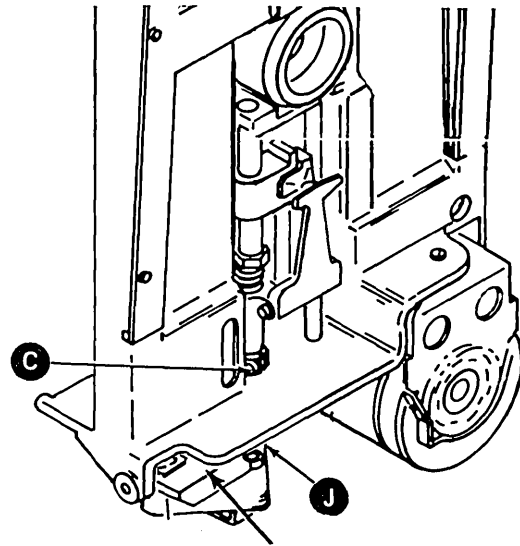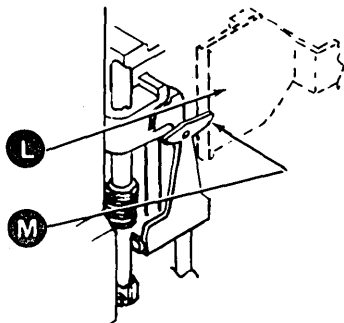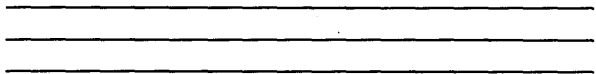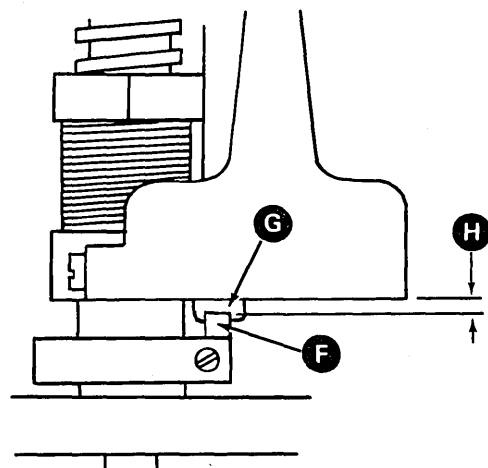
_____
_____
_____

Motor

Top or front view

Adjustment

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Loosen the clamp screw and slide the stop **B** up as far as possible.

4. Starting at track 0, turn the stepper motor wheel 19 complete revolutions to track 76. The wheels must be aligned as shown at **D**.

5. Position the upper limit stop so **J** is behind the head carriage assembly, and the clamp screw faces directly back **E**.

6. Tighten the clamp screw while maintaining 0.76 ± 0.13 mm (0.030 ± 0.005 inch) at **K**.
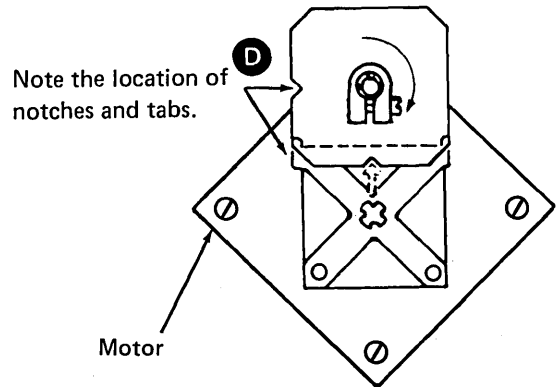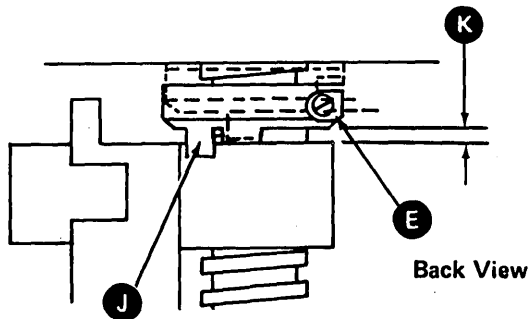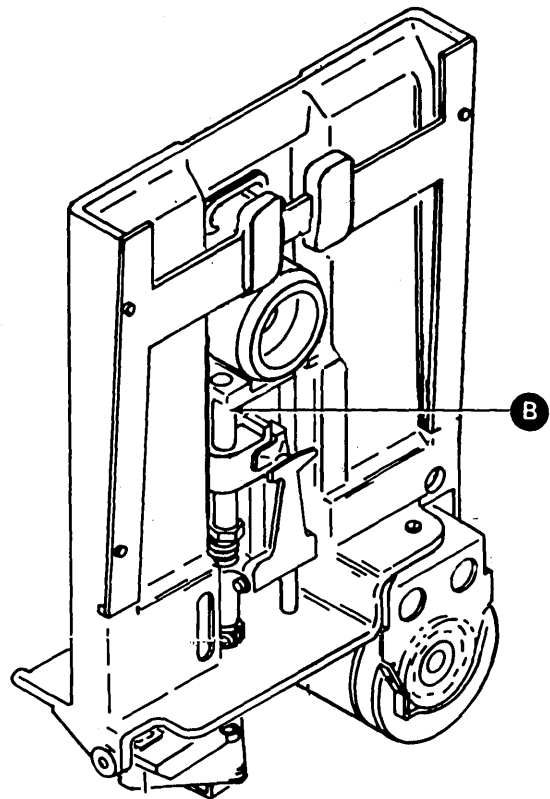
Back View

7. Install the 33FD in the machine (see paragraph 23-100).

CAUTION
Before reinstalling the cover screws, put the actuator bail **N**, located on the cover, under the pressure pad arm **P**.

Note the location of **D** notches and tabs.

Motor

Top or front view
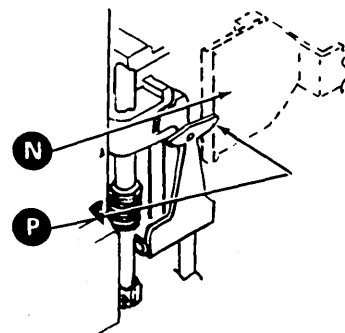
23-260 STEPPER MOTOR AND BRACKET

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the five leads from the connector.

Black
White
Yellow
Red
Blue
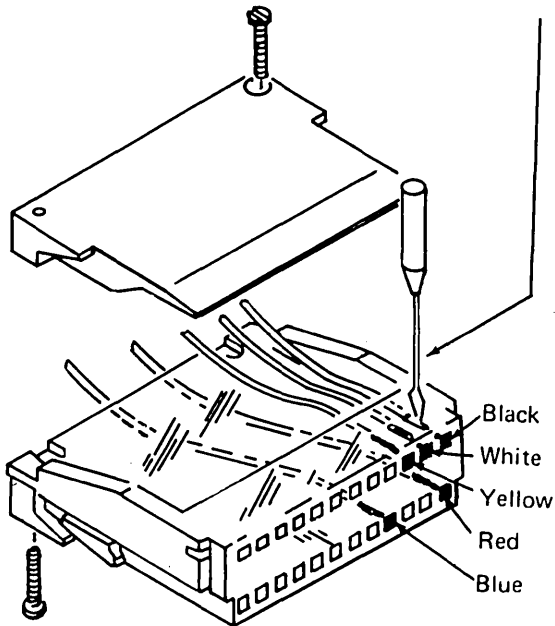
4. Remove the two screws **B**.

    CAUTION
    To prevent breaking parts when the stepper motor is reinstalled, ensure the pins are in the groove of the leadscrew wheel.

    _____
    _____
    _____
    _____

5. To reinstall, reverse the above procedure and do the stepper motor adjustment.

6. Install the 33FD in the machine.
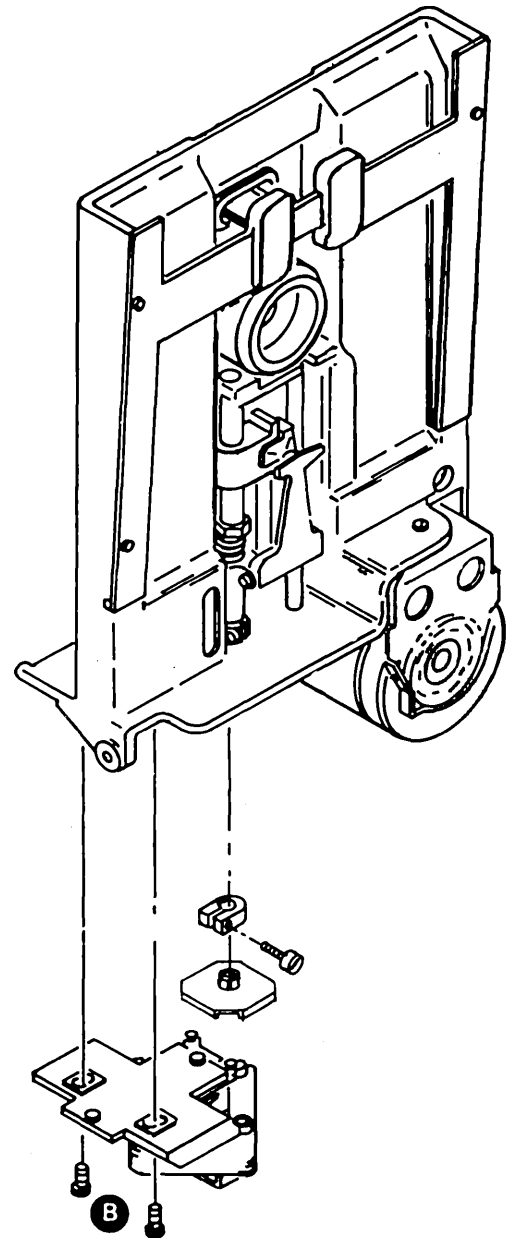
23

B

Adjustment

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Loosen the two screws **B**.

4. Move the stepper motor away from the leadscrew.

5. Loosen the clamp screw **A** and move the leadscrew wheel up until it turns freely.

6. Position the leadscrew wheel as shown in **C**.

7. Pull the leadscrew wheel down until the pins on the stepper motor wheel fit into the notches on the leadscrew wheel **D**.
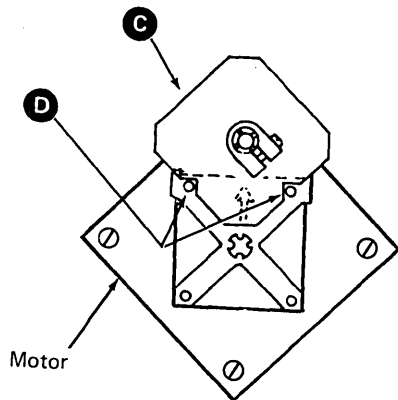
Front or Top View

8. Slide the stepper motor wheel toward the leadscrew until the pins touch the notches. (There should be no gap between the pins and the notches.)

9. Tighten the two stepper motor mounting screws **B**.

10. Move the leadscrew wheel up until it turns freely.

11. Move the leadscrew wheel and slide it down on the drive pins in the position **E**.

12. Turn the leadscrew wheel and slide it down on the drive pins in the position shown.

13. Do the head adjustment (see paragraph 23-220).

14. Install the 33FD in the machine (see paragraph 23-100).

Note the location of notches and tabs.
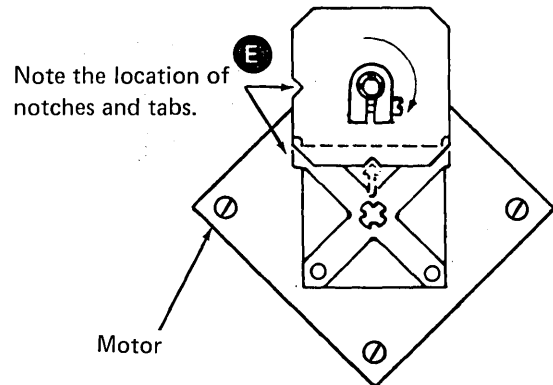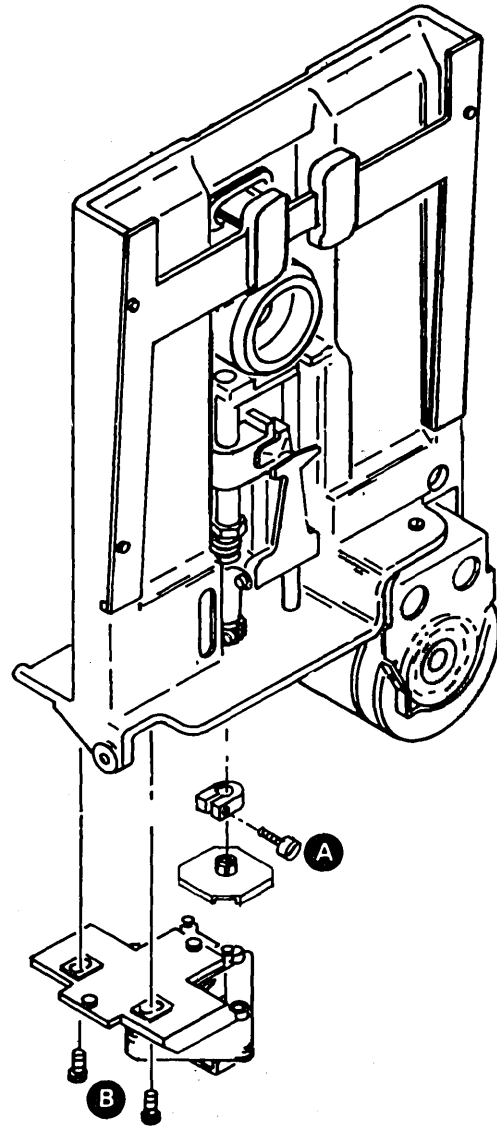
Motor

Top or Front View

23-270 PHOTOTRANSISTOR

Service Check

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine and disconnect the drive motor plug (see paragraph 23-100).

3. Attach the positive probe of the volt ohm meter (15 Vdc scale) to the +5 Vdc test point and the negative probe to the phototransistor current test point on the file control card located on the 33FD.

4. Close the diskette drive cover, and set Power to I (operator panel). The volt ohm meter should read 3.5 Vdc to 5.5 Vdc.

5. Open the diskette drive cover and insert a diskette backward and close the cover. The volt ohm meter should read 0.0 Vdc to 0.5 Vdc.

6. Connect the drive motor plug.

7. If a scope is available, connect the probe to '+Index'. Check for an index pulse width of 1.7 to 8.0 ms. Check for approximately 160 ms between index pulses.

8. Set the Power to O (operator panel), check that the cables are connected; then install the 33FD in the machine.

500 μs/cm
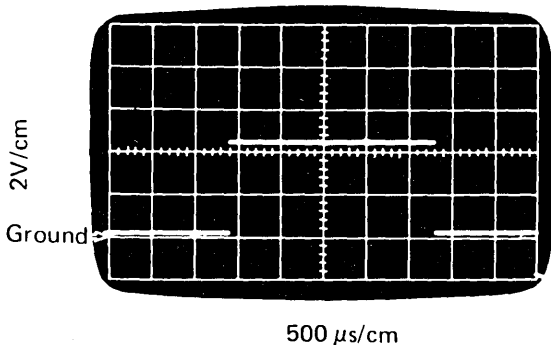
Old Style File Control Card[1]
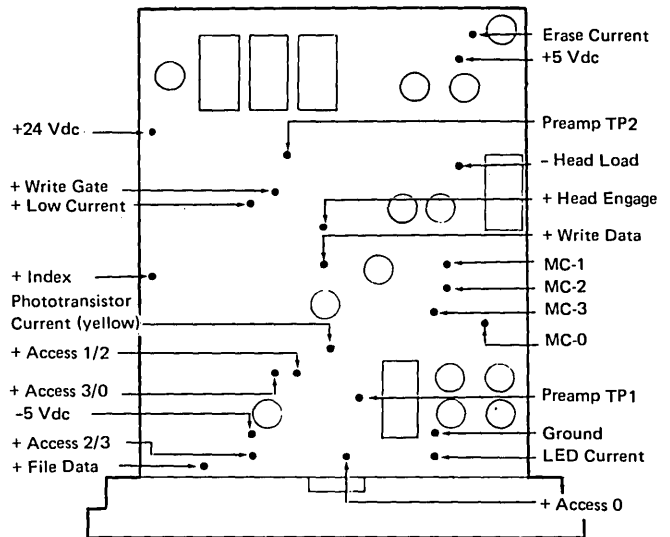
New Style File Control Card[1]
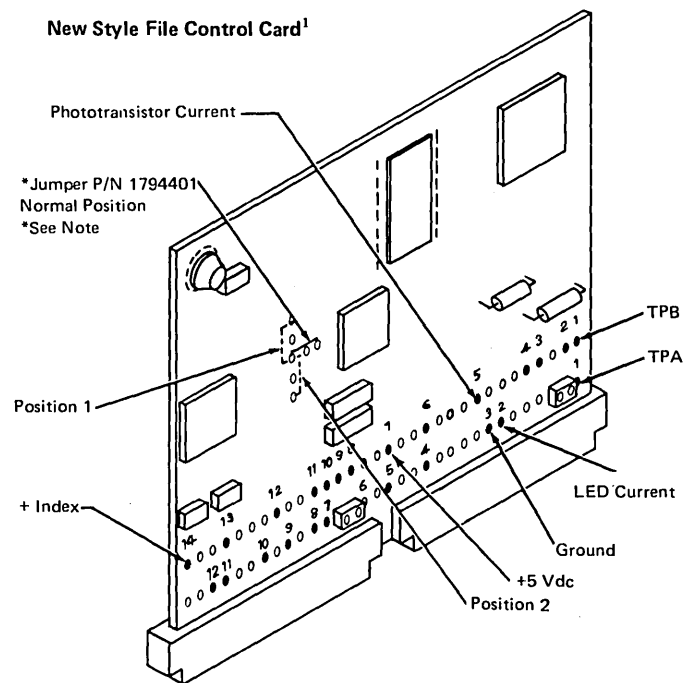
[1]On the old style file control card (2 wide, 3 high), test points are located randomly on the component side of the card. On the new style file control card (2 wide, 2 high), test points are brought out to two rows of pins labeled TPA and TPB.

Note: If a problem is experienced with multiple index due to shine-through, the threshold level of the index amplifier can be increased by paralleling input resistance. Position 1 will increase the threshold by a factor of 5; position 2 will increase the threshold by a factor of 25. The threshold level should not be raised more than is necessary to ensure proper operation.

Adjustment

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Seek to track 0.

4. Remove the covers (see paragraph 23-130).

5. Loosen the mounting screw **E**, and move the phototransistor to the left.

6. Install the CE tool **D** by screwing the thumbscrew into the drive hub **B**. Turn the tool until it touches surface **C**.

7. Adjust the phototransistor so that the higher edge touches the CE tool **A**.

8. Tighten the mounting screw.

9. Remove the CE tool.

10. Reinstall the covers (see paragraph 23-130).

11. Install the 33FD in the machine.

Removal

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Seek to track 0.

4. Remove the covers, (see paragraph 23-130).

5. Remove the mounting screw **E**.

6. Remove the leads.

Replacement

1. Reinstall the leads. (Yellow wire goes to terminal marked Y.)

2. Reinstall the mounting screw, but do not tighten.

3. Complete the replacement by going to the adjustment starting at step 5.

Install the CE tool by screwing the thumb-screw into the drive hub.

Rotate the CE tool so it touches this surface.

Phototransistor
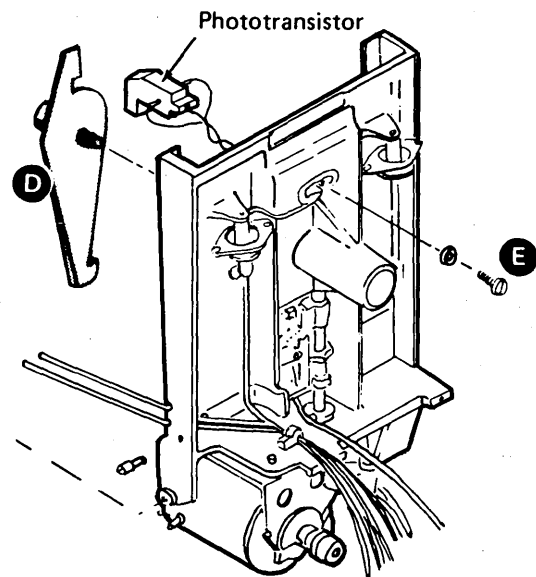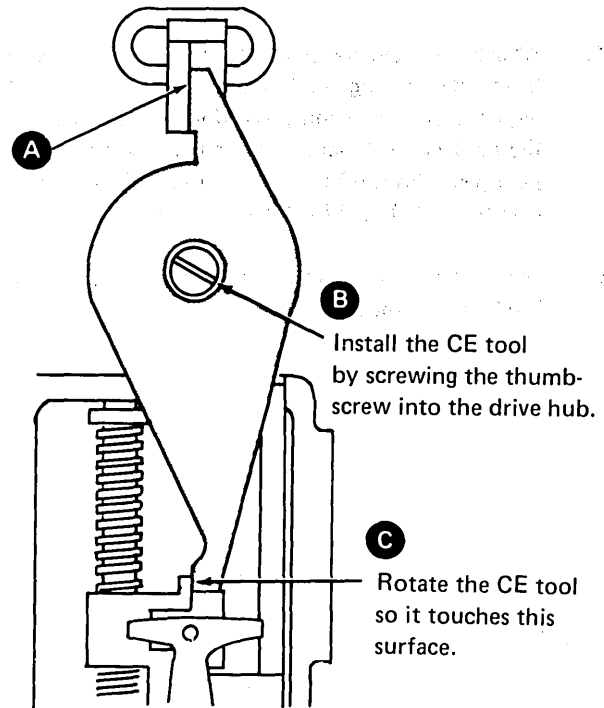
23-280   LIGHT-EMITTING DIODE

Service Check

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Set Power to I (operator panel).

4. Attach the positive probe of the volt ohm meter to the light-emitting diode current test point and the negative probe to the grounded test point on the file control card located on the 33FD (see paragraph 23-290 for test points). Voltage should measure +1.0 to +1.6 Vdc.

5. Set Power to O (operator panel) and install the 33FD in the machine.

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the covers (see paragraph 23-130).

4. Remove two mounting screws Ⓐ.

5. Remove leads. (Yellow wire goes to terminal marked Y.)

6. To reinstall, reverse above procedure.

CAUTION
Before reinstalling the cover screws, place the actuator bail Ⓑ, located on the cover, under the pressure pad arm Ⓒ.
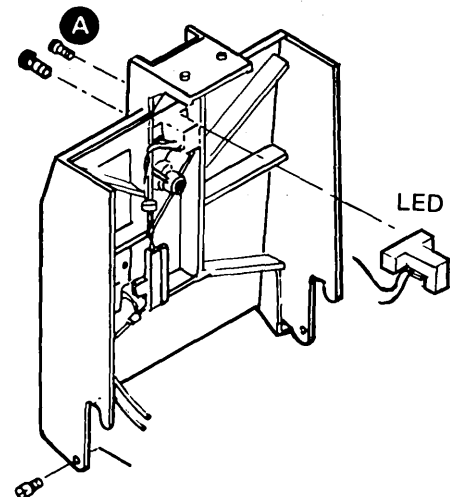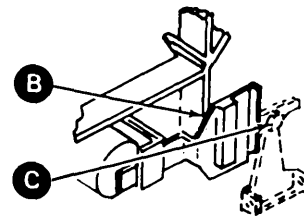
23

Removal and Replacement

1. Set Power to O (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Loosen screw **(A)** and turn bracket 90 degrees. Tighten the screw.

4. Remove the file control card.

5. To reinstall, reverse the above procedure. Ensure that you reseat the card correctly in the socket and clamping bracket.

MST File
Control Card
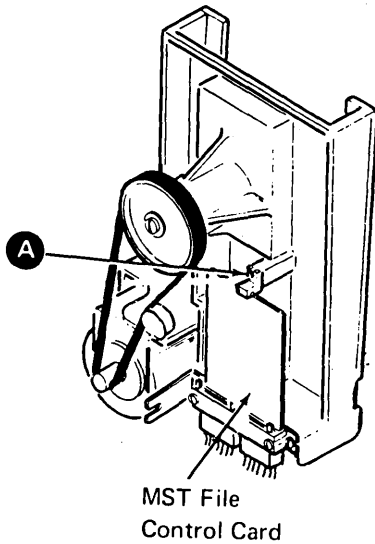
File Card Pin Assignment

Name	Color	Old Style File Card Test Pin	New Style File Card Test Pin
Stepper Motor MC-0 (track 0)	White	B03	TPB2
Stepper Motor MC-1 (track 1)	Red	D02	TPA1
Stepper Motor MC-2 (track 2)	Yellow	B04	TPB3
Stepper Motor MC-3 (track 3)	Black	B02	TPB1
Stepper Common +24 Vdc	Blue	D05	TPA11
Head Magnet +24 Vdc	Yellow	D04	TPA11
– Head Load	Black	B05	TPB4
LED Return	Black	D06	
LED Current	Yellow	D07	TPA2
Phototransistor Return	Black	D09	
Phototransistor Current	Yellow	B08	TPB5
Head Input	Black	B12	
Head Input	White	B13	
Erase Current	Red	B10	
Head Ground and Shield	Green	B09	
Preamp TP1		D12	TPA4
Preamp TP2		D13	TPA5
Ground	Black	D08	TPA3/TPA10
+ Access 0/1		G02	TPB8
+ Access 1/2		G03	TPB9
+ Access 2/3		G04	TPB10
+ Access 3/4		G05	TPB11
+ Raw Read Data		G07	TPB12
+ Head Engage		G10	TPB13
+ Write Data		J02	TPA6
+ Erase Gate		J04	TPA7
+ Write Gate		J05	TPA8
+ Low Current		J06	TPA9
+ Index		G13	TPB14
+24 Vdc		J10	TPA11
+18 Vdc			TPB6
+5 Vdc		J03	TPB7
–5 Vdc		J11	TPA12
Ground		J08	TPA10/TPA3

Test Points

On the old type file control card (2 wide, 3 high), the
test points are located on the transistor side of the card.
On the new type file control card (2 wide, 2 high), the
test points are the two rows of pins TPA and TPB.

Only the major parts are shown as an aid in locating
pins.

Old Style File Control Card[1]

+24 Vdc
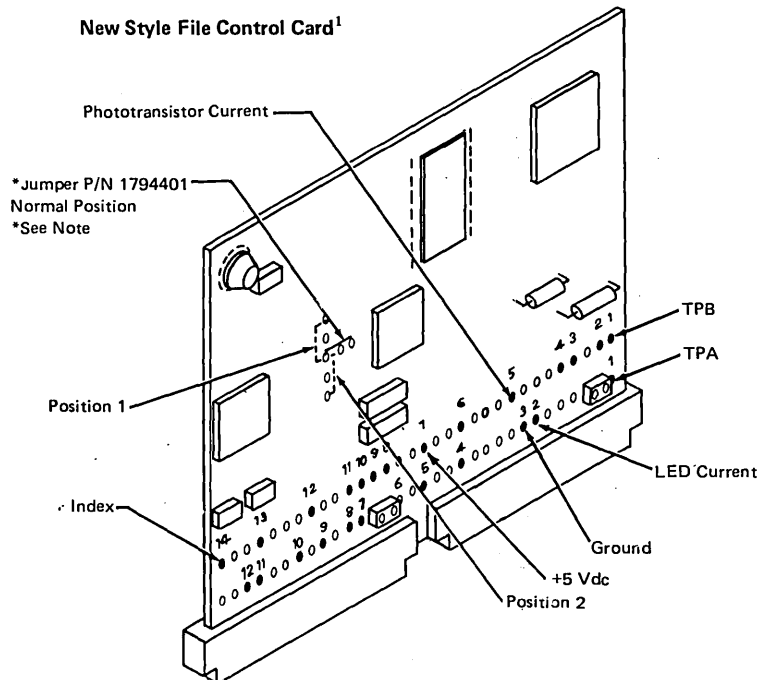
+ Write Gate
+ Low Current

+ Index
Phototransistor
Current (yellow)
+ Access 1/2
+ Access 3/0
-5 Vdc
+ Access 2/3
+ File Data

Erase Current
+5 Vdc

Preamp TP2
- Head Load
+ Head Engage
+ Write Data
MC-1
MC-2
MC-3
MC-0

Preamp TP1

Ground
LED Current

+ Access 0

MST File
Control Card

New Style File Control Card[1]

Phototransistor Current

*Jumper P/N 1794401
Normal Position
*See Note

Position 1

Index

Position 2
+5 Vdc
Ground
LED Current
TPA
TPB

[1] On the old style file control card (2 wide, 3 high), test
points are located randomly on the component side of
the card. On the new style file control card (2 wide,
2 high), test points are brought out to two rows of pins
labeled TPA and TPB.

Note: If a problem is experienced with multiple index due to shine-through, the threshold level of the
index amplifier can be increased by paralleling input resistance. Position 1 will increase the threshold by
a factor of 5; position 2 will increase the threshold by a factor of 25. The threshold level should not be
raised more than is necessary to ensure proper operation.

File Control Card Socket Pins

The file control card is installed bottom side up.
Therefore, the pin numbers start at the bottom of the
socket. The pin numbers, as seen from the cable side,
are shown below:

Note: Maple block causes B and D
pin reversal.

33FD Adapter A-A2L2

Data Separator A-A2P2

33FD Cable A-A2Z6

23
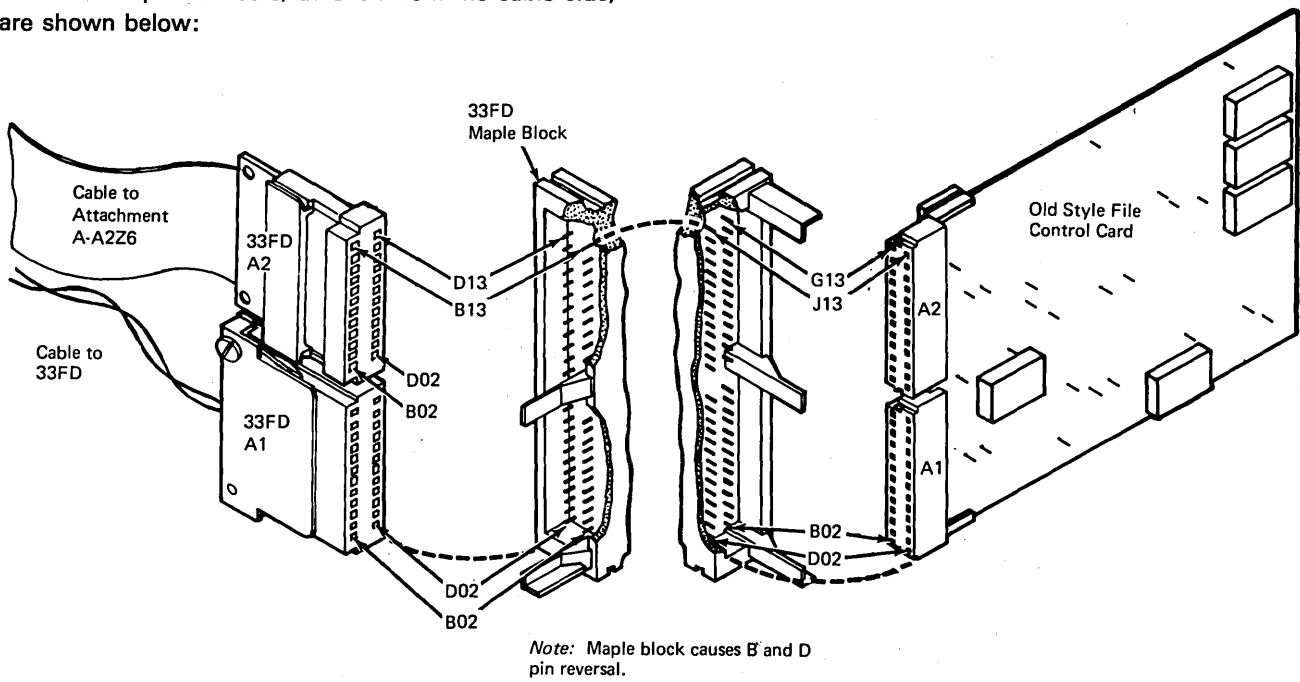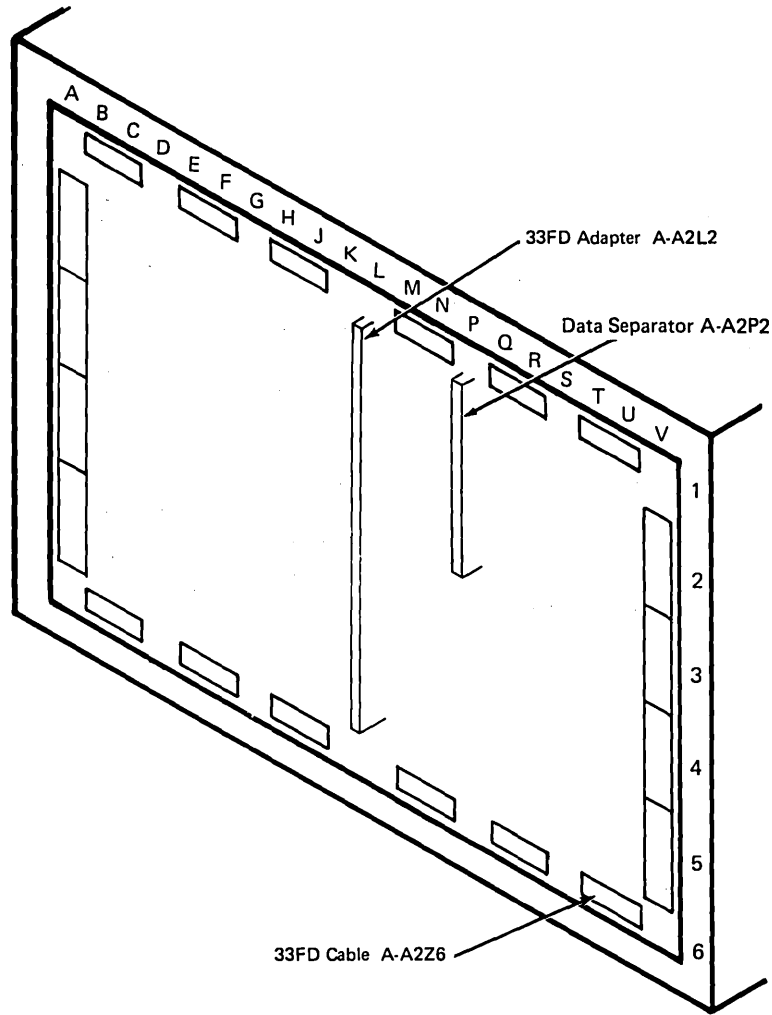
23-310   DISKETTE QUALITY SERVICE CHECK

CAUTION
The diskette quality service check must be performed
with the diskette drive in the same position as when
installed or the results might not be accurate.

_____
_____
_____
_____
_____

The tests described in this paragraph will aid in
determining the quality of the diskette.

Note: Some of the failures indicated by these tests
cannot always be repeated.

Inspect the diskette failure descriptions, print the ERAP
error history table, and run the following tests as
necessary to verify the errors indicated by the ERAP.

23-311   Diskette Failure Descriptions

- A bump, scratch, crease, or fingerprint causes errors
  on the same sectors, usually across tracks that are
  next to each other.

- Too large of a center hole causes errors on sectors
  that are on opposite sides of the center hole.
  (Example: sectors hexadecimal 01 and 0E or sectors
  hexadecimal 06 and 13.)

- Material from the diskette jacket cause random
  errors.

23-313   Diskette Test Description

Diskette analysis—This routine reads a complete diskette
(written in any IBM format) and causes a printout, which
identifies the locations (logical cylinder, head, and
sector) of any failures. Each sector is read only once
(without trying again). To run this routine:

1.   Perform a CSIPL from the DIAGB1 diskette.

2.   Select the UTILITIES option on the main menu.

3.   Select the EC UPDATE COPY option.

23-315   Diskette Figure

To look for visible damage, align the index hole in the
diskette with the hole in the diskette jacket, then use
the following figure of the diskette shown to locate the
damaged area of the diskette.

Note: For a normal size figure of the diskette, see
Appendix A of the _5340 System Unit Theory Diagrams
Manual._
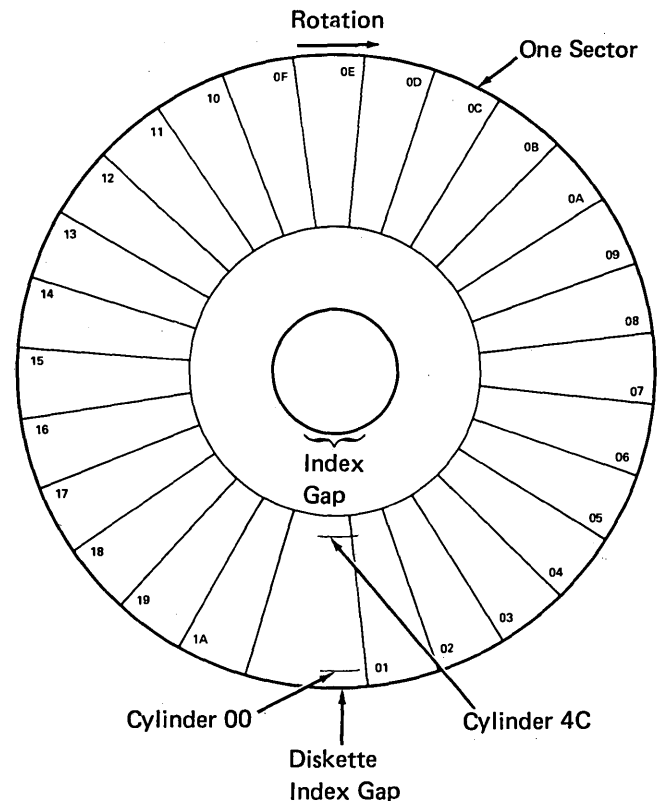
Notes:
1. The cylinder labels are hexadecimal 00 through 4C.
2. The sector labels are hexadecimal 01 through 1A as
   shown or hexadecimal 01 through 08.
3. The diskette is shown above as seen from the label
   side of diskette jacket, which is the side the pressure
   pad touches.

23-317 Diskette Quality Service Check for Level 1 Attachments

After determining the failing area of a diskette from the ERAP and diskette analysis printouts, the following exercisers may be run:

- Read sector exerciser—This exerciser attempts to read the sector up to 10 times and, if an error is sensed, does up to 20 read verifies to identify any failing byte. You may use this exerciser to locate the failing byte.

- Read loop exerciser—This exerciser permits you to synchronize on any byte in a sector to scope a failing area of a diskette.

The following two examples of scoping damaged diskettes show the loss of amplitude at the read circuit preamplifier. These are examples of damage such as scratches or bumps. The loss of amplitude on a diskette with a very small scratch will not be as visible.

Example 1: The diskette analysis printout indicates that the data did not compare on cylinder 24, head 1, and sector 11.

To scope this failure, do the following:

1. Set up an oscilloscope as follows:

    Note: Use a Tektronix 453, 454, or a similar oscilloscope with X10 probes.

	Old Style File Card	New Style File Card
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[1]	5 mV/cm	
Channel 2 volts/division[1]	5 mV/cm	
Channel 1 input	AC	
Channel 2 input	AC	
Invert	Pull out	
Times per division	0.1 ms/cm	
Channel 1 probe[2]	Preamp TP1	TPA-4 (preamp TP1)
Channel 2 probe[2]	Preamp TP2	TPA-5 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)	

[1]The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

[2]See paragraph 23-290 for control card test pins.

2. Set the Address/Data switches to F800 (CE panel) and perform an IPL.

3. Select the EXERCISERS option from the main menu.

4. Select the DISKETTE DRIVE option from the first exerciser menu.

5. Select the DISKETTE EXERCISER MODULE option from the second exerciser menu.

6. Select a recalibrate and, for this example, a seek to track 24 from the diskette exerciser test 1 command menu (enter an E after selecting the cylinder number).

7. Use the default option to execute the commands.

8. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.

9. Select the READ LOOP command and, for this example, select FM mode, cylinder 24, head 1, and sector 11 from the displays (enter an E after selecting the sector number).

10. Select the LOOP ON CMND TABLE option and turn the Address/Data switches (CE panel) from 6000 to 6010 to 6020 and so on until the failure is located.

The loss of amplitude can be seen on the oscilloscope.

Example 2: To scope a damaged track (contains all ones in the ID field), the following changes must be made to the preceding procedure:

1. Set the Times Per Division on the oscilloscope to 20 ms/cm.

2. Connect the trigger to the '+Index test' pin on the old type file card (connect the trigger to TPB-14 on the new type file card).

3. In step 6 of example 1, seek to the damaged cylinder.

4. In step 9 of example 1, select the READ SECTOR command (select the head, sector number, and cylinder number that you want to scope).

5. In step 10 of example 1, select the SCOPE LOOP A CMND option.

The following oscilloscope screen image shows the damaged area of the diskette.

1 Track

Damaged Area

23-319   Diskette Quality Service Check
for Level 2 Attachments

After determining the failing area of a diskette from the
ERAP and diskette analysis printouts, the following
exercisers may be run:

- Read sector exerciser–This exerciser attempts to read
  the sector up to 10 times and, if an error is sensed,
  does up to 20 read verifies to identify any failing
  byte. You may use this exerciser to locate the failing
  byte.

- Read loop exerciser–This exerciser permits you to
  synchronize on any byte in a sector to scope a failing
  area of a diskette.

The following two examples of scoping damaged
diskettes show the loss of amplitude at the read circuit
preamplifier. These are examples of damage such as
scratches or bumps. The loss of amplitude on a diskette
with a very small scratch will not be as visible.

Example 1: The diskette analysis printout indicates that
the data did not compare on cylinder 24, head 1, sector
11.

To scope this failure, do the following:

1.   Set up an oscilloscope as follows:

     Note: Use a Tektronix 453, 454, or a similar
     oscilloscope with X10 probes.

	Old Style File Card	New Style File Card
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[1]	5 mV/cm	
Channel 2 volts/division[1]	5 mV/cm	
Channel 1 input	AC	
Channel 2 input	AC	
Invert	Pull out	
Times per division	0.1 ms/cm	
Channel 1 probe [2]	Preamp TP1	TPA-4 (preamp TP1)
Channel 2 probe [2]	Preamp TP2	TPA-5 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)	

[1] The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

[2] See paragraph 23-290 for control card test pins.

2.   Set the Address/Data switches to F800 (CE panel)
     and perform an IPL.

3.   Select the EXERCISERS option from the main
     menu.

4.   Select the DISKETTE DRIVE option from the first
     exerciser menu.

5.   Select the DISKETTE EXERCISER LOAD MODULE
     option from the second exerciser menu.

6. Select a recalibrate and, for this example, a seek to track 24 from the diskette exerciser test 1 command menu (enter an E after selecting the cylinder number).

7. Use the default option to execute the commands.

8. Press the Attn key (3 times) to return to the diskette exerciser test 1 command menu.

9. Select the READ LOOP command and, for this example, select FM mode, cylinder 24, head 1, sector length = 128, sector 11, and M/S data field 1 from the displays (enter an E after selecting the sector number).

10. Select the LOOP ON CMND TABLE option and turn the Address/Data switches (CE panel) from 0000 to 0010 to 0020 and so on until the failure is located.

The loss of amplitude can be seen on the oscilloscope.

Example 2: To scope a damaged track (contains all ones in the ID field), the following changes must be made to the preceding procedure:

1. Set the Times Per Division on the oscilloscope to 20 ms/cm.

2. Connect the trigger to the +Index test pin on the old type file card. (Connect the trigger to TPB-14 on the new type file card.)

3. In step 6 of example 1, seek to the damaged cylinder.

4. In step 9 of example 1, select the READ 1 SECTOR ON CURRENT CYL command (select the mode, head, sector length, sector number, M/S data field, and cylinder number that you want to scope).

5. In step 10 of example 1, select the SCOPE LOOP A CMND option.

The following oscilloscope screen image shows the damaged area of the diskette.

1 Track

Damaged Area

CONTENTS

25

DANGER

1. The system supplies the alternating current and direct current power. Voltages are present on the connector terminals in the diskette drive when the drive motor is turning.
2. Motor and solenoid cases become hot after continuous use; wait enough time for parts to cool before servicing.

CAUTION

1. Do not use IBM cleaning fluid or other cleaning fluids near plastic parts.
2. Diskette drives can be damaged if they are not operated or serviced correctly.
3. Never use damaged diskettes in a diskette drive. Diskettes that are physically damaged (creased or bent) or contaminated by pencil marks, finger marks, or cleaning fluid can cause data errors, equipment errors, or head damage.
4. The head/carriage assembly, head timing block, and drive hub and pulley assembly are units that are adjusted and tested at the factory. The head timing block and drive hub and pulley assembly may not be changed in the field. The head/carriage assembly may be changed in the field. Do not repair or clean any part of this assembly.

25-030   TOOLS

Two timing pins (part 5562019, located inside the cover
assembly) are used to align the following:

- The stepper motor shaft and pulley

- The light-emitting diode assembly

Timing Pins

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

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

Do not use clips or rubber bands on a diskette.

Do not place heavy books on diskettes.

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

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

Do not expose diskettes to heat greater than 51.5° C (125°F) or direct sunlight.

Do not write outside the label area on diskettes.

4
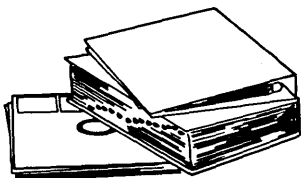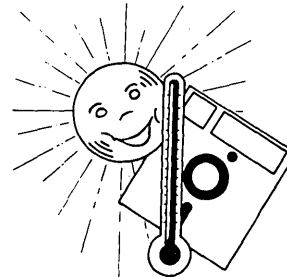
25-130 DISKETTE DRIVE ASSEMBLY

Removal and Replacement

1. Set Power to O (operator panel).

2. Open the diskette drive cover.

3. Open the front left side cover and remove screw **A**; open the front right side cover and remove screw **B**. Remove the panel assembly.

4. Remove the ground wire **C**.

5. Remove the four side panel screws **D** and the side panel.

6. Remove one end of the 53FD cable clamps.

7. Turn the locks **E**; remove the 53FD and mounting frame from the machine.

8. If power is not needed disconnect the cables so the unit can be moved to a convenient location.

CAUTION
Ensure that the cables are clear of the bracket **F** when the 53FD and mounting frame are reinstalled.

_____
_____
_____

9. To reinstall, reverse the above procedure.

Panel
Assembly
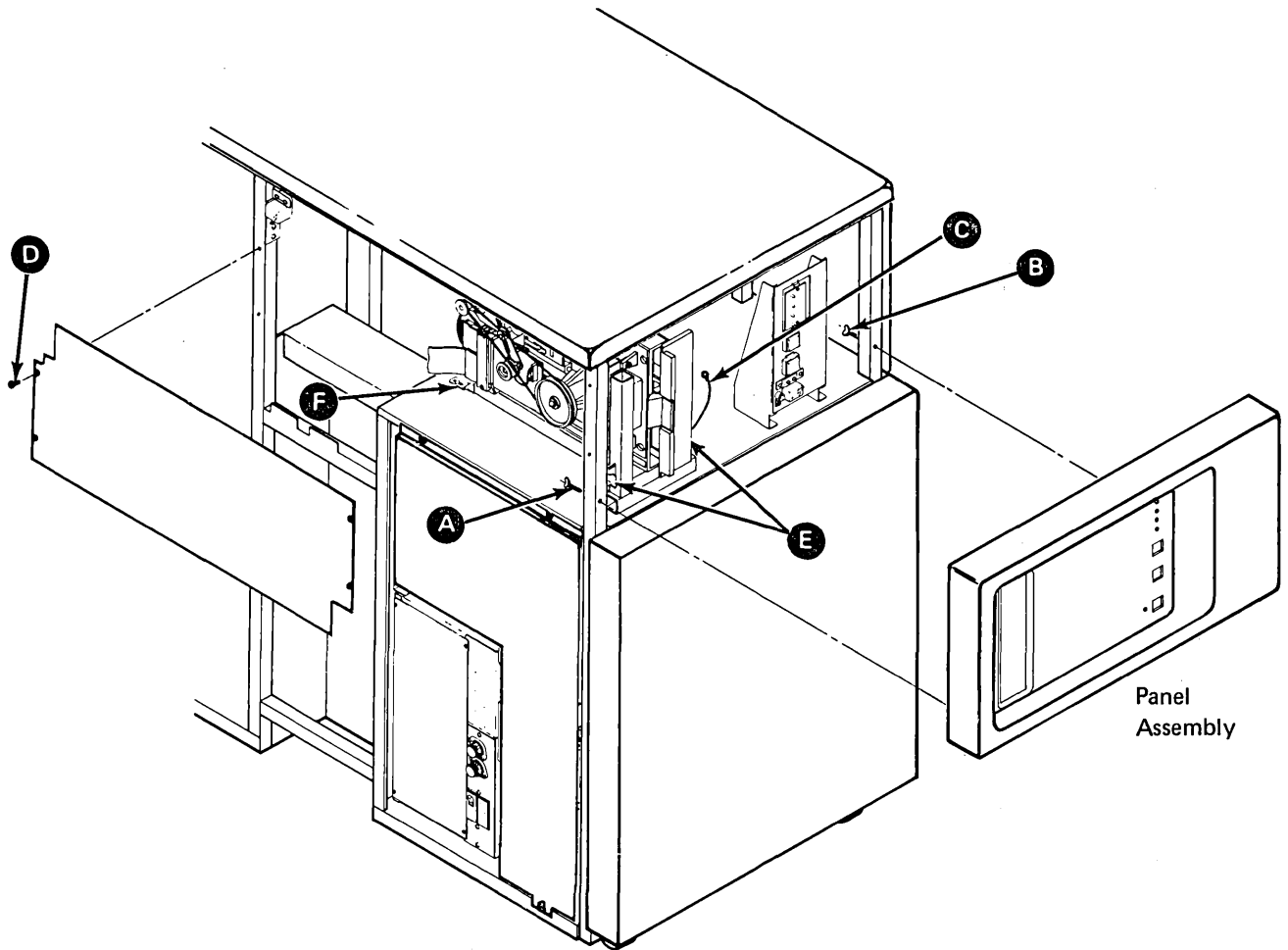
25-420   COVER REMOVAL

1. Remove the diskette drive (see paragraph 25-130).

2. Open the cover assembly.

3. Disconnect the spring **(A)** from the cover.

4. Loosen the two pivot screws with a wrench.

5. While holding the cover assembly remove the pivot screws.

6. Lift the cover away from the diskette drive.

25-430   COVER REPLACEMENT

1. While holding the cover assembly aligned with the mounting holes in the casting, reinstall the two pivot screws. (Ensure that spring **(A)** is installed.)

2. Tighten the pivot screws with a wrench.

3. Connect the spring **(A)** to the cover.

4. Close the cover assembly.

Cover
Assembly

(A)

Pivot Screws (2)
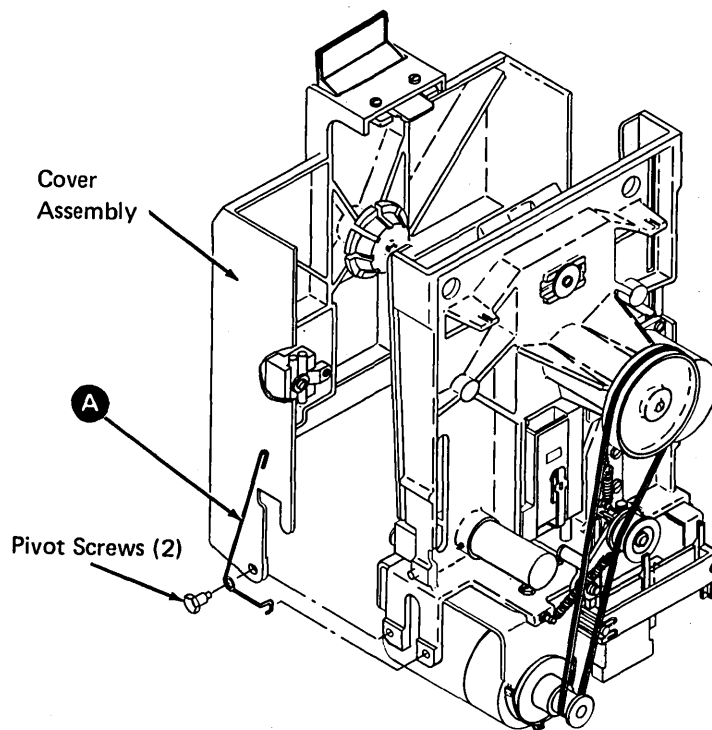
25-440   LATCH ASSEMBLY REMOVAL

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover (see paragraph 25-420).

3. Loosen the screws **A** and remove the latch cover.

4. Open the cover assembly and remove the two latch mounting screws **B**.

5. Carefully remove the latch **C** and the two pivots by pulling the latch toward the rear of the cover assembly. Do not lose the spring **D**.

25-450   LATCH ASSEMBLY REPLACEMENT

1. Place the latch **C** into the cover assembly. Then place the two pivots in position. Ensure you reinstall the spring **D**.

2. Reinstall the two latch mounting screws **B**.

3. Reinstall the latch cover and tighten the two screws **A**.

4. Perform the cover replacement (see paragraph 25-430).

5. Close the cover.

Latch Cover

25-460 COLLET REMOVAL

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Remove the mounting screw **A**.

4. Remove the collet assembly **B** and the other parts shown.

5. Remove the clip **C**; remove the collet.

25-470 COLLET REPLACEMENT

1. Reinstall the collet and clip **C**.

2. Reinstall the remaining parts on the collet assembly shaft in the order shown.

3. Reinstall the collet assembly **B** and the mounting screw **A**.

4. Reinstall the cover assembly (see paragraph 25-430).

Spring

Tubing

Washers

Shim

Collet

This page is intentionally left blank.

25-480   HEAD/CARRIAGE SERVICE CHECK

Note: Run the head alignment exerciser before performing this service check. If the head alignment is good, go to the *Diskette Quality and Head Wear Service Check* (see paragraph 25-991). If the head alignment is bad, continue with this service check.

CAUTION
The head/carriage assembly is adjusted and tested at the factory. Do not repair or clean any part of this assembly.

_____
_____
_____
_____
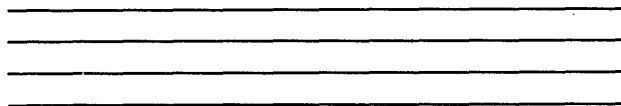
The head/carriage service check must be done with the diskette drive in the same position as when installed or the adjustment can be wrong.

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Remove the wiper assembly ⒸC.

4. Disconnect the drive motor power plug.

5. Insert a strip of clean paper between the heads to keep the head surfaces from touching.

6. Turn the stepper motor pulley by hand to about cylinder 40 and insert a timing pin Ⓑ.

7. Remove the attachment card at A-A2L2 to prevent the stepper motor access lines from being activated by an external source.

8. Set Power to I (operator panel).

9. Install a jumper Ⓐ from TPA13 (ground) to THP11 (-align access 0).

10. If the timing pin passes freely through the stepper motor pulley into the timing slot in the casting, go to step 11. If the timing pin does not pass freely through the stepper motor pulley into the timing slot in the casting, do the following:
    - Remove the timing pin Ⓑ.
    - Remove the jumper Ⓐ.
    - Set Power to O (operator panel).
    - Go to 25-490, step 5.

11. Remove the timing pin Ⓑ.

12. Remove the jumper end from THP11. Then install the jumper end to TPB10 (MC-3).

13. Verify that this is cylinder 39 by visually checking for no gap Ⓓ between the timing pointer and the timing block.

14. Remove the jumper end from TPB10 (MC-3). Then install the jumper end to THP11 (-align access 0).

15. Verify that this is cylinder 40 by visually checking that the timing hole in the pulley lines up with the timing slot in the casting. (Do not use a timing pin.)

16. If the head/carriage assembly is at cylinder 40, go to step 17. If the head/carriage assembly is not at cylinder 40, go to 25-490, step 5.

17. Verify the 0.508 millimeter (0.020 inch) gap Ⓔ as follows:
    - Visually checking that the head/carriage assembly does not move while carefully inserting a 0.0195 thickness gauge.
    - Visually check that the head/carriage assembly moves slightly while carefully inserting a 0.021 thickness gauge.

    Note: Because of the torque of the stepper motor, this step can be performed only once. If it is necessary to perform this step again, go back to step 12.

18. If the adjustment is correct, go to step 19. If the adjustment is not correct, go to 25-490, step 14.

19. Remove the jumper Ⓐ

20. Reinstall the wiper assembly ⒸC.

    Note: If a new head/carriage was installed, go to 25-520, step 6. If a new head/carriage was not installed, go to step 21.

21. Set Power to O (operator panel) and remove the paper from between the heads.

22. Reinstall the drive motor power plug and the attachment card.

23. Reinstall the cover assembly (see paragraph 25-430).
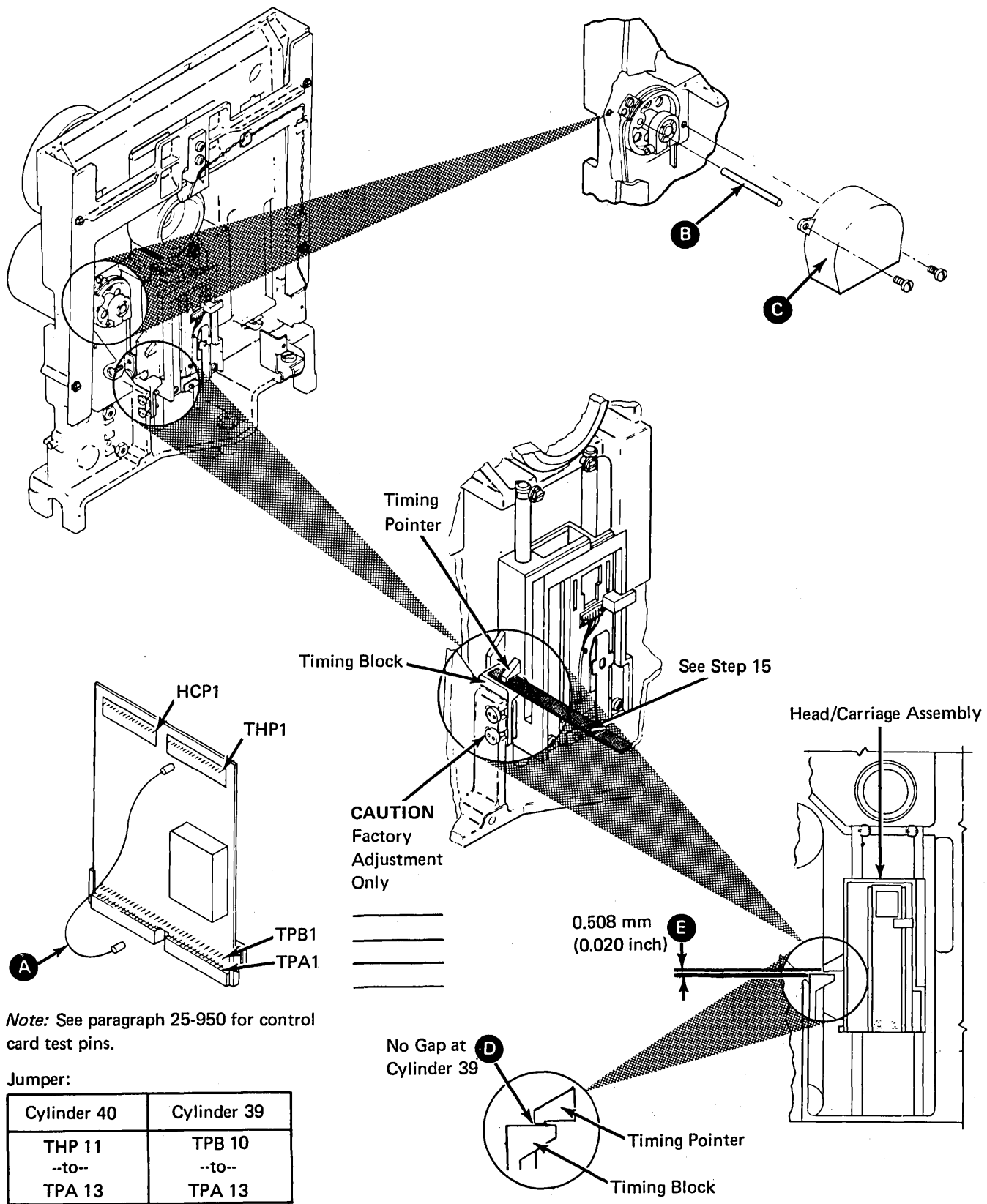
Timing
Pointer

Timing Block

See Step 15

Head/Carriage Assembly

HCP1

THP1

CAUTION
Factory
Adjustment
Only

TPB1
TPA1

A

0.508 mm
(0.020 inch)

E

Note: See paragraph 25-950 for control
card test pins.

Jumper:

Cylinder 40	Cylinder 39
THP 11	TPB 10
--to--	--to--
TPA 13	TPA 13

No Gap at **D**
Cylinder 39

Timing Pointer

Timing Block

B

C

25-490   HEAD/CARRIAGE ADJUSTMENT

CAUTION
The head/carriage assembly adjustment must be done with the diskette drive in the same position as when installed or the adjustment can be wrong.

_____
_____
_____
_____

1.   Remove the diskette drive (see paragraph 25-130).

2.   Remove the cover assembly (see paragraph 25-420).

3.   Remove the wiper assembly **F**.

4.   Insert a strip of clean paper between the heads to prevent the head surfaces from touching.

5.   Measure the gap **B** between the stepper motor pulley and the casting. Write the measurement here.

        Gap is:_____

6.   Loosen the clamp screw **C** so the stepper motor shaft is free to turn inside the pulley.

7.   Turn the stepper motor pulley by hand to about cylinder 40 and insert a timing pin **E**.

8.   Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

_____
_____
_____

9.   Remove the attachment card at A-A2L2 to prevent the stepper motor access lines from being activated by an external source.

10.   Set Power to I (operator panel).

11.   Install a jumper **A** from TPA13 (ground) to THP11 (-align access 0).

12.   Make the gap **B** the same size as the gap recorded in step 5 and tighten the clamp screw **C**. (Ensure that the timing pin passes freely through the stepper motor pulley into the timing slot in the casting.)

13.   Remove the timing pin **E**.

14.   Loosen the two band clamping screws **D**.

15.   Remove the jumper end from THP11. Then install the jumper end to TPB10 (MC-3).

16.   Remove the jumper end from TPB10. Then install jumper end to THP11 (-align access 0).

17.   Verify that this is cylinder 40 by visually checking that the timing hole in the pulley lines up with the timing slot in the casting. (Do not use a timing pin.)

18.   If the head/carriage assembly is at cylinder 40, go to step 19. If the head/carriage assembly is not at cylinder 40 repeat steps 6 through 17.

19.   Insert a 0.020 thickness gauge **G** between the timing pointer and the timing block. (Put light finger pressure to the top of the carriage to hold the thickness gauge in place.)

20.   Tighten the band clamping screws **D**. (Ensure that the drive band is straight.)

21.   Go to 25-480, step 12.
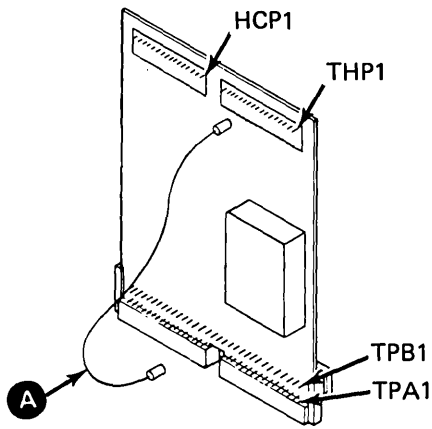
HCP1

THP1

TPB1
TPA1

A

Note: See paragraph 25-950 for control card test pins.

Jumper:

Cylinder 40	Cylinder 39
THP 11 --to-- TPA 13	TPB 10 --to-- TPA 13

Timing
Pointer

D

Timing Block

CAUTION
Factory
Adjustment
Only

G

B

C

E

F
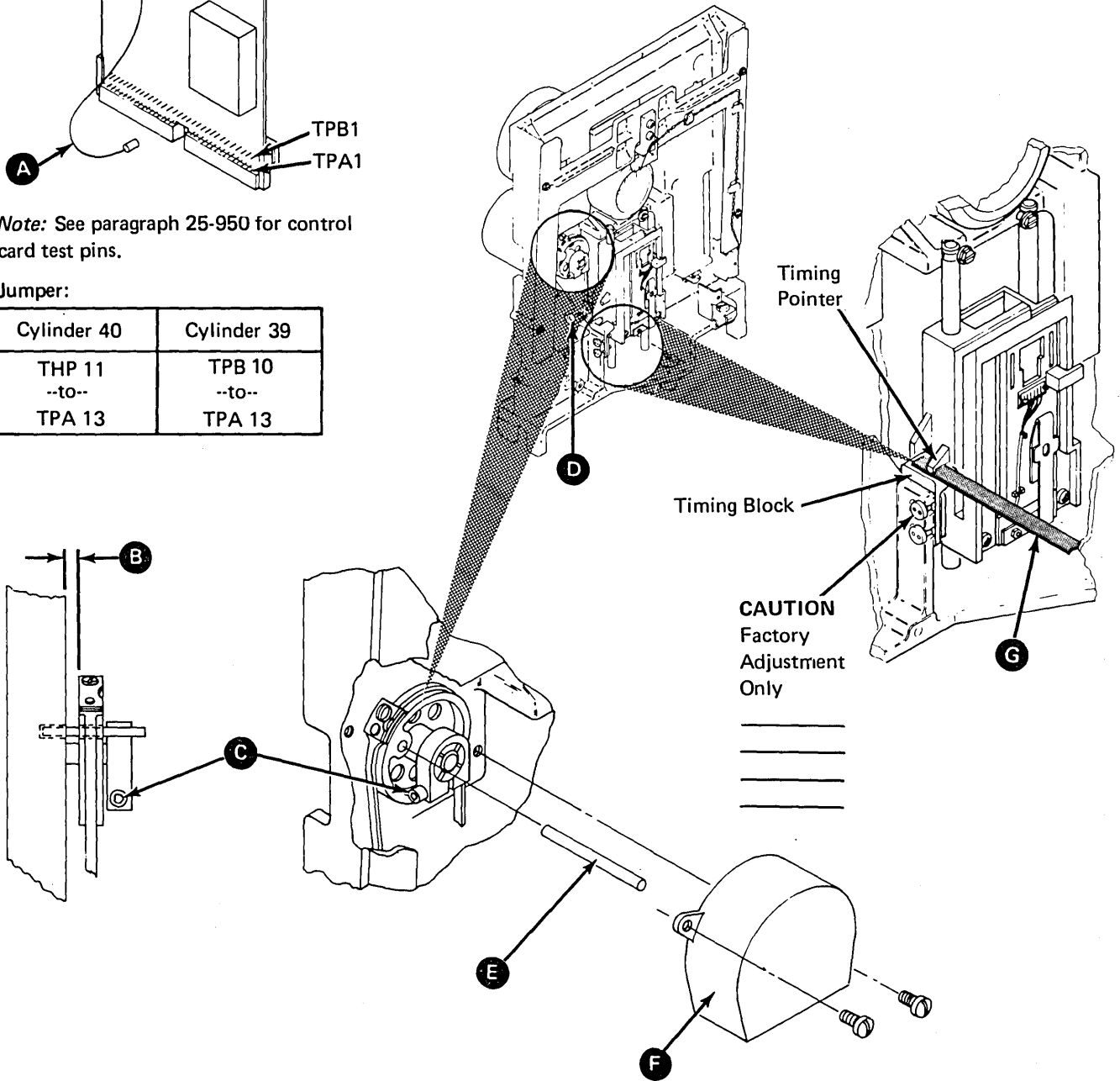
25-500   HEAD/CARRIAGE REMOVAL

1.   Remove the diskette drive (see paragraph 25-130).

2.   Remove the cover assembly (see paragraph 25-420).

3.   Remove the wiper assembly **D**.

4.   Carefully remove the head cable from the diskette drive control card. (Remember the cable path for the replacement procedure.)

5.   Place the head/carriage assembly to about cylinder 40.

6.   Remove the two band clamping screws **B** and the clamp. Place the head/carriage assembly at the lower limit (cylinder 00).

7.   Loosen the screw **H** and remove the guide rod **G**.

8.   Carefully lift and turn the head/carriage assembly to remove it from the guide rod **K**.

25-510   HEAD/CARRIAGE REPLACEMENT

CAUTION
When installing the head/carriage assembly, ensure that the bail **L** is under the tab **M** of the carriage arm. Ensure that the bail return spring **J** is installed. Also, ensure that a strip of clean paper is inserted between the head surfaces during installation.

_____
_____
_____
_____
_____
_____
_____

1.   Carefully install the head/carriage assembly on the guide rod **K** and place the head/carriage assembly at the lower limit (cylinder 00).

2.   Reinstall the guide rod **G** and tighten the screw **H**. (Ensure that the guide rod notch **F** is aligned with the screw and is seated as shown **E**.)

3.   Place the head/carriage assembly at about cylinder 40.

4.   Reinstall the clamp and the two band clamping screws **B**. (Do not tighten these two screws now.)

5.   Carefully place and connect the head cable to the diskette drive control card.

6.   Turn the stepper motor pulley to about cylinder 40 and insert a timing pin **C**.

7.   Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the head/carriage is disconnected and power is on.
> _____
> _____
> _____

8.   Remove the attachment card at A-A2L2 to prevent the stepper motor access lines from being activated by an external source.

9.   Set Power to I (operator panel).

10.   Install a jumper **A** from TPA13 (ground) to THP11 (-align access 0).

11.   If the timing pin passes freely through the stepper motor pulley into the timing slot in the casting, go to step 12. If the timing pin does not pass freely through the stepper motor pulley into the timing slot in the casting, do the following:
       — Remove the timing pin **C**.
       — Remove the jumper **A**.
       — Set Power to O (operator panel)
       — Go to 25-490, step 5.

12.   Remove the timing pin **C**.

13.   Go to 25-490, step 15.

HCP1

THP1

TPB1

TPA1

Ⓐ

Note: See paragraph 25-950 for control card test pins.

Jumper:

Cylinder 40	Cylinder 39
THP 11	TPB 10
--to--	--to--
TPA 13	TPA 13

Ⓔ

Properly
Seated Guide Rod

Improperly
Seated Guide Rod

Ⓚ

Ⓕ

Ⓖ

Ⓗ

Ⓛ

Ⓜ

Ⓙ

Ⓑ

Ⓒ

Ⓓ

Solenoid

Solenoid
Locking Screw

Diskette

Read/Write Heads

Carriage Assembly

Bail Stop Setscrew

Front Cover

Bail Assembly
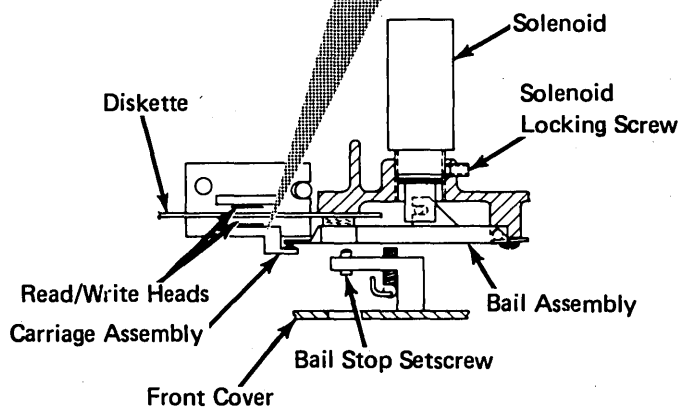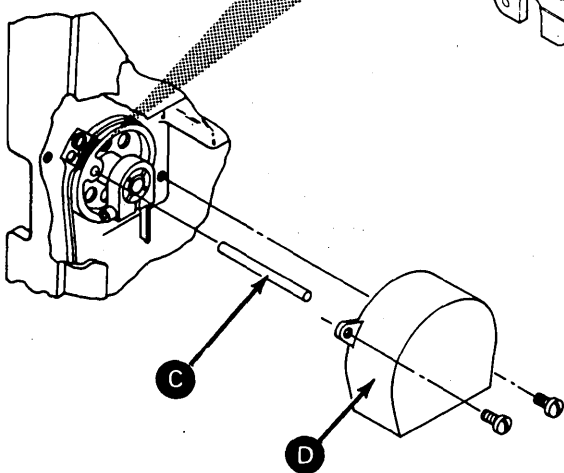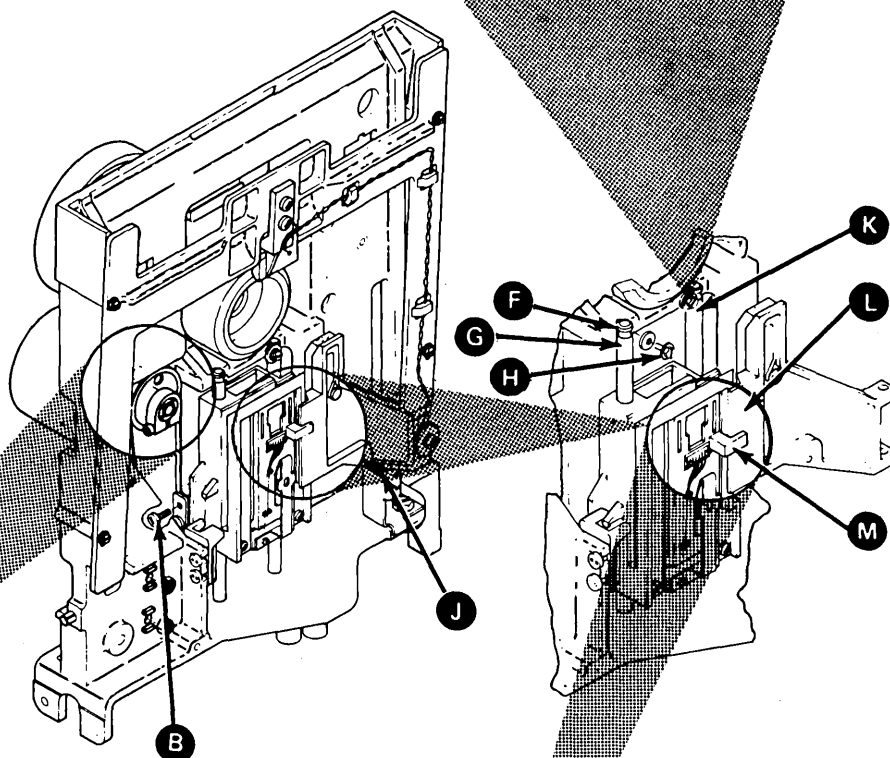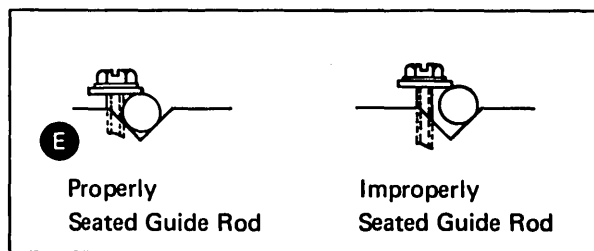
25-520   SOLENOID AND BAIL SERVICE CHECK

1. Remove the diskette drive (see paragraph 25-130).

2. Disconnect the drive motor power connector.

    > **DANGER**
    > Voltage is still present at the power connector when the diskette drive solenoid and bail are disconnected and power is on.
    > _____
    > _____
    > _____

3. Set Power to I (operator panel).

4. Remove the cover assembly (see paragraph 25-420).

5. Insert a strip of clean paper between the heads to prevent the head surfaces from touching.

6. Install a jumper **A** from TPA13 (ground) to TPB13 (-head load) to activate the head load solenoid.

7. Verify a 0.4 ± 0.13 millimeter (0.015 ± 0.005 inch) gap **C** between the bail and the carriage arm for all of the carriage movement (cylinder 00 to cylinder 76).

8. If the gap is correct, go to step 9. If the gap is not correct, go to 25-530, step 7.

9. Remove the jumper **A**.

10. Remove the paper from between the heads.

11. Reinstall the cover assembly (see paragraph 25-430).

12. With the head load solenoid de-activated and the cover closed, visually check for a gap **B** of approximately 3/32 to 4/32 of an inch between the head surfaces. (This gap cannot be measured.)

13. If the gap is correct, go to step 14. If the gap is not correct, go to 25-530, step 14.

14. Set Power to O (operator panel).

15. Connect the drive motor power cable. (If you came from paragraph 25-480, reinstall the attachment card at A-A2L2.)

16. Set Power to I (operator panel).

Solenoid

Power Cable

THP1

HCP1

TPB1

TPA1

A

Jumper:
TPB13 (-head load)
-- to --
TPA13 (ground)

Note: See paragraph 25-950 for control card test pins.

Solenoid
(de-activated)

Carriage Assembly

Plunger

B

3/32 to 4/32 inch

Read/Write Heads

Bail Assembly

Carriage Tab

Cover Assembly

Bail Stop Setscrew

Bail

Tab

25

Solenoid
(activated)

Carriage Assembly

Strip of Clean Paper

Plunger

Read/Write Heads

Carriage Tab

C

0.4 ± 0.13 mm
(0.015 ± 0.005 inch)

Bail Assembly

25-530   SOLENOID AND BAIL ADJUSTMENT

1. Remove the diskette drive (see paragraph 25-130).

2. Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.
> _____
> _____
> _____

3. Set Power to I (operator panel).

4. Remove the cover assembly (see paragraph 25-420).

5. Insert a strip of clean paper between the heads to prevent the head surfaces from touching.

6. Install a jumper **E** to activate the head load solenoid.

> **DANGER**
> The solenoid case becomes hot after continuous use.
> _____
> _____
> _____

7. Loosen the solenoid locking screw **B**.

8. Turn the solenoid in the casting for a 0.4 ± 0.13 millimeter (0.015 ± 0.005 inch) gap **C** between the bail and the carriage arm (a clockwise turn decreases the gap).

9. If the gap is correct for all of the carriage movement (cylinder 00 to cylinder 76), go to step 10. If the gap is not correct for all the carriage movement, go back to step 8.

10. Tighten the solenoid locking screw.

11. Remove the jumper **E**.

12. Remove the paper from between the heads.

13. Reinstall the cover assembly (see paragraph 25-430).

14. With the head load solenoid de-activated and the cover closed, visually check for a gap **D** of approximately 3/32 to 4/32 of an inch between the head surfaces. (This gap cannot be measured.)

15. If the gap is correct, go to step 16. If it is not correct, turn the bail stop screw **A** clockwise until the heads just touch, then turn the screw counterclockwise one complete turn.

16. Set Power to O (operator panel).

17. Connect the drive motor power cable. (If you came from paragraph 25-480, reinstall the attachment card at A-A2L2.)

18. Set Power to I (operator panel).

Wrench
(part 450373)

A

B

Solenoid

Power Cable

E

Jumper:
TPB13 (-head load)
-- to --
TPA13 (ground)

25.
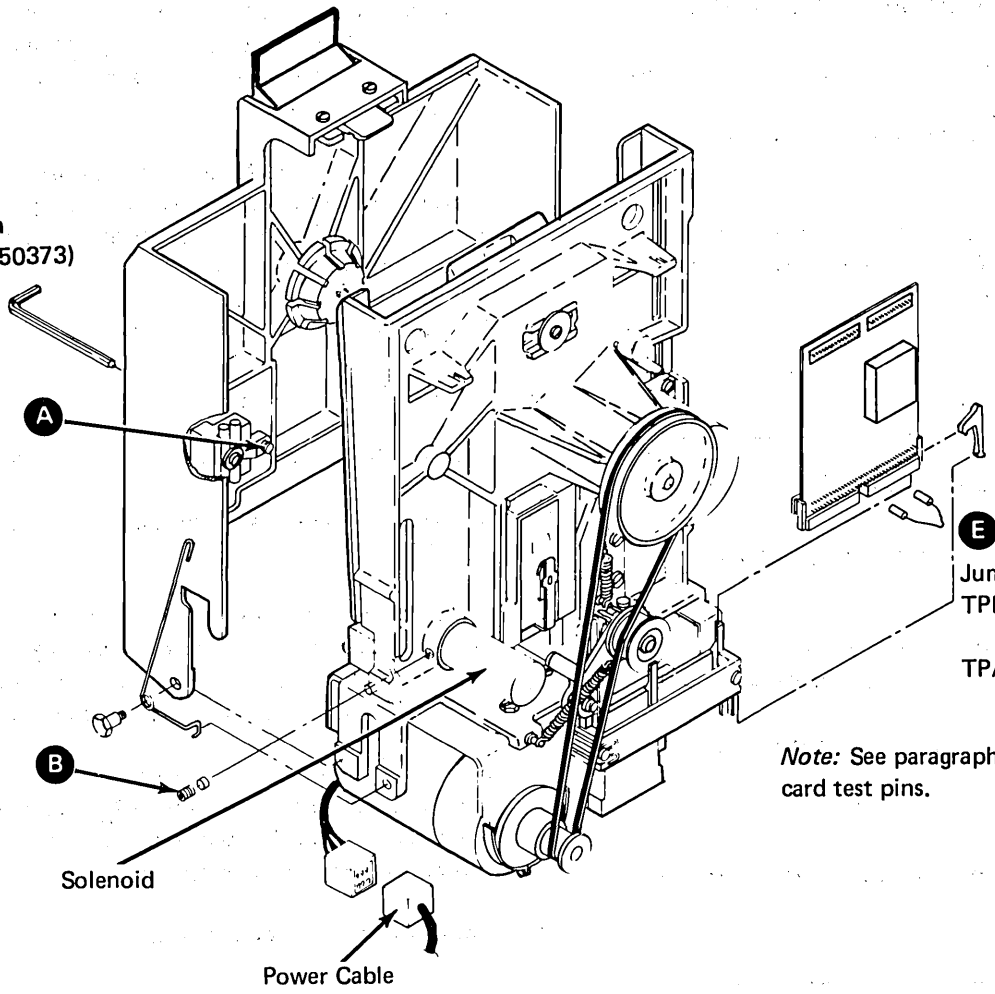
Note: See paragraph 25-950 for control card test pins.

Note: Turn the solenoid clockwise to decrease this gap.

Solenoid
(activated)

Carriage Assembly

Strip of
Clean Paper

Plunger

Read/Write Heads

C

Bail Assembly

Carriage Tab

0.4 ± 0.13 mm
(0.015 ± 0,005 inch)

Carriage Assembly

Solenoid
(de-activated)

Plunger

D

3/32 to 4/32 inch

Read/Write Heads

Bail Assembly

Carriage Tab

Cover Assembly

Bail Stop Setscrew
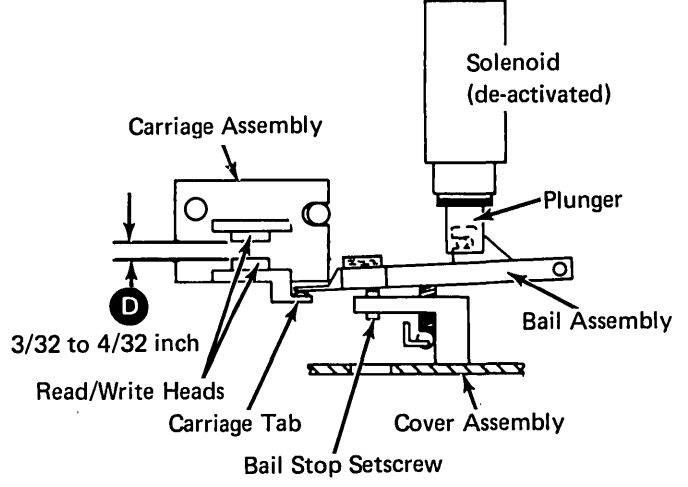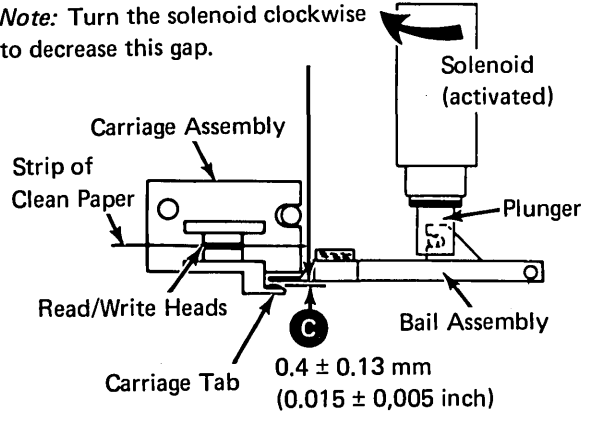
25-540 SOLENOID AND BAIL REMOVAL (MACHINES WITH TAPER PIN BLOCK ⓕ)

1. Remove the diskette drive (see paragraph 25-130).

2. Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.
>
> _____
> _____
> _____

3. Remove the cover assembly (see paragraph 25-420).

4. Insert a strip of clean paper between the heads to prevent the head surfaces from touching.

5. Remove the solenoid leads ⓖ from the taper pin terminal block ⓕ. (Remember the cable path for the replacement procedure.)

6. Remove the bail return spring ⓔ.

7. Remove the mounting screw ⓓ and the bail ⓒ. (This pulls the solenoid plunger out of the solenoid. Be careful not to damage the plated surface of the plunger.)

8. Remove the plunger from the bail.

9. Loosen the solenoid locking screw ⓐ.

10. Remove the head load solenoid by turning it counterclockwise.

25-545 SOLENOID AND BAIL REPLACEMENT (MACHINES WITH TAPER PIN BLOCK ⓕ)

1. Install the solenoid about four turns clockwise into the casting.

2. Install the plunger to bail. (Be careful not to damage the plated surface of the plunger.)

3. While inserting the plunger into the solenoid, reinstall the bail and the mounting screw ⓓ. Ensure that the bail is under the tab ⓑ of the carriage arm.

4. Reinstall the bail return spring ⓔ.

5. Carefully place and connect the solenoid leads ⓖ to the taper pin terminal block ⓕ.

6. Set Power to I (operator panel).

7. Go to 25-530, step 6.

Plunger

Solenoid

Ⓐ

Ⓕ

25

Ⓑ

Ⓒ

Ⓓ

Ⓔ

Capacitor	+

28 ohms

White Ⓖ

Solenoid

White

160 ohms

Black   Yellow

+24 Vdc ➤   H   Solenoid

+   A   160 ohms   F

28 ohms

D
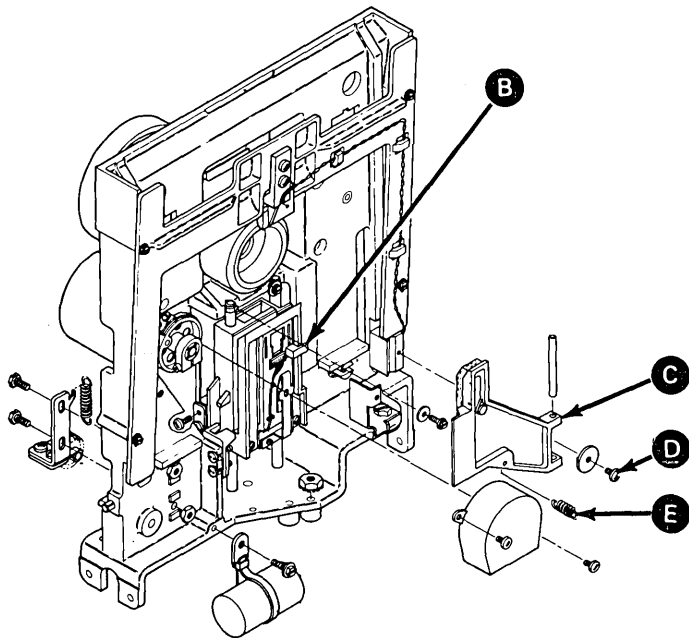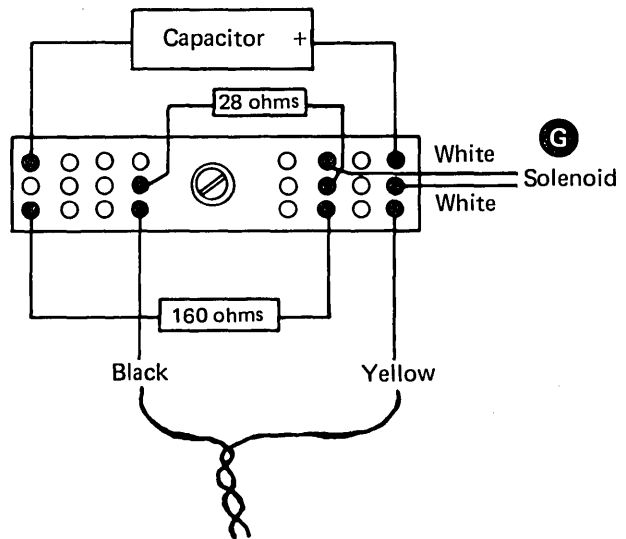
25-550   SOLENOID AND BAIL REMOVAL (MACHINES WITHOUT TAPER PIN BLOCK F)

1. Remove the diskette drive (see paragraph 25-130).

2. Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the solenoid and bail are disconnected and power is on.
>
> _____
> _____
> _____

3. Remove the cover assembly (see paragraph 25-420).

4. Insert a strip of clean paper between the heads to prevent the head surfaces from touching.

5. Remove the ball return spring **E**.

6. Remove the mounting screw **D** and the bail **C**. (This pulls the solenoid plunger out of the solenoid. Be careful not to damage the plated surface of the plunger.)

7. Disconnect the cable from location A2 **G**.

8. Remove the two screws **H** and the two connector covers.

9. Remove the solenoid leads **J** from the cable connector by pushing down on the terminal tabs with a small screwdriver.

10. Remove the plunger from the bail.

11. Loosen the solenoid locking screw **A**.

12. Remove the head load solenoid by turning it counterclockwise.

25-555   SOLENOID AND BAIL REPLACEMENT (MACHINES WITHOUT TAPER PIN BLOCK F)

1. Install the solenoid about four turns clockwise into the casting.

2. Install the plunger to bail. (Be careful not to damage the plated surface of the plunger.)

3. While inserting the plunger into the solenoid, reinstall the bail and the mounting screw **D**. Ensure that the bail is under the tab **B** of the carriage arm.

4. Reinstall the bail return spring **E**.

5. Insert the solenoid leads **J** into the cable connector. Ensure that the locking tabs **K** on the terminals lock in the connector slots.

6. Reinstall the connector covers and the two screws **H**.

7. Connect the cable to location A2 **G**.

8. Set Power to I (operator panel).

9. Go to 25-530, step 6.

Plunger

Solenoid

F

G Location A2

H

A

25

B04
Black

B11
White

J

B

C

D

E

K
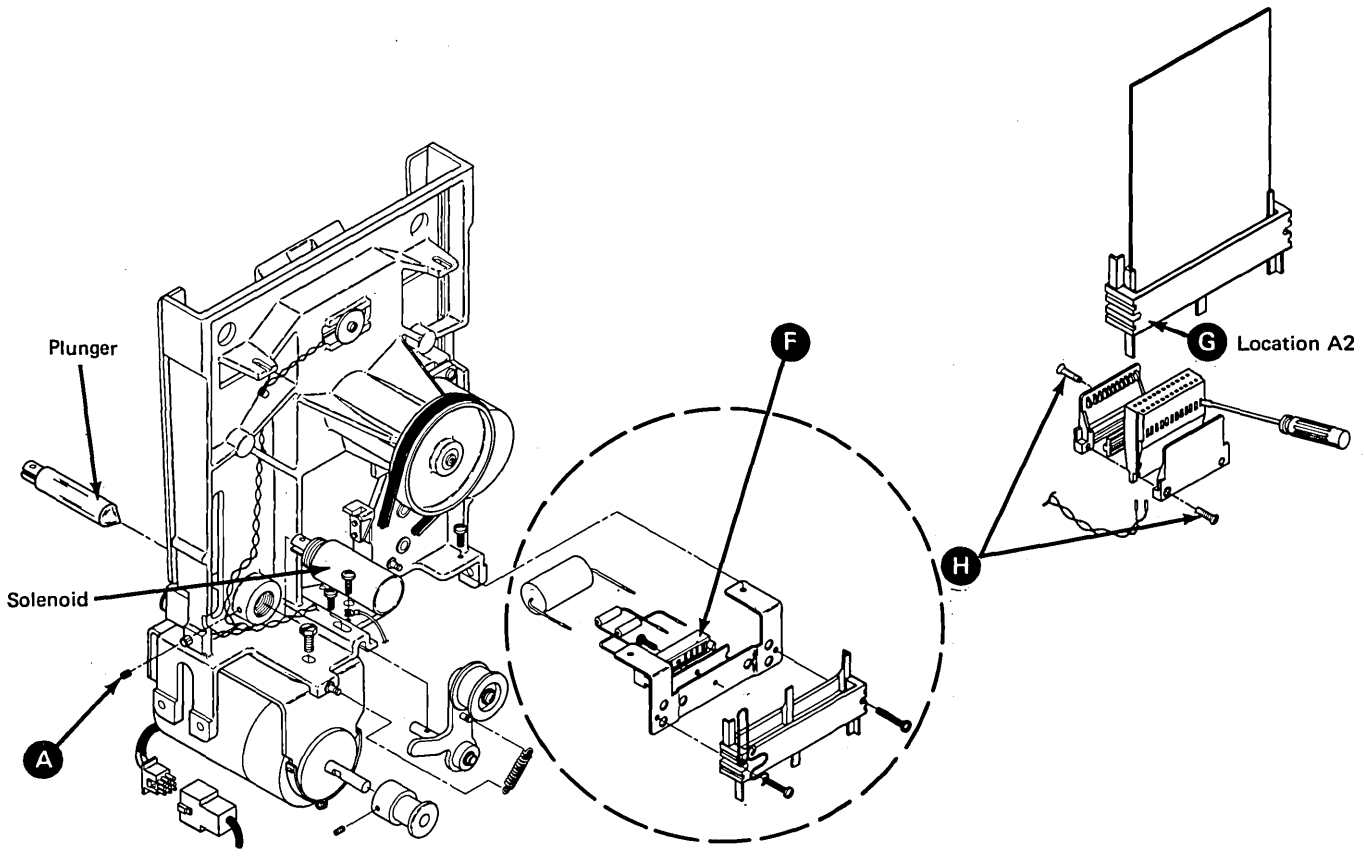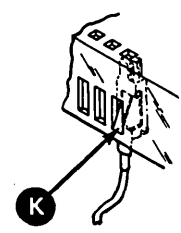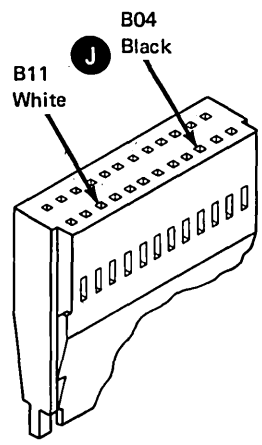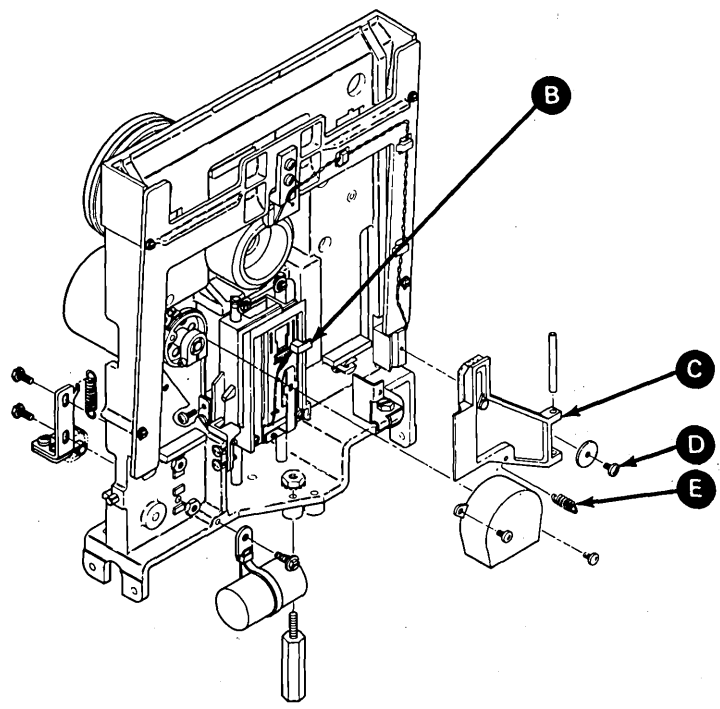
25-560   BELT TRACKING SERVICE CHECK

1.   With power on, check that the drive belt is centered on the hub pulley and the drive pulley.

2.   If the drive belt is not centered, go to 25-570.

25-570   BELT TRACKING ADJUSTMENT

1.   Remove the diskette drive (see paragraph 25-130).

2.   Loosen the idler locking screw (F) and the drive pulley set screw (D).

3.   Slide the idler assembly and the drive pulley in or out so the belt is centered on the hub pulley and the drive pulley when the drive pulley is turned counterclockwise.

4.   Tighten the idler locking screw and the drive pulley set screw. Ensure that the drive pulley set screw is on the flat surface of the drive motor shaft.

5.   Set Power to I (operator panel).

6.   Go to 25-560.

25-580   BELT REMOVAL

1.   Set Power to O (operator panel).

2.   Release the idler tension by hand and remove the drive belt.

25-590   BELT REPLACEMENT

1.   Install the belt, ensuring that the idler is in place as shown (A).

2.   Set Power to I (operator panel).

3.   Go to 25-560.

25-600   DRIVE MOTOR REMOVAL

1.   Remove the diskette drive (see paragraph 25-130).

2.   Disconnect the drive motor power cable.

3.   Remove the drive belt (see paragraph 25-580).

> **DANGER**
> The motor case becomes hot after continuous use.
> _____
> _____
> _____

4.   Remove the two motor bracket mounting screws (E) and remove the drive motor and the bracket as an assembly. (Be careful not to lose the bail return spring and bracket (C).)

5.   Loosen the set screw (D) and remove the drive pulley.

25-610   DRIVE MOTOR REPLACEMENT

1.   Reinstall the drive pulley on the new motor. Ensure that the set screw (D) is on the flat surface of the motor shaft.

> **DANGER**
> (60 Hz motors)
> To prevent personal injury, if your motor case has two large holes, position the two large holes (B) in the motor frame so the holes are under the bracket.
> _____
> _____
> _____
> _____
> _____

2.   Install the motor and bracket assembly and the two screws (E). (Ensure that the bail return spring and bracket (C) is installed.)

3.   Reinstall the cover assembly (see paragraph 25-430).

4.   Connect the drive motor power cable.

5.   Go to 25-590.
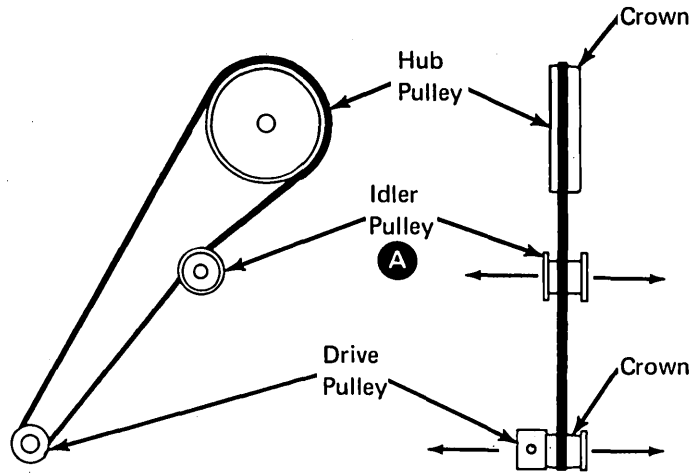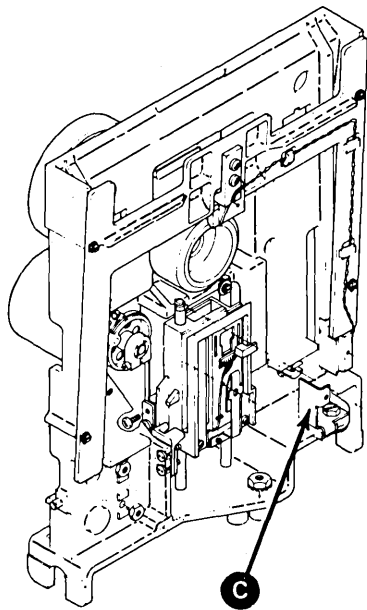
Crown

Hub
Pulley

Idler
Pulley

A

Drive
Pulley

Crown

Hub Pulley
CAUTION
Not replaceable
in the field.

C

Belt

Drive Motor and
Bracket Assembly

E

F

B

Idler Pulley

Power Cable

D

Drive Pulley

Flat Surface

25-610
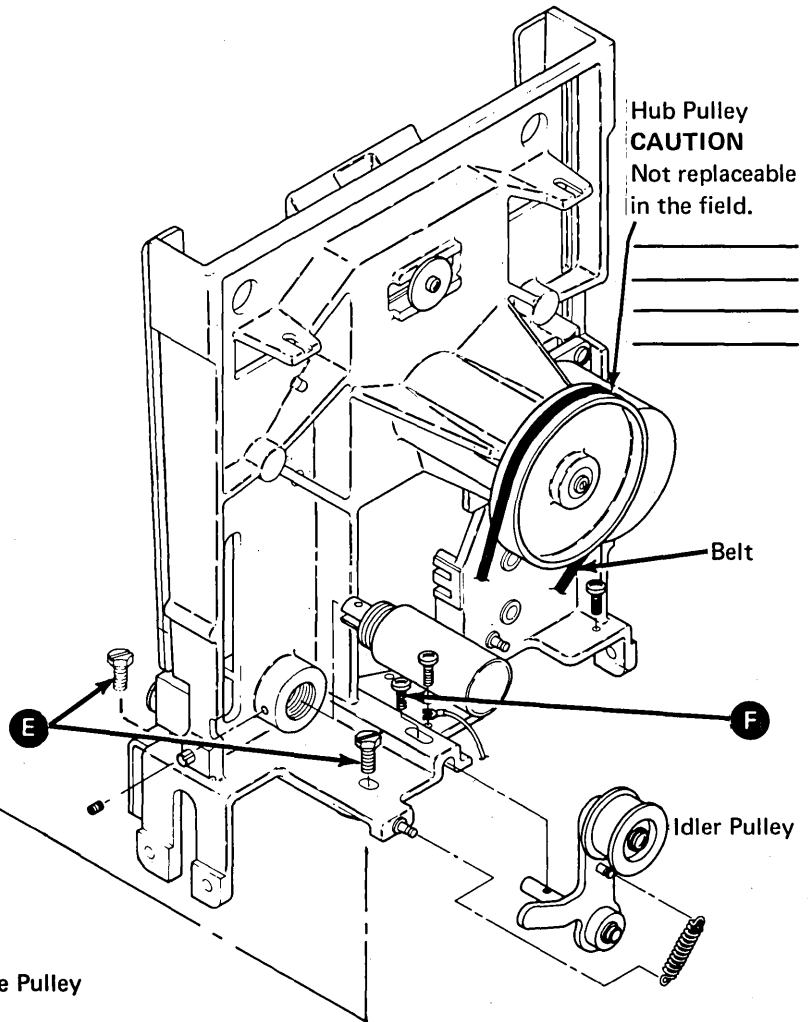
53FD Diskette Drive   25
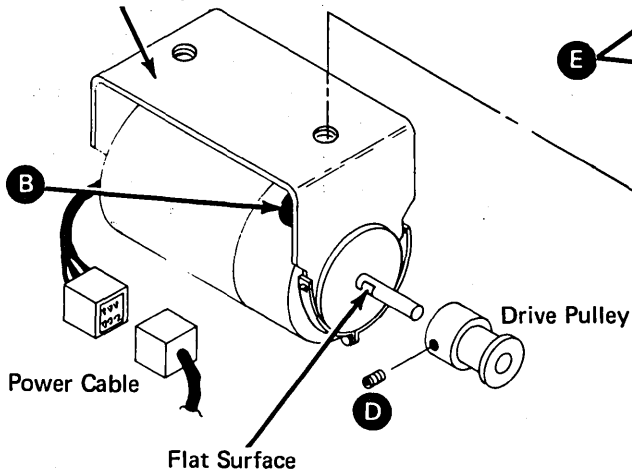
25-620 DRIVE PULLEY REMOVAL
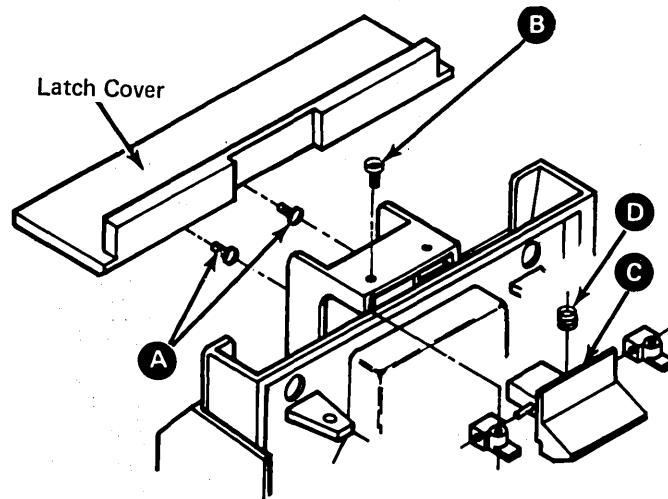
1. Remove the diskette drive (see paragraph 25-130).

2. Remove the drive belt (see paragraph 25-580).

3. Loosen the set screw **D** and remove the drive pulley.

25-630 DRIVE PULLEY REPLACEMENT

1. Install the drive pulley on the motor shaft with the set screw **D** on the flat surface of the shaft.

2. Go to 25-590.

25-640 IDLER ASSEMBLY REMOVAL

1. Remove the drive belt (see paragraph 25-580)

2. Remove the idler spring **G**.

3. Remove the locking screw **F** and the idler assembly.

25-650 IDLER ASSEMBLY REPLACEMENT

1. Install the idler assembly and the locking screw **F** (do not tighten).

2. Reinstall the idler spring **G**.

3. Go to 25-590.

Crown

Hub
Pulley

Idler
Pulley

Drive
Pulley

Crown

Hub Pulley
CAUTION
Not replaceable
in the field.

Belt

F

Drive Motor and
Bracket Assembly

Idler Pulley

G

Power Cable

Drive Pulley

D

Flat Surface
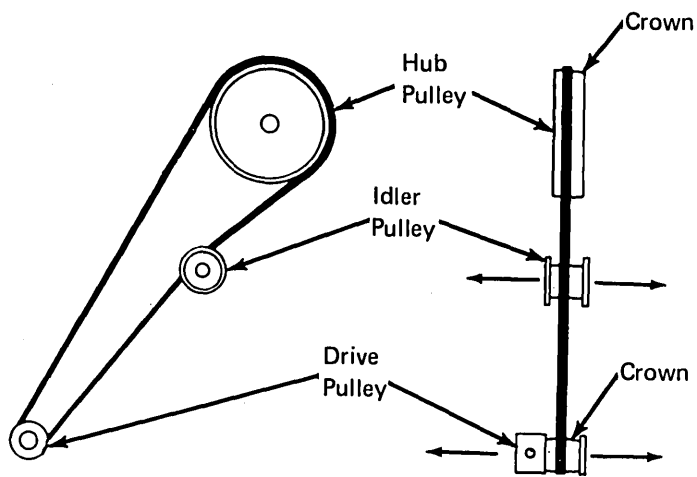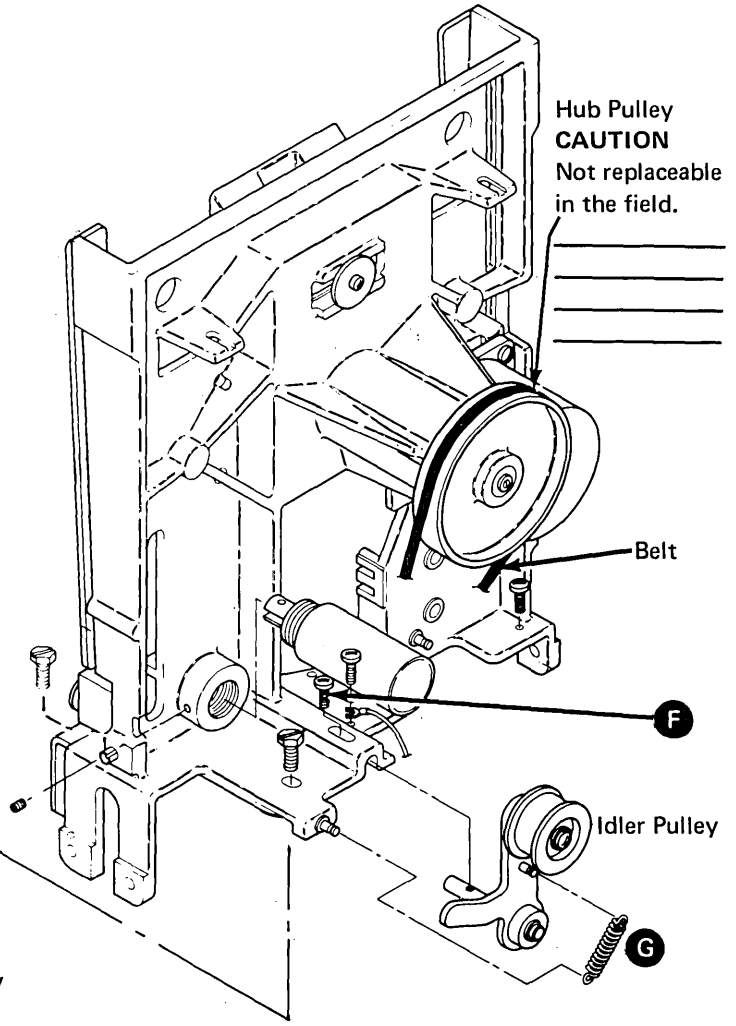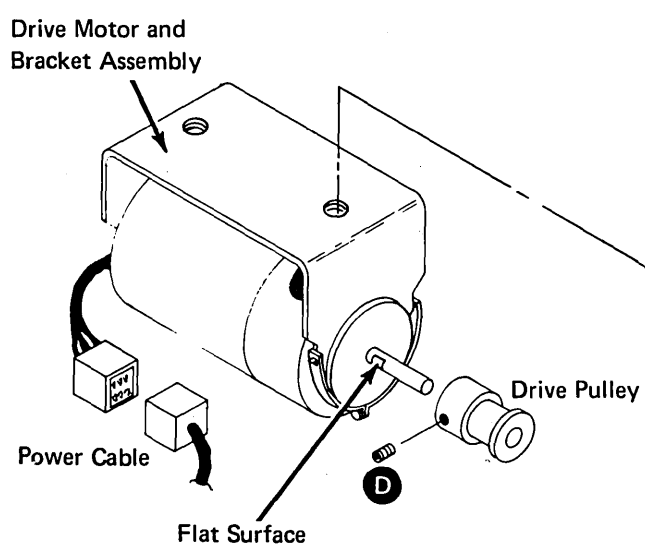
25-680   STEPPER MOTOR REMOVAL
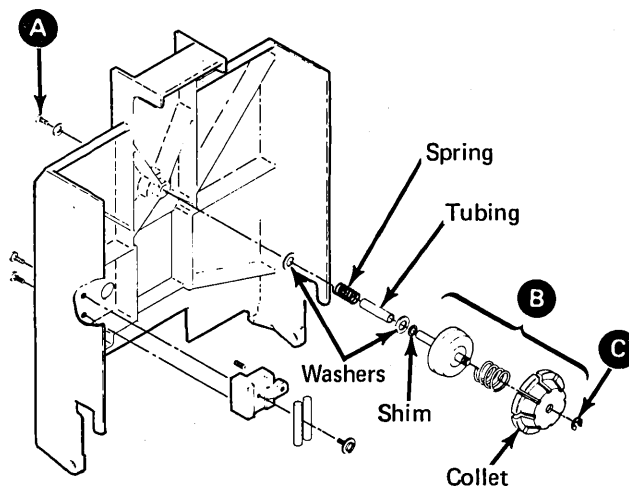
1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Disconnect the head cable from the diskette drive control card.

4. Remove the card retainer and the diskette drive control card.

5. Disconnect the cable from location A2 **J**.

6. Remove the two screws **G** and the two connector covers.

7. Remove the stepper motor leads **H** from the cable connector by pushing down on the terminal tabs with small screwdriver.

8. Remove the wiper assembly **F**.

9. Loosen the two mounting screws **E**. Push the idler assembly against spring tension and tighten the screws.
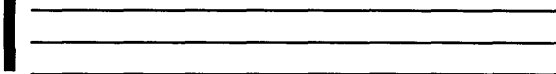
CAUTION
While performing the following steps, be careful not to damage the drive band.

_____
_____
_____

10. Remove the clamp screw **B** and the band clamp.

11. Carefully remove the drive band ends from the pulley pin.

12. Measure the gap **A** between the stepper motor pulley and the casting. Write the measurement here.

    Gap is:_____

13. Loosen the clamp screw **C** and remove the stepper motor pulley.

14. Remove the three stepper motor mounting screws **D** and remove the motor.

D

E

J Location A2

G

25

Band Clamp

Drive Band

Pulley

Pulley Clamp

A

H

D02 Blue

D03 Orange

D04 Yellow

B02 Red

B05 Black

B

C

F
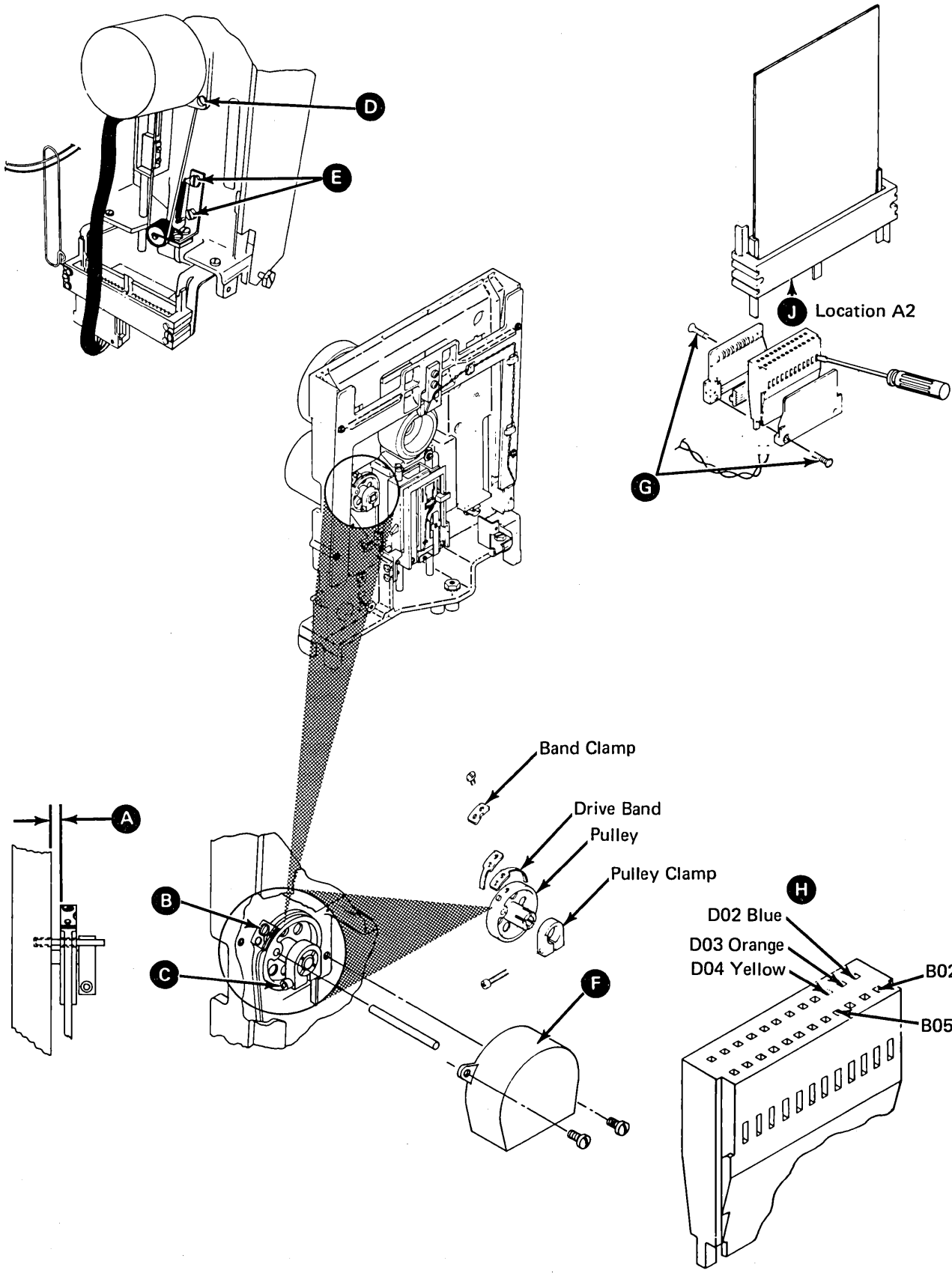
25-690   STEPPER MOTOR REPLACEMENT

1. Install the stepper motor using the three mounting screws **G**. (Position the motor cable toward the diskette drive control card.)

2. Insert the stepper motor leads **M** into the cable connector. Ensure that the locking tabs **K** on the terminals lock in the connector slots.

3. Reinstall the connector covers and two screws **L**.

4. Connect the cable to location A2 **N**.

5. Reinstall the stepper motor pulley. (Keep the clamp screw **E** loose so that the motor shaft can turn inside the pulley.)

6. Carefully reinstall the drive band ends on the pulley pin as shown **D**. Reinstall the band clamp (with the notch facing away from the stepper motor) and screw **C**. (Do not tighten the screw.)

7. Loosen the two mounting screws **H** and let spring tension position the idler.

8. Tighten the mounting screws and center the drive band on the idler pulley as shown **J**.

9. Reinstall the diskette drive control card and the card retainer.

10. Reinstall the head cable on the diskette drive control card.

11. Turn the stepper motor pulley to cylinder 40 and insert a timing pin **F**.

12. Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the stepper motor is disconnected and power is on.

13. Remove the attachment card at A-A2L2 to prevent the stepper motor access lines from being activated by an external source.

14. Set Power to I (operator panel).

15. Install a jumper **A** from TPA13 (ground) to THP11 (-align access 0).

16. Make the gap **B** between the pulley and the casting the same size as the gap that was recorded in 25-680, step 12.

17. Tighten the clamp screw **E**.

18. Remove the timing pin **F**.

19. Remove the jumper **A**.

20. Tighten the band clamp screw **C**. (Ensure that the drive band is straight.)

21. Turn the stepper motor pulley by hand and check to see that the drive band is centered **J** on the idler pulley in all of the head/carriage assembly movement (cylinder 00 to cylinder 76).

22. If the drive band is centered, go to 25-480, step 5. If the drive band is not centered, go to 25-740, step 4.
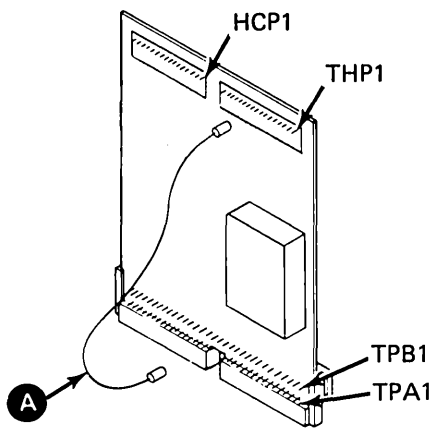
HCP1

THP1

A

TPB1
TPA1

Note: See paragraph 25-950 for
control card test pins.

Jumper:

Cylinder 40
THP 11
--to--
TPA 13

N Location A2

L

25

G

H

Idler Assembly

J

Center Drive Band

K

B

C Band Clamp

Drive Band

Pulley

Pulley Clamp

D

E

F

M D02 Blue
D03 Orange
D04 Yellow

B02 Red

B05 Black
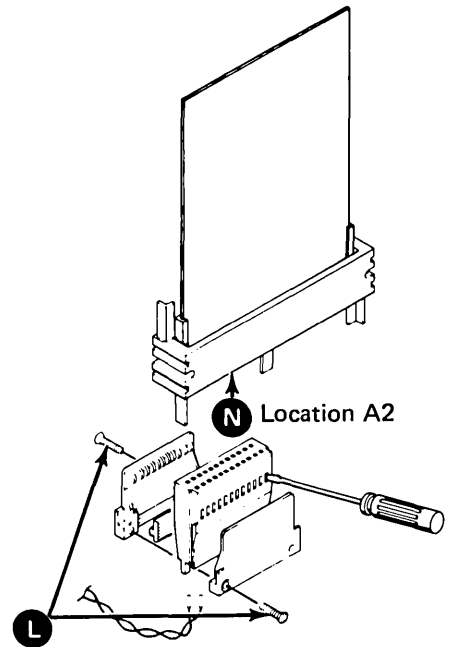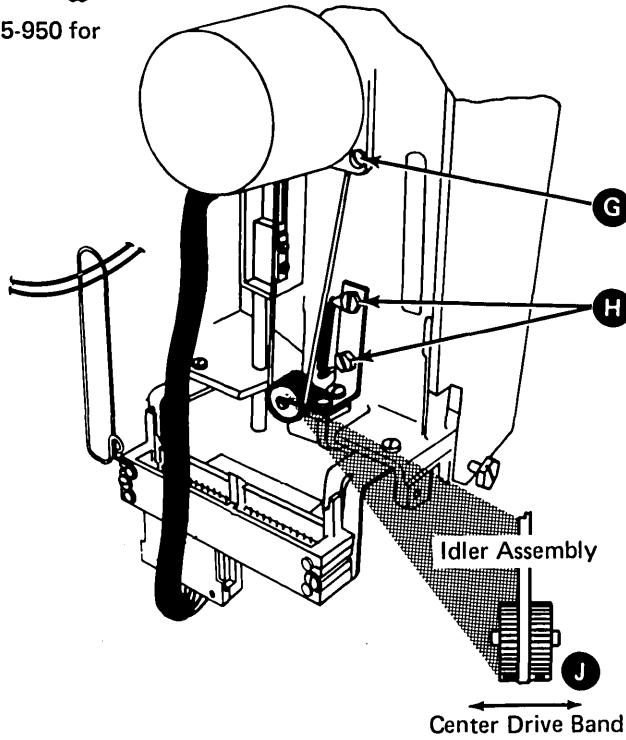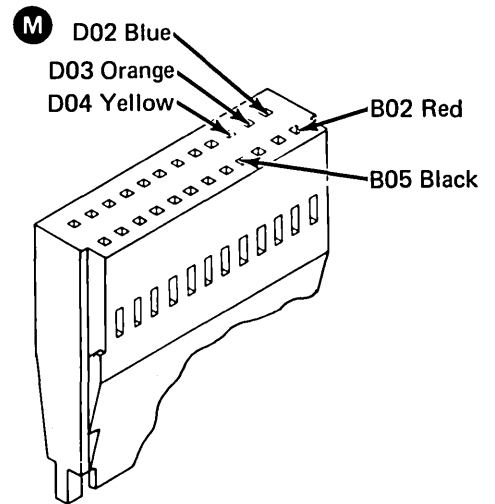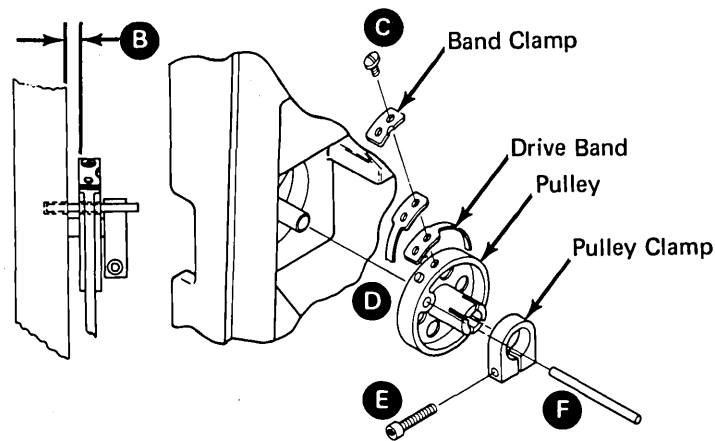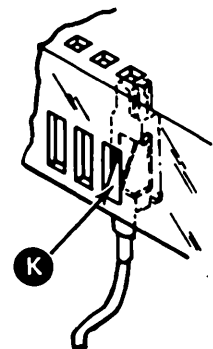
25-700   PULLEY AND CLAMP REMOVAL

1.   Remove the diskette drive (see paragraph 25-130).

2.   Remove the cover assembly (see paragraph 25-420).

3.   Remove the wiper assembly **D**.

4.   Disconnect the head cable from the diskette drive control card.

5.   Remove the card retainer and the diskette drive control card.

6.   Loosen the two mounting screws **E**. Push the idler assembly against the spring tension and tighten screws.

CAUTION
During the following steps, be careful not to damage the drive band.

_____

_____

_____

7.   Remove the clamp screw **B** and the band clamp from the pulley.

8.   Carefully remove the drive band ends from the pulley pin.

9.   Measure the gap **A** between the stepper motor pulley and the casting. Write the measurement here.

    Gap is:_____

10.   Loosen the clamp screw **C** and remove the pulley and the clamp.
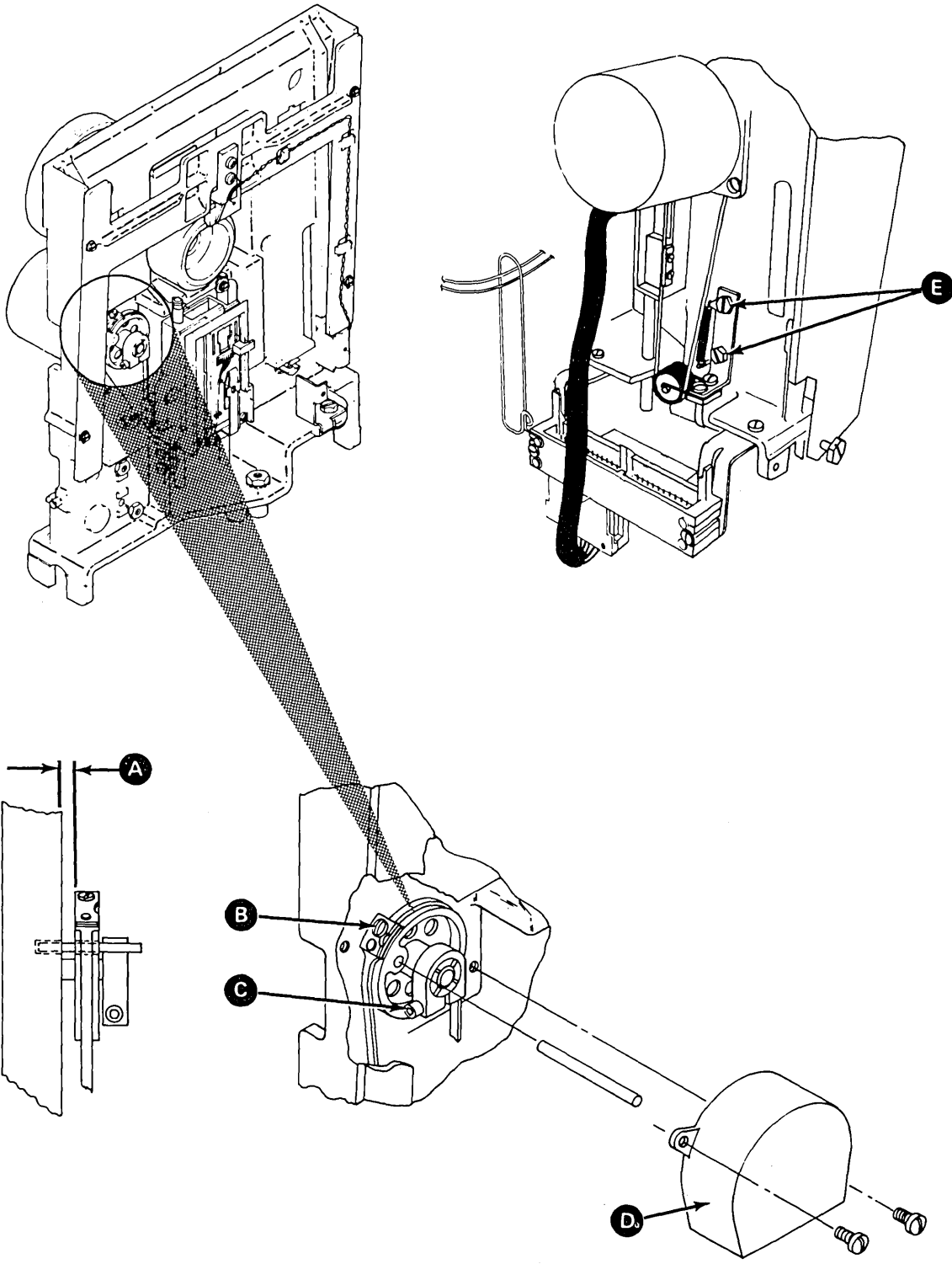
25-710   PULLEY AND CLAMP REPLACEMENT

1. Reinstall the pulley, clamp, and clamp screw **E**. (Keep the screw loose so the motor shaft can turn inside the pulley.)

2. Carefully reinstall the drive band ends on the pulley pin **D**. Reinstall the band clamp (with the notch facing away from the stepper motor) and screw **C**. (Do not tighten the screw.)

3. Loosen the two mounting screws **G** and let spring tension position the idler.

4. Tighten the mounting screws and center the drive band on the idler pulley as shown **H**.

5. Reinstall the diskette drive control card and the card retainer.

6. Reinstall the head cable on the diskette drive control card.

7. Turn the stepper motor pulley by hand to about cylinder 40 and insert a timing pin **F**.

8. Disconnect the drive motor power connector.

> **DANGER**
> Voltage is still present at the power connector when the pulley and clamp are disconnected and power is on.
>
> _____
> _____
> _____

9. Remove the attachment card at A-A2L2 to prevent the stepper motor access lines from being activated by an external source.

10. Set Power to I (operator panel).

11. Install a jumper **A** from TPA13 (ground) to THP11 (-align access 0).

12. Make the gap **B** between the pulley and the casting the same as the gap that was recorded in 25-700, step 9.

13. Tighten the clamp screw **E**.

14. Remove the timing pin **F**.

15. Remove jumper **A**.

16. Tighten the band clamp screw **C**. (Ensure that the drive band is straight.)

17. Turn the stepper motor pulley by hand and check that the drive band is centered **H** on the idler pulley in all of the head/carriage assembly movement (cylinder 00 to cylinder 76).

18. If the drive band is centered, go to step 19. If the drive band is not centered, go to 25-740, step 4.

19. Go to 25-480, step 5.
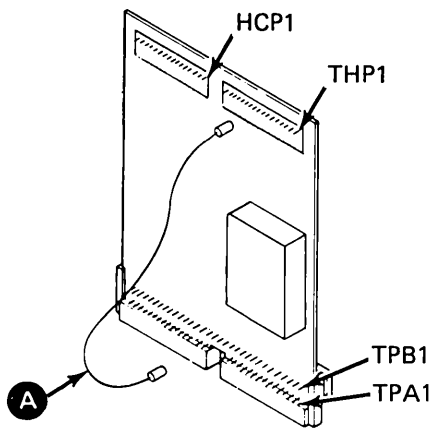
HCP1

THP1

A

TPB1
TPA1

Note: See paragraph 25-950 for control card test pins.

Jumper:

Cylinder 40
THP 11 --to-- TPA 13

G

Idler Assembly

H

Center Drive Band

25

B

C
D

E

F
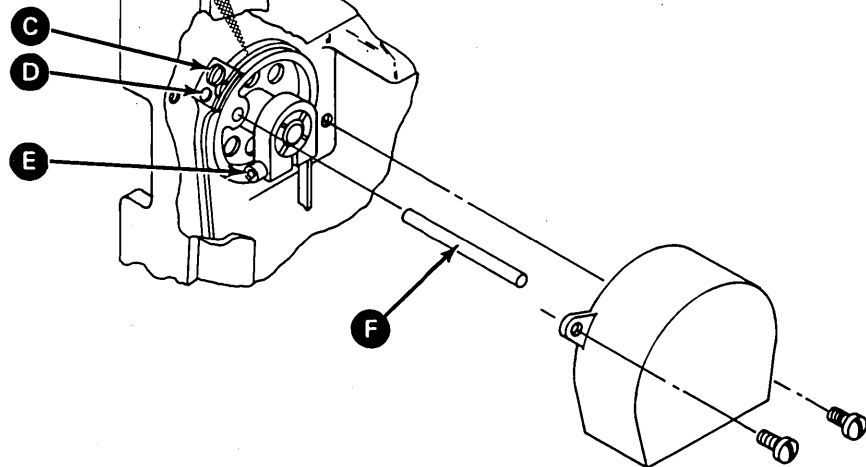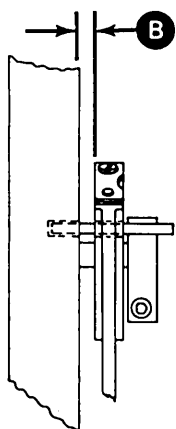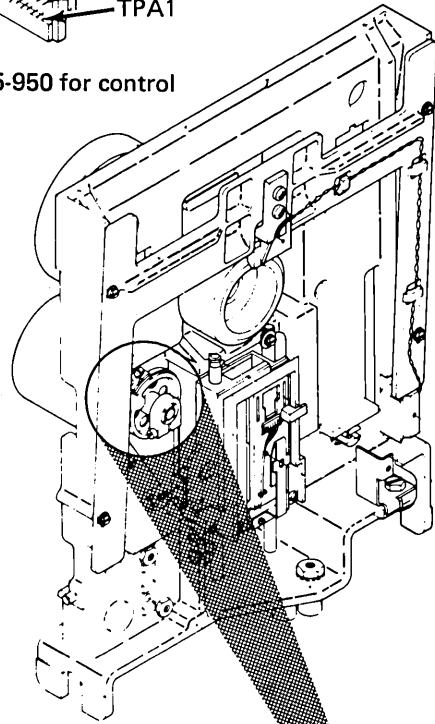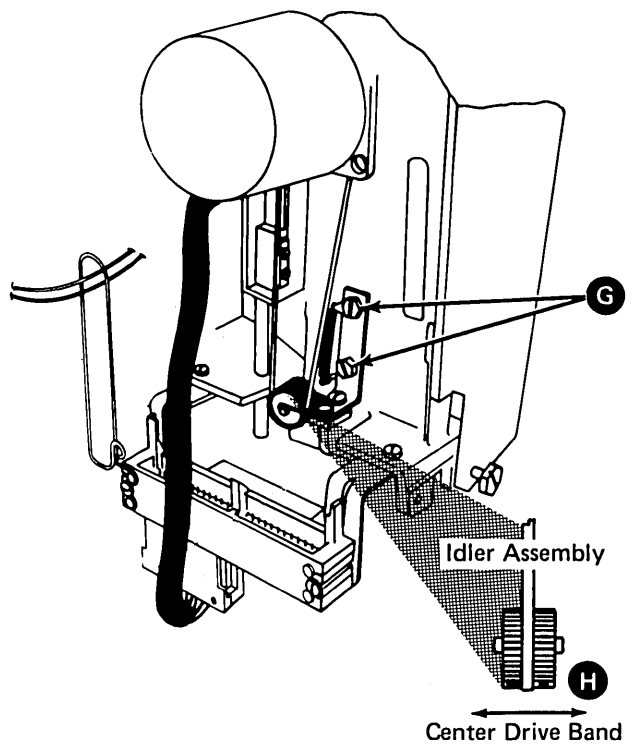
25-730   DRIVE BAND SERVICE CHECK

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Remove the wiper assembly **D**.

4. Turn the stepper motor pulley by hand and check that the drive band is centered **G** on idler pulley in all of the head/carriage assembly movement (cylinder 00 to cylinder 76).

5. If the drive band is centered, go to step 6. If the drive band is not centered, go to 25-740, step 6.

6. Reinstall the wiper assembly **D**.

7. Reinstall the cover assembly (see paragraph 25-430).

25-740   DRIVE BAND ADJUSTMENT

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Remove the wiper assembly **D**.

4. Disconnect the head cable from the diskette drive control card.

5. Remove the card retainer and the diskette drive control card.

6. Place the head/carriage assembly at about cylinder 40.

7. Remove the two band clamp screws **E** and the clamp.

8. Loosen the two mounting screws **F** and let spring tension position the idler. Tighten the mounting screws.

9. Turn the stepper motor pulley by hand a few times to center the drive band on the idler pulley **G**.

10. Place the head/carriage assembly by hand to about cylinder 40 and check to see that the band mounting slots **A** are centered (left to right) over the mounting holes on the carriage pad.

11. Repeat step 10 with the head/carriage assembly at cylinder 00 and cylinder 76.

12. If the mounting slots are centered, go to step 16. If the mounting slots are not centered, go to step 13.

13. Loosen the clamp screw **C**.

14. Loosen the band clamp screw **B**.

15. Place the stepper motor pulley to center the mounting slots and tighten the clamp screws **C** and **B**.

16. Move the head/carriage assembly by hand to about cylinder 40.

17. Reinstall the clamp and the two clamp screws **E** (do not tighten).

18. Reinstall the diskette drive control card and the card retainer.

19. Connect the head cable to the diskette drive control card.

20. Go to 25-490, step 4.

Carriage Pad

A

E

F

Idler Assembly

G

Center Drive Band

25

B

C

D

25-740

53FD Diskette Drive   37
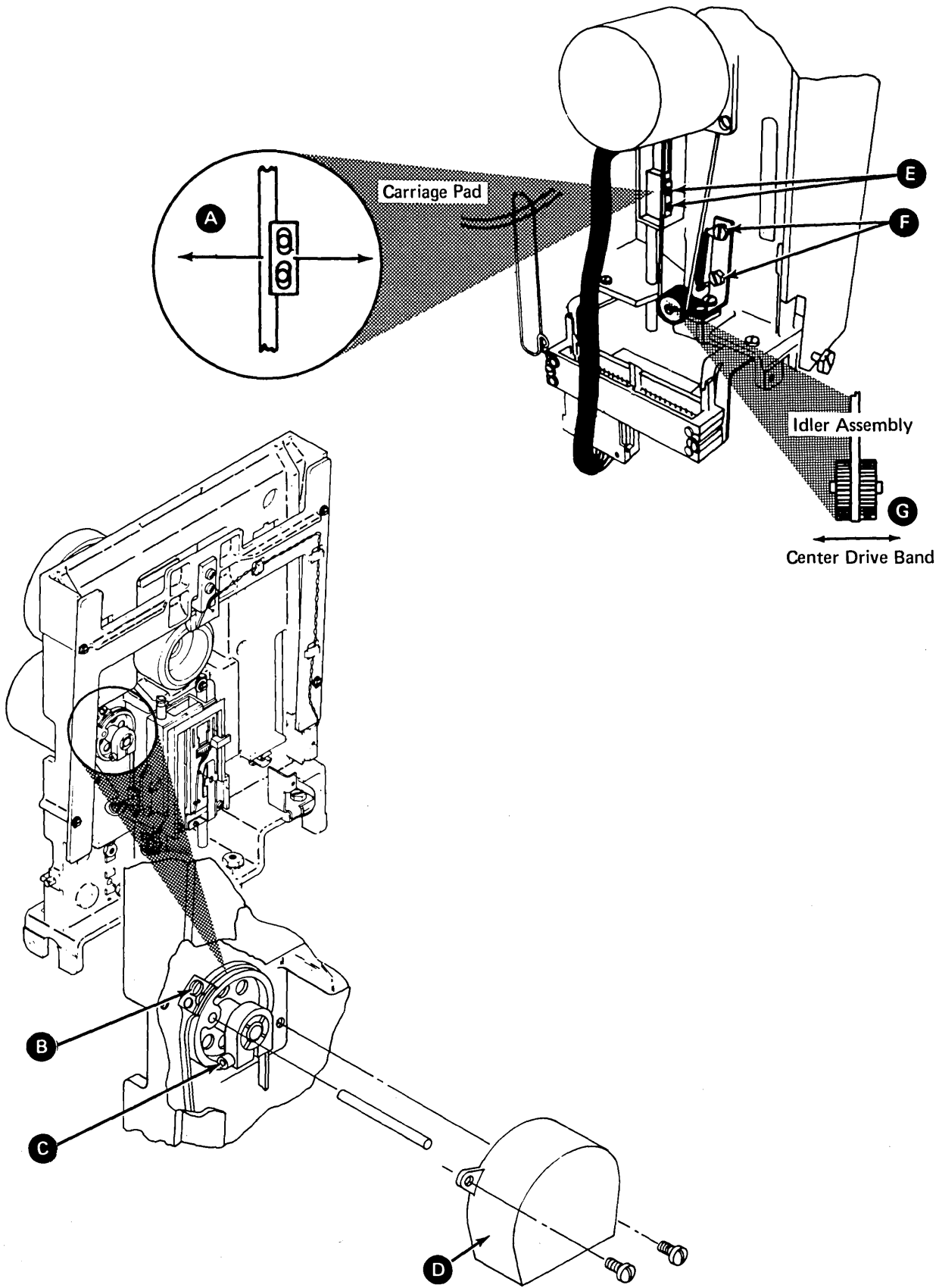
25-750   DRIVE BAND REMOVAL

1.   Remove the diskette drive (see paragraph 25-130).

2.   Remove the cover assembly (see paragraph 25-420).

3.   Remove the wiper assembly **G**.

4.   Disconnect the head cable from the diskette drive control card.

5.   Remove the card retainer and the diskette drive control card.

6.   Loosen the two mounting screws **C**. Push the idler assembly against the spring tension and tighten the mounting screws.

7.   Place the head/carriage by hand at about cylinder 40.

8.   Remove the two band clamp screws **A** and the clamp and place the head/carriage assembly at the lower limit (cylinder 00).

9.   Remove the clamp screw **E** and the clamp.

10.   Remove the drive band ends from the pulley pin and remove the band.

25-760   DRIVE BAND REPLACEMENT

1.   Place the drive band around the idler assembly.

2.   Install the drive band ends on the pulley pin as shown **F**.

3.   Reinstall the band clamp (with the notch facing away from the stepper motor) and the clamp screw **E**. (Ensure that the drive band is straight.)

4.   Go to 25-740, step 8.

25-770   IDLER ASSEMBLY REMOVAL

1.   Remove the drive band (see paragraph 25-750).

2.   Loosen the two mounting screws **C**.

3.   Remove the idler spring **B**.

4.   Remove the mounting screws and the idler assembly **D**.

25-780   IDLER ASSEMBLY REPLACEMENT

1.   Reinstall the idler assembly **D** and the two mounting screws **C** (do not tighten).

2.   Reinstall the idler spring **B**.

3.   Push the idler assembly against spring tension and tighten the mounting screws.

4.   Go to 25-760.

25-780
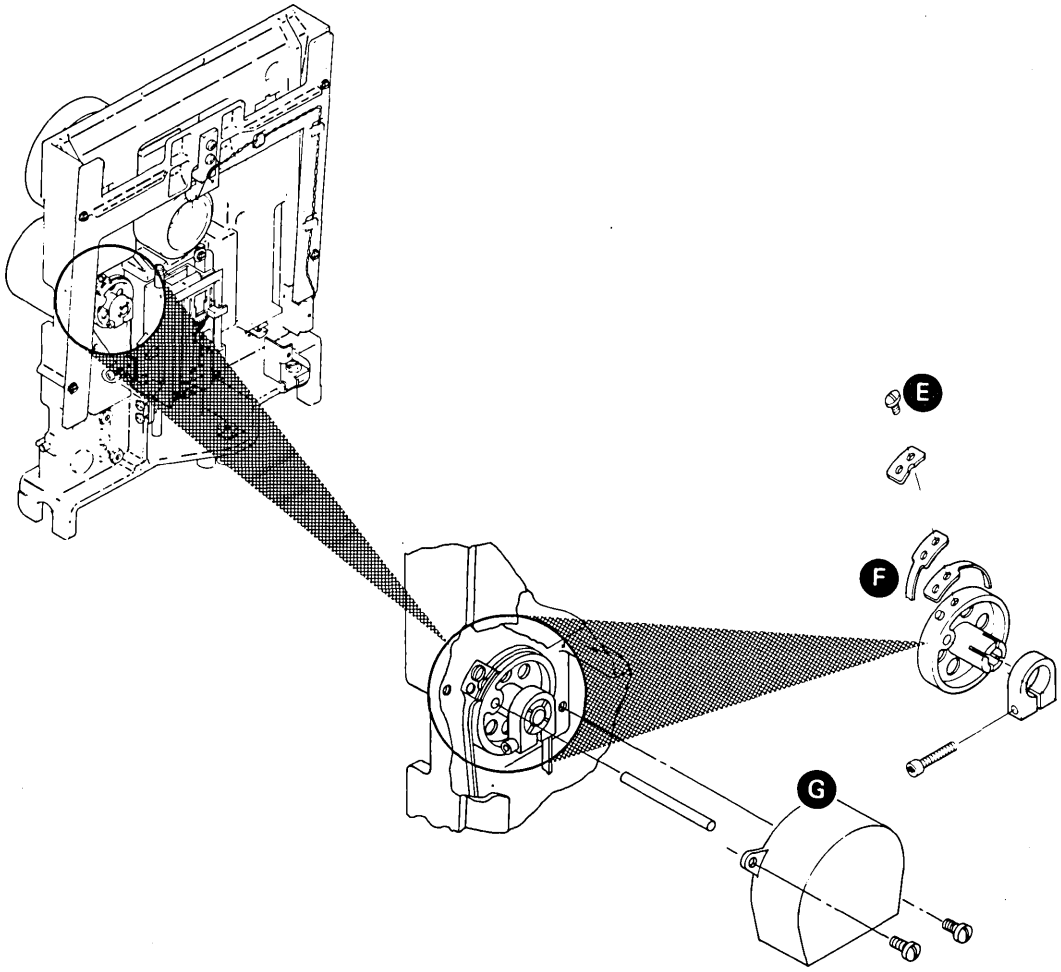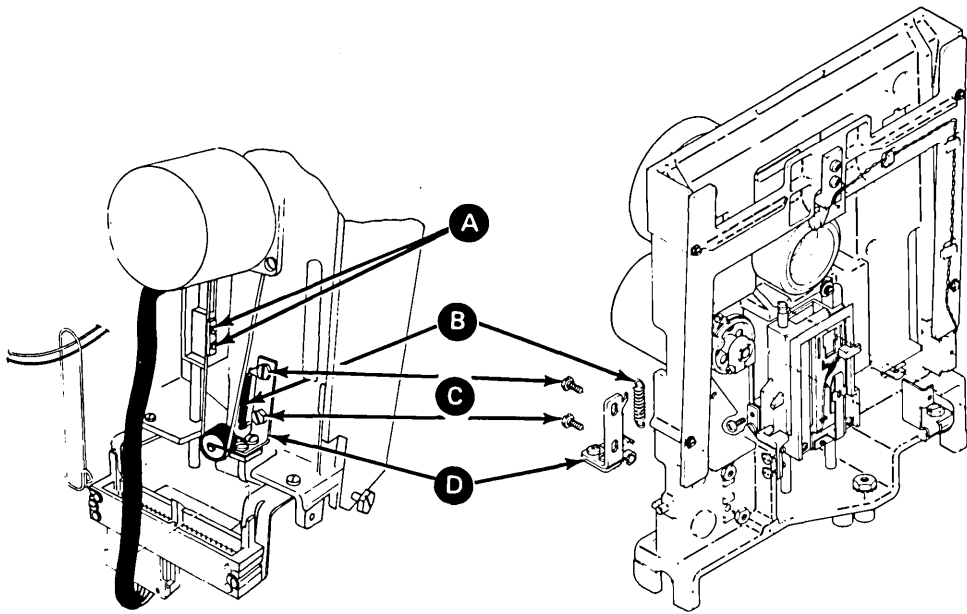
25-790   DISKETTE SPEED SERVICE CHECK

1.   Insert a diskette. (Ensure that the cover assembly is closed.)

2.   Install a jumper **A** to activate the head load solenoid.

3.   Set up an oscilloscope as shown in the table.

    Note: Use a Tektronix 453, 454, or a similar scope with X10 probes.

4.   Observe an index pulse width of 1.5 to 3.0 milliseconds **E** occurring each 166.7 ± 4.2 milliseconds **C**. Pulse amplitude should be between 2.4 and 4.2 Vdc **D**.

5.   Remove the jumper **A**.

6.   Remove the diskette.

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	1.0 V/div
Channel 1 input	DC
Times per division	20 ms
Channel 1 probe to **B**	+Index Test Pin
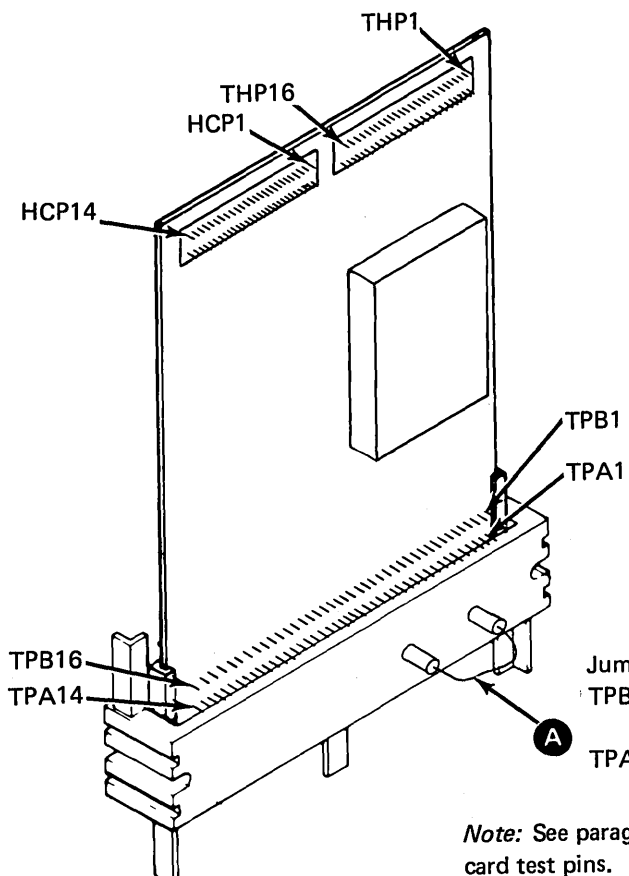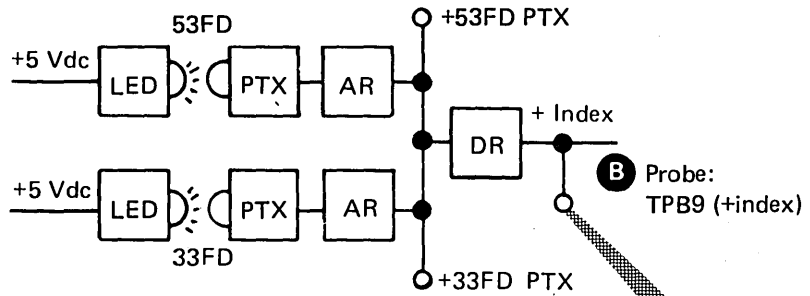
1.0 V/div

20 ms/div

THP1
THP16
HCP1
HCP14

TPB1
TPA1

TPB16
TPA14

Jumper:
TPB13 (-head load)
-- to --
TPA13 (ground)

Note: See paragraph 25-950 for control card test pins.
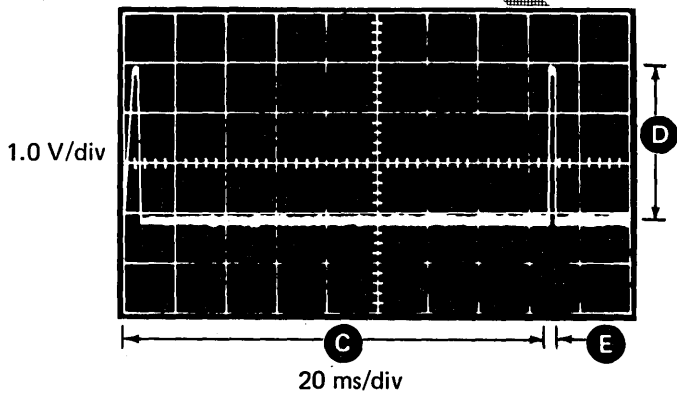
25-800 LIGHT-EMITTING DIODE AND PHOTOTRANSISTOR ALIGNMENT

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Loosen the phototransistor mounting screw **A**.

4. Position the phototransistor assembly against the casting stop **B** (away from the leads) and tighten the mounting screw.

5. Loosen the two light-emitting diode mounting screws **D**.

6. Insert two timing pins **C** through the light-emitting diode into the phototransistor assembly and tighten the light-emitting diode mounting screws.

7. Remove the timing pins.

8. Reinstall the cover assembly (see paragraph 25-430).

Guide
Base Casting
PTX Assembly
C Timing Pins (2)
LED Assembly

PTX Assembly
LED Assembly
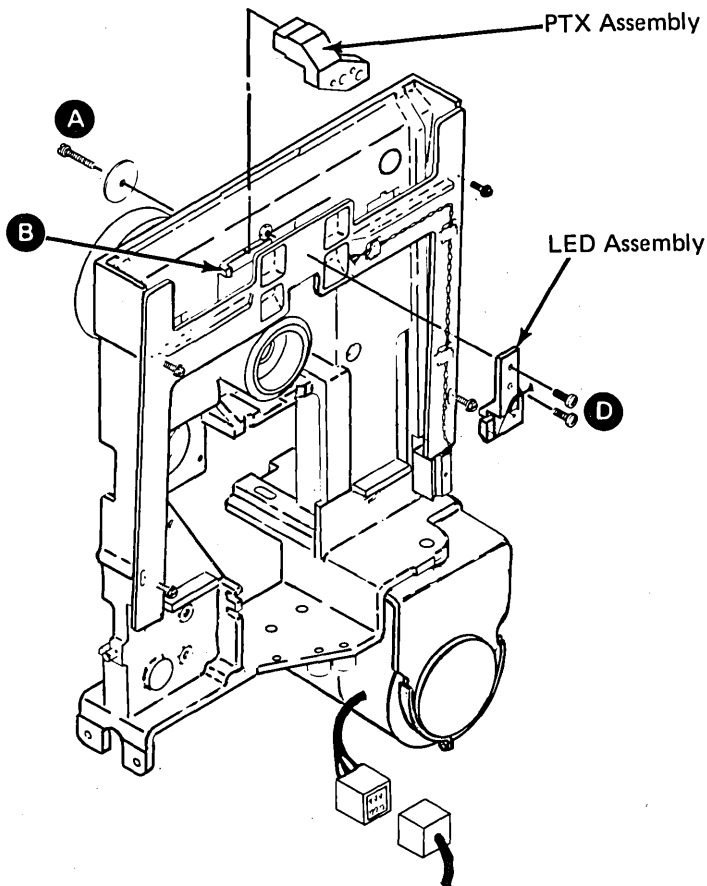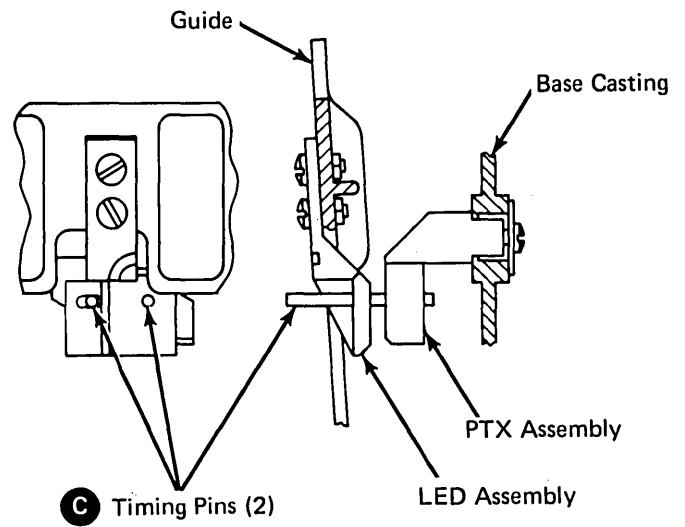
25-810   LIGHT-EMITTING DIODE OUTPUT
             SERVICE CHECK

1.   Set Power to I (operator panel).

2.   Connect the negative probe of a multimeter to the
     ground test pin **C** on the diskette drive control
     card.

3.   Set the multimeter scale to 5 Vdc and connect the
     positive probe to the 53FD light-emitting diode
     voltage test pin **A**.

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

5.   Move the positive probe to the 33FD
     light-emitting diode voltage test pin **B**.

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

25
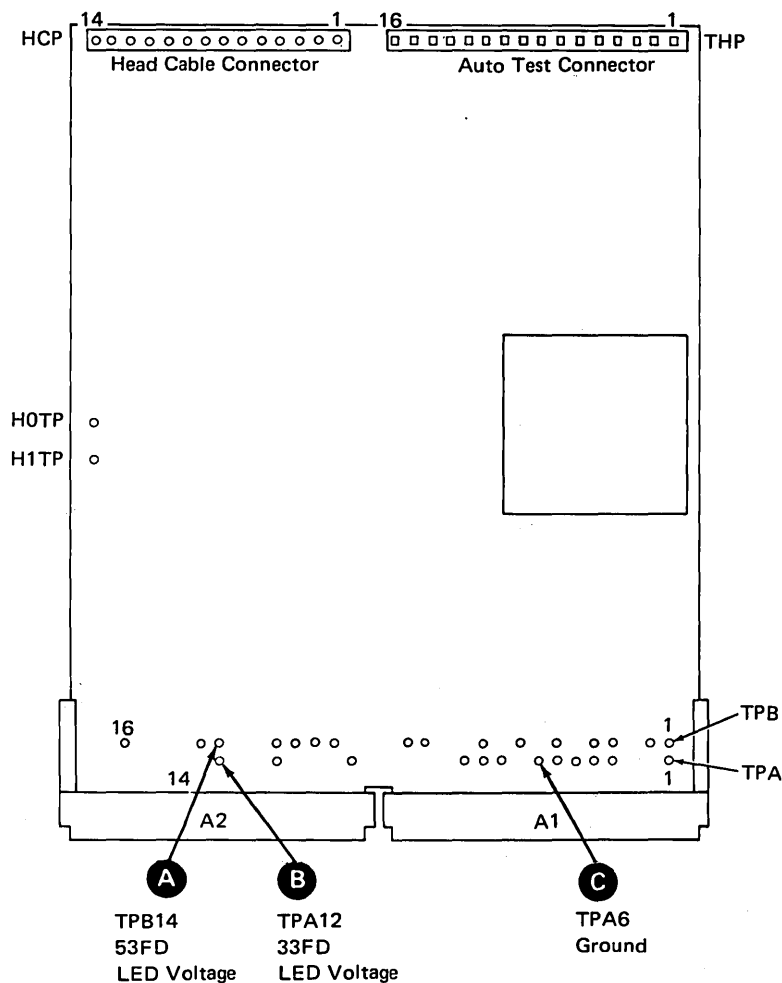
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25-820   LIGHT-EMITTING DIODE REMOVAL

1. Remove the diskette drive (see paragraph 25-130).

2. Remove the cover assembly (see paragraph 25-420).

3. Disconnect the diskette drive control cable from location A2 **(H)**.

4. Remove two screws **(G)** and the connector covers.

5. Remove the two 33FD light-emitting diode leads **(J)** and the two 53FD light-emitting diode leads **(F)** by pushing down on tabs with a small screwdriver.

6. Remove the light-emitting diode cable from the three retainers **(C)**. (Remember the cable path for the replacement procedure.)

7. Remove the four mounting screws **(B)** and the guide.

8. Remove the two light-emitting diode mounting screws **(D)** and nuts **(E)** and remove the light-emitting diode assembly.

25-830   LIGHT-EMITTING DIODE REPLACEMENT

1. Install the light-emitting diode assembly, two mounting screws **(D)** and nuts **(E)** on the guide (do not tighten). Pass the wires through the guide locating slots **(C)**.

2. Reinstall the guide and the four mounting screws **(B)**.

3. Follow the cable path through three retainers **(C)** and insert the two 33FD light-emitting diode leads (leads have a tube around them) **(J)** and the two 53FD leads **(F)** into the diskette drive control cable connector. Ensure that the locking tabs **(A)** on the terminals lock in the connector slots.

4. Reinstall the cable connector covers and the two screws **(G)**.

5. Plug the cable into location A2 **(H)** on the diskette drive control card socket.

6. Go to 25-800, step 6.

PTX Assembly

Guide

B (4 screws)

C

LED Assembly

D

E

H Location A2

G

25

A

F D06 Red 53FD LED
D07 Black 53FD LED

D10 Black 53FD PTX
D11 Yellow 53FD PTX

Wrapped Leads

B06 Red 33FD LED **J**
B07 Black 33FD LED

Wrapped Leads

D08 Black 33FD PTX
B09 Yellow 33FD PTX
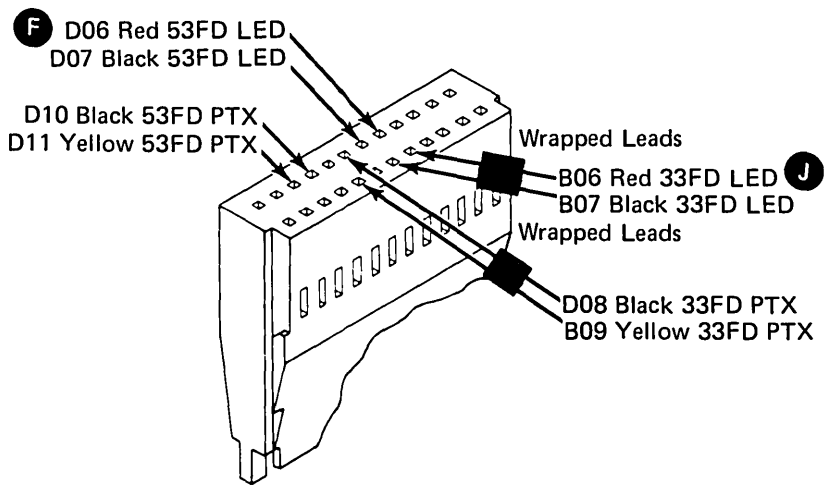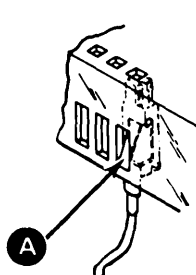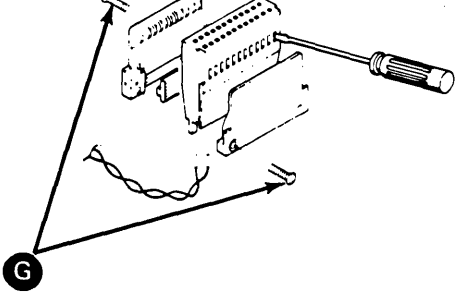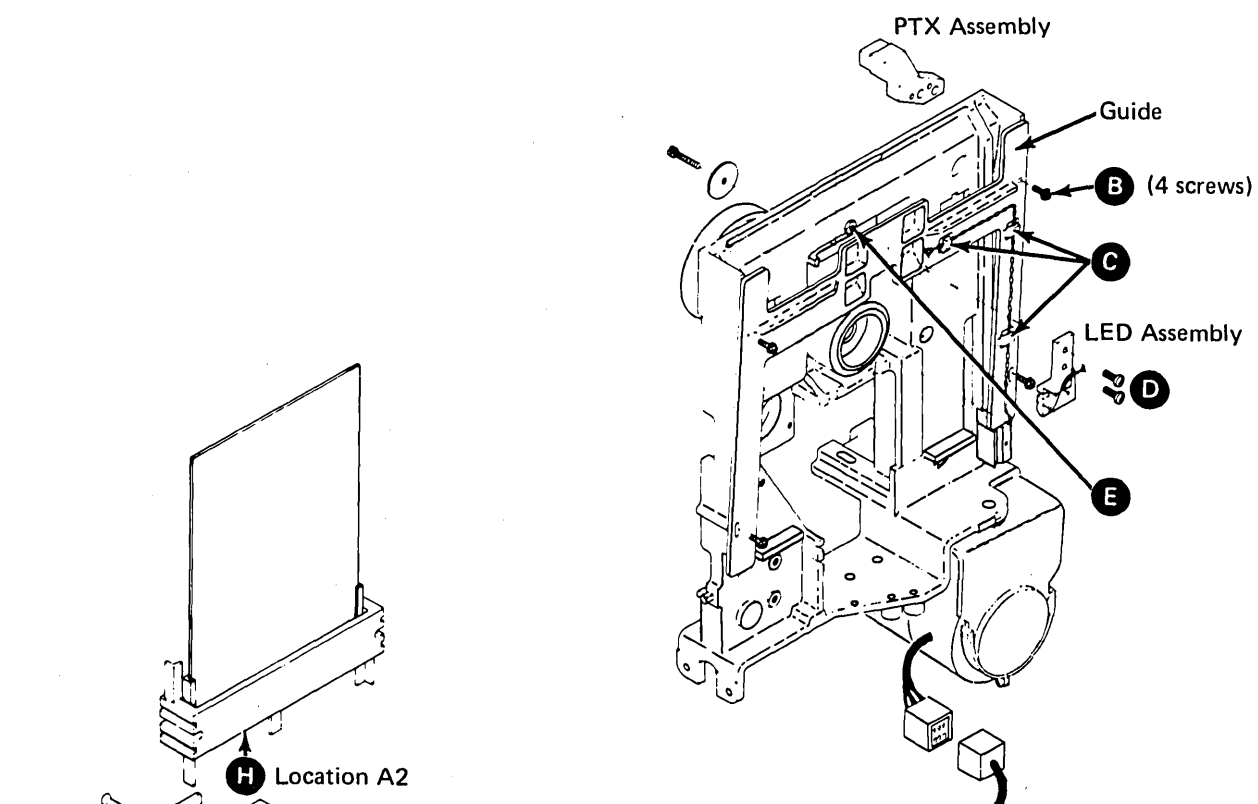
25-840   PHOTOTRANSISTOR AMPLIFIER
SERVICE CHECK

CAUTION
Always perform this service check with a diskette
inserted backward (with the label facing the hub pulley),
so that the light-emitting diode does not cause a wrong
service check or destroy the phototransistor.

_____
_____
_____
_____

1.   Remove the diskette drive from the machine (see
      paragraph 25-130).
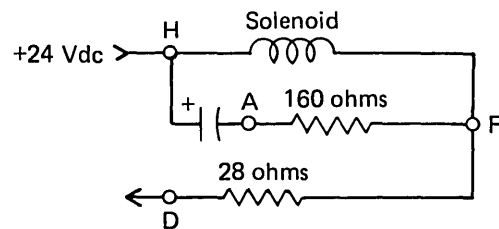
2.   Disconnect the drive motor power connector.

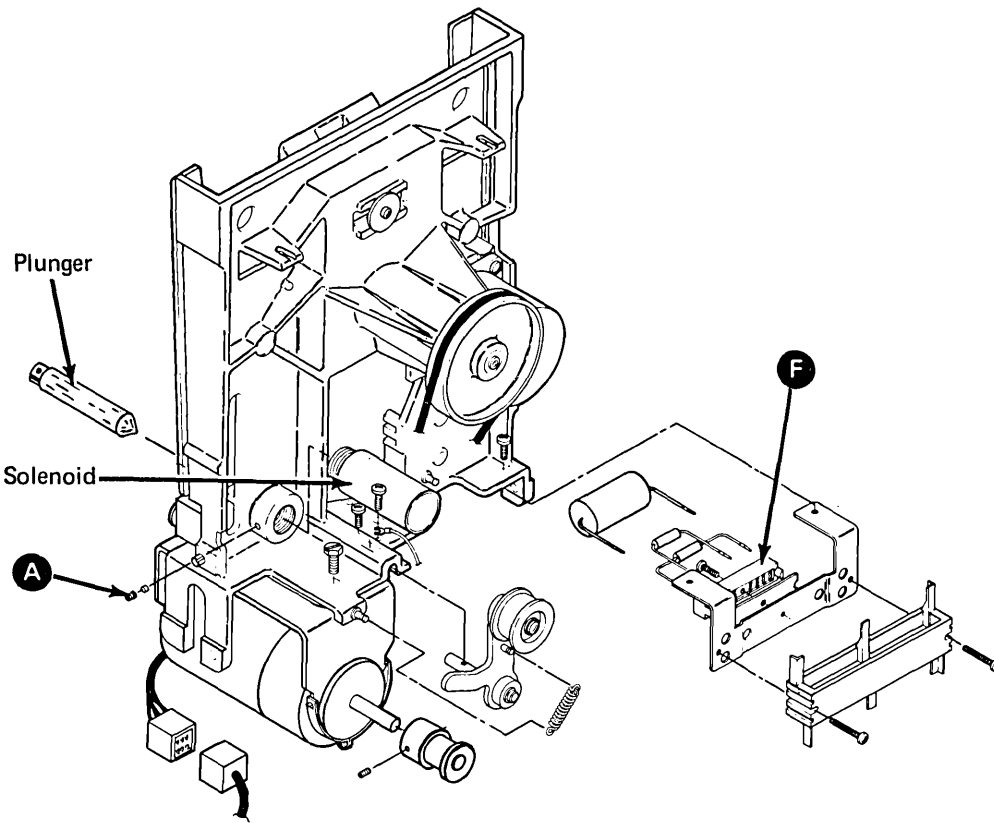   **DANGER**
   Voltage is still present at the power connector
   when the phototransistor amplifier is
   disconnected and power is on.

   _____
   _____
   _____

3.   Set Power to I (operator panel).

4.   Insert a diskette backward. (Ensure that the cover
      assembly is closed.)

5.   Connect the positive probe of a multimeter (15
      Vdc scale) to the index test pin **D** on the diskette
      drive control card.

6.   Connect the negative probe of the multimeter to
      the ground test pin **E**.

7.   Check the multimeter for a reading of less than 1
      Vdc.

8.   Install one end of a jumper to the 53FD
      phototransistor test pin **B**.

9.   While observing at the multimeter, touch the other
      end of the jumper to the +5 Vdc test pin **A**
      several times. The multimeter should read 2.5 Vdc
      or more when the test pin is touched. (A wrong
      reading can occur the first time the test pin is
      touched.)

10.   Repeat steps 8 and 9 with the jumper on the
      33FD phototransistor test pin **C**.

11.   Set Power to O (operator panel).

12.   Remove the jumper.

13.   Remove the diskette.

14.   Connect the drive motor power cable.

14 _____ 1 16 _____ 1
HCP   THP

○ H0TP
○ H1TP

Ⓐ
TPB15
+5 Vdc
16○
14○
                                        1
                                    TPB
                                    TPA
                                        1

Ⓑ   Ⓒ   Ⓓ   Ⓔ
TPB16   TPA14   TPB9   TPA6
53FD PTX   33FD PTX   +Index   Ground

25
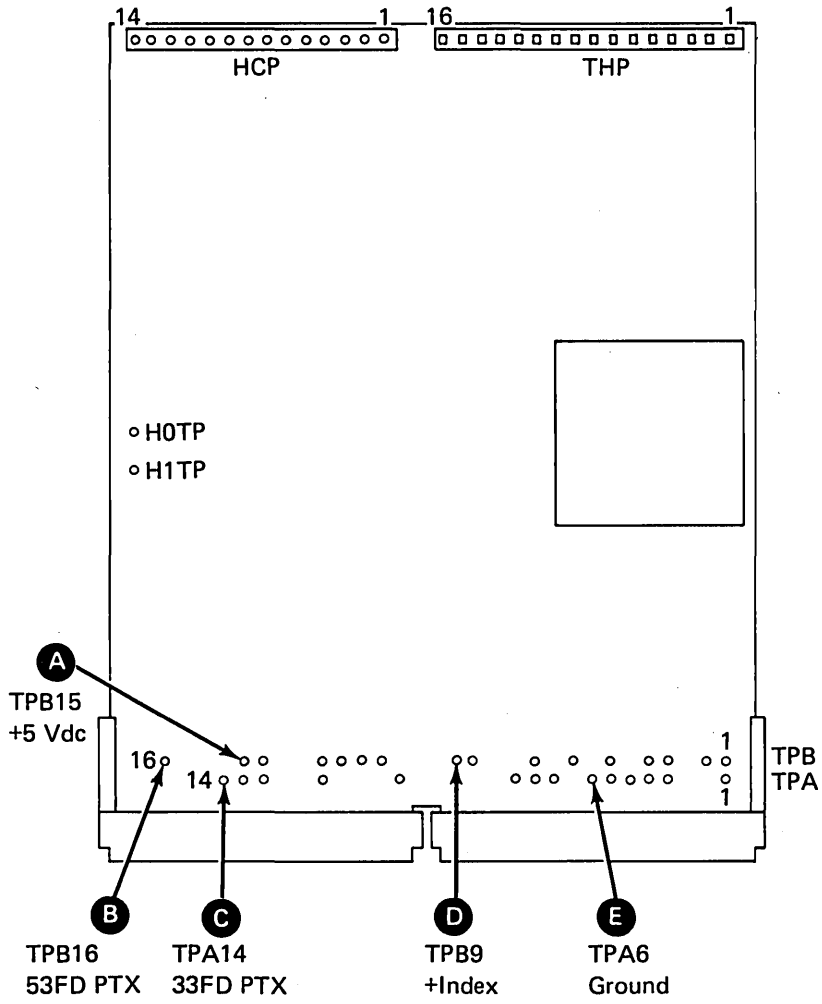
25-850   PHOTOTRANSISTOR REMOVAL

1.   Remove the diskette drive (see paragraph 25-130).

2.   Remove the cover assembly (see paragraph 25-420).

CAUTION
While performing the following steps, be careful not to damage the light-emitting diode leads.

_____
_____
_____
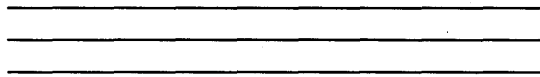
3.   Remove the four screws **H** and the guide.

4.   Disconnect the diskette drive control cable from location A2 **D**.

5.   Remove the two screws **A** and the connector covers.

6.   Remove the two 33FD phototransistor leads **G** and the two 53FD phototransistor leads **C** by pushing down on tabs with a small screwdriver.

7.   Remove the phototransistor mounting screw **E** and washer.

8.   Remove the phototransistor assembly. (Remember the cable path for the replacement procedure.)

25-860   PHOTOTRANSISTOR REPLACEMENT

1.   Install the phototransistor assembly against the casting stop **F** (away from leads) and reinstall screw **E** and washer.

2.   Follow the cable path and insert the two 33FD phototransistor leads **G** (leads have a tube around them) and the two 53FD leads **C** into the diskette drive control cable connector. Ensure that the locking tabs **B** on the terminals lock in connector slots.

3.   Reinstall the connector covers and the two screws **A**.

4.   Plug the connector into location A2 **D** of the diskette drive control card socket.

5.   Reinstall the guide and the four mounting screws **H**.

6.   Go to 25-800, step 5.

PTX Assembly

Washer

E

Guide

F

H (4 screws)

LED Assembly

D Location A2

A

D06 Red 53FD LED
D07 Black 53FD LED

C D10 Black 53FD PTX
D11 Yellow 53FD PTX

Wrapped Leads

B06 Red 33FD LED
B07 Black 33FD LED

Wrapped Leads

G

D08 Black 33FD PTX
B09 Yellow 33FD PTX

B
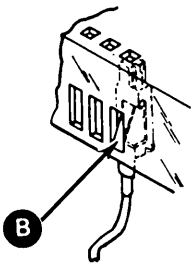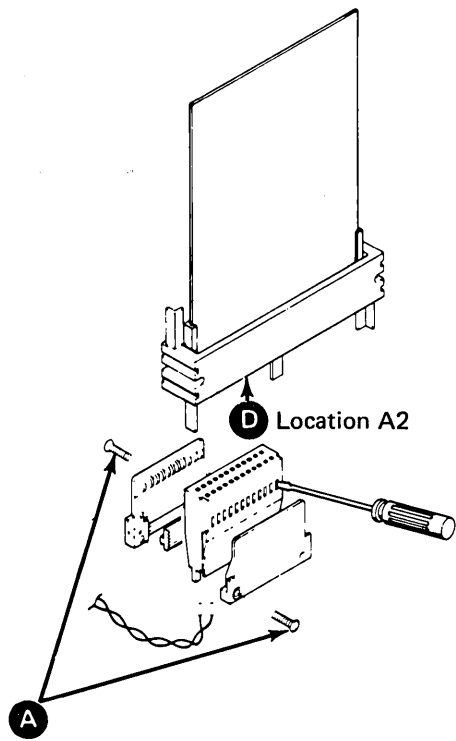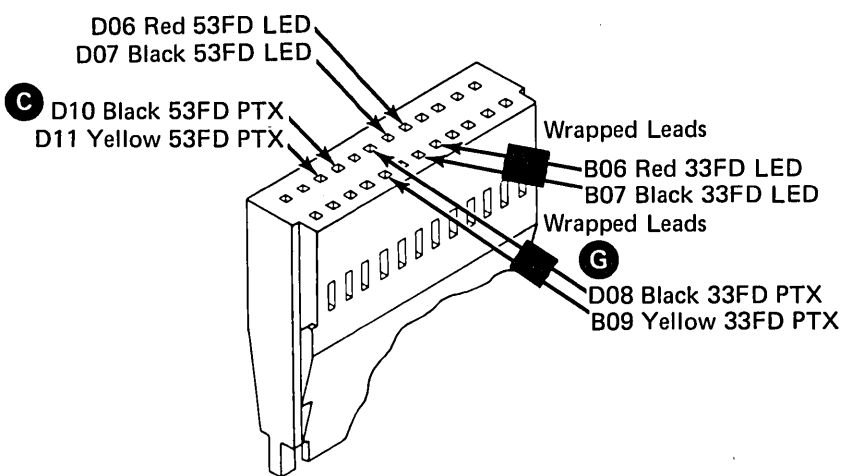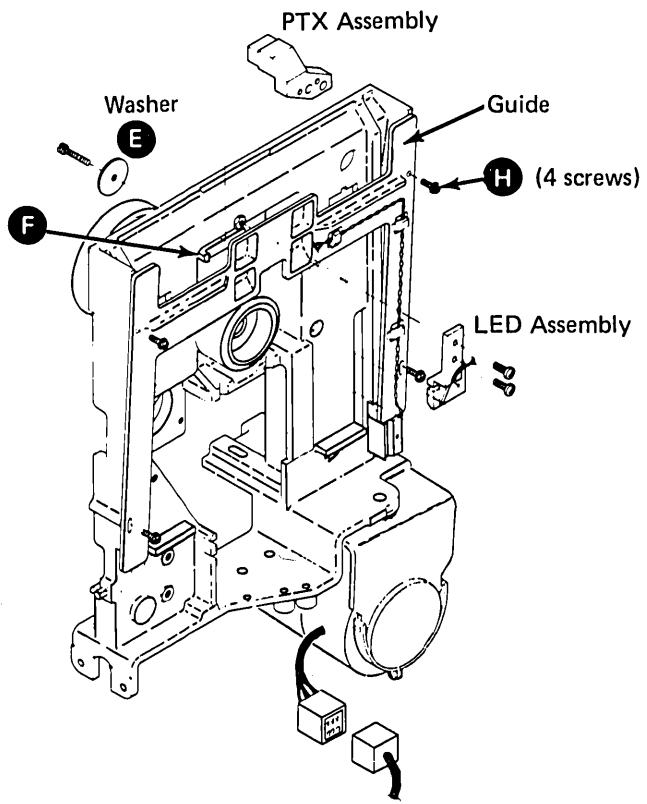
25-930   CONTROL CARD REMOVAL

1. Disconnect the head cable **A** from the diskette
    drive control card **B**.

2. Remove the card retainer **C**.

3. Remove the diskette drive control card.

25-940   CONTROL CARD REPLACEMENT

1. Reinstall the diskette drive control card **B**. Ensure
    the card is seated in the socket.

2. Reinstall the card retainer **C**.

3. Connect the head cable **A** to the diskette drive
    control card.

25-950   CONTROL CARD TEST PINS

14 _____ 1 — 16 _____ 1

HCP   THP

A

Early EC Level Card

o H0TP

o H1TP

o TP14V

16 o   o o   o o o o   o o   o o o o o   o 1

14 o o o   o   o   o o o   o o o o   o 1

TPB

TPA

C

B

Location A2   Location A1

25

	A			**B**			**C**	
THP1	+Diskette Loaded		TPA1	+Write Data		TPB1	+Access 0
THP2	+Predrive MC-3		TPA2	+Erase Gate		TPB2	+Access 1
THP3	+Predrive MC-2		TPA3	+Write Gate		TPB3	+Access 2
THP4	+Predrive MC-1		TPA4	+Inner Tracks		TPB4	+Access 3
THP5	+Predrive MC-0		TPA5	+Select Head 1		TPB5	+File Data
THP6	+53FD Index		TPA6	Ground		TPB6	+Diskette Sense
THP7	+33FD Index		TPA7	+Erase Current Sense		TPB7	+Head Engage
THP8	Diff Read A		TPA8	+24 Vdc		TPB8	+Switch Filter
THP9	Diff Read B		TPA9	-5 Vdc		TPB9	+Index
THP10	-High Gain		TPA10	MC-1		TPB10	MC-3
THP11	-Align Access 0		TPA11	MC Common		TPB11	MC-0
THP12	-High Current		TPA12	33FD LED Voltage		TPB12	MC-2
THP13	Preamp TP1		TPA13	Ground		TPB13	-Head Load
THP14	Preamp TP2		TPA14	33FD PTX		TPB14	53FD LED Voltage
THP15	-High Gain A					TPB15	+5 Vdc
THP16	-High Gain B					TPB16	53FD PTX

Late EC Level Card

A

THP1	+Diskette Inserted
THP2	-Hd Ld Osc (see note)
THP3	+14 Vdc
THP4	Ground
THP5	Ground
THP6	+53FD Index
THP7	+33FD Index
THP8	Diff Read A
THP9	Diff Read B
THP10	-High Gain
THP11	-Align Access 0
THP12	-High Current
THP13	Preamp TP1
THP14	Preamp TP2
THP15	-High Gain A
THP16	-High Gain B

B

TPA1	+Write Data
TPA2	+Erase Gate
TPA3	+Write Gate
TPA4	+Inner Tracks
TPA5	+Select Head 1
TPA6	Ground
TPA7	+Current Enabled
TPA8	+24 Vdc
TPA9	-5 Vdc
TPA10	MC-1
TPA11	+Hd Load Solenoid
TPA12	33FD LED Voltage
TPA13	Ground
TPA14	33FD PTX

C

TPB1	+Access 0
TPB2	+Access 1
TPB3	+Access 2
TPB4	+Access 3
TPB5	+File Data
TPB6	+Diskette Sense
TPB7	+Head Engage
TPB8	+Switch Filter
TPB9	+Index
TPB10	MC-3
TPB11	MC-0
TPB12	MC-2
TPB13	-Head Load
TPB14	53FD LED Voltage
TPB15	+5 Vdc
TPB16	53FD PTX

Note: A jumper must be installed from THP2 (– Hd Ld Osc) to THP4 (Ground).

25-960 **CONTROL CARD SOCKET AND CONNECTOR PINS**

HOTP
H1TP
HCP14
Cable to the 53FD Data Head
TPB16
TPA14
HCP1
53FD Maple Block
Cable to the 53FD
53FD A2
D13
B13
G13
J13
A2
File Control Card
THP16
D02
B02
Cable to the Attachment A-A2Z6
53FD A1
A1
B02
D02
TPB1
D02
B02
D02
B02
TPA1

Note: Maple block causes B and D pin reversal.
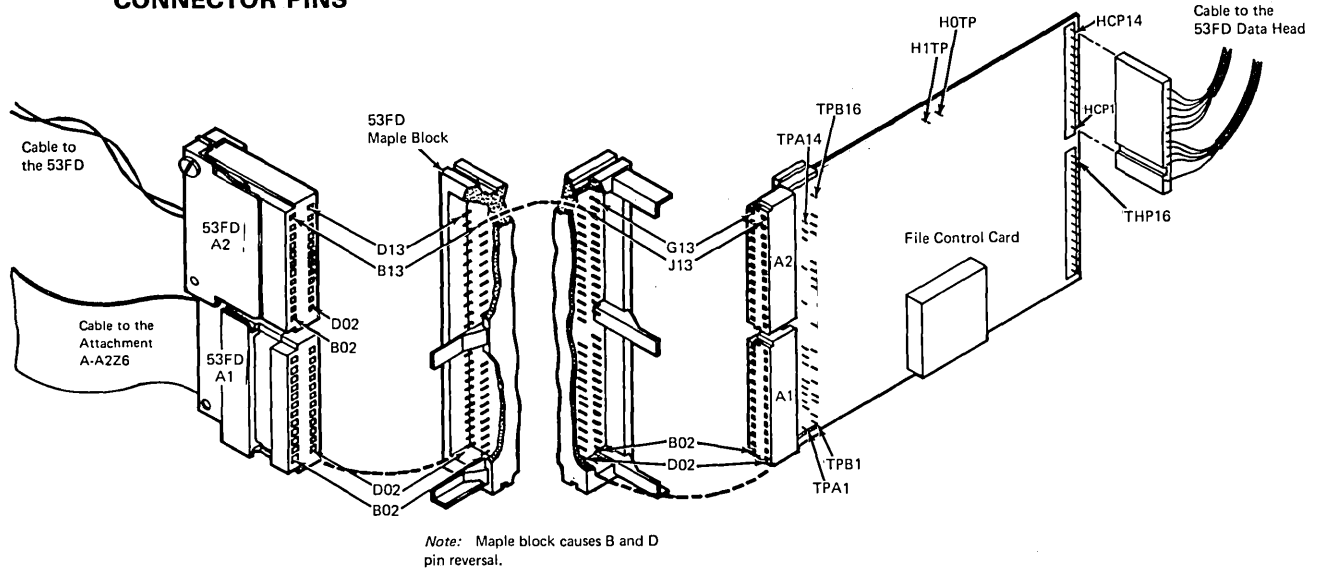
25-980 **CONTROL CARD LOGIC PINS**

Read/Write Head 0	(white)	Head 0 Read/Write
Center Tap Read/Write Head 0	(blue)	
Read/Write Head 0	(black)	
Erase Head 0	(red)	Head 0 Erase
Erase Head 0	(yellow)	
Cable Shield Head 0		
Cable Shield Head 1		
Erase Head 1	(yellow)	Head 1 Erase
Erase Head 1	(red)	
Read/Write Head 1	(black)	Head 1 Read/Write
Center Tap Read/Write Head 1	(blue)	
Read/Write Head 1	(white)	

(A1) Connector Card

Card Connector (A2)

Head Connector (HCP)
1 2 3 4 5 6 7 8 9 10 11 12 13 14

Diskette Drive Control Card

+Access 0	D02	B02
+Access 1	D03	B03
+Access 2	D04	B04
+Access 3	D05	B05
Write Data	B02	D02
+Write Gate	B05	D05
+Erase Gate	B04	D04
Note 1	B09	D09
+Select Head 1	B07	D07
+Head Engage	D10	B10
+Index	D13	B13
+File Data	D07	B07
+Diskette Sense	D08	B08
-Diskette Drive Sense	D09	B09
+Inner Tracks	B06	D06
+Switch Filter	D12	B12
Ground	B08	D08/J08
+24 Vdc	B10	D10/J12
+5 Vdc	B03	D03/J03
-5 Vdc	B11	D11/J13

J07	B07	33FD LED Voltage	(black)
G08	D08	33FD PTX	(black)
		33FD PTX	33FD LED
J09	B09	33FD PTX Return	(yellow)
J06	B06	33FD LED Ground	(red)
G07	D07	43FD LED Voltage	(black)
G10	D10	43FD PTX	(black)
		43FD PTX	43FD LED
G11	D11	43FD PTX Return	(yellow)
G06	D06	43FD LED Ground	(red)
G03	D03	Stepper Motor MC-0	(orange)
J02	B02	Stepper Motor MC-1	(red)
G04	D04	Stepper Motor MC-2	(yellow)	Stepper Motor
G02	D02	Stepper Motor MC-3	(blue)
J05	B05	Stepper Motor Common	(black)
J04	B04	Head Load Solenoid	
			(yellow)	H (black)
G05	D05	-Head Load	

A
160Ω
Head Load Solenoid
28Ω F (white)
Note 2

Notes:
1. +Erase Current Sense (Early EC Level Card).
   +Current Enabled (Late EC Level Card).
2. Drives with the late EC level card may not have the two resistors and the capacitor.

53FD Adapter A-A2L2

Data Separator A-A2P2

53FD Cable A-A2Z6

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25-991   DISKETTE QUALITY AND HEAD WEAR SERVICE CHECK

CAUTION
The diskette quality and head wear service check must be performed with the diskette drive in the same position as when installed or the results might not be accurate.

_____
_____
_____
_____
_____

A new head will write and read correctly on most diskettes. As the head wears, the quality of the diskette becomes more important. The tests described in this paragraph will aid in determining the quality of the diskette and the condition of the head.

Note: Some of the failures indicated by these tests cannot always be repeated.

Inspect the diskette failure descriptions, print the ERAP error history table, and run the following tests as necessary to verify the errors indicated by the ERAP.

25-992   Diskette Failure Descriptions

- A bump, scratch, crease, or fingerprint causes errors on the same sectors, usually across tracks that are next to each other.

- Too large of a center hole causes errors on sectors that are on opposite sides of the center hole. (Example: sectors hexadecimal 01 and 0E or sectors hexadecimal 06 and 13.)

- Material from the diskette jacket cause random errors.

- A diskette written by a worn 33FD head causes random read errors on cylinders hexadecimal 2B through 4C when read by a 53FD.

- A worn 53FD head causes read errors on the inner tracks area of the diskette (cylinders hexadecimal 40 through 4C) when using MFM mode. If there are failures in this area, suspect a worn head. TUs E1, 9A, and 9B may be run to indicate the quality of the head in your system.

25-993   Test Descriptions

Diskette analysis—This routine reads the complete diskette (written in any IBM format) and causes a printout, which identifies the locations (logical cylinder, head, and sector) of any failures. Each sector is read only once (without trying again). To run this routine:

1. Perform a CSIPL from the DIAGB1 diskette.

2. Select the UTILITIES option on the main menu.

3. Select the EC UPDATE COPY option.

The following three tests are diskette TUs and are selected after taking the TU SELECT option on the main menu. (For easier use, set the Address/Data switches to F800 (CE panel) and perform an IPL before running the TUs.)

CAUTION
The following three TUs write on the diskette.

_____
_____

TU E1—This TU runs only on a diskette 2D. This TU writes on each sector of the diskette and then reads each sector of the diskette. The 'switch filter' line is off (not normal) when cylinders hexadecimal 3D through 4C are read. A printout identifies the location (cylinder[1], head, sector, byte, and bit) of any failures. Because of the pattern written by this TU and because the 'switch filter' line is off while reading the inner cylinders, the printout may indicate failures not found by the diskette analysis routine or failures not indicated by ERAP. Four or more data bytes that do not compare per track on cylinders hexadecimal 48 through 4C indicates that TU 9A should be run.

Note: The location of a failure indicated by this TU may be used when scoping diskette damage using the read loop exerciser.

-----

[1]The cylinder number is the number of the logical cylinder if a level 1 attachment is installed. If a level 2 attachment is installed, the identified cylinder is the physical cylinder.

TU 9A–This TU runs only on a diskette 2D diskette formatted to 256-byte sectors. This TU writes on each sector of the inner cylinders of the diskette with the 'inner tracks/ line off (not normal). The same cylinders are then read with the 'inner tracks' and 'switch filter' lines off (not normal). A printout identifies the location (cylinder, head, and sector) of any failures. Because of the pattern written by this TU and because the 'inner tracks' and 'switch filter' lines were not used normally, the printout may indicate many errors on cylinders hexadecimal 49 through 4C. If the following two conditions are indicated, the head is probably worn:

- Fourteen or more sectors on cylinders hexadecimal 4B and 4C have failures.

- There are four or more failures per track on any cylinder hexadecimal 40 through 48.

For more information, check the head resolution (see paragraph 25-997 or paragraph 25-998).

Note: Because of the difference in diskette quality, some diskettes may fail on this TU and some may not. It is typical for the failures to occur as early as 10 tracks earlier on a diskette with acceptable quality than on diskettes with the best quality.

TU 9B–This TU runs only on a diskette 2D. This TU writes on each sector of cylinder 4C with the 'inner tracks' line off (not normal) and then writes a different pattern on the same cylinder with the 'inner tracks' line on (normal). This cylinder is then read with the 'inner tracks' and 'switch filter' lines on (normal) to test the ability of the head to write over old data. Four or more failures indicates that the head is probably worn. This test should be run on more than one diskette. For more information, check the head resolution (see paragraph 25-997 or paragraph 25-998).

25-994   Diskette Figure

To correct for visible damage, align the index hole in the diskette with the hole in the diskette jacket, then use the following figure of the diskette shown to locate the damaged area of the diskette.

Note: For a normal size figure of the diskette, see Appendix A of the *5340 System Unit Theory Diagrams Manual.*
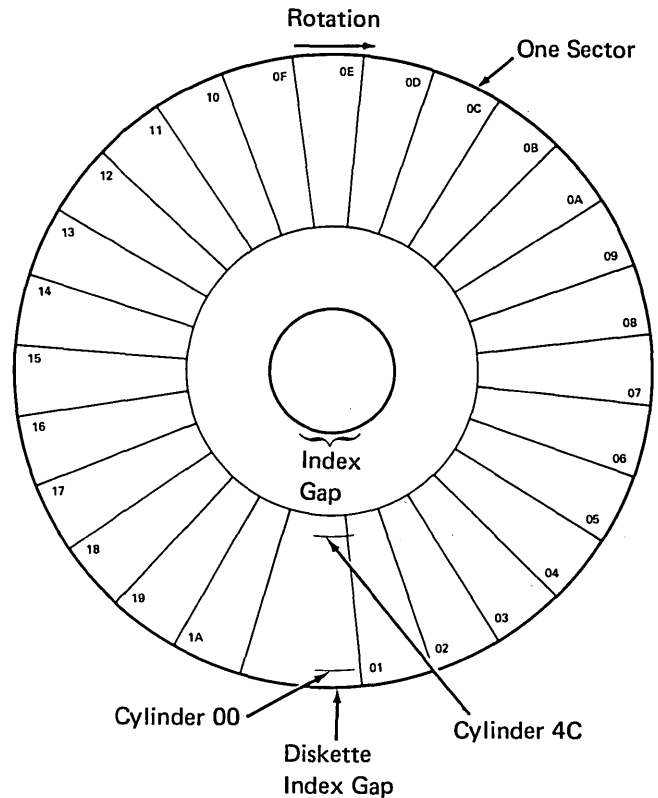
Notes:
1. The cylinder labels are hexadecimal 00 through 4C.
2. The sector labels are hexadecimal 01 through 1A as shown or hexadecimal 01 through 08.
3. The diskette is shown above as seen from the label side of diskette jacket, which is also the head 1 side of the diskette.

25-995   Diskette Quality Service Check for Level 1 Attachments

After determining the failing area of a diskette from the ERAP and diskette analysis printouts, the following exercisers may be run:

- Read sector exerciser—This exerciser attempts to read the sector up to 10 times and, if an error is sensed, does up to 20 read verifies to identify any failing byte. You may use this exerciser to locate the failing byte if TU-E1 does not fail.

- Read loop exerciser—This exerciser permits you to synchronize on any byte in a sector to scope a failing area of a diskette.

The following two examples of scoping damaged diskettes show the loss of amplitude at the read circuit preamplifier. These are examples of damage such as scratches or bumps. The loss of amplitude on a diskette with a very small scratch will not be as visible.

Example 1: The TU-E1 printout indicates that data did not compare on cylinder 24, head 1, sector 11, byte 93.

To scope this failure do the following:

1.   Set up an oscilloscope as follows:

   Note: Use a Tektronix 453, 454, or a 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[1]	5 mV/cm
Channel 2 volts/division[1]	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	0.1 ms/cm
Channel 1 probe[2]	THP-13 (preamp TP1)
Channel 2 probe[2]	THP-14 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)

[1] The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

[2] See paragraph 25-950 for control card test pins.

2.   Set the Address/Data switches to F800 (CE panel) and perform an IPL.

3.   Select the EXERCISERS option from the main menu.

4.   Select the DISKETTE DRIVE option from the first exerciser menu.

5.   Select the DISKETTE EXERCISER MODULE option from the second exerciser menu.

6. Select a recalibrate and, for this example, a seek to track 24 from the diskette exerciser test 1 command menu (enter an E after selecting the cylinder number).

7. Use the default option to execute the commands.

8. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.

9. Select the READ LOOP command and, for this example, select MFM mode, cylinder 24, head 1, and sector 11 from the displays (enter an E after selecting the sector number).

10. Select the LOOP ON CMND TABLE option and, for this example, set Address/Data switches (CE panel) to 6093 to display byte 93.
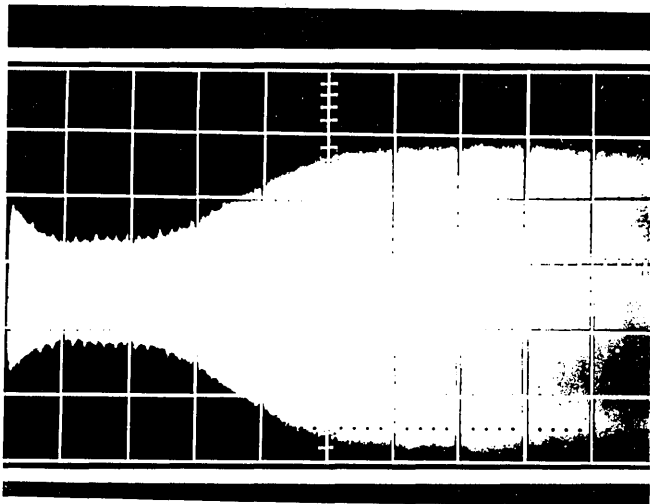
The loss of amplitude can be seen on the oscilloscope.

Example 2: To scope a damaged track (contains all ones in the ID field), the following changes must be made to the preceding procedure:

1. Set the Times Per Division on the oscilloscope to 20 ms/cm.

2. Connect the trigger to test pin TPB-9 (+index).

3. In step 6 of example 1, seek to the damaged cylinder.

4. In step 9 of example 1, select the READ SECTOR command (select the head, sector number, and cylinder number that you want to scope).

5. In step 10 of example 1, select the SCOPE LOOP A CMND option.

The following oscilloscope screen image shows the damaged area of the diskette.

25

1 Track

Damaged Area

25-996 Diskette Quality Service Check for Level 2 Attachments

After determining the failing area of a diskette from the ERAP and diskette analysis printouts, the following exercisers may be run:

- Read sector exerciser–This exerciser attempts to read the sector up to 10 times and, if an error is sensed, does up to 20 read verifies to identify any failing byte. You may use this exerciser to locate the failing byte if TU–E1 does not fail.

- Read loop exerciser–This exerciser permits you to synchronize on any byte in a sector to scope a failing area of a diskette.

The following two examples of scoping damaged diskettes show the loss of amplitude at the read circuit preamplifier. These are examples of damage such as scratches or bumps. The loss of amplitude on a diskette with a very small scratch will not be as visible.

Example 1: The TU–E1 printout indicates that data did not compare on cylinder 24, head 1, sector 11, byte 93.

To scope this failure do the following:

1. Set up an oscilloscope as follows:

   Note: Use a Tektronix 453, 454, or a 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[1]	5 mV/cm
Channel 2 volts/division[1]	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	0.1 ms/cm
Channel 1 probe[2]	THP-13 (preamp TP1)
Channel 2 probe[2]	THP-14 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)

[1]The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

[2]See paragraph 25-950 for control card test pins.

2. Set the Address/Data switches to F800 (CE panel) and perform an IPL.

3. Select the EXERCISERS option from the main menu.

4. Select the DISKETTE DRIVE option from the first exerciser menu.

5. Select the DISKETTE EXERCISER LOAD MODULE option from the second exerciser menu.

6. Select a recalibrate and, for this example, a seek to track 24 from the diskette exerciser test 1 command menu (enter an E after selecting the cylinder number).

7. Use the default option to execute the commands.

8. Press the Attn key (3 times) to return to the diskette exerciser test 1 command menu.

9. Select the READ LOOP command and, for this example, select MFM mode, cylinder 24, head 1, sector length = 256, sector 11, and M/S data field 1 from the displays (enter an E after selecting the sector number).

10. Select the LOOP ON CMND TABLE option and, for this example, set the Address/Data switches (CE panel) to 0093 to display byte 93.

The loss of amplitude can be seen on the oscilloscope.

Example 2: To scope a damaged track (contains all ones in the ID field), the following changes must be made to the preceding procedure:

1. Set the Times Per Division on the oscilloscope to 20 ms/cm.

2. Connect the trigger to the test pin TPB-9 (+index).

3. In step 6 of example 1, seek to the damaged cylinder.

4. In step 9 of example 1, select the READ 1 SECTOR ON CURRENT CYL command (select the mode, head, sector length, sector number, M/S data field, and cylinder number that you want to scope).

5. In step 10 of example 1, select the SCOPE LOOP A CMND option.

The following oscilloscope screen image shows the damaged area of the diskette.

25

1 Track

Damaged Area
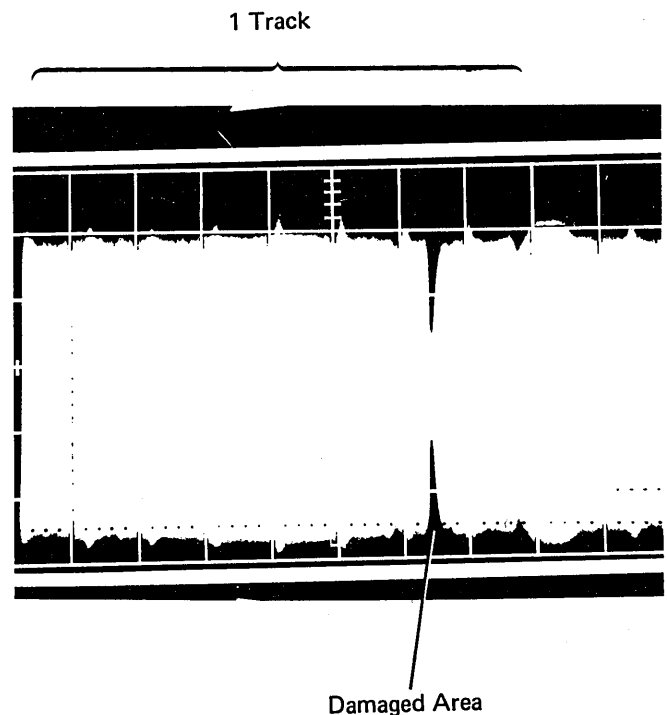
25-997   Head Wear Service Check for Level 1 Attachments

Head wear is determined by the head resolution and the errors indicated on the inner tracks area of a diskette (cylinders hexadecimal 40 through 4C).

Head resolution is the ratio of the signal amplitude of hexadecimal FF in centimeters to the signal amplitude of hexadecimal AA in centimeters multiplied by 100.

If the head resolution of both heads is more than 50, the heads are good. If the head resolution of either head is less than 40, that head is bad and the assembly should be exchanged. When the resolution is between 40 and 50, use the ERAP data and the TU printouts to determine if the head is bad.

The head is bad if the ERAP data and the TU printouts indicate data errors on cylinders hexadecimal 40 through 4C on a diskette 2D and the head resolution is less than 50.

Example: Perform the following to scope head resolution:

1. Initialize a diskette 2D.
    a. Perform an IPL under SSP.
    b. Sign on the system (if the system has the password security function specified in the machine configuration, you will need aid from the customer to sign on).
    c. Initialize a diskette 2D with the following command:

        INIT ƀ ,, FORMAT

2. Set up an oscilloscope as follows:

    Note: Use a Tektronix 453, 454, or a 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	5 mV/cm
Channel 2 volts/division	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	20 μs/cm
Channel 1 probe[1]	THP-13 (preamp TP1)
Channel 2 probe[1]	THP-14 (preamp TP2)
Connect trigger to	TPB-9 (+index)
[1]See paragraph 25-950 for control card test pins.	

3. Move the data heads to track hexadecimal 4C and determine head resolution as follows:

a. Set the Address/Data switches to F800 (CE panel) and perform an IPL.

b. Select the EXERCISERS option from the main menu.

c. Select the DISKETTE DRIVE option from the first exerciser menu.

d. Select the 33FD/53FD DISK EXERCISER MODULE option from the second exerciser menu.

e. Select a recalibrate and a seek to track 4C from the diskette exerciser test 1 command menu (enter an E after selecting cylinder 4C).

f. Use the default option to execute the commands.

g. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.

h. Select the READ LOOP command (select MFM mode, cylinder 4C, and the head and sector that you want to scope from the displays, enter an E after selecting the sector number).

i. Select the LOOP ON CMND TABLE option and measure the amplitude of the hexadecimal FF and AA.

AA=4cm   FF=2.2cm
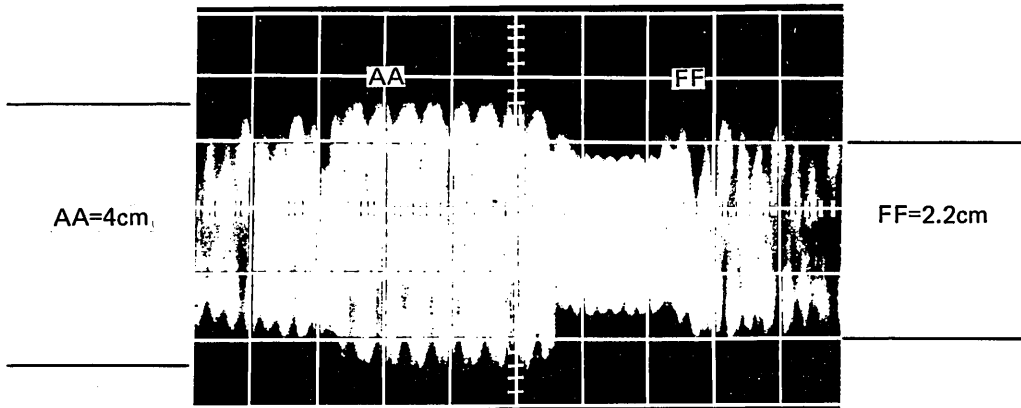
$$\text{Head Resolution} = \frac{2.2}{4} \times 100 = 55$$

25-998   Head Wear Service Check for
Level 2 Attachments

Head wear is determined by the head resolution and the errors indicated on the inner tracks area of a diskette (cylinders hexadecimal 40 through 4C).

Head resolution is the ratio of the signal amplitude of hexadecimal FF in centimeters to the signal amplitude of hexadecimal AA in centimeters multiplied by 100.

If the head resolution of both heads is more than 50, the heads are good. If the head resolution of either head is less than 40, that head is bad and the assembly should be exchanged. When the resolution is between 40 and 50, use the ERAP data and the TU printouts to determine if the head is bad.

The head is bad if the ERAP data and the TU printouts indicate data errors on cylinders hexadecimal 40 through 4C on diskette 2D diskettes and the head resolution is less than 50.

Example: Perform the following to scope head resolution:

1.   Initialize a diskette 2D.
      a. Perform an IPL under SSP.
      b. Sign on the system (if the system has the password security function specified in the machine configuration, you will need aid from the customer to sign on).
      c. Initialize a diskette 2D with the following command:

             INITƀ,,FORMAT

2.   Set up an oscilloscope as follows:

      Note: Use a Tektronix 453, 454, or a 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	5 mV/cm
Channel 2 volts/division	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	20 µs/cm
Channel 1 probe[1]	THP-13 (preamp TP1)
Channel 2 probe[1]	THP-14 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)

[1]See paragraph 25-950 for control card test pins.

3. Move the data heads to track hexadecimal 4C and determine head resolution as follows:
   a. Set the Address/Data switches to F800 (CE panel) and perform an IPL.
   b. Select the EXERCISERS option from the main menu.
   c. Select the DISKETTE DRIVE option from the first exerciser menu.
   d. Select the DISKETTE EXERCISER LOAD MODULE option from the second exerciser menu.
   e. Select RECALIBRATE, SEEK to track 4C, and WRITE 1 SECTOR ON CURRENT CYL (select MFM mode, the head you want to scope, the sector length, the sector number, and M/S data field 1 from the displays). Enter an E after selecting M/S data field 1.
   f. Select Y to see the COMMAND DATA FIELD option.
   g. Select the SCROLL FIELDS option.
   h. Change the first 8 bytes of M/S data field 1 from:

      FF FF FF FF FF FF FF FF
      to:

      AA AA AA FF FF AA AA AA
      and the @@@@S on line 11 to:
      @@@@M

   i. Press the Attn key to return to the menu.
   j. Select an E to exit.
   k. Use the default option to execute the commands.
   l. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.
   m. Select the READ LOOP command (select MFM mode, cylinder 4C, the head you want to scope, the sector length, the sector number, and M/S data field 1 from the displays). Enter an E after selecting the cylinder number.
   n. Select the LOOP ON CMND TABLE option, set the Address/Data switches to 0005 (CE panel), and measure the amplitude of the hexadecimal FF and AA.

25

AA=4.2cm   FF=2.4cm

Head Resolution=$\frac{2.4}{4.2}$X100=57

CONTENTS

27

27-000   SAFETY

DANGER

1. The system supplies the alternating current and the direct current power. Voltages are present on the connector terminals in the diskette drive when the drive motor is turning.
2. Motor and solenoid cases become hot after continuous use; wait enough time for parts to cool before servicing.

CAUTION

1. Do not use IBM cleaning fluid or other cleaning fluids near plastic parts.
2. Diskette drives can be damaged if they are not operated or serviced correctly.
3. Never use damaged diskettes in a diskette drive. Diskettes that are physically damaged (creased or bent) or contaminated by pencil marks, finger marks, or cleaning fluid can cause data errors, equipment errors, or head damage.
4. Never use damaged magazines on the autoloader. Magazines that are physically damaged can cause the autoloader to fail.
5. The head/carriage assembly, head timing block, and drive hub and pulley assembly are units that are adjusted and tested at the factory. The head timing block and drive hub and pulley assembly may not be changed in the field. The head/carriage assembly may be changed in the field. Do not repair or clean any part of this assembly.

27

27-030   TOOLS

Two timing pins (part 5562019, located on the base of
the 72MD unit) are used to align the following:

- The read/write head carriage stepper motor.

- The PTX-LED assembly.

Use the adjusting tool (part 2462583 for old style picker,
part 2462612 for new style picker) for the following:

- The carriage bed adjustments and service checks.

- The picker finger adjustments and service checks.

- The picker/cam adjustments and service checks.

- The magazine pressure roll housing replacement.
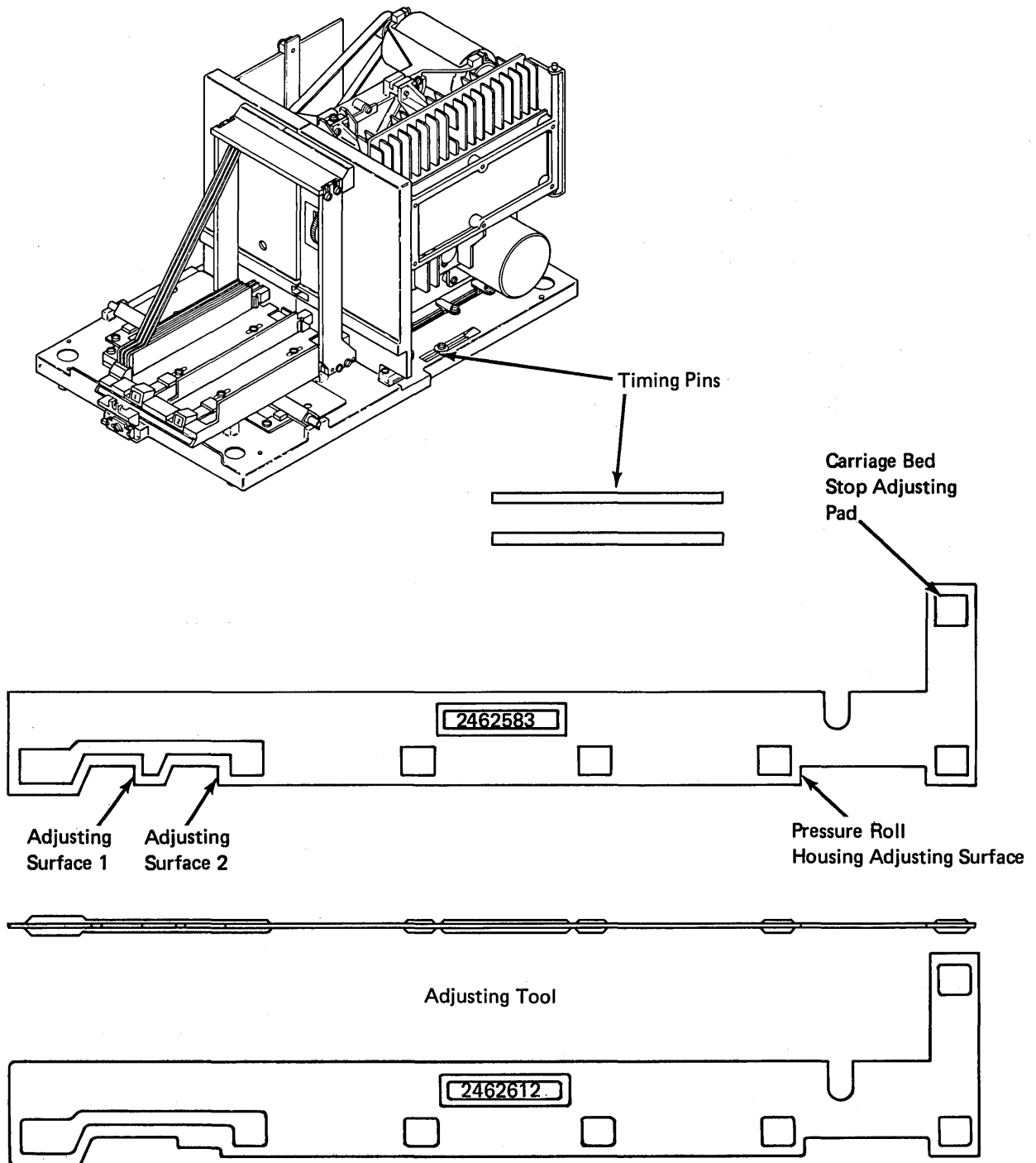
Timing Pins

Carriage Bed
Stop Adjusting
Pad

2462583

Adjusting   Adjusting
Surface 1   Surface 2

Pressure Roll
Housing Adjusting Surface

Adjusting Tool

2462612

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

Do not lay diskettes near smoke or other things that can cause the diskette to be contaminated.
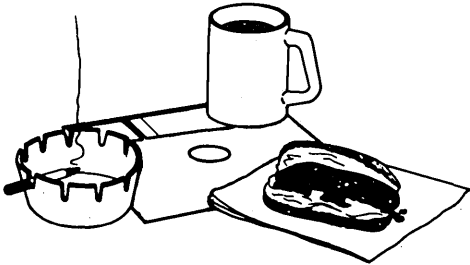
Do not use clips or rubber bands on a diskette.
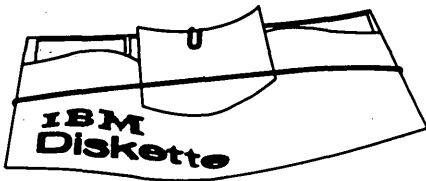
Do not place heavy books on diskettes.
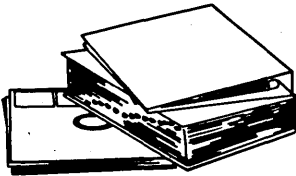
Do not touch or attempt to clean diskette surfaces. Contaminated diskettes will not work correctly.

Do not place diskettes near magnetic materials. Data can be lost from a diskette exposed to a magnetic field.
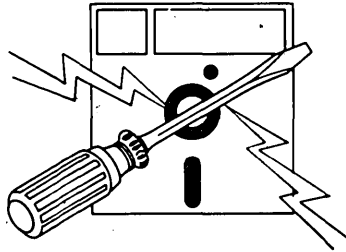
Do not expose diskettes to heat greater than 51.7° C (125°F) or direct sunlight.
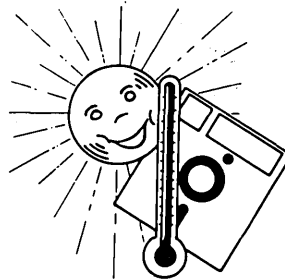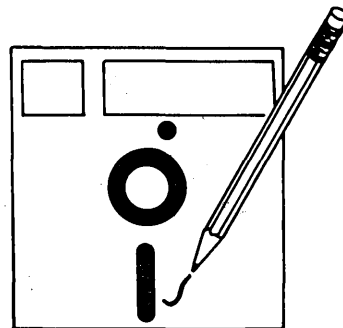
Do not write outside the label area on diskettes.

27-200   72MD REMOVAL AND REPLACEMENT

1.   Set Power to O (operator panel).

2.   Open the front left side cover and remove screw
      B, open the front right side cover and remove
      screw **G**. Remove the panel assembly.

3.   Loosen the two front safety shield screws and
      remove the two rear safety shield screws **A** and
      the safety shield.

4.   Disconnect the AC drive motor power cable.

5.   Disconnect the A2 signal cable from the control
      card socket.

> **DANGER**
> The 72MD unit weight is 18 kg (40 pounds).

_____
_____

CAUTION
1. The DC power cable is still connected.
2. Ensure that the cables on the right side of the 72MD
   unit clear the operator panel bracket.

_____
_____
_____
_____

6.   Release the latch mechanism **H** and slide the
      72MD unit forward and place the 72MD unit **C**
      on top of the 5340 system unit.

      Note: The cable straps must be removed.

7.   Open the heat sink assembly **D** and disconnect
      the DC power cable **E** from the J1 socket.

8.   To operate the 72MD outside the machine,
      connect the cables removed in steps 4, 5, and 7
      and tape the actuator of the interlock switch **F** to
      the operated position.

9.   To reinstall, reverse the above procedure.

27-205   72MD SERVICE POSITION

1.   Set Power to O (operator panel).

2.   Open the front left side cover and remove screw
      B, open the front right side cover and remove
      screw **G**. Remove the panel assembly.

3.   Loosen the two front safety shield screws and
      remove the two rear safety shield screws **A** and
      the safety shield.

4.   Remove the cable straps.

CAUTION
Ensure that the cables on the right side of the
72MD unit clear the operator panel bracket when
the 72MD is placed in the service position.

_____
_____
_____
_____

5.   Release the latch mechanism **H** and slide the
      72MD unit forward to the service position (the
      second time the latch has stopped the unit).

6.   To operate the 72MD in the service position, tape
      the actuator of the interlock switch **F** to the
      operated position.

7.   To reinstall, reverse the above procedure.

6

C

D

E

A

F

G

B

H

27

Panel
Assembly

Read/Write
Head Cable
Connector
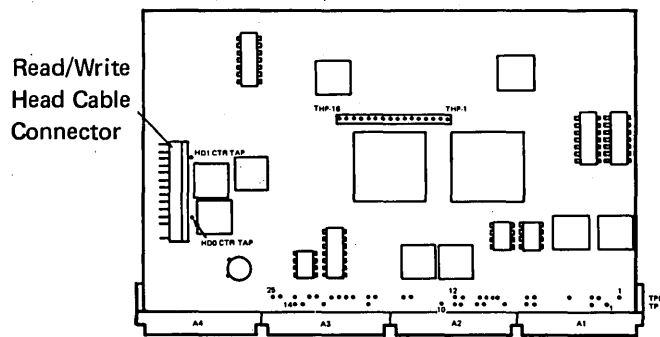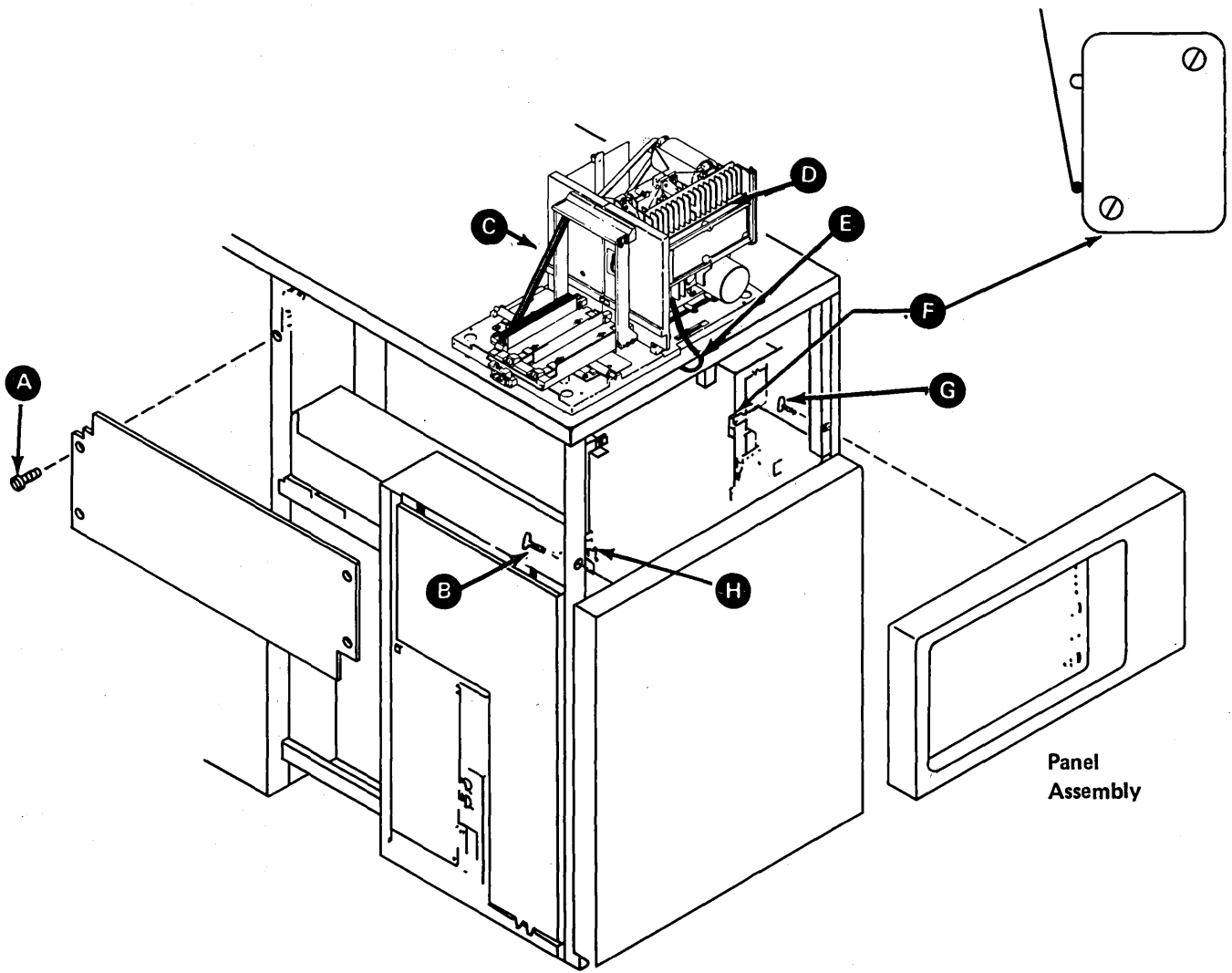
27-210 COVER OPEN SWITCH SERVICE CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws **(A)** and the safety shield.

3. Probe test pin TPB-25 **(H)** (+ cover open) for a minus (-) when the cover is closed and for a plus (+) when the cover is open.

4. If the level is not correct, go to cover open switch adjustment (see paragraph 27-215).

5. If the level is correct, reinstall the safety shield using the four screws **(A)** and close the front left side cover.

27-215 COVER OPEN SWITCH ADJUSTMENT

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws **(A)** and the safety shield.

3. Loosen the four screws **(J)** that attach the switch assembly to the operator panel bracket.

4. Place the switch assembly **(M)** so that the switch **(F)** is made when the cover **(L)** is closed and tighten the four screws **(J)**.

5. Perform the cover open switch service check (see paragraph 27-210).

27-220 COVER OPEN SWITCH REMOVAL AND REPLACEMENT

Removing the Cover Open Switch

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Open the front left side cover.

3. Loosen the two front safety shield screws and remove the two rear safety shield screws **(A)** and the safety shield.

4. Remove the four screws **(J)** that attach the switch assembly **(M)** to the operator panel bracket **(N)** (do not lose the nut plate **(P)**).

5. Disconnect the two leads from the cover open switch.

6. Remove the two mounting screws **(Q)** and the cover open switch **(F)**.

Reinstalling the Cover Open Switch

1. Position the cover open switch **(F)** and fasten with the two mounting screws **(Q)**.

2. Connect the leads to the cover open switch.

3. Attach the switch assembly **(M)** to the operator panel bracket **(N)** using the four screws **(J)** and the nut plate **(P)**. (Do not tighten the screws.)

4. Perform the cover open switch adjustment (see paragraph 27-215).

5. Reinstall the 72MD unit (see paragraph 27-200).

Panel
Assembly

Read/Write
Head Cable
Connector

Note: See paragraph 27-820 for control card test pins.

72MD Diskette Magazine Drive   9
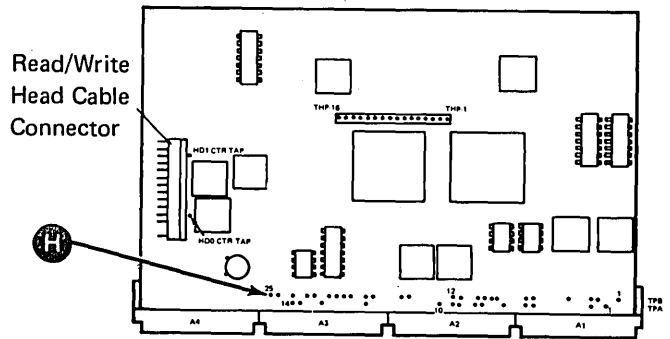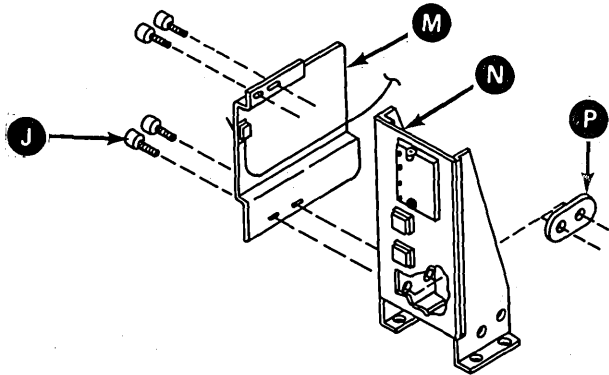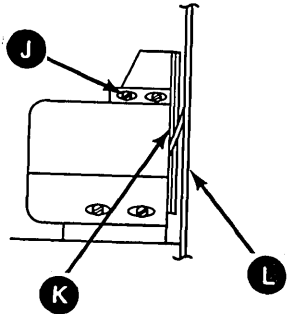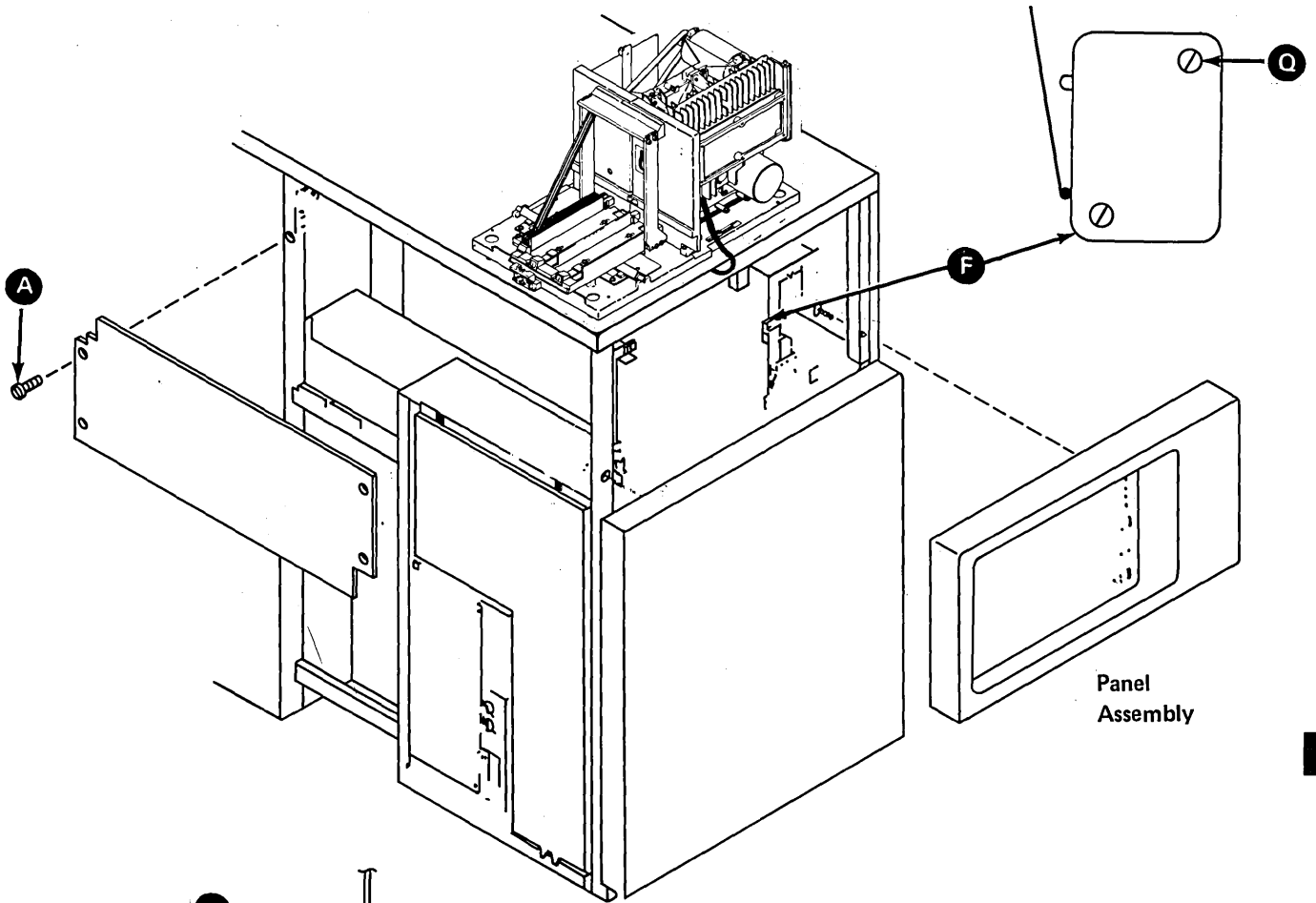
27-225   AC DRIVE MOTOR REMOVAL AND REPLACEMENT

Removing the AC Drive Motor

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Disconnect the AC drive motor power cable **C**.

3.   Remove the drive belt **A**.

4.   Remove the two motor mounting clamps **B**.

5.   Remove the motor **D**.

Reinstalling the AC Drive Motor

1.   Place the drive motor **D** on the casting and fasten it with the two motor mounting clamps **B**.

2.   Reinstall the drive belt **A**.

3.   Connect the AC drive motor power cable **C**.

4.   Reinstall the 72MD unit (see paragraph 27-200).
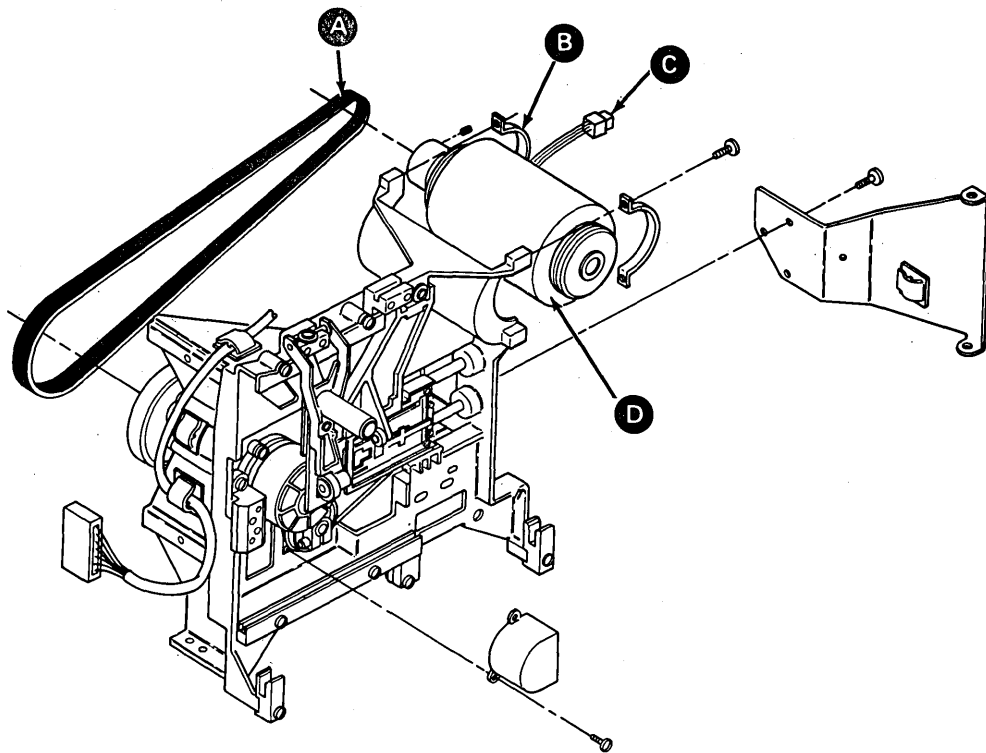
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27-230 CARRIAGE BED STOP SERVICE CHECK

1. Set Power to I (operator panel).

2. Press the Reset switch (CE panel) to orient the carriage bed.

3. Visually check to ensure that I/O slot 1 is aligned with the window diskette guide.

4. If the 72MD has the old style tray, remove the carriage bed assembly (see paragraph 27-300).

5. Check the gap from the carriage bed casting **F** to the rubber bed stop pad **D** with end **H** of the adjusting tool **G**. (If the 72MD has the new style tray, insert the tool through the hole in the tray.) If the gap is not correct do the carriage bed stop adjustment (see paragraph 27-235).

6. If the 72MD has the old style tray, reinstall the carriage bed assembly (see paragraph 27-300).
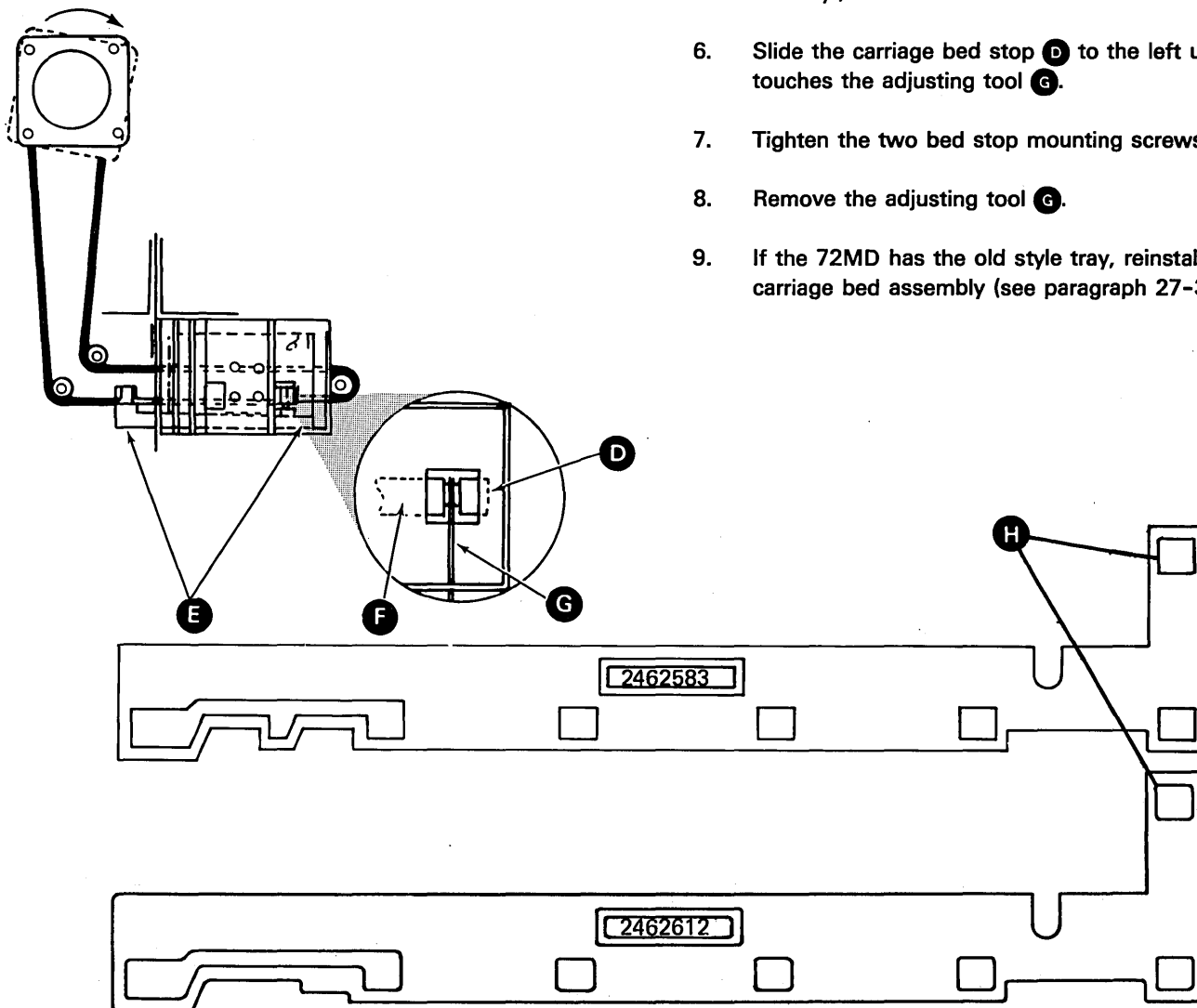
27-235 CARRIAGE BED STOP ADJUSTMENT

Note: The carriage bed orient adjustment (see paragraph 27-295) must be correct before this adjustment can be made.

1. Set Power to I (operator panel).

2. Press the Reset switch (CE panel) to orient the carriage bed.

3. If the 72MD has the old style tray, remove the carriage bed assembly (see paragraph 27-300).

4. Loosen the two bed stop mounting screws **E** and slide the carriage bed stop **D** to the right.

5. Insert end **H** of the adjusting tool **G** (part 2462583 for old style picker, part 2462612 for new style picker) between the carriage bed stop **D** and the carriage bed **F**. (If the 72MD has the new style tray, insert the tool through the hole in the tray.)

6. Slide the carriage bed stop **D** to the left until it touches the adjusting tool **G**.

7. Tighten the two bed stop mounting screws **E**.

8. Remove the adjusting tool **G**.

9. If the 72MD has the old style tray, reinstall the carriage bed assembly (see paragraph 27-300).

2462583

2462612

27-240   CARRIAGE BED STOP REMOVAL AND REPLACEMENT

Removing the Carriage Bed Stop

1. Remove the carriage bed assembly (see paragraph 27-300).

2. Remove the two mounting screws **B** from the carriage bed casting stabilizer guide rail **C** and remove the rail. (Remove both rails if the 72MD has the old style tray.)

3. Remove the two bed stop assembly mounting screws **E**.

4. Lift the carriage bed casting assembly **A** (old style tray only) and remove the bed stop assembly **D** .

Reinstalling the Carriage Bed Stop

1. Locate the bed stop assembly **D** on the base casting and reinstall the two mounting screws **E**. (Do not tighten the screws.)

2. Place the carriage bed casting assembly **A** on the monorail (old style tray only) and reinstall the carriage bed casting stabilizer guide rail **C** and screws **B**. (Both rails must be reinstalled for old style tray.)

3. Perform the carriage bed stop adjustment (see paragraph 27-235).

4. Reinstall the carriage bed assembly (see paragraph 27-300).

27

New Style Tray

Old Style Tray
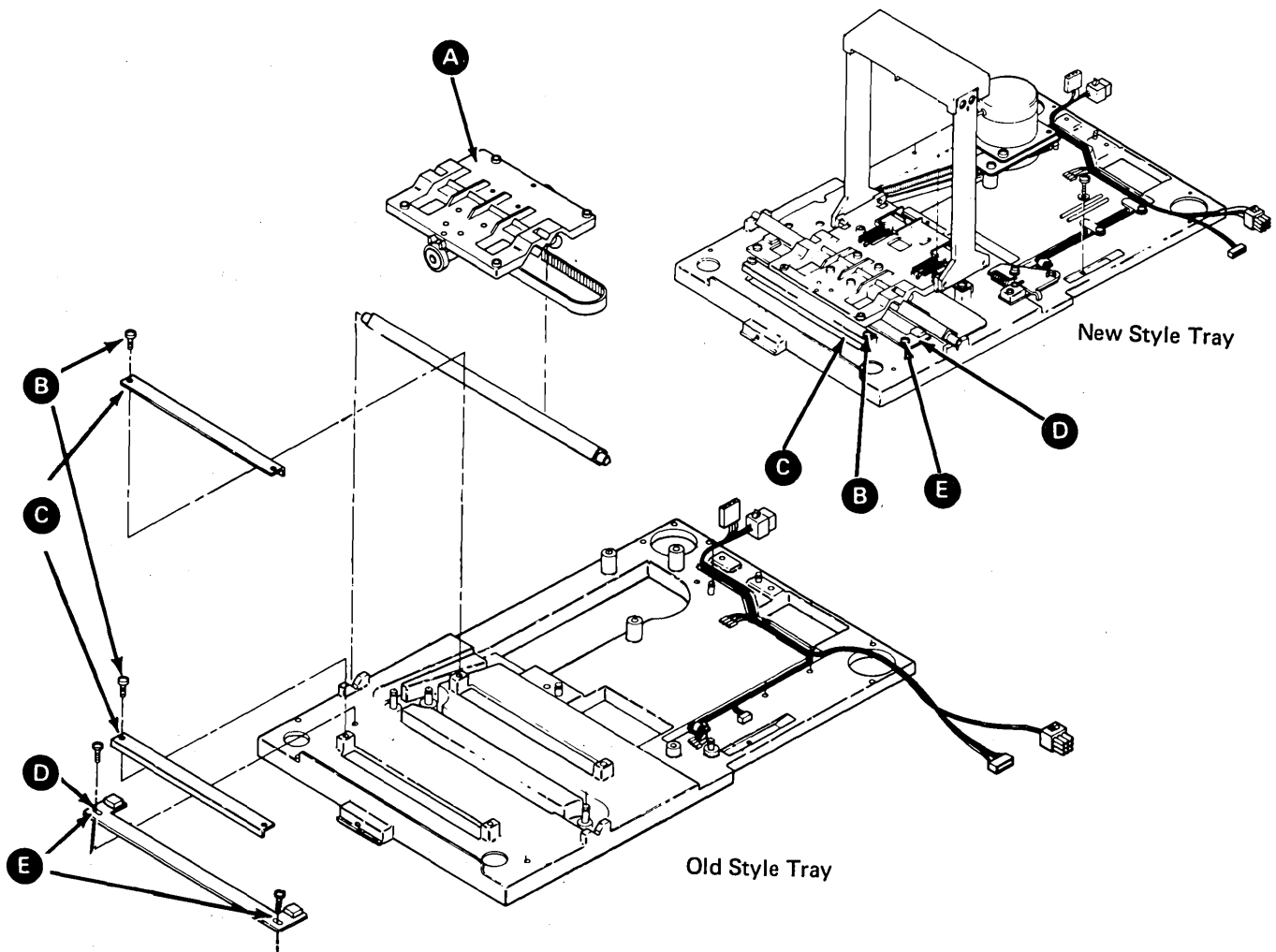
27-245 CARRIAGE BED STEPPER MOTOR REMOVAL AND REPLACEMENT

Removing the Carriage Bed Stepper Motor

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Remove the control card mounting assembly (see paragraph 27-840).

3. Disconnect the stepper motor connector **P** from the base cable connector near the motor.

4. Loosen the three screws **K** holding the belt tension bracket assembly **L**.

5. Turn the stepper motor against the belt tension spring to release belt tension and tighten bracket screw **J**.

6. Remove the three stepper motor screws **H** from their nut plate **M**.

7. Lift the stepper motor and attached pulley **G** clear of the belt **C** and remove.

8. Remove the pulley and collar **N** from the stepper motor shaft.

Reinstalling the Carriage Bed Stepper Motor

1. Reinstall the pulley and collar **N** on the stepper motor shaft. The pulley should be even with the end of the stepper motor shaft.

2. Locate the stepper motor and attached pulley **G** on the base casting **Q**. Be careful to place the belt **C** around the stepper motor pulley.

3. Reinstall the three stepper motor screws **H** and their nut plate **M** (do not tighten the screws).

4. Loosen the tightened bracket screw **J** to permit the belt tension spring to set the belt tension.

5. Tighten the three screws **K** for the belt tension bracket assembly **L**.

6. Connect the stepper motor connector **P** to the base cable connector near the motor.

7. Reinstall the control card mounting assembly (see paragraph 27-840).

8. Perform the carriage bed orient adjustment (see paragraph 27-295).

9. Perform the carriage bed orient switch adjustment (see paragraph 27-265).

10. Perform the carriage bed orient switch service check (see paragraph 27-260).

11. Reinstall the 72MD unit (see paragraph 27-200).

27-250 CARRIAGE BED MONORAIL REMOVAL AND REPLACEMENT

Removing the Carriage Bed Monorail

1. Remove the carriage bed assembly (see paragraph 27-300).

2. If the 72MD has the old style tray, remove the belt shield **E**.

3. Remove the two mounting screws **B** from each of the carriage bed casting stabilizer guide rails **A** and remove the rails.

4. Lift the carriage assembly **F** and remove the monorail **D**.

Reinstalling the Carriage Bed Monorail

1. Place the monorail **D** into the carriage bed belt yoke **S** and set the monorail into the V-slots **R** on the base casting.

2. Place the carriage assembly **F** on the monorail and fasten with the two carriage bed stabilizer guide rails **A** and mounting screws **B**.

3. If the 72MD has the old style tray, reinstall the belt shield **E**.

4. Reinstall the carriage bed assembly (see paragraph 27-300).

5. Perform the carriage bed orient service check (see paragraph 27-290).

6. Reinstall the 72MD unit (see paragraph 27-200).

See Detail

Detail

Old Style Tray

New Style Tray

27
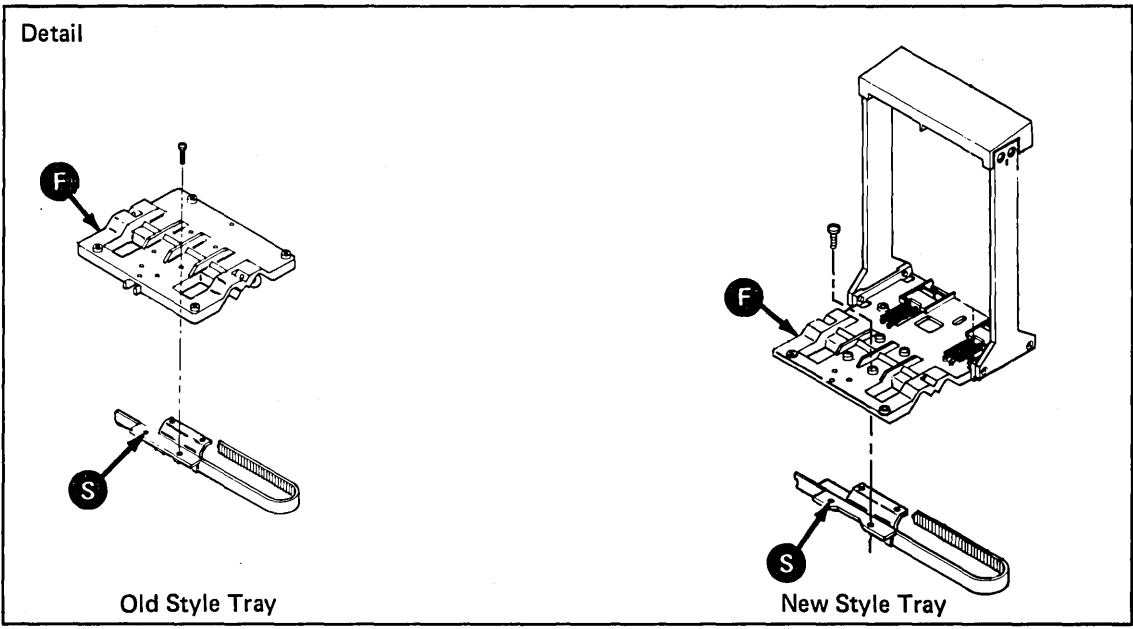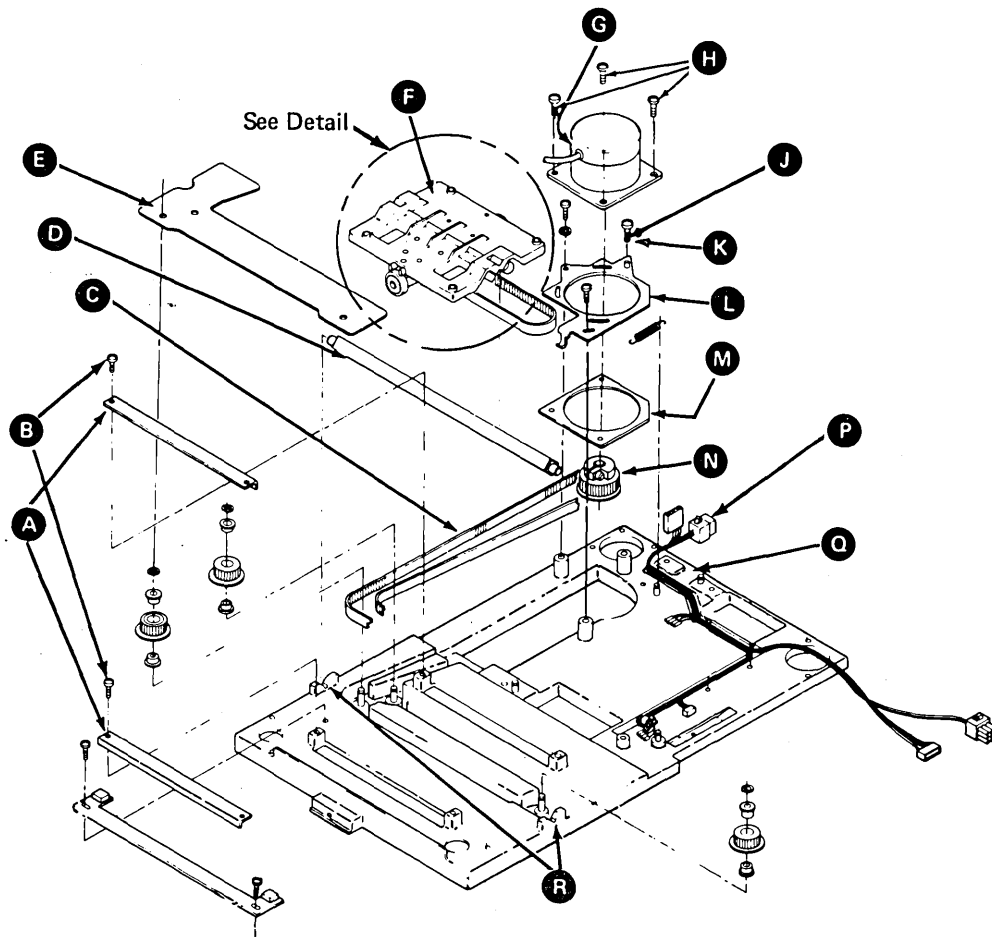
27-255 CARRIAGE BED BELT REMOVAL AND REPLACEMENT

Machines with Old Style Tray

Removing the Carriage Bed Belt

1. Remove the carriage bed assembly (see paragraph 27-300).

2. Remove the diskette drive assembly bezel (see paragraph 27-665).

3. Loosen the three belt tension bracket screws (K).

4. Turn the stepper motor against the belt tension spring to release belt tension and tighten bracket screw (J).

5. Remove the belt shield (E).

6. Remove the two mounting screws (B) from each of the carriage bed casting stabilizer guide rails (A) and remove the rails.

7. Lift the carriage bed casting assembly (F) and attached belt from the base.

8. Pull the monorail (D) from under the carriage bed casting.

9. Remove the belt (C) from around the stepper motor pulley (N).

10. Remove the carriage bed belt yoke (S) from the carriage bed casting assembly (F).

Reinstalling the Carriage Bed Belt

1. Reinstall the carriage bed belt yoke (S) on the bottom of the carriage bed casting assembly (F).

2. Reinstall the belt (C) around the stepper motor pulley (N).

3. Place the monorail (D) into the carriage bed yoke (S) and set the ends of the monorail into the V-slots (R) in the base casting.

4. Locate the carriage bed casting assembly (F) and attached belt on the base.

5. Loosen the tightened bracket screw (J) to permit the spring to set the tension.

6. Tighten the three belt tension bracket screws (K).

7. Reinstall the two carriage bed casting stabilizer guide rails (A) and the mounting screws (B).

8. Reinstall the belt shield (E).

9. Reinstall the diskette drive assembly bezel (see paragraph 27-665).

10. Reinstall the carriage bed assembly (see paragraph 27-300).

11. Perform the carriage bed orient adjustment (see paragraph 27-295).

12. Perform the carriage bed orient switch service check (see paragraph 27-260).

13. Reinstall the 72MD unit (see paragraph 27-200).

See Detail

E

D

C

B

A

F

J

K

N

R

Detail

F

Old Style Tray

S
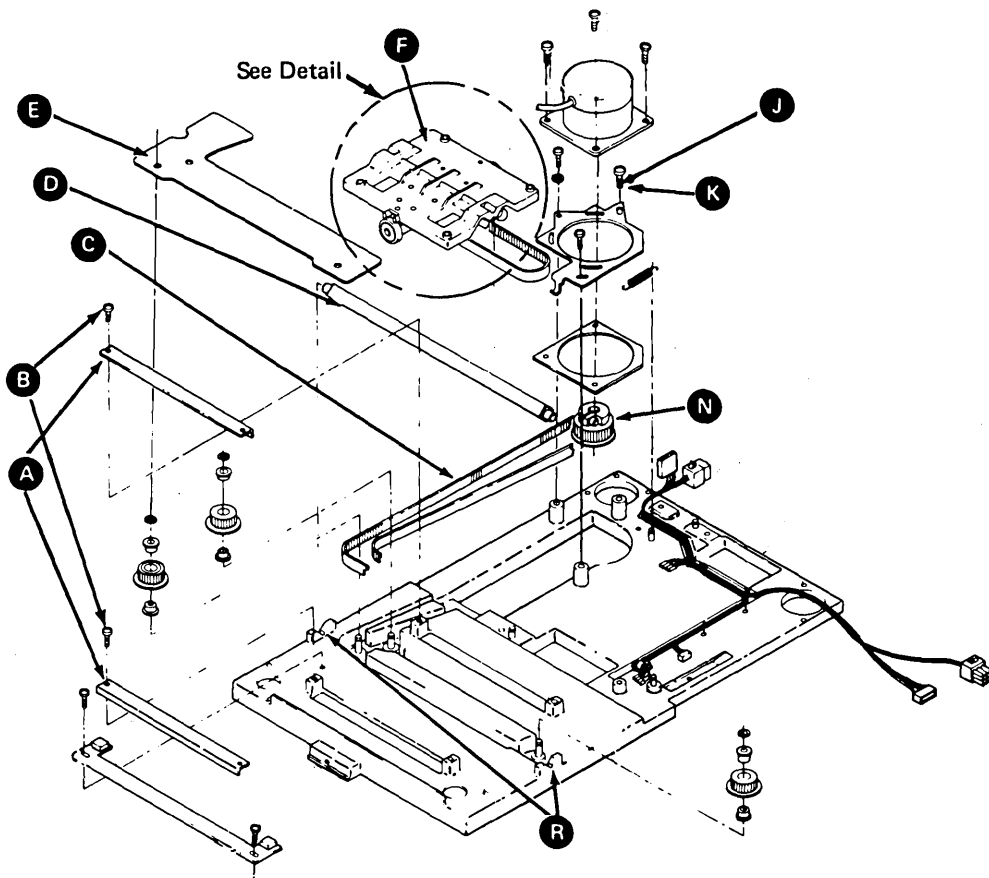
27
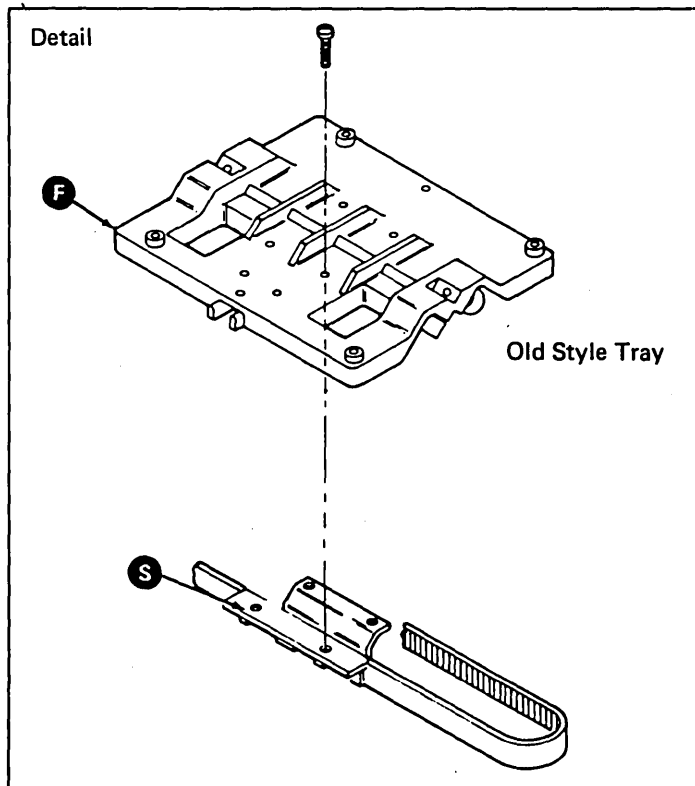
Machines with New Style Tray

Removing the Carriage Bed Belt

1. Remove the carriage bed assembly (see paragraph 27-300).

2. Remove the two mounting screws **B** from each of the carriage bed stabilizer guide rails **A** and remove the rails.

3. Remove the four screws **T** to remove the carriage assembly **F** from the carriage bed belt yoke **S**.

4. Remove the monorail **D** from the V-slots **R** in the base casting.

5. Remove the diskette drive assembly bezel (see paragraph 27-665).

6. Loosen the three belt tension bracket screws **K**.

7. Turn the stepper motor against the belt tension spring to release belt tension and tighten bracket screw **J**.

8. Remove the belt shield **E**.

9. Lift the carriage bed belt yoke **S** and attached belt from the base.

10. Remove the belt **C** from around the stepper motor pulley **N**.

Reinstalling the Carriage Bed Belt

1. Reinstall the belt **C** around the stepper motor pulley **N**.

2. Locate the carriage bed belt yoke **S** and attached belt on the base.

3. Reinstall the belt shield **E**.

4. Loosen the tightened bracket screw **J** to permit the spring to set the tension.

5. Tighten the three belt tension bracket screws **K**.

6. Reinstall the diskette drive assembly bezel (see paragraph 27-665).

7. Place the ends of the monorail **D** into the V-slots **R** in the base casting.

8. Attach the carriage bed belt yoke **S** to the carriage assembly **F** using the four screws **T**.

9. Reinstall the two carriage bed stabilizer guide rails **A** and the mounting screws **B**.

10. Reinstall the carriage bed assembly (see paragraph 27-300).

11. Perform the carriage bed orient adjustment (see paragraph 27-295).

12. Perform the carriage bed orient switch service check (see paragraph 27-260).

13. Reinstall the 72MD unit (see paragraph 27-200).

See Detail

Detail

New Style Tray

27
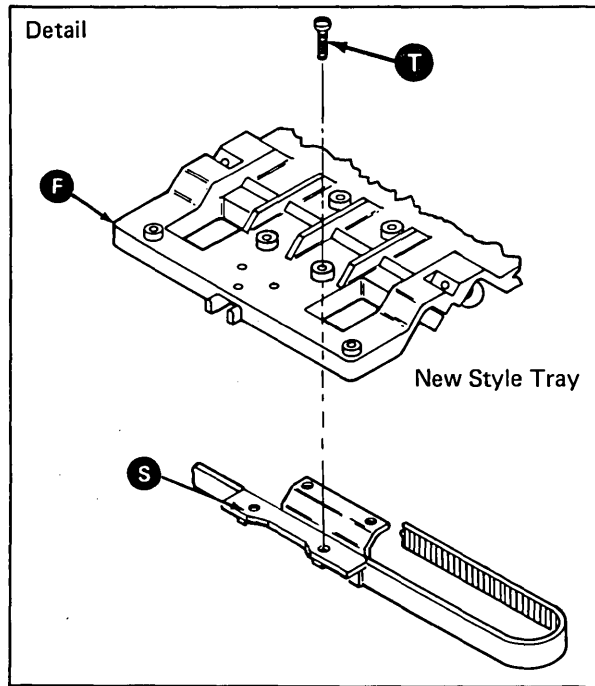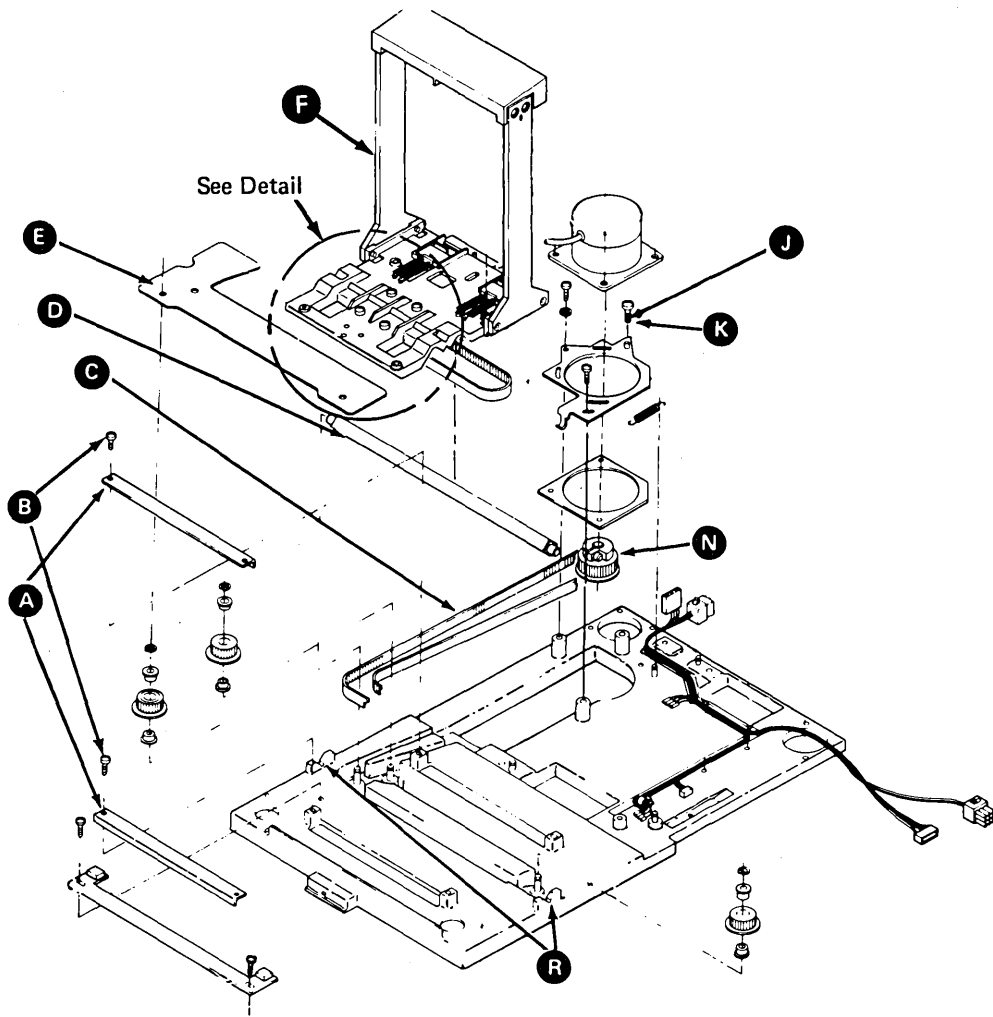
27-260 CARRIAGE BED ORIENT SWITCH SERVICE CHECK

1. Place the 72MD unit in the service position (see paragraph 27-20F).

2. Set Power to I (operator panel).

3. Press the Reset switch (CE panel) to orient the carriage bed.

4. Visually check that I/O slot 1 aligns with the diskette guide.

   If the I/O slot 1 does not align with the diskette guide, perform the carriage bed orient switch adjustment (see paragraph 27-265).

5. Verify that the switch is good by probing its output as you activate the switch Ⓐ (the level should change).

   Probe the output at:

   For the old style picker, TPB-16 Ⓕ.
   For the new style picker, TPB-17 Ⓕ.

27-265 CARRIAGE BED ORIENT SWITCH ADJUSTMENT

At power on time as well as at the end of a command the picker/cam stepper motor and the carriage bed stepper motor are at normal detent with windings 0 and 1 active.

Carriage bed orient is when I/O slot 1 is aligned with the drive diskette guide and the stepper motor is at normal detent.

To check or adjust the carriage bed orient switch, the carriage bed must be at the orient position with the stepper motor at normal detent.

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Set Power to I (operator panel).

3. Remove the magazine in position 2 to view the carriage bed orient switch.

4. Disconnect the carriage stepper motor cable Ⓔ from the driver board at J4.

5. Align I/O slot 1 with the diskette guide window.

6. Connect the carriage stepper motor cable Ⓔ to J4.

7. Loosen the switch adjusting screw Ⓓ.

8. Turn the orient switch assembly until the gap between the actuator and the switch is 0.0 to 0.25 millimeter (0.01 inch).

9. Tighten the switch adjusting screw Ⓓ.

10. Reinstall the 72MD unit (see paragraph 27-200).

27-270 CARRIAGE BED ORIENT SWITCH REMOVAL AND REPLACEMENT

Removing the Carriage Bed Orient Switch

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Remove the leads from the switch Ⓐ.

3. Remove the two mounting screws Ⓒ from the the switch bracket Ⓑ, and remove the switch.

Reinstalling the Carriage Bed Orient Switch

1. Locate the switch Ⓐ and fasten it to the switch bracket Ⓑ with the two mounting screws Ⓒ.

2. Connect the leads to the switch.

3. Adjust the carriage bed orient switch (see paragraph 27-265).

4. Reinstall the 72MD unit (see paragraph 27-200).
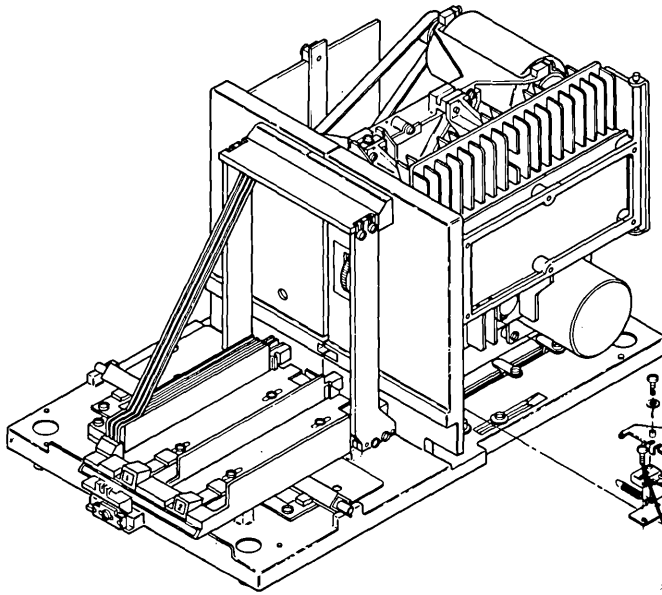
Diskette-In, Carriage Bed Orient and Window Stripper Switches
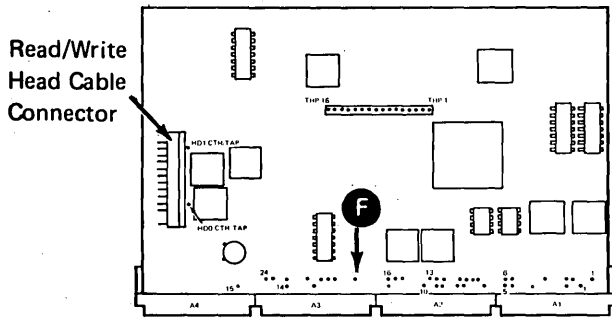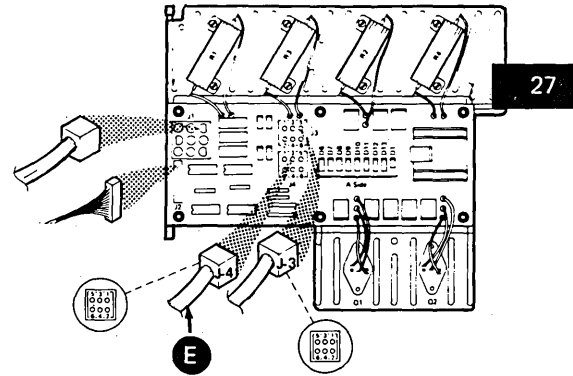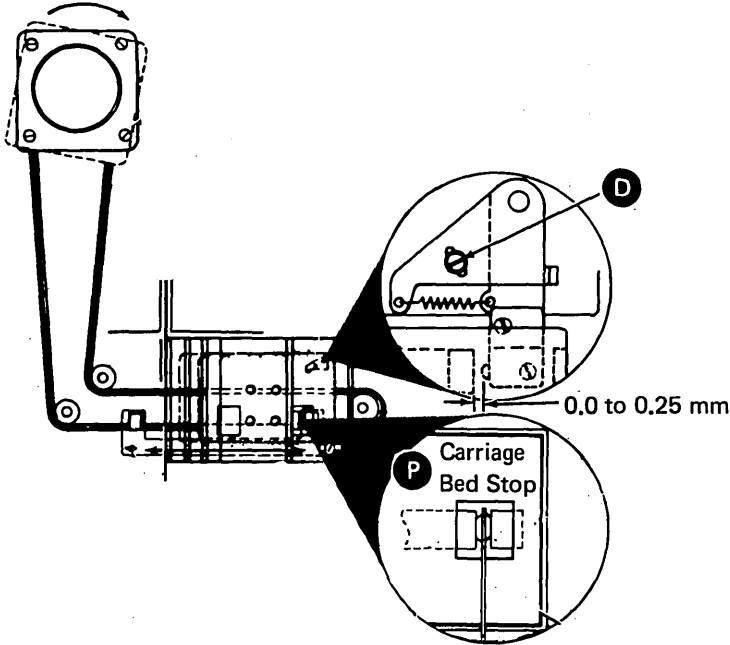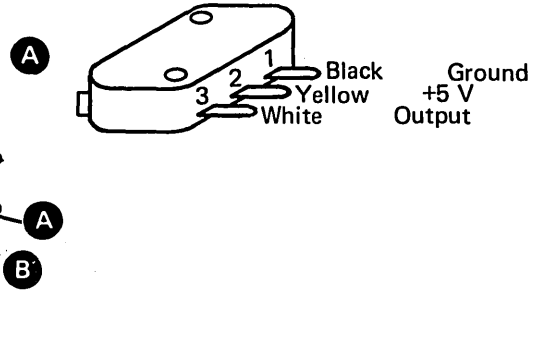
Ⓐ

	Black	Ground
1		
2	Yellow	+5 V
3	White	Output

Ⓐ
Ⓑ
Ⓒ

Ⓓ

0.0 to 0.25 mm

Ⓟ Carriage Bed Stop

Ⓔ

Read/Write
Head Cable
Connector

THP·16   THP·1

HD1 CTH TAP

HD0 CTH TAP

Ⓕ

Note: See paragraph 27-820 for control card test
pins for the new style picker.

Read/Write
Head Cable
Connector

THP·16   THP·1

HD1 CTR TAP

HD0 CTR TAP

Ⓕ
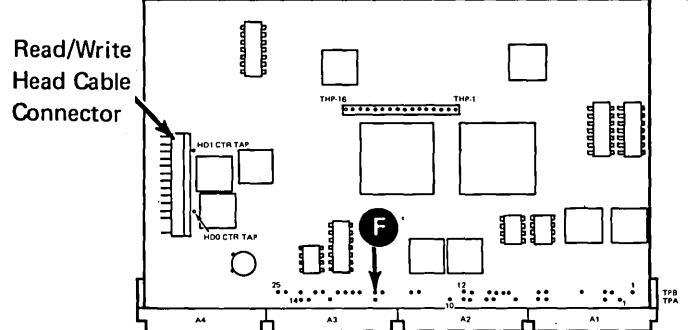
Note: See paragraph 27-820 for control card test
pins for the old style picker.

27-275   CARRIAGE BED STEPPER MOTOR
WINDINGS RESISTANCE
SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Disconnect the stepper motor cable Ⓐ from driver board connector J4.

3. Use a multimeter to measure the resistance between pins: 2 and 4, 4 and 6, 1 and 3, 3 and 5.

   The resistance should be 3 ohms ± 10% each.
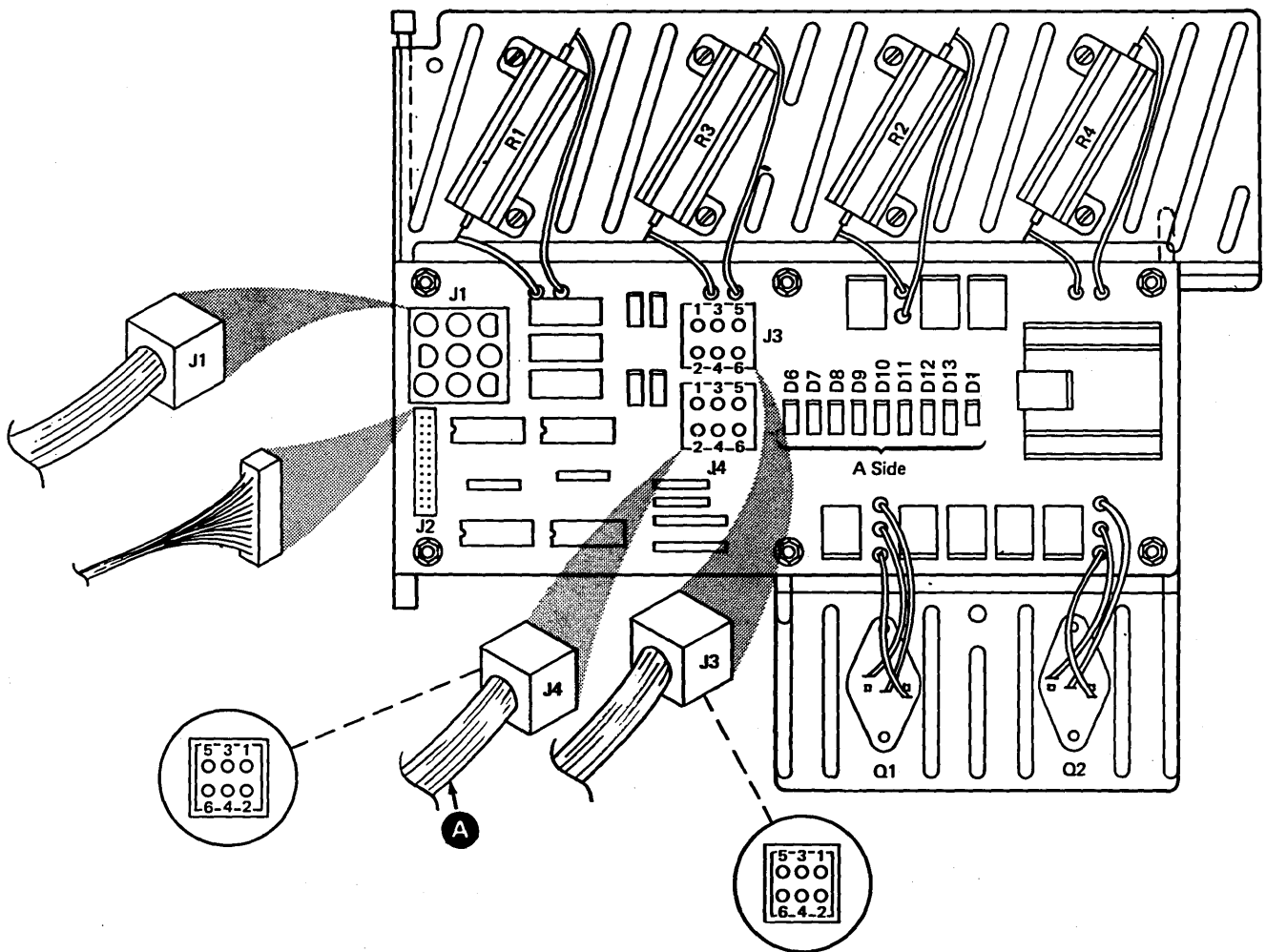
Stepper Motor Logic
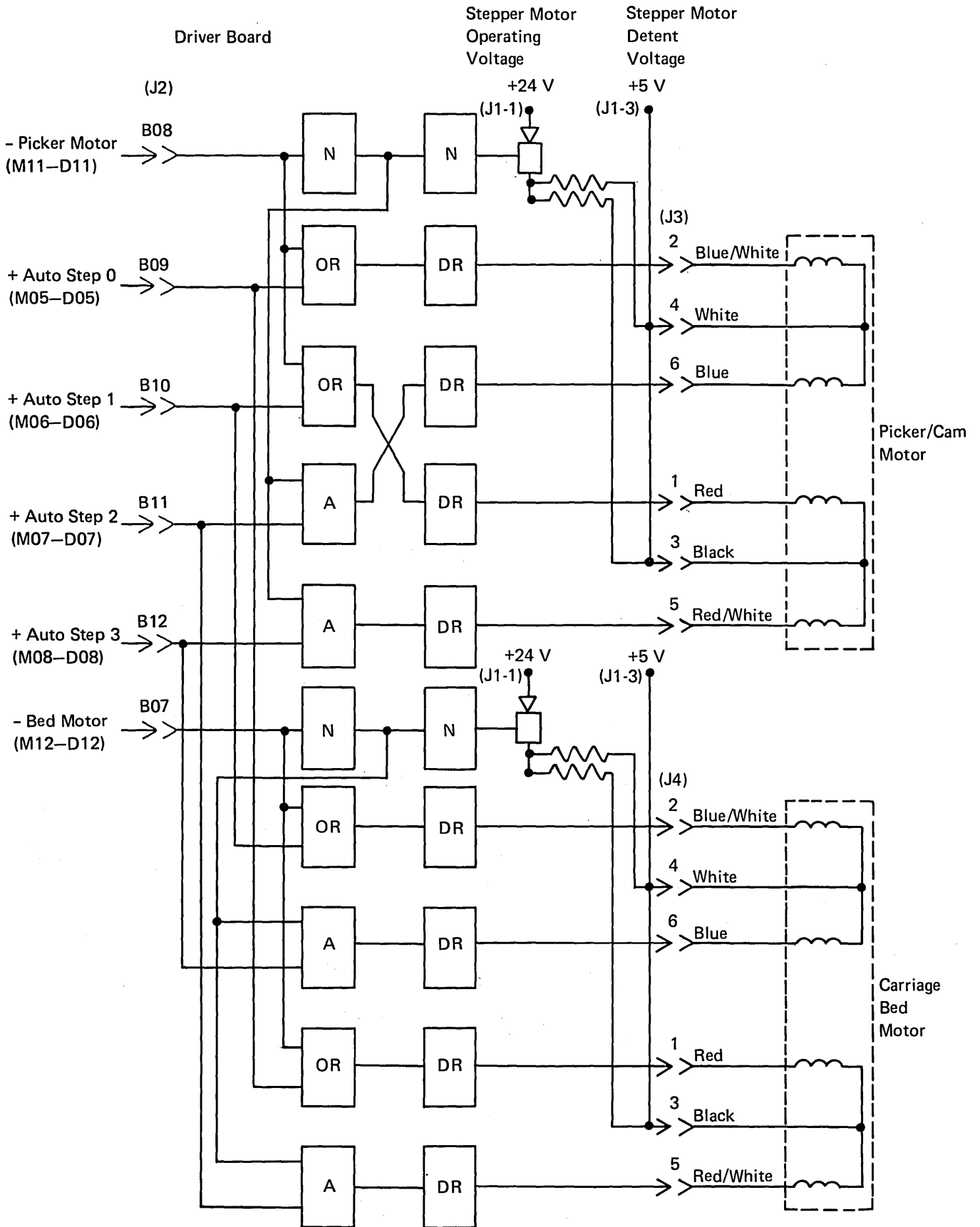
27

27-280 MAGAZINE INTERLOCK/INDICATOR ADJUSTMENT

1. With power on, press the Reset switch (CE panel) to orient the carriage bed.

2. Loosen the screw **A** on the interlock/indicator assembly **C** and center the indicator slot on the 1 in the I/O positions.

3. Tighten the screw **A**.

27-285 MAGAZINE INTERLOCK/INDICATOR REMOVAL AND REPLACEMENT

Removing the Magazine Interlock/Indicator

Remove the screw **A** that holds the magazine interlock/indicator assembly **C** and remove the assembly.

Reinstalling the Magazine Interlock/Indicator

1. Insert the stop plate **B** into the interlock/indicator and fasten this assembly **C** to the base casting with the mounting screw **A**. (Do not tighten the screw.)

2. Perform the magazine interlock/indicator assembly adjustment (see paragraph 27-280).
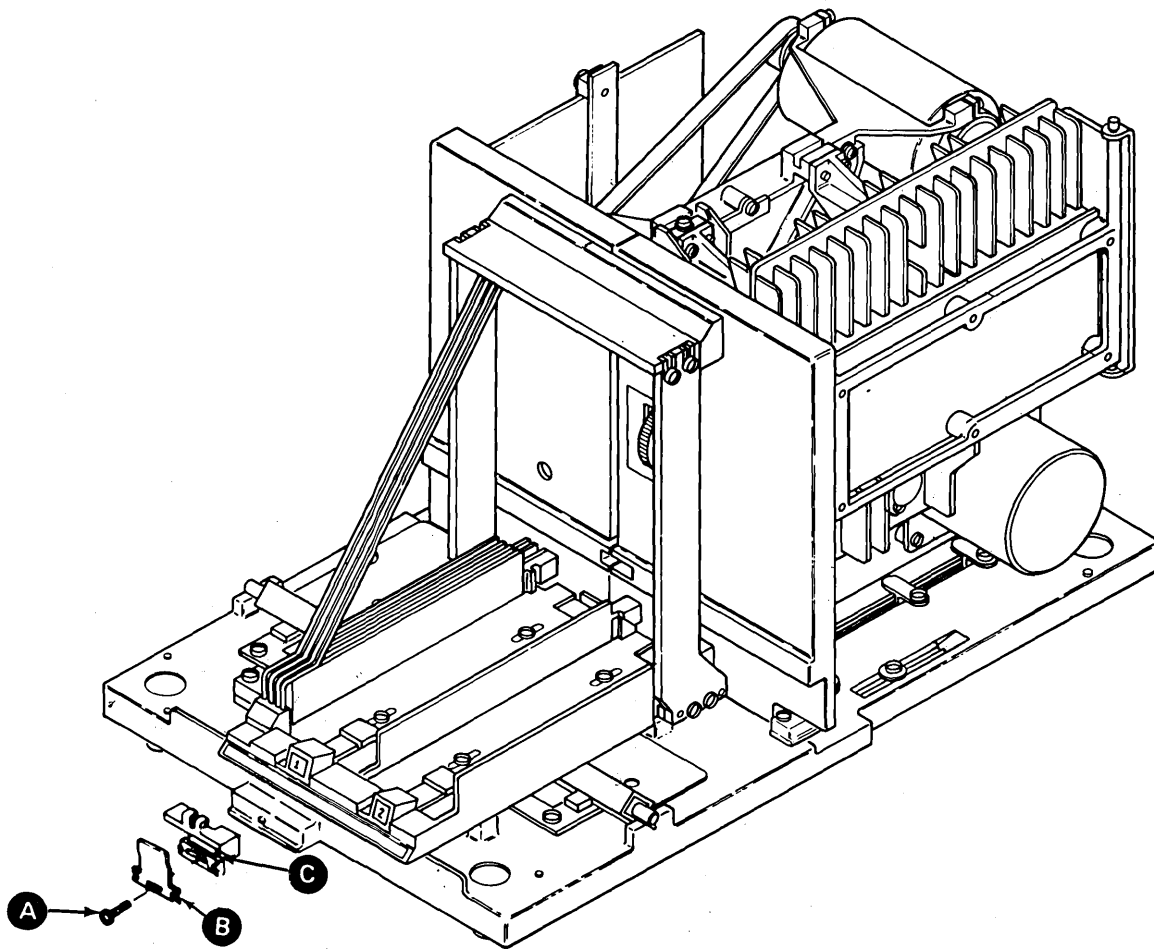
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27-290   CARRIAGE BED ORIENT SERVICE CHECK

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Set Power to I (operator panel).

3.   Disconnect connector J1 Ⓐ from the driver board.

4.   Visually align I/O slot 1 with the drive diskette guide.

5.   Locate the picker carriage assembly Ⓕ near the picker carriage detent assembly Ⓔ.

6.   Power on by connecting J1 Ⓐ to the driver board.

7.   Insert the adjusting tool (part 2462583 for old style picker, part 2462612 for new style picker) into the drive diskette guide and carefully put downward pressure to the top of the tool. (This will align the tool to the drive diskette guide.

8.   Check for the following conditions:
     a. Check that the right wall of I/O slot 1 and the right side of the tool touch.
     b. Check that the carriage bed does not move when the tool is inserted or that the tool must not be forced into the I/O slot.

9.   If both conditions are not correct, perform the carriage bed orient adjustment (see paragraph 27-295).

10.   If both conditions are correct, reinstall the 72MD unit (see paragraph 27-200).

27-295   CARRIAGE BED ORIENT ADJUSTMENT

1.   Remove power and the 72MD unit (see paragraph 27-200). Do not connect the AC power connector Ⓑ to the drive motor or connector J1 Ⓐ to the driver board.

2.   Set Power to I (operator panel).

> **DANGER**
> Voltage is still present at the power connector when it is disconnected and power is on.
>
> _____
> _____
> _____
> _____

3.   Visually align I/O slot 1 with the drive diskette guide.

4.   Loosen the three screws Ⓒ that fasten the carriage stepper motor Ⓓ to the motor plate.

5.   Locate the picker carriage assembly Ⓕ near the picker carriage detent assembly Ⓔ.

6.   Connect J1 Ⓐ to the driver board.

7.   Insert the adjusting tool (part 2462583 for old style picker, part 2462612 for new style picker) into the drive diskette guide and carefully put downward pressure to the top of the tool. (This will align the tool to the drive diskette guide.)

8.   Turn the stepper motor clockwise by hand until the right wall of I/O slot 1 and the right side of the tool touch.

9.   Tighten the three screws Ⓒ.

10.   Perform the carriage bed orient switch adjustment (see paragraph 27-265).

11.   Visually check the magazine interlock/indicator. If the indicator slot is not centered on the 1 in the I/O positions, perform the magazine interlock/indicator adjustment (see paragraph 27-280).

12.   Remove power and reinstall the 72MD unit (see paragraph 27-200).
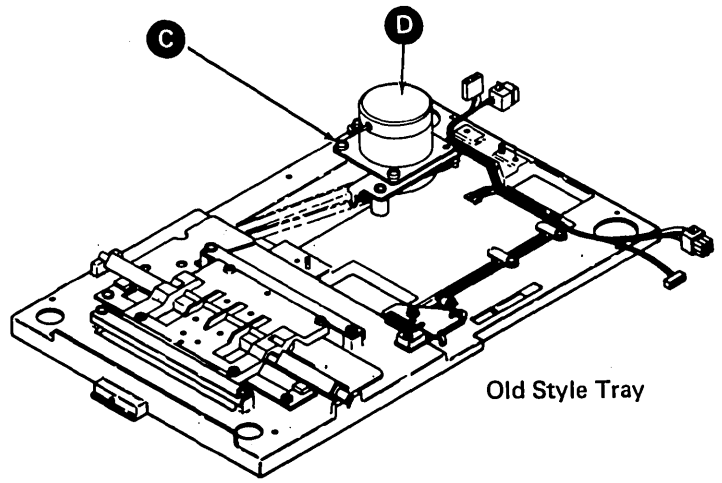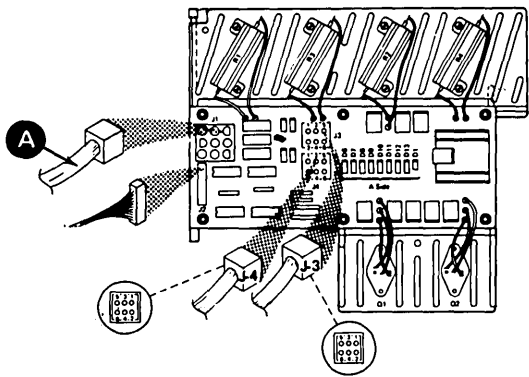
Old Style Tray

New Style Tray
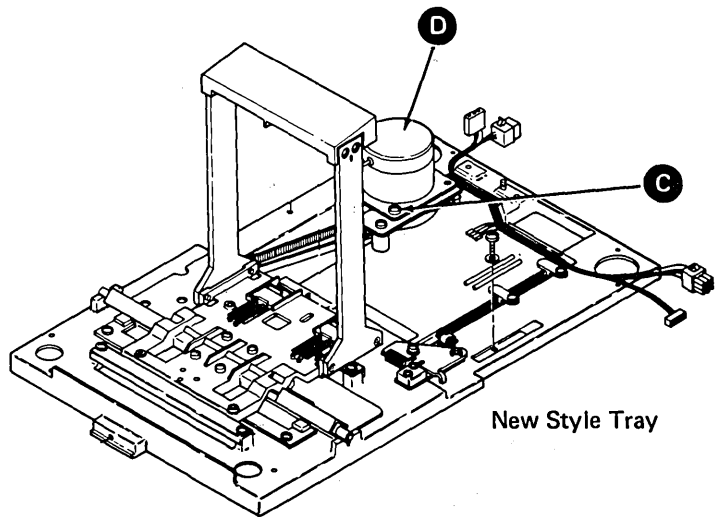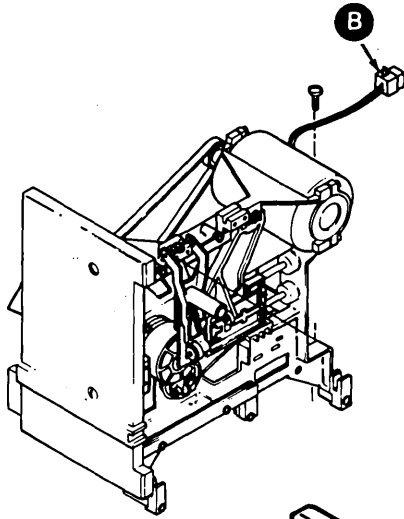
Detail
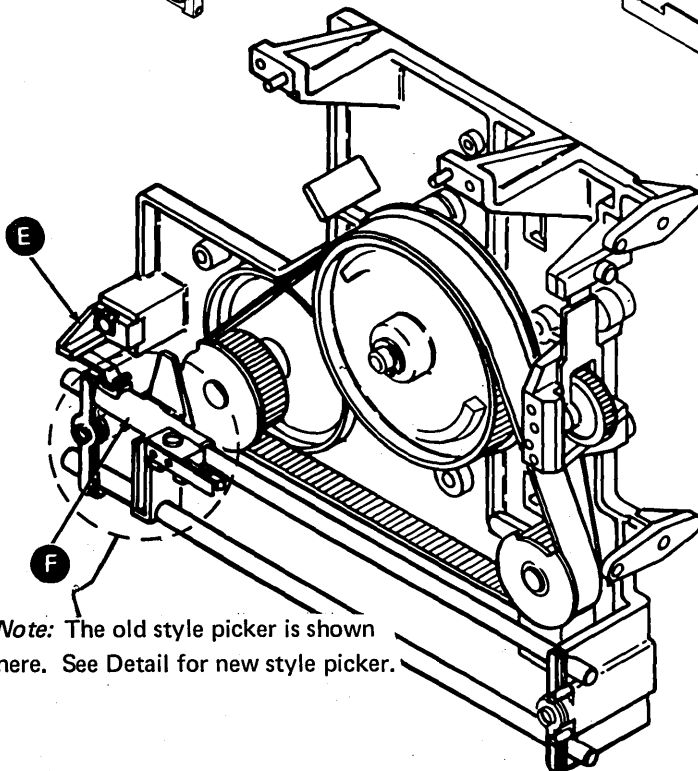
New Style Picker

Note: The old style picker is shown here. See Detail for new style picker.
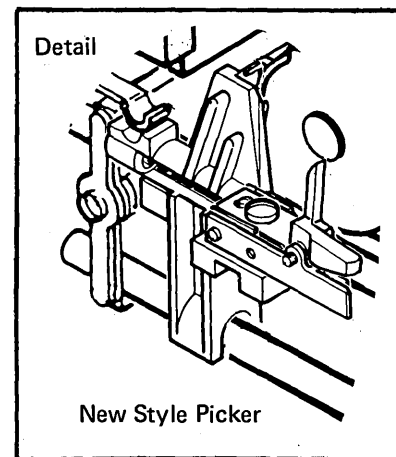
27-300 CARRIAGE BED ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Carriage Bed Assembly

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Remove the four mounting screws Ⓐ.

3.   Lift the carriage bed assembly Ⓑ from the carriage bed casting Ⓓ. (Be careful not to damage the locating pins Ⓒ on the bottom of the carriage bed.)

Reinstalling the Carriage Bed Assembly

1.   If the 72MD has the new style tray, insert the I/O slot guide wires Ⓔ in the slots in the housing Ⓕ and place the carriage bed assembly locating pins Ⓒ on the carriage bed assembly Ⓓ. Fasten the carriage bed assembly with the four mounting screws Ⓐ (do not tighten the screws).

2.   Perform the carriage bed to diskette drive bezel adjustment (see paragraph 27-305).

3.   Perform the carriage bed orient service check (see paragraph 27-290).

4.   Reinstall the 72MD unit (see paragraph 27-200).

New Style Tray

Old Style Tray
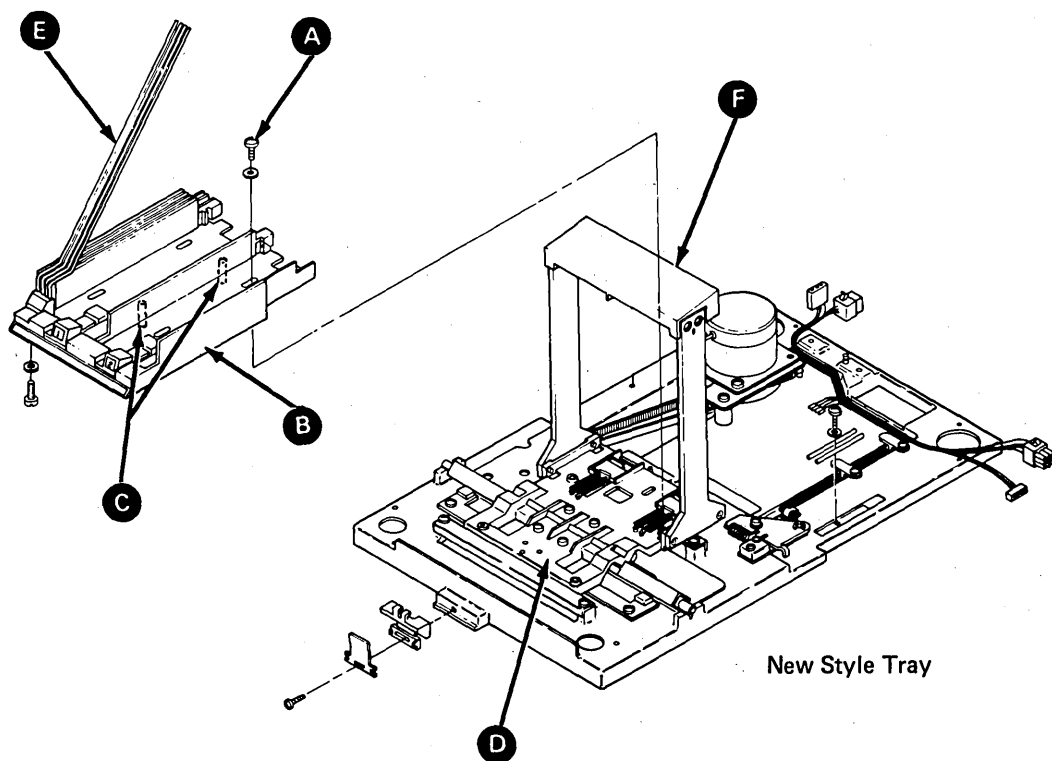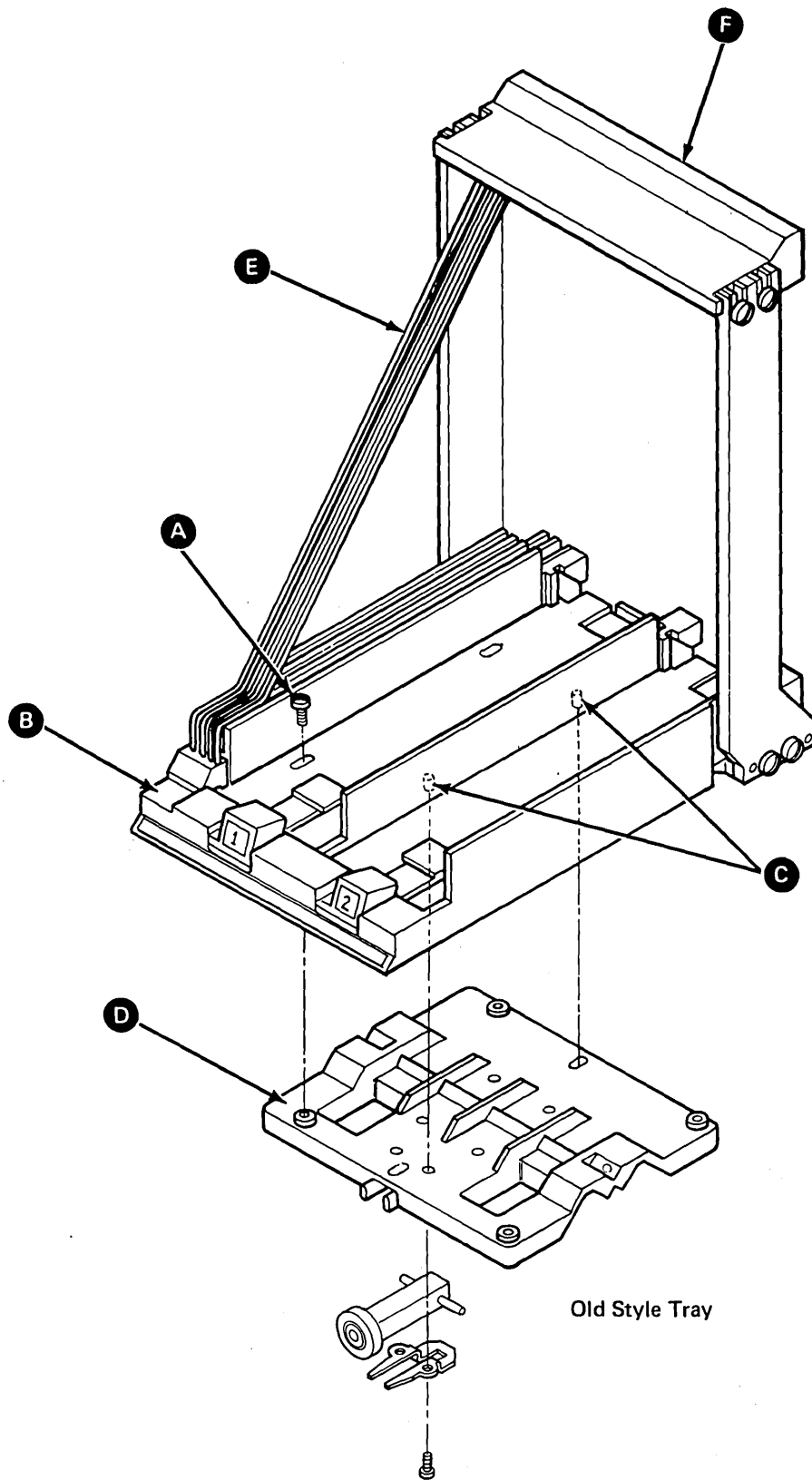
27-305 CARRIAGE BED TO DISKETTE DRIVE BEZEL ADJUSTMENT

1. Place the 72MD unit in the service position (see paragraph 27-205).

2. Place I/O slot 1 at the center of the drive bezel.

3. Loosen the four carriage bed screws **B** and slide the carriage bed **D** away from the bezel **E**.

4. Install the adjusting tool **A** (part 2462583 for old style picker, part 2462612 for new style picker) into I/O slot 1 with the second adjusting surface **C** of the tool touching the carriage bed **D**.

5. Slowly move the bed **D** toward the bezel **E** until the other end **F** of the tool **A** touches the drive bezel **E**.

6. Tighten the four carriage bed screws **B**.

7. Return the 72MD unit from the service position (see paragraph 27-205).

27-310 CARRIAGE BED TO DISKETTE DRIVE BEZEL SERVICE CHECK

1. Place the 72MD unit in the service position (see paragraph 27-205).

2. Place I/O slot 1 at the center of the diskette drive bezel.

3. Slowly lower the adjusting tool **A** (part 2462583 for old style picker, part 2462612 for new style picker) into I/O slot 1 so that the second adjusting surface **C** touches the carriage bed **D**.

4. Check that the other end **F** of the tool **A** touches the drive bezel **E**. If it does not, perform the carriage bed to diskette drive bezel adjustment (see paragraph 27-305).
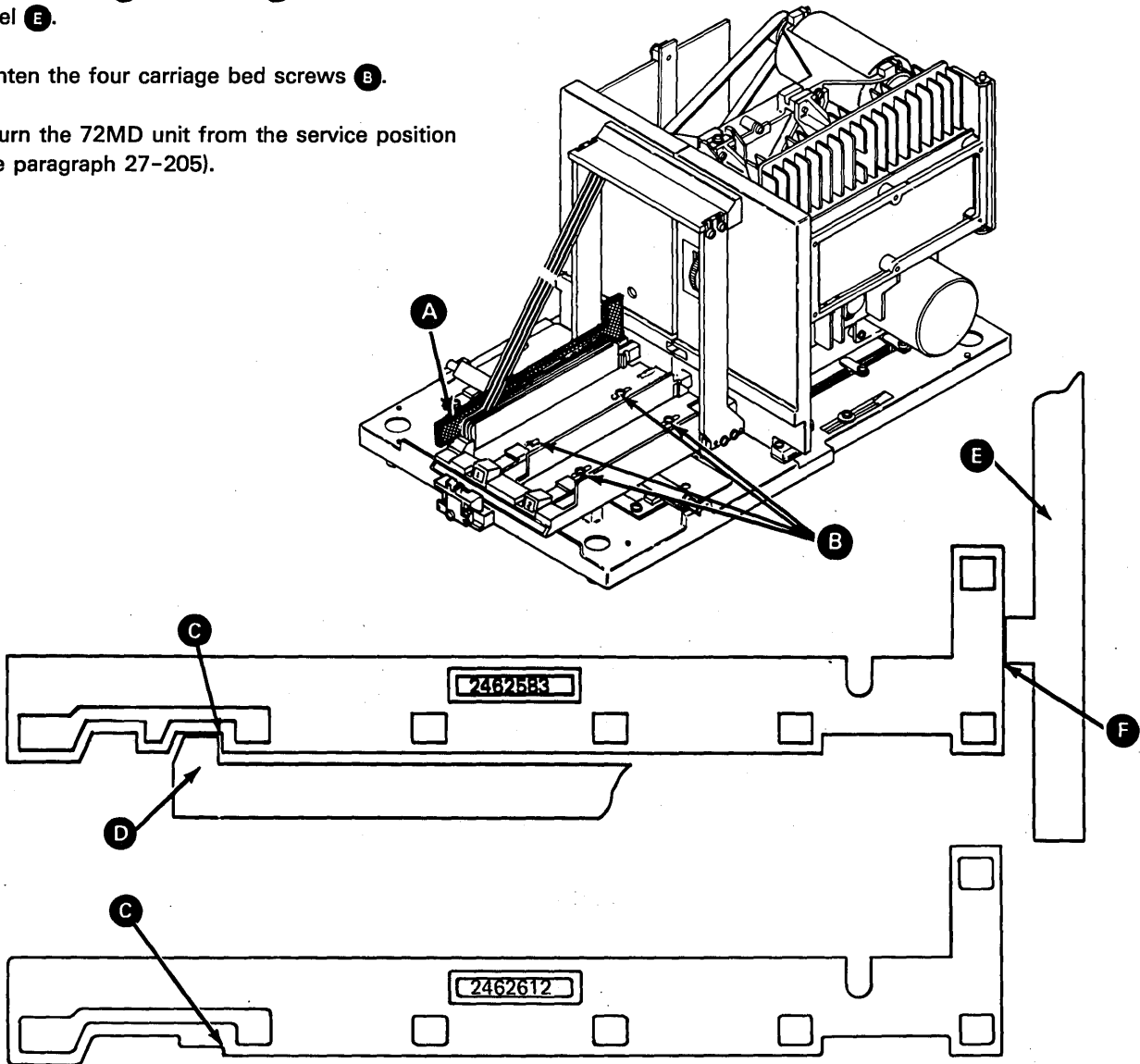
27-315   MAGAZINE PRESSURE ROLL HOUSING REMOVAL AND REPLACEMENT

Removing the Magazine Pressure Roll Housing

1. Place the 72MD in the service position (see paragraph 27-205).

2. Loosen the four screws **F** in the magazine pressure roll housing **E** and remove the housing from the supports **B** and **G**. (Be careful not to damage the four diskette I/O slot guide wires **A**).

Reinstalling the Magazine Pressure Roll Housing

1. Locate the magazine pressure roll housing **E** on the supports **B** and **G**.

2. Insert the four diskette I/O slot guide wires **A** into the carriage bed and the magazine pressure roll housing **E**.

3. Place the adjusting tool **C** (part 2462583 for old style picker, part 2462612 for new style picker) between the magazine pressure roll housing **E** (on the surface of the guide rail **D**) and the carriage bed near the diskette I/O slots and tighten the two screws on the left end of the magazine pressure roll housing **E**. (Ensure that the magazine pressure roll housing is parallel to the carriage bed as you tighten the screws.)

4. Place the adjusting tool **C** between the magazine pressure roll housing **E** and the carriage bed near the support **G** and tighten the two screws on the right end of the magazine pressure roll housing **E**.

5. Return the 72MD unit from the service position (see paragraph 27-205).
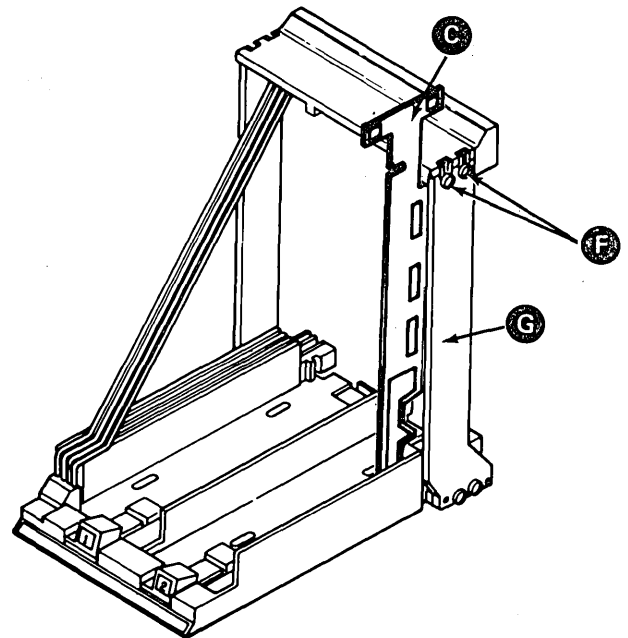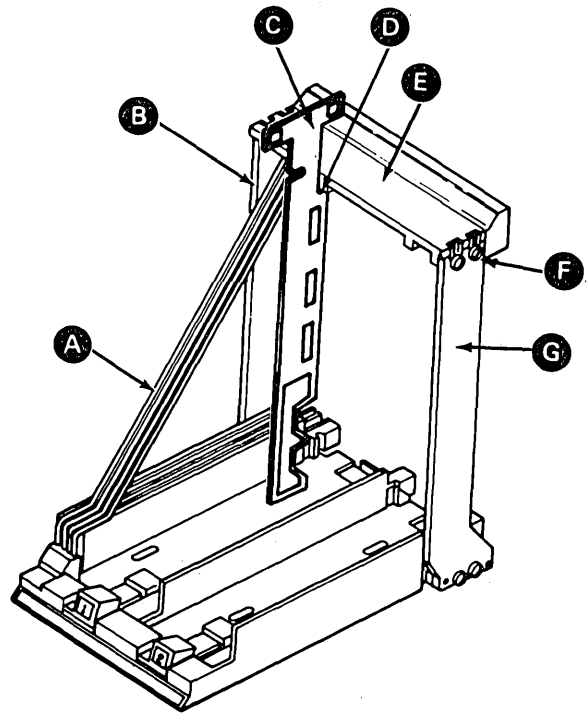
27-400 PICKER/CAM CASTING ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Picker/Cam Casting Assembly

1. Remove power and the 72MD unit (see paragraph 27-200).

   Note: If the two driver board gate shipping bolts **A** are still in place, remove them.

2. Release the gate spring latch **M** and open the driver board gate **J**.

3. Disconnect the picker/cam stepper motor cable **B** from driver board connector J3 .

4. Disconnect the sensor cable connector **F** (located near the top of the picker/cam casting).

5. If the 72MD has the old style picker, disconnect the stripper magnet cable connector **L** (located in the lower base).

6. Move the carriage bed assembly away from the orient position to the left end **K** of its movement.

7. Locate the picker carriage assembly **P** between the diskette in position and the picker rest position.

8. Remove the two picker/cam casting holding screws **N**.

   CAUTION
   Be careful not to hit the head load bail assembly on the cam when you remove the picker/cam casting. This can damage the read/write head carriage assembly.

   _____
   _____
   _____
   _____
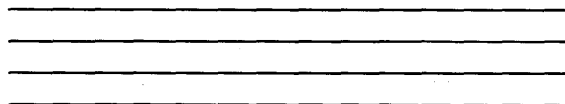
9. Separate the picker/cam casting **H** from the diskette drive casting **E** and lift it out.

Reinstalling the Picker/Cam Casting Assembly

1. Locate the picker carriage assembly **P** between the diskette in position and the picker rest position.

2. Set the lower picker arm rail on its two brackets **C**.

3. Align the picker/cam casting pins **G** with the holes **D** in the diskette drive casting **E**.

4. Reinstall the two holding screws **N**.

5. If the 72MD has the old style picker, connect the stripper cable connector **L**.

6. Connect the sensor cable connector **F**.

7. Connect the stepper motor cable **B** to driver board connector J3.

8. Perform the picker/cam bezel to carriage bed adjustment (see paragraph 27-420).

9. Perform the head load bail assembly service check (see paragraph 27-653).

10. Close the driver board gate until the latch engages.

11. Reinstall the 72MD unit (see paragraph 27-200).

Note: The old style picker is shown here. See Detail for new style picker.
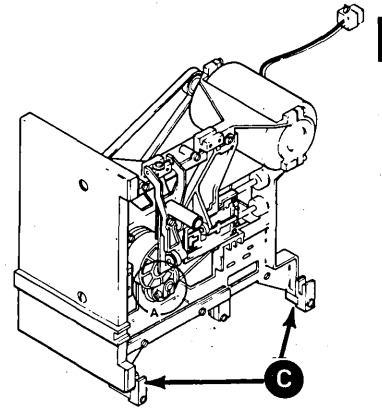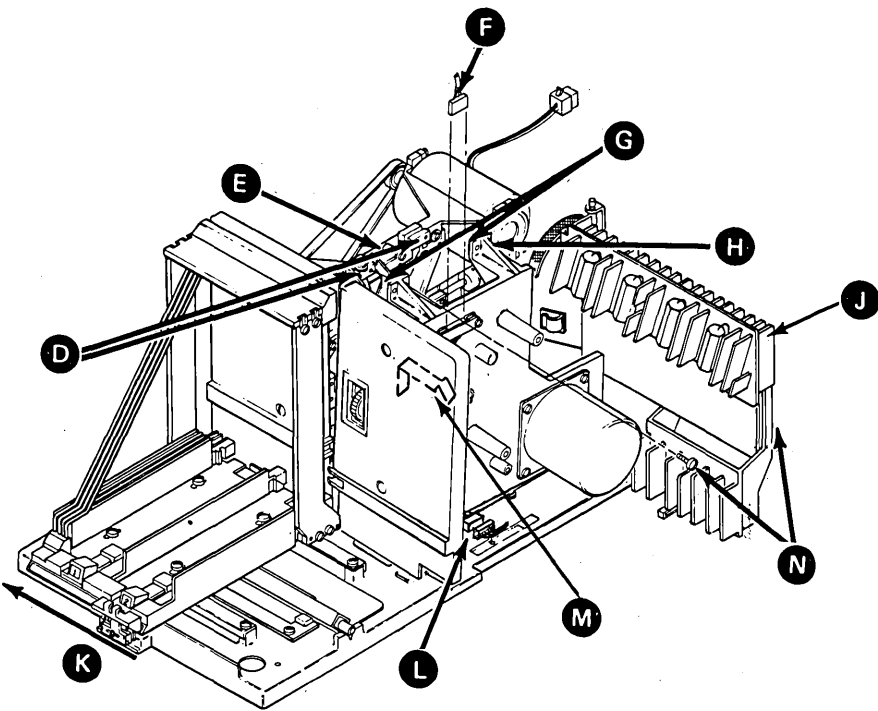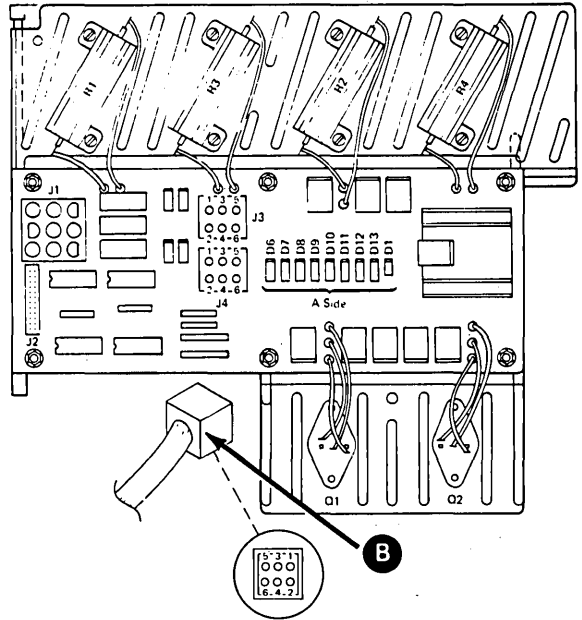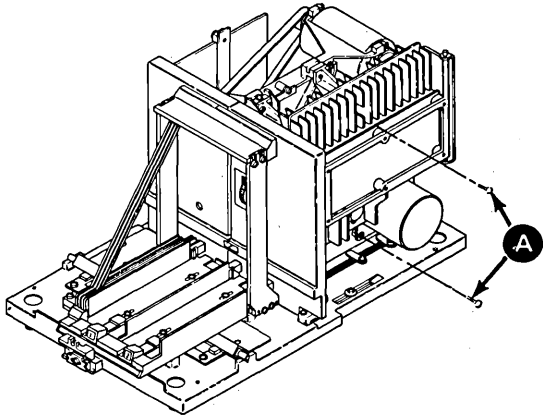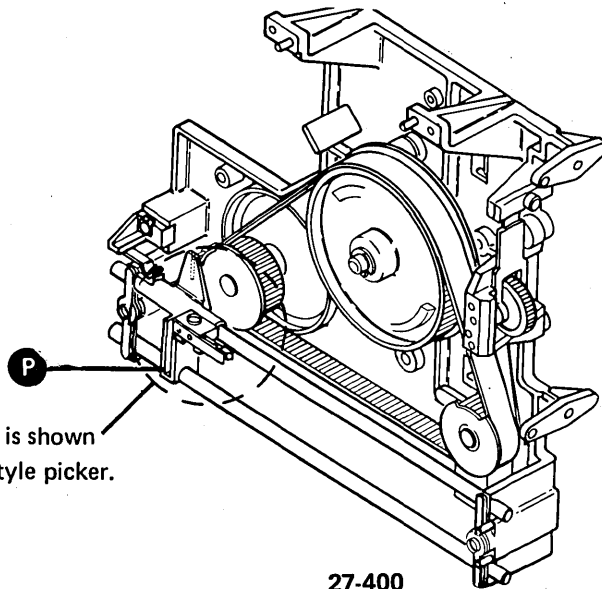
Detail

New Style Picker
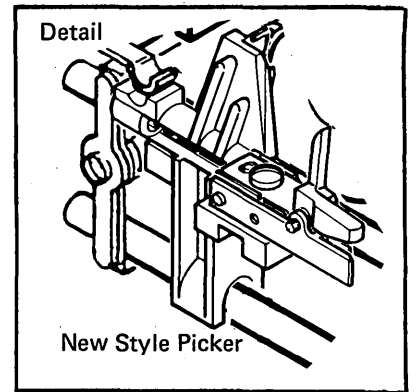
27-405   PICKER/CAM TIMING SERVICE CHECK

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Turn the cam **B** clockwise until it touches the cam stop pin **A**.

3. Check that the belt pin **D** aligns with the timing indicator **C** on the casting.

4. Turn the cam **B** counterclockwise and check that the belt pin **D** aligns with the notch **F** in the drive pulley flange and the notch **G** in the idler pulley flange. If it does not, repeat the picker/cam timing adjustment (see paragraph 27-410).

5. Reinstall the picker/cam casting assembly (see paragraph 27-400).

27-410   PICKER/CAM TIMING ADJUSTMENT

1. Remove the picker/cam assembly (see paragraph 27-400).

2. Loosen the holding screw **L** for the belt idler assembly **G**.

3. Loosen the pivot screw **K**.

4. Press on the belt **H** to move the belt idler pulley **G** to the end of its movement and tighten the screw **K**.

5. Turn the cam **B** clockwise until it touches the cam stop pin **A**.

6. Keep the cam **B** against the cam stop pin **A** and slip the belt **E** until the pin **D** on the belt aligns with the timing indicator **C** on the casting. Place the notches **G** and **F** in the idler assembly pulley and the stepper motor pulley flanges as shown.

7. Loosen the belt idler assembly screw **K** to permit the spring to set the belt tension.

8. Tighten the locking screw **L** on the belt idler assembly.

9. Tighten the pivot screw **K**.

10. Turn the picker/cam and check that the belt pin aligns with both the notch in the stepper drive pulley flange **F**, the notch in the idler pulley flange **G**, and the picker carriage slot **J**.

11. Reinstall the picker/cam assembly (see paragraph 27-400).

Detail
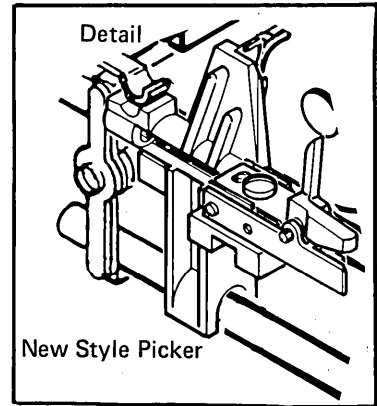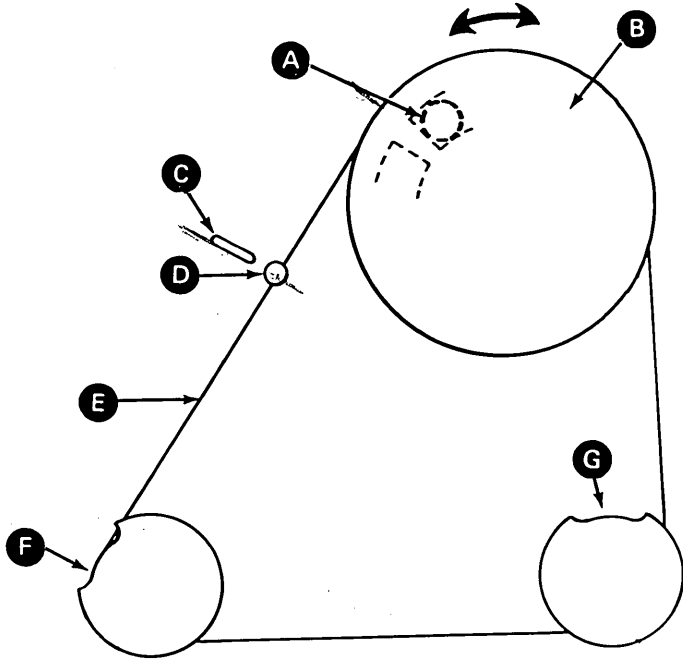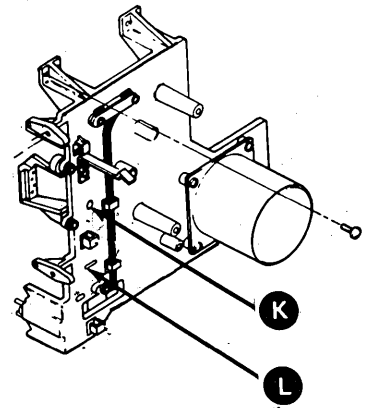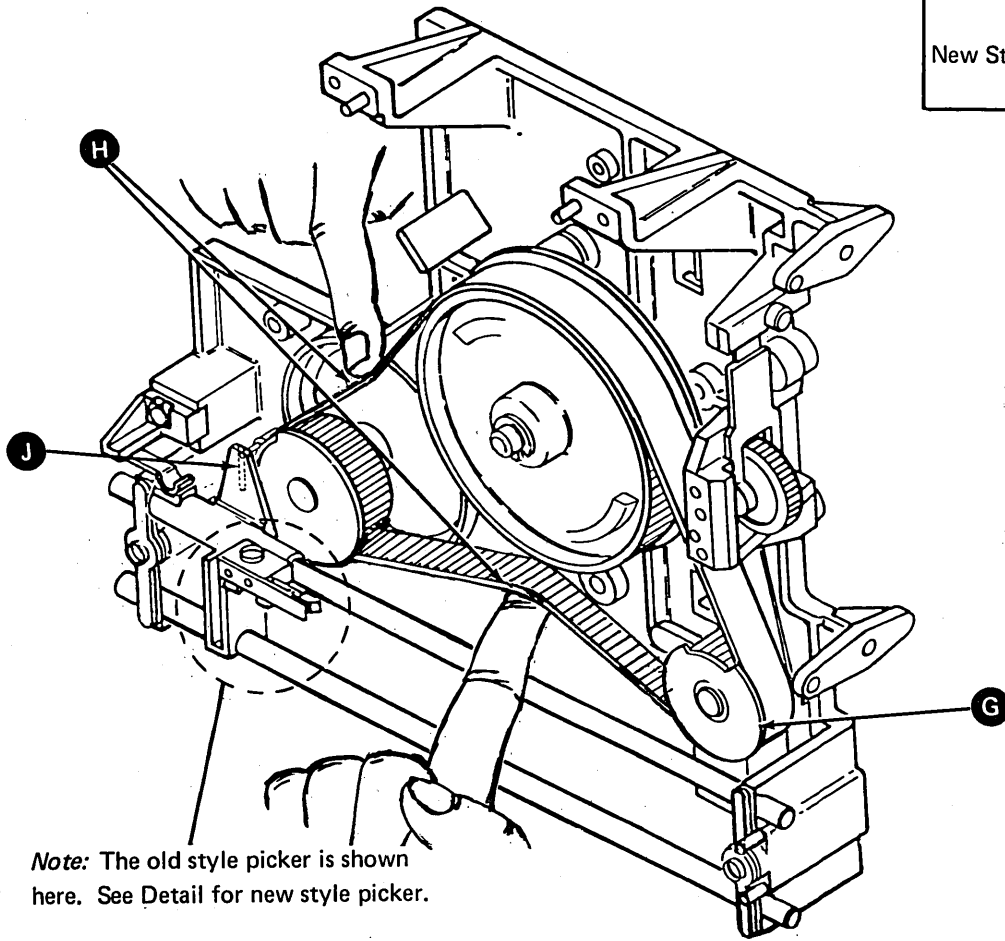
New Style Picker

Note: The old style picker is shown here. See Detail for new style picker.

**27-415   PICKER/CAM BEZEL TO CARRIAGE BED
SERVICE CHECK**

1. Remove power and the 72MD unit (see paragraph
    27-200).

2. Move the carriage bed to the carriage bed orient
    position.

3. Slowly lower the adjusting tool Ⓐ (part 2462583
    for old style picker, part 2462612 for new style
    picker) into I/O slot 3 so that the second adjusting
    surface Ⓖ touches the carriage bed.

4. Check that the other end Ⓗ of the tool touches
    the picker/cam bezel Ⓙ. If it does not, perform
    the picker/cam bezel to carriage bed adjustment
    (see paragraph 27-420).

**27-420   PICKER/CAM BEZEL TO CARRIAGE BED
ADJUSTMENT**

1. Remove power and the 72MD unit (see paragraph
    27-200).

2. Perform the carriage bed to diskette drive bezel
    service check (see paragraph 27-310)

    Note: The carriage bed to drive bezel adjustment
    must be correct before the picker/cam bezel to
    carriage bed adjustment can be made.

3. Move the carriage bed to the carriage bed orient
    position.

4. Loosen the two picker/cam casting screws Ⓑ.

5. Install the adjusting tool Ⓐ (part 2462583 for old
    style picker, part 2462612 for new style picker) in
    I/O slot 3 with the second adjusting surface Ⓖ
    against the carriage bed.

6. Place a slight pressure on the bottom of the
    picker/cam casting toward the carriage bed Ⓒ to
    ensure the bezel Ⓙ touches the tool.

7. Tighten the two picker/cam casting screws Ⓑ.

8. Reinstall the 72MD unit (see paragraph 27-200).

27-425 PICKER/CAM BEZEL REMOVAL AND REPLACEMENT

Removing the Picker/Cam Bezel Assembly

1. Remove the carriage bed assembly (see paragraph 27-300).

2. If the 72MD has the old style picker, remove the stripper assembly cable from the two guides **F** on the picker/cam casting.

3. Remove the two bezel mounting screws **D** and remove the bezel assembly **E**.

Reinstalling the Picker/Cam Bezel Assembly

1. Reinstall the bezel **E** using the two bezel mounting screws **D**.

2. If the 72MD has the old style picker, insert the stripper assembly cable in the two guides **F** on the picker/cam casting.

3. Reinstall the carriage bed assembly (see paragraph 27-300).
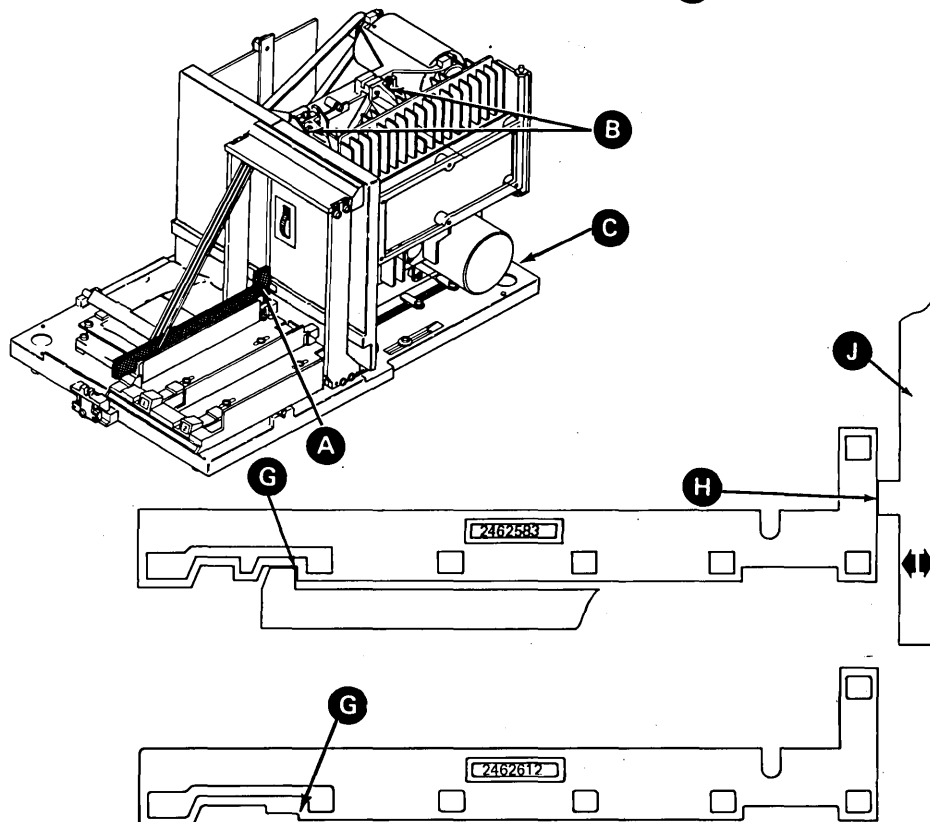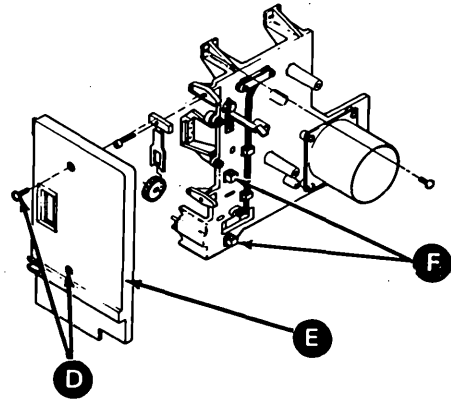
27-430   PICKER/CAM, STEPPER MOTOR, AND BELT REMOVAL AND REPLACEMENT

Removing the Picker/Cam, Stepper Motor, and Belt

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Loosen the screw Ⓙ in the belt idler assembly.

3. Loosen the pivot screw Ⓓ.

4. Press on the belt Ⓐ to move the belt idler pulley Ⓗ to the end of its movement and tighten the screw Ⓙ.

5. Remove the belt Ⓐ.

6. If the cam Ⓖ is being removed, remove the clip Ⓔ from the cam stud Ⓒ and remove the cam Ⓖ. (Note the spacer Ⓕ behind the cam.)

7. If the stepper motor Ⓛ is being removed, remove the four stepper motor mounting screws Ⓚ and remove the stepper motor.

8. Remove the pulley and collar Ⓑ on the motor shaft.

Reinstalling the Picker/Cam Stepper Motor and Belt

1. Reinstall the pulley and collar Ⓑ on the motor shaft.

2. Reinstall the picker/cam stepper motor Ⓛ in position with the leads extending away from the bezel and reinstall the four mounting screws Ⓚ.

3. Reinstall the cam Ⓖ on its stud Ⓒ and attach the clip Ⓔ. (Ensure that the spacer Ⓕ is installed first.)

4. Reinstall the picker/cam drive belt Ⓐ.

5. Perform the picker/cam timing adjustment, starting at step 5 (see paragraph 27-410).

Note: The old style picker is shown
here. See Detail for new style picker.

Detail

New Style Picker

27
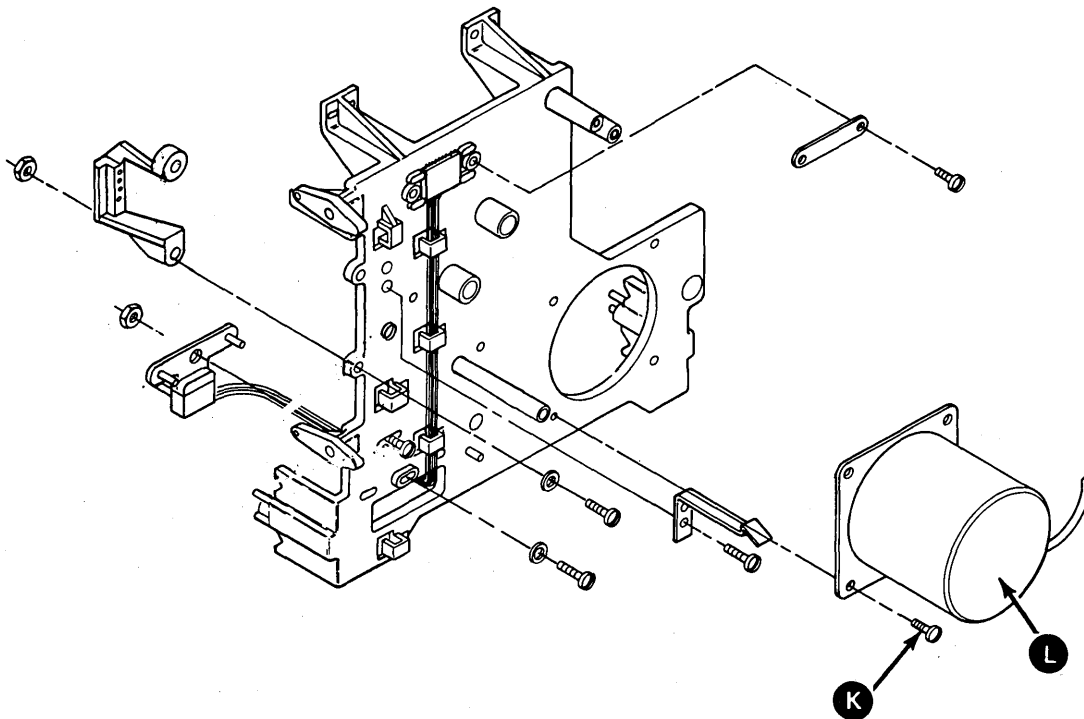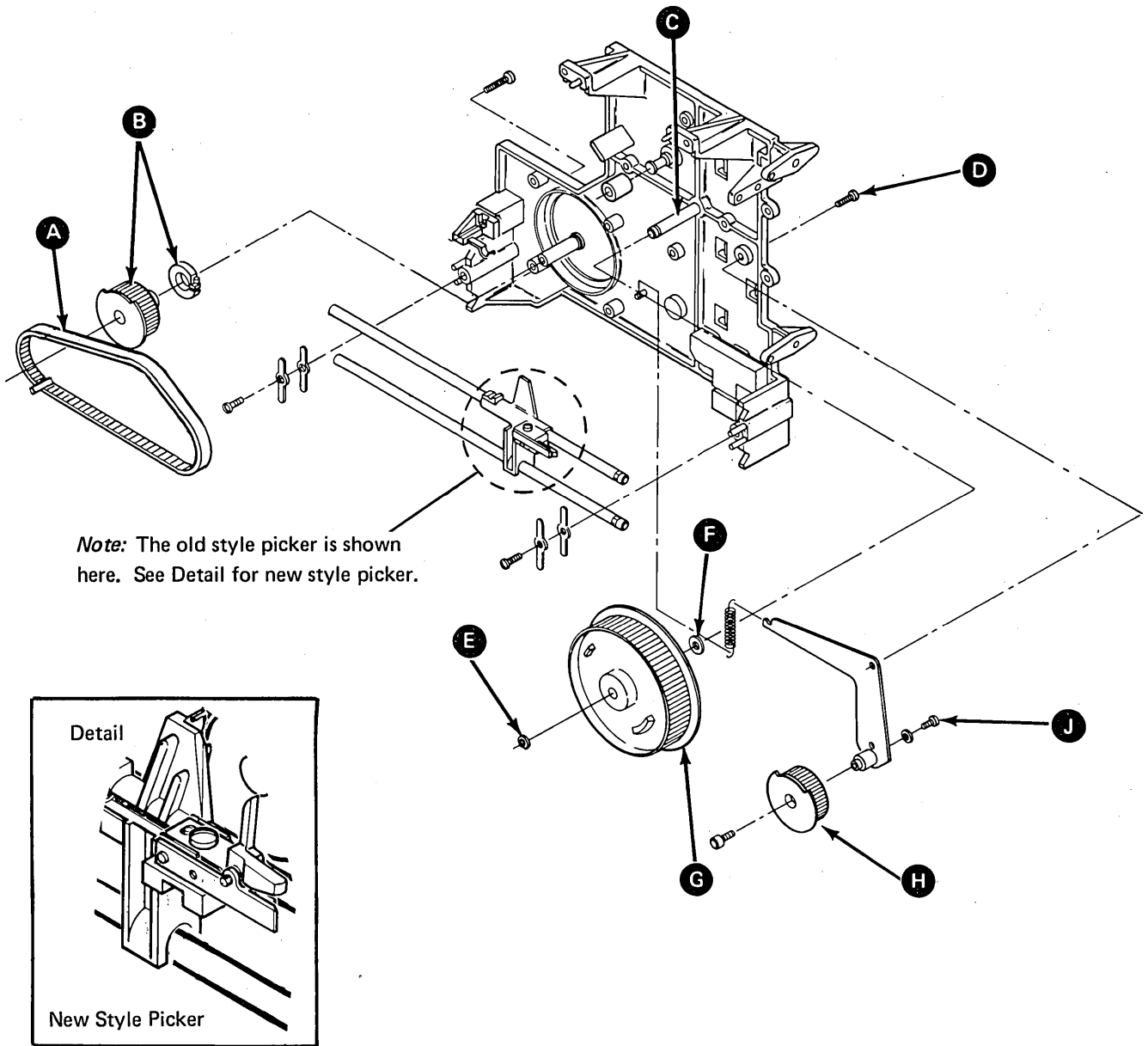
27-435 PICKER CARRIAGE ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Picker Carriage Assembly

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the picker carriage assembly rail holding straps **D**.

3. Remove the rails **A** and the picker carriage assembly **E**.

4. Slide the picker carriage off the rails.

Reinstalling the Picker Carriage Assembly

1. Reinstall the picker carriage **E** on the rails **A**.

2. Place the rails **A** on the casting with the ground ends **F** nearest to the picker/cam bezel and reinstall the holding straps **D**.

3. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

4. Perform the picker finger assembly adjustment (see paragraph 27-455).

5. Perform the picker rest adjustment (see paragraph 27-470).

6. Reinstall the 72MD unit (see paragraph 27-200).

27-440 PICKER CARRIAGE DETENT SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Align the belt pin **H** with the timing mark **G** on the casting.

3. Move the picker carriage assembly **M** to where the lobe on the detent spring **K** touches the bottom of the dwell **L** on the picker carriage.

4. Turn the picker/cam **B** to advance the belt pin **H** toward the picker carriage.

5. Check that the pin enters the center of the slot **J** in the picker carriage. If it does not, perform the picker carriage detent adjustment (see paragraph 27-445).

6. Reinstall the 72MD unit (see paragraph 27-200).

Note: The old style picker is shown here. See Detail for new style picke[r]

27

Detail

New Style Picker

Note: The old style picker is shown here. See Detail for new style picker.
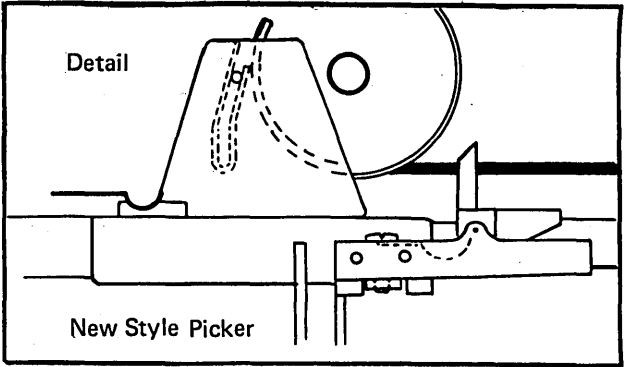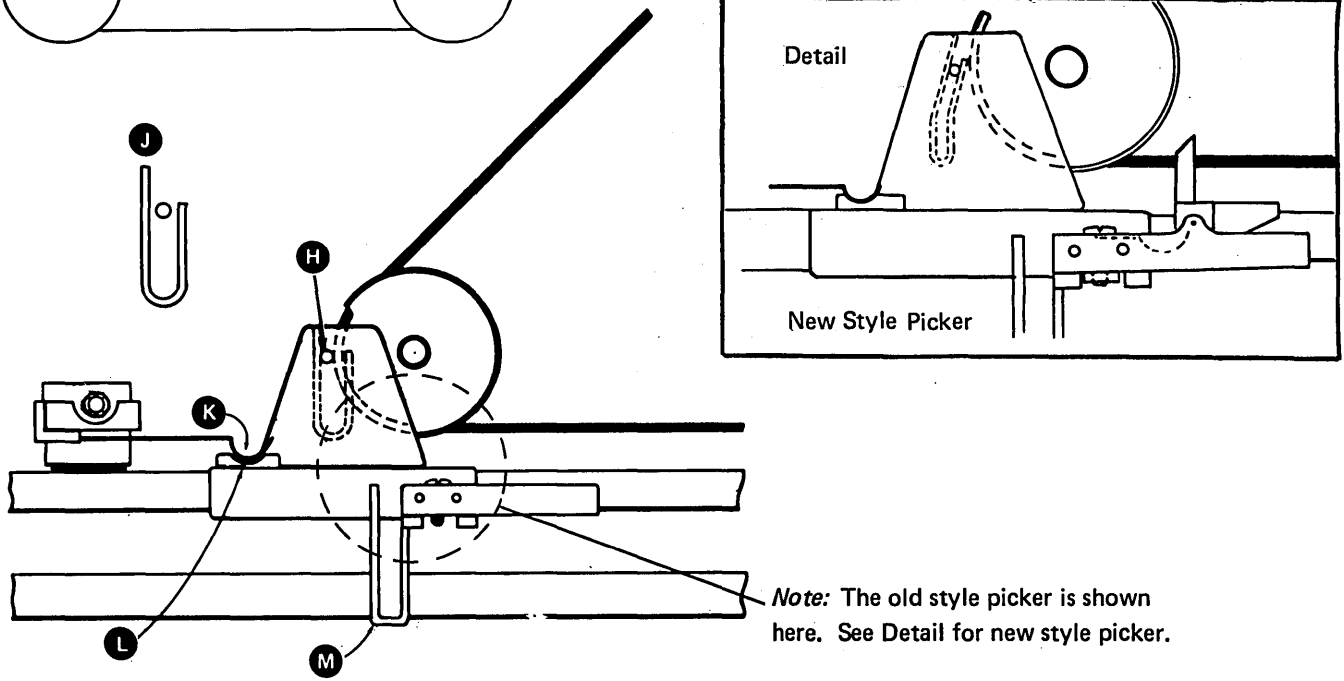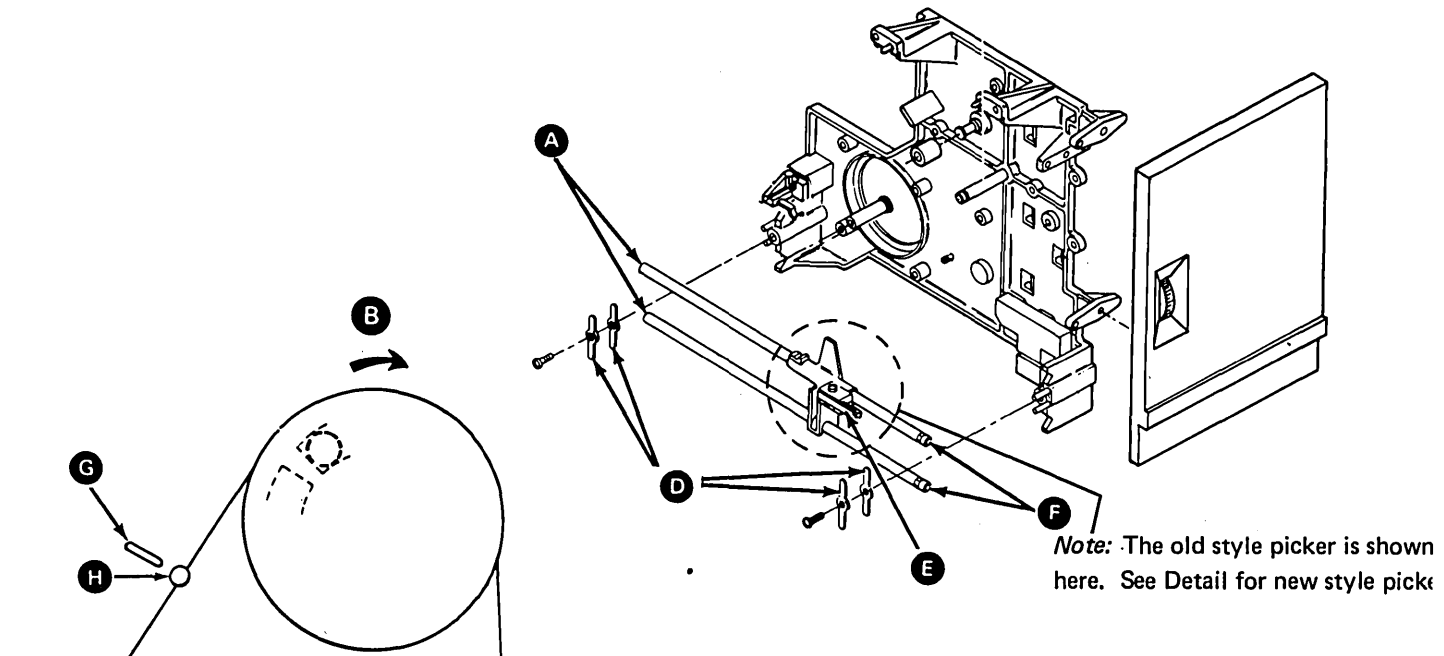
27-445   PICKER CARRIAGE DETENT ADJUSTMENT

1. Remove power and the 72MD unit (see paragraph 27-200).

2. With the belt pin **H** engaged in its slot **J** in the picker carriage **M**, turn the picker/cam **A** clockwise until the picker carriage stops moving. (The belt pin should still be touching the rear surface of the slot.)

3. Carefully move the picker carriage to where the belt pin is centered inside the slot **J**.

4. Loosen the screw **C** in the detent **B** and locate the detent assembly to where the lobe on the detent spring **K** touches the bottom of the dwell **L** on the picker carriage.

5. Tighten the screw **C**.

6. Reinstall the 72MD unit (see paragraph 27-200).

27-450   PICKER CARRIAGE DETENT REMOVAL AND REPLACEMENT

Removing the Picker Carriage Detent

1. Remove power and the 72MD unit (paragraph 27-200).

2. Remove the fastening screw and nut **C** from the detent assembly **B**.

3. Remove the detent assembly **B**.

Reinstalling the Picker Carriage Detent

1. Place the detent **B** in position on the picker/cam casting.

2. Reinstall the fastening screw and nut **C** (do not tighten).

3. Perform the picker carriage detent adjustment (see paragraph 27-445).

4. Reinstall the 72MD unit (see paragraph 27-200).

Detail
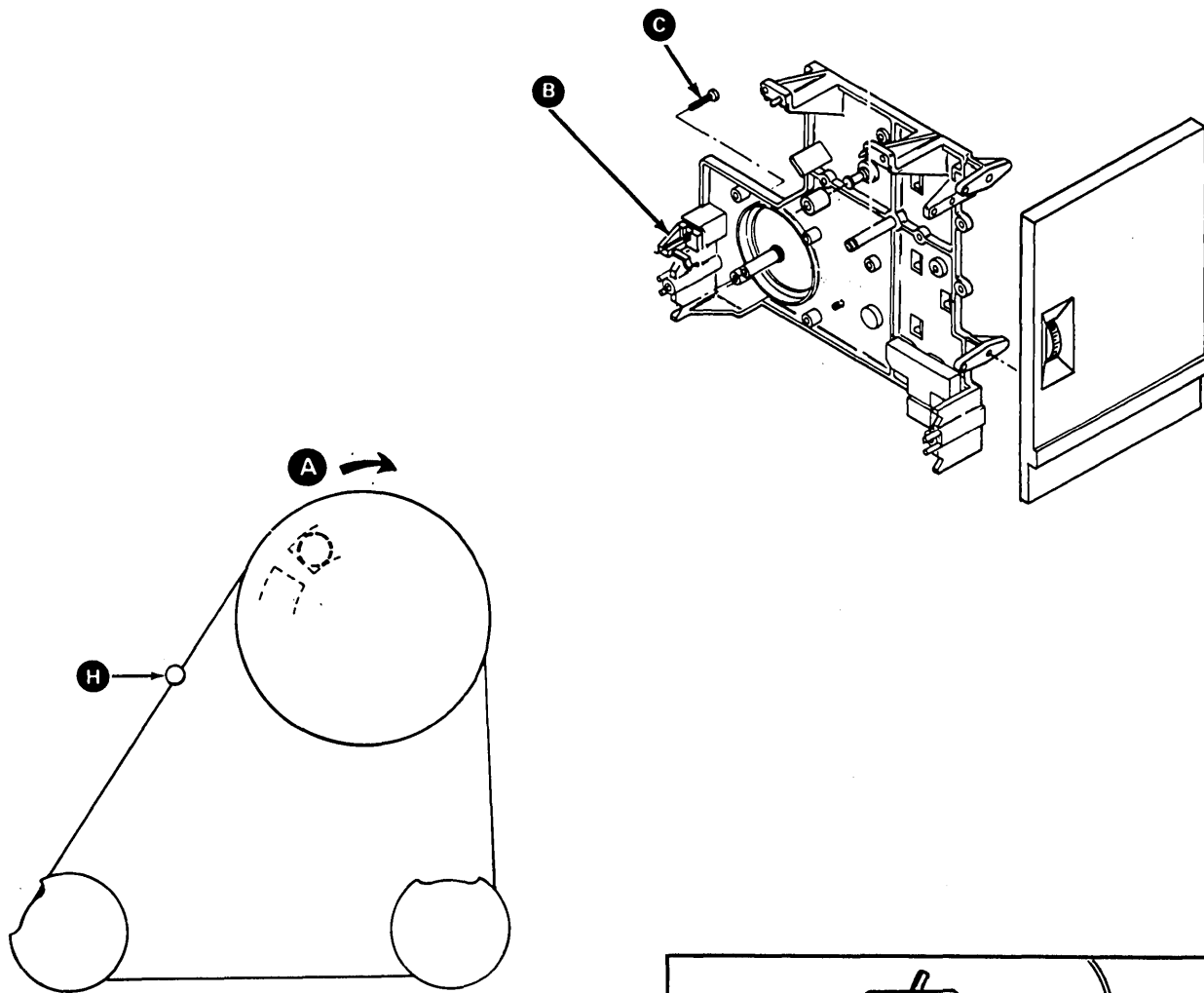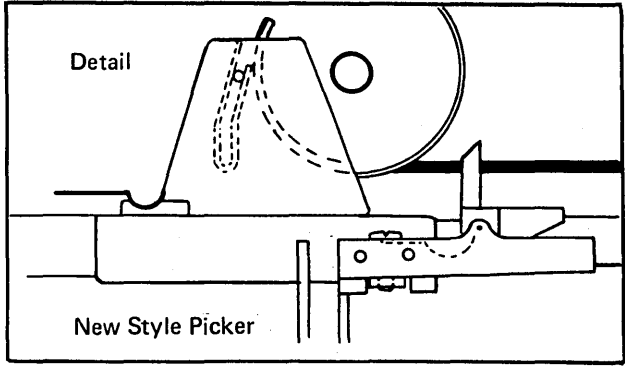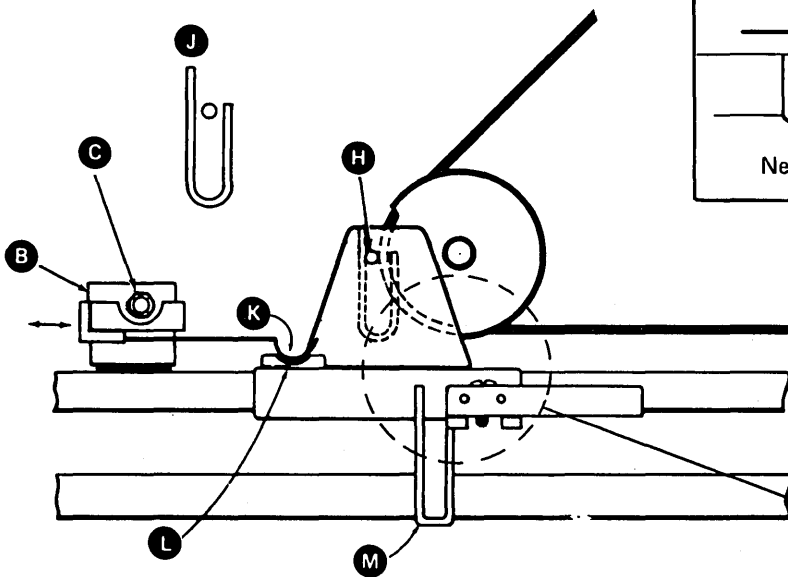
New Style Picker

Note: The old style picker is shown here. See Detail for new style picker.

27-453   PICKER FINGER SERVICE CHECK

Note: The Carriage Bed to Diskette Drive Bezel
Adjustment (27-305), Picker Extend Adjustment
(27-485), and Picker Finger Adjustment (27-455) must
be correct before this service check can be made.

1.   Disconnect the DC cable (J1) from the driver
      board.

2.   Place the carriage bed so that slot 2 (approximate)
      of magazine 2 is aligned with the drive station
      diskette guide.

3.   Place the picker carriage assembly so that the
      picker finger assembly is completely extended.

4.   Place a 1.0 millimeter (0.040 inch) gauge between
      the picker fingers. Measure the force needed to
      make the gauge move or fall out of position (use a
      gram gauge [Part 450459] with a X10 blade).

      If the gauge will not remain in position or if the
      force needed is less than 100 grams or more than
      400 grams, replace the picker spring finger.

5.   Connect the DC cable (J1) to the driver board.

If the machine still fails to pick diskettes, check that the
I/O slot guide wires are not bent and that the diskettes
are not damaged. To check for damaged diskettes, do
the following:

1.   Place a failing diskette in the I/O slot that fails the
      most.

2.   Use the gram gauge to measure the force needed
      to move the diskette out of the slot. If more than
      60 grams are needed, the diskette is damaged.

44   27-453

DC
Cable

A Side

100-400
grams

GRAMS

.040

Less than or equal to 60 grams

27
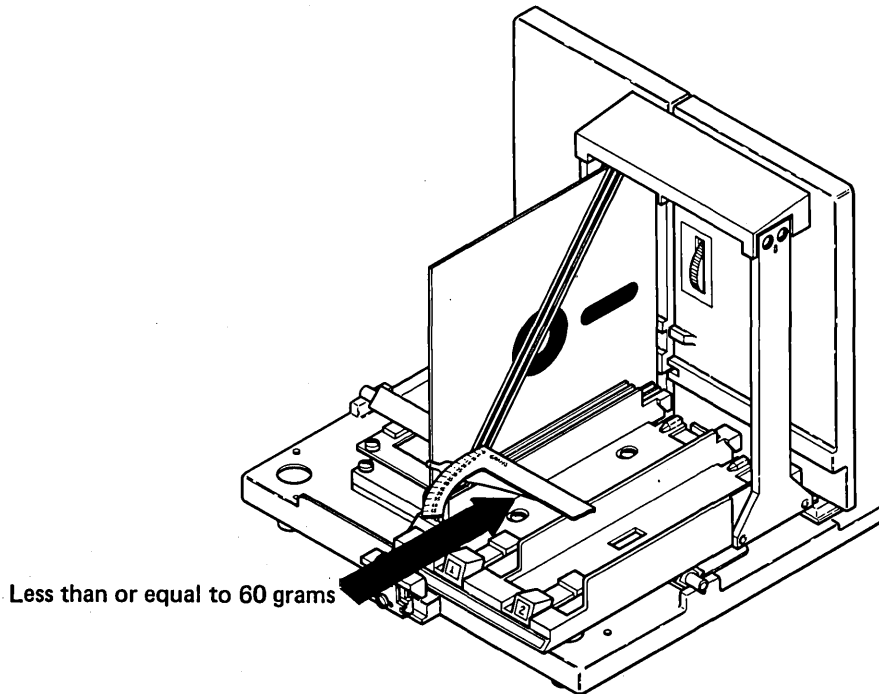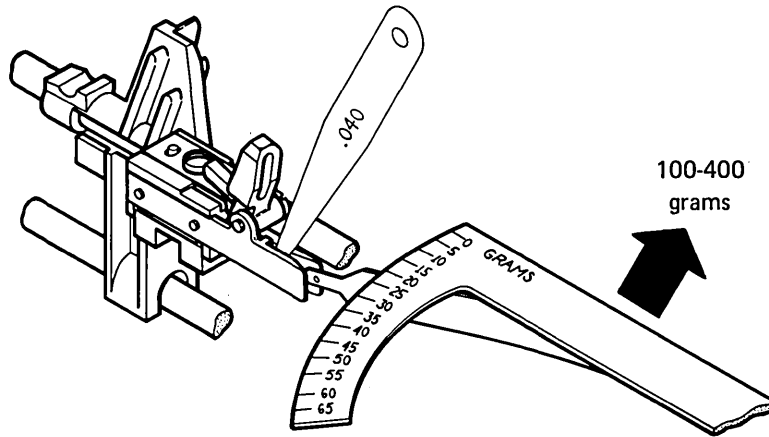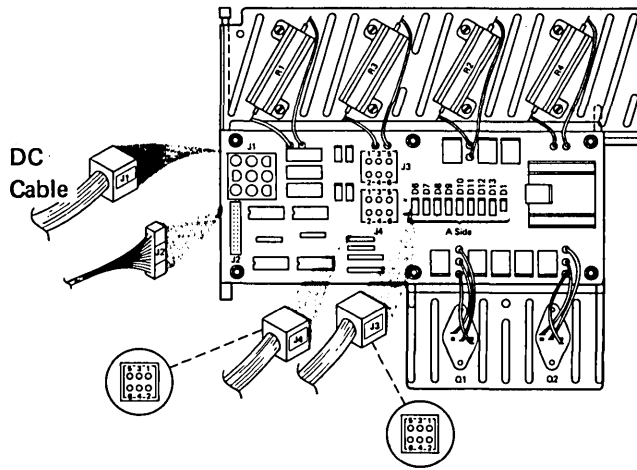
27-455   PICKER FINGER ADJUSTMENT

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Place the carriage bed so that magazine 1 position 5 aligns with the diskette guide.

3. Place the picker assembly so that the front tips of the picker fingers are even with the front guide surfaces of the bezels.

4. Push the collet assembly until it engages the hub. (This will permit you to access the picker finger mounting screw.)

5. Loosen the picker finger mounting screw **A**.

6. If the 72MD has the new style picker, turn the diskette ejector **H** up.

7. Pivot the stripper assembly out of the way and install the adjusting tool **D** (part 2462583 for old style picker, part 2462612 for new style picker) with one end between the solid finger **E** and the spring finger **C** of the picker and against the picker diskette stop **B**.

8. Slide the tool approximately 13 millimeters (0.512 inch) into the drive (be careful to maintain the position of the tool and the picker finger from step 6).

9. Carefully put downward pressure to the top of the tool. (This will align the tool and the angle of the picker arms to the diskette guide.)

10. Tighten the picker mounting screw **A** and remove the tool.

11. Perform the picker extend service check (see paragraph 27-480).

12. Reinstall the 72MD unit (see paragraph 27-200).
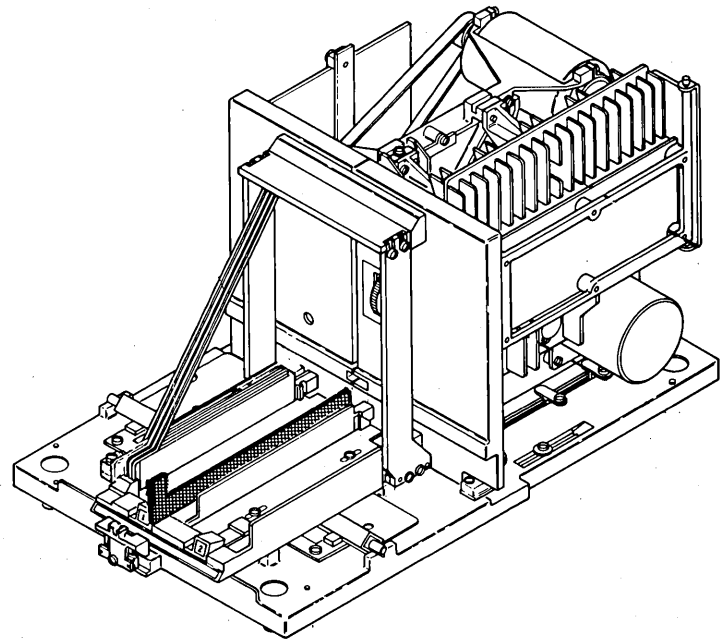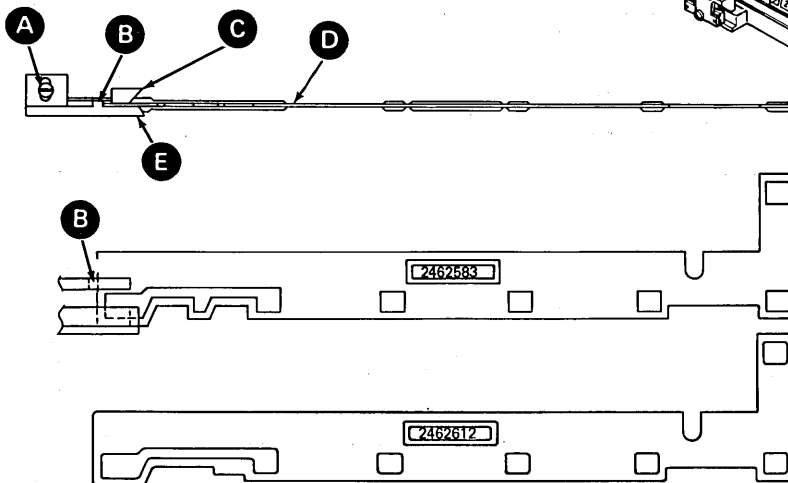
27-460   PICKER FINGER REMOVAL AND REPLACEMENT

Machines with Old Style Picker

Removing the Picker Finger

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the picker finger assembly mounting screw **A** and nut **F** and the picker finger assembly **G**.

Reinstalling the Picker Finger

1. Reinstall the picker finger assembly **G** on the picker carriage and fasten it with the mounting screw **A** and nut **F**. (Do not tighten.)

2. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

3. Perform the picker finger assembly adjustment (see paragraph 27-455).
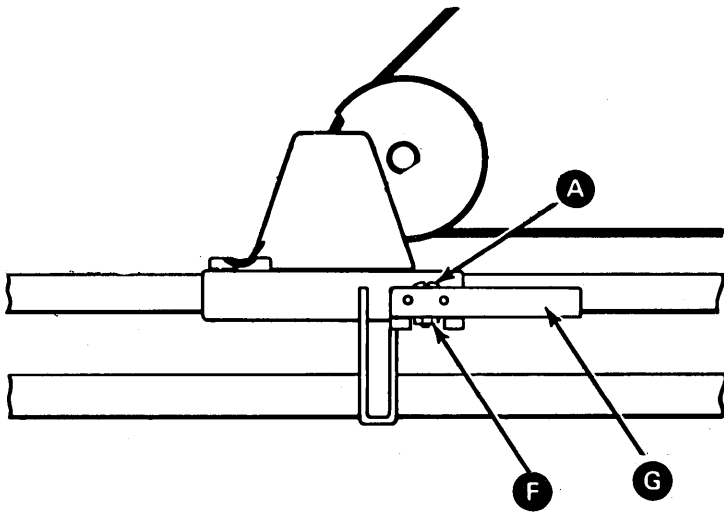
Machines with New Style Picker

Removing the Picker Finger

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the picker finger assembly mounting screw **A** and nut **F**, then remove the diskette ejector **H**, the ejector detent spring **J**, and the picker finger assembly **G**.

Reinstalling the Picker Finger

1. Reinstall the picker finger assembly **G** on the picker carriage and fasten it with the mounting screw **A** and nut **F**. (Do not tighten.)

2. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

3. Perform the picker finger assembly adjustment (see paragraph 27-455).

27
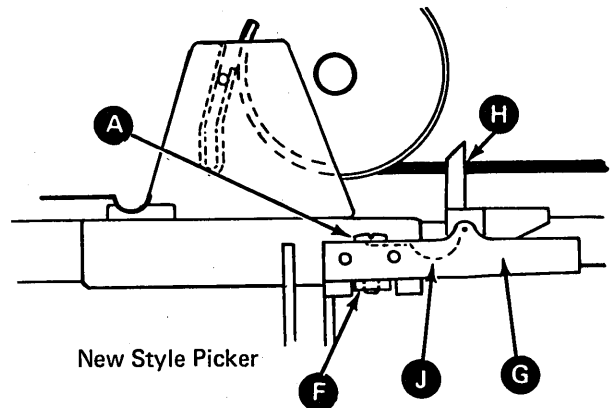
Old Style Picker

New Style Picker

27-465 PICKER REST SENSOR SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Set Power to I (operator panel).

3. Press the Reset switch (CE panel) to orient the carriage bed.

4. Disconnect the picker stepper motor cable **H** from the driver board connector J3.

5. Probe test pin THP-5 **N** (-picker extended).

6. Insert the adjusting tool **J** (part 2462583 for old style picker, part 2462612 for new style picker) into I/O slot 1 and locate the picker stop **M** against one end of the tool and the carriage bed **L** against adjusting surface 1. The output should be minus (-).

7. Turn the picker/cam so that the picker carriage moves away from the carriage bed. The output should become positive when the picker/cam has been turned approximately one tooth. If the output is not positive, perform the picker rest sensor adjustment (see paragraph 27-470).

8. Connect the picker/cam stepper motor cable **H** to driver board connector J3.

9. Reinstall the 72MD unit (paragraph 27-200).

27-470 PICKER REST SENSOR ADJUSTMENT

1. Perform the picker extend service check (see paragraph 27-480).

   Note: The picker extend timing must be corrected before the picker rest sensor can be correctly adjusted.

2. Disconnect the carriage bed stepper motor cable **G** from driver board connector J4.

3. Locate the carriage bed assembly **K** so that I/O slot 1 aligns with the diskette guide in the drive.

4. Disconnect the picker drive stepper motor cable **H** from driver board connector J3.

5. Set Power to I (operator panel).

6. Insert the adjusting tool **J** (part 2462583 for old style picker, part 2462612 for new style picker) into I/O slot 1 and turn the picker by hand to place the picker stop **M** against one end of the tool and the carriage bed **L** against adjusting surface 1.

7. Probe test pin THP-5 **N** (-picker extend).

8. Loosen the sensor mounting screw **F** and adjust the sensor **E** so that the output is minus (-).

9. Tighten the sensor mounting screw **F**. Turn the picker/cam so that the picker carriage moves away from the carriage bed. The output should become positive when the picker/cam has been turned approximately one tooth.

10. Connect the carriage bed stepper motor cable **G** to driver board connector J4 and the picker drive stepper motor cable **H** to driver board connector J3.

11. Reinstall the 72MD unit (see paragraph 27-200).

Read/Write
Head Cable
Connector
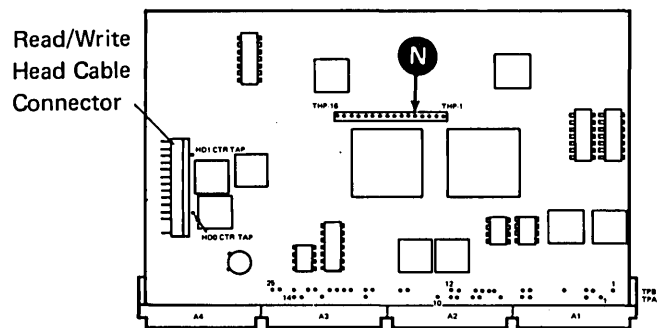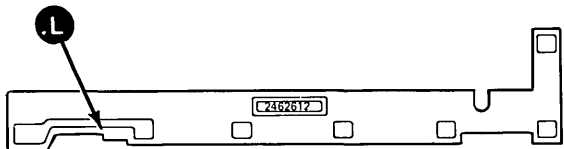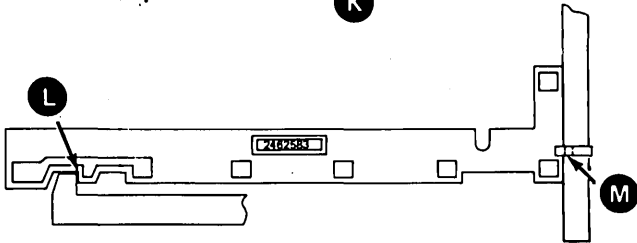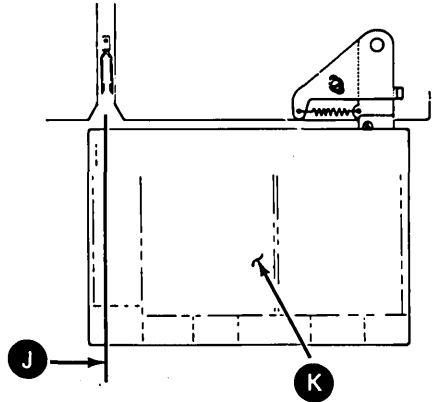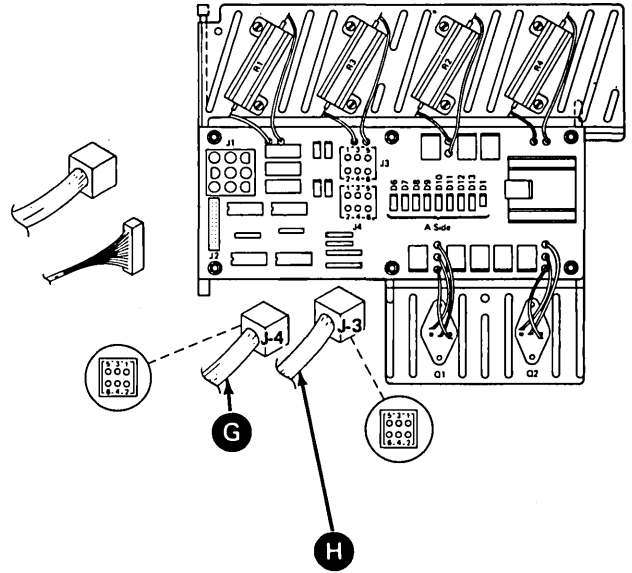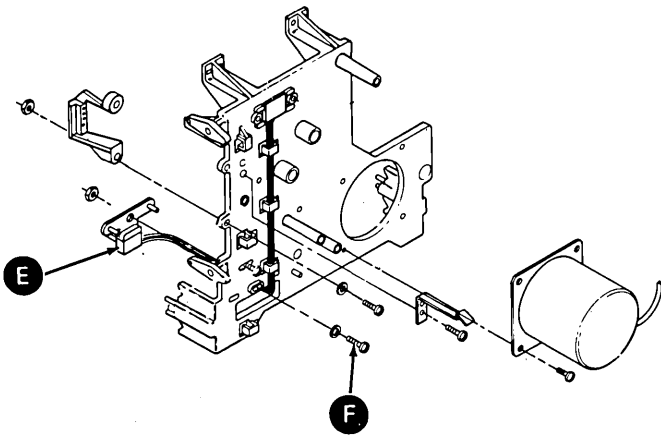
Note: See paragraph 27-820 for control card test pins.

27-475 PICKER REST SENSOR REMOVAL AND REPLACEMENT

Removing the Picker Rest Sensor

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the two screws **D** and the clamp **C** from the sensor cable connector **A**.

3. Remove the picker rest sensor leads from connector A1 by pressing the tabs **B** in the connector with a small screwdriver.

4. Remove the mounting screw **F** from the bottom of the sensor **E** and remove the sensor.

Reinstalling the Picker Rest Sensor

1. Locate the picker rest sensor **E** and fasten it with the screw **F**.

2. Attach the picker rest sensor leads to connector A1.

3. Reinstall the sensor cable connector **A** on the picker/cam casting and fasten it with the clamp **C** and the two mounting screws **D**.

4. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

5. Perform the picker rest sensor adjustment (see paragraph 27-470).

6. Reinstall the 72MD unit (see paragraph 27-200).
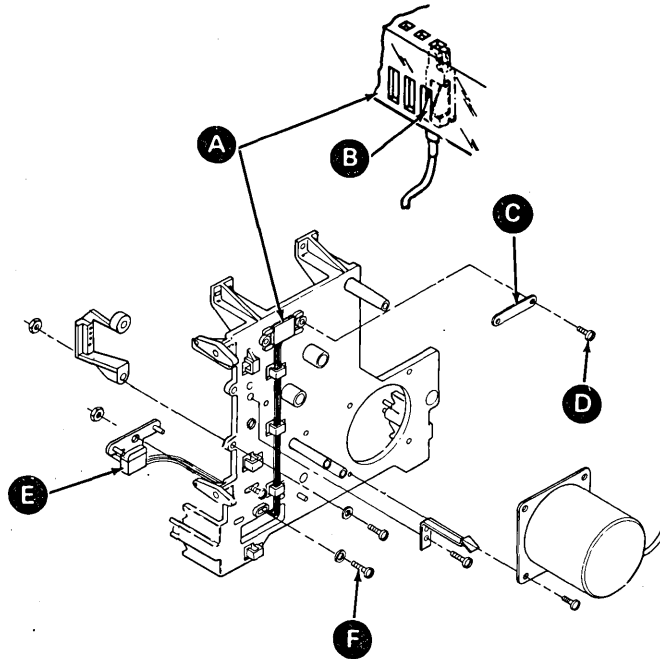
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27-480   PICKER EXTEND SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Set Power to I (operator panel).

3. Disconnect the picker/cam stepper motor cable **(H)** from driver board connector J3 and the carriage bed stepper motor cable **(G)** from driver board connector J4.

4. Align the carriage bed assembly **(K)** I/O slot 1 with the diskette guide.

5. Connect the carriage bed stepper motor cable **(G)** to driver board connector J4.

6. Insert the adjusting tool **(J)** (part 2462583 for old style picker, part 2462612 for new style picker) in I/O slot 1 (use adjusting surface 2 **(A)** and the diskette guide).

7. Turn the picker/cam by hand to place the picker stop **(C)** against the tool.

8. Connect the picker/cam stepper motor cable **(H)** to driver board connector J3.

9. Remove the adjusting tool.

10. Ensure that the stepper motor is held in place.

11. Verify the position of the picker stop **(C)** using the adjusting tool. The tool should touch at **(B)**. If it is not correct, perform the picker extend adjustment (see paragraph 27-485).

27-485   PICKER EXTEND ADJUSTMENT

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Turn the cam until the pin on the belt starts to enter the slot **(L)** on the picker carriage.

3. Loosen the collar **(E)** on the stepper motor pulley and set the gap between the stepper motor pulley flange and the picker carriage **(D)** to 1.68 ± 0.13 millimeters (0.066 ± 0.005 inch).

4. Tighten the collar **(E)**.

5. Place the carriage bed **(K)** to where I/O slot 1 aligns with the drive diskette guide.

6. Disconnect connector plug J3 **(H)**.

7. Set power to I (operator panel).

8. Insert the picker tool **(J)** into I/O slot 1 and place the picker stop **(C)** near the tool. Connect connector plug J3 **(H)**. Loosen the collar **(E)** and carefully turn the pulley until one end of the tool touches the picker stop **(C)** and the other end touches the back of I/O slot 1 **(B)**. (Be careful when turning the pulley that the gap from step 3 is not changed.)

9. Verify the adjustment from step 8 and tighten the collar **(E)**.

10. Remove the tool **(J)**.

11. Check the gap from step 3.

12. Perform the picker rest service check (see paragraph 27-465).

1.68 mm ± 0.13
(0.066 in ± 0.005)

2462612

2462583

A Side

J-4   J-3

Detail

New Style Picker

Note: The old style picker is shown
here. See Detail for new style picker.

Detent
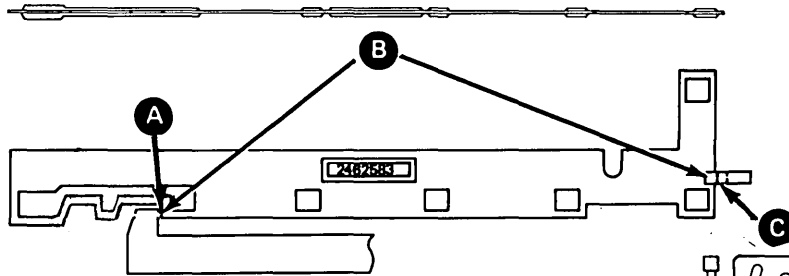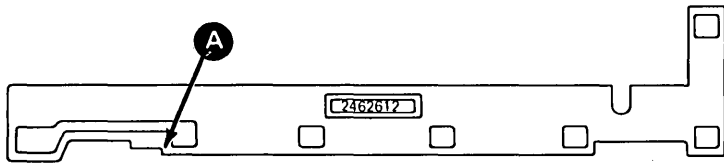
27-485
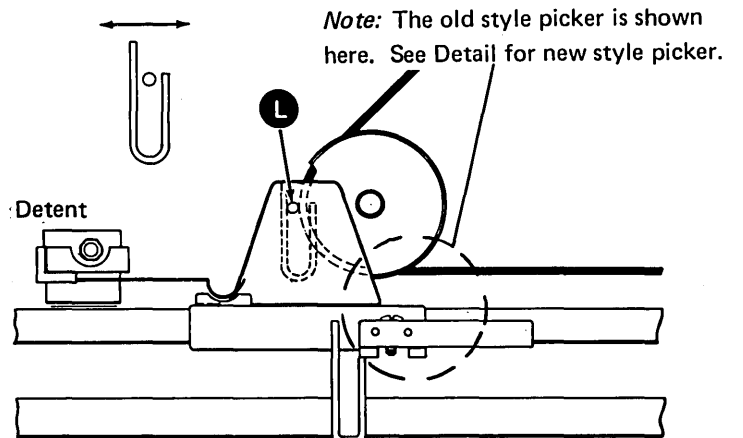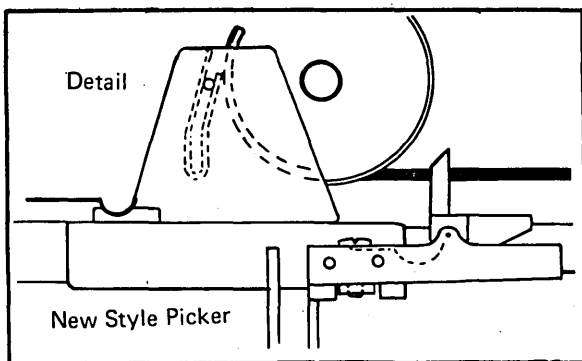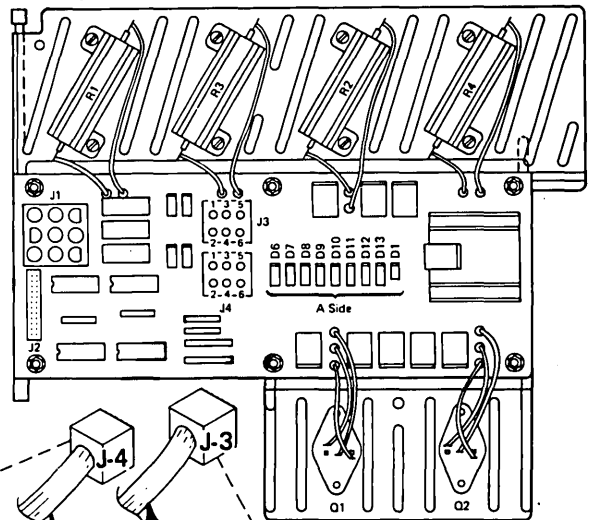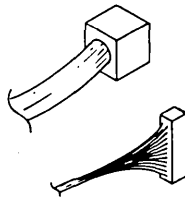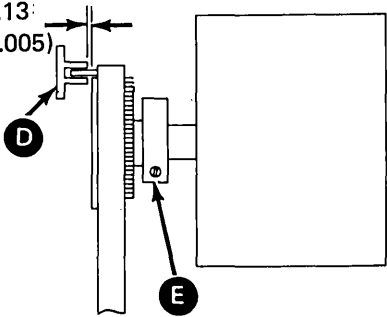
27-490 PICKER/CAM STEPPER MOTOR WINDINGS RESISTANCE SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Disconnect the stepper motor cable **Ⓐ** from driver board connector J3.

3. Use a multimeter to measure the resistance between pins: 2 and 4, 4 and 6, 1 and 3, 3 and 5.

   The resistance should be 3 ohms ± 10%.

4. Reinstall the 72MD unit (see paragraph 27-200).

Stepper Motor Logic

Driver Board

Stepper Motor Operating Voltage

Stepper Motor Detent Voltage

(J2)

+24 V (J1-1)

+5 V (J1-3)

- Picker Motor (M11–D11)

B08

N   N

+ Auto Step 0 (M05–D05)

B09

OR   DR

(J3)

2 Blue/White

4 White

6 Blue

+ Auto Step 1 (M06–D06)

B10

OR   DR

+ Auto Step 2 (M07–D07)

B11

A   DR

1 Red

3 Black

+ Auto Step 3 (M08–D08)

B12

A   DR

5 Red/White

Picker/Cam Motor

+24 V (J1-1)

+5 V (J1-3)

- Bed Motor (M12–D12)

B07

N   N

OR   DR

(J4)

2 Blue/White

4 White

6 Blue

A   DR

OR   DR

1 Red

3 Black

A   DR

5 Red/White

Carriage Bed Motor

27

27-490

72MD Diskette Magazine Drive   55

27-495   JAM REMOVAL WHEEL REMOVAL AND REPLACEMENT

Removing the Jam Removal Wheel

1. Remove the picker/cam bezel assembly (see paragraph 27-425).

2. Remove the mounting screw **A** and the jam removal wheel assembly **B**.

   Note: Be careful not to damage the stripper sensor wires.

Reinstalling the Jam Removal Wheel

1. Reinstall the jam removal wheel **B** using the mounting screw **A**.

2. Reinstall the picker/cam bezel assembly (see paragraph 27-425).

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27
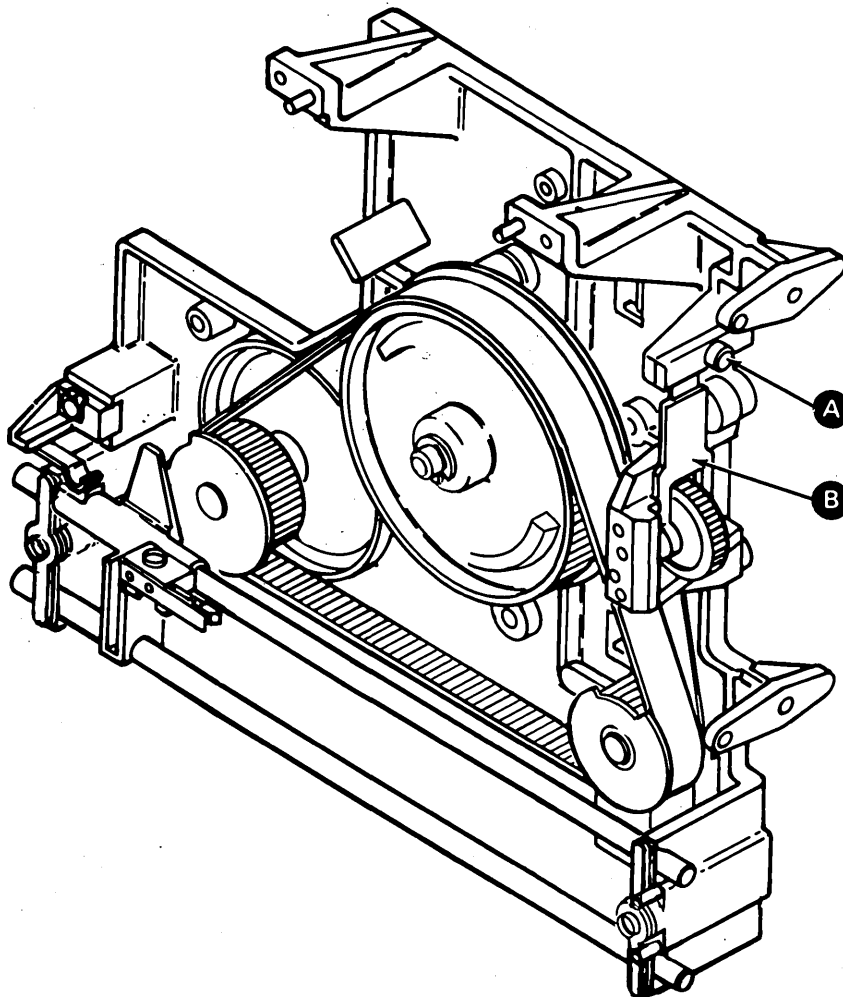
27-500   STRIPPER REMOVAL AND REPLACEMENT

Removing the Stripper

1. Remove the picker/cam bezel assembly (see paragraph 27-425).

2. Remove the two screws **F** from the stripper magnet bracket assembly **E** and remove the assembly.

3. Remove the holding clip **C** from the stripper pivot stud **A**.

4. Lift the stripper **B** from the pivot stud.

Reinstalling the Stripper

1. Place the stripper **B** on the pivot stud **A** and attach the holding clip **C**.

2. Reinstall the stripper magnet bracket assembly **E** using the two mounting screws **F**. (Ensure that the magnet armature tip is in the stripper fork **D**.)

3. Reinstall the picker/cam bezel assembly (see paragraph 27-425). Do not reinstall the 72MD unit at this time.

4. Adjust the stripper magnet and switch assembly (see paragraph 27-520).

5. Reinstall the 72MD unit (see paragraph 27-200).

27-505   STRIPPER MAGNET SERVICE CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3. Set Power to I (operator panel).

4. Activate the magnet by jumpering test point TPB-22 **H** (-window magnet) to THP-1 **G** ground.

5. Check that the stripper foot **B** moves. If it does not move, reinstall the stripper magnet assembly.

6. Check that the stripper foot is aligned ± 0.5 millimeters (0.02 inches) to the picker/cam bezel surface. If it is not, perform the stripper magnet switch adjustment (see paragraph 27-520).

7. Reinstall the safety shield using the four screws.

Read/Write
Head Cable
Connector
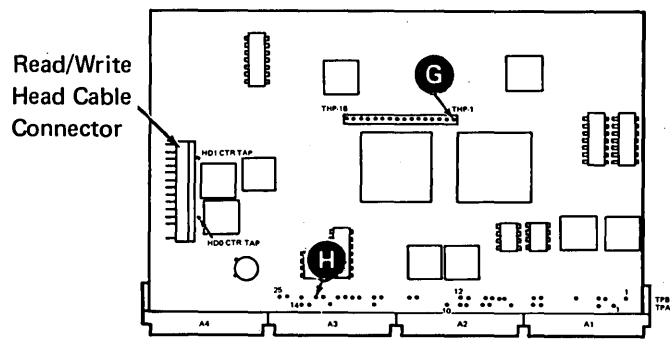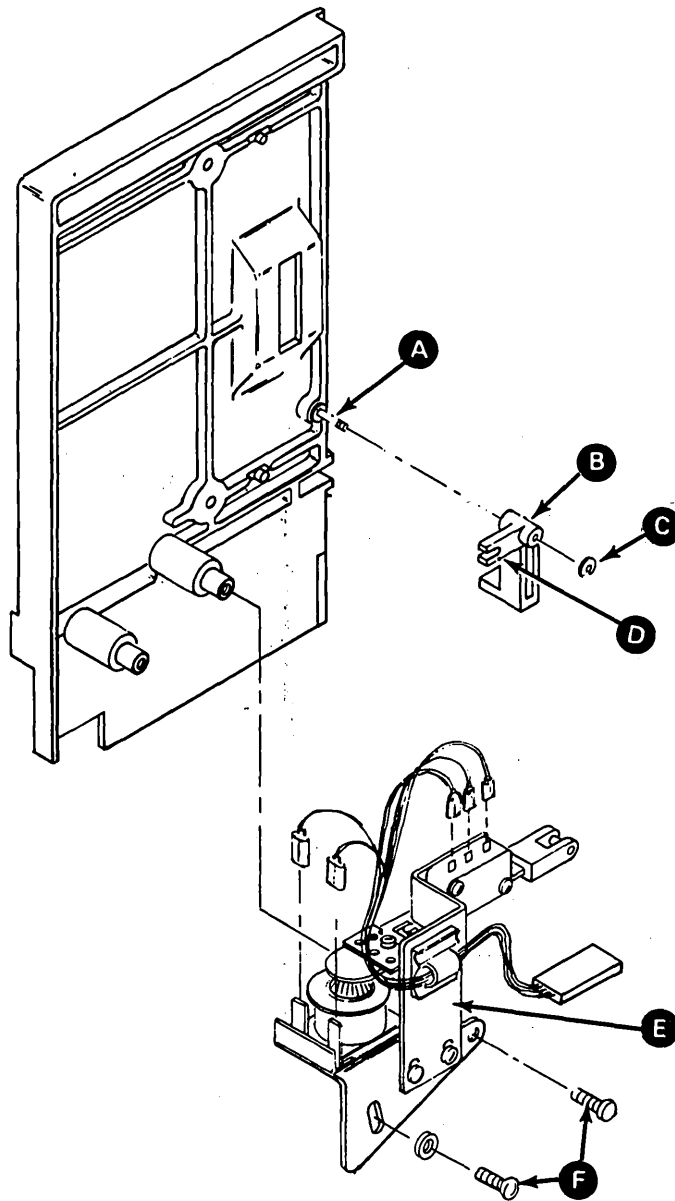
Note: See paragraph 27-820 for control card test pins.

27-510 STRIPPER MAGNET AND SWITCH ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Stripper Magnet and Switch Assembly

1. Remove the picker/cam bezel (see paragraph 27-425).

2. Remove the two screws **F** from the stripper magnet bracket assembly **E** and remove the assembly.

Reinstalling the Stripper Magnet and Switch Assembly

1. Reinstall the stripper magnet bracket assembly **E** using the two mounting screws **F**. (Ensure that the magnet armature tip is in the stripper fork.)

2. Reinstall the picker/cam bezel (see paragraph 27-425). Do not reinstall the 72MD unit at this time.

3. Adjust the stripper magnet and switch assembly (see paragraph 27-520).

27-515 STRIPPER MAGNET SWITCH SERVICE CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3. Set Power to I (operator panel).

4. Press the Reset switch (CE panel) to orient the carriage bed.

5. Insert a diskette **A** into the drive by hand.

6. Probe test point TPB-17 **Q** (-window open).

7. Check that the switch output (-window open) is minus (-) with the stripper **C** held tightly against the diskette.

8. Remove the diskette **A** and check that the output is plus (+).

9. Reinstall the safety shield using the four screws.

Read/Write
Head Cable
Connector
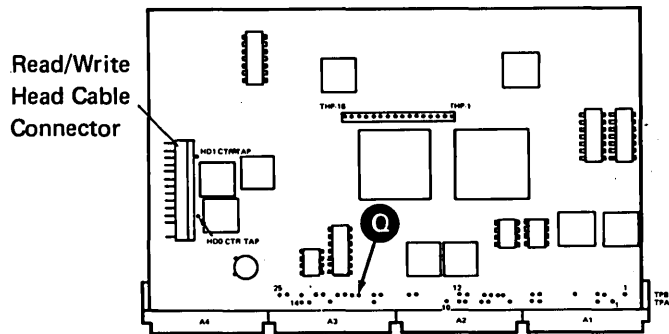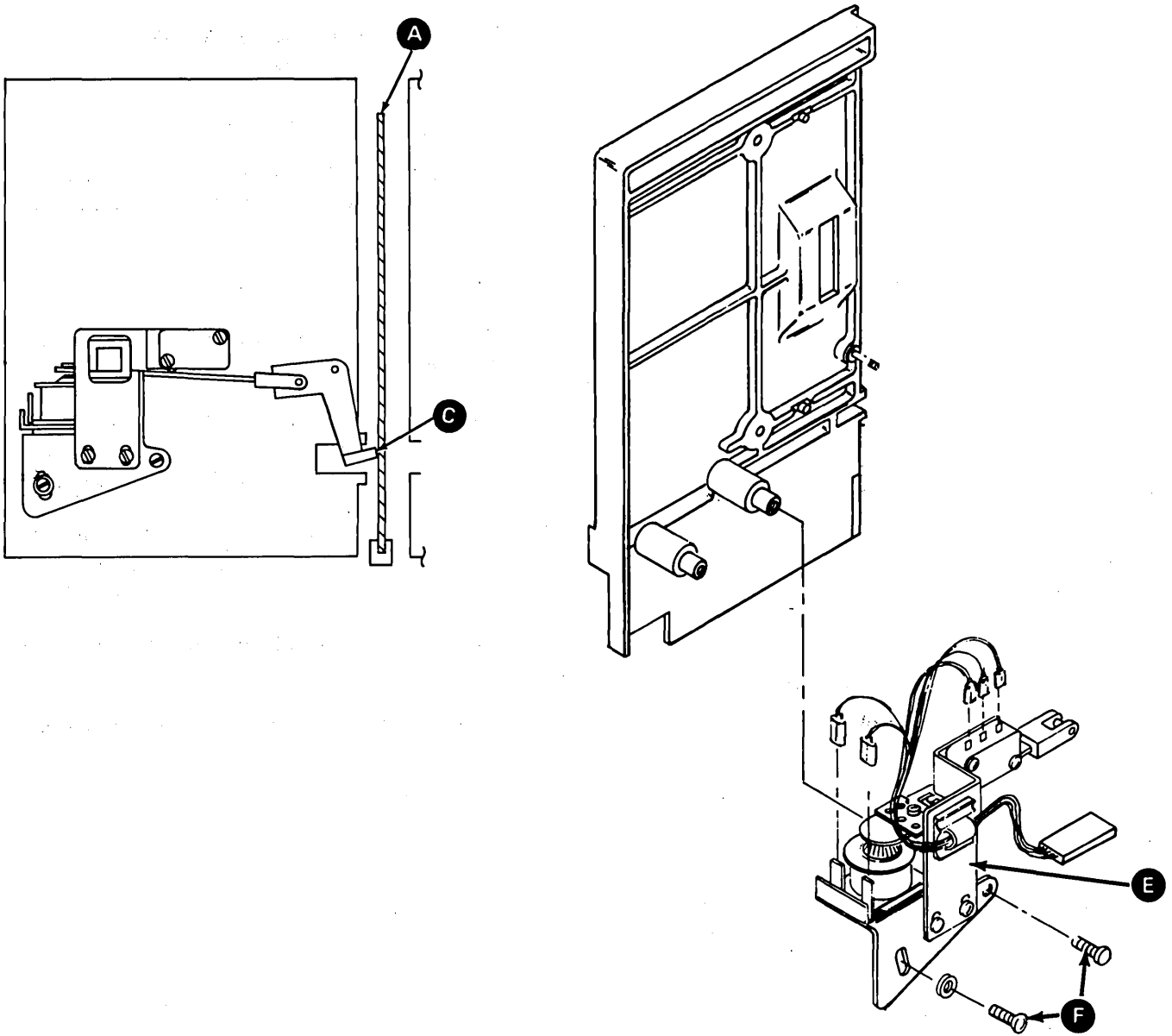
Note: See paragraph 27-820 for control card test pins.

27-520 STRIPPER MAGNET SWITCH ADJUSTMENT

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Set Power to I (operator panel).

3. Activate the magnet by jumpering test point TPB-22 **P** (-window open) tp THP-1 **N** (ground) with both the pivot **H** and the adjusting **G** screws loose.

4. Turn the assembly in the direction shown until the stripper foot **F** is aligned ± 0.5 millimeter (0.020 inches) to the bezel surfaces **J**. Then tighten both of the screws **G** and **H**.

5. Insert a diskette **A** into the drive station by hand.

6. Remove the jumper installed in step 3.

7. Probe test point TPB-17 **Q** (-window open).

8. Loosen the pivot screws **M** in the switch bracket.

9. Adjust the switch **L** so that the output (-window open) goes minus (-) with the stripper **C** against the diskette.

10. Tighten the screws **M**.

11. Test the switch **L** to ensure that it returns to normal (+window open) with the diskette **A** removed.

12. Reinstall the 72MD unit (see paragraph 27-200).

27-525 STRIPPER MAGNET SWITCH REMOVAL AND REPLACEMENT

Removing the Stripper Magnet Switch

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Remove the two switch bracket screws **D**.

3. Remove the leads **K** from the switch.

4. Remove the screws **M** that fasten the switch **L** to the bracket.

Reinstalling the Stripper Magnet Switch

1. Reinstall the switch **L** on the switch bracket and fasten with the two screws **M**.

2. Connect the leads **K** to the switch.

3. Reinstall the switch bracket (do not tighten the screws **D**).

4. Perform the stripper magnet switch adjustment (see paragraph 27-520).

Read/Write
Head Cable
Connector
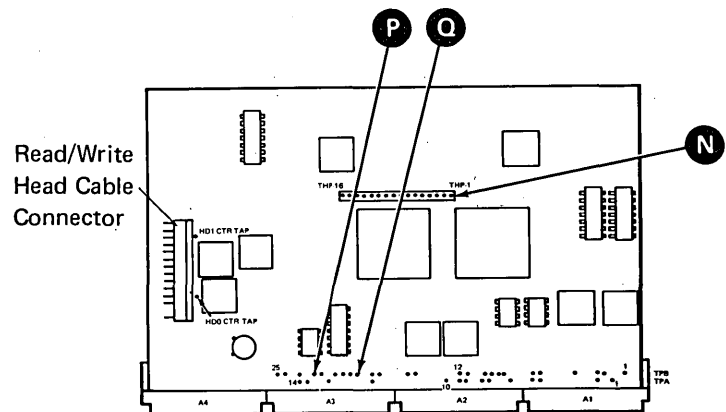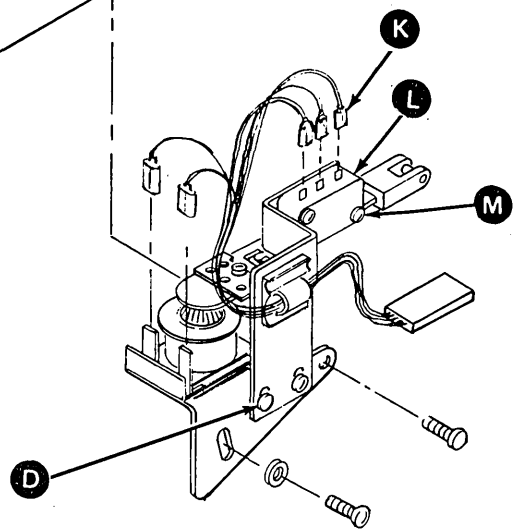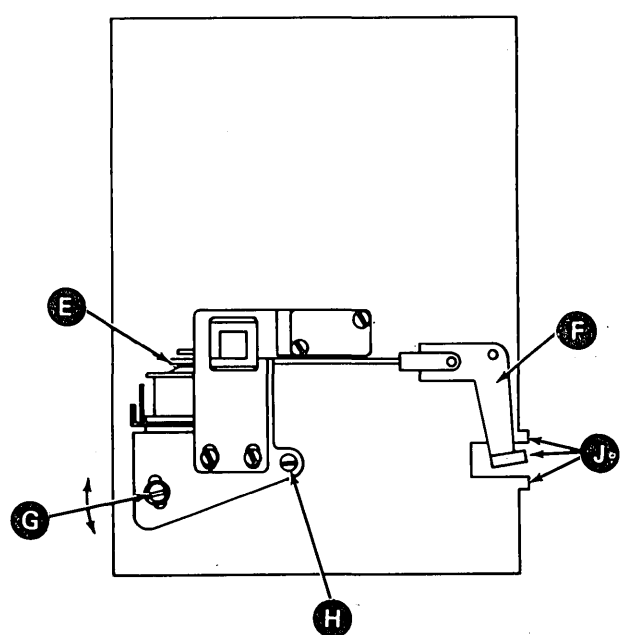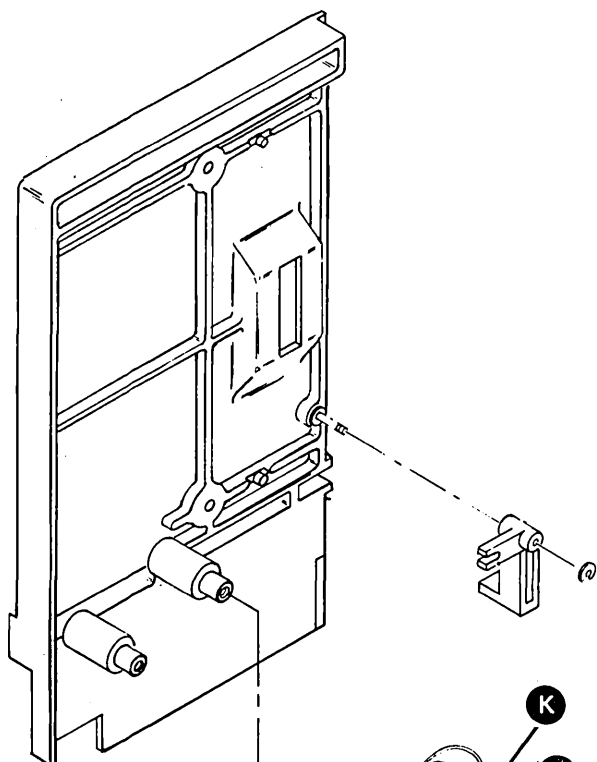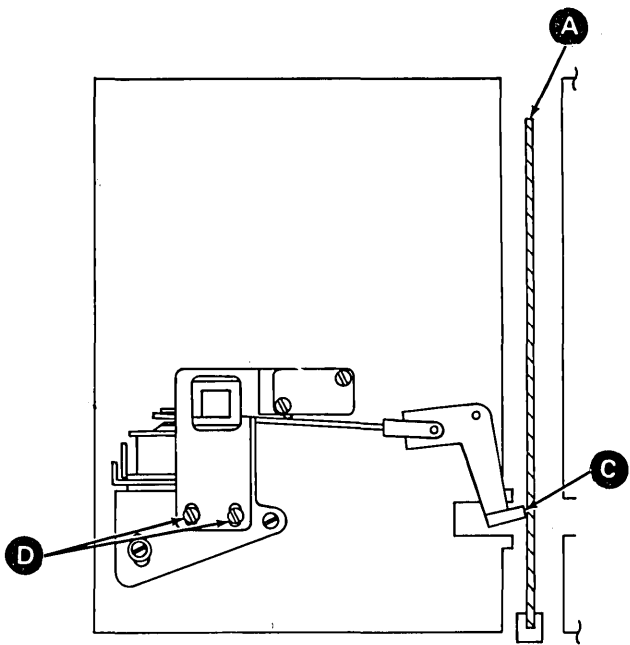
Note: See paragraph 27-820 for control card test pins.

27-600   HEAD/CARRIAGE SERVICE CHECK

Note: Run the head alignment exerciser before performing this service check. If the head alignment is good, go to the *Diskette Quality and Head Wear Service Check* (see paragraph 27-900). If the head alignment is bad, continue with this service check.

CAUTION
The head carriage service check must be performed with the diskette drive in the same position as when installed or the adjustment might not be accurate.

_____
_____
_____
_____

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Remove the picker/cam casting assembly (see paragraph 27-400).

CAUTION
Insert a strip of clean paper **S** between the heads **U** to keep the head surfaces from touching.

_____
_____
_____
_____

3.   Remove the two screws **D** and the wiper assembly **C**.

4.   Turn the stepper motor pulley to cylinder 40. Use the timing pin **B** to verify the alignment but remove the timing pin before going to the next step.

5.   Disconnect the AC power cable **A** to the drive motor.

> **DANGER**
> Voltage is still present at the power connector when the head/carriage is disconnected and power is on.
>
> _____
> _____
> _____
> _____

6.   Install a jumper from THP-2 **G** (head reference) to THP-1 **H** (ground).

7.   Set Power to I (operator panel).

8.   Insert the timing pin **B** through the hole in the pulley and into the casting.

9.   Does the timing pin pass freely through the stepper motor pulley into the timing slot in the casting?
Y N
    | – Remove the timing pin **B**.
    | – Remove the jumper.
    | – Power down.
    | – Go to paragraph 27-605, step 5.

10.   Remove the timing pin **B**.

11.   Load the diskette exerciser (if you have not already loaded it in another paragraph) by the following steps:
    – Set the Mode Selector switch to the Proc Run position (CE panel).
    – Set the Address/Data switches to F800 (CE panel).
    – Set all CE panel switches to their down positions.
    – Press the Load switch (operator panel).
    – Select the exerciser option.
    – Select the diskette option.
    – Select the head/carriage option.

12.   Remove the jumper from THP-2 and THP-1.

13.   Use the exerciser to select cylinder 39 (hexadecimal 27).

14.   Verify that this is cylinder 39 (hexadecimal 27) by visually checking for no gap **E** between the timing pointer and the timing block.

15.   Use the exerciser to select cylinder 40 (hexadecimal 28).

16.   Verify that this is cylinder 40 (hexadecimal 28) by visually checking that the timing hole in the pulley lines up with the timing slot in the casting. (Do not use a timing pin.)

17. Verify the 0.508 millimeter (0.020 inch) gap **E** as follows:
    - Insert thickness gauges measuring 0.495 millimeter (0.0195 inch) and visually check that the head/carriage assembly does not move.
    - Insert thickness gauge measuring 0.533 millimeter (0.021 inch) and visually check that the head/carriage moves slightly while carefully inserting a 0.021 thickness gauge.

    Note: Because of the torque of the stepper motor, this step can only be performed once. If it is necessary to perform this again, go back to step 13 of this service check.

18. Is the adjustment correct?
    Y N
    | - Go to paragraph 27-605, step 14

19. Set Power to O (operator panel).

20. Reinstall the wiper assembly **C** using the two screws **D**.

21. Remove the paper **S** from between the heads **U**.

22. Reinstall the picker/cam casting assembly (see paragraph 27-400).

23. Connect the drive motor power cable **A**.

VIEWS **1** and **2**

27

CAUTION
Factory
Adjustment
Only

View **1**

Front Limit (76)   Rear Limit (00)

0.508 mm (0.020 inch)

View **2**

Detail **3**

Detail **4**
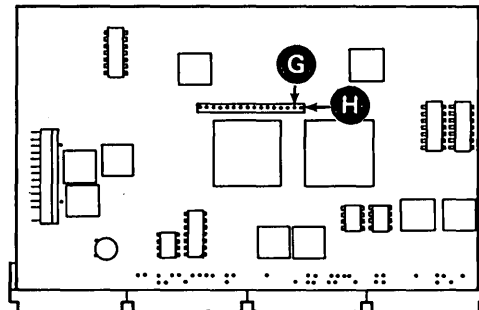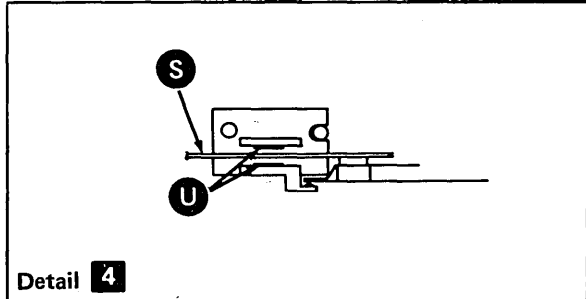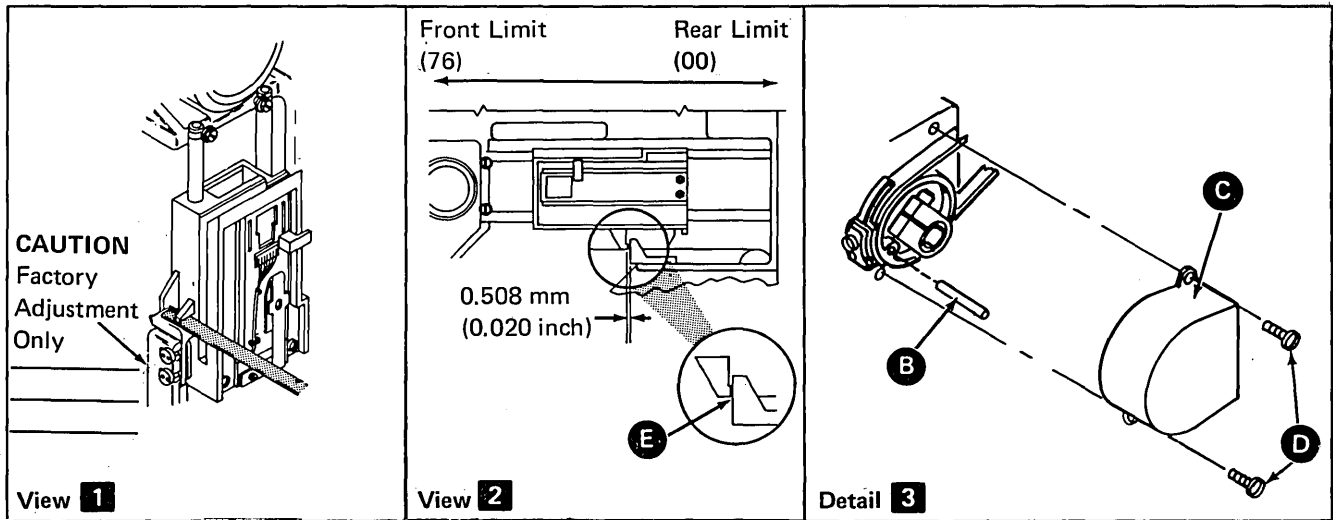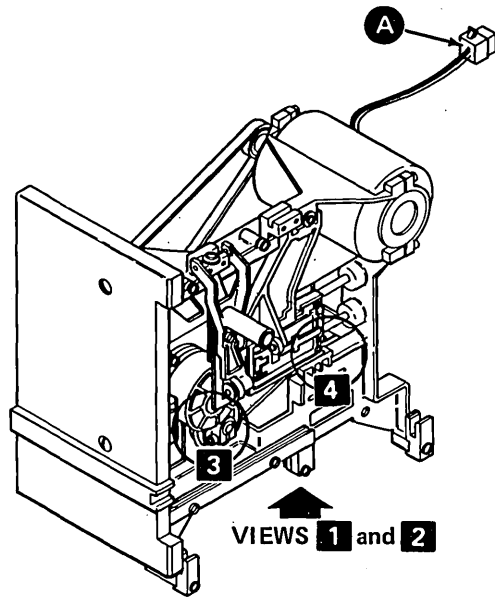
Note: See paragraph 27-820 for control card test pins.

27-605   HEAD/CARRIAGE ADJUSTMENT

CAUTION
The head/carriage assembly adjustment must be performed with the diskette drive installed (or in the same position as when installed) or the adjustment might not be accurately made.

_____
_____
_____
_____
_____
_____

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Remove the picker/cam casting assembly (see paragraph 27-400).

3.   Remove the two screws **D** and the wiper assembly **C**.

4.   Remove the diskette drive bezel (see paragraph 27-665).

5.   Measure and record the gap **P** between the stepper motor pulley and the casting.

6.   Loosen the clamp screw **T** so that the stepper motor shaft can turn inside the pulley.

7.   Turn the stepper motor pulley by hand to cylinder 40 and insert a timing pin **B**.

8.   Disconnect the AC power cable **A** to the drive motor.

> **DANGER**
> Voltage is still present at the power connector when the head/carriage is disconnected and power is on.
>
> _____
> _____
> _____
> _____

9.   Install a jumper from THP-2 **G** (head reference) to THP-1 **H** (ground).

10.   Set Power to I (operator panel).

11.   Make the gap **P** the same size as the gap recorded in step 5 and tighten the clamp screw **T**. (Ensure that the timing pin **B** passes freely through the stepper motor pulley into the timing slot in the casting.)

12.   Remove the timing pin **B**.

13.   Load the diskette exerciser (if you have not already loaded it in another paragraph) by the following steps:
   – Set the Mode Selector switch to the Proc Run position (CE panel).
   – Set the Address/Data switches to F800 (CE panel).
   – Set all CE switches to their down position.
   – Press the Load switch (operator panel).
   – Select the exerciser option.
   – Select the diskette option.
   – Select the head/carriage option.

14.   Loosen the two band clamp screws **Q**.

15.   Remove the jumper from THP-2 and THP-1 (if installed).

16.   Use the exerciser to select cylinder 39 (hexadecimal 27).

17.   Use the exerciser to select cylinder 40 (hexadecimal 28).

18.   Verify that this is cylinder 40 by visually checking that the timing hole in the pulley lines up with the timing slot in the casting. (Do not use a timing pin.)

19.   Insert a 0.508 millimeter (0.020 inch) thickness gauge between the timing pointer and the timing block **E**. (Put light finger pressure to the top of the carriage to hold the thickness gauge in place.)

20.   Tighten the band clamp screws **Q**. (Ensure that the drive band is straight.)

21.   Reinstall the diskette drive bezel (see paragraph 27-665).

22.   Go to paragraph 27-600, step 13.

CAUTION
Factory
Adjustment
Only

VIEWS **1** and **2**

Detail **4**

Front Limit   Rear Limit
(76)   (00)

0.508 mm
(0.020 inch)

View **1**

View **2**

Detail **3**
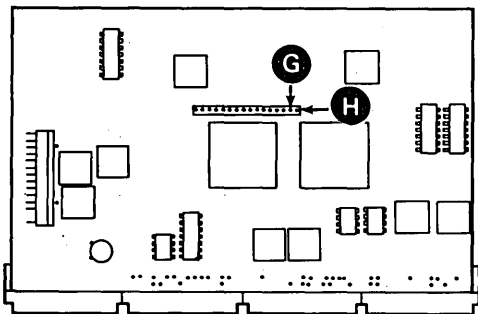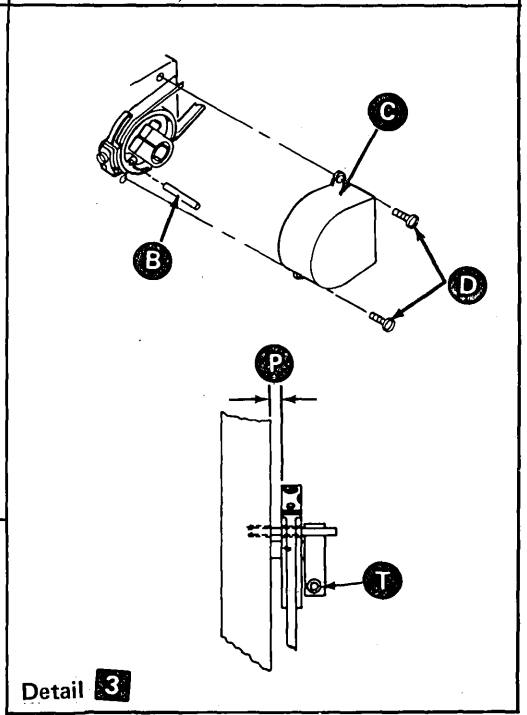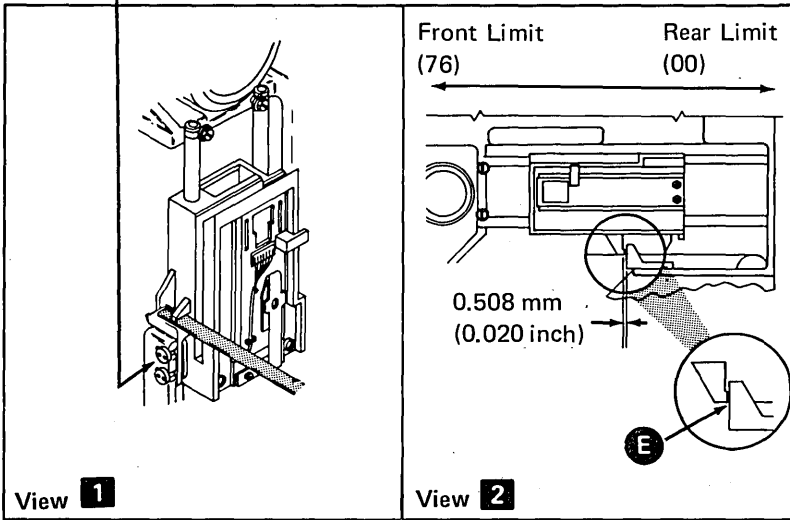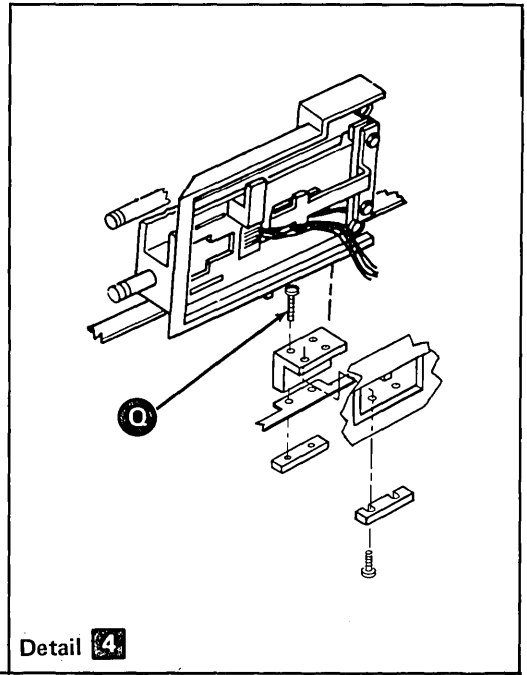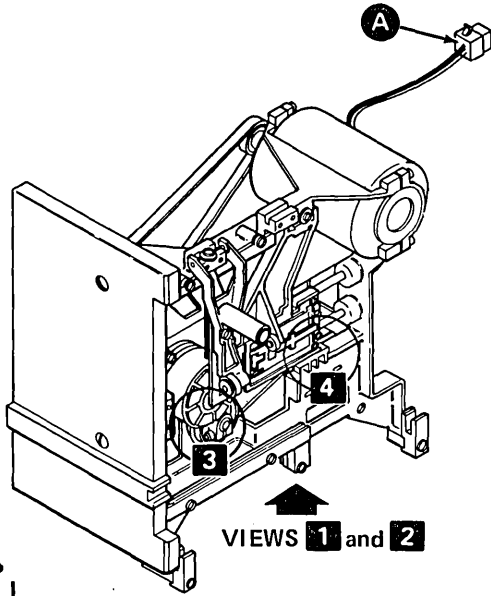
Note: See paragraph 27-820 for control card test pins.

27-610 HEAD/CARRIAGE REMOVAL AND REPLACEMENT

Removing the Head/Carriage

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the two screws **D** and the wiper assembly **C**.

3. Carefully remove the head cable **F** from the control card. (Remember the cable path for the replacement procedure.)

4. Move the head/carriage assembly toward the hub to its front limit (cylinder 76).

5. Remove the two band clamp screws **Q** and the clamp **R**.

6. Place the head/carriage assembly at the back limit (cylinder 00).

CAUTION
Insert a strip of clean paper between the heads to keep the head surfaces from touching.

_____
_____
_____
_____

7. Remove the bail assembly (see paragraph 27-655).

8. Loosen the screw **K** and remove the lower guide rod **J**.

9. Carefully lift and turn the head/carriage assembly **L** to remove it from the guide rod **M**. (Be careful not to damage the drive band.)

10. If the head/carriage assembly is to be exchanged with a different assembly, remove the two screws **U**, the retainer **T**, and the block **S**, and reinstall them on the replacement assembly.

Reinstalling the Head/Carriage

CAUTION
When reinstalling the head/carriage assembly, ensure that the bail is under the tab of the carriage arm. Also, ensure that a strip of clean paper is inserted between the head surfaces during installation.

_____
_____
_____
_____
_____
_____
_____

1. Disconnect the AC power **A** to the drive motor.

DANGER
Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

_____
_____
_____
_____

2. If the head/carriage assembly is being exchanged with a different assembly, remove the two screws **U**, the retainer **T**, and the block **S**, and reinstall them on the replacement assembly if they are not already installed.

3. Carefully reinstall the head/carriage assembly **L** on the guide rod **M** and then place the head/carriage assembly at the back limit (cylinder 00).

4. Reinstall the lower guide rod **J** and tighten the screw **K**. (Ensure that the guide rod notch **N** is aligned with the screw and the guide rod **J** is seated in the V-slot correctly.)

5. Reinstall the bail assembly (see paragraph 27-655).

6. Move the head/carriage assembly toward the hub to its front limit (cylinder 76).

7. Reinstall the clamp **R** and the two band clamp screws **Q**. (Do not tighten these two screws now.)

8. Connect the head cable **F** to the diskette drive control card.

   Note: Ensure that you use the same head cable path that was used before you removed the head/carriage.

9. Turn the stepper motor pulley to cylinder 40. Use the timing pin to verify the alignment but remove the timing pin **B** before going to the next step.

10. Install a jumper from THP-2 **G** (head reference) to THP-1 **H** (ground).

11. Set Power to I (operator panel).

12. Insert the timing pin **B** through the hole in the pulley and into the casting.

13. Does the pin slide freely?

   Y   N
   | Go to paragraph 27-605, step 5.

   Go to paragraph 27-605, step 12.

Note: See paragraph 27-820 for control card test pins.

Properly Seated Guide Rod

Improperly Seated Guide Rod

Detail **2**

Detail **1**
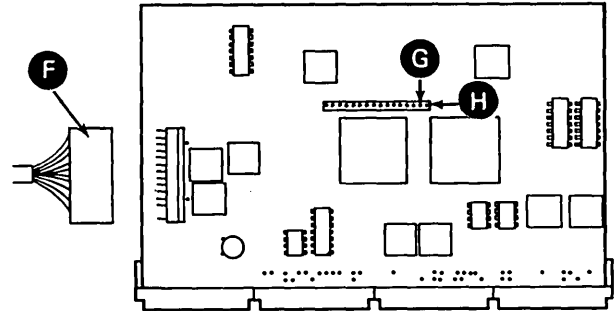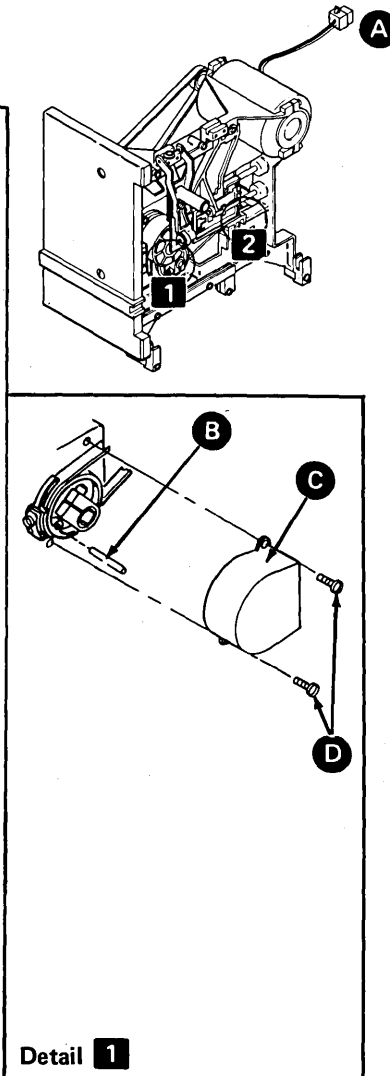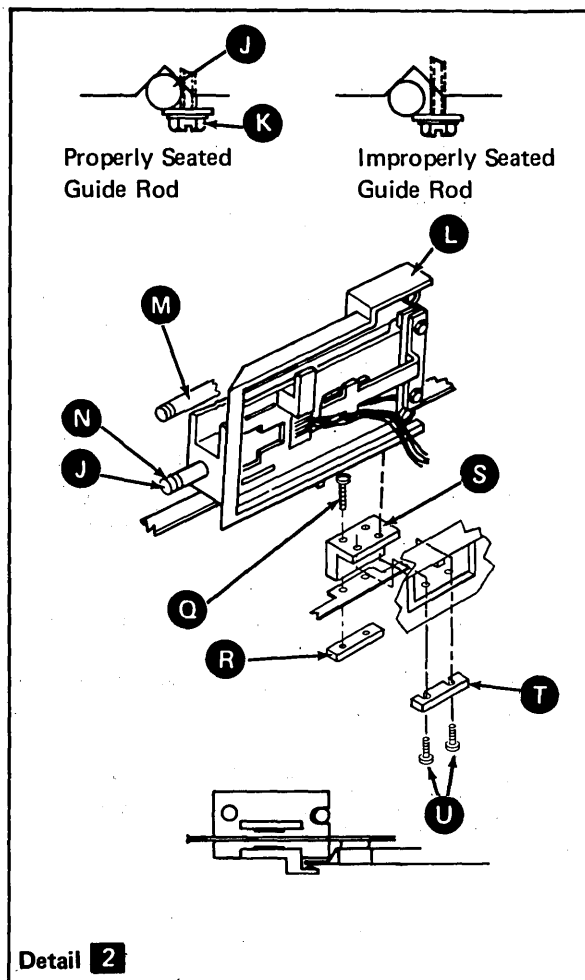
27-615 HEAD/CARRIAGE STEPPER MOTOR REMOVAL AND REPLACEMENT

Removing the Head/Carriage Stepper Motor

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Carefully disconnect the head cable **T** from the control card.

3. Remove the control card and mounting assembly (see paragraph 27-840).

4. Remove the two screws **G** and the two connector covers **F** from the A1 cable.

5. Remove the stepper motor leads from the cable connector by pushing down on the terminal tabs with a small screwdriver.

CAUTION
While performing the following steps, be careful not to damage the drive band.

6. Remove the two screws **Q** and the wiper assembly **P**.

7. Loosen the two idler mounting screws **D**, push the idler assembly **C** against the spring tension, and tighten the screws **D**.

8. Remove the diskette drive bezel (see paragraph 27-665).

9. Remove the clamp screw **J** and the band clamp **K**.

10. Carefully remove the drive band ends **L** from the pulley pin **R**.

11. Measure and record the gap **H** between the stepper motor pulley and the casting.

12. Loosen the clamp screw **N** and remove the stepper motor pulley **M**.

13. Remove the three stepper motor mounting screws **A** and then remove the stepper motor **B**.
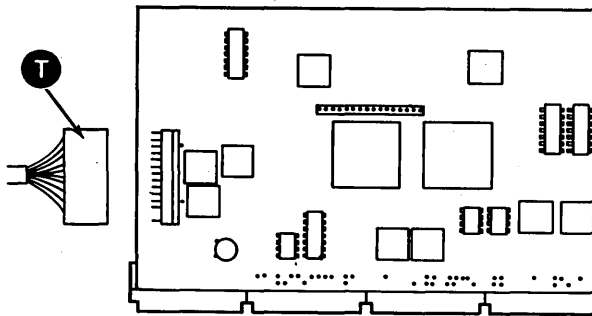
Note: See paragraph 27-820 for control card test pins.

Orange D12

Red D13

Black B10

Yellow B12

Blue B13

27

Detail **1**
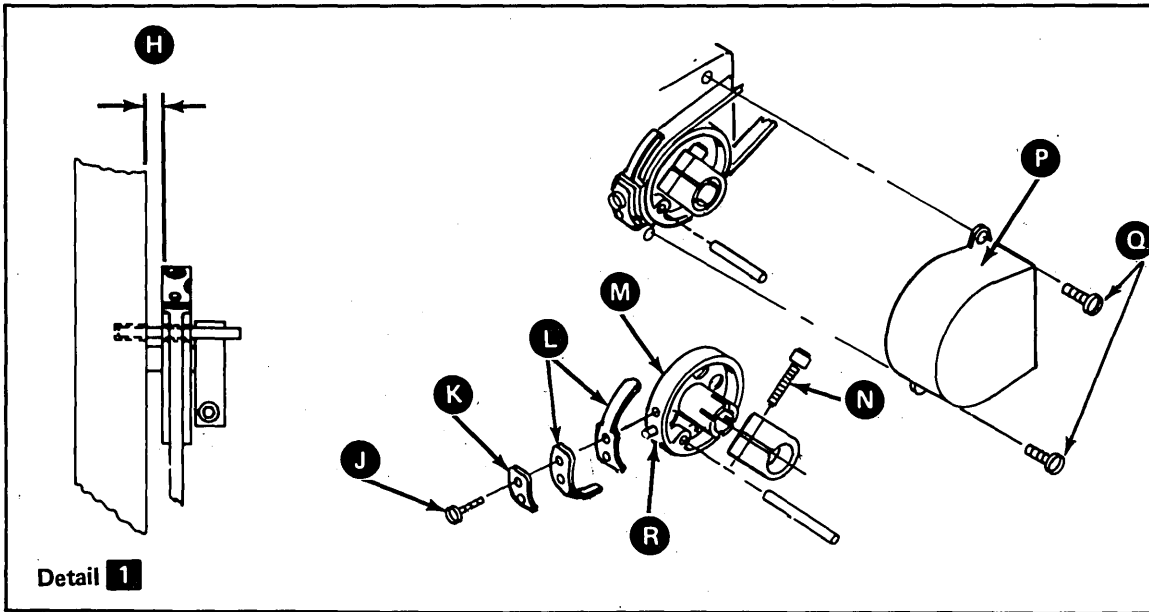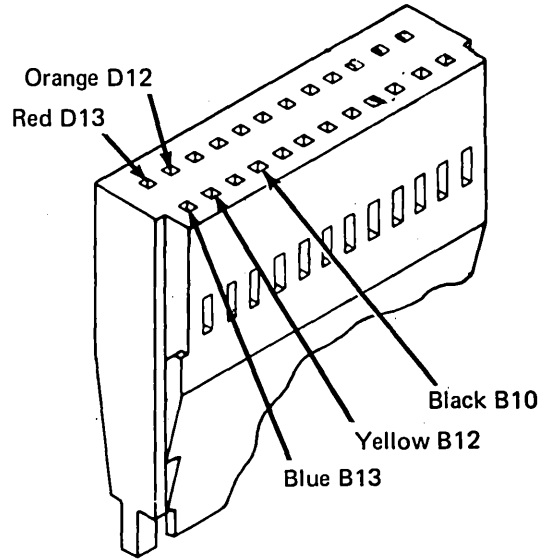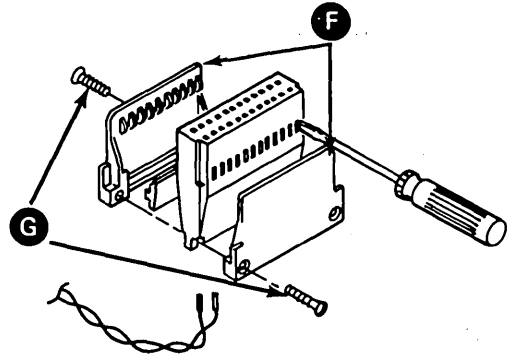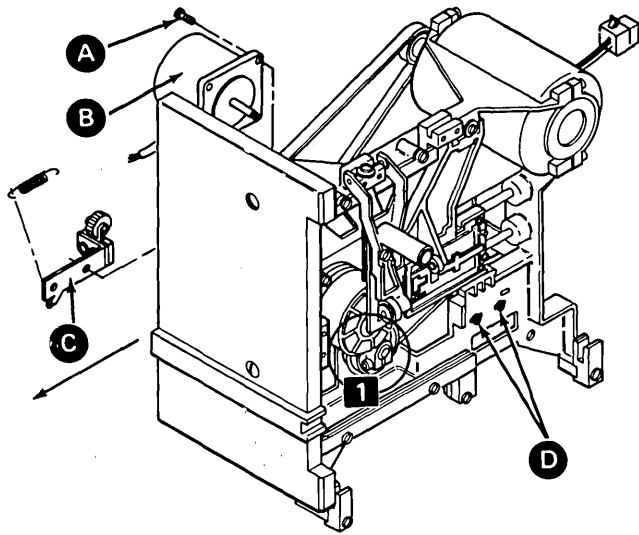
Reinstalling the Head/Carriage Stepper Motor

1. Reinstall the stepper motor **B** using the three mounting screws **A**. (Place the motor cable at the rear of the unit.)

2. Insert the stepper motor leads into the cable connector. Ensure that the locking tabs on the terminals lock in the connector slots.

3. Reinstall the connector covers **F** and the two screws **G**.

4. Reinstall the stepper motor pulley **M**. (Keep the clamp screw **N** loose so that the motor shaft can turn inside the pulley.)

5. Carefully reinstall the drive band ends **L** on the pulley pin **R** as shown. Reinstall the band clamp **K** (with the notch facing away from the stepper motor) and the screw **J**. (Do not tighten the screw.)

6. Loosen the two idler mounting screws **D** and let the spring tension place the idler **C**.

7. Tighten the mounting screws **D** and center the drive band on the idler pulley as shown **E**.

8. Reinstall the control card and mounting assembly (see paragraph 27-840).

9. Carefully reinstall the head cable **T** on the control card.

10. Turn the stepper motor pulley to cylinder 40 and insert a timing pin **S**.

11. Disconnect the AC power **W** to the drive motor.

> **DANGER**
> Voltage is still present at the power connector when the head/carriage stepper motor is disconnected and power is on.
>
> _____
> _____
> _____
> _____

12. Install a jumper from THP-2 **U** (head reference) to THP-1 **V** (ground).

13. Set Power to I (operator panel).

14. Make the gap **H** between the pulley and the casting the same size as the gap that was recorded in *Removing the Head/Carriage Stepper Motor,* step 11.

15. Tighten the pulley clamp screw **N**.

16. Remove the timing pin **S**.

17. Remove the jumper.

18. Tighten the band clamp screw **J**. (Ensure that the drive band is straight.)

19. Set Power to O (operator panel).

20. Reinstall the diskette drive bezel (see paragraph 27-665).

21. Turn the stepper motor pulley by hand and check to see that the drive band is centered on the idler pulley in all of the head/carriage assembly movement (cylinder 00 to cylinder 76).

22. Is the band centered?
    Y N
    | – Go to paragraph 27-630, step 4.

    Go to paragraph 27-600, step 4.

Orange D12
Red D13

Black B10
Yellow B12
Blue B13

Detail **1**

Note: See paragraph 27-820 for control card test pins.

27
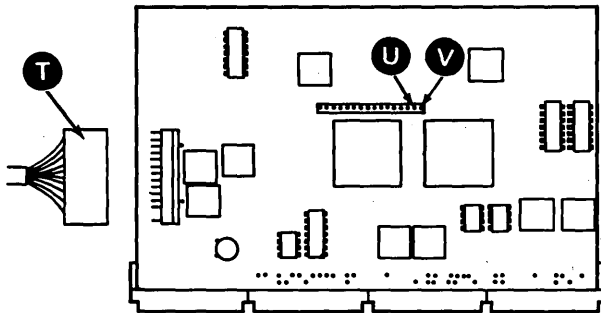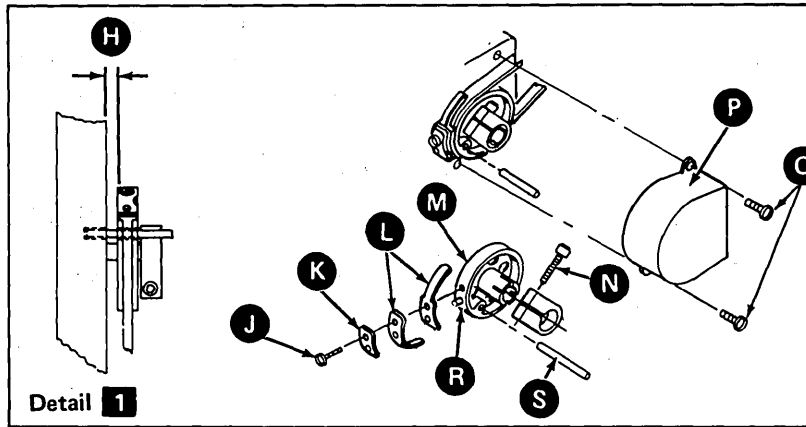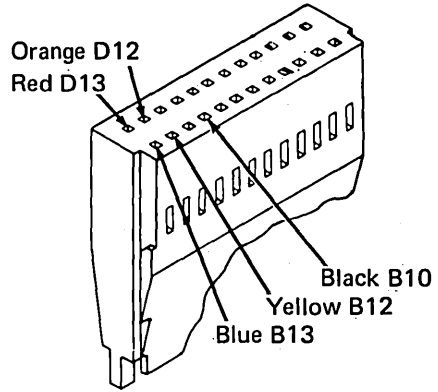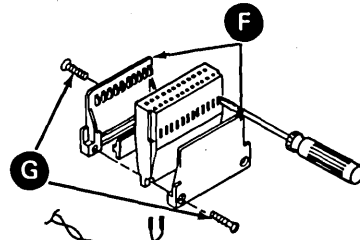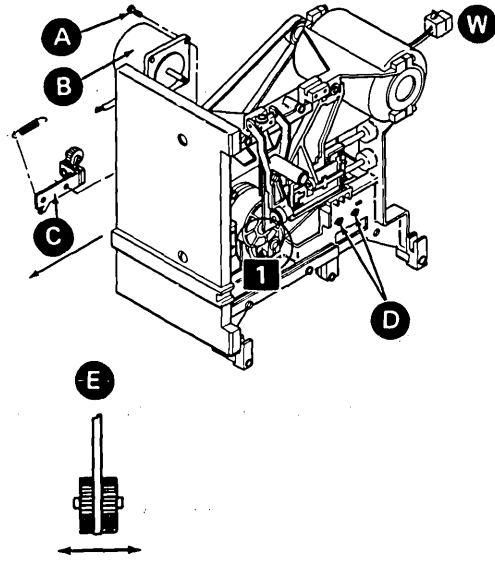
27-620 HEAD/CARRIAGE PULLEY AND CLAMP REMOVAL AND REPLACEMENT

Removing the Head/Carriage Pulley and Clamp

1. Remove the picker/cam casting assembly (see paragraph 27-400).

CAUTION
While performing the following steps, be careful not to damage the drive band.

_____
_____
_____
_____

2. Remove the two screws **M** and the wiper assembly **F**.

3. Loosen the two idler mounting screws **B**, push the idler assembly **A** against the spring tension, and tighten the screws **B**.

4. Remove the clamp screw **G** and the band clamp **H** from the pulley.

5. Carefully remove the drive band ends **J** from the pulley pin **N**.

6. Measure and record the gap **E** between the stepper motor pulley and the casting.

7. Loosen the clamp screw **L** and remove the stepper motor pulley **K** and the clamp **Q**.

Reinstalling the Head/Carriage Pulley and Clamp

DANGER
Voltage is still present at the power connector when the head/carriage is disconnected and power is on.

_____
_____
_____
_____

1. Reinstall the pulley **K**, clamp **Q**, and clamp screw **L**. (Keep the screw loose so that the motor shaft can turn inside the pulley.)

2. Carefully reinstall the drive band ends **J** on the pulley pin **N** as shown, reinstall the band clamp **H** (with the notch facing away from the stepper motor), and the screw **G**. (Do not tighten the screw.)

3. Loosen the two idler mounting screws **B** and let the spring tension place the idler **A**.

4. Tighten the idler mounting screws **B**. (Center the drive band on the idler pulley **D**).

5. Turn the stepper motor by hand to cylinder 40 and insert a timing pin **P**.

6. Disconnect the AC power **C** to the drive motor.

7. Install a jumper from THP-2 **R** (head reference) to THP-1 **S** (ground).

8. Set Power to I (operator panel).

9. Make the gap **E** between the pulley and the casting the same as the gap that was recorded in _Removing the Head/Carriage Pulley and Clamp_, step 6.

10. Tighten the pulley clamp screw **L**.

11. Remove the timing pin **P**.

12. Remove the jumper.

13. Tighten the band clamp screw **G**. (Ensure that the drive band is straight.)

14. Set Power to O (operator panel).

15. Turn the stepper motor pulley **K** by hand and check to ensure that the drive band is centered on the idler pulley in all of the head/carriage assembly movement (cylinder 00 through cylinder 76).

16. Is the drive band centered?
    Y N
    | – Go to paragraph 27-630, step 4.

    Go to paragraph 27-600, step 4.

Read/Write
Head Cable
Connector
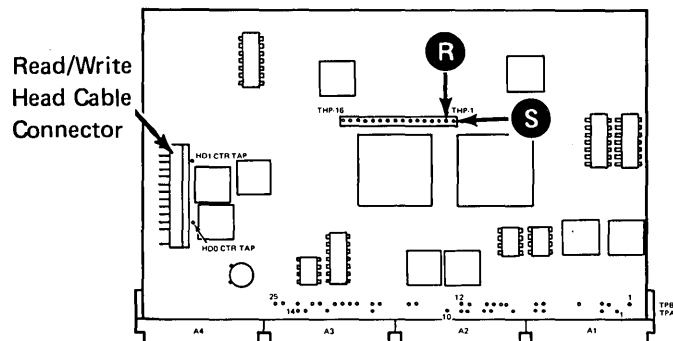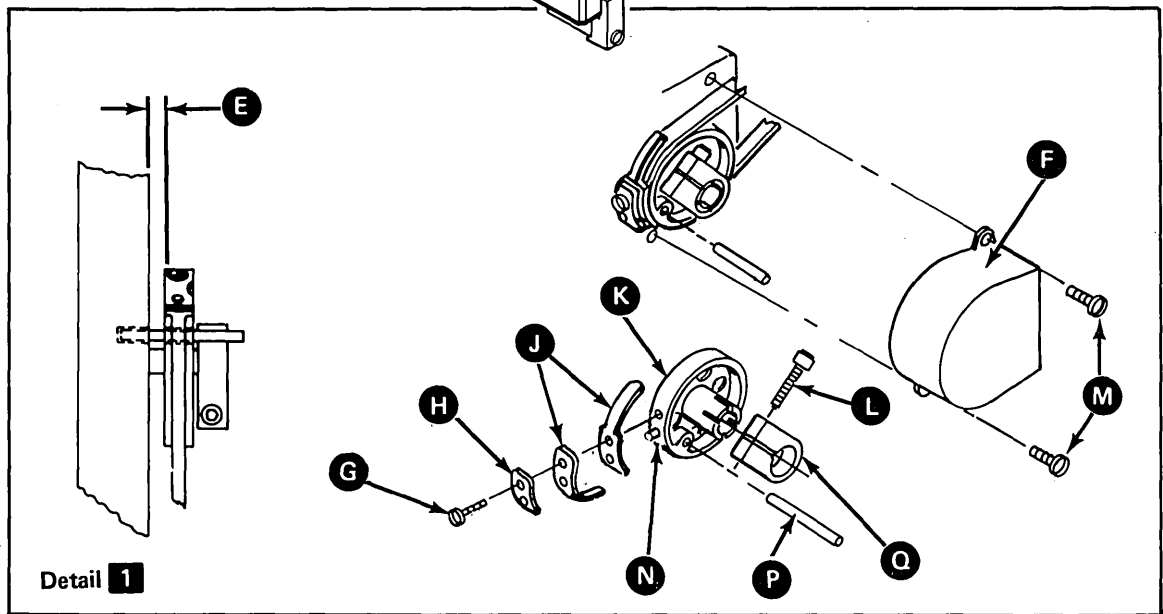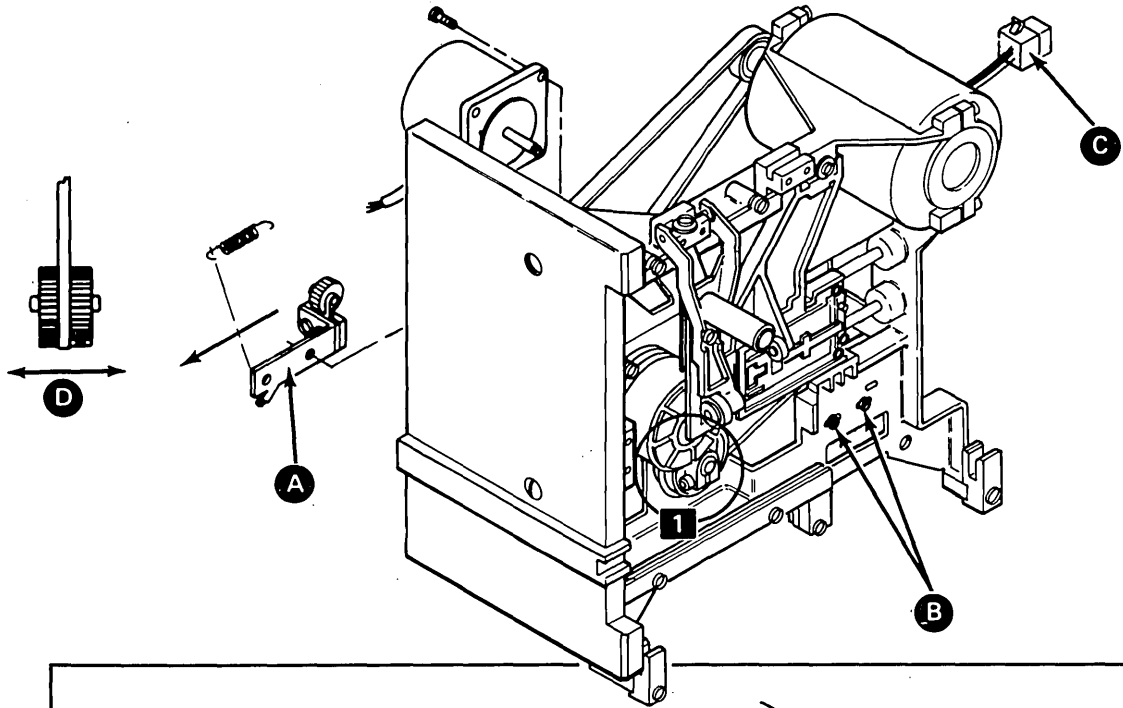
Note: See paragraph 27-820 for control card test pins.

27-625   DRIVE BAND SERVICE CHECK

1. Remove power and the 72MD unit (see paragraph
    27-200).

2. Remove the picker/cam casting assembly (see
    paragraph 27-400).

3. Remove the two screws **L** and the wiper
    assembly **K**.

4. Move the head/carriage assembly **C** toward the
    hub to its front limit (cylinder 76).

5. Turn the stepper motor pulley by hand and check
    that the drive band **E** is centered on the idler
    pulley **D** in all of the head/carriage assembly
    movement (cylinder 00 through cylinder 76).

6. Is the drive band centered?
    Y N
    │ — Go to paragraph 27-630, step 4.
    │

7. Reinstall the wiper assembly **K** using the two
    screws **L**.

8. Reinstall the picker/cam casting assembly (see
    paragraph 27-400).

Back
Limit (00)

Front
Limit (76)

© C

© E
© D

1

27

Detail 1

© K
© L
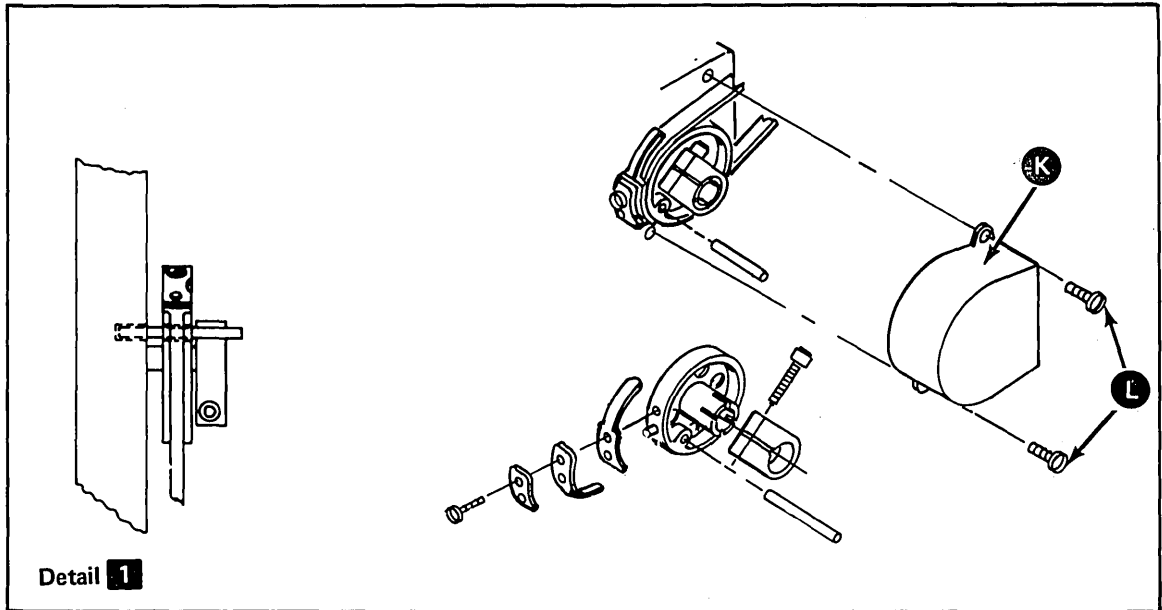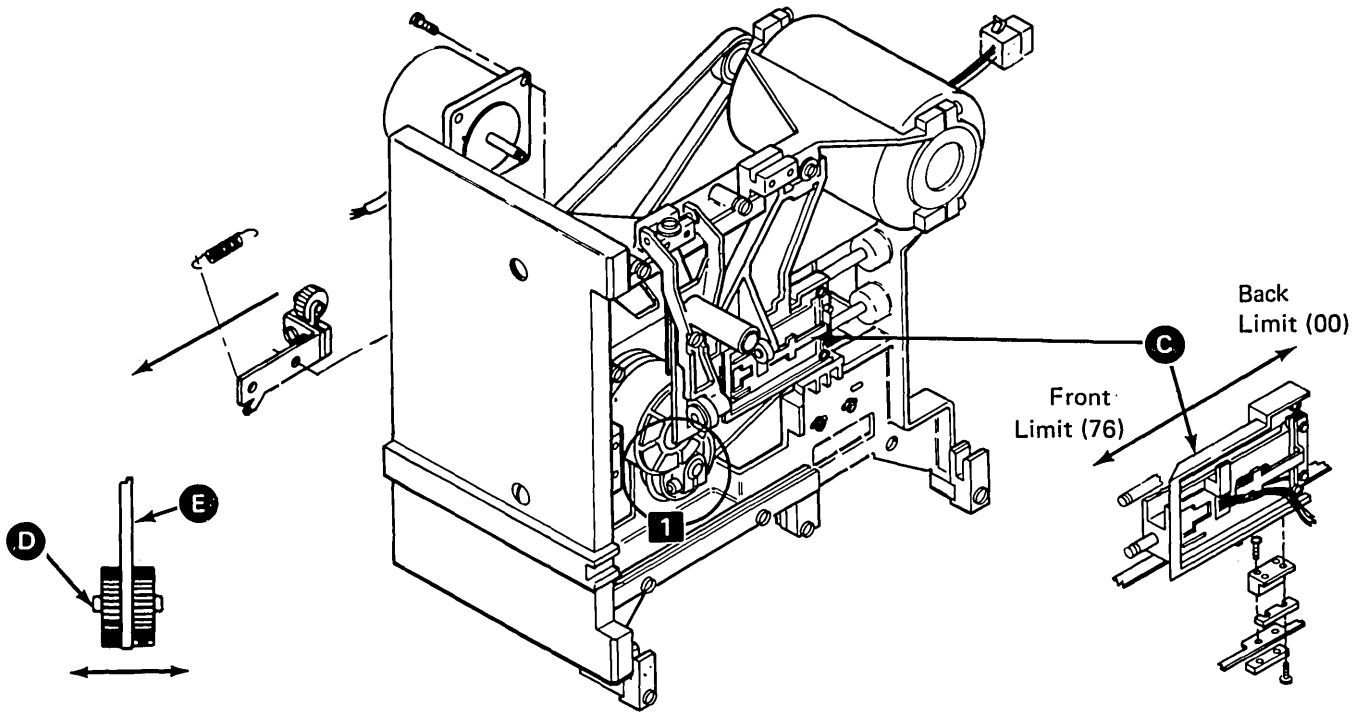
27-630   DRIVE BAND ADJUSTMENT

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Remove the picker/cam casting assembly (see paragraph 27-400).

3.   Remove the two screws Ⓛ and the wiper assembly Ⓚ.

4.   Move the head/carriage assembly Ⓒ toward the hub to its front limit (cylinder 76).

5.   Remove the two band clamp screws Ⓜ and the clamp.

6.   Loosen the two idler mounting screws Ⓑ and let the spring tension place the idler Ⓐ. Tighten the mounting screws.

7.   Turn the stepper motor pulley by hand a few times to center the drive band Ⓔ on the idler pulley Ⓓ.

8.   Place the head/carriage assembly Ⓒ at cylinder 40. Check to see that the band mounting slots Ⓝ are centered (left to right) over the mounting holes on the carriage pad.

9.   Repeat steps 7 and 8 with the head/carriage assembly at cylinder 76 and then cylinder 00.

10.   Are the mounting slots centered?
       Y N
       │ – Loosen the band clamp screw Ⓕ.
       │ – Place the head/carriage at approximately cylinder 40.
       │ – Turn the stepper motor pulley to center the mounting slots Ⓝ and then tighten the clamp screw Ⓕ.
       │ – Repeat step 9.

11.   Move the head/carriage assembly Ⓒ toward the hub to its front limit (cylinder 76).

12.   Reinstall the clamp and the two clamp screws Ⓜ. (Do not tighten.)

13.   Go to paragraph 27-605, step 4.

27-635   DRIVE BAND REMOVAL AND REPLACEMENT

Removing the Drive Band

1.   Remove the picker/cam casting assembly (see paragraph 27-200).

2.   Remove the two screws Ⓛ and the wiper assembly Ⓚ.

3.   Move the head/carriage assembly Ⓒ toward the hub to its front limit (cylinder 76).

4.   Loosen the two idler mounting screws Ⓑ, push the idler assembly Ⓐ against the spring tension, and then tighten the mounting screws Ⓑ.

5.   Remove the two band clamp screws Ⓜ and the clamp and place the head/carriage assembly at the back limit (cylinder 00).

6.   Remove the clamp screw Ⓕ and the clamp Ⓖ.

7.   Carefully remove the drive band ends Ⓗ from the pulley pin Ⓙ and remove the band.

Reinstalling the Drive Band

1.   Place the drive band Ⓔ around the idler assembly Ⓓ.

2.   Carefully install the drive band ends Ⓗ on the pulley pin Ⓙ as shown.

3.   Reinstall the band clamp Ⓖ (with the notch facing away from the stepper motor) and the clamp screw Ⓕ. (Ensure that the drive band is straight.)

4.   Go to paragraph 27-630, step 6.

Back
Limit (00)

Front
Limit (76)

Detail **1**

Back Limit (00)   Front Limit (76)
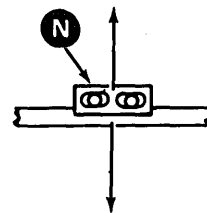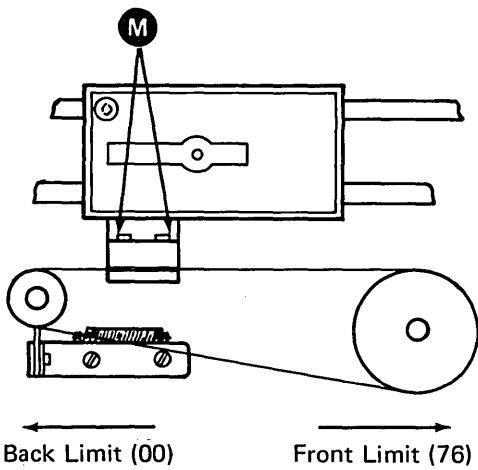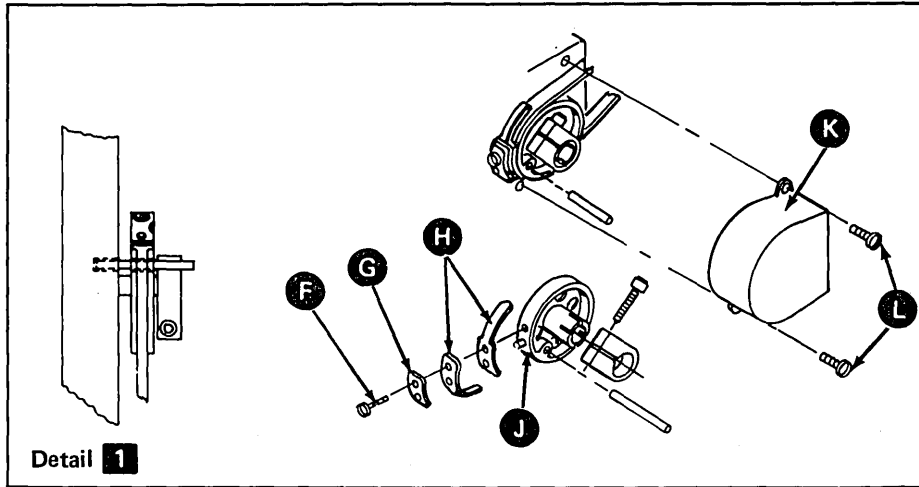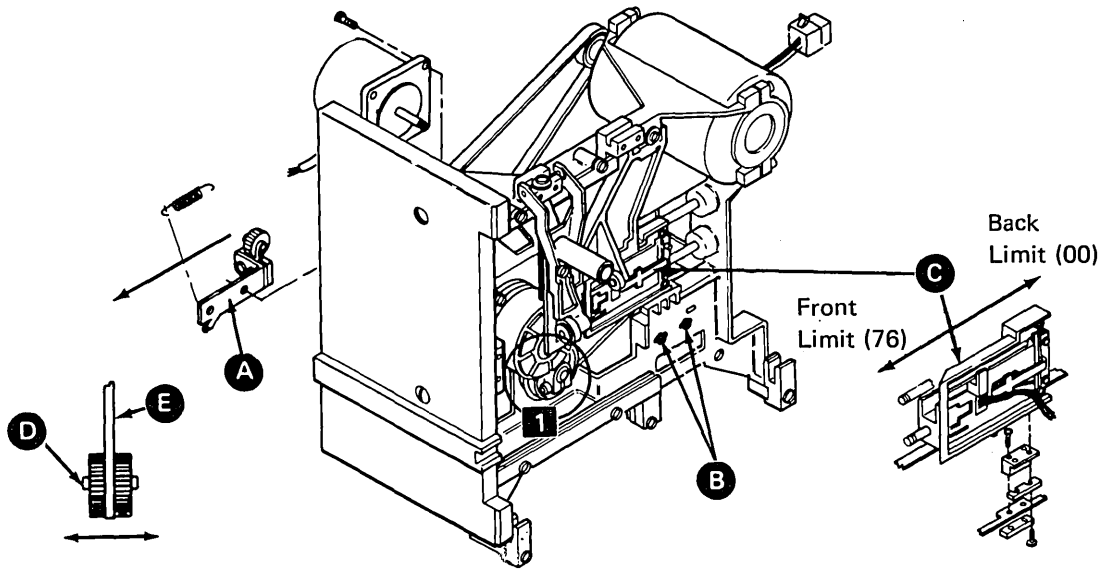
27-635

27-640 IDLER ASSEMBLY REMOVAL
AND REPLACEMENT

Removing the Idler Assembly

1.   Remove the drive band (see paragraph 27-635).

2.   Loosen the two mounting screws **B**.

3.   Remove the idler spring **C**.

4.   Remove the mounting screws **B** and the idler assembly **A**.

Reinstalling the Idler Assembly

1.   Reinstall the idler assembly **A** and the two mounting screws **B** (do not tighten).

2.   Reinstall the idler spring **C**.

3.   Push the idler assembly against spring tension and tighten the mounting screws **B**.

4.   Reinstall the drive band (see paragraph 27-635).

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27
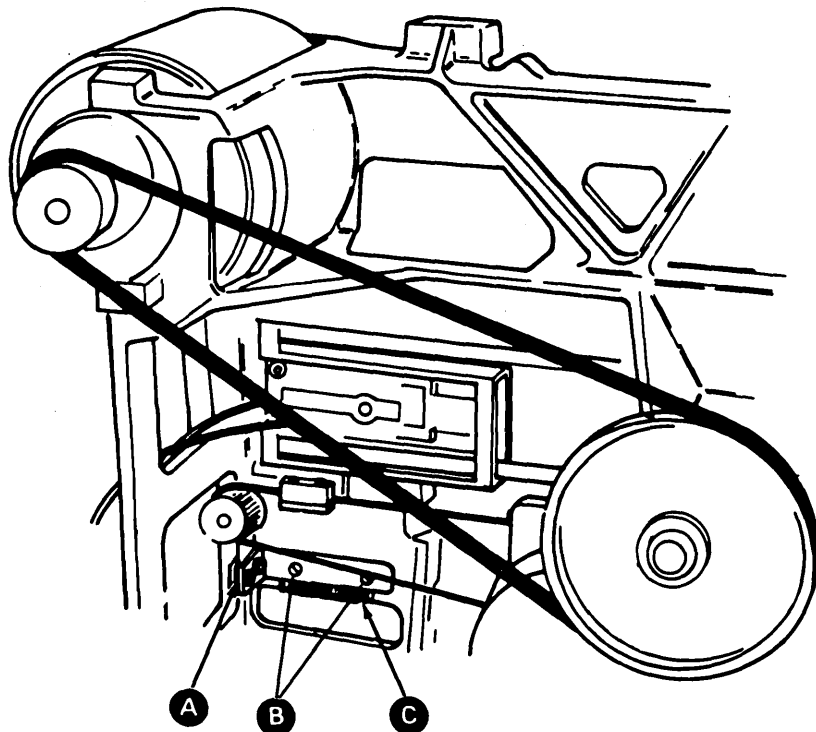
27-645   DISKETTE IN SWITCH ADJUSTMENT AND SERVICE CHECK

1.   Remove power and the 72MD unit (see paragraph 27-200).

2.   Remove the picker/cam casting assembly (see paragraph 27-400).

3.   Insert the diskette **(A)** into the diskette drive by hand until the diskette is against the diskette stop **(B)**.

4.   Loosen the two screws **(J)** holding the diskette in switch **(H)**.

5.   Adjust the switch for a gap of 0.0 to 0.4 millimeter (0.000 to 0.016 inch) between the diskette **(A)** and the switch lever **(C)** when the lever is touching the switch case.

6.   Tighten the two screws **(J)**.

      Note: Ensure that the diskette is stopped by the stop **(B)** and not the switch.

7.   Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

8.   Connect the probe to test pin TPB-15 **(K)** (diskette in).

9.   Check that the output is minus (-) when a diskette is in the drive against the stop and plus (+) when the diskette is removed from the drive.

10.   Reinstall the 72MD unit (see paragraph 27-200).

27-650   DISKETTE IN SWITCH REMOVAL AND REPLACEMENT

Removing the Diskette In Switch

1.   Remove the picker/cam casting assembly (see paragraph 27-400).

2.   Disconnect the leads from the diskette in switch **(H)**.

3.   Remove the two mounting screws **(J)**, the spacer **(G)**, and the nut clamp **(F)** from the back.

4.   Remove the diskette in switch **(H)**.

Reinstalling the Diskette In Switch

1.   Reinstall the diskette in switch **(H)** using the two mounting screws **(J)**, the spacer **(G)**, and the nut clamp **(F)**.

2.   Connect the leads to the diskette in switch **(H)**.

3.   Perform the diskette in switch adjustment (see paragraph 27-645).

Read/Write Head Cable Connector

Note: See paragraph 27-820 for control card test pins.

27-645

Detail

Black — Ground
1
2 Yellow — +5 V
3 White — Output

G

H See Detail

J

F

B

A

0.0 to 0.4 mm
(.000 to .016 inches)

C

H
See Detail

J

27
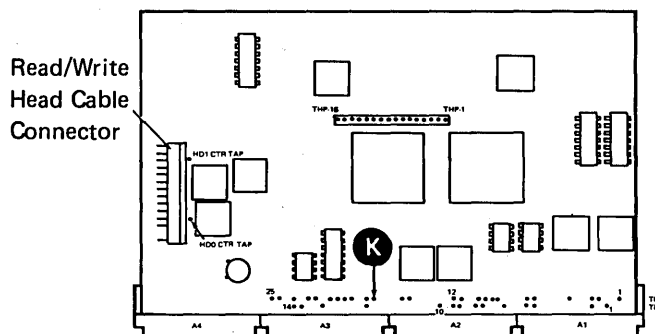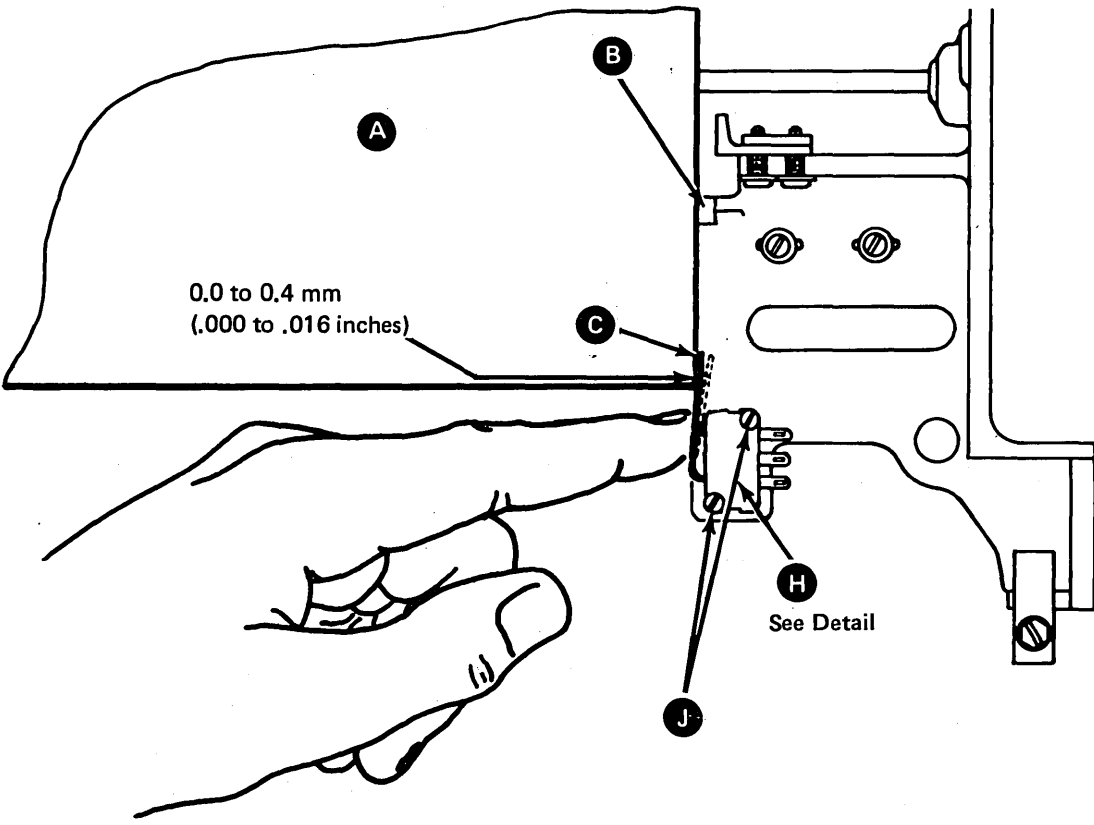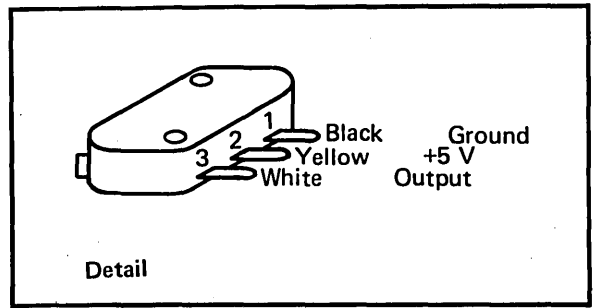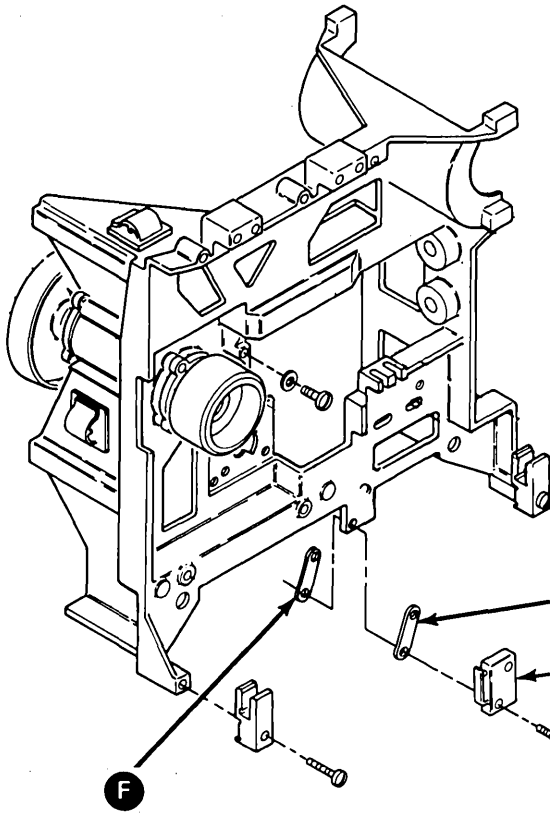
27-653 HEAD LOAD BAIL ASSEMBLY SERVICE CHECK AND ADJUSTMENT

1. Remove the 72MD unit (see paragraph 27-200).

2. Turn the cam **Q** counter clockwise until the cam stops.

3. Move the head carriage assembly **N** in both directions as far as it will go and ensure that there is always a gap between the bail assembly **P** and the head carriage tabs **H**.

4. If the gap **K** is not correct, turn the bail adjusting screw **G** until the bail assembly **P** just touches the head carriage tab **H**.

5. Turn the bail adjusting screw clockwise 90 degrees to make a gap of 0.25 to 0.5 millimeters (0.010 to 0.020 inches) between the bail assembly **P** and the head carriage tab **H**.

6. Repeat step 3 and check for the gap.

7. Reinstall the 72MD unit (see paragraph 27-200).

27-655 HEAD LOAD BAIL ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Head Load Bail Assembly

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Insert a strip of clean paper **L** between the heads **M**.

3. Loosen the clamp screw **E** on the head load bail pivot shaft **D**.

4. Slide the pivot shaft **D** out and remove the bail assembly **F**.

Reinstalling the Head Load Bail Assembly

1. Reinstall the head load bail assembly **F** and pivot shaft **D**. (Ensure that the bail **P** is on the correct side of the head carriage tab **H**.)

2. Tighten the clamp screw **E** on the head load bail pivot shaft.

3. Remove the strip of paper **L** from between the heads **M**.

4. Reinstall the picker/cam casting assembly (see paragraph 27-400).

27-660 COLLET ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Collet Assembly

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Loosen the clamp screw **A** on the collet assembly pivot shaft **B**.

3. Slide the pivot shaft **B** out.

4. Remove the collet assembly **C**.

Reinstalling the Collet Assembly

1. Reinstall the collet assembly **C**.

2. Reinstall the pivot shaft **B**.

3. Tighten the clamp screw **A** on the collet assembly pivot shaft **B**.

4. Reinstall the picker/cam casting assembly (see paragraph 27-400).

A

B

D
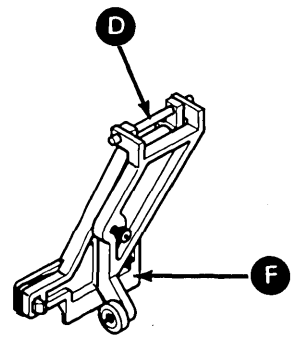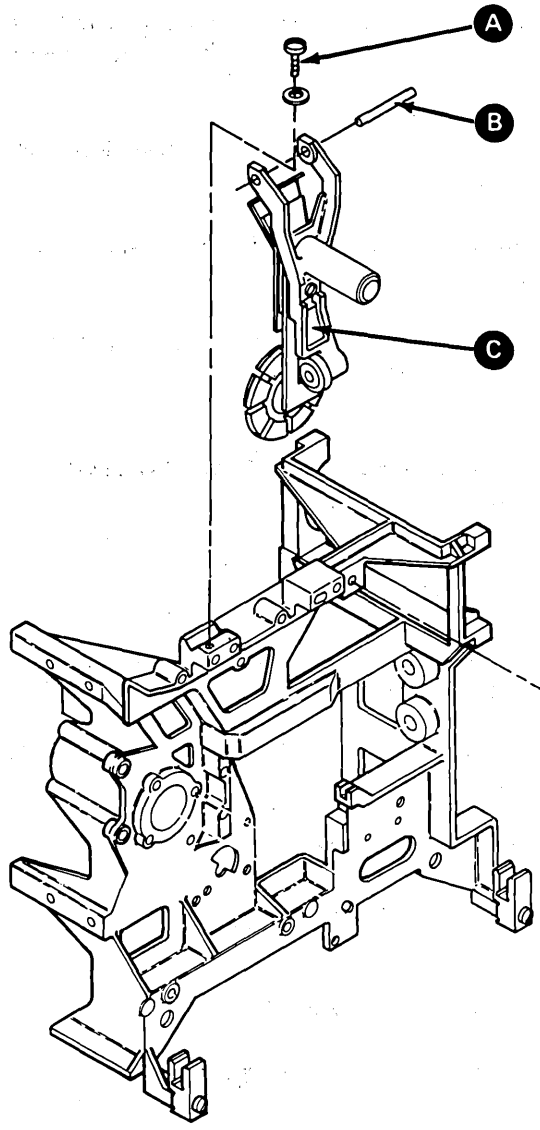
New Style
Bail Assembly

C

D

E

Old Style
Bail Assembly

F

G

Wrench Position
Without Access Hole

Picker Cam Casting

Access Hole

Wrench

P

N

M

H

L

Cam

Q

K   0.25 to 0.5 mm
     (0.010 to 0.020 in.)

27
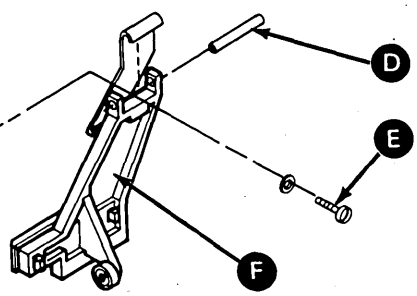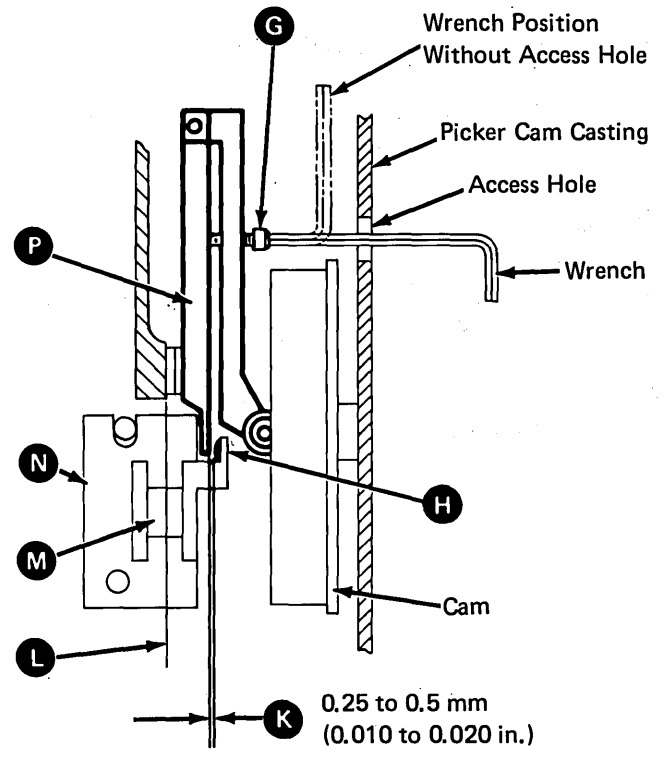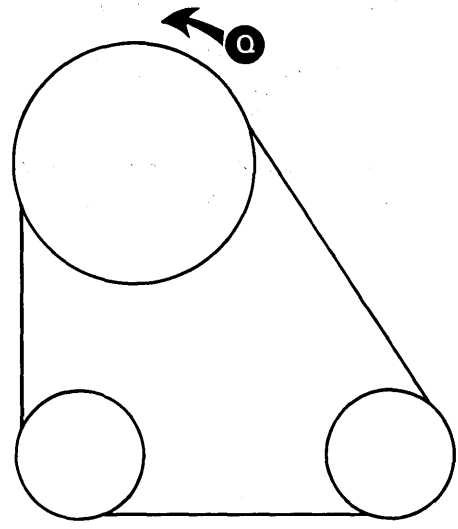
27-665   DISKETTE DRIVE BEZEL REMOVAL AND REPLACEMENT

Removing the Diskette Drive Bezel

1.   Remove the two mounting screws **A** from the bezel.

2.   Remove the bezel **B**.

Reinstalling the Diskette Drive Bezel

Reinstall the bezel **B** using the two mounting screws **A**. (No adjustment needed.)
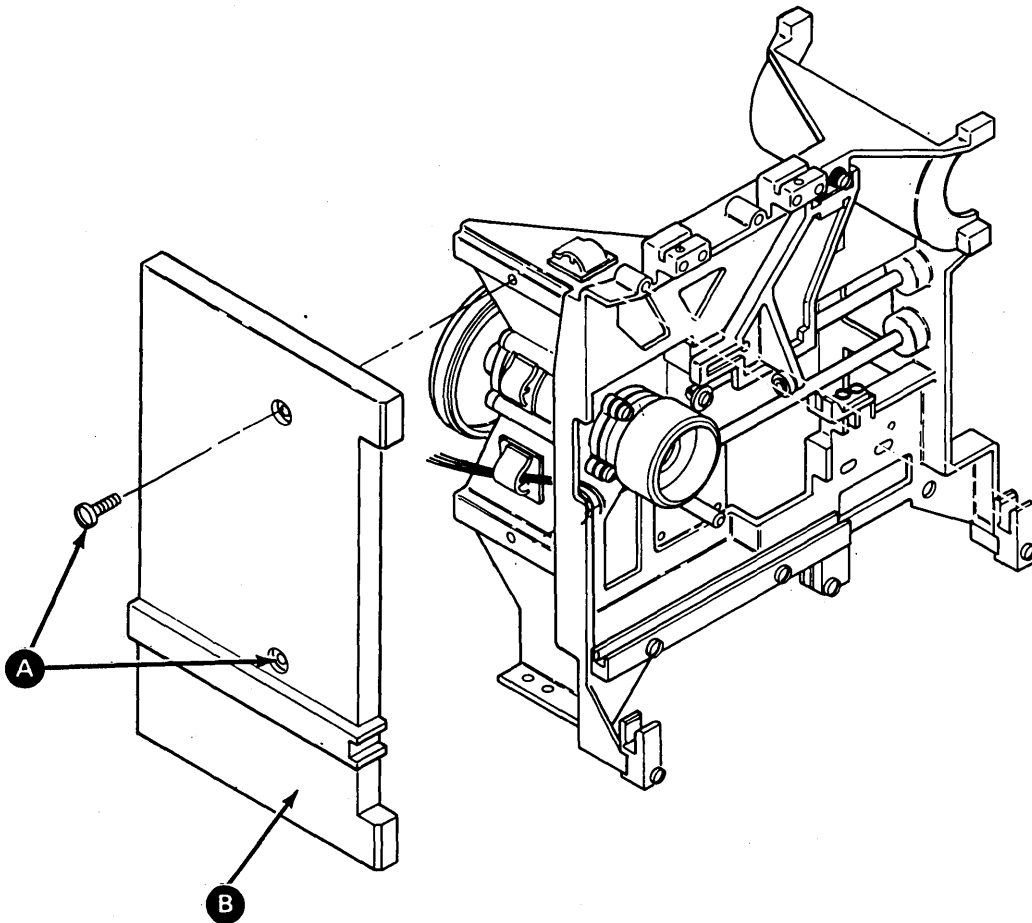
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27-670 DISKETTE DRIVE ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Diskette Drive Assembly

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Disconnect the drive motor AC cable **E**.

3. Disconnect the head cable **K** from the control card.

4. Disconnect the diskette drive stepper motor/sensor cable (A1) **A** from the control card.

5. Remove the ground wire **C** from the control card bracket screw **B**.

6. If the 72MD has the old style picker, disconnect the leads **J** from the diskette in switch.

7. Remove the three screws **F** from the driver board bracket **G** and remove the bracket.

8. Remove the diskette drive bezel (see paragraph 27-665).

9. Remove the three mounting screws **D** (and star washers) for the diskette drive assembly. (One at the carriage bed end and two in the rear.)

10. Lift the drive assembly from the locating pins **H**.

Reinstalling the Diskette Drive Assembly

1. Reinstall the diskette drive assembly on the locating pins **H** and fasten it with the three mounting screws **D** (and star washers). (One at the carriage bed end and two in the rear.) Ensure the safety ground wire is attached while tightening the screws.

2. Reinstall the diskette drive bezel (see paragraph 27-665).

3. If the 72MD has the old style picker, connect the leads **J** to the diskette in switch.

4. Connect the diskette drive stepper motor/sensor cable (A1) **A** to the control card.

5. Attach the ground wire **C** to the control card bracket screw **B**.

6. Connect the head cable **K** to the control card.

7. Reinstall the driver board bracket **G** using the three screws **F**.

8. Connect the drive motor AC cable **E**.

9. Reinstall the picker/cam casting assembly (see paragraph 27-400).

Old Style Tray

New Style Tray
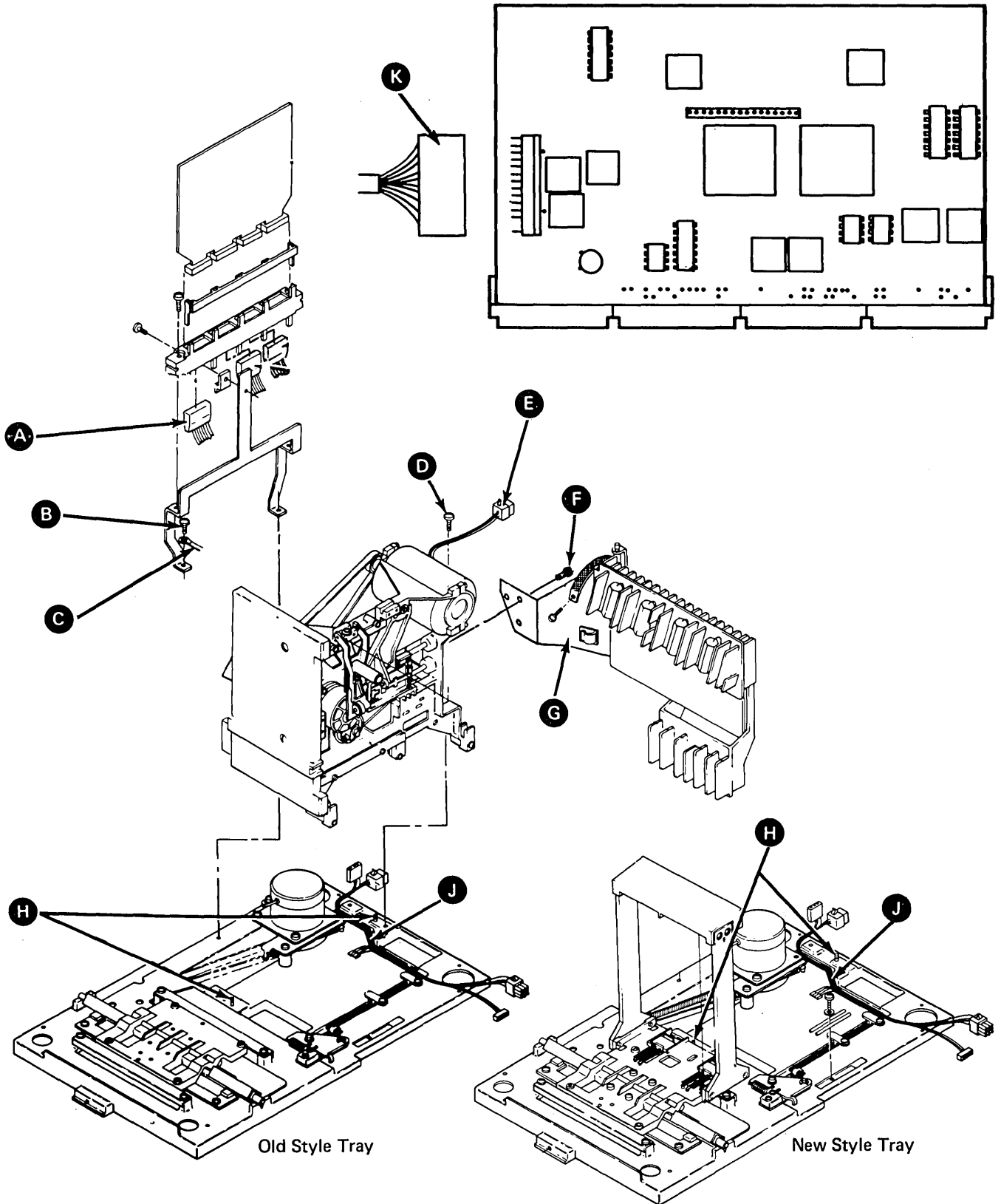
**27-675   INDEX SENSE ALIGNMENT
             SERVICE CHECK**

1.   Place the 72MD unit in the service position (see
      paragraph 27-205).

2.   Remove the diskette drive bezel (see paragraph
      27-665).

3.   Loosen the two LED mounting screws **F** that are
      located on the picker/cam casting assembly.

4.   Insert the alignment pins **D** to align the LED
      assembly **E** to the PTX assembly **G**. (Insert the
      pins from the diskette drive assembly side.)

5.   Tighten the two LED mounting screws **F**.

6.   Remove the alignment pins **D**.

7.   Reinstall the diskette drive bezel (see paragraph
      27-665)

8.   Return the 72MD from the service position (see
      paragraph 27-205).

**27-680   INDEX SENSE LED OUTPUT SERVICE
             CHECK**

1.   Open the front left side cover.

2.   Loosen the two front safety shield screws and
      remove the two rear safety shield screws and the
      safety shield.

3.   Set Power to I (operator panel).

4.   For the old style picker, connect the negative
      probe of a multimeter to test pin TPA-12 **H**
      (ground) on the control card.

      For the new style picker, connect the negative
      probe of a multimeter to test pin TPA-13 **H**
      (ground) on the control card.

5.   Set the multimeter scale to 5 Vdc and connect the
      positive probe to test pin TPA-2 **J** (53FD LED
      anode).

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

7.   Move the positive probe to test pin TPA-1 **K**
      (33FD LED anode).

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

**27-685   INDEX SENSE LED ASSEMBLY
             REMOVAL AND REPLACEMENT**

Removing the Diskette Sense LED Assembly

1.   Remove the picker/cam casting assembly (see
      paragraph 27-400).

2.   Remove the drive assembly bezel (see paragraph
      27-665).

3.   Remove the two screws **B** and the clamp **A**
      from the sensor cable connector located near the
      top of the picker/cam casting.

4.   Remove the LED leads (the wrapped leads are for
      the 33FD LED) from the sensor cable connector
      (lift the tabs in the connector with a small
      screwdriver).

5.   Remove the two mounting screws **F** and nuts
      from the LED assembly.

6.   Remove the LED assembly **E**.

Reinstalling the Index Sense LED Assembly

1.   Reinstall the index sense LED assembly **E** on the
      casting and fasten it with the two mounting
      screws **F** and two nuts. (Do not tighten.)

2.   Reinstall the picker/cam casting assembly (see
      paragraph 27-400). Do not reinstall the 72MD unit
      at this time.

3.   Insert the alignment pins **D** to align the LED
      assembly **E** and the PTX assembly **G** and tighten
      the two screws **F**. Then remove the alignment
      pins.

4.   Insert the LED leads (the wrapped leads are for
      the 33FD LED) into the cable connector. Ensure
      that the locking tabs on the terminals lock in the
      connector slots.

5.   Reinstall the sensor cable connector, clamp **A**,
      and the two screws **B** on the picker/cam casting.

6.   Reinstall the drive assembly bezel (see paragraph
      27-665).

7.   Reinstall the 72MD unit (see paragraph 27-200).
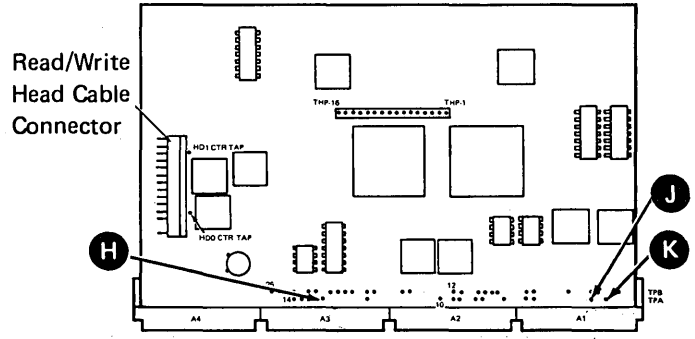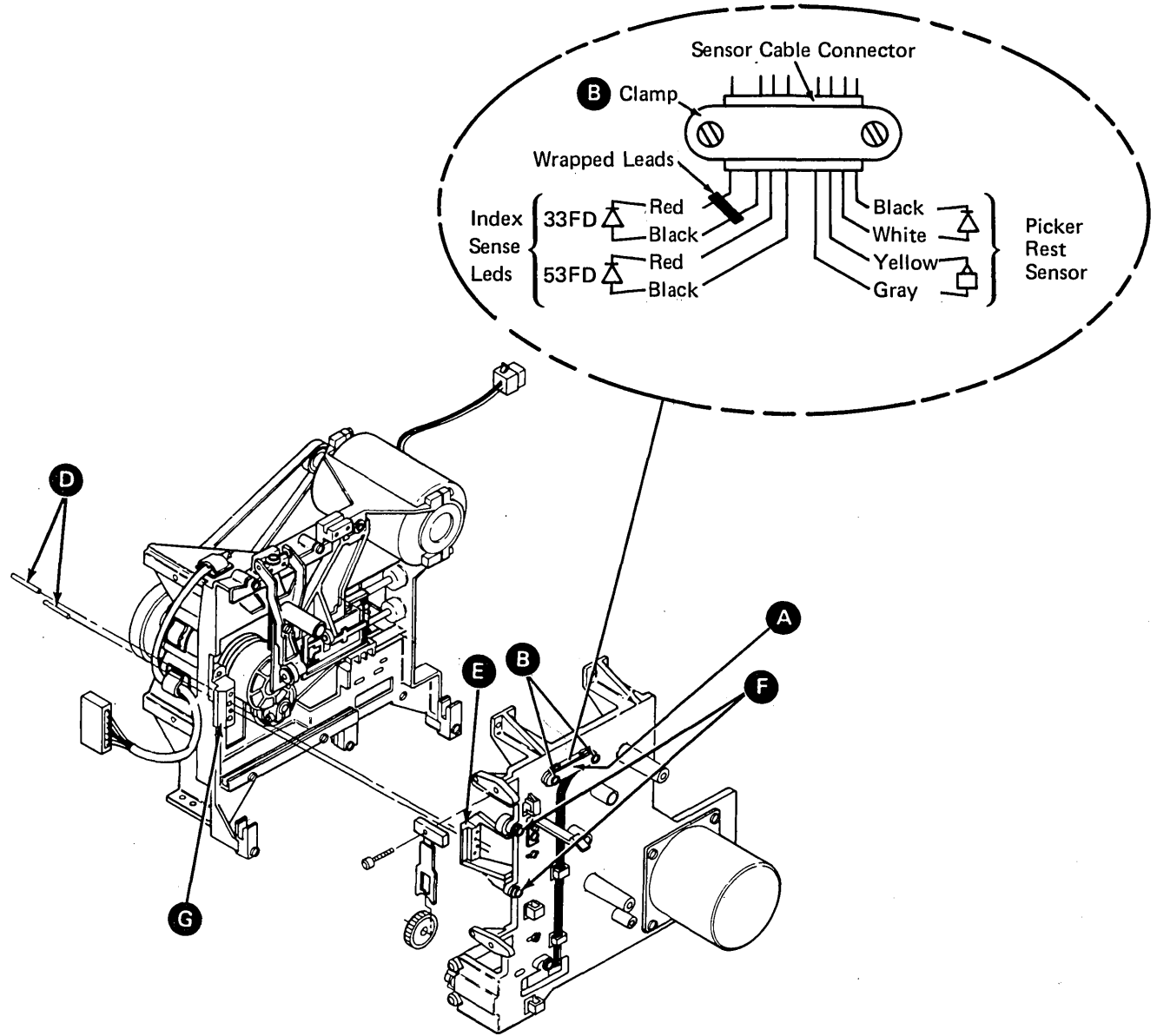
Sensor Cable Connector

B Clamp

Wrapped Leads

Index Sense Leds
{
33FD — Red / Black
53FD — Red / Black
}

{
Black
White
Yellow
Gray
}
Picker Rest Sensor

D

E **B** **A** **F**

G

27

Read/Write Head Cable Connector

THP-16   THP-1

HD1 CTR TAP

HD0 CTR TAP

H   **J** **K**

A4   A3   A2   A1   TPR TPA

Note: See paragraph 27-820 for control card test pins for the old style picker.

Read/Write Head Cable Connector

THP-16   THP-1

HD1 CTR TAP

HD0 CTR TAP

H   **J** **K**

A4   A3   A2   A1   TPR TPA
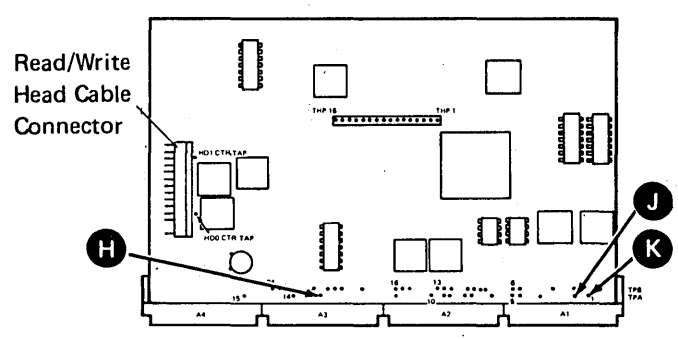
Note: See paragraph 27-820 for control card test pins for the new style picker.

27-690 INDEX SENSE PTX OUTPUT SERVICE CHECK

CAUTION

Always perform this service check with a diskette inserted backward (with the label facing the hub pulley), so that the LED (light-emitting diode) does not cause a wrong service check or destroy the PTX.

_____
_____
_____
_____
_____
_____

1. Remove power and the 72MD unit (see paragraph 27-200).

2. Disconnect the drive motor AC power cable **K** and driver board connector J3 **J**.

DANGER
Voltage is still present at the power connector when it is disconnected and power is on.

_____
_____
_____
_____
_____

3. Set Power to I (operator panel).

4. Place the picker assembly to the rear of the unit.

5. Insert a diskette backward until it touches the collet.

6. For the old style picker, connect the positive probe of a multimeter (15 Vdc scale) to test pin TPB-14 **L** (+index) on the control card.

   For the new style picker, connect the positive probe of a multimeter (15 Vdc scale) to test pin TPB-16 **L** (+index) on the control card.

7. For the old style picker, connect the negative probe of the multimeter to test pin TPA-12 **M** (ground).

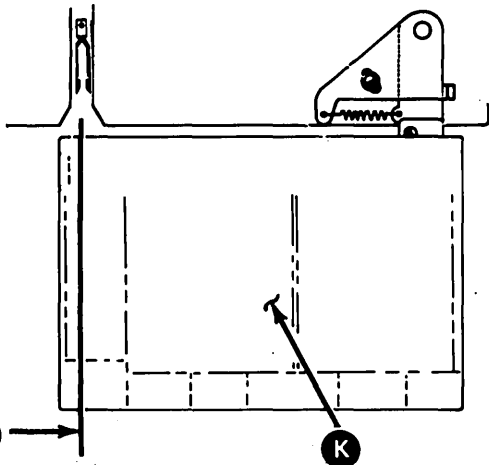   For the new style picker, connect the negative probe of the multimeter to test pin TPA-13 **M** (ground).

8. Check the multimeter for a reading of less than 1 Vdc.

9. Install one end of a jumper to test pin TPB-2 **P** (53FD PTX emitter).

10. For the old style picker, while observing the multimeter, touch the other end of the jumper to test pin TPA-11 **N** (+5 volts) several times. The multimeter should read 2.5 Vdc or more when the test pin is touched. (A wrong reading can occur the first time the test pin is touched.)

    For the new style picker, while observing the multimeter, touch the other end of the jumper to test pin TPA-15 **N** (+5 volts) several times. The multimeter should read 2.5 Vdc or more when the test pin is touched. (A wrong reading can occur the first time the test pin is touched.)

11. Repeat steps 9 and 10 with the jumper on test pin TPB-1 **O** (33FD PTX emitter).

12. Set Power to 0 (operator panel).

13. Remove the jumper.

14. Remove the diskette.

15. Connect the drive motor AC power cable **K** and driver board connector J3 **J**.

16. Reinstall the 72MD unit (see paragraph 27-200).
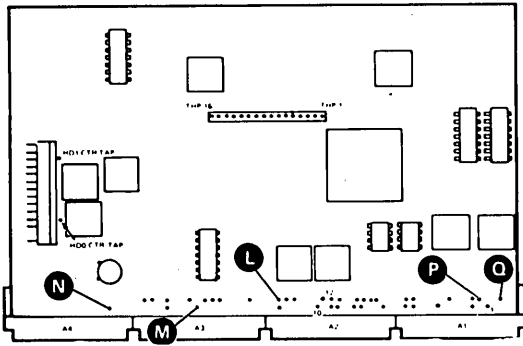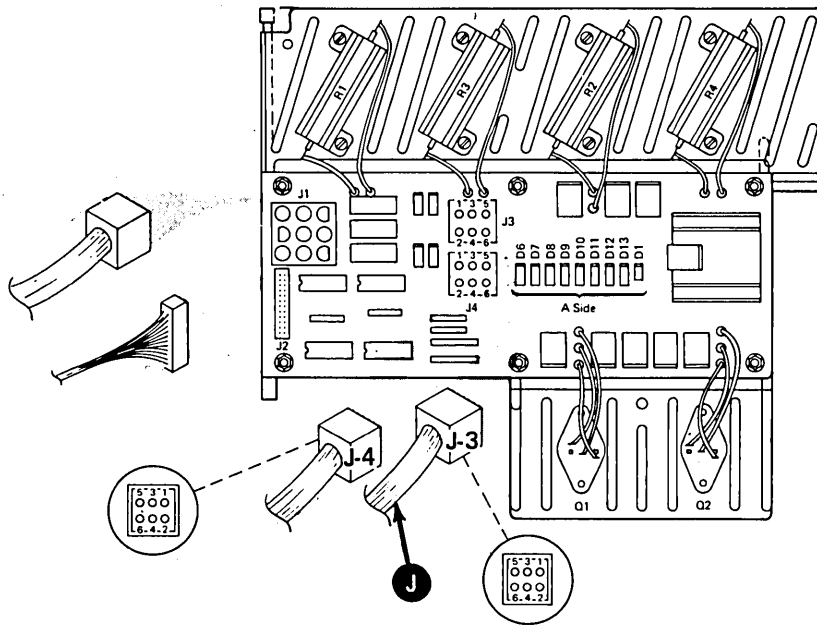
Note: See paragraph 27-820 for control card test pins for the new style picker.
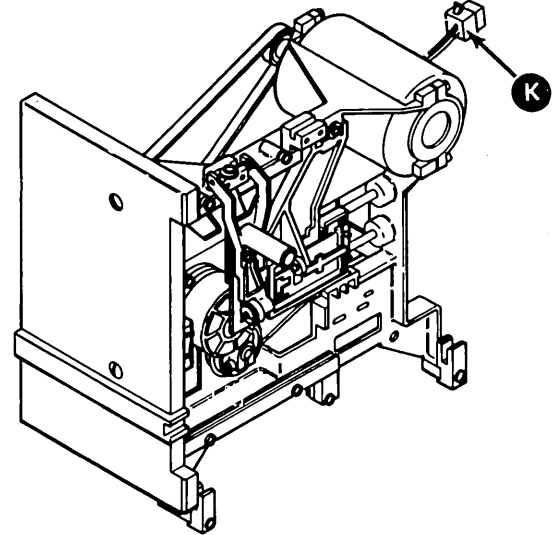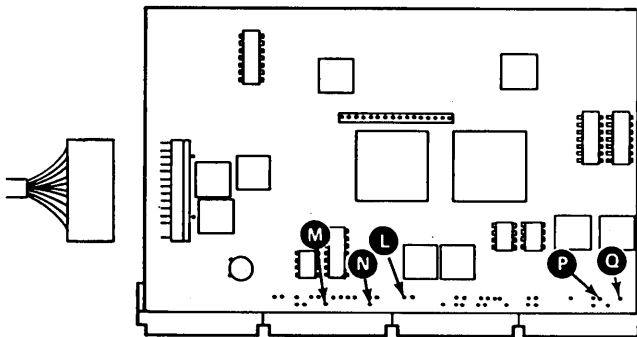
Note: See paragraph 27-820 for control card test pins for the old style picker.

27

27-695 INDEX SENSE PTX ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Index Sense PTX Assembly

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the diskette drive assembly bezel (see paragraph 27-665).

3. Disconnect the diskette drive stepper motor/sensor cable (A1) **A** from the control card.

4. Remove the two screws **C** and the two connector covers **B**.

5. Remove the PTX leads (the wrapped leads are for the 33FD PTX) from the cable connector by pushing down on the terminal tabs with a small screwdriver.

6. Remove the two mounting screws **G** from the PTX assembly **H**.

7. Remove the PTX assembly **H**.

Reinstalling the Index Sense PTX Assembly

1. Reinstall the PTX assembly **H** on the casting and fasten it with the two mounting screws **G**.

2. Loosen the two mounting screws **F** for the LED assembly **E** on the picker/cam casting.

3. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.

4. Insert the alignment pins **D** and align the LED assembly **E** to the PTX assembly **H** and tighten the two screws **F**.

5. Insert the PTX leads (the wrapped leads are for the 33FD PTX) into the cable connector. Ensure that the locking tabs on the terminals lock in the connector slots.

6. Reinstall the connector covers **B** and the two screws **C**.

7. Connect the diskette drive stepper motor/sensor cable (A1) **A** to the control card.

CAUTION
Ensure that the cables are located in the slot in the casting when installing the diskette drive assembly bezel.
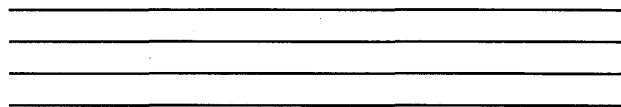
8. Reinstall the diskette drive assembly bezel (see paragraph 27-665).

9. Reinstall the 72MD unit (see paragraph 27-200).

33FD {
Black D02
Yellow D03

53FD {
Black D04
Yellow D05

Yellow
Black

33FD
(wrap

27

27-695

72MD Diskette Magazine Drive   95
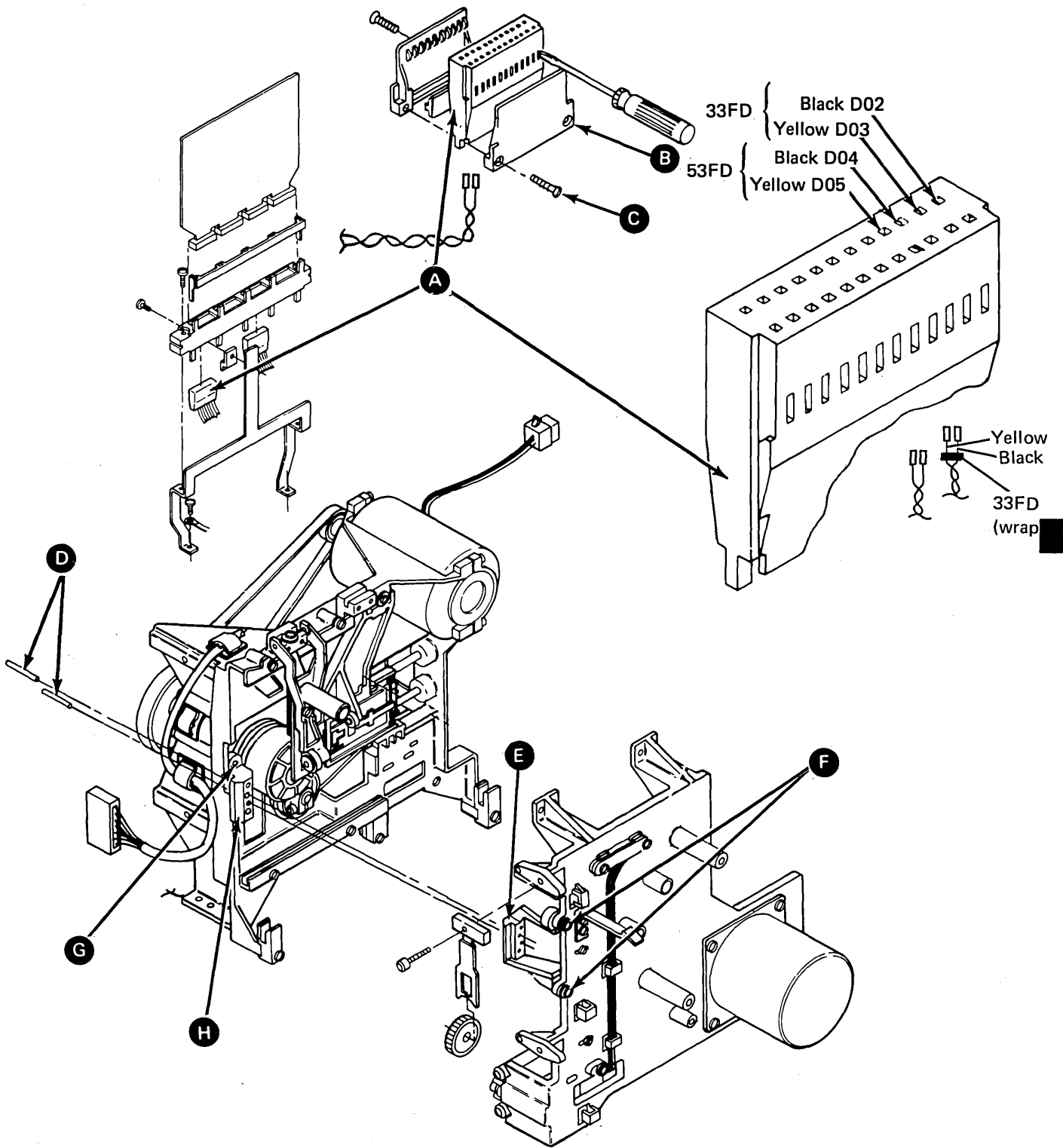
27-700   DISKETTE SPEED SERVICE CHECK

This service check must have a diskette engaged to the hub and the read/write heads must be loaded at cylinder 00.

1.   Open the front left side cover.

2.   Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3.   Set Power to I (operator panel).

4.   Clamp a diskette to the hub and load the read/write heads at cylinder 00 as follows:
      – Set the Mode Selector switch to the Proc Run position (CE panel).
      – Set the Address/Data switches to FF00 (CE panel).
      – Set the MSIPL switch to the Diskette position (CE panel).
      – Set the CSIPL switch to the Diskette position (CE panel).
      – Set all other CE panel switches to their down position.

      • Insert a scratch diskette.

      • Press the Load switch (operator panel).

Note: The Load light remains on during this service check. Press the Reset switch (CE panel) to release the loaded heads and to eject the diskette.

5.   Set up an oscilloscope as follows:

Note: Use a Tektronix 453, 454, or a similar scope 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	1.0 V/cm
Channel 1 input	DC
Times per division	10 ms
Channel 1 probe	(See note)

Note: For the old style picker, connect the channel 1 probe to TPB–14 (+index). For the new style picker, connect the channel 1 probe to TPB–16 (+index).

6.   Observe an index pulse width of 0.75 to 1.5 milliseconds occurring each 83.3 ± 2.1 milliseconds. Pulse amplitude should be between 2.4 Vdc and 4.2 Vdc.

7.   Reinstall the safety shield using the four screws.

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27

27-800   DRIVER BOARD OUTPUT TO THE PICKER/CAM STEPPER MOTOR SERVICE CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3. Set Power to I (operator panel).

4. Connect the negative probe of a multimeter to test pin THP-1 **C** (ground). With the positive probe measure the voltage at point **A** on diodes 7 and 9 (3.5 Vdc to +4.7 Vdc).

5. Access the read/write head carriage to single step the picker/cam stepper motor as follows: (Do not access the read/write head carriage more than one cylinder at a time.)
   - Set the Mode Selection switch to the Proc Run position (CE panel).
   - Set the Address/Data switches to hexadecimal F800 (CE panel).
   - Set all CE panel switches to their down position.
   - Press the Load switch (operator panel).
   - Select the exerciser option.
   - Select the diskette option.
   - Select the stepper motor step test option and the read/write head carriage will move to cylinder 40.
   - Install a jumper from THP-3 **B** (single step picker) to THP-1 **C** (ground).
   - Use the advance motor option of the stepper motor test to single step the picker/cam stepper motor.

Note: This procedure uses the read/write head carriage control circuits to move the picker/cam motor. Therefore, be careful to prevent damaging the read/write head circuit as well as the read/write head carriage assembly.

DANGER
Parts of the driver board become hot after continuous use.

_____
_____
_____
_____

6. For the old style picker, probe test pin TPB-23 **D** (-picker motor) for a down level. If the output is not at the desired level, perform the control card output check (see paragraph 27-850).

   For the new style picker, probe test pin TPB-22 **D** (-picker motor) for a down level. If the output is not at the desired level, perform the control card output check (see paragraph 27-850).

7. For the old style picker, connect the negative probe of a multimeter to test pin TPA-12 **E** (ground). With the positive probe, measure the voltages at point **A** on diodes D6, D7, D8, and D9. The voltages should compare with those shown on the chart when single stepping. The measured not active level (measured when single stepping) should be higher than the detent voltage measured in step 4.

   For the new style picker, connect the negative probe of a multimeter to test pin TPA-13 **E** (ground). With the positive probe, measure the voltage at point **A** on diodes D6, D7, D8, and D9. The voltages should compare with those shown on the chart when single stepping. The measured not active level (measured when single stepping) should be higher than the detent voltage measured in step 4.

8. Remove the jumper.

9. Reinstall the safety shield using the four screws.

TEST POINTS

Read/Write Control Line	Picker Motor Test Point	Bed Motor Test Point
Auto Step 0	D6-A	D12-A
Auto Step 1	D8-A	D10-A
Auto Step 2	D7-A	D13-A
Auto Step 3	D9-A	D11-A

Condition of Stepper Motor Phases at:

Cyl 40	Cyl 41	Cyl 42	Cyl 43	Cyl 44
1	0	0	1	1
1	1	0	0	1
X	1	1	0	X
X	0	1	1	X

0 = Not active level 5.0 Vdc or more at point A
1 = Active level 0.5 Vdc to 1.1 Vdc at point A
X = When at detent position, 3.5 Vdc to 4.7 Vdc at point A
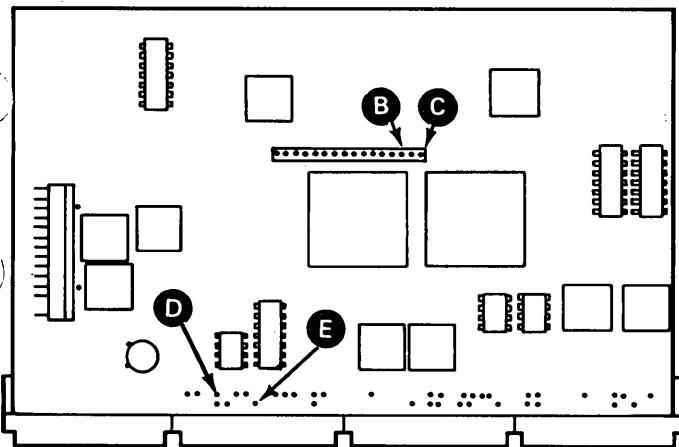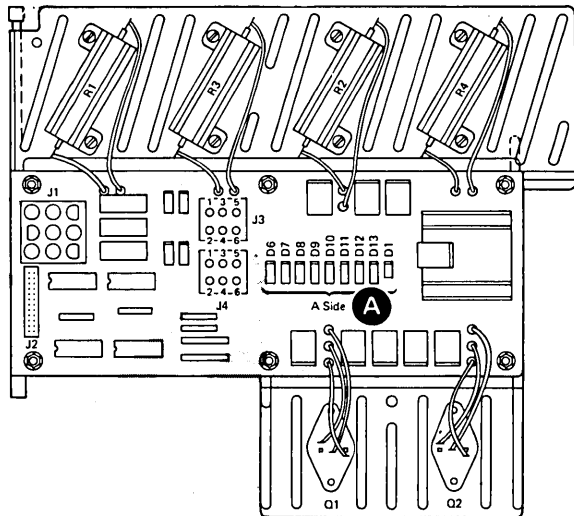
27

Note: See paragraph 27-820 for control card test pins for the old style picker.
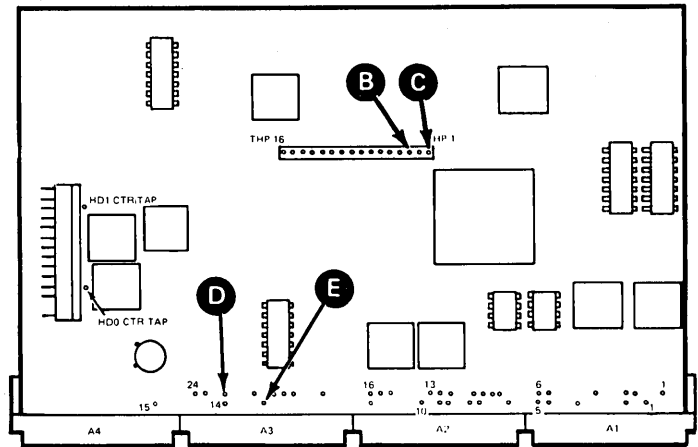
Note: See paragraph 27-820 for control card test pins for the new style picker.

27-805 DRIVER BOARD OUTPUT TO THE CARRIAGE BED STEPPER MOTOR SERVICE CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3. Set Power to I (operator panel).

4. Connect the negative probe of a multimeter to test pin THP-1 **C** (ground). With the positive probe measure the voltage at point **A** on diodes 11 and 13 (3.5 Vdc to 4.7 Vdc).

5. Access the read/write head carriage to single step the carriage bed stepper motor as follows: (Do not access the read/write head carriage more than one cylinder at a time.)
   - Set the Mode Selector switch to the Proc Run position (CE panel).
   - Set the Address/Data switches to F800 (CE panel).
   - Set all CE panel switches to their down position.
   - Press the Load switch (operator panel).
   - Select the exerciser option.
   - Select the diskette option.
   - Select the stepper motor step test option and the read/write head carriage will move to cylinder 40.
   - Install a jumper from THP-4 **B** (single step bed) to THP-1 **D** (ground).
   - Use the advance motor option of the stepper motor test to single step the bed stepper motor.

Note: This procedure uses the read/write head carriage circuits to move the carriage bed stepper motor. Therefore, be careful to prevent damaging the read/write head carriage control circuits as well as the read/write carriage assembly.

DANGER
Parts of the driver board become hot after continuous use.

_____
_____
_____
_____
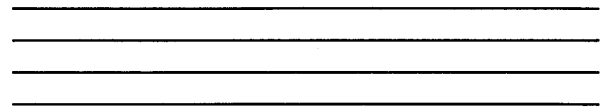
6. For the old style picker, probe test pin TPB-24 **D** (-bed motor) for a down level. If the output is not at the desired level, perform the control card output check (see paragraph 27-850).

   For the new style picker, probe test pin TPB-23 **D** (-bed motor) for a down level. If the output is not at the desired level, perform the control card output check (see paragraph 27-850).

7. For the old style picker, connect the negative probe of a multimeter to test pin TPA-12 **E** (ground). With the positive probe measure the voltage at point **A** on diodes D10, D11, D12, and D13. The voltages should compare with those shown on the chart when single stepping. The measured not active level voltage (measured when single stepping) should be higher than the detent voltage measured in step 4.

   For the new style picker, connect the negative probe of a multimeter to test pin TPA-13 **E** (ground). With the positive probe measure the voltage at point **A** on diodes D10, D11, D12, and D13. The voltages should compare with those shown on the chart when single stepping. The measured not active level voltage (measured when single stepping) should be higher than the detent voltage measured in step 4.

8. Remove the jumper.

9. Reinstall the safety shield using the four screws.

TEST POINTS

Read/Write Control Line	Picker Motor Test Point	Bed Motor Test Point
Auto Step 0	D6-A	D12-A
Auto Step 1	D8-A	D10-A
Auto Step 2	D7-A	D13-A
Auto Step 3	D9-A	D11-A

Condition of Stepper Motor Phases at:

Cyl 40	Cyl 41	Cyl 42	Cyl 43	Cyl 44
1	0	0	1	1
1	1	0	0	1
X	1	1	0	X
X	0	1	1	X

0 = Not active level +5.0 V or more at point A
1 = Active level +0.5 V to +1.1 V at point A
X = When at detent position, +3.5 V to +4.7 V at point A
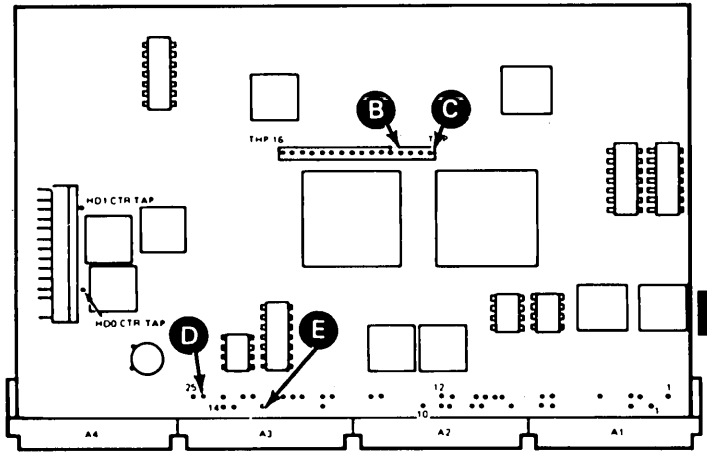
Note: See paragraph 27-820 for control card test pins for the old style picker.
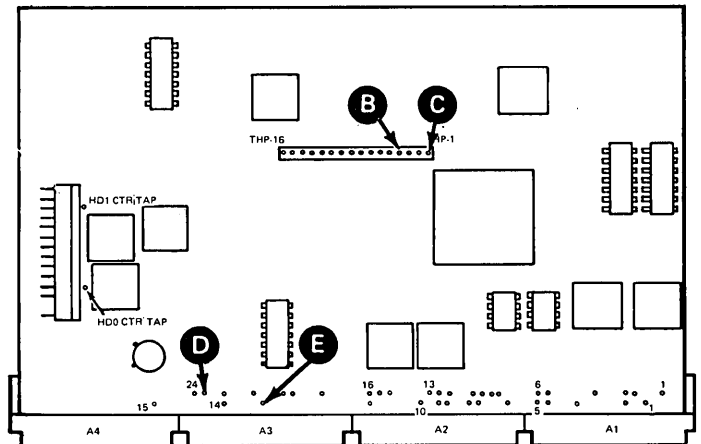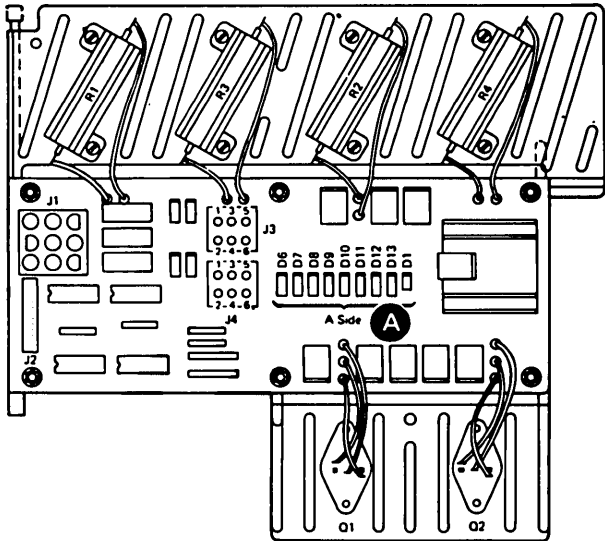
Note: See paragraph 27-820 for control card test pins for the new style picker.

27-810   DRIVER BOARD ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Driver Board Assembly

1. Remove power and the 72MD unit (see paragraph 27-200).

2. If the two driver board shipping bolts **G** are still in place, remove them.

3. Release the gate spring latch **H** and open the driver board gate assembly **B**.

4. Disconnect the DC cable J1 **C**.

5. Disconnect the control card cable J2 **D**.

6. Disconnect the two stepper motor cables J3 **E** and J4 **F**.

7. Remove the driver board ground strap **A**.

8. Lift the driver board assembly up and pivot the bottom hinge pin away from the hinge bracket to remove the driver board assembly.

Reinstalling the Driver Board Assembly

1. Insert the top hinge pin into the single bracket and pivot the bottom hinge pin into the open hinge to mount the driver board assembly.

2. Connect the two stepper motor cables J3 **E** and J4 **F**.

3. Connect the control card cable J2 **D**.

4. Connect the DC cable J1 **C**.

5. Connect the driver board ground strap **A**.

6. Close the driver board gate until the spring latch **H** engages.

7. Reinstall the 72MD unit (see paragraph 27-200).

J1

12

1

Not used J2

C

D

J-4 E

J-3 F

J3

J4

A Side

D6 D7 D8 D9 D10 D11 D12 D13 D1

R1 R3 R2 R4

Q1 Q2

A

B

G

H

27
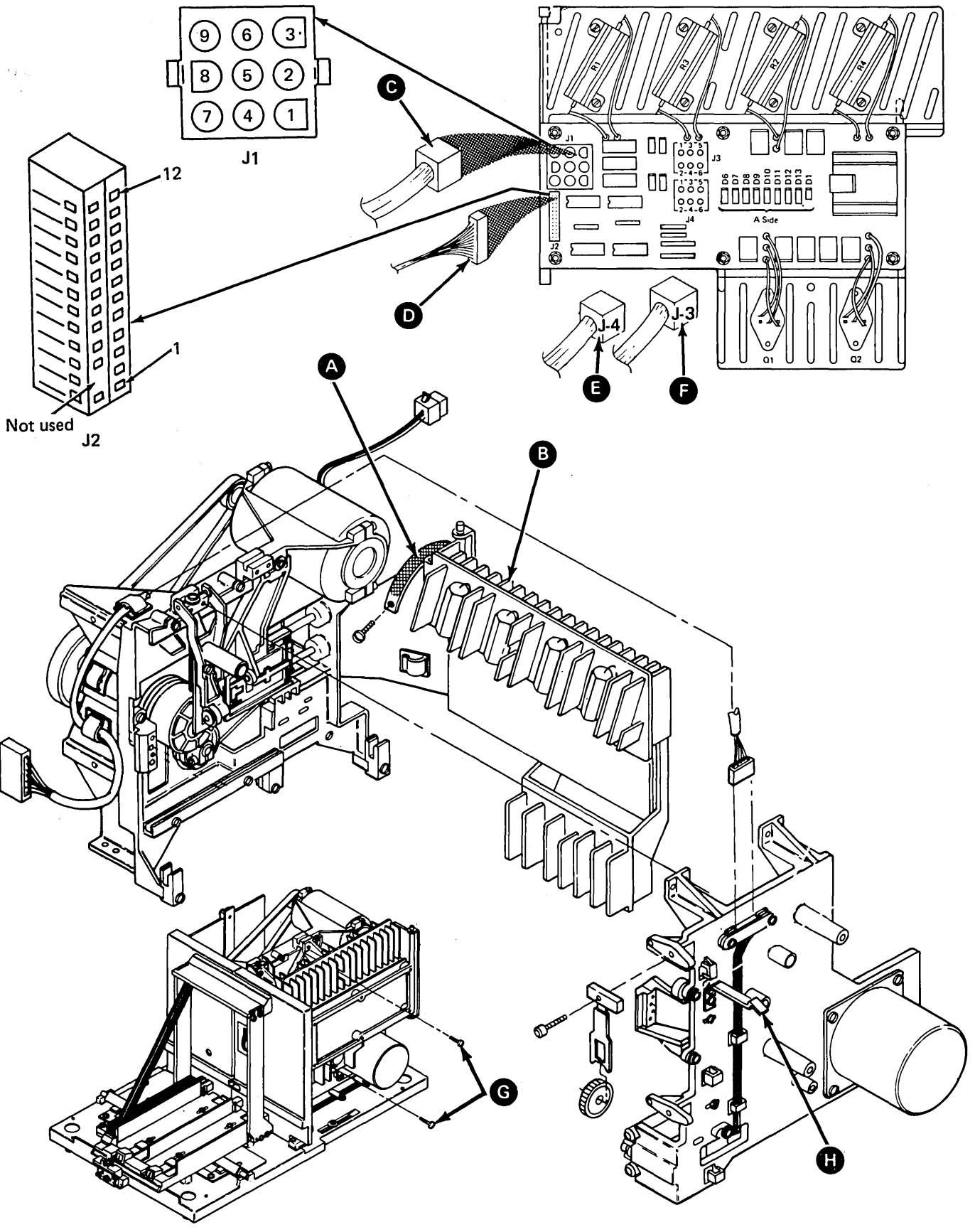
27-815 CONTROL CARD REMOVAL AND REPLACEMENT

Removing the Control Card

1. Set Power to O (operator panel).

2. Open the front left side cover.

3. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

4. Disconnect the read/write head cable **C**.

5. Remove the card retainer **B** at the top of the card.

6. Remove the card **A**.

Reinstalling the Control Card

1. Reinstall the control card **A**.

2. Attach the card retainer **B** at the top of the card.

3. Connect the read/write head cable **C**.

4. Reinstall the safety shield using the four screws.

5. Close the front left side cover.

Note: See paragraph 27-820 for control card test pins.

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27
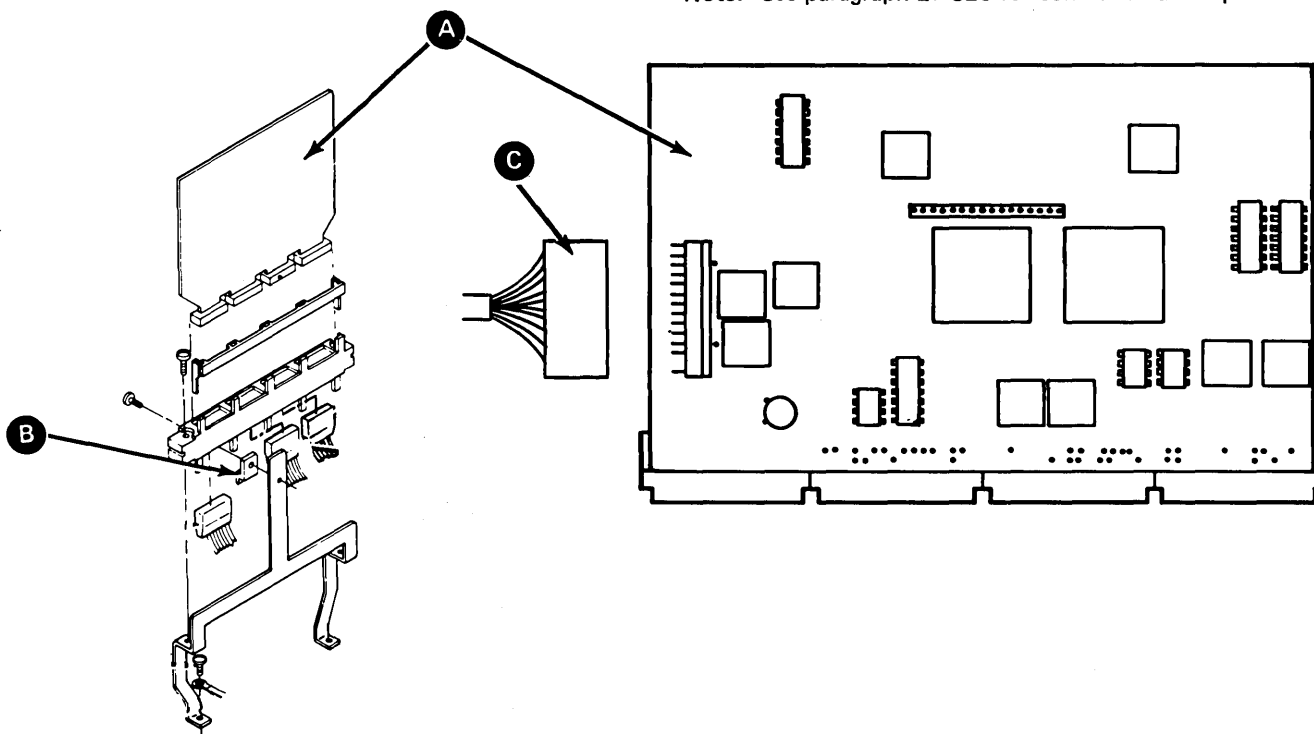
Machines with Old Style Picker

TPA-1	33FD LED anode
TPA-2	53FD LED anode
TPA-3	Head motor MC-2 (yellow)
TPA-4	Head motor MC-3 (blue)
TPA-5	+Write data/+500 kHz osc.
TPA-6	+Erase gate
TPA-7	+Write gate
TPA-8	+Inner tracks/+command 5
TPA-9	+Head select/+command P
TPA-10	+Erase current sense/+status C
TPA-11	+5 volts
TPA-12	Ground
TPA-13	+24 volts
TPA-14	-5 volts

THP-1	Ground
THP-2	Head reference (CE mode)
THP-3	Single step picker
THP-4	Single step bed
THP-5	Picker extended
THP-6	-AGC out
THP-7	+AGC out
THP-8	Ground
THP-9	Control voltage
THP-10	
THP-11	
THP-12	+14.3 volts
THP-13	
THP-14	-VGA in preamp TP-1
THP-15	+VGA in preamp TP-2
THP-16	Ground

TPB-1	33FD PTX emitter
TPB-2	53FD PTX emitter
TPB-3	Picker PTX collector
TPB-4	Picker LED anode
TPB-5	Head motor MC-0 (orange)
TPB-6	Head motor MC-1 (red)
TPB-7	+Access 0/+command 0
TPB-8	+Access 1/+command 1
TPB-9	+Access 2/+command 2
TPB-10	+Access 3/+command 3
TPB-11	+enable autoloader
TPB-12	+File data/xxxx
TPB-13	+Switch filter/+command 4
TPB-14	+Index
TPB-15	-Diskette In
TPB-16	-Bed orient switch
TPB-17	-Window open
TPB-18	+Auto step 0
TPB-19	+Auto step 1
TPB-20	+Auto step 2
TPB-21	+Auto step 3
TPB-22	-Window magnet
TPB-23	-Picker motor
TPB-24	-Bed motor
TPB-25	+Cover open
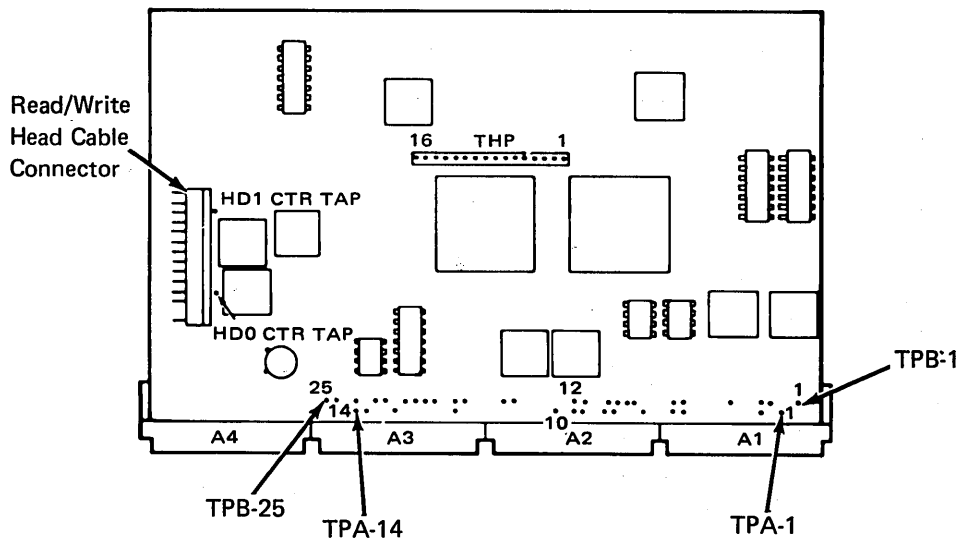
Machines with New Style Picker

TPA-1	33FD LED anode
TPA-2	53FD LED anode
TPA-3	+24 volts
TPA-4	Head motor MC-2 (yellow)
TPA-5	Head motor MC-3 (blue)
TPA-6	+Write data/+500 kHz osc.
TPA-7	+Erase gate
TPA-8	+Write gate
TPA-9	+Inner tracks/+command 5
TPA-10	+Head select/+command P
TPA-11	+Erase current sense/+status C
TPA-12	XXXX/+status D
TPA-13	Ground
TPA-14	-5 volts
TPA-15	+5 volts

THP-1	Ground
THP-2	Head reference (CE mode)
THP-3	Single step picker
THP-4	Single step bed
THP-5	Picker extended
THP-6	-AGC out
THP-7	+AGC out
THP-8	Ground
THP-9	Control voltage
THP-10	
THP-11	
THP-12	+14.3 volts
THP-13	
THP-14	-VGA in preamp TP-1
THP-15	+VGA in preamp TP-2
THP-16	Ground

TPB-1	33FD PTX emitter
TPB-2	53FD PTX emitter
TPB-3	Picker PTX collector
TPB-4	Picker LED anode
TPB-5	Head motor MC-0 (orange)
TPB-6	Head motor MC-1 (red)
TPB-7	+Access 0/+command 0
TPB-8	+Access 1/+command 1
TPB-9	+Access 2/+command 2
TPB-10	+Access 3/+command 3
TPB-11	+enable autoloader
TPB-12	+File data/XXXX
TPB-13	+Diskette 2/status B
TPB-14	XXXX/+status A
TPB-15	+Switch filter/+command 4
TPB-16	+Index
TPB-17	-Bed orient switch
TPB-18	+Auto step 0
TPB-19	+Auto step 1
TPB-20	+Auto step 2
TPB-21	+Auto step 3
TPB-22	-Picker motor
TPB-23	-Bed motor
TPB-24	+Cover open

27

Read/Write Head Cable Connector

16 THP 1

HD1 CTR TAP

HD0 CTR TAP

15 24 14 16 13 6 1 — TPB-1

10 5

A4 A3 A2 A1

TPB-24   TPA-14   TPA-1
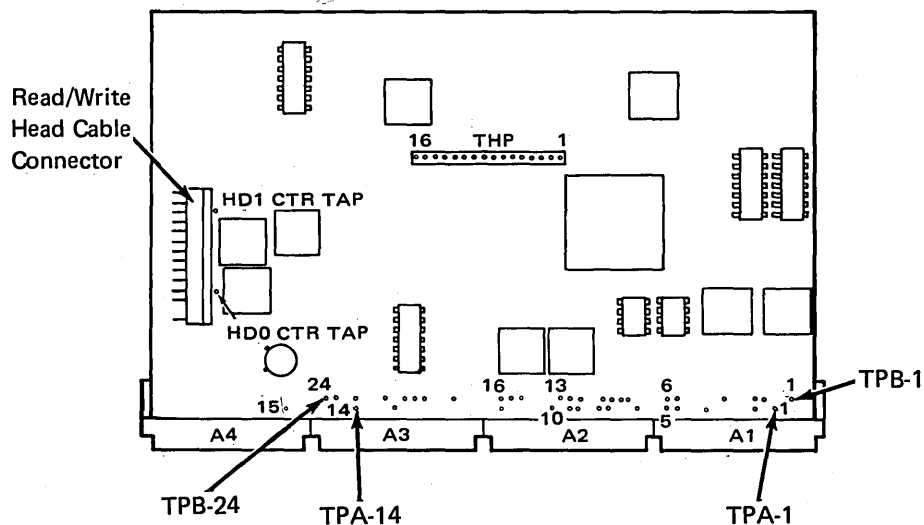
I/O Pin	B02/D02 Line Name
B02	33FD PTX Collector
B03	33FD PTX Emitter
B04	53FD PTX Collector
B05	53FD PTX Emitter
B06	Picker PTX Collector
B07	Picker PTX Emitter
B08	Picker LED Anode
B09	Picker LED Cathode
B10	Erase and Write Detect
B11	−Diskette 2
B12	Head Motor Phase 0
B13	Head Motor Phase 1
D02	
D03	+5 Volts (reserved)
D04	33FD LED Anode
D05	33FD LED Cathode
D06	53FD LED Anode
D07	53FD LED Cathode
D08	Ground (reserved)
D09	
D10	Head Motor Common (+24 volts)
D11	
D12	Head Motor Phase 2
D13	Head Motor Phase 3

I/O Pin	G02/J02 Line Name
G02	+Access 0/+Command 0
G03	+Access 1/+Command 1
G04	+Access 2/+Command 2
G05	+Access 3/+Command 3
G06	+Enable Autoloader
G07	+File Data/XXXX
G08	+Diskette 2 Sense/+Status B
G09	−Drive Sense
G10	
G11	XXXX/+Status A
G12	+Switch Filter/+Command 4
G13	+Index
J02	+Write Data/+500 kHz Oscillator
J03	+5 Volts (reserved)
J04	+Erase Gate/XXXX
J05	+Write Gate/XXXX
J06	+Inner Tracks/+Command 5
J07	+Head Select/+Command P
J08	Ground (reserved)
J09	+Erase Current Sense/+Status C
J10	+24 Volts (reserved)
J11	−5 Volts (reserved)
J12	−Power on Reset
J13	XXXX/+Status D

I/O Pin	M02/P02 Line Name
M02	−Diskette-In[1]
M03	−Bed Orient Switch
M04	−Window Open[1]
M05	+Auto Step 0
M06	+Auto Step 1
M07	+Auto Step 2
M08	+Auto Step 3
M09	−Window Solenoid[1]
M10	+24 Volts Window Solenoid[1]
M11	−Picker Motor
M12	−Bed Motor
M13	+Cover Open
P02	Diskette Switch +5[1]
P03	+5 Volts (enters card)
P04	Bed Switch +5
P05	Window Switch +5[1]
P06	Diskette Switch Ground[1]
P07	Bed Switch Ground
P08	Ground (enters card)
P09	Window Switch Ground[1]
P10	+24 Volts (enters card)
P11	−5 Volts (enters card)
P12	VFO Test Mode
P13	−Data Protect

I/O Pin	S02/U02 Line Name
S02	−A Clock
S03	−B Clock
S04	−C Clock
S05	+Gated A Clock
S06	+Gated B Clock
S07	+Gated C Clock
S08	−Disable Abort
S09	−Single Step Picker
S10	−Single Step Bed
S11	−Head Reference
S12	
S13	
U02	−Scan In
U03	+5 Volts (reserved)
U04	−Set Clock Latch
U05	
U06	−Reset Clock/Head Latches
U07	
U08	Ground (reserved)
U09	
U10	
U11	
U12	
U13	

[1] Applies only to machines with the old style picker.

Read/Write Head 0   (white)
Center Tap Read/Write Head 0   (blue)   Head 0 Read/Write
Read/Write Head 0   (black)
Erase Head 0   (red)   Head 0 Erase
Erase Head 0   (yellow)
Cable Shield Head 0
Cable Shield Head 1
Erase Head 1   (yellow)   Head 1 Erase
Erase Head 1   (red)
Read/Write Head 1   (black)
Center Tap Read/Write Head 1   (blue)   Head 1 Read/Write
Read/Write Head 1   (white)

Sensor Cable Connector 3 Pins

Conn A1		Head Connector (see note 1)	Conn A3				
(black) 33FD PTX Collector	D02	B02	M02	D02	– Diskette-In	(orange)	3 Diskette-In Switch (see note 2)
(black) 33FD LED Anode	B04	D04	P02	B02	+5 Volts Diskette-In Switch (yellow)		2
(red) (yellow) 33FD LED Cathode	B05	D05	P06	B06	Gnd Diskette-In Switch (black)		1
(yellow) 33FD PTX Emitter	D03	B03	M03	D03	– Bed Orient	(orange)	3 Orient Switch
(black) 53FD PTX Collector	D04	B04	P04	B04	+5 Volts Bed Orient Switch (yellow)		2
(black) 53FD LED Anode	B06	D06	P07	B07	Gnd Bed Orient Switch (black)		1
(red) (yellow) 53FD LED Cathode	B07	D07	M04	D04	– Window Open	(orange)	3 Window (stripper) Switch
(yellow) 53FD PTX Emitter	D05	B05	P05	B05	+5 Volts Window Sw (yellow)		2
(gray) PTX Collector	D06	B06	P09	B09	Gnd Window Sw (black)		1
(white) (yellow) LED Anode	D08	B08	M09	Db9	– Window Magnet		Window (stripper) Magnet
(black) (black) LED Cathode	D09	B09	M10	D10	+24 Volts Window Magnet		(see note 2)
(yellow) (yellow) PTX Emitter	D07	B07			Window Cable Connector 5 Pins		
(orange) MC-0	D12	B12					
(red) MC-1	D13	B13	M05	D05	+ Auto Step 0	B09	2 (blue/white)
(yellow) MC-2	B12	D12	M06	D06	+ Auto Step 1	B10	4 (white) Picker/Cam Motor
(blue) MC-3	B13	D13	M07	D07	+ Auto Step 2	B11	6 (blue)
(black) Common +24 V	B10	D10	M08	D08	+ Auto Step 3	B12	1 (red)
– Diskette 2	D11	B11	M11	D11	– Picker Motor	B08	3 (black)
Erase and Write Detect	B09	D09	M12	D12	– Bed Motor	B07	5 (red/white)
	D10	B10	M13	D13	+ Cover Open	B06	2 (blue/white)
	B02	D02	P12	B12	VFO Test Mode	B05	4 (white) Carriage Bed Motor

Control Card   Driver Board (see note 3)   J-3   J-2   J-1   J-4

Conn A2				
+ Access 0/+ Command 0	D02	G02	P03	B03 +5 Volts 6 (blue)
+ Access 1/+ Command 1	D03	G03	P08	B08 Ground 1 (red)
+ Access 2/+ Command 2	D04	G04	P10	B10 +24 Volts 3 (black)
+ Access 3/+ Command 3	D05	G05	P11	B11 – 5 Volts 5 (red/white)
+ Enable Auto Loader	D06	G06		B01 Aside of Conn
+ File Data/XXXX	D07	G07		B04
+ Diskette 2 Sense/+ Status B	D08	G08		
– Drive Sense	D09	G09		+ Cover Open
Not used	D10	G10		VFO Test
XXXX/+ Status A	D11	G11		+5 Volts
+ Switch Filter/+ Command 4	D12	G12		Ground
+ Index	D13	G13		+24 Volts
+ Write Data/+500 kHz Osc	B02	J02		–5 Volts
+ Erase Gate/XXXX	B04	J04		
+ Write Gate/XXXX	B05	J05		
+ Inner Tracks/+ Command 5	B06	J06		
+ Head Select/+ Command P	B07	J07		
+ Erase Current Sns/+ Status C	B09	J09		
– Power On Reset	B12	J12		
XXXX/+ Status D	B13	J13		

33FD
53FD
Picker Sensor
Head/Carriage Stepper Motor

27

Notes:

1. See paragraph 27-835 for the location of the head connector.
2. The diskette-in switch, window switch, and window magnet are present only on machines with the old style picker.
3. See paragraph 27-810 for the location of the J connectors.

	Read/Write	(white)
	Center tap R/W	(blue)
Head 1	Read/Write	(black)
	Erase	(red)
	Erase	(yellow)
Cable Shield Gnd		(black)
Cable Shield Gnd		(black)
	Erase	(yellow)
	Erase	(red)
Head 0	Read/Write	(black)
	Center tap R/W	(blue)
	Read/Write	(white)

A14

A03

27

Control
Card

A4	A3	A2	A1
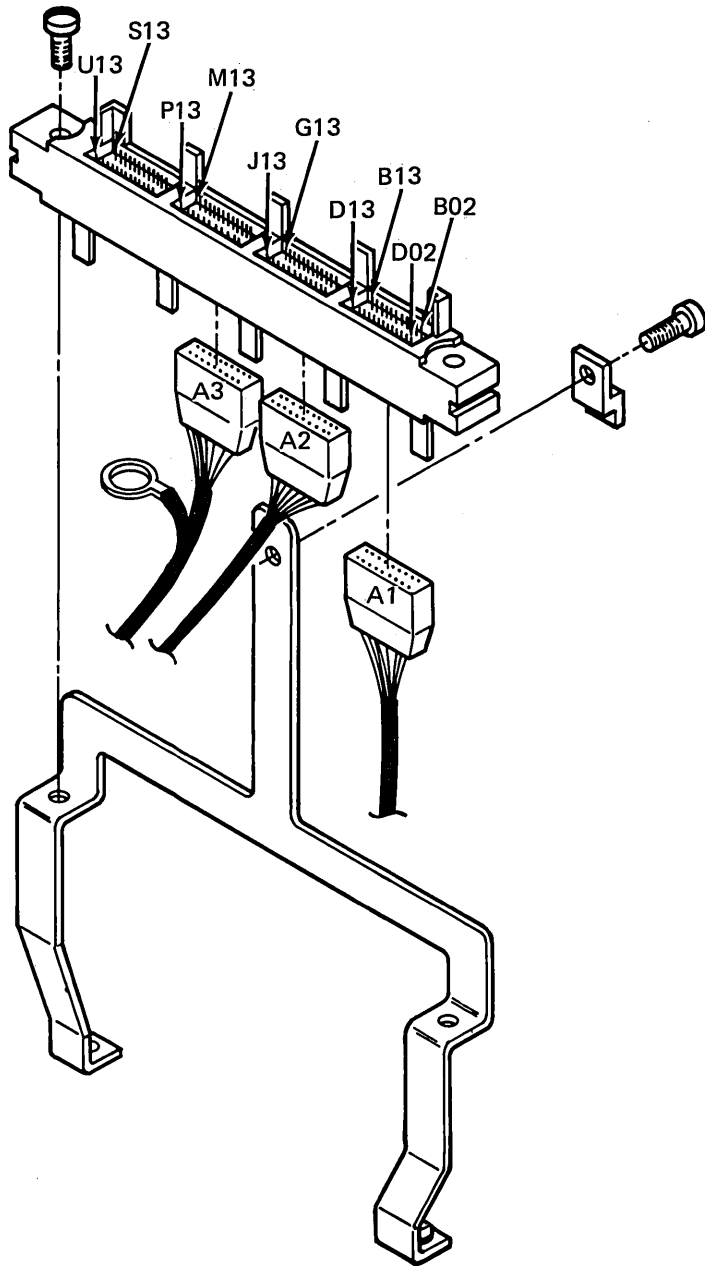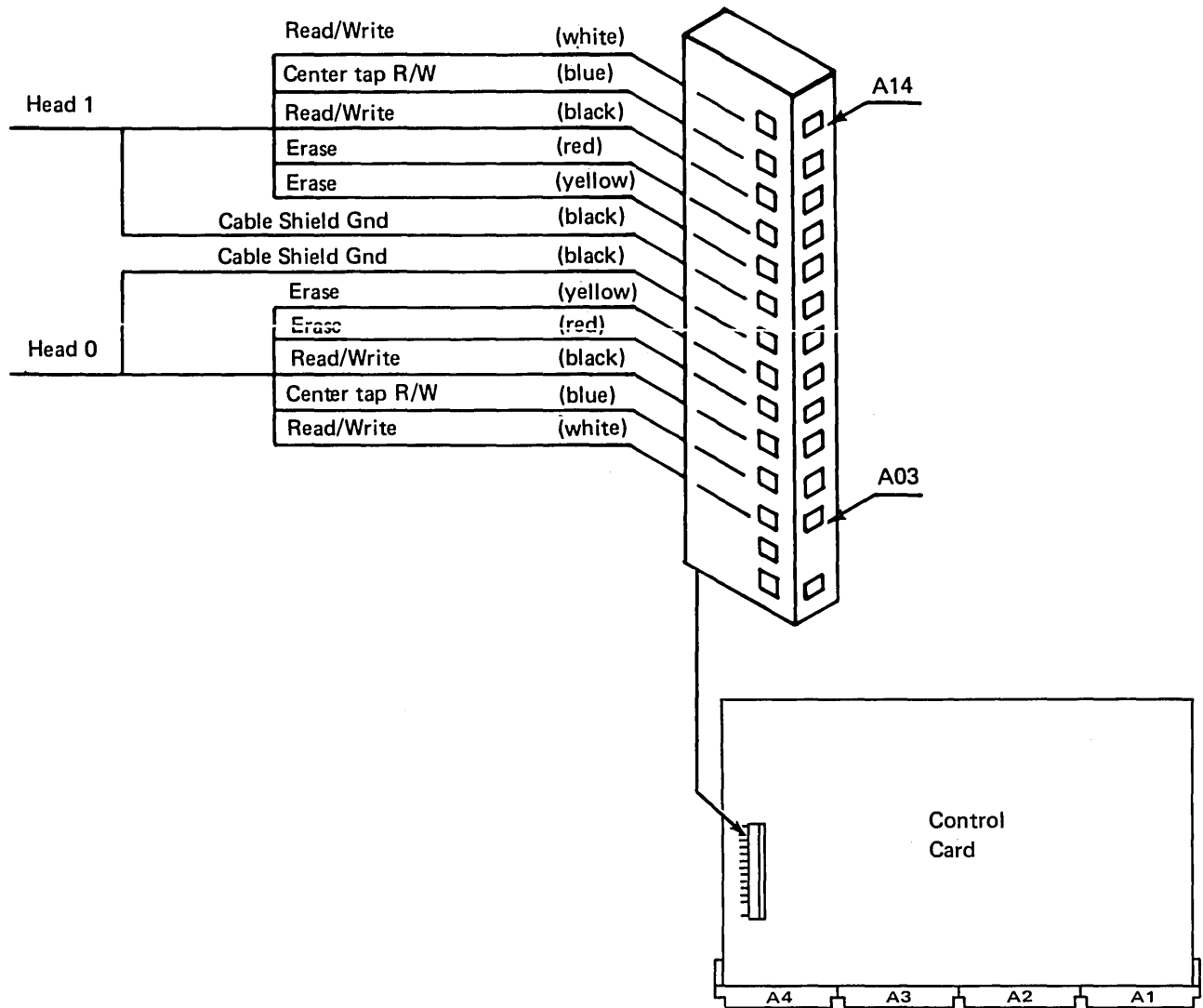
27-840   CONTROL CARD AND MOUNTING ASSEMBLY REMOVAL AND REPLACEMENT

Removing the Control Card and Mounting Assembly

1. Set Power to O (operator panel).

2. Open the front left side cover.

3. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

4. Disconnect the read/write head cable **A**.

5. Disconnect the system cable A2 **E**, the diskette stepper motor/sensor cable A1 **F**, and the cable from the driver board A3 **D**.

6. Remove the two mounting screws **C** and the ground wire **G** from the bracket assembly and then remove the control card and mounting assembly **B**.

Reinstalling the Control Card and Mounting Assembly

1. Reinstall the control card and mounting assembly **B** using the two mounting screws **C**. (Attach the ground wire **G** to the bracket assembly before you tighten the mounting screws.)

2. Connect the system cable A2 **E**, the diskette stepper motor/sensor cable A1 **F**, and the cable from the driver board A3 **D**.

3. Connect the read/write head cable **A**.

4. Reinstall the safety shield using the four screws and close the front left side cover.
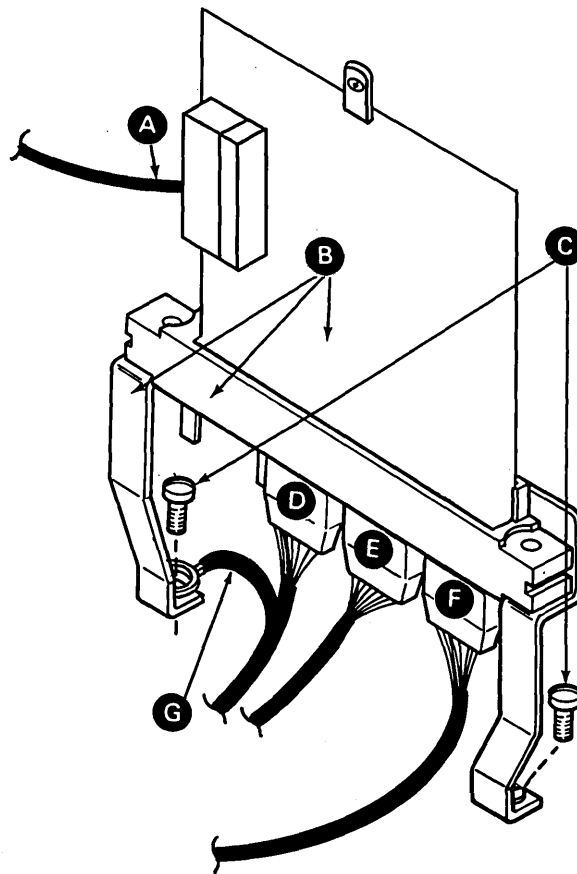
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27-845 CARRIAGE BED STEPPER MOTOR CONTROL CARD SIGNAL OUTPUT CHECK

1. Open the front left side cover.

2. Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3. Set Power to I (operator panel).

4. Access the read/write head carriage to single step the carriage bed stepper motor as follows: (Do not access the read/write head carriage more than one cylinder at a time.)
   - Set the Mode Selector switch to the Proc Run position (CE panel).
   - Set the Address/Data switches to F800 (CE panel).
   - Set all CE panel switches to their down position.
   - Press the Load switch (operator panel).
   - Select the exerciser option.
   - Select the diskette option.
   - Select the stepper motor step test option and the read/write head carriage will move to cylinder 40.
   - Install a jumper from THP-4 **A** (single step bed) to THP-1 **B** (ground).
   - Use the advance motor option of the stepper motor test to single step the bed motor.

Note: This procedure uses the read/write head carriage circuits to move the carriage bed stepper motor. Therefore, be careful to prevent damaging the read/write head carriage control circuits as well as the read/write carriage assembly.

DANGER
Parts of the driver board become hot after continuous use.

_____
_____
_____
_____

5. For the old style picker, probe test pin TPB-24 **C** (-bed motor) for a down level.

   For the new style picker, probe test pin TPB-23 **C** (-bed motor) for a down level.

6. Probe test pins TPB-18 **G**, 19 **F**, 20 **E**, and 21 **D** (+auto step 0 through 3) for up levels (two lines should be active at each step). Single step for this check. (See chart.)

7. Remove the jumper.

8. Reinstall the safety shield using the four screws.

TEST POINTS

Read/Write Control Lines	Test Points
Auto Step 0	TPB-18
Auto Step 1	TPB-19
Auto Step 2	TPB-20
Auto Step 3	TPB-21

Condition of Stepper Motor Phases at:

Cyl 40	Cyl 41	Cyl 42	Cyl 43	Cyl 44
Up	Down	Down	Up	Up
Up	Up	Down	Down	Up
Down	Up	Up	Down	Down
Down	Down	Up	Up	Down

Up level = 5 Vdc
Down level = Ground

Note: See paragraph 27-820 for control card test pins for the new style picker.

Read/Write Head Cable Connector

Note: See paragraph 27-820 for control card test pins for the old style picker.

27

27-850   PICKER/CAM STEPPER MOTOR
CONTROL CARD SIGNAL
OUTPUT CHECK

1.   Open the front left side cover.

2.   Loosen the two front safety shield screws and remove the two rear safety shield screws and the safety shield.

3.   Set Power to I (operator panel).

4.   Access the read/write head carriage to single step the picker/cam stepper motor as follows: (Do not access the read/write head carriage more than one cylinder at a time.)
    — Set the Mode Selector switch to the Proc Run position (CE panel).
    — Set the Address/Data switches to F800 (CE panel).
    — Set all CE panel switches to their down position.
    — Press the Load switch (operator panel).
    — Select the exerciser option.
    — Select the diskette option.
    — Select the stepper motor step test option and the read/write head carriage will move to cylinder 40.
    — Install a jumper from THP-3 **A** (single step picker) to THP-1 **B** (ground).
    — Use the advance motor option of the stepper motor test to single step the picker/cam stepper motor.

DANGER
Parts of the driver board become hot after continuous use.

————————————————————
————————————————————
————————————————————
————————————————————
————————————————————

Note: This procedure uses the read/write head carriage circuits to move the picker/cam stepper motor. Therefore, be careful to prevent damaging the read/write head carriage control circuits as well as the read/write carriage assembly.

5.   For the old style picker, probe test pin TPB-23 **C** (-picker motor) for a down level.

    For the new style picker, probe test pin TPB-22 **C** (-picker motor) for a down level.

6.   Probe test pins TPB-18 **G**, 19 **F**, 20 **E**, and 21 **D** (+auto step 0 through 3) for up levels (two lines should be active at each step). Single step for this check.

7.   Remove the jumper.

8.   Reinstall the safety shield using the four screws.

TEST POINTS

Read/Write Control Lines	Test Points
Auto Step 0	TPB-18
Auto Step 1	TPB-19
Auto Step 2	TPB-20
Auto Step 3	TPB-21

Condition of Stepper Motor Phases at:

Cyl 40	Cyl 41	Cyl 42	Cyl 43	Cyl 44
Up	Down	Down	Up	Up
Up	Up	Down	Down	Up
Down	Up	Up	Down	Down
Down	Down	Up	Up	Down

Up level = 5 Vdc
Down level = Ground

Note: See paragraph 27-820 for control card test pins for the new style picker.

Read/Write Head Cable Connector

Note: See paragraph 27-820 for control card test pins for the old style picker.

27

27-900   DISKETTE QUALITY AND HEAD WEAR SERVICE CHECK

CAUTION
The diskette quality and head wear service check must be performed with the diskette drive in the same position as when installed or the results might not be accurate.

_____

_____

_____

_____

A new head will write and read correctly on most diskettes. As the head wears, the quality of the diskette becomes more important. The tests described in this paragraph will aid in determining the quality of the diskette and the condition of the head.

Note: Some of the failures indicated by these tests cannot always be repeated.

Inspect the diskette failure descriptions, print the ERAP error history table, and run the following tests as necessary to verify the errors indicated by the ERAP.

27-910   Diskette Failure Descriptions

- A bump, scratch, crease, or fingerprint causes errors on the same sectors, usually across tracks that are next to each other.

- Too large of a center hole causes errors on sectors that are on opposite sides of the center hole. (Example: sectors hexadecimal 01 and 0E or sectors hexadecimal 06 and 13.)

- Material from the diskette jacket cause random errors.

- A diskette written by a worn 33FD head causes random read errors on cylinders hexadecimal 2B through 4C when read by a 72MD.

- A worn 53FD or 72MD head causes read errors on the inner tracks area of the diskette (cylinders hexadecimal 40 through 4C) when using MFM mode. If there are failures in this area, suspect a worn head. TUs E1, 9A, and 9B may be run to indicate the quality of the head in your system.

27-920   Diskette Test Descriptions

Diskette analysis–This routine reads the complete diskette (written in any IBM format) and causes a printout, which identifies the locations (logical cylinder, head, and sector) of any failures. Each sector is read only once (without trying again). To run this routine:

1. Perform a CSIPL from the DIAGB1 diskette.

2. Select the UTILITIES option on the main menu.

3. Select the EC UPDATE Copy option.

The following three tests are diskette TUs and are selected after taking the TU SELECT option on the main menu. (For easier use, set the Address/Data switches to F800 (CE panel) and perform an IPL before running the TUs.)

CAUTION
The following three TUs write on the diskette.

_____

_____

TU E1–This TU runs only on a diskette 2D. This TU writes on each sector of the diskette and then reads each sector of the diskette. The 'switch filter' line is off (not normal) when cylinders hexadecimal 3D through 4C are read. A printout identifies the location (physical cylinder, head, sector, byte, and bit) of any failures. because of the pattern written by this TU and . because the 'switch filter' line is off while reading the inner cylinders, the printout may indicate failures not found by the diskette analysis routine or failures not indicated by ERAP. Four or more data bytes did not compares per track on cylinders hexadecimal 48 through 4C indicates that TU 9A should be run.

Note: The location of a failure indicated by this TU may be used when scoping diskette damage using the read loop exerciser.

TU 9A–This TU runs only on a diskette 2D formatted to 256-byte sectors. This TU writes on each sector of the inner cylinders of the diskette with the 'inner tracks' line off (not normal). The same cylinders are then read with the 'inner tracks' and 'switch filter' lines off (not normal). A printout identifies the location (cylinder, head, and sector) of any failures. Because of the pattern written by this TU and because the 'inner tracks' and 'switch filter' lines were not used normally, the printout may indicate many errors on cylinders hexadecimal 49 through 4C If the following two conditions are indicated, the head is probably worn:

- Fourteen or more sectors on cylinders hexadecimal 4B and 4C have failures.

- There are four or more failures per track on any cylinder hexadecimal 40 through 48.

For more information, check the head resolution (see paragraph 27-950).

Note: Because of the difference in diskette quality, some diskettes may fail on this TU and some may not. It is typical for the failures to occur as early as 10 tracks earlier on a diskette with acceptable quality than on diskettes with the best quality.

TU 9B–This TU runs only on a diskette 2D. This TU writes on each sector of cylinder 4C with the 'inner tracks' line off (not normal) and then writes a different pattern on the same cylinder with the 'inner tracks' line on (normal). This cylinder is then read with the 'inner tracks' and 'switch filter' lines on (normal) to test the ability of the head to write over old data. Four or more failures indicates that the head is probably worn. This test should be run on more than one diskette. For more information, check the head resolution (see paragraph 27-950).

27-930   Diskette Figure

To look for visible damage, align the index hole in the diskette with the hole in the diskette jacket, then use the following figure of the diskette shown to locate the damaged area of the diskette.

Note: For a normal size figure of the diskette, see Appendix A of the 5340 System Unit Theory Diagrams Manual.

Rotation — One Sector

Index Gap

Cylinder 00 — Diskette Index Gap — Cylinder 4C
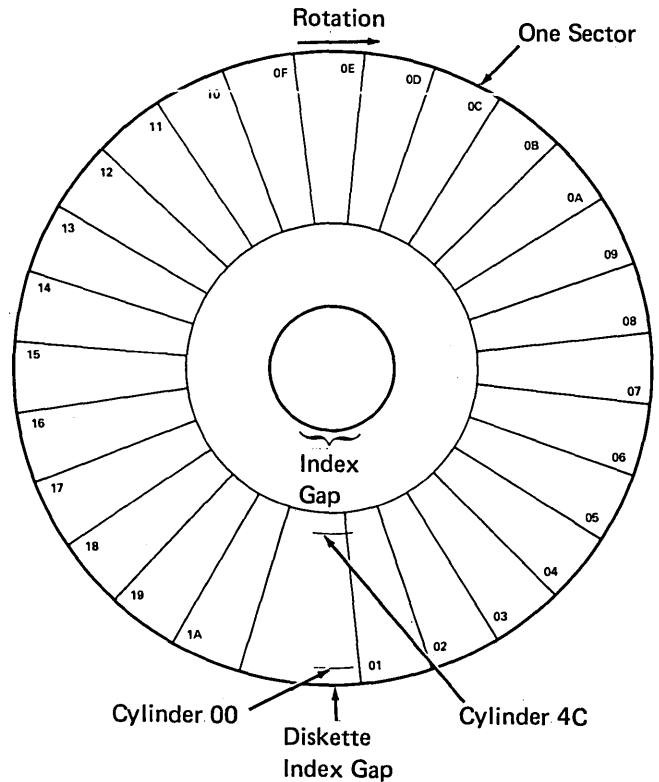
Notes:
1. The cylinder labels are hexadecimal 00 through 4C.
2. The sector labels are hexadecimal 01 through 1A as shown or hexadecimal 01 through 08.
3. The diskette is shown above as seen from the label side of diskette jacket, which is also the head 1 side of the diskette.

27-940   Diskette Quality Service Check

After determining the failing area of a diskette from the ERAP and diskette analysis printouts, the following exercisers may be run:

* Read sector exerciser—This exerciser attempts to read the sector up to 10 times and, if an error is sensed, does up to 20 read verifies to identify any failing byte. You may use this exerciser to locate the failing byte if TU E1 does not fail.

* Read loop exerciser—This exerciser permits you to synchronize on any byte in a sector to scope a failing area of a diskette.

The following two examples of scoping damaged diskettes show the loss of amplitude at the read circuit preamplifier. These are examples of damage such as scratches or bumps. The loss of amplitude on a diskette with a very small scratch will not be as visible.

Example 1: The TU-E1 printout indicates that data did not compare on cylinder 24, head 1, sector 11, byte 93.

To scope this failure do the following:

1. Set up an oscilloscope as follows:

    Note: Use a Tektronix 453, 454, or a 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[1]	5 mV/cm
Channel 2 volts/division[1]	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	50 µs/cm
Channel 1 probe[2]	THP-14 (preamp TP1)
Channel 2 probe[2]	THP-15 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)

[1] The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

[2] See paragraph 27-820 for control card test pins.

2. Set the Address/Data switches to F800 (CE panel) and perform an IPL.

3. Select the EXERCISERS option from the main menu.

4. Select the DISKETTE DRIVE option from the first exerciser menu.

5. Select the DISKETTE EXERCISER LOAD MODULE option from the second exerciser menu.

6. Select an orient carriage, select diskette from slot 3, recalibrate, and for this example, a seek to cylinder 24 from the diskette exerciser test 1 command menu (enter an E after selecting the cylinder number).

7. Use the default option to execute the commands.

8. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.

9. Select the READ LOOP command and, for this example, select MFM mode, cylinder 24, head 1, sector length = 256, sector 11, and M/S data field 1 from the displays (enter an E after selecting the sector number).

10. Select the LOOP ON CMND TABLE option and, for this example, set the Address/Data switches (CE panel) to 0093 to display byte 93.

The loss of amplitude can be seen on the oscilloscope.
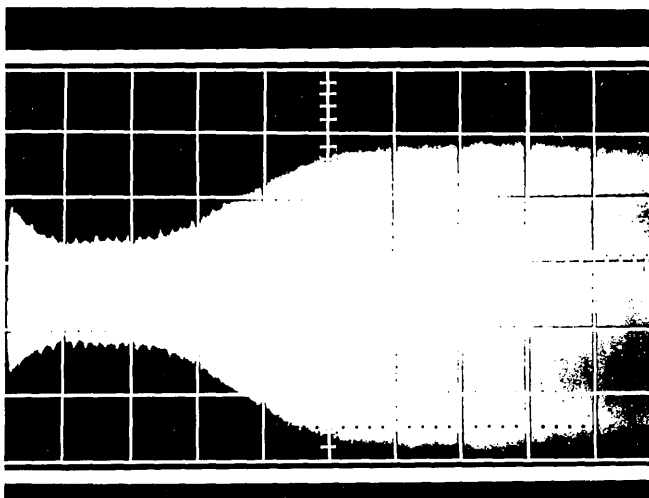
Example 2: To scope a damaged track, the following changes must be made to the preceding procedure:

1. Set the Times Per Division on the oscilloscope to 10 ms/cm.

2. Connect the trigger to the +index test pin (TPB-14 for machines with the old style picker, TPB-16 for machines with the new style picker).

3. In step 6 of example 1, seek to the damaged cylinder.

4. In step 9 of example 1, select the READ 1 SECTOR ON CURRENT CYL command (select the mode, head, sector length, sector number, M/S data field, and cylinder number that you want to scope).

5. In step 10 of example 1, select the SCOPE LOOP A CMND option.

The following oscilloscope screen image shows the damaged area of the diskette.

27

1 Track

Damaged Area
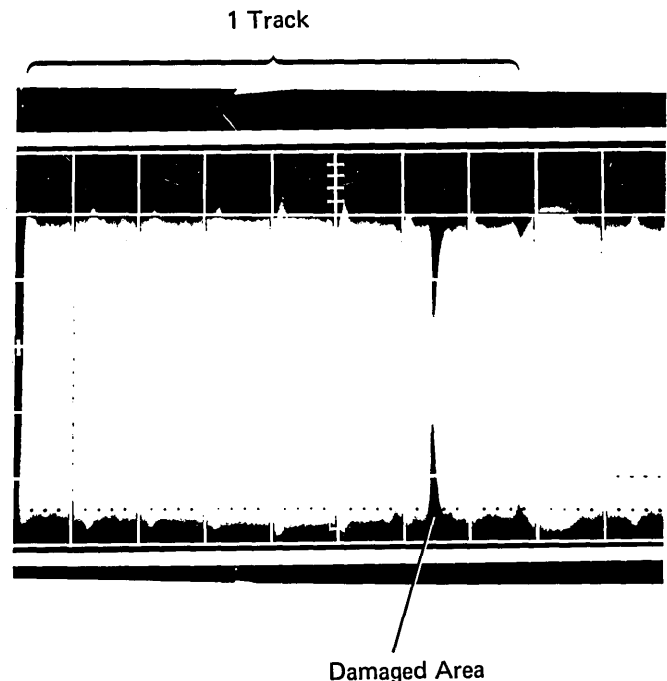
27-950   Head Wear Service Check

Head wear is determined by the head resolution and the errors indicated on the inner tracks area of a diskette (cylinders hexadecimal 40 through 4C).

Head resolution is the ratio of the signal amplitude of hexadecimal FF in centimeters to the signal amplitude of hexadecimal AA in centimeters multiplied by 100.

If the head resolution of both heads is more than 50, the heads are good. If the head resolution of either head is less than 40, that head is bad and the assembly should be exchanged. When the resolution is between 40 and 50, use the ERAP data and the TU printouts to determine if the head is bad.

The head is bad, if the ERAP data and the TU printouts indicate data errors on cylinders hexadecimal 40 through 4C on diskette 2D and the head resolution is less than 50.

Example: Perform the following to scope head resolution:

1.   Initialize a diskette 2D:
   a. Perform an IPL under SSP.
   b. Sign on the system (if the system has the password security function specified in the machine configuration, you will need aid from the customer to sign on).
   c. Initialize a diskette 2D with the following command:

   INITƀ,,FORMAT

2.   Set up an oscilloscope as follows:

   Note: Use a Tektronix 453, 454, or a 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	5 mV/cm
Channel 2 volts/division	5 mV/cm
Channel 1 input	AC
Channel 2 input	AC
Invert	Pull out
Times per division	10 µs/cm
Channel 1 probe[1]	THP-14 (preamp TP1)
Channel 2 probe[1]	THP-15 (preamp TP2)
Connect trigger to	A-A1Q2U02 (+MS address compare)

[1] See paragraph 27-820 for control card test pins.

3. Move the data heads to track hexadecimal 4C and determine head resolution as follows:

   a. Set the Address/Data switches to F800 (CE panel) and perform an IPL.

   b. Select the EXERCISERS option from the main menu.

   c. Select the DISKETTE DRIVE option from the first exerciser menu.

   d. Select the DISKETTE EXERCISER LOAD MODULE option from the second exerciser menu.

   e. Select ORIENT CARRIAGE, SELECT DISKETTE FROM SLOT 3, RECALIBRATE, SEEK to track 4C, and WRITE 1 SECTOR ON CURRENT CYL (select MFM mode, the head you want to scope, the sector length, the sector number, and M/S data field 1 from the displays). Enter an E after selecting M/S data field 1.

   f. Select Y to see the command data field option.

   g. Select the scroll fields option.

   h. Change the first 8 bytes of M/S data field 1 from:

```
FF FF FF FF  FF FF FF FF
to:

AA AA AA FF  FF AA AA AA
```
and the @@@@S on line 11 to:
@@@@M

   i. Press the Attn key to return to the menu.

   j. Select an E to exit.

   k. Use the default option to execute the commands.

   l. Press the Attn key (three times) to return to the diskette exerciser test 1 command menu.

   m. Select the READ LOOP command (select MFM mode, cylinder 4C, the head you want to scope, the sector length, the sector number, and M/S data field 1 from the displays). Enter an E after selecting the cylinder number.

   n. Select the LOOP ON CMND TABLE option, set the Address/Data switches to 0005 (CE panel), and measure the amplitude of the hexadecimal FF and AA.

AA=4.2cm   FF=2.4cm

$$\text{Head Resolution} = \frac{2.4}{4.2} \times 100 = 57$$

CONTENTS

30

30-010 INTRODUCTION

The multiline communications adapter (MLCA) is a processor controlled attachment giving System/34 the ability to concurrently control one to four communications lines. On each communications line, the System/34 can function as a primary station (SDLC only) or as a terminal in a point-to-point or multipoint network. The hardware associated with each line is described as line 1, line 2, line 3, or line 4. The MLCA feature uses attachment controller 2 (see MLCA controller in all communication references).

Data is transmitted and received serial-by-bit and serial-by-character over voice-grade (or equal to) communications networks (switched or nonswitched), or over DDSA. The system may be connected to a half-duplex or duplex network, but the adapter operates in half-duplex mode only; that is, data transmission is in only one direction at a time.

During transmit operations, data is sent from main storage to buffers in MLCA controller storage. Then, each byte to be transmitted is sent to the communications adapter where the data is put in serial form and sent 1 bit at a time to the modem or digital adapter. The modem or digital adapter then sends the bits to the receiving terminal over the communications network.

During receive operations, the communications adapter receives each bit from the modem and assembles the bits into bytes (deserializes). Each byte of data is then sent to buffers in MLCA controller storage. Data is then sent from the buffers into main storage for processing.

30-100 LOCATIONS

Figures 30-1 through 30-7 show the locations of the major parts used in the multiline communications adapter.

A-B3
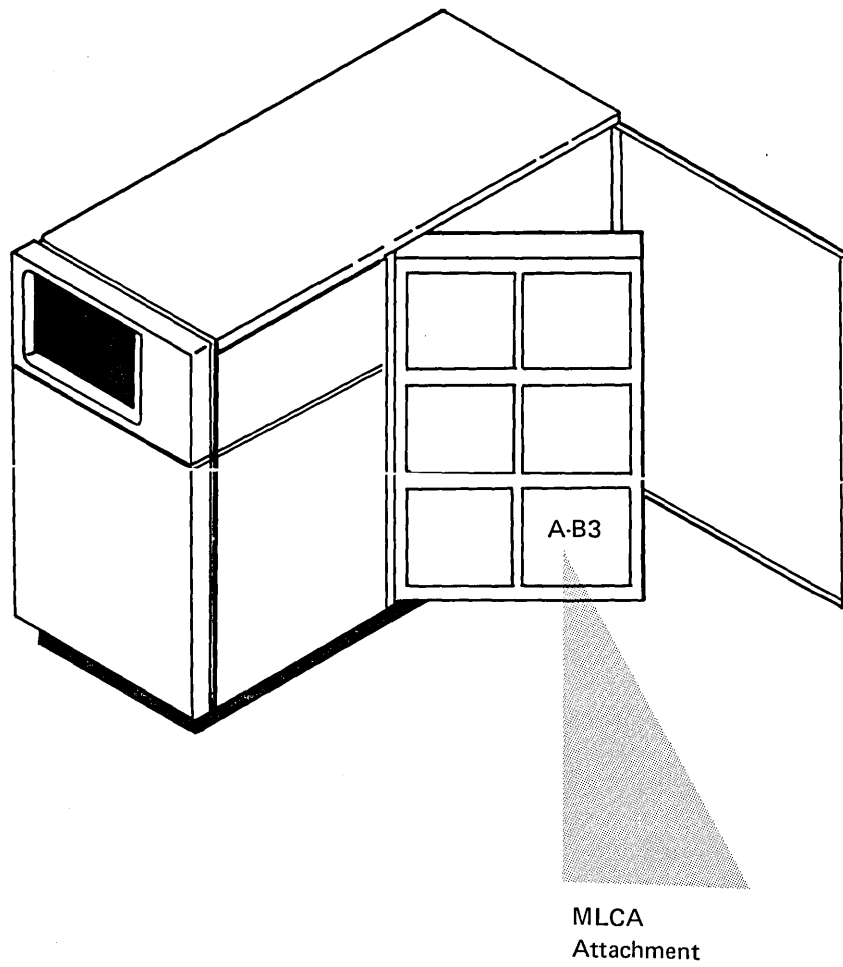
MLCA
Attachment

Figure 30-1. MLCA Attachment Location on A-Gate

30

Line 1 Line 2 Line 3 Line 4
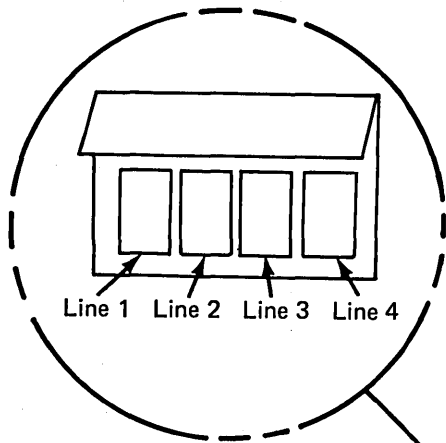
Line Plates for:
1200 BPS Integrated Modem for
World Trade Public
Switched Network
            or
4800 Switched Network
(incorporated protective coupler,
coupler adapter, or World
Trade coupler)

IBM 4800 BPS Integrated
Modem Operator Panels
(only two per system)

D-B6, D-B7, and D-B8
Cable Locations for
MLCA

Line 2 Line 3
Line 1   Line 4

(see 30-410)
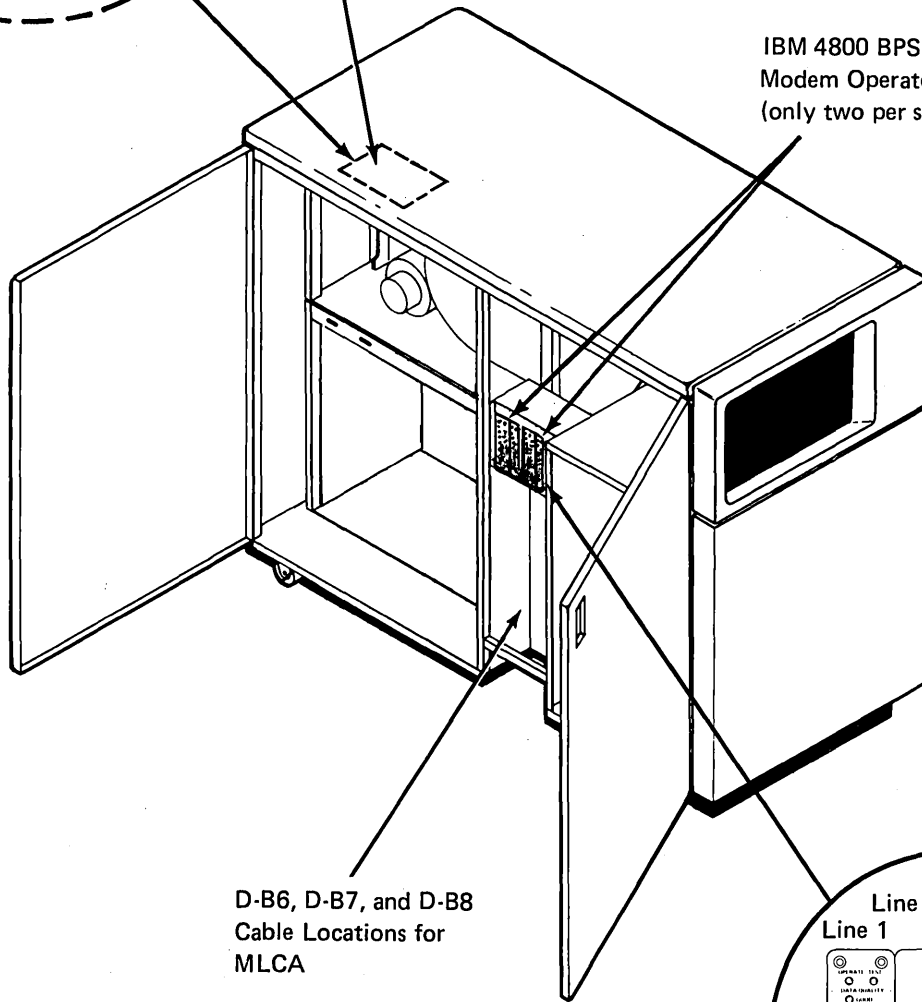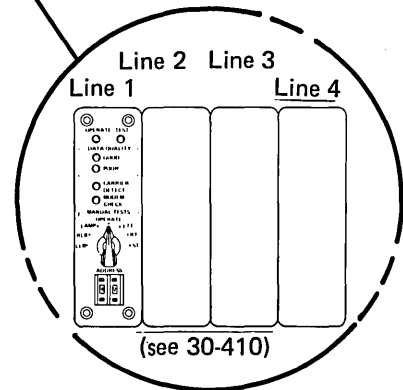
Figure 30-2. Cable Tower and Line Plates

A   B   C   D   E   F   G   H   J   K   L   M   N   P   Q   R   S   T   U   V

CABLE CE SW

CHANNEL CABLE 1 IN

CHANNEL CABLE 2 IN

CHANNEL CABLE 3 IN

CABLE CE IND

SPARE

MLCA CONTROLLER CHANNEL

MLCA CONTROLLER DATA FLOW

STORAGE

SPARE

CA 1

CA 2

CA 3

CA 4

SPARE

LA 1

LA 3

LA 2

LA 4

4800 BPS MODEM A

4800 BPS MODEM A

4800 BPS MODEM A

4800 BPS MODEM B

4800 BPS MODEM B

4800 BPS MODEM B

INTERNAL CLOCK

CHANNEL TERMINATOR

CABLE A 4800 BPS

CABLE B 4800 BPS

LINE ADPT

LINE ADPT

LINE ADPT

LINE ADPT

CABLE 1 OUT

CABLE 2 OUT

CABLE 3 OUT

CABLE 4 OUT

4800 OP PANEL CABLE A

4800 OP PANEL CABLE B

A-B3 Board

30

Card Locations

B3-C2   MLCA Controller Channel ⎞ Attachment
B3-D2   MLCA Controller Data Flow⎬ Controller 2
B3-E2   Storage   ⎠
B3-F2   Communications Adapter 1
B3-G2   Communications Adapter 2
B3-H2   Communications Adapter 3
B3-J2   Communications Adapter 4
B3-L2   Line Adapter 1 ⎞ ⎛ 1200 BPS Integrated Modem
B3-M2   Line Adapter 2 ⎪ ⎪ EIA/CCITT
B3-L4   Line Adapter 3 ⎬ ⎨ DDSA
B3-M4   Line Adapter 4 ⎪ ⎪ Analog Wide Band Adapter*
B3-U2   Internal Clock ⎠ ⎝ Autocall**
B3-N2
B3-P2   4800 BPS Integrated Modem A
B3-Q2
B3-R2
B3-S2   4800 BPS Integrated Modem B
B3-T2

*Maximum of one per system
**Maximum of two per system

Cables

- Locations A2, A3, and A4 are channel cables 1, 2, and 3 (in), respectively.

- Location U3 contains a channel terminator card.

- Location U4 is the cable out for the first (A) 4800-bps integrated modem, and location U5 is the cable out for the second (B) 4800-bps integrated modem.

- Location Z5 is the cable out to the first (A) 4800-bps integrated modem operator panel, and location Z6 is the cable out to the second (B) 4800-bps integrated modem operator panel.

- Locations V2, V3, V4, and V5 are the cables out for line adapters 1, 2, 3, and 4, respectively.

Figure 30-3. MLCA Card and Cable Locations
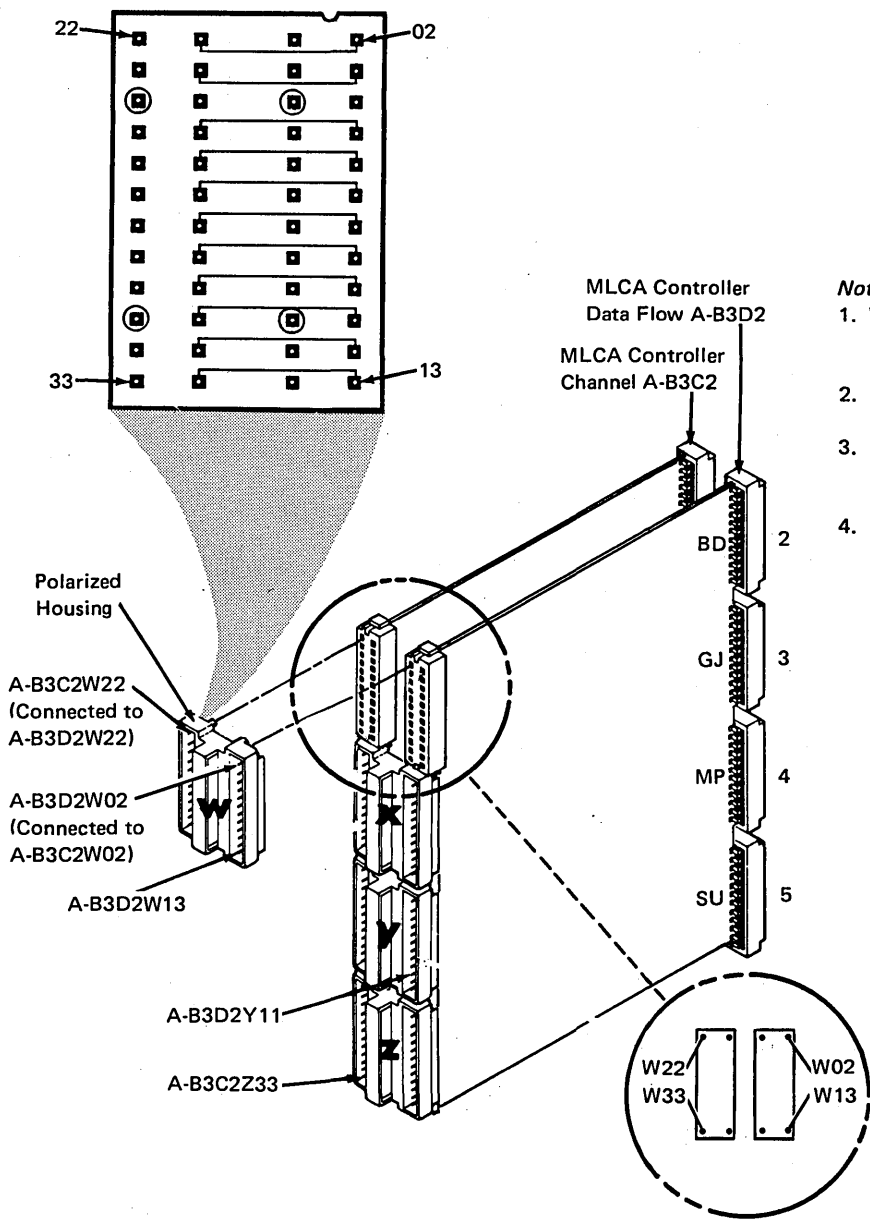
Notes:
1. W and Z shrouds and top connectors on cards C2 and D2 are turned 180° from those on the X and Y connectors.
2. All the top card connector pins can be probed.
3. Pins 04 and 31 of the top card connectors are tied together by an internal plane to ground.
4. Pin W26 is connected to +5 volts.

Figure 30-4. MLCA Controller Top Card Connectors

30-100

Line 1

CA LA Clock Cable
F2 L2 U2 V2

Line 2

CA LA Clock Cable
G2 M2 U2 V3

Line 3

CA Clock U2
LA Cable V4
H2 L4

Line 4

CA Clock U2
LA Cable
J2 M4 V5
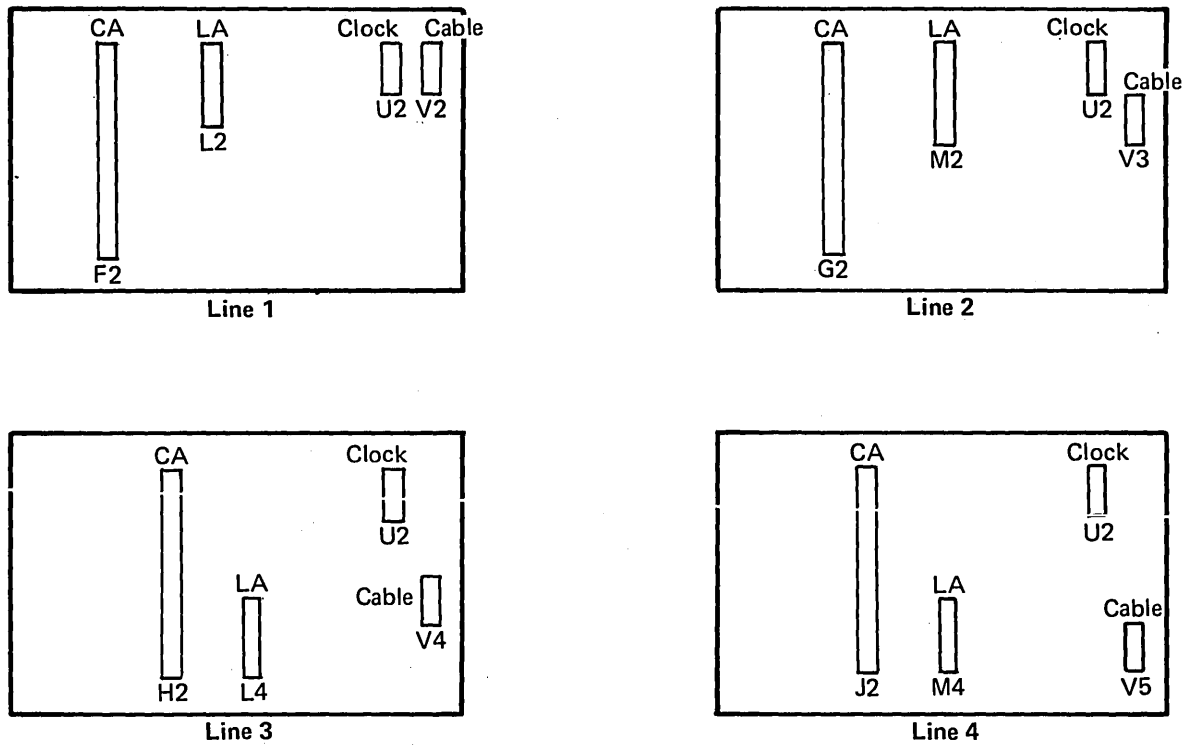
CA Communications Adapter
LA Line Adapter
  ● EIA/CCITT
  ● 1200 BPS Integrated Modem
  ● DDSA
  ● Analog Wideband (one per system, max.)
  ● Autocall (two per system, max.)

Figure 30-5. Communications Lines (A-B3 Board)

Modem A

Top Card
Connector
(see Figure
30-4)

Cable
U4

N2P2 Q2
Z5

Modem B

Top Card
Connector
(see Figure
30-4)

Cable

R2S2 T2 U5
Z6

Modem Op
Panel Cable
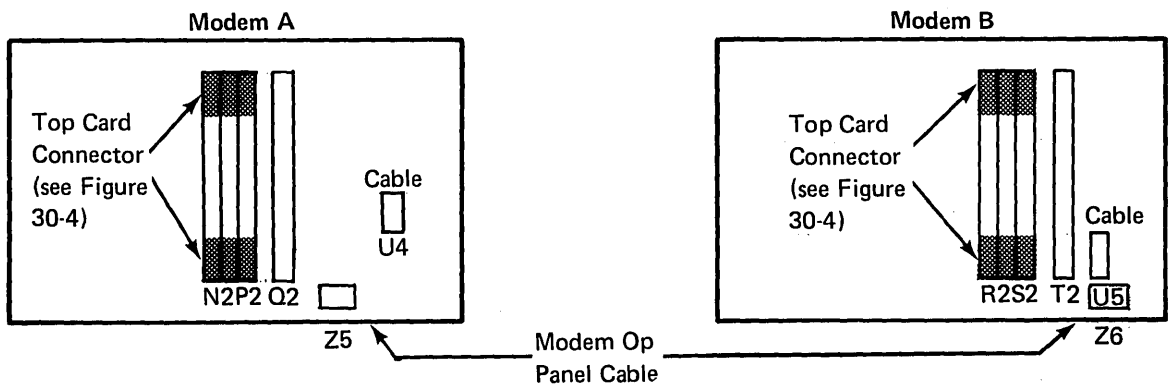
Notes:
1. Either modem can be attached to any line and any communications adapter.
2. Top card connectors used on the B3 board cannot be used for other boards.

Figure 30-6. 4800 BPS Integrated Modem (A and B) (A-B3 Board)

30-110   External Cables

The cable tower locations of the external cables are
shown in Figure 30-7. See the individual line adapter
sections for internal cable locations.

Autocall
EIA/CCITT
Integrated Modems for
  Nonswitched Networks
1200 BPS Integrated Modem
  for Switched Network
  (not World Trade Public
  Switched Network)
Analog Wideband

DDSA
1200 BPS Integrated Modem for World Trade
  Public Switched Network (PSN)
4800 BPS Integrated Modem for Switched
  Network
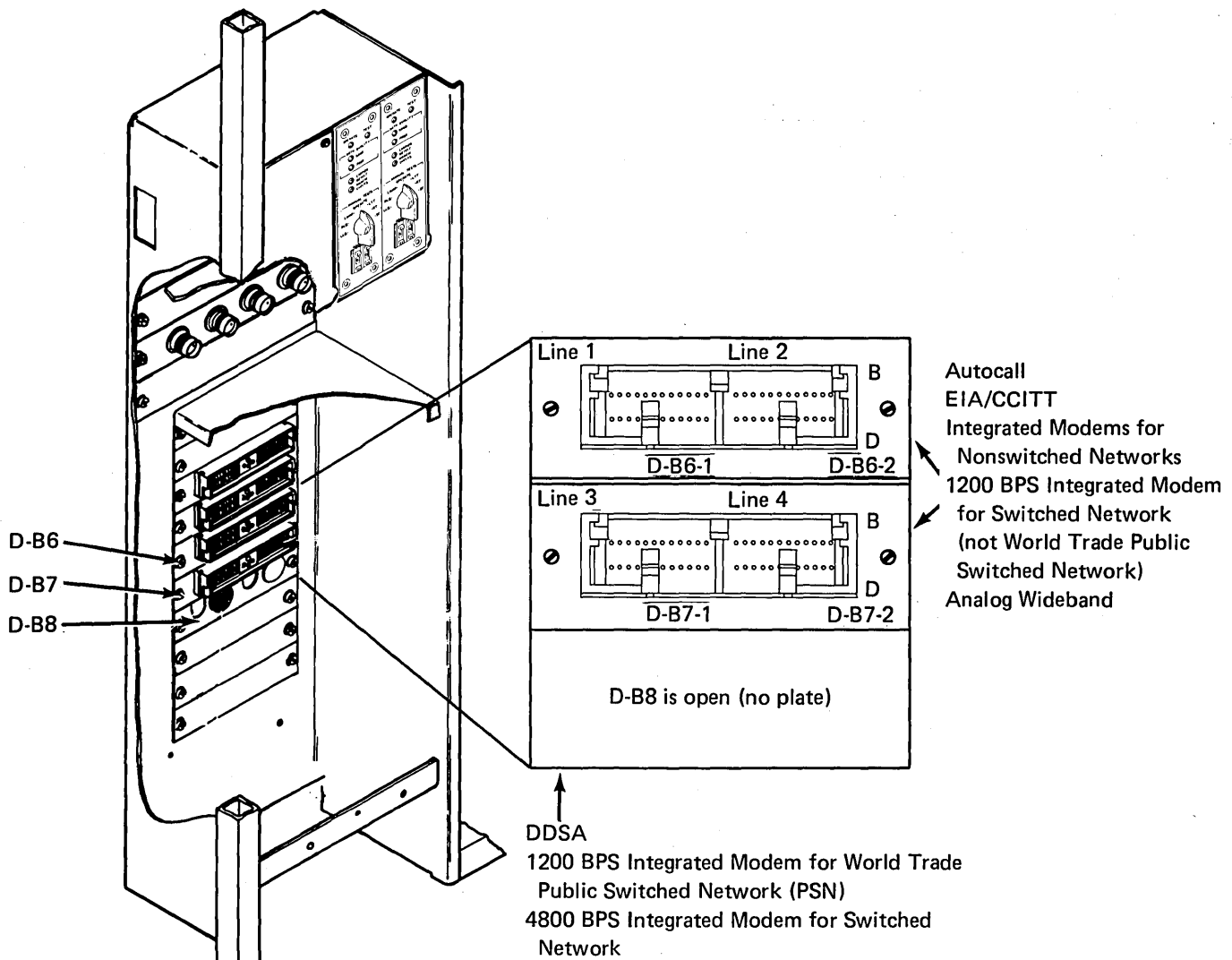
Note: See Section 45 for more information on the
cable connector and the lightning protect card.

Figure 30-7. Cable Tower Locations for External Cables

30-200   ADAPTER CARD

The communications adapter cards are the common interface between System/34 and all modems. Each card has six switches; set them for each line as instructed in Figure 30-8.

Switch	Condition	Meaning
1	On	Continuous carrier (the 'request to send' line is always on). This option can be used only on a 4-wire nonswitched line on a point-to-point network or on a multipoint control station.
	Off	Not continuous carrier (set off for DDSA or autocall).
2	On	The line speed is equal to or less than 9600 bps (set on for autocall).
	Off	The line speed is greater than 9600 bps (analog wideband or 56K-bps DDSA).
3	On	Enable rate select interface lead for EIA, autocall, analog wideband, or 4800-bps integrated modem (allows microcode control over the rate select interface lead).
	Off	For DDSA or 1200-bps integrated modem.
4	On	Not NRZI coding.
	Off	NRZI coding used.
		Note: The customer can use BSC and/or SDLC on the same communications line. Therefore, the following information is important to the setting of the NRZI switch (switch 4) on the adapter card: ● The NRZI switch setting must match the option chosen in the configuration for diagnostics to work correctly. ● If the customer is operating with only BSC or with DDSA, select not NRZI (switch 4 is set on). ● Select not NRZI for autocall. ● BSC microcode disables the NRZI function regardless of the switch setting. ● Only SDLC uses NRZI, but the selection of NRZI depends on the following: — If the customer is operating with SDLC (or with SDLC and BSC on the same communications line), the switch setting and the configuration record must be set for SDLC operation. — The NRZI switch setting depends on the remote device and on the modem being used. For SDLC, all data terminal equipment communicating with each other must select the same coding option (NRZI or not NRZI). Contact your IBM marketing representative for identification of those modems that have pattern sensitive synchronization problems, and to determine which coding option should be used. When PTT mandatory modems are used in World Trade, refer to the *IBM World Trade Signal Converter Handbook*, ZZ19-6066. This manual will help determine which coding option should be used.

5-6	Device address selection		Jumper adapter microinterrupt request to interrupt level	
	5	6 Device Address	Jumper (see note)	Interrupt Level
	off	off 10	A-B3XXJ09 to A-B3C2M05	3
	off	on 20	A-B3XXJ09 to A-B3C2M05	3
	on	on 40	A-B3XXJ09 to A-B3C2M05	3
	on	off 80	A-B3XXJ09 to A-B3C2P05	2

Each communications line must use a different device address. With the exception of the high-speed line, the lines may use any address, but the device address must be the same as the address selected in the line's configuration record. If a high-speed line is installed (line speed greater than 9600 bps), this line must use device address 80. A general rule to follow is to start with address 10 and use address 80 last.

The device address of the communications adapter in the unit definition table (UDT) and in the configuration record is X'8X'; where 8 is the MLCA controller address (X'80') from the control storage processor, and X is either 1, 2, 4, or 8 for the communications line adapter address (10, 20, 40, or 80) from the MLCA controller.

Note: XX is communications adapter F2 (line 1), G2 (line 2), H2 (line 3), or J2 (line 4).

Figure 30-8. Communications Adapter Card

30-300   1200 BPS INTEGRATED MODEM

30-310   Locations

Four different 1200-bps integrated modems can be used with MLCA on System/34. Each modem is contained on one card and all are plug compatible in the same card socket. The modem that is used relies on the network type. An internal clock card (A-B3U2) must be installed with the 1200-bps integrated modem to supply business machine clocking.

Figures 30-9 through 30-11 show the terminate connections of the internal cables used with the different modems. For switched networks, the cables are terminated at the cable tower; for World Trade public switched networks, the cables are terminated at the line plate; and for nonswitched networks, the cables are terminated at the lightning protect card at the cable tower. Figures 30-9 through 30-11 show only the parts for line 1. If the 1200-bps integrated modem is installed on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.

Note: If the 1200-bps integrated modem is installed on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.

SH	Switch Hook
SG	Signal Ground
DA	Data Modem Ready
CCT	Coupler Cut Through
OH	Off Hook
RI	Ring Indicate
DT	Data Tip
DR	Data Ring
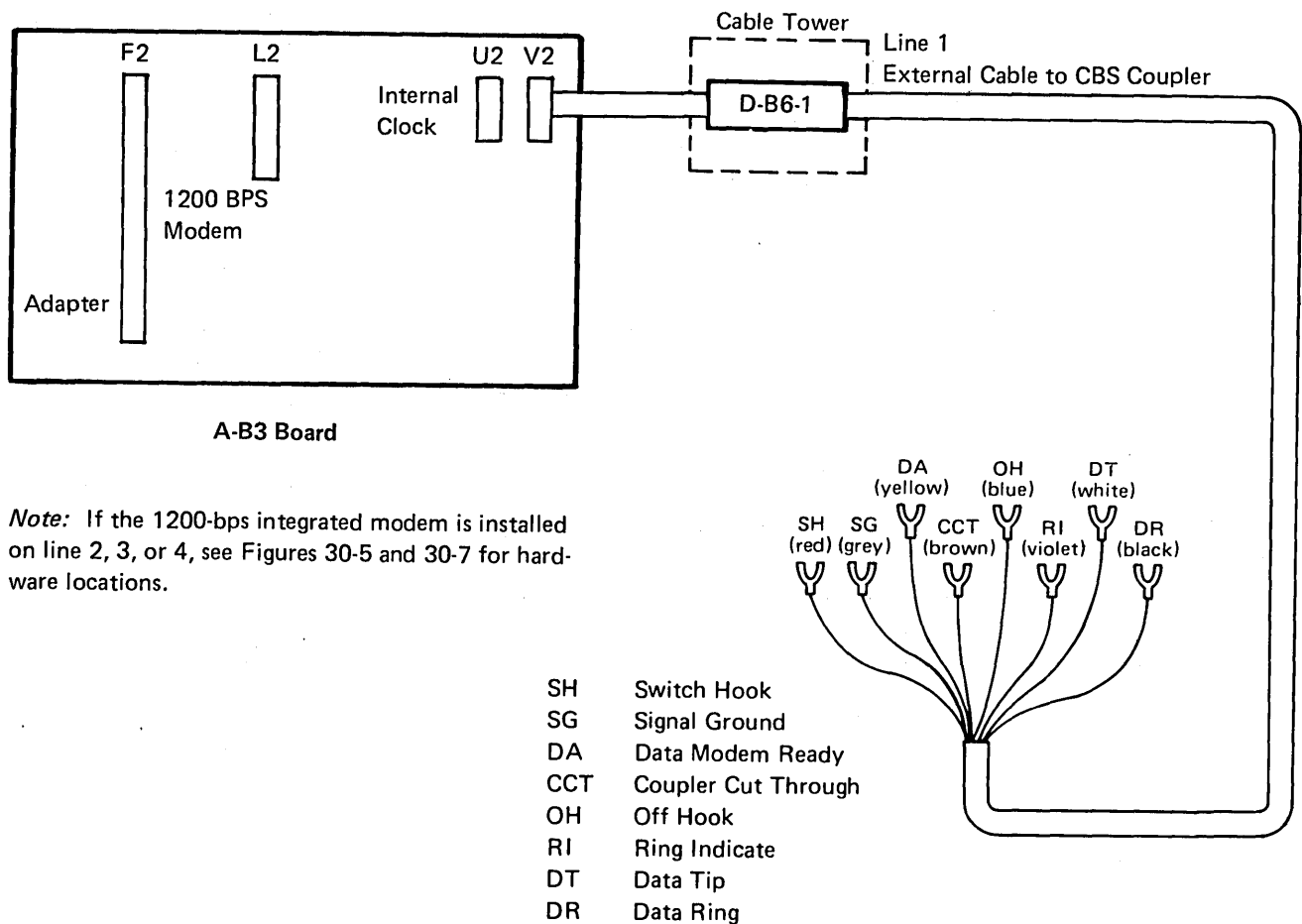
Figure 30-9. 1200 BPS Integrated Modem—Switched Network (Line 1)
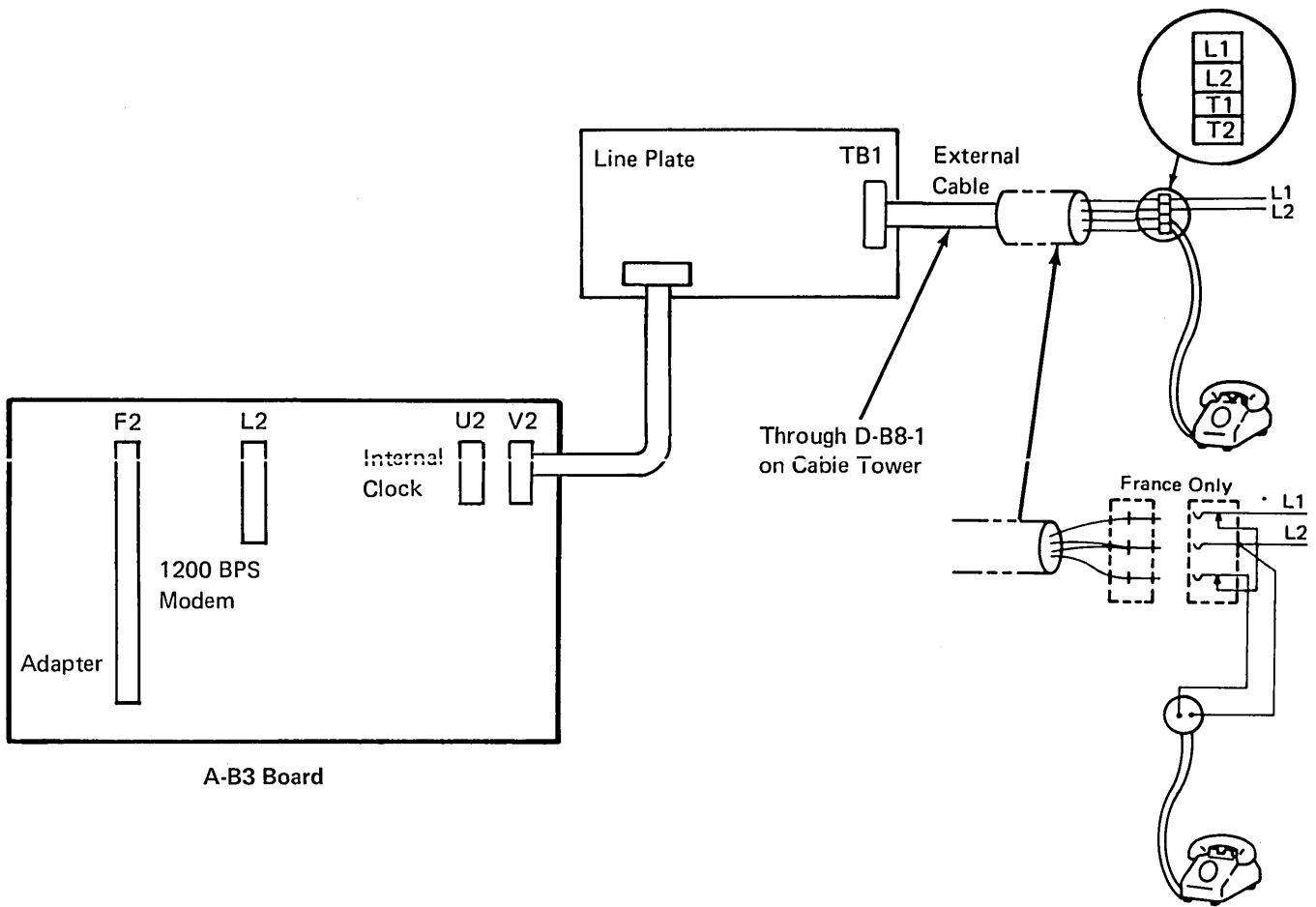
External Cable

Line Plate	Cable	Telephone Plug
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L2)	White
TB1-9	Telephone 2 (L1)	Red

Note: If the 1200-bps integrated modem is installed on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.

Figure 30-10. 1200 BPS Integrated Modem—World Trade Public Switched Network (Line 1)

Lightning
Protect
Card

Cable
Tower

External Cable to
Nonswitched Line

D-B6-1

(red) ⎫
       ⎬ Transmit
(white) ⎭

Or

(yellow) ⎫ Receive
         ⎬ (not used
(black) ⎭ with 2-wire
           connection)

WT Countries—Remove 283-B Plug
U.S. and Canada—
            Red and Green (white)—Transmit
            Black and Yellow—Receive

(yellow)   (red)

(black)   (green or white)

283-B Plug

F2   L2   U2 V2

Internal
Clock

1200 BPS
Modem

Adapter

Note: If the 1200-bps integrated modem is installed
on line 2, 3, or 4, see Figures 30-5 and 30-7 for hard-
ware locations.

A-B3 Board

Figure 30-11. 1200 BPS Integrated Modem—Nonswitched Network (Line 1)

30-350   Card Switch Settings

Because of different networks, the 1200-bps modem card can be one of four different cards. Each of these cards has at least 16 switches that must be set as described in Figures 30-12 through 30-15.
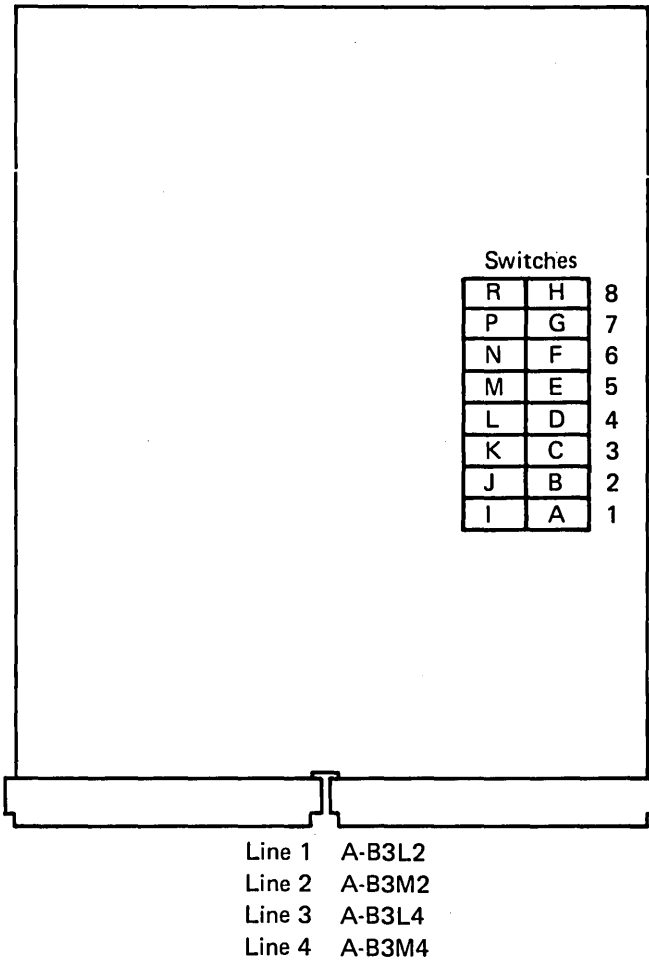
Switches

R	H	8
P	G	7
N	F	6
M	E	5
L	D	4
K	C	3
J	B	2
I	A	1

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

Set switches J and K on and switches L, M, N, P, and R off. Set the transmit level switches A through I, as shown in the table at the right.

Note: Switches N and P are set off for a clear-to-send delay of 230 ms, and switch L is set off for an echo clamp delay of 150 ms.

Figure 30-12. Switch Settings for Switched Network

Transmit Level

Set the transmit level to match the level specified on the CBS data coupler. A bullet (●) in the table below indicates that the switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	I
0	●								
-1		●							
-2			●						
-3				●					
-4					●				
-5						●			
-6	●						●		
-7		●					●		
-8			●				●		
-9				●			●		
-10					●		●		
-11						●	●		
-12	●							●	
-13		●						●	
-14			●					●	
-15				●				●	
-16					●			●	
-17						●		●	
-18	●								●

Switches

R	H	8
P	G	7
N	F	6
M	E	5
L	D	4
K	C	3
J	B	2
I	A	1

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

Figure 30-13. Switch Settings for Nonswitched Network

Set switches A through I, M, and R off. The remaining switches are set for:

- 4-wire nonswitched line (set J off and K on)

- 2-wire nonswitched line (set J on and K off)

Also attach the following jumpers:

Line 1   A-B3L2G02 to A-B3L2G09
         A-B3L2J05 to A-B3L2J13
Line 2   A-B3M2G02 to A-B3M2G09
         A-B3M2J05 to A-B3M2J13
Line 3   A-B3L4G02 to A-B3L4G09
         A-B3L4J05 to A-B3L4J13
Line 4   A-B3M4G02 to A-B3M4G09
         A-B3M4J05 to A-B3M4J13

- Clear-to-send delay of:
  - 30 ms; set N off and P on (recommended for a 4-wire nonswitched line).
  - 80 ms; set N on and P off (use only for a special short 2-wire nonswitched line).
  - 230 ms; set N and P off (recommended for a switched line or a 2-wire nonswitched line).

Note: The clear-to-send delay must always be longer than the echo clamp delay.

- Echo clamp delay of:
  - 0 ms; L can be set on or off because the 0-ms delay is automatically selected if the 30-ms clear-to-send delay is selected.
  - 50 ms; set L on nonswitched or switched line).
  - 150 ms; set L off (recommended for a switched line or a 2-wire nonswitched line).

Switches

R	H	8
P	G	7
N	F	6
M	E	5
L	D	4
K	C	3
J	B	2
I	A	1

V	
U	
T	
S	

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

Set switches N, S, T, U, and V on and switch P off.

Set the transmit level switches A through H and R as shown in the table at the right.

The remaining switches are set for:
- 4-wire nonswitched line (set I on and M off)
- 2-wire nonswitched line (set I off and M on)

Also attach the following jumpers:

Line 1   A-B3L2G02 to A-B3L2G09
         A-B3L2J05 to A-B3L2J13
Line 2   A-B3M2G02 to A-B3M2G09
         A-B3M2J05 to A-B3M2J13
Line 3   A-B3L4G02 to A-B3L4G09
         A-B3L4J05 to A-B3L4J13
Line 4   A-B3M4G02 to A-B3M4G09
         A-B3M4J05 to A-B3M4J13

- Clear-to-send delay of:
  - 30 ms; set K on and J off (recommended for a 4-wire nonswitched line).
  - 80 ms; set K off and J on (use only for a special short 2-wire nonswitched line).
  - 230 ms; set K and J off (recommended for a switched line or a 2-wire nonswitched line).

Note: The clear-to-send delay must always be longer than the echo clamp delay.

Figure 30-14. Switch Settings for World Trade Nonswitched Network

Transmit Level

A bullet (●) in the table below indicates that a switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	R
0	●								
-1		●							
-2			●						
-3				●					
-4					●				
-5						●			
-6	●						●		
-7		●					●		
-8			●				●		
-9				●			●		
-10					●		●		
-11						●	●		
-12	●							●	
-13		●						●	
-14			●					●	
-15				●				●	
-16					●			●	
-17						●		●	
-18	●								●

- Echo clamp delay of:
  - 0 ms; L can be set on or off because the 0-ms delay is automatically selected if the 30-ms clear-to-send delay is selected.
  - 50 ms; set L on (nonswitched or switched line).
  - 150 ms; set L off (recommended for a switched line or a 2-wire nonswitched line).

30

Switches

R	H	8
P	G	7
N	F	6
M	E	5
L	D	4
K	C	3
J	B	2
I	A	1

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

Set switches I, J, K, N, P on and switches L and M off. Set the transmit level switches A through H and R as shown in the table at the right while performing the adjustments in 30-360.

Figure 30-15. Switch Settings for World Trade Public Switched Network (PSN)

Transmit Level

A bullet (•) in the table below indicates that the switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	R
0	•								
-1		•							
-2			•						
-3				•					
-4					•				
-5						•			
-6	•						•		
-7		•					•		
-8			•				•		
-9				•			•		
-10					•		•		
-11						•	•		
-12	•							•	
-13		•						•	
-14			•					•	
-15				•				•	
-16					•			•	
-17						•		•	
-18	•								•

30-360   Line Plate Adjustment

The line plate adjustment is needed only when the network is a World Trade public switched network (PSN).

The DC level of the telephone line must be adjusted between 20 milliamperes and 70 milliamperes. In addition, the level in data status (modem connected to the line) must be as close as possible to the level in talk status (telephone set connected to the line). Therefore, the level is adjusted in two steps:

1. The data station is set to talk status (line plate relay not activated). A jumper is selected determined by the voltage level observed between both wires of the line.

2. The data set is set to data status (line plate relay activated). The voltage level is checked, and a jumper is selected to obtain a voltage level nearest to that observed in talk status.

The line plates are located under the top cover. See Figure 30-2.

> **DANGER**
> Voltage is present on the line plate from the telephone lines.

Preparatory Line Plate Adjustments

1. Install input voltage jumpers K, M, and N.

2. When the telephone set is used, install jumper G. When the telephone set is not used, install jumper H.

Line Plate Adjustments with Telephone Set Installed

1. Connect a DC voltmeter (50-Vdc scale) across TP1 (+) and TP2 (-). See Figure 30-16 for the locations of TP1 and TP2.

   Note: Polarity can be reversed with some telephone companies.

2. Set the data station to talk status and pick up the handset.

3. Record the voltage level observed on the meter.

4. Select one jumper position A through F on the line plate by using the line plate jumper table that follows. Select the jumper that matches the voltage level observed in step 3. Ignore jumpers in parentheses at this time.

5. Set the data station to data status by returning the system telephone to its cradle and then installing a jumper from the 'data terminal ready' line to ground to activate the relay on the line plate:

Line 1	A-B3L2B02	to	A-B3L2D08
Line 2	A-B3M2B02	to	A-B3M2D08
Line 3	A-B3L4B02	to	A-B3L4D08
Line 4	A-B3M4B02	to	A-B3M4D08

6. Dial the system from a local telephone. Leave the telephone handset that you are dialing from off the cradle (off the hook).

7. Observe the meter. If the voltage level is different from the level observed in step 3, attempt the jumper position(s) given between parentheses in the line plate jumper table. Select the position that gives the voltage level nearest to that observed in step 3.

8. Return the handset to the cradle (on the hook) and the data station to talk status. (Remove the jumpers that were installed to activate the line plate relay.)

Line Plate (PSN Coupler)
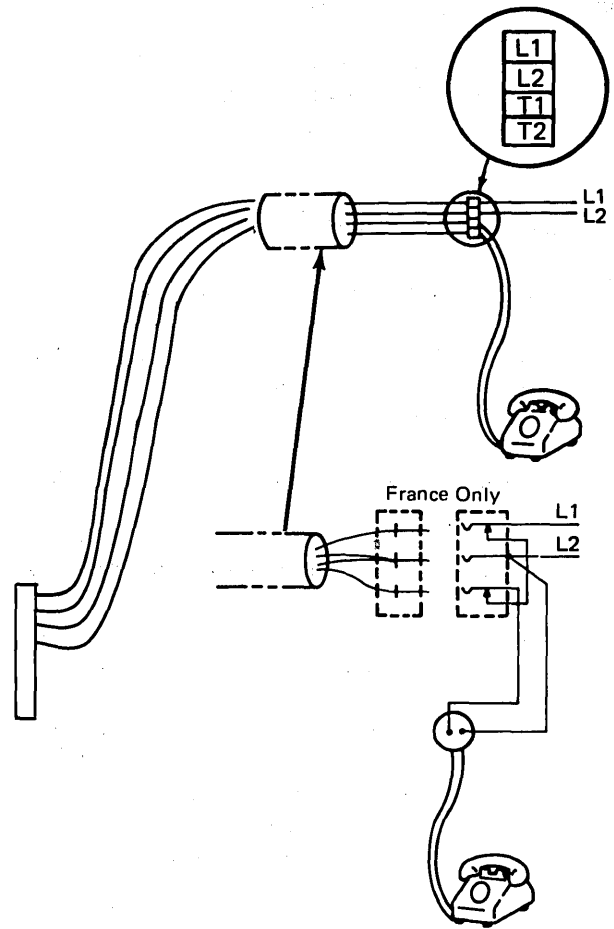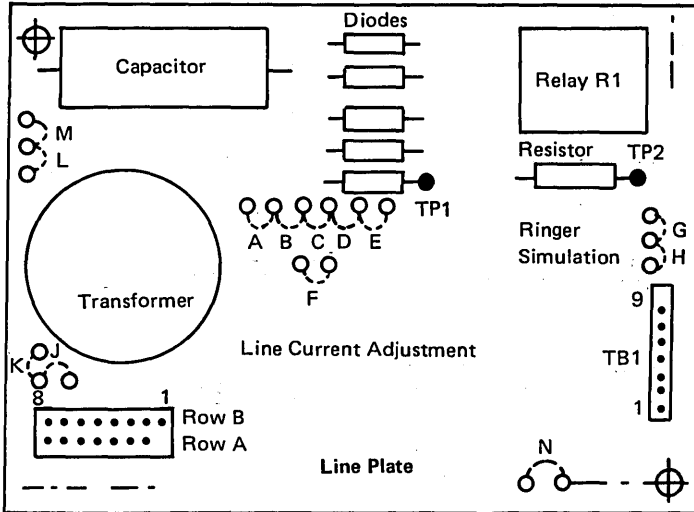
External Cable

Line Plate	Cable	Telephone Plug
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L2)	White
TB1-9	Telephone 2 (L1)	Red

Figure 30-16. World Trade PSN Line Plate and Cable Connections

Line Plate Adjustments without Telephone Set Installed

1. Connect a DC voltmeter (50-Vdc scale) across TP1 (+) and TP2 (-). See Figure 30-16 for the locations of TP1 and TP2.

    Note: Polarity can be reversed with some telephone companies.

2. Install jumper D on the line plate.

3. Set the data station to data status by installing one of the following jumpers to activate the relay on the line plate:

Line 1	A-B3L2B02	to	A-B3L2D08
Line 2	A-B3M2B02	to	A-B3M2D08
Line 3	A-B3L4B02	to	A-B3L4D08
Line 4	A-B3M4B02	to	A-B3M4D08

4. Dial the system from a local telephone. Leave the telephone off the cradle (off the hook) and observe:
    a. The system answers the telephone call with a high-pitched answer tone on the telephone line.
    b. The DSR light on the CE panel comes on. Set the Comm Dply switch on the CE panel to On. Select the desired line number with the Comm Select switch.

If either of these conditions does not occur, perform diagnostics on the communications line.

5. Observe the voltage level of the meter. It must be between 4 Vdc and 37 Vdc. If it is not, attempt jumper position E, C, B, or A.

6. Remove the jumpers that were installed to activate the line plate relay.

Line Plate Jumper Table

Voltage Level	Jumper to Be Selected
0.5-2	F
2-3.5	E (F)
3.5-4	E (C)
4-6	E (C,D)
6-8	C (E,D,B)
8-9	C (E,D,B,A)
9-14	D (E,C,B,A)
14-26	B (C,D,A)
26-37	A (D,B)
37-50	A (B)

The jumper positions given between parentheses are used to select the jumper when in data status. Use only the indicated jumper positions.

Modem Transmit Level

1. Disconnect the cable from the 2X8 connector on the line plate.

2. Connect a decibel meter, set to 600-ohm termination, across DT (data tip) and DR (data ring) at the modem:

	Data Tip	Data Ring
Line 1	A-B3L2D06	A-B3L2D08
Line 2	A-B3M2D06	A-B3M2D08
Line 3	A-B3L4D06	A-B3L4D08
Line 4	A-B3M4D06	A-B3M4D08

3. Perform steps 2 through 10 of paragraph 30-370.

4. Set the transmit output level switches of the modem to match the level specified by the PTT, taking into account the added loss of the line plate (approximately 1.5 dB).

30

30-370 Couplers and Transmit Level Limiting Check

The level control circuit of the CBS data coupler (or similar coupler) can be set to a lower signal level than the transmit level on the modem. When this is the case, overloading of the level control circuit causes slow recovery after change of direction and a possible loss of the received signal. The modem transmit level must be decreased enough to prevent overloading the coupler.

The following steps give the procedure to check transmit level limiting.

1. Connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the external coupler interface. Set the meter to Bridging (no terminating resistance).

2. Set the Mode Selector switch to the Proc Run position (CE panel).

3. Set the Address/Data switches to 0000.

4. Set the MSIPL switch to the Diskette position (CE panel).

5. Set the CSIPL switch to the Diskette position (CE panel).

6. Set all other CE panel switches to their down positions.

7. Insert diskette DIAGB1.

8. Press the Load switch (operator panel).

9. Select the data communications exerciser test (transmit test).

10. Select 16 or 32 as data to be transmitted. Select the Scope Loop A Cmd as the test run option.

11. If this is a new installation, dial the system from a local telephone. If you are troubleshooting a problem, have your system dialed from the remote system. Leave the telephone handset off the cradle (off the hook).

12. Observe the meter. The transmit signal level meter reading should equal the level of the coupler ± 1 dB. If the reading decreases in less than three seconds, the coupler is limiting the transmit level. If the reading remains constant, that level is being transmitted to the line.

13. If the coupler is limiting the transmit signal level, adjust the transmit level switches on the modem card until the transmit level is below the controlled level in the coupler. (Limiting no longer takes place.) The correct level is one decibel below the lower level reading in step 12. Stop here if this is a new installation.

14. Check to see that another modem receives a suitable signal level when this modem transmits by doing the following:
    a. Have another person at the remote station connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the coupler interface.
    b. Ensure that the meter is set to Bridging (no terminating resistance).
    c. Observe the meter. The receive level at the remote station should be 16 dB less than the transmit level. However, an acceptable level could be from -31 dB up to the same level as the transmit level.

30-400   4800 BPS INTEGRATED MODEM
(3864 COMPATIBLE)

Two 4800-bps integrated modems can be installed for MLCA. These modems, described as A and B, can be connected to any communications adapter card (communications line) by the use of discrete board feature wires between the modem and the communications adapter card for that line. The modem is available in two models: U.S. and World Trade nonswitched network modem (Model 1) and U.S. and World Trade switched network modem (Model 2).

U.S. and World Trade Nonswitched Network Modem (Model 1)

The U.S. and World Trade nonswitched network modem (Model 1) operates on 4-wire lines point-to-point or multipoint as a tributary or control modem. A lightning protect card is also supplied.

Point-to-Point Operation: Both the transmit and receive sections of the modems are permanently on between data transmissions. A holding signal is sent over the line to maintain synchronization and equalization.

Multipoint Operation: In the multipoint configuration, one data station is the control station and the other data stations are tributary stations. Between data transmissions, the transmit section of the modem at the control station and the receive section of the modem at the tributary stations are permanently on. A holding signal is sent over the line to maintain synchronization and equalization.

Note: Both models of the 4800-bps integrated modem are set to take and execute all LPDA (line problem determination aid) commands. Some LPDA tests run under MDIs, and others are supplied as stand-alone tests under TU select.

U.S. and World Trade Switched Network Modem (Model 2)

The U.S. and World Trade switched network modem (Model 2) operates on 2-wire switched networks. Auto-answer is a basic function of the switched network modem. The modem is attached to the communications line by way of the following:

- Coupler adapter for external couplers similar to CBS (Canada only)

- Incorporated protective coupler (U.S. only)

- WT coupler (World Trade except Canada)

Switched Operation: The local (or remote) operator makes the manual connection by dialing the other data station telephone number.

At the start of data communications from local to remote:

1.   The local transmit section initializes the remote receive section of the modem.

2.   The local receive section of the modem is clamped off.

3.   The remote transmit section of the modem is clamped off.

At the start of data communications from remote to local:

1.   The remote transmit section initializes the local receive section of the modem.

2.   The remote receive section of the modem is clamped off.

3.   The local transmit section of the modem is clamped off.

Between data communications, the transmit section of the modems is off and a delay is necessary to change the direction of the signal over the line. The turn-around time is 50 milliseconds (with short initialization delay at 4800 bps).

Backup Speed

The modem normally operates at 4800 bps. If necessary, a backup speed of 2400 bps can be used.

When the speed on a communications line is switched, an initialization sequence is started automatically. The time of the sequence compares to the ready-for-sending delay.

Multipoint Network: In a multipoint network configuration, the operator at the control station can select the backup speed through programming and the secondary stations will change speed automatically. The secondary stations cannot initialize a change in line speed.

Switched Network: In a switched network, speed control is possible from either station.

Nonswitched Point-to-Point Network: In a nonswitched point-to-point network, the control modem is jumpered for local speed control and the secondary modem is jumpered for remote speed control. The operator at the control modem station can select the backup speed through programming and the secondary modem station will automatically change speed. The station with the secondary modem cannot initialize a change in line speed.

Maintenance: In case of line problems where full-speed operation is not possible, attempt a backup speed of 2400 bps.

Backup-speed operation is useful at installation time as a diagnostic aid when full-speed operation is not acceptable. If the network operates correctly at backup speed, the programming, the modem, and the DTE hardware are probably correct.

Because equalization is done during the request-to-send/ready-for-sending delay, no user action is needed for new equalization when selecting half or full speed.

The half-speed operation indicates a condition of limited or poor communications link. Low error rate and good data quality when operating at half speed (if full-speed operation does not operate correctly or if data quality is limited) indicate that the communications link may be the problem. However, the wrap test at full speed should be completed with no failures indicated before the communications link is suspected.

30-400

Figures 30-17 through 30-19 show the locations of the
major parts used with the 4800-bps integrated modem.

Modem A

A-B3 Board

Dummy Top
Card Connector

Cable Tower Location
Line 1   D-B6-1
Line 2   D-B6-2
Line 3   D-B7-1
Line 4   D-B7-2

Cable Tower

U4

Z5

F2 G2 H2 J2   N2 P2 Q2

Top Card
Connector

Lightning
Protect
Card

External Cable to
Nonswitched Line

30

Communications Adapter Card
Line 1, 2, 3, or 4

To Modem
Operator Panel

(red) ⎫
       ⎬ Transmit
(white)⎭

Or

(yellow)⎫ Receive
        ⎪ (not used
        ⎬ with 2-wire
(black) ⎭ connection)

WT Countries—Remove 283-B Plug
U.S. and Canada—
          Red and Green (white)—Transmit
          Black and Yellow—Receive

Note: For Modem B locations, see
paragraph 30-100.

(yellow)   (red)

(black)   (green or white)

283-B Plug

Figure 30-17. 4800 BPS Integrated Modem–Nonswitched Network (Modem A)

Modem A

A-B3 Board

Dummy Top
Card Connector

To Coupler Adapter
or
Incorporated Protective Coupler
or
WT Coupler

F2 G2 H2 J2

N2 P2 Q2

Z5

U4

Top Card
Connector

To Modem
Operator Panel

Communications Adapter Card
Line 1, 2, 3, or 4
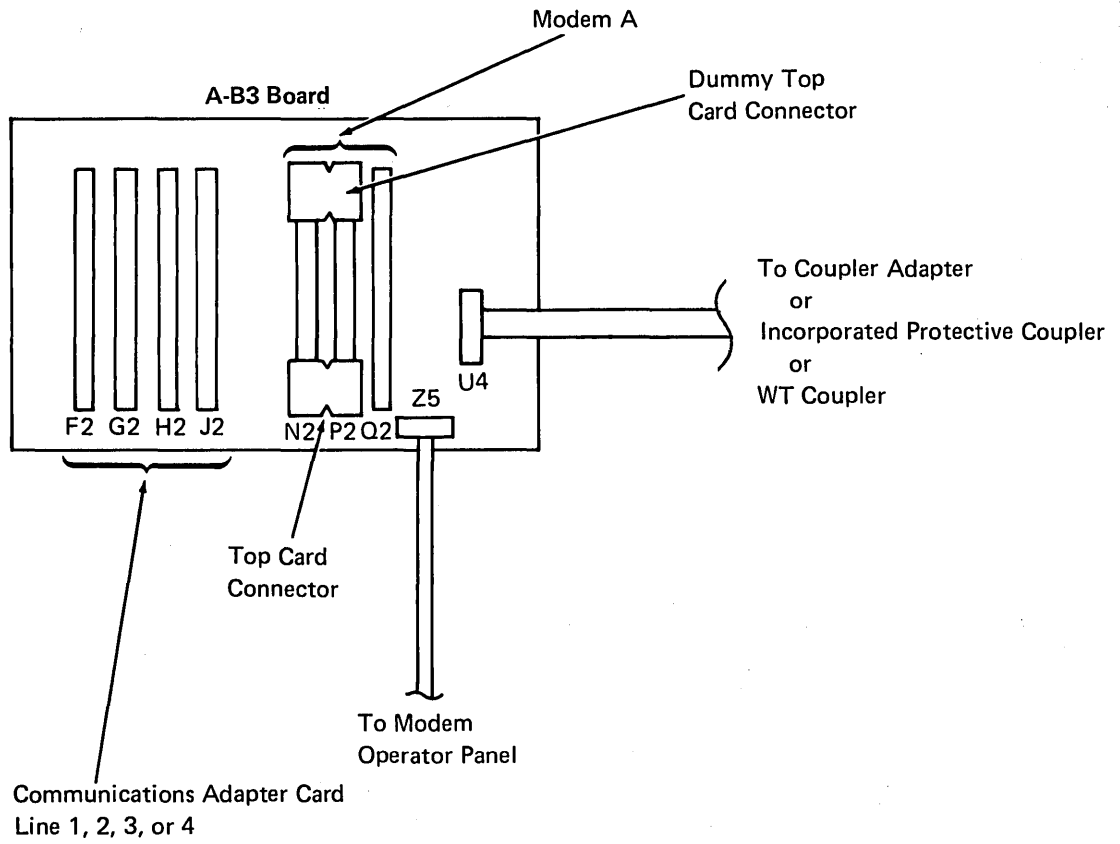
Note: For Modem B locations, see
paragraph 30-100.

Figure 30-18. (Part 1 of 4). 4800 BPS Integrated Modem—Switched Network (Modem A)

24

30-405

Through D-B8
Cable Tower
Opening

External Cable to
CBS or Equivalent
Data Coupler

To
A-B3U4

Coupler Adapter

DA   OH   DT
(yellow)   (blue)   (white)

SH   SG   CCT   RI   DR
(red) (grey)   (brown)   (violet)   (black)

SH   Switch Hook
SG   Signal Ground
DA   Data Modem Ready
CCT   Coupler Cut Through
OH   Off Hook
RI   Ring Indicate
DT   Data Tip
DR   Data Ring

30
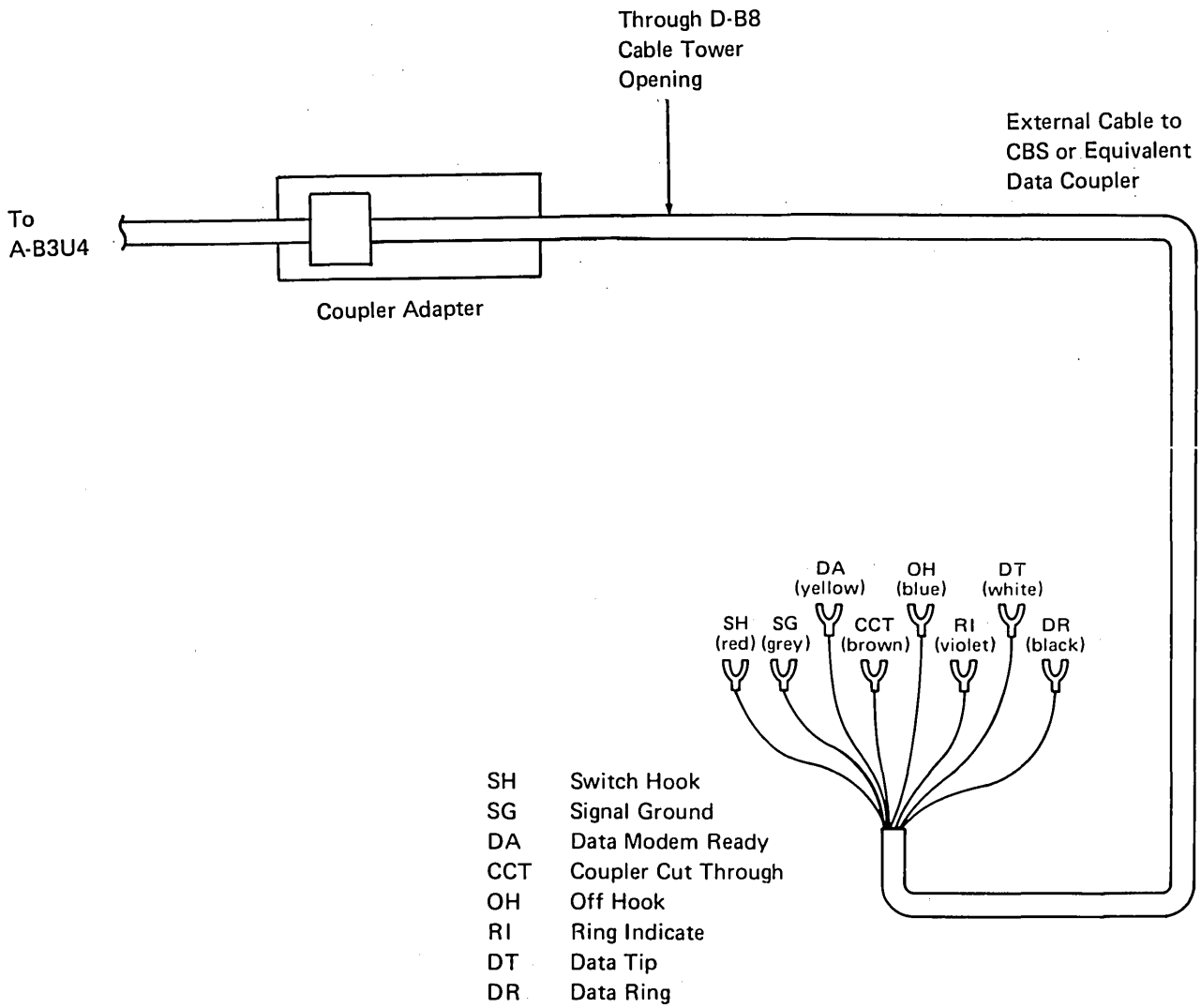
Figure 30-18. (Part 2 of 4). 4800 BPS Integrated Modem—Switched Network (Modem A) (Canada Only)

Coupler Adapter

Coupler

Through D-B8
Cable Tower Opening

To
A-B3U4

Incorporated
Protective
Coupler

MI (yellow)

MIC (black)

PC (brown)

PR (gray)

T (green)

R (red)

Telephone Line
Connection to
Jacks RJ45S or
RJ45M and
RJ41S or RJ41M
(jack must be set
to programmed
position)
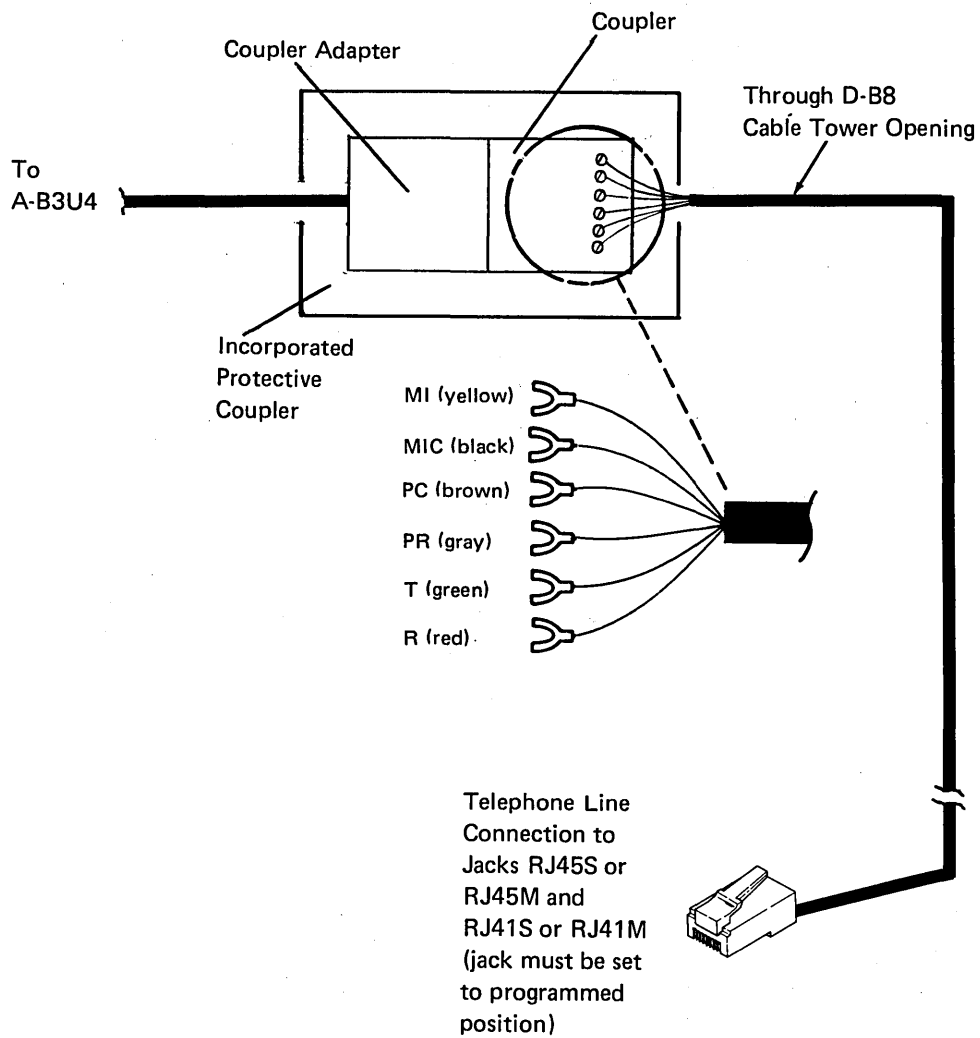
Figure 30-18. (Part 3 of 4). 4800 BPS Integrated Modem–Switched Network (Modem A) (U.S. Only)
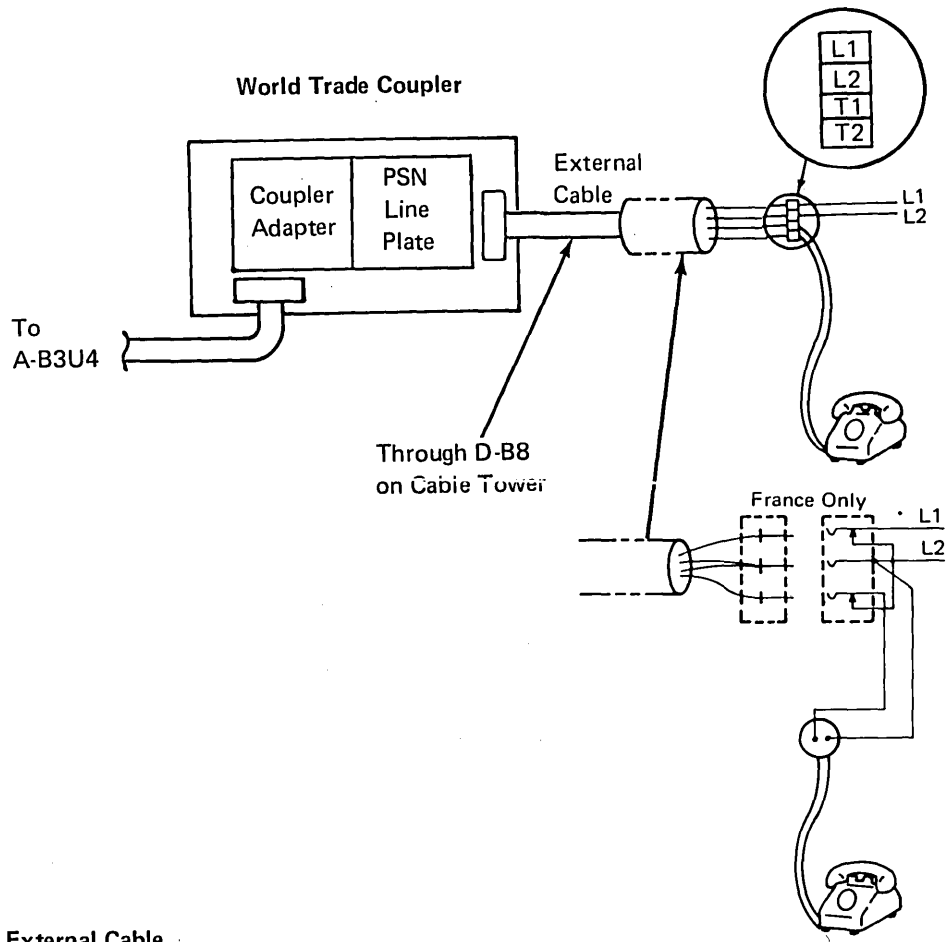
World Trade Coupler

Coupler Adapter | PSN Line Plate

External Cable

L1
L2
T1
T2

L1
L2

To
A-B3U4

Through D-B8
on Cable Tower

France Only

L1
L2

External Cable

Line Plate	Cable	Telephone Plug
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L2)	White
TB1-9	Telephone 2 (L1)	Red

Figure 30-18. (Part 4 of 4). 4800 BPS Integrated Modem–Switched Network (Modem A) (World Trade)

```
        Modem                 Internal Coupler Failed
    A          B               (switched network)
                               Receive Card Check
    —          —               Front End Card Check
    P2         S2              Processor Card Check
    N2         R2
    Q2         T2
```

Modem A   A-B3Q2
Modem B   A-B3T2
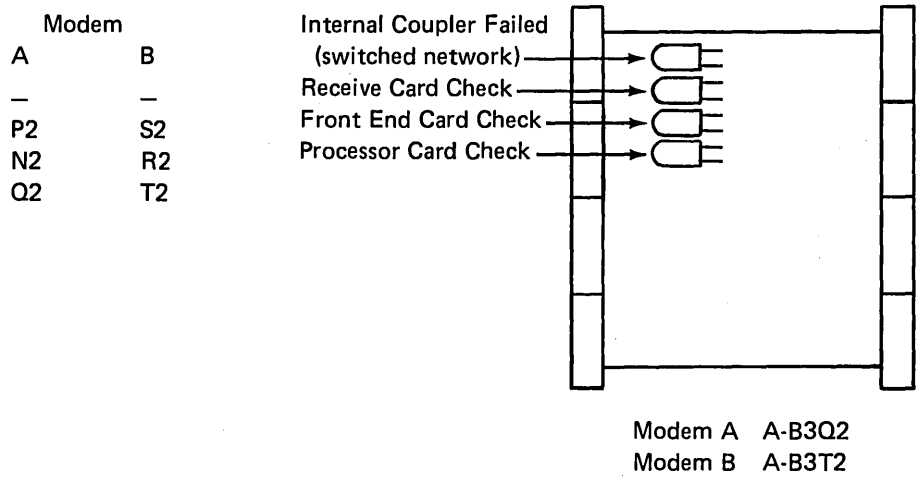
Figure 30-19. 4800 BPS Integrated Modem Processor Card LED Locations

30-410   Operator Panel

The operator panel for the 4800-bps integrated modem
and the panel indicators are shown in Figure 30-20.
Table 30-1 specifies the function of each of the controls
and indicators.

Cable Tower

Note: Only two integrated
modems can be installed on
a system.

Modem A   A-B3Z5
Modem B   A-B3Z6

Note: Address switches installed only on
nonswitched modem (used only with
multipoint).
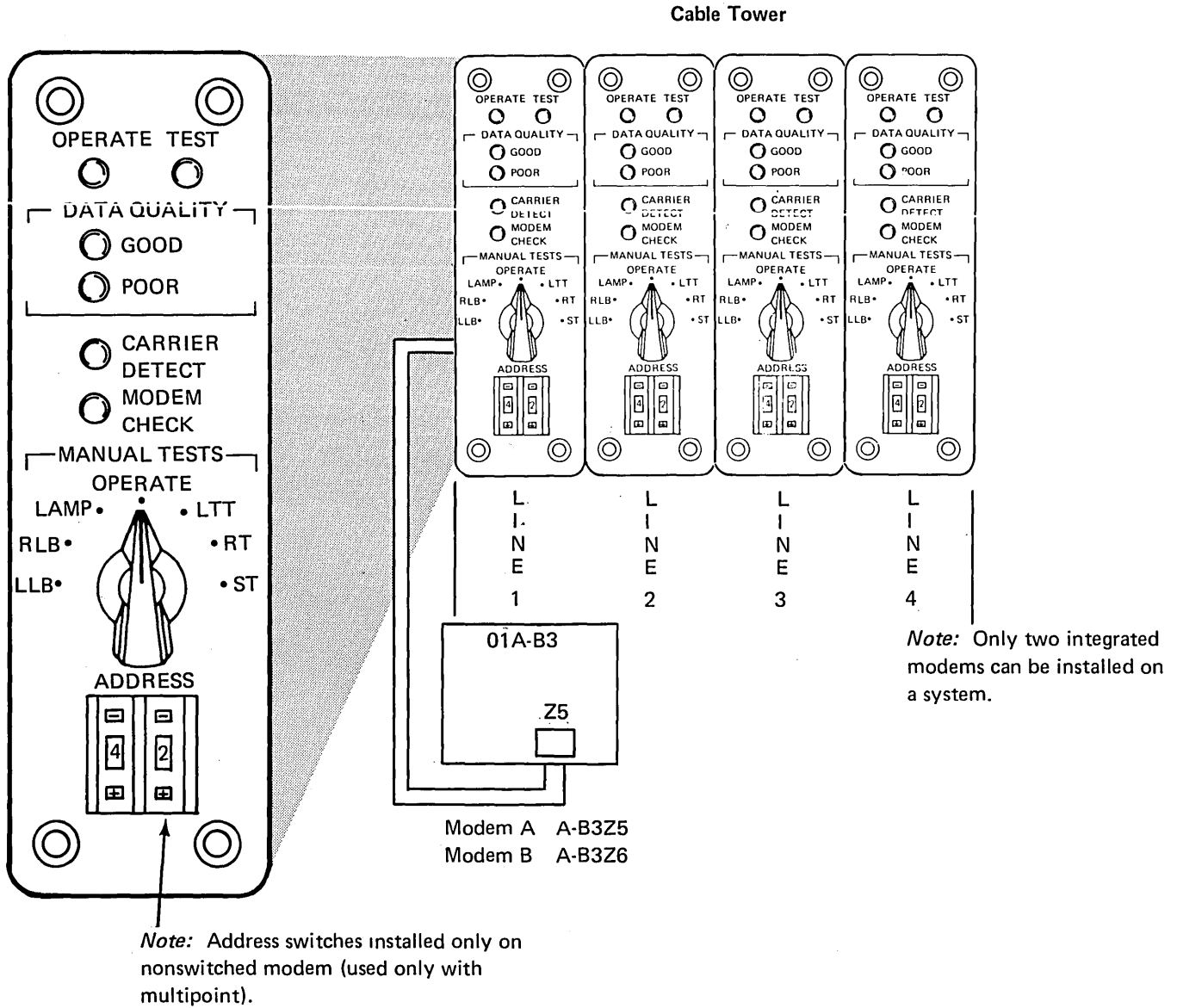
Figure 30-20. Operator Panel for 4800 BPS Integrated Modem

Table 30-1. 4800 BPS Integrated Modem Operator Panel Controls/Indicators

Controls/Indicators	Function
Operate	This indicator is on when the Manual Tests switch is in the Operate position, the DSR (data set ready) lead is on, and either the antistreaming condition is not present or the switched network connection has been made.
Test	This indicator is on when either of the following occurs:
	1. The test indicate lead is on because the Manual Tests switch is in one of the testing positions (LLB, RLB, LAMP, LTT, RT, or ST), or
	2. An LPDA test is being run locally or from a remote system.
Data Quality	*Note:* Both Data Quality indicators (Good and Poor) may be on at the same time. This is a temporary condition of less than one second. Both Data Quality indicators may be off at the same time. This condition indicates that Carrier Detect has been off during one or more periods of 256 bps.
Good	This indicator is on when data errors are not probable.
Poor	This indicator is one when data errors are probable.
Carrier Detect	This indicator is on when the Carrier Detect signal is present.
Modem Check	This indicator is on when the modem has sensed an error during transmission (see Figure 30-19 to isolate the LEDs to a FRU).
Manual Tests (rotary switch)	
LLB	Local Loop Back Test. Not used.
RLB	Remote Loop Back Test. Not used.
Lamp	When this switch is set to Lamp, all of the operator panel indicators should come on.
Operate	When this switch is set to Operate, the modem can be used for normal operation. The Operate indicator should come on (if the connection has been completed for a switched network).
LTT	Loop Transmit Test. When this switch is set to LTT, a test executes that checks the operation of the local modem, the remote modem, and the line connection.
RT	Receive Test. When this switch is set to RT, the modem is ready to operate as the receive modem during the LTT test (see 30-414 for a description of the LTT test).
ST	Self Test. When this switch is set to ST, the modem generates a test pattern that checks the operation of the local modem.
Address switches	Used in multipoint networks only (see 30-440, *Setting the Modem Address*).

30-414 Test Diagnostics Operation

·The Manual Tests rotary switch on the 4800-bps integrated modem operator panel selects either normal operation or diagnostic test run conditions on the communications system. This section describes each switch position and the diagnostic tests available with the 4800-bps integrated modem.

Normal Operation

When the Manual Tests switch is in the Operate position and the Operate indicator is on, the modem is ready for normal operation (for switched networks, the line connection must be complete before the Operate indicator comes on). When in the operate mode, check the Data Quality indicators on the operator panel. If only the Good indicator is on, the line quality is equal to or better than the specifications for accurate data transmission. If only the Poor indicator is on, the line quality is low enough to cause a 10% block error rate. If both indicators are on, the line quality is neither good nor poor (some data transmissions are completed). If both indicators are off, the carrier detect signal has not been on during the move period (256 bps).

Lamp Test

To test all of the indicators on the operator panel to see if they are operating correctly, perform the following steps:

1. Set the Manual Tests switch to the Lamp position. All indicators on the operator panel should come · on.

2. Check the operator panel indicators and exchange any bad indicator (one that is not on).

Self Test

The self test feature of the 4800-bps integrated modem checks the operation of the modem without it being connected to an operating communications line. During the test, the modem generates a test pattern and transmits it to the receive modem in a local loop to sense any errors. The test runs continuously in a loop as long as the Manual Tests switch is in the ST position. Perform the following steps to run the self test on a specific modem:

1. Set the Manual Tests switch to the ST (self test) position.

2. Observe the following conditions of the indicators on the operator panel:
    a. The Test indicator comes on.
    b. The Data Quality Good indicator flashes on and off during the self test.
    c. The Modem Check indicator does not come on during the self test.

3. If any errors are found during the self test (the modem check indicator will come on), check the LEDs on card B-A3Q2 (modem A) or B-A3T2 (modem B). If any of these LEDs are on, they indicate a failing FRU. See Figure 30-19 for the locations of LEDs on this card.

4. When you are through testing the modem, set the Manual Tests switch to the Operate position to return to normal operation.

Loop Transmit Test (Nonswitched Modems Only)

The loop transmit test checks the operation of the local modem, the remote modem, and the communications line. This test is used for nonswitched modems only. The loop transmit test cannot be used by a multipoint tributary station.

The local modem generates a test pattern and sends it to the remote modem. The remote modem receives the test pattern and transmits it back to the local modem. The local modem then compares the received test pattern with the expected test pattern to determine if an error has occurred. No operator aid is needed at the remote site.

Notes:
1. In a point-to-point configuration, only the primary modem can start this test.
2. In a multipoint configuration, only the control modem at the multipoint control station can start this test.

Perform the following steps to run the loop transmit test from a multipoint control station:

1. At the multipoint control station, set the address assigned to the modem at the tributary station on the local modem operator panel.

2. Set the Manual Tests switch on the operator panel to the LTT (loop transmit test) position.

During the test, the Test indicator is lighted at both stations. If the network is operating correctly, the Data Quality Good indicator on the local modem operator panel is also lighted. At the remote modems, the Carrier Detect and Data Quality Good indicators are also on while the test is running. The test runs as long as the Manual Tests switch is in the LTT position.

If the local modem senses an error in the received test pattern, the Modem Check indicator on the local modem comes on. The test does not isolate the FRU.

Transmit/Receive Test (Switched Modems Only)

Switched Networks: For switched modems using the transmit/receive test, the transmitting modem generates a test pattern and sends it to the receiving modem. The receiving modem checks the received pattern for errors. Operator aid is needed at both the local site and the remote site. Perform the following steps to execute the test for switched networks:

Note: Always perform the following steps in this sequence for correct operation.

1. For World Trade only, ensure that the Manual Test switch on both the local and the remote modem operator panels is set to Operate.

   For World Trade only, make the switched line connection by dialing the remote modem telephone number from the telephone at the System/34 modem. Do not return the handset to the cradle (on the hook) at this time.

2. Have the Manual Tests switch on the remote modem set to the RT (receive test) position.

3. Set the System/34 modem Manual Tests switch to the LTT (loop transmit test) position. The transmitting modem starts sending the test pattern to the receiving modem.

4. For World Trade only, return the handset to the cradle (on the hook), and go to step 6.

5. Ensure that the System/34 modem telephone is in voice mode, then make the switched-line connection by dialing the remote modem telephone number from the telephone at the System/34 modem. When you hear the answer tone, return your handset to the cradle (on the hook). The transmit/receive test then starts running.

6. During the test, the Test indicator is lighted at both modems. If the network is operating correctly, the Data Quality Good indicator on the operator panel of the remote modem comes on. The test runs as long as the switches are in the indicated positions. If the remote modem senses an error in the received pattern, the Modem Check indicator at the remote modem comes on. The test does not isolate the FRU.

To test the System/34 receive section of the modem, perform the following additional steps:

7. Set the System/34 modem Manual Test switch to the RT (receive test) position.

8. Have the remote modem Manual Test switch set to the LTT (loop transmit test) position. The transmit/receive test then starts and runs in the opposite direction.

9. Check that the remote modem test indicator and the System/34 modem Data Quality Good and Test indicators are on while the test is running.

An error causes the System/34 modem Modem Check indicator to come on. The test does not isolate any FRUs.

30-440   Setting the Modem Address

The modem address switch is used in multipoint configurations only. See Figure 30-20.

Tributary Modem Addressing

On a multipoint tributary modem, set the address switch to the same address as that of the attached DTE. The low-order digit (right-hand digit) of the 2-digit address must not be zero on a multipoint tributary modem. Also, each modem DTE address must be different from other modem DTE addresses in the network.

Multipoint Control Modem Addressing

A multipoint control modem address switch is active only when one of the manual tests is being run (loop transmit test).

30-450   Card Switch Settings Transmit Level

United States and Canada

Over nonswitched lines, the transmit level is 0 dBm (-10 dBm for Canadian National/Canadian Pacific Telecommunications Networks). No adjustment is needed. Ensure that the transmit level switches are set to the correct level.

Over switched lines, the modem transmit level is set to 0 dBm when the modem is connected to the line through the IBM Incorporated Protective Coupler (United States only). The IBM Incorporated Protective Coupler automatically adjusts to the correct transmit level by testing the program resistor installed in the wall socket by the common carrier. No adjustment is needed. Ensure that the transmit level switches are set to the correct level.

In Canada, the modem is connected to the line through a CBS Data Coupler or a similar coupler. The transmit level must be adjusted to the value indicated on the coupler box as shown in Figure 30-21.

30

Other Countries

In countries outside the U.S. and Canada, the transmit level may change as described by local PTT codes. When possible, the transmit level is set when the host unit is assembled as instructed by codes specified at ordering time.

Setting the Transmit Level

The modem transmit level is set through transmit level control switches. One set of switches is for nonswitched lines, and one set of switches is for switched lines. Set the switches by using the information given in Figure 30-21.

Model 1 Nonswitched Network

Modem A   A-B3N2
Modem B   A-B3R2

Board Connector Side

1 2 3 4
On
Off
Not Used

On
Off
Used for Nonswitched Line
1 2 3 4
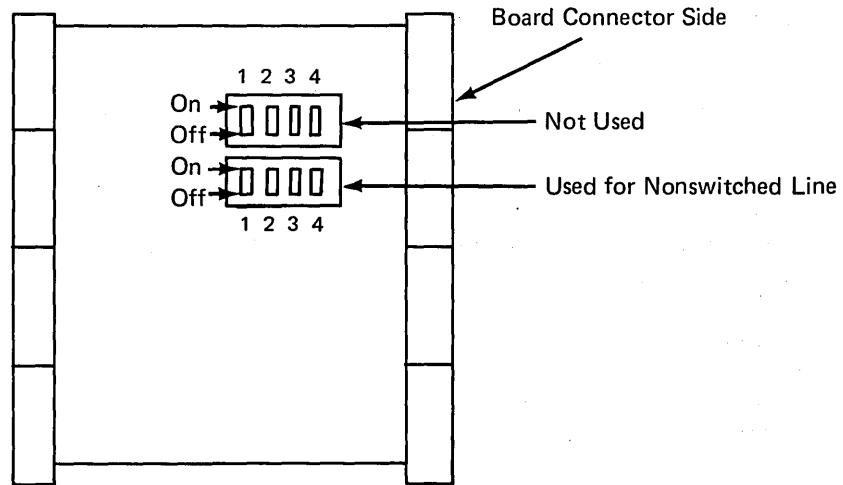
Model 2 Switched Network

Modem A   A-B3N2
Modem B   A-B3R2

Board Side Connector
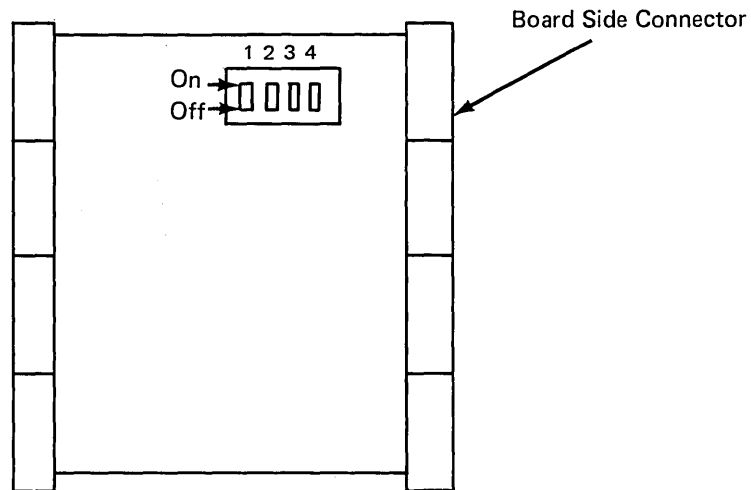
1 2 3 4
On
Off

Switch Setting

Note: 1 = switch in On position,
          0 = switch in Off position.

Digital Code 1 2 3 4				Output Level (dBm)
1	1	1	1	-0
0	1	1	1	-1
1	0	1	1	-2
0	0	1	1	-3
1	1	0	1	-4
0	1	0	1	-5
1	0	0	1	-6
0	0	0	1	-7
1	1	1	0	-8
0	1	1	0	-9
1	0	1	0	-10
0	0	1	0	-11
1	1	0	0	-12
0	1	0	0	-13
1	0	0	0	-14
0	0	0	0	-15

Figure 30-21. 4800 BPS Integrated Modem Front End Card Transmit Level Switches

30-460   Board Jumpers

Model 1 Options (Nonswitched)

For nonswitched networks, the modem is always
shipped from the factory with the jumpers installed that
make it a multipoint control station. If the modem is not
to be used as a control station, add or remove the
jumpers as needed. See Table 30-2 for the jumpers
needed for Model 1 options.

Model 2 Options (Switched)

Table 30-3 specifies the jumper configuration needed for
Model 2 options.

Discrete Wires

Discrete wires are needed to connect the 4800-bps integrated
modem to the communications adapter card. These wires are
described in Figure 30-22.

30

Table 30-2. Model 1 Option Jumpers (Nonswitched)

Option	Modem A		Modem B	
	From	To	From	To
Network Configurations				
Multipoint Control	A-B3N2P07	A-B3N2D08	A-B3R2P07	A-B3R2D08
Multipoint Tributary	A-B3N2P07	A-B3N2D08	A-B3R2P07	A-B3R2D08
	A-B3N2P09	A-B3N2J08	A-B3R2P09	A-B3R2J08
Point-to-Point (4-wire)	Remove multipoint control jumper above		Remove multipoint control jumper above	
Speed Control				
Local Speed Control (primary or multipoint control modem) (see Note 1)	No jumpers needed		No jumpers needed	
Remote Speed Control (secondary or multipoint tributary modem) (see Note 1)	A-B3N2P09	A-B3N2D08	A-B3R2P09	A-B3R2D08
Initialization RFS Delay				
24 ms (normal)	No jumpers needed		No jumpers needed	
50 ms (long) (see Note 2)	A-B3N2P11	A-B3N2P08	A-B3R2P11	A-B3R2P08
Carrier Detect Sensitivity (Receive Level)				
Above -32 dBm (normal position for U.S. and World Trade above -32 dBm)	No jumpers needed		No jumpers needed	
Below -32 dBm (World Trade below -32 dBm)	A-B3N2P13	A-B3N2U08	A-B3R2P13	A-B3R2U08

Notes:
1. For point-to-point speed control only, both modems must *not* be set for remote speed control. Set the modem at the station that most often controls the network (the station that transmits or is polled first) to local speed control. Set the other modem for remote speed control.
2. The long delay time is needed for a multipoint tributary station that does not respond because of an overload on the line (a poor link in a multipoint network).

Table 30-3. Model 2 Option Jumpers (Switched)

Option	Modem A		Modem B	
	From	To	From	To
Point-to-Point (2-wire) CCITT	A-B3N2P09	A-B3N2D08	A-B3R2P09	A-B3R2D08
Point-to-Point (2-wire) U.S.	No jumpers needed		No jumpers needed	
Initialization RFS Delay				
Long (normal)	No jumpers needed		No jumpers needed	
Short (see note)	A-B3N2P11	A-B3N2P08	A-B3R2P11	A-B3R2P08

Note: The short initialization RFS delay can be set by the service representative when switched network connections are limited to local calls inside one central office. Because telephone line conditions may change, this option needs testing when installed in such a local configuration.

Adapter Card*	Signal	Modem Card**
M13	DTR	B02
S10	DSR	B13
P06	RTS	D02
S09	CTS	D13
S13	CD	B12
P10	Rate Select	B04
M10	Test Control	B05
P11	Test Ind	D10
S07	Ring Ind	D12
S05	Rcv Clk	B08
S08	Xmit Clk	B07
U10	Rcv Data	B10
P13	Xmit Data	D04
M05	Sel Stby (used for diagnostics only)	B03

*Line 1   A-B3F2

Line 2   A-B3G2

Line 3   A-B3H2

Line 4   A-B3J2

**Modem A-B3N2

  Modem B-B3R2

Figure 30-22. 4800 BPS Integrated Modem Discrete Wires

30-470   Line Plate Adjustment

The line plate adjustment is needed only when the
network is a World Trade public switched network
(PSN). This adjustment for the 4800-bps integrated
modem is the same as the adjustment performed for the
1200-bps integrated modem. See procedure 30-360 for
the steps to perform the line plate adjustment.

30-480   Couplers and Transmit Level
**   Limiting Check (Canada Only)**

This procedure is the same as procedure 30-370. See
30-370 for problems in this area.

30-500   DIGITAL DATA SERVICE ADAPTER

30-510   Locations

Figure 30-23 shows the parts needed for the Digital
Data Service Adapter (DDSA) for line 1. If installation is
on line 2, 3, or 4, see Figures 30-5 and 30-7 for
hardware locations.
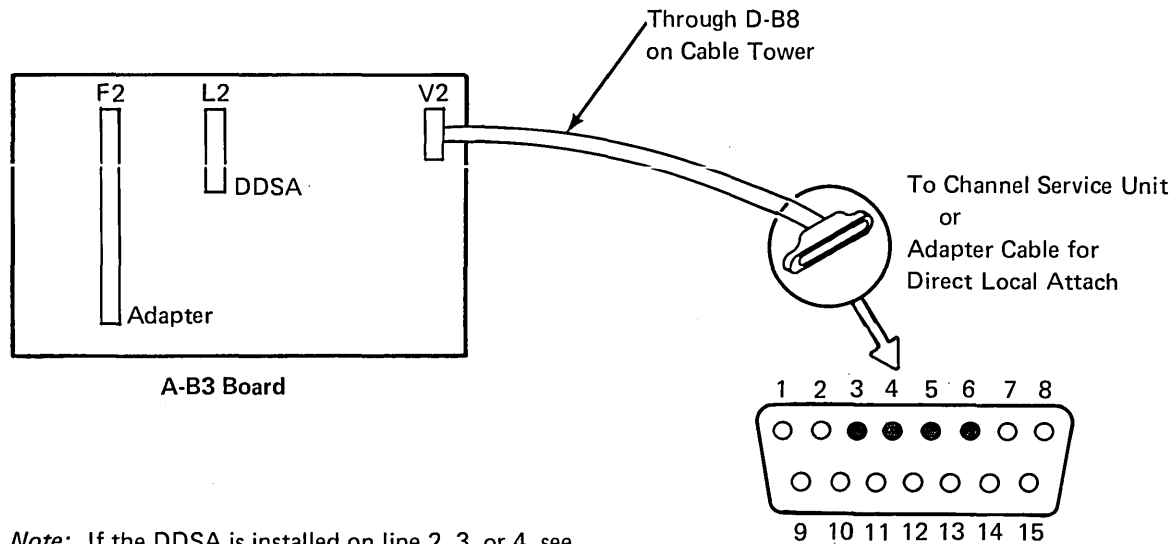
Note: If the DDSA is installed on line 2, 3, or 4, see
Figures 30-5 and 30-7 for hardware locations.

3	Received Data (DT1)
4	Received Data (DR1)
5	Transmitted Data (DT)
6	Transmitted Data (DR)

1, 2, and 7 through 15 are
not used.

Figure 30-23. Digital Data Service Adapter (Line 1)

The Digital Data Service Adapter cards have five jumper
locations; attach these jumpers as instructed in Figure
30-24.

```
            \      • A •    • B •    • C •        • D •
                                                  • E •
```
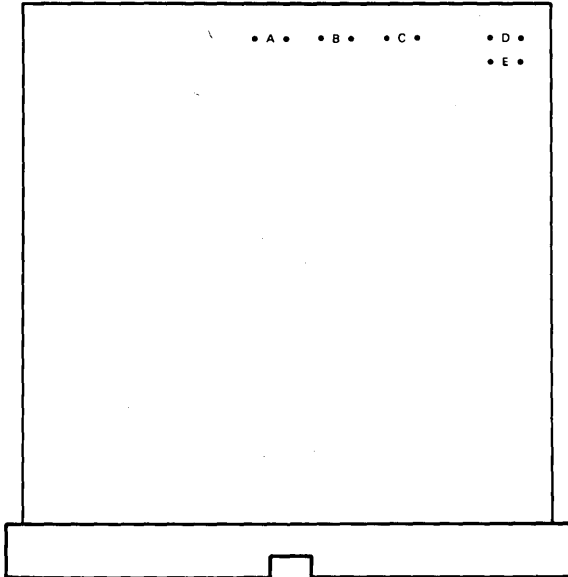
```
Line 1    A-B3L2
Line 2    A-B3M2
Line 3    A-B3L4
Line 4    A-B3M4
```

A — Needed for 2400 bps operation (see note)
B — Needed for 4800 bps operation (see note)
C — Needed for 9600 bps operation (see note)
D — Needed for 56,000 bps operation (see note)
E — Needed for multipoint operation (disables the
    channel service unit loop-back)
    Not used for point-to-point operation (enables
    the channel service unit loop-back in test mode)

Note: The bits-per-second rate must be set to the rate
specified in the customer's order for service to the
common carrier. Clocking is controlled by the common
carrier central office or by the adapter (local direct
attach). If 56,000 bps is specified, the communications
adapter card switch settings and configuration for this
line must be set for device address 80.

Figure 30-24. Card Jumpers for DDSA

30-600   EIA/CCITT ADAPTER

30-610   Locations

External medium-band modems are attached to
System/34 by the EIA/CCITT (Electronic Industries
Association/International Consultative Committee on
Telegraph and Telephone adapter card. Figure 30-25
shows the parts for the external modem configuration
for line 1. If installation is on line 2, 3, or 4, see Figures
30-5 and 30-7 for hardware locations.

The EIA/CCITT adapter card converts the signal level
and changes the voltage to the levels specified in
RS-232C and CCITT recommendation V.28.

If the internal stand-alone modem is either an IBM
3863, 3864 or 3865, have the modem configuration
switch set to take all LPDA commands.

A-B3 Board

2	Transmit Data	11	Select Standby
3	Receive Data	15	Transmit Timing
4	Request to Send	17	Receive Timing
5	Clear to Send	18	Wrap
6	Data Set Ready	20	Data Terminal Ready
7	Signal Ground	22	Ring Indicator
		23	Rate Select

1, 8, 9, 10, 12, 13, 14, 16, 19, 21, 24, and 25 are not used
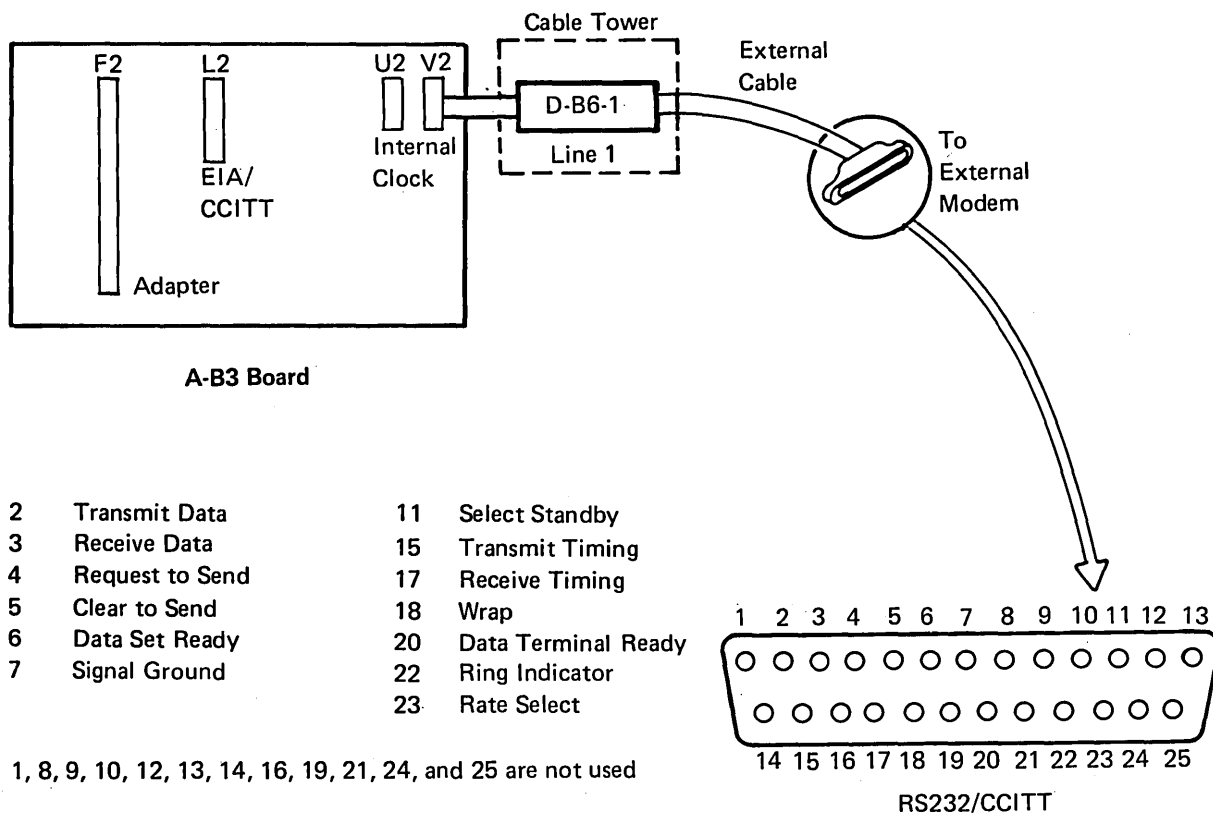
Note: If the EIA/CCITT adapter is installed on line
2, 3, or 4, see Figures 30-5 and 30-7 for hardware
locations.

Figure 30-25. EIA/CCITT Installed on Communication Line 1

Multiline Communications Adapter   41

30-650   Card Jumpers

The EIA/CCITT cards have 10 jumper locations, but none of the jumpers is needed.
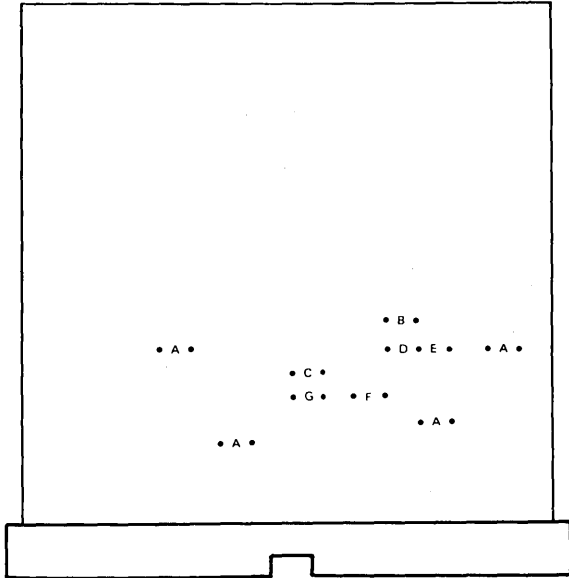
```
                          • B •
    • A •               • D • E •    • A •
                    • C •
                    • G •  • F •
                              • A •
             • A •
```

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

A — Not used or missing (four locations)
B — Not used
C — Not used
D — Not used
E — Not used
F — Not used
G — Not used

If you have a multipoint control modem that needs *new sync*, the following jumpers are added for each line:

Line 1   A-B3L2G08   to   A-B3V2D13
Line 2   A-B3M2G08   to   A-B3V3D13
Line 3   A-B3L4G08   to   A-B3V4D13
Line 4   A-B3M4G08   to   A-B3V5D13

30-660   EIA/CCITT Modem Control Lines

The modem control lines for the EIA/CCITT interface are active during the up level. These lines and their associated pin numbers are shown in Figure 30-26. The following paragraphs describe eight of these lines.

The 'RTS' (request to send) line controls the transmit and receive functions of the modem. When this line is active, the modem is in transmit mode; when this line is not active, the modem is in receive mode. On a 2-wire nonswitched line, 'RTS' is switched by System/34. On a 4-wire nonswitched line, 'RTS' can be switched by System/34, held permanently on by System/34, or held permanently on by the modem. On a switched line, 'RTS' is switched by System/34. The 'RTS' line is on during the transmission of each block or frame.

The 'standby' line selects the switched network backup (SNBU) line.

The 'test' line selects the modem wrap function. When the modem wrap test is running, the transmit function of the modem is sent back to the receive function of the modem.

The 'DTR' (data terminal ready) line signals the modem that the terminal is ready to send or receive data. On a switched line, 'DTR' initializes and holds the line connection.

The 'rate select' line selects the bit rate on modems with half speed. When this line is down, half speed is selected.

The 'CTS' (clear to send) line indicates that the modem is ready to transmit data. On a 4-wire nonswitched line, 'CTS' can be active all the time. On a 2-wire nonswitched or switched line, 'CTS' is turned on and off by the 'RTS' line.

The 'DSR' (data set ready) line indicates that the modem is ready. The modem is ready when power is on, when the modem is connected to the line, and when the modem is not in test mode; all three conditions must be met.

The 'ring indicator' line indicates that the modem is receiving a call.

Adapter		EIA/CCITT Interface Card			Modem
	B05		J07	Test (wrap)	18
	B04		J06	Rate Select	23
	B02		J02	DTR (data terminal ready)	20
	D02		G03	RTS (request to send)	4
	D04		G07	Transmit Data	2
	B03		G05	Standby	11
	B09		G08	New Sync*	14
	B10		G04	Receive Data	3
	D13		G10	CTS (clear to send)	5
	B08		J10	Receive Timing	17
	B13		J09	DSR (data set ready)	6
	B07		J04	Transmit Timing	15
	D12		G13	RI (ring indicator)	22
	D08		J08	Signal Ground	7
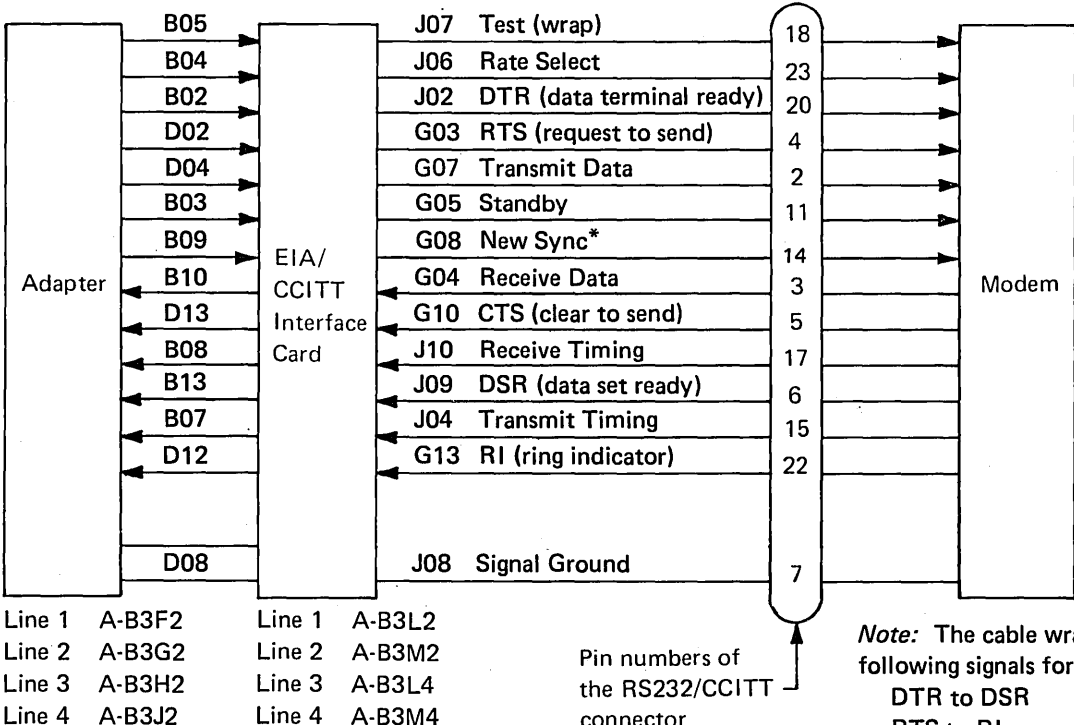
Line 1 A-B3F2   Line 1 A-B3L2
Line 2 A-B3G2   Line 2 A-B3M2   Pin numbers of
Line 3 A-B3H2   Line 3 A-B3L4   the RS232/CCITT
Line 4 A-B3J2   Line 4 A-B3M4   connector
*New Sync requires a board jumper

Figure 30-26. Modem Control Lines for EIA/CCITT Interface

30

Note: The cable wrap connector connects the following signals for testing:
    DTR to DSR
    RTS to RI
    Transmit Data to CTS
    Rate Select to Transmit Timing
    Wrap to Receive Data
    Standby to Receive Timing

30-700   ANALOG WIDEBAND ADAPTER

The analog wideband adapter card is used to convert
the signal levels of the communications adapter card to
the levels needed by a high-speed WE303 modem. See
Figures 30-27 through 30-29 for more information.

System/34 Communications Adapter Signals (see Note 1)

Analog Wideband Adapter Card

External Modem Signals (see Note 2)

Drivers

System/34 Signal	Adapter pin		Modem pin	External Modem Signal
- Request to Send	D02		G03	+Request to Send
+Transmit Data Space	D04		J05	- Transmit Data Space
-Wrap (cable wrap only)	B05		J07	+Wrap

Receivers

System/34 Signal	Adapter pin		Modem pin	External Modem Signal
- Data Set Ready	B13		J09	+Data Set Ready
- Clear to Send	D13		G10	+Clear to Send
+Receive Data	B10		J13	- Receive Data
- Transmit Timing	B07		J04	+Transmit Timing
- Receive Timing	B08		J10	+Receive Timing
- Carrier Detect	B12		J12	+Carrier Detect

Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

Notes:
1. The communications adapter signals are at a VTL level.
2. The external modem signals are at a WE303 level.
3. The wrap connector connects the following signals for
   diagnostic testing:
   - Wrap → Transmit Timing
   - Transmit Timing → Receive Timing
   - Transmit Data → Receive Data
   - RTS → CTS
            DSR
            Carrier Detect

Figure 30-27. Analog Wideband Adapter Signal Lines

WE303

Logic 0 (high) = > sink 23 milliamperes minimum
Logic 1 (low) = > sink 5 milliamperes maximum

Notes:
1. If the WE303 input signal is low, the VTL output signal is high; if the WE303 input signal is high, the VTL output signal is low.
2. No voltage levels are shown for the WE303, because the WE303 is a current-driven device.

VTL
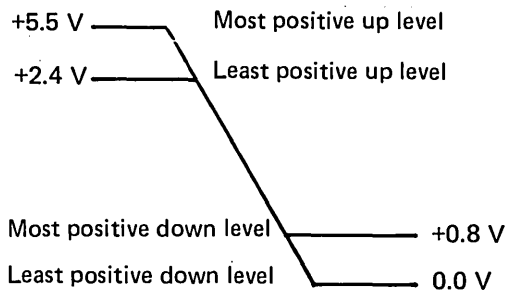
Current at up level = 8 milliamperes loaded to the source of the signal
Current at down level = 1.45 milliamperes maximum supplied to the source

Figure 30-28. Normal Input Signals

WE303

Current load =100 ohms ± 10% to ground:
Logic 0 (high) = > 23 milliamperes minimum
Logic 1 (low) = > 5 milliamperes maximum

VTL
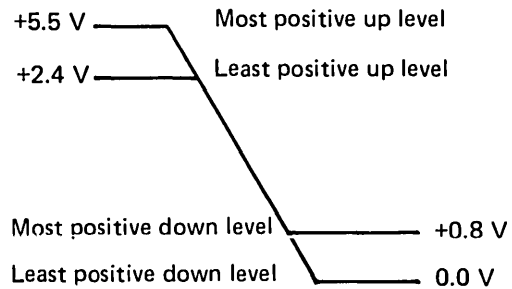
Current at up level = 10 milliamperes maximum
Current at down level = sink 4.8 milliamperes maximum

Figure 30-29. Normal Output Signals

30

30-710 Locations

Figure 30-30 shows the parts for the external modem configuration for line 1. If installation is on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.

A-B3 Board

C	Clear to Send
D	Request to Send
E	Send Data
F	Data Set Ready
J	Transmit Clock
K	Receive Data
L	Receive Clock
M	Carrier Detect

A, B, G and H are not used
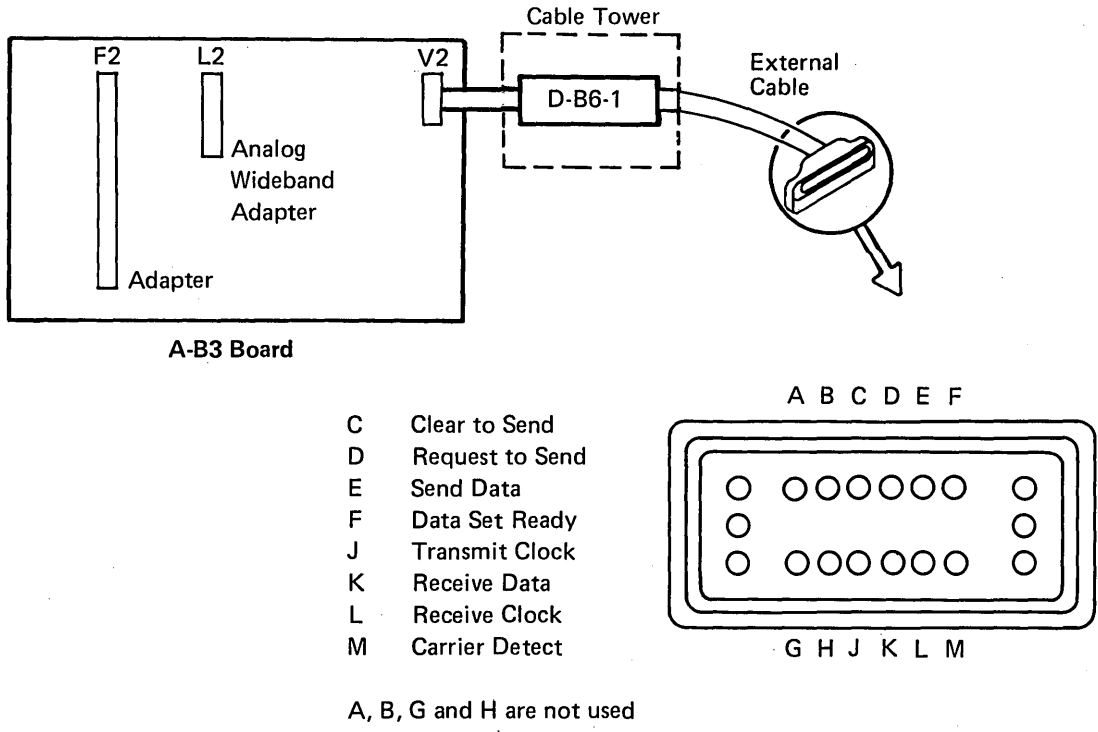
Note: If the wideband adapter is installed on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.

Figure 30-30. Analog Wideband Adapter Locations (Line 1)

30-750 Card Jumpers

The analog wideband adapter card needs 14 jumpers installed to run WE303 mode; attach these jumpers as instructed in Figure 30-31. (Only one wideband card can be installed on the system.)
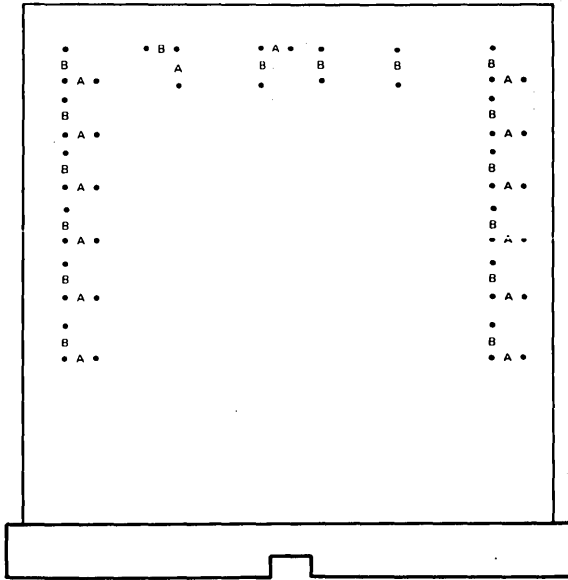
Line 1   A-B3L2
Line 2   A-B3M2
Line 3   A-B3L4
Line 4   A-B3M4

A   Needed (14 locations)
B   Not used

Note: The communications adapter card switch settings and configuration for this line must be set for device address 80; ensure that the jumper for microinterrupt request to interrupt level 2 is installed on this communications line (see 30-200).

Figure 30-31. Card Jumpers for Analog Wideband Adapter

30-810 Locations

Figure 30-32 shows the parts needed for the autocall
adapter installed on line 1. If installation is on line 2, 3,
or 4, see Figures 30-5 and 30-7 for hardware locations.

2   Digit Present (DPR)
3   Abandon Call and Retry (ACR)
4   Call Request (CRQ)
5   Present Next Digit (PND)
6   Power Indication (PWI)
7   Signal Ground
8   Diagnostic Wrap Return Line for NB1 (not used in normal operation)
13   Distant Station Connected (DSC)
14   Digit Signal (NB1)
15   Digit Signal (NB2)
16   Digit Signal (NB4)
17   Digit Signal (NB8)
22   Data Line Occupied (DLO)
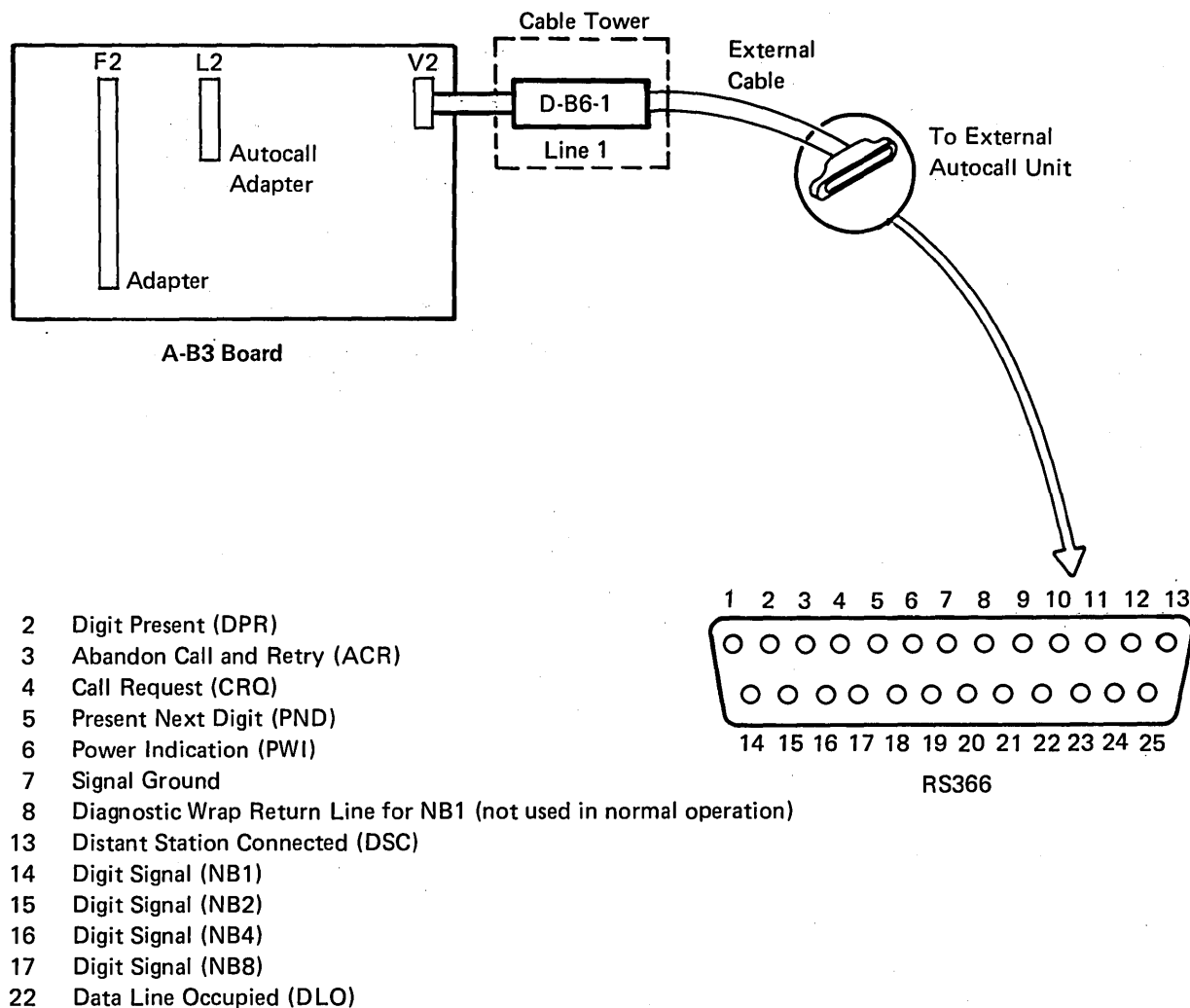
Note: For testing purposes, pin 6 is tied to pin 11, and pin 16
is tied to pin 18 at the end of the cable.

Figure 30-32. Autocall Adapter Installed on Communication Line 1

30-820 Autocall Control Lines

The autocall control lines and their associated pin
numbers are shown in Figure 30-33. The autocall wrap
connector is shown in Figure 30-34.

Line 1	A-B3F2	
Line 2	A-B3G2	
Line 3	A-B3H2	
Line 4	A-B3J2	

Line 1	A-B3L2
Line 2	A-B3M2
Line 3	A-B3L4
Line 4	A-B3M4

Pin numbers of
the RS366
connector
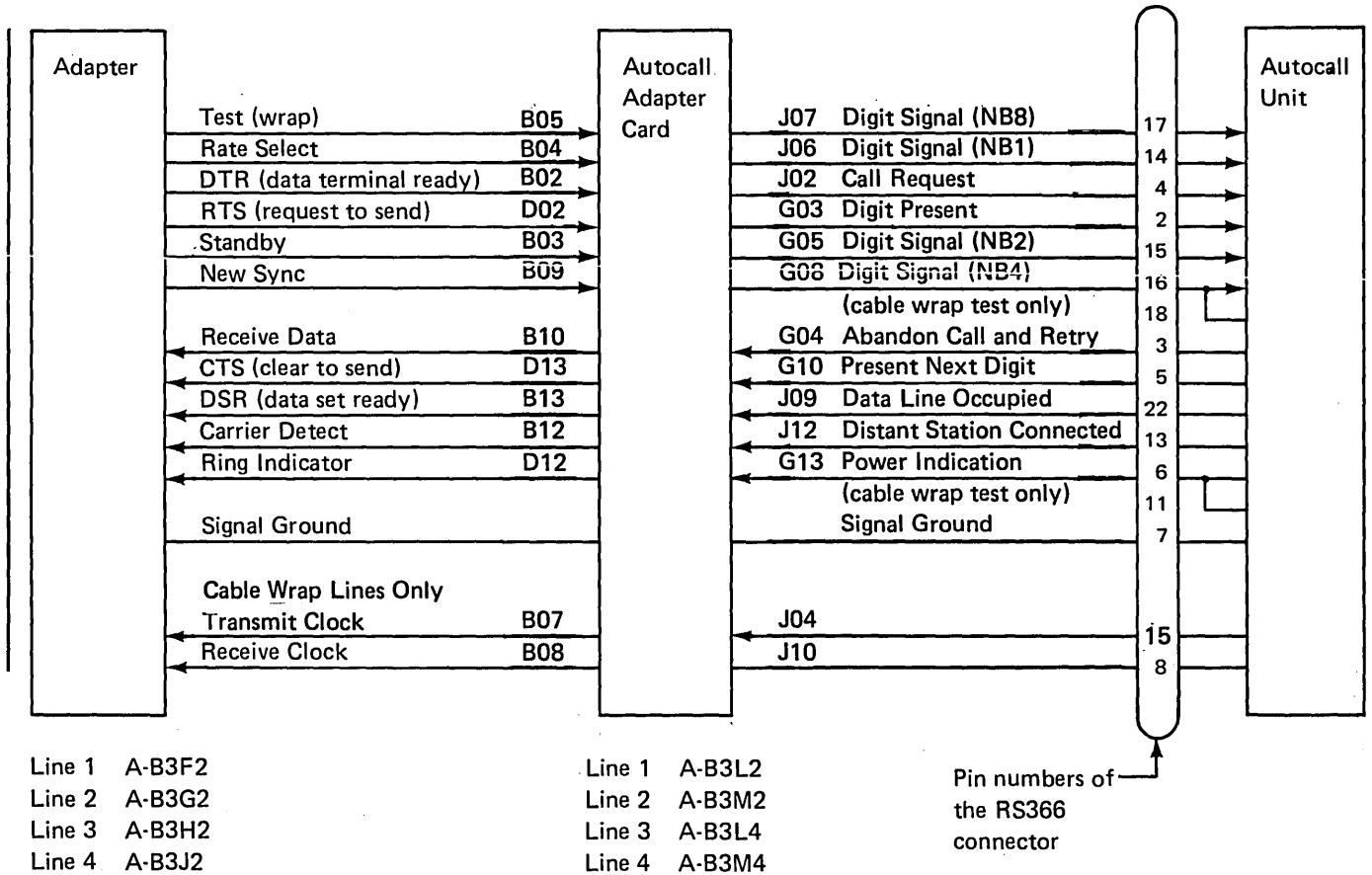
Figure 30-33. Autocall Control Lines

Call Request	>	4	DTR
Data Line Occupied	<	22	DSR
Digit Signal (NB2)	>	15	STBY
Distant Station Connected	<	13	CD
Digit Signal (NB1)	>	14	RATE
Receive Timing	<	8	RCLK
Digit Signal (NB8)	>	17	WRAP
Power Indication	<	11	RI
Digit Signal (NB4)	>	18	NSYNC
Abandon Call and Retry	<	3	RDATA
Digit Present	>	2	RTS
Present Next Digit	<	5	CTS

Cable   Wrap Connector
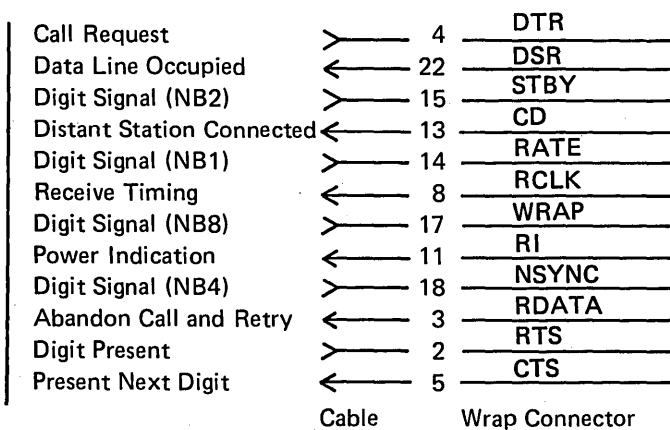
Figure 30-34. Autocall Cable Wrap Connector

30-850 Card Jumpers

The autocall adapter cards are the same as the
EIA/CCITT cards. The cards have 10 jumper locations
(see Figure 30-35), but none of the jumpers is needed.
However, you must connect one of the following board
jumpers to supply the digit signal (NB4):

Line 1	A-B3L2G08	to	A-B3V2D13
Line 2	A-B3M2G08	to	A-B3V3D13
Line 3	A-B3L4G08	to	A-B3V4D13
Line 4	A-B3M4G08	to	A-B3V5D13
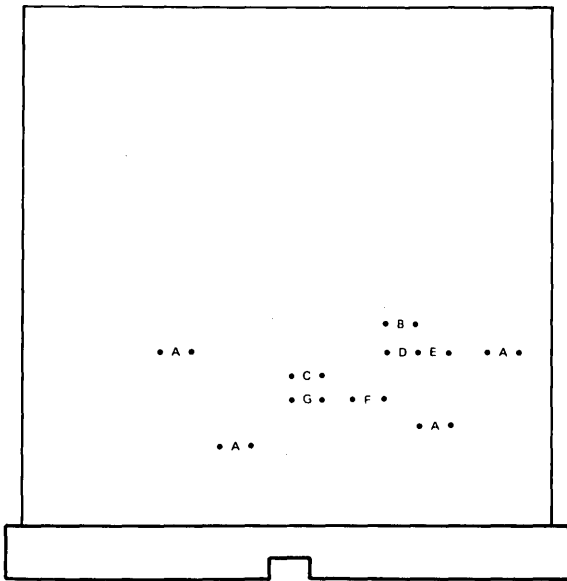
Line 1	A-B3L2
Line 2	A-B3M2
Line 3	A-B3L4
Line 4	A-B3M4

A — Not used or missing (four locations)
B — Not used
C — Not used
D — Not used
E — Not used
F — Not used
G — Not used

Note: The communications adapter card switch settings for
this line must have switch 3 in the On position.

Figure 30-35. Autocall Adapter Card Jumpers

31-000   Data Communications (First or Second Communications Adapter)

CONTENTS

31

31-010   INTRODUCTION

Data communications is an optional feature that lets
System/34 function as a primary station (SDLC only) or
a terminal in a point-to-point or multipoint network.
Two communication features can be installed and run at
the same time. The hardware associated with line 1 is
described as line 1. The hardware associated with line 2
is described as line 2. Data is transmitted and received
serial-by-bit and serial-by-character over voice-grade
communication networks (switched or nonswitched), or
over DDSA. The system may be connected to a
half-duplex or duplex network but the adapter operates
in half-duplex mode only; that is, data transmission is
only in one direction at a time.

During transmit operations, each byte to be transmitted
is sent to the communications adapter where the data is
serialized and then sent one bit at a time to the modem
or digital adapter. The modem or digital adapter, then
sends the bits to the receiving terminal over the
communications network.

During receive operations, the communications adapter
receives each bit from the modem and assembles the
bits into bytes (deserializes). Each byte of data is then
sent to the processing unit.

31-100   LOCATIONS

Figures 31-1 and 31-2 show the locations of the major
parts used for data communications. The
communications adapter cards are always in location
A-A2J2 for line 1; and in location A-A2K2 for line 2.
The internal clock card, when used, is always in location
A-A2Q2 and supplies clock pulses for both line 1 and
line 2. The internal clock is used when the modem
does not supply an external clock.

Locations of other parts such as the integrated modems,
external adapters, and external cables are shown in
paragraphs 31-110 through 31-150.

A-A2
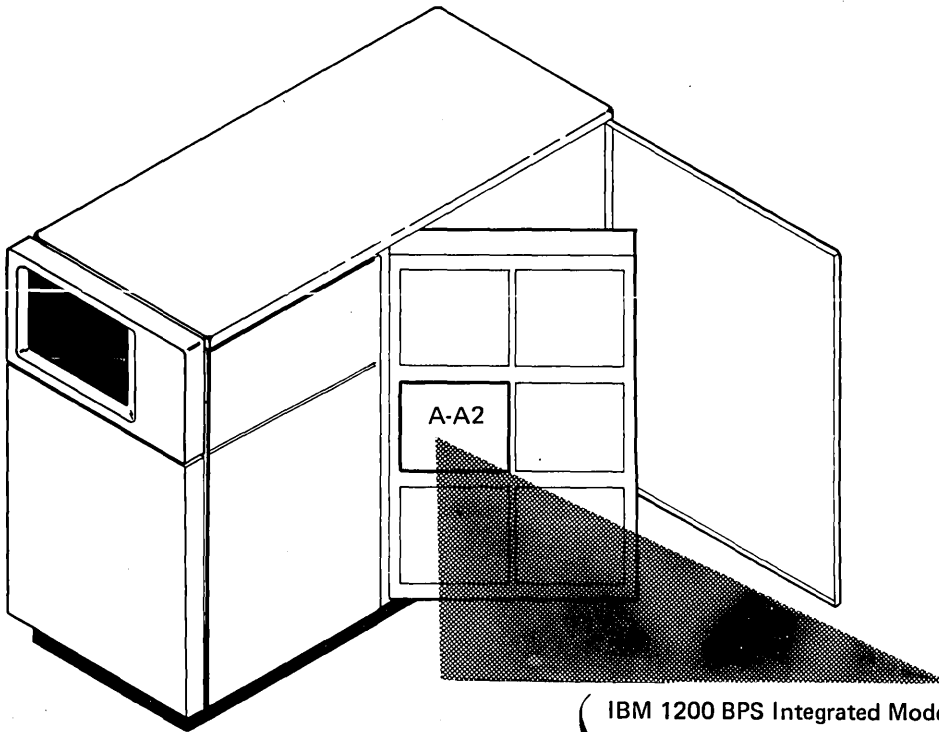
A-A2H2
Line 1 } IBM 1200 BPS Integrated Modem
or
Electronic Industries Association Adapter Card
or
Digital Data Service Adapter

A-A2H4
Line 2 } IBM 1200 BPS Integrated Modem
or
Electronic Industries Association Adapter Card
or
Digital Data Service Adapter

A-A2J2   Communications Adapter Card (Line 1)

A-A2K2   Communications Adapter Card (Line 2)

A-A2Q2   Internal Clock

Figure 31-1. Data Communications Card Locations on A-Gate

Line Plates for
World Trade Public
Switched Network
or
COMTB1
COMTB2

(line 1)

(line 2)

(line 2)

(line 1)

B-A1
(line 1)

B-A2
(line 2)

IBM 2400 BPS
Integrated Modems

IBM 2400 BPS Integrated
Modem Operator Panels

D-B6, D-B7, and D-B8
Cable Locations for
Data Communications
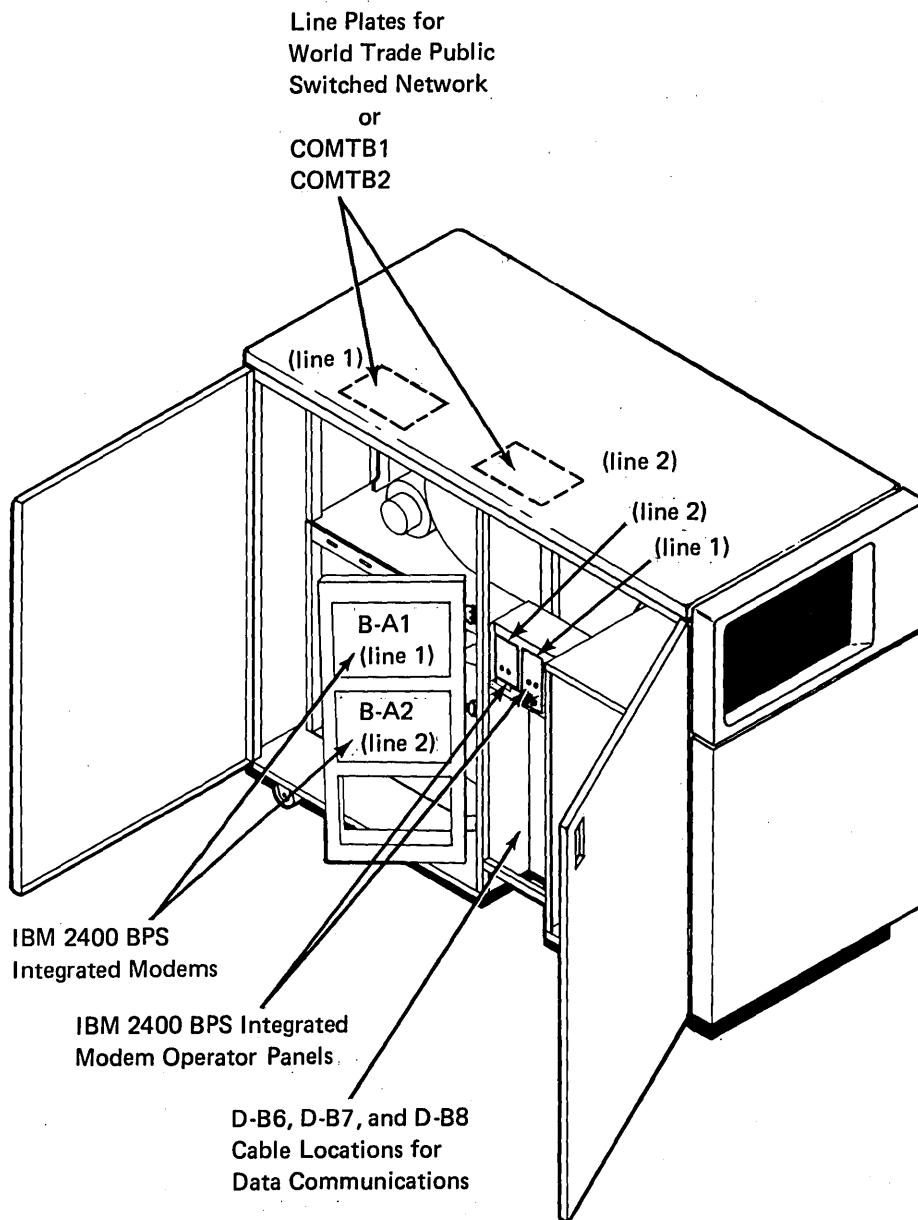
Note: See paragraphs 31-120, 31-150, and 31-320
for additional hardware description.

Figure 31-2. B-Gate and Cable Tower

31-100

31-110 EIA/CCITT

When external modems are attached to System/34, an
EIA/CCITT (Electronic Industries
Association/International Consultative Committee on
Telegraphy and Telephony) adapter card is in card
location A-A2H2 for line 1; and in card location A-A2H4
for line 2. Figure 31-3 shows all the parts for the
external modem configuration.

A-A2 Board

2	Transmit Data	11	Select Standby
3	Receive Data	15	Transmit Timing
4	Request to Send	17	Receive Timing
5	Clear to Send	18	Wrap
6	Data Set Ready	20	Data Terminal Ready
7	Signal Ground	22	Ring Indicator
		23	Rate Select

1, 8, 9, 10, 12, 13, 14, 16, 19, 21, 24. and 25 are not used

RS232/CCITT
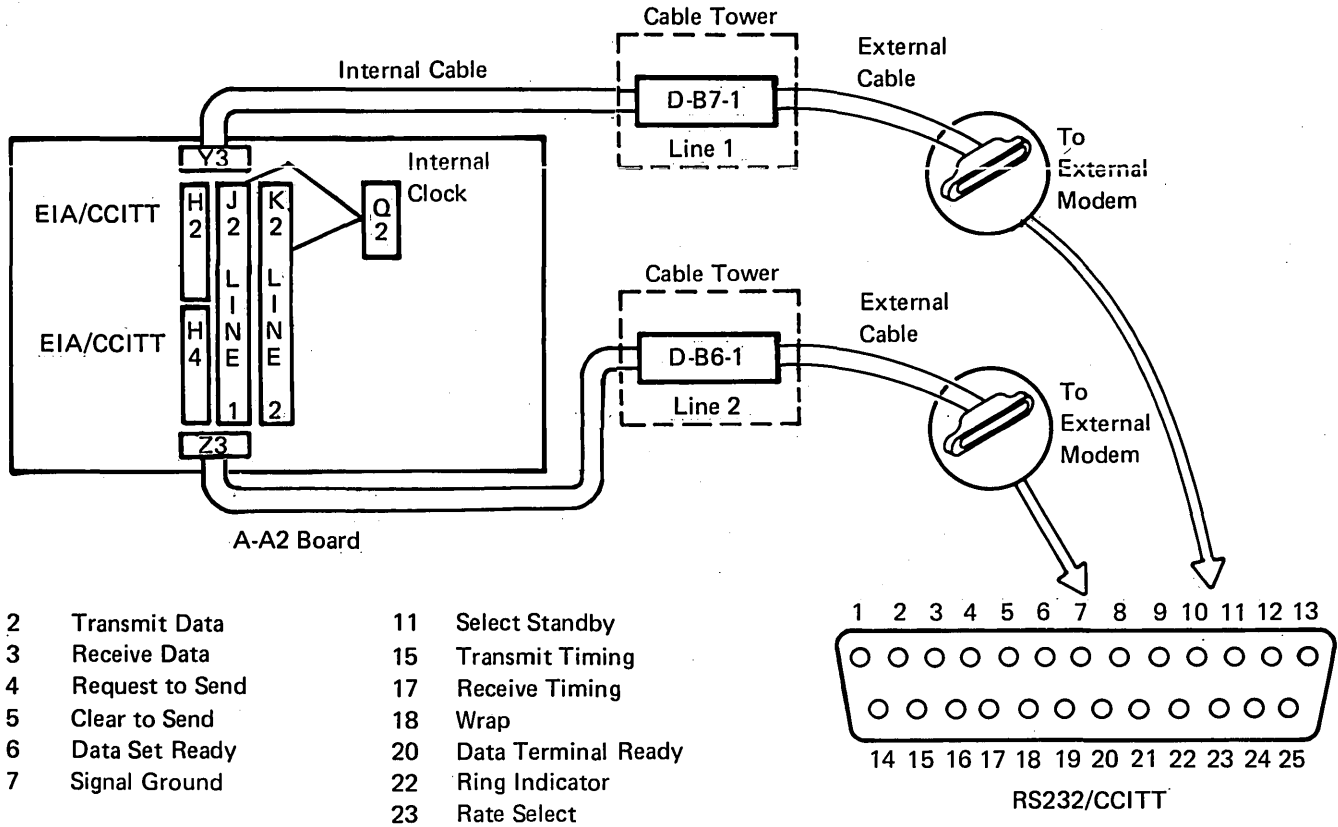
Figure 31-3. Data Communications with EIA/CCITT

Because of different networks, there are different ways to attach the 2400-bps integrated modem to System/34. For line 1, the adapter card is always in A-A2J2 and the 2400-bps modem is always on the B-A1 board. The line 2 adapter card is always in A-A2K2 and the 2400-bps modem is always in the B-A2 board. The operator panels, needed for all configurations of the 2400-bps modem, are located on top of the cable tower. The panel on the right side is for line 1 operation, and if line 2 is installed, its operator panel will be located on the left side (see Figure 31-2).

The different configurations and cable locations for the 2400-bps integrated modems are shown in Figures 31-4 through 31-13.

Adapter

J2   Z5

A-A2 Board

Cable Tower

D-B7-1   External Cable To CBS Coupler

2400 BPS Integrated Modem   V2

V3

V5

B-A1 Board

Operator Panel

Located on
Cable Tower

DA   OH   DT
(yellow) (blue) (white)
SH   SG   CCT   RI   DR
(red) (grey) (brown) (violet) (black)

(SH)   Switch Hook
(SG)   Signal Ground
(DA)   Data Modem Ready
(CCT)   Coupler Cut Through
(OH)   Off Hook
(RI)   Ring Indicator
(DT)   Data Tip
(DR)   Data Ring
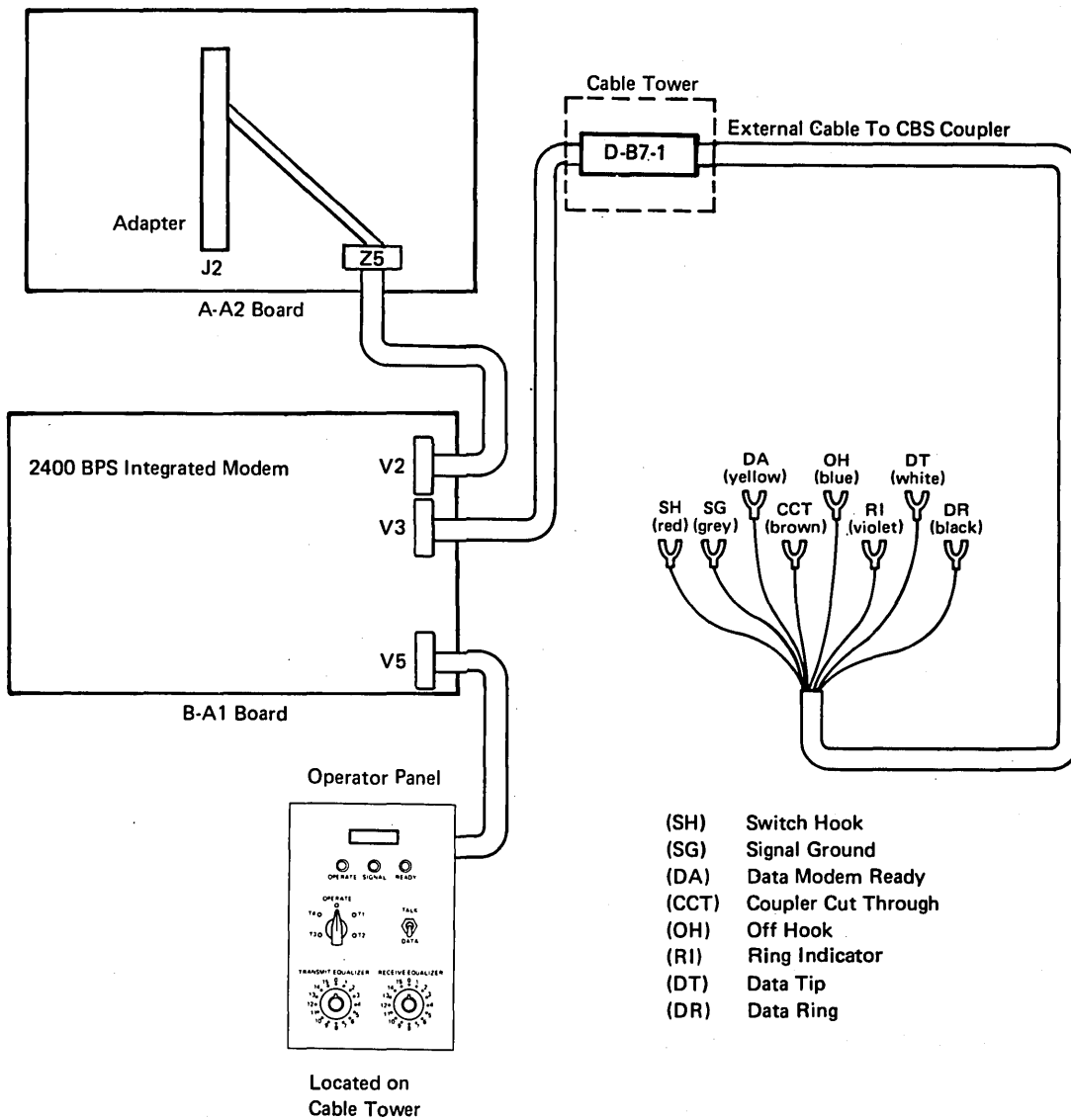
Figure 31-4. 2400 BPS Integrated Modem—Switched Network (Line 1)
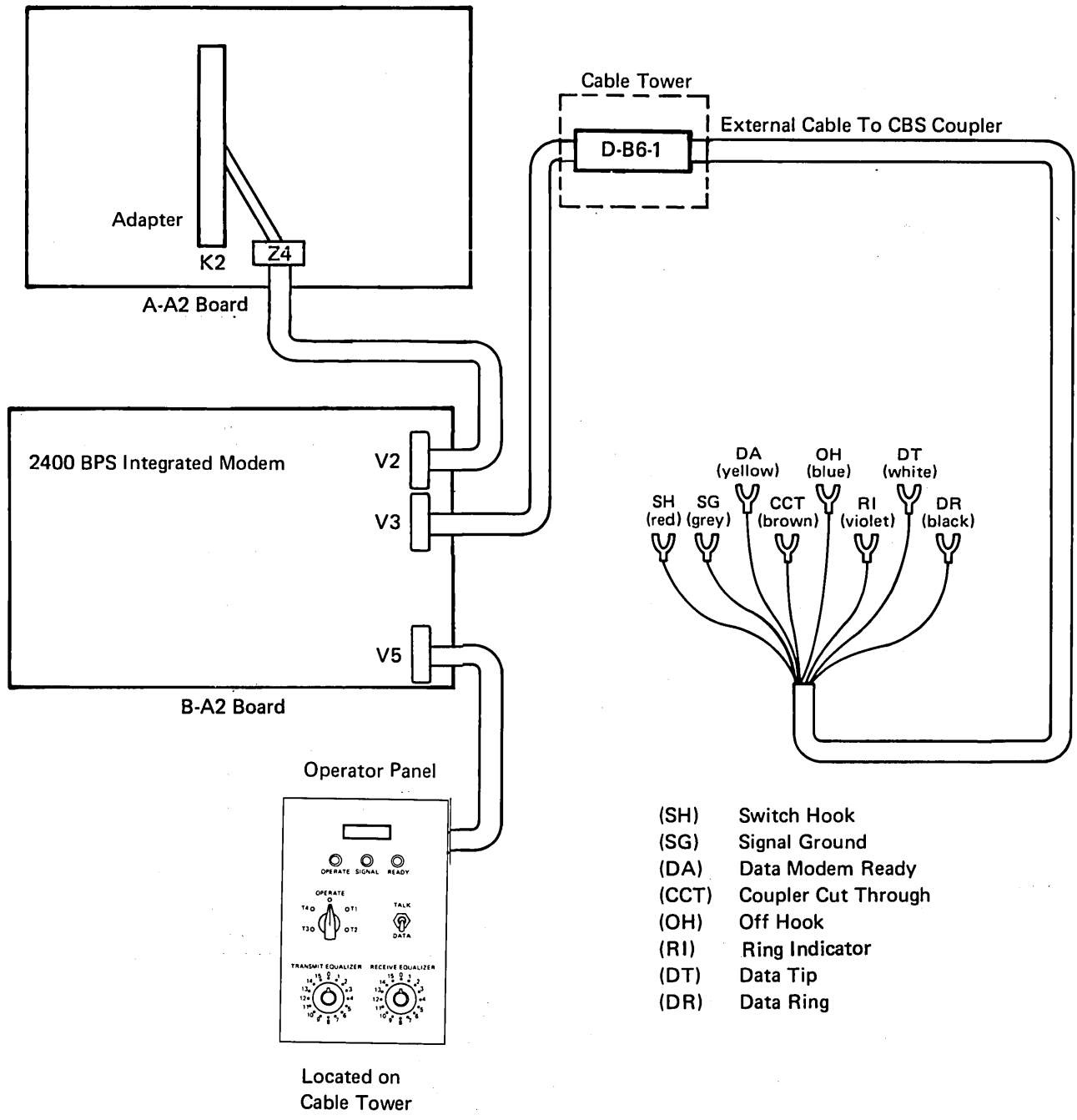
Figure 31-5. 2400 BPS Integrated Modem—Switched Network (Line 2)

(SH)   Switch Hook
(SG)   Signal Ground
(DA)   Data Modem Ready
(CCT) Coupler Cut Through
(OH)   Off Hook
(RI)   Ring Indicator
(DT)   Data Tip
(DR)   Data Ring

External
Cable
To Nonswitched
Line or
CDT Coupler

(red) ⎫
       ⎬ Transmit
(white) ⎭

(yellow) ⎫ Receive
          ⎬ (not used
(black) ⎭ with 2-wire
            connection)

Or

COMTB2

Through D-B8-1
on Cable Tower

Adapter

J2

Z5

A-A2 Board

2400 BPS Integrated Modem

V2

U3

V4

V5

B-A1 Board

WT Countries—Remove 283-B Plug
U.S.A. and Canada—
         Red and Green (white)—Transmit
         Black and Yellow—Receive

(yellow)   (red)

(black)   (green or white)

283-B Plug

Operator Panel

OPERATE   SIGNAL   READY

OPERATE

T4   0   T1
T3   0   T2

TALK
DATA

TRANSMIT EQUALIZER   RECEIVE EQUALIZER

Located on
Cable Tower

Figure 31-6. 2400 BPS Integrated Modem—Nonswitched Network (Line 1)
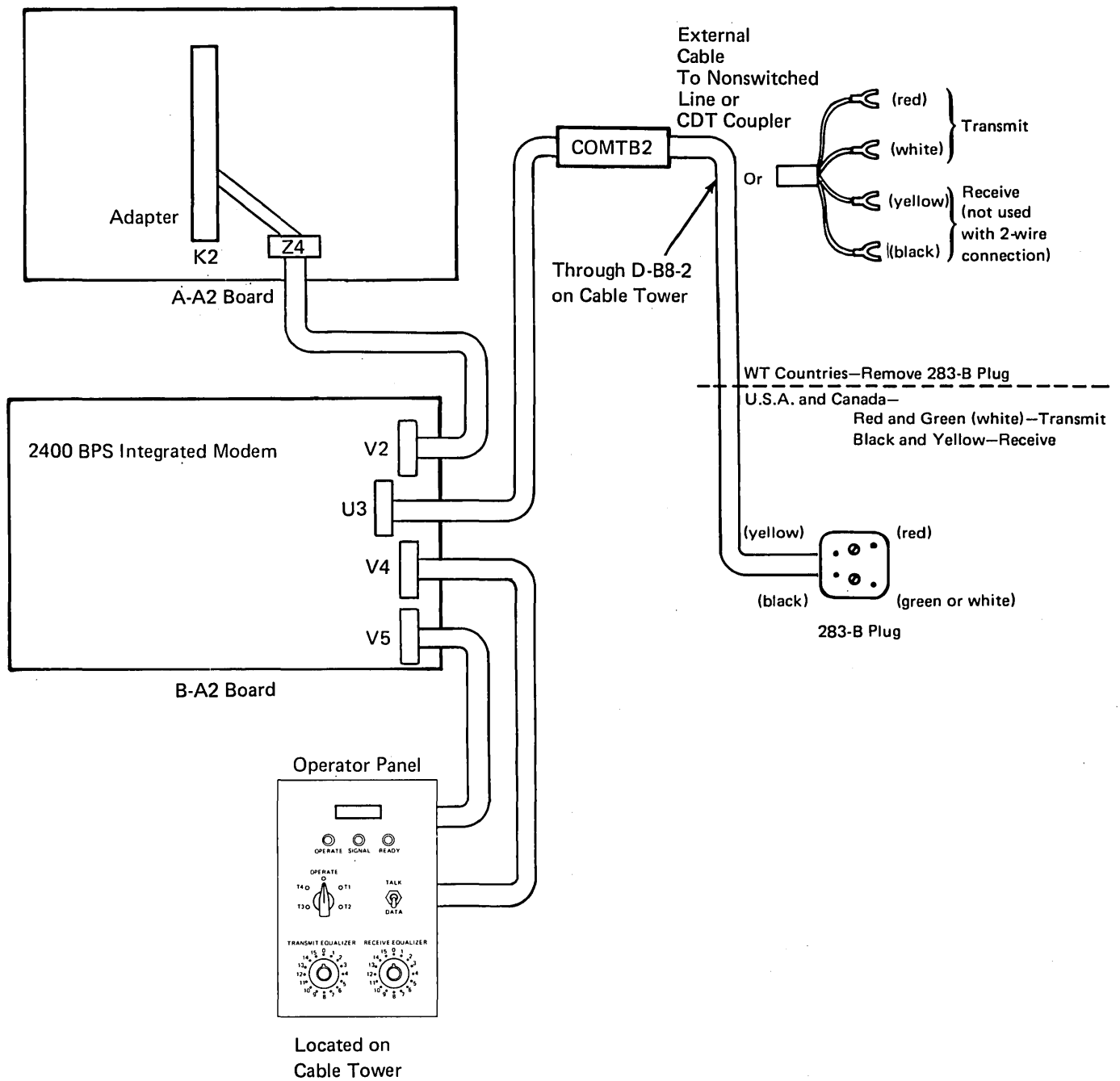
Figure 31-7. 2400 BPS Integrated Modem—Nonswitched Network (Line 2)

Adapter
J2
Z5
A-A2 Board

2400 BPS Integrated Modem
V2
U3
V4
V5
B-A1 Board

Operator Panel

OPERATE   SIGNAL   READY

OPERATE
14   OT1
13   OT2

TALK
DATA

TRANSMIT EQUALIZER   RECEIVE EQUALIZER

Located on
Cable Tower

U.S.A. and Canada—
Red and Green (white)—Transmit
Black and Yellow—Receive

(yellow)   (red)

COMTB2

(black)   (green or white)

283-B Plug

Through D-B8-1
on Cable Tower

External Cable to SNBU or CDT Coupler

COMTB1

Transmit/Receive
(red)
(white)

Or

Not Used
(yellow)
(black)

(red)   (yellow)

(green or white)   (black)

283-B Plug

Figure 31-8. 2400 BPS Integrated Modem—Nonswitched Network with Manual SNBU (Line 1)
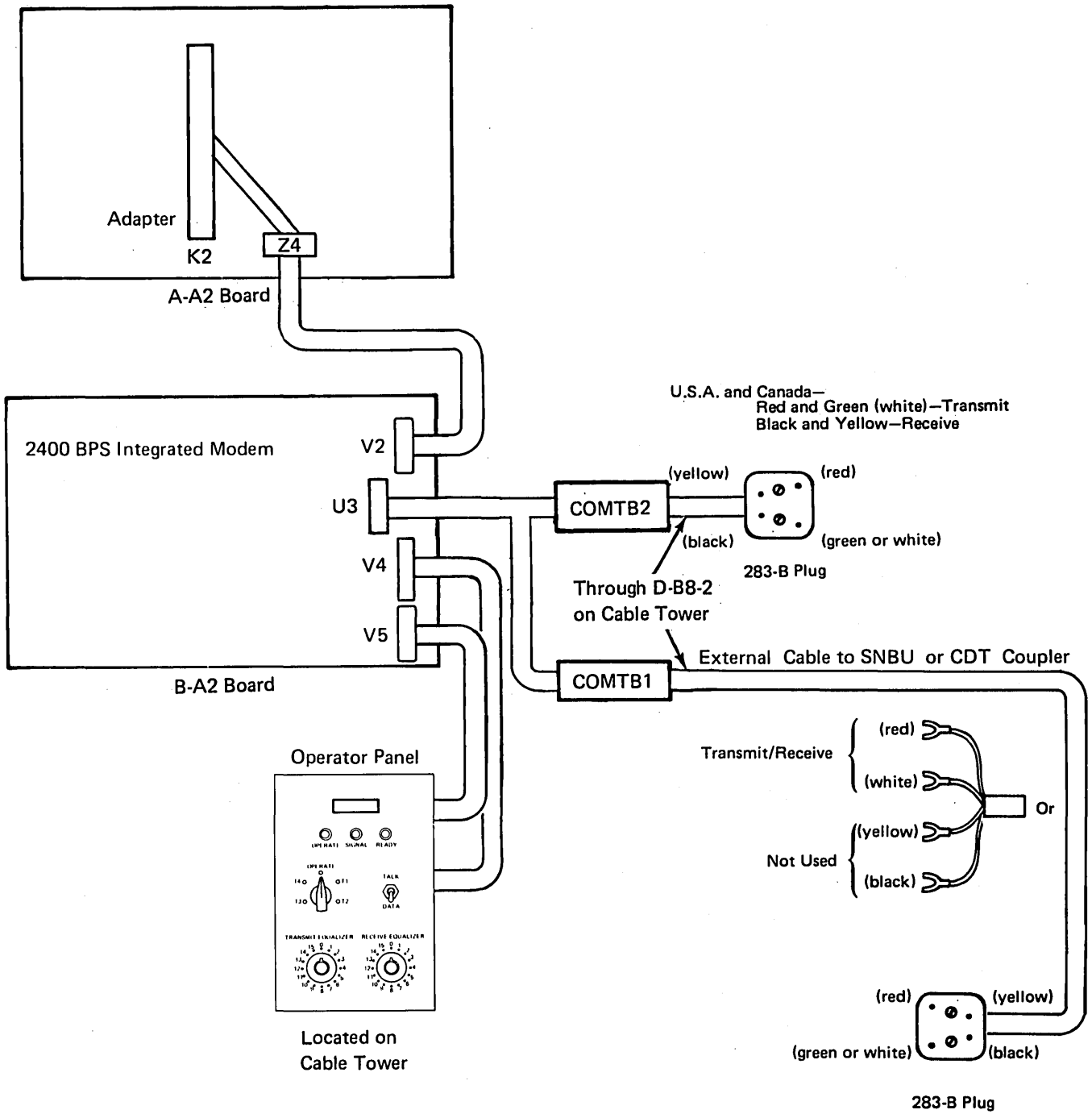
Figure 31-9. 2400 BPS Integrated Modem–Nonswitched Network with Manual SNBU (Line 2)
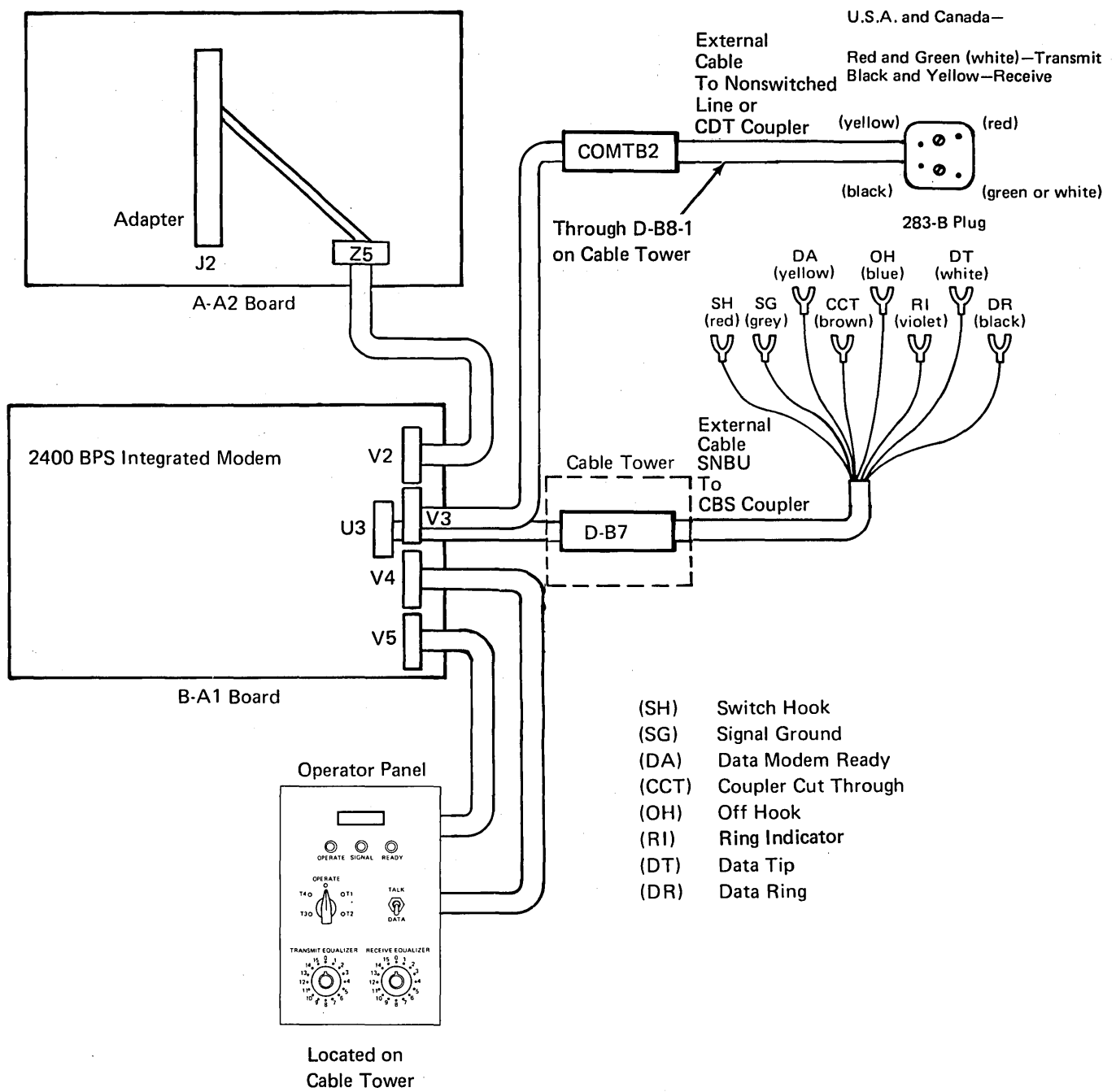
Figure 31-10. 2400 BPS Integrated Modem—Nonswitched Network with SNBU and Automatic Answering (Line 1)
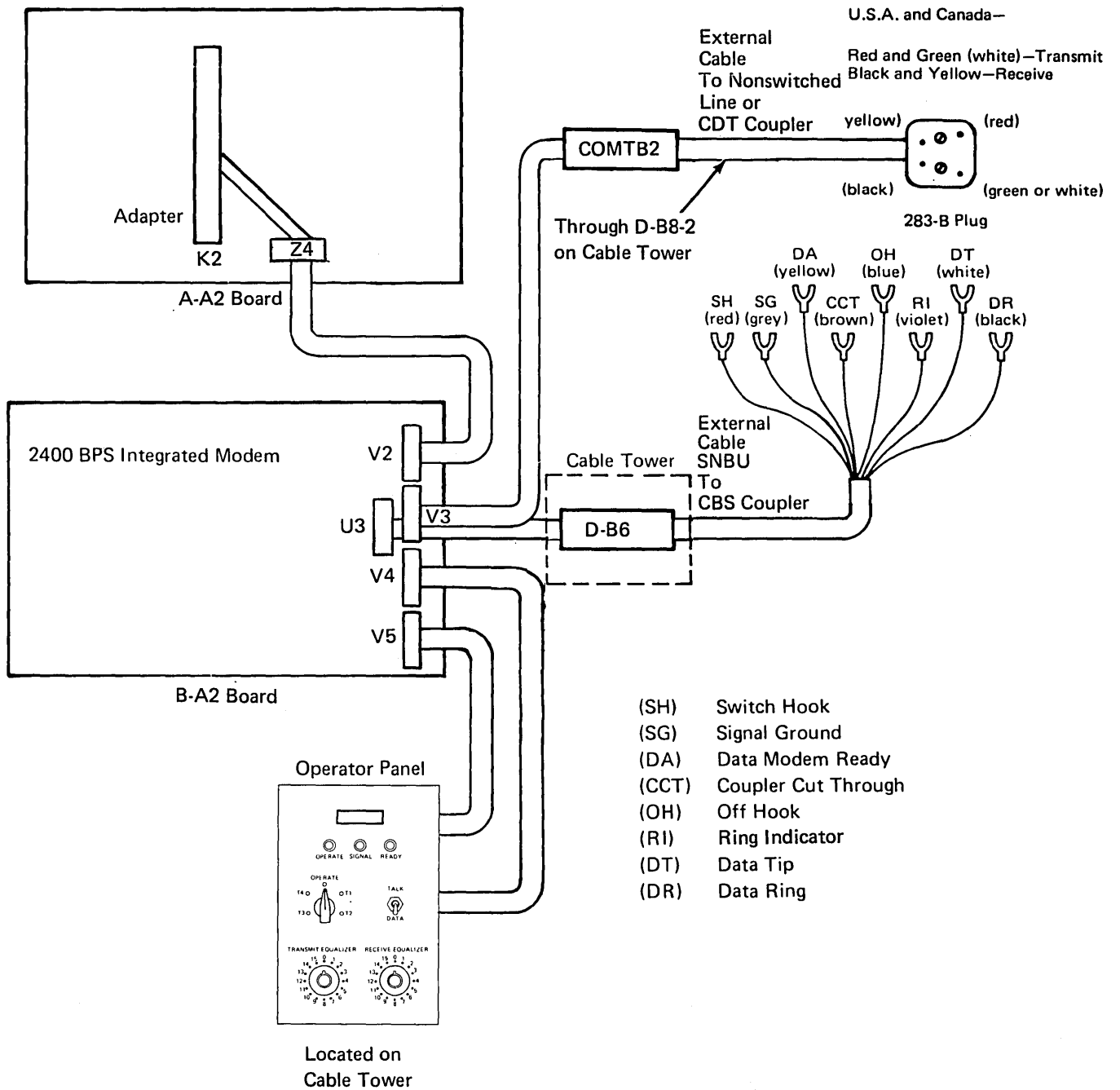
Figure 31-11. 2400 BPS Integrated Modem—Nonswitched Network with SNBU and Automatic Answering (Line 2)

Data Communications   13
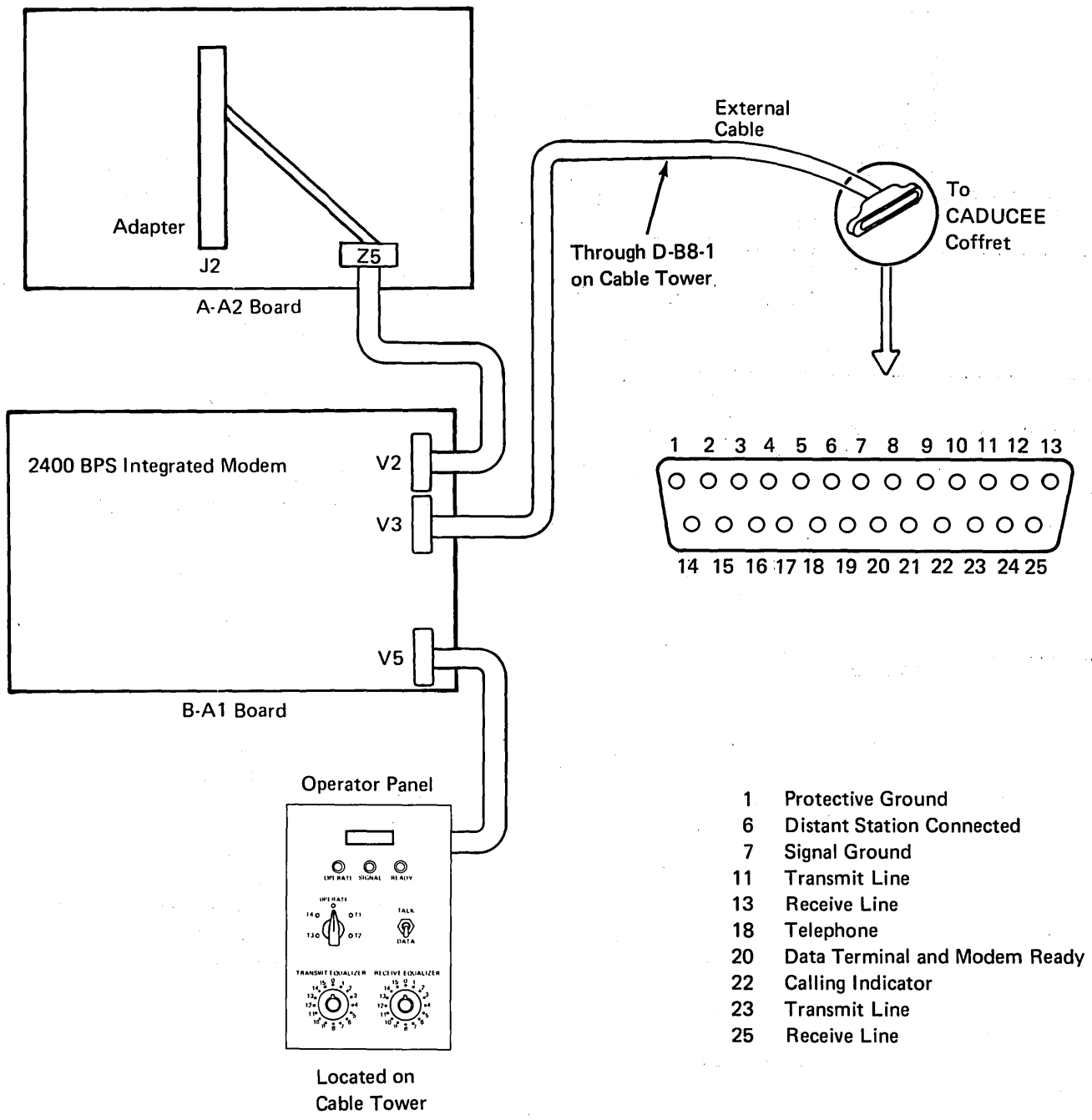
Figure 31-12. 2400 BPS Integrated Modem—CADUCEE (France Only)—Line 1

1	Protective Ground
6	Distant Station Connected
7	Signal Ground
11	Transmit Line
13	Receive Line
18	Telephone
20	Data Terminal and Modem Ready
22	Calling Indicator
23	Transmit Line
25	Receive Line
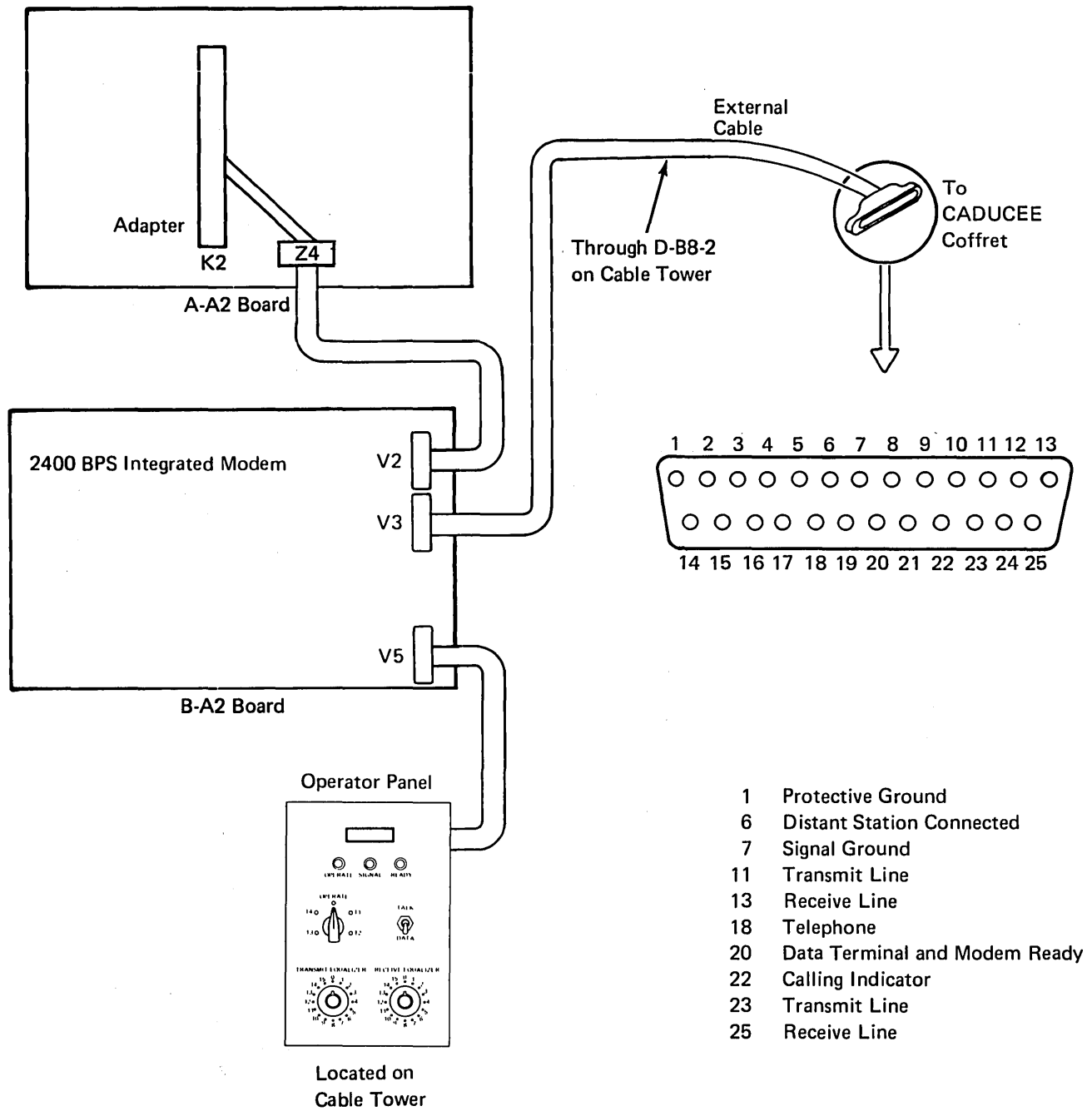
Figure 31-13. 2400 BPS Integrated Modem–CADUCEE (France Only)–Line 2

Pin	Signal
1	Protective Ground
6	Distant Station Connected
7	Signal Ground
11	Transmit Line
13	Receive Line
18	Telephone
20	Data Terminal and Modem Ready
22	Calling Indicator
23	Transmit Line
25	Receive Line

31-130   1200 BPS Integrated Modem

When the 1200-bps integrated modems are used, the location of the cards on the A-A2 board are the same; that is, the adapter cards are in J2 and K2; the 1200-bps modem cards are in H2 and H4. The differences, as shown in Figures 31-14 through 31-16, are that the internal cables are terminated at the cable tower (switched networks), the line plates (World Trade public switched networks), or at the terminal blocks (nonswitched networks).

(SH)	Switch Hook
(SG)	Signal Ground
(DA)	Data Modem Ready
(CCT)	Coupler Cut Through
(OH)	Off Hook
(RI)	Ring Indicator
(DT)	Data Tip
(DR)	Data Ring
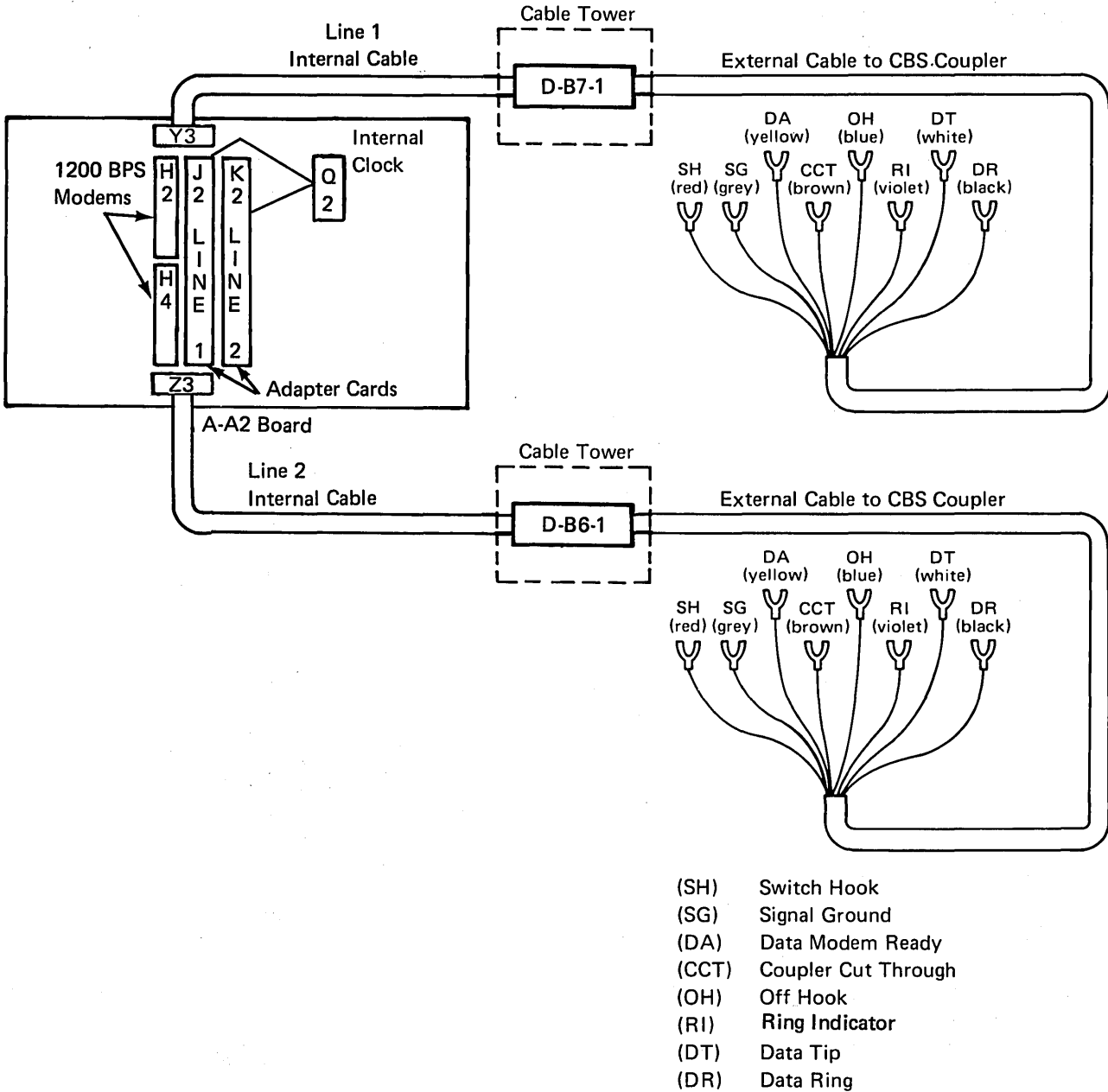
Figure 31-14. 1200 BPS Integrated Modem—Switched Network
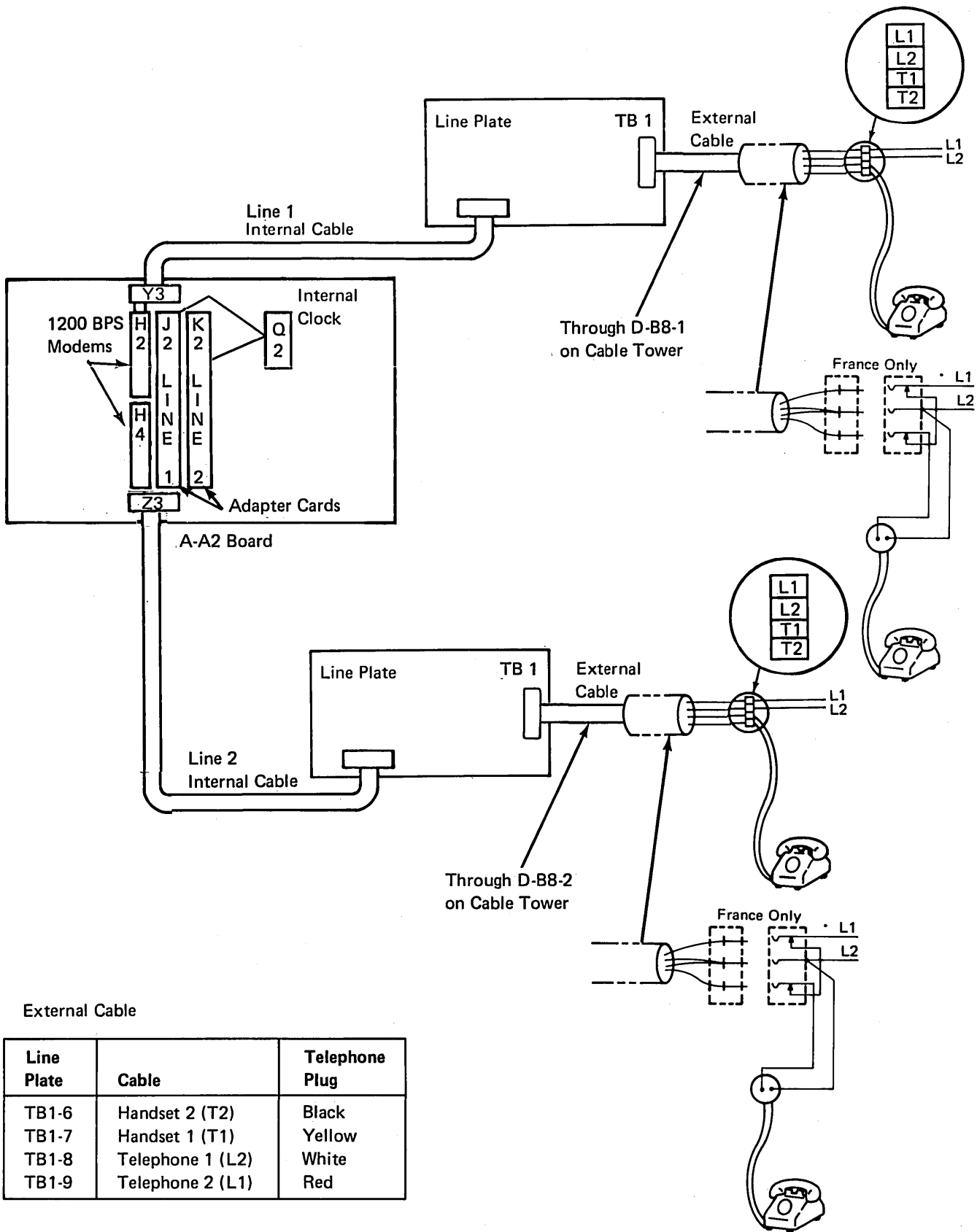
External Cable

Line Plate	Cable	Telephone Plug
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L2)	White
TB1-9	Telephone 2 (L1)	Red

Figure 31-15. 1200 BPS Integrated 'Modem–World Trade Public Switched Network (PSN)
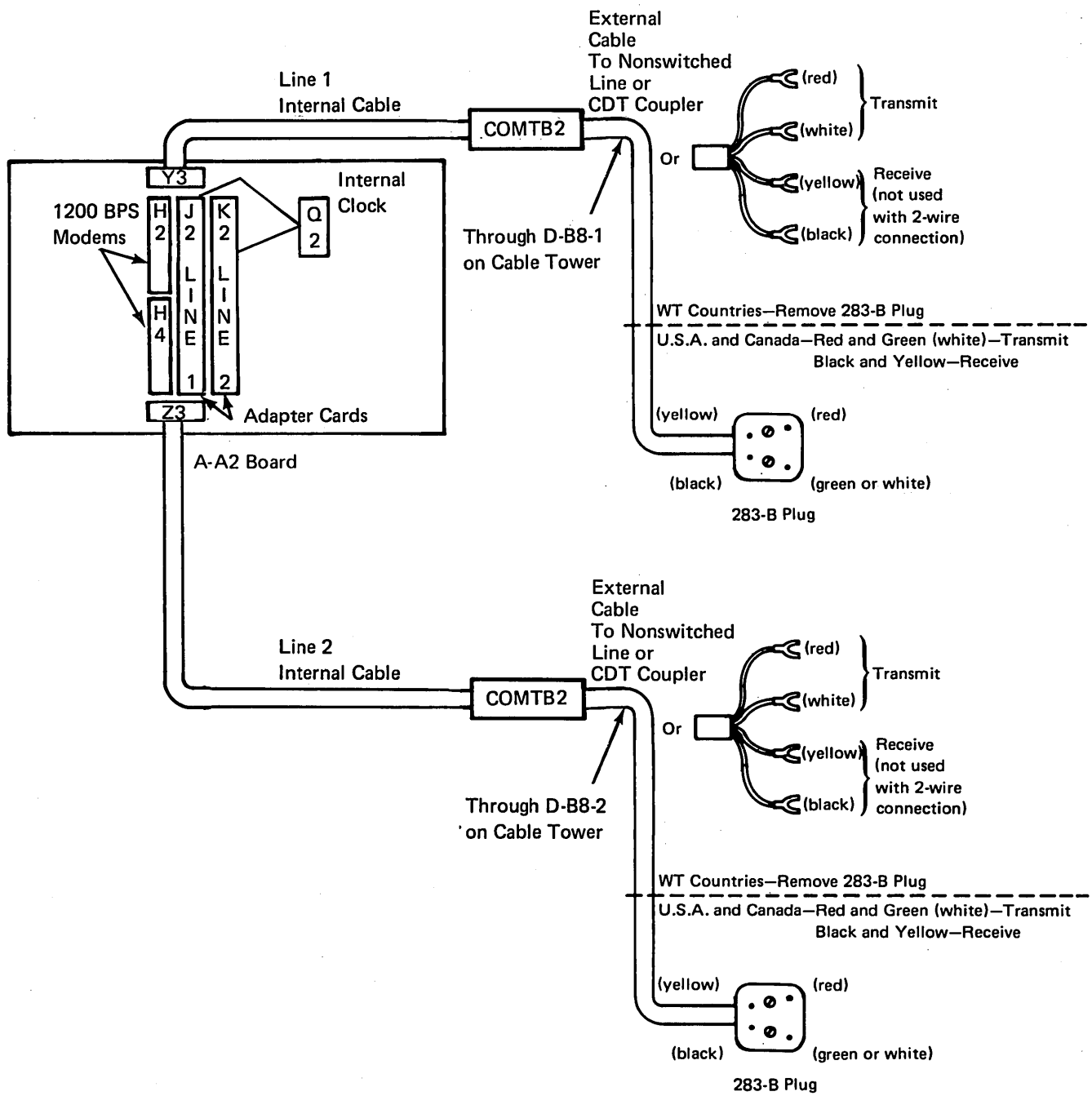
Figure 31-16. 1200 BPS Integrated Modem—Nonswitched Network

31-140   Digital Data Service Adapter

The Digital Data Service Adapter cards are located in
A-A2H2 (line 1) and in A-A2H4 (line 2). The
communications adapter cards are located in A-A2J2
(line 1) and in A-A2K2 (line 2). Figure 31-17 shows the
parts needed for the Digital Data Service Adapter.
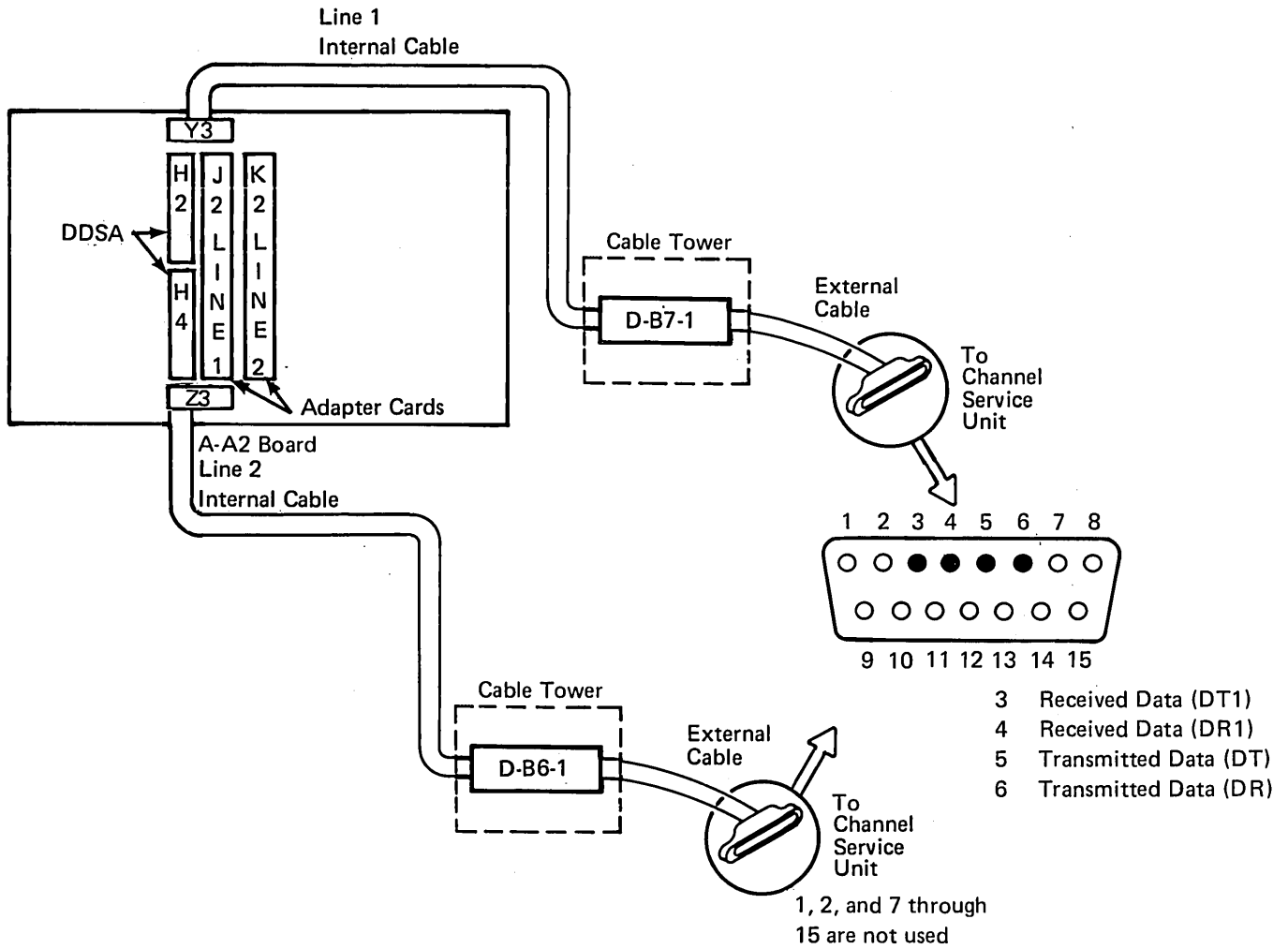
Figure 31-17. Data Communications with the Digital Data Service Adapter

31-150 External Cables

The locations of the external cables are shown in Figure 31-18. The cables that come through the plate in the D-B8 location are connected to either COMTB1, COMTB2, or the line plate (for World Trade). FSL pages FA592 and FA792 show the wiring for COMTB1 and COMTB2, and Figure 31-24 shows the wiring for the line plate.
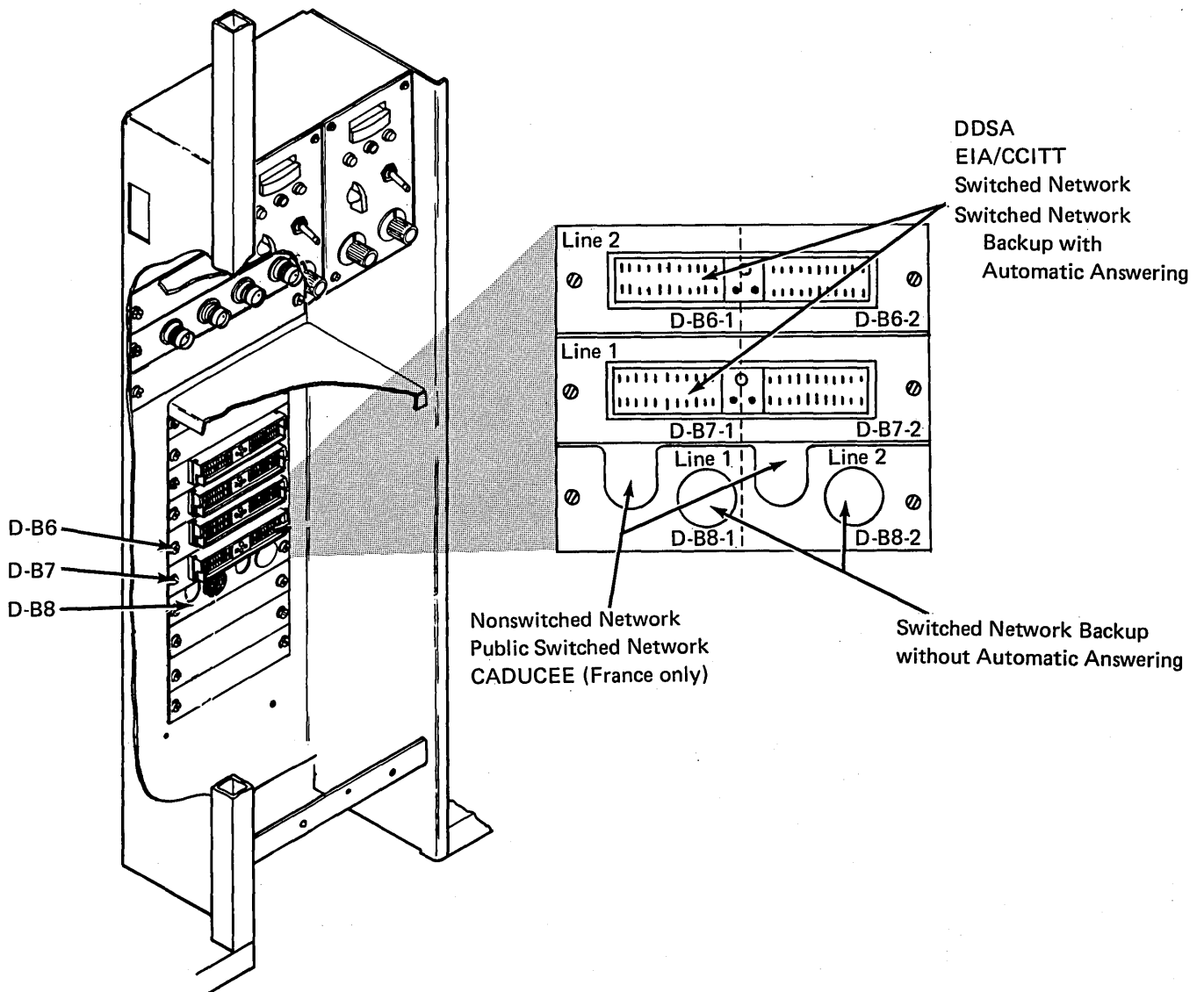
Figure 31-18. Cable Tower Locations for External Cables

31-200   ADAPTER CARD

The data communications adapter cards in A-A2J2 and
A-A2K2 are the common interface between System/34
and all modems. Each card has four switches; set them
as instructed in Figure 31-19.

A-A2J2 (line 1); A-A2K2 (line 2)

Switch	Condition	Meaning
1	On	Continuous carrier (the 'request to send' line is always on). *Note:* Set this switch off if continuous carrier is needed with the 2400 BPS modem with SNBU and attach a jumper from B-A1M2G02 to B-A1T2B09 (line 1), or jumper from B-A2M2G02 to B-A2T2B09 (line 2).
	Off	Not continuous carrier (set off for DDSA and for switched networks)
2	On	For EIA, 2400 BPS modem, and for enable rate select.
	Off	For DDSA, 1200 BPS modem, and for disable rate select.
3	On	Not NRZI coding
	Off	NRZI coding used
		Note: The customer can use BSC and/or SDLC on the same communication line. Therefore, the following information is important to the setting of the NRZI switch (switch 3) on the adapter card: ● The NRZI switch setting must match the option chosen in the configuration for diagnostics to work correctly. ● If the customer is operating with *only* BSC or with DDSA, select not NRZI (switch 3 is set on). ● BSC microcode disables the NRZI function regardless of the switch setting. ● Only SDLC uses NRZI but the selection of NRZI depends on the following: — If the customer is operating with SDLC (or with SDLC and with BSC on the same communication line), the switch setting and the configuration record must be set for SDLC operation. operation. — The NRZI switch setting depends on the remote device and on the modem being used. For SDLC, all data terminal equipment communicating with each other must select the same coding option (NRZI or not NRZI). Contact your IBM marketing representative for identification of those modems that have pattern sensitive synchronization problems, and to determine which coding option should be used. When PTT mandatory modems are used in World Trade, refer to the *IBM World Trade Signal Converter Handbook*, ZZ19-6066. This manual will help determine which coding option should be used.
4	On	Device address and interrupt request bit. If only one communication line is installed on the system, set switch 4 on. If switch 4 is on, the device address 80 and the interrupt request bit 0 (bit 0 = DBI 0) are used by the adapter.
	Off	If switch 4 is off, the device address 20 and the interrupt request bit 2 (bit 2 = DBI 2) are used by the adapter.
		Note: If two communication lines are installed, one adapter must use address 80 (switch on) and the other adapter must use address 20 (switch off). If one of the lines operates at a speed greater than 4800 bps, it should use address 80 (switch on); the other line should use address 20 (switch off). If a 1255 is installed, always set line 1 to use address 80 (switch on).

Figure 31-19. Data Communications Adapter Card

31-310 Card Switch Settings

Because of different networks, the 1200-bps modem cards in A-A2H2 (line 1) and A-A2H4 (line 2) are one of four different cards. Each of these cards has at least 16 switches that must be set as described in Figures 31-20 through 31-23.

Switches

R	H	8
P	G	7
N	F	6
M	E	5
L	D	4
K	C	3
J	B	2
I	A	1
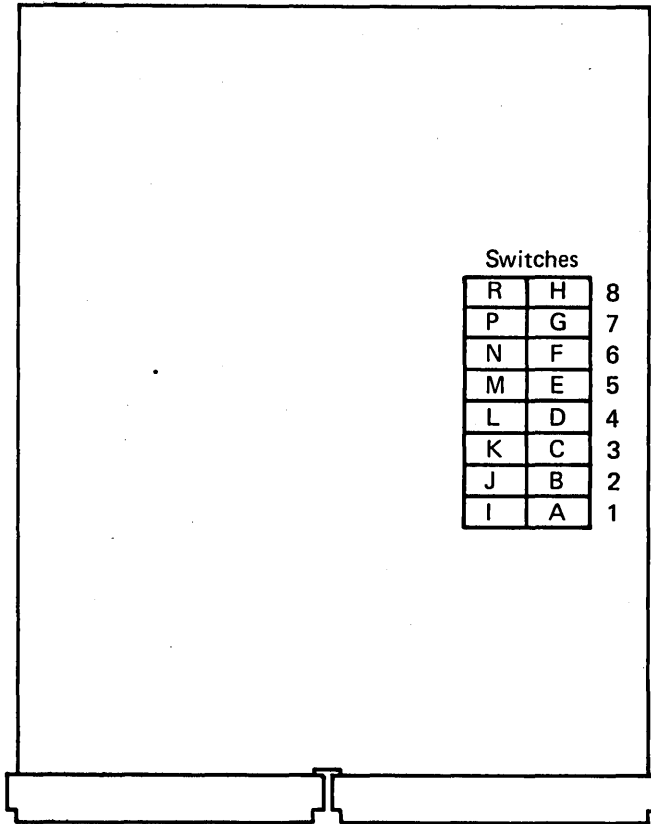
A-A2H2 (line 1); A-A2H4 (line 2)

Set switches J and K on and switches L, M, N, P, and R off. Set the transmit level switches A through I as shown in the table at right.

Note: Switches N and P are set off for a clear-to-send delay of 230 ms, and switch L is set off for an echo clamp delay of 150 ms.

Figure 31-20. Switch Settings for Switched Network

Transmit Level

Set the transmit level to match the level specified on the CBS data coupler. A ● in the table below indicates that the switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	I
0	●								
-1		●							
-2			●						
-3				●					
-4					●				
-5						●			
-6	●						●		
-7		●					●		
-8			●				●		
-9				●			●		
-10					●		●		
-11						●	●		
-12	●							●	
-13		●						●	
-14			●					●	
-15				●				●	
-16					●			●	
-17						●		●	
-18	●								●

```
            Switches
          ┌───┬───┐
          │ R │ H │ 8
          ├───┼───┤
          │ P │ G │ 7
          ├───┼───┤
          │ N │ F │ 6
          ├───┼───┤
          │ M │ E │ 5
          ├───┼───┤
          │ L │ D │ 4
          ├───┼───┤
          │ K │ C │ 3
          ├───┼───┤
          │ J │ B │ 2
          ├───┼───┤
          │ I │ A │ 1
          └───┴───┘
```

A-A2H2 (line 1); A-A2H4 (line 2)

Set switches A through I, M, and R off. The
remaining switches are set for:
- 4-wire nonswitched line (set J off and K on)
- 2-wire nonswitched line (set J on and K off)
  Also attach a jumper from A-A2H2G02 to
  A-A2H2G09 and a jumper from A-A2H2J05
  to A-A2H2J13 (line 1); attach a jumper from
  A-A2H4G02 to A-A2H4G09 and a jumper
  from A-A2H4J05 to A-A2H4J13 (line 2).
- Clear-to-send delay of:
  - 30 ms; set N off and P on
    (recommended for a 4-wire
    nonswitched line)
  - 80 ms; set N on and P off
    (use only for a special
    short 2-wire nonswitched line)
  - 230 ms; set N and P off
    (recommended for a switched
    line or a 2-wire nonswitched line)

Note: The clear-to-send delay must always be longer
than the echo clamp delay.

- Echo clamp delay of:
  - 0 ms; L can be set on or off
    because the 0 ms delay is
    automatically selected if
    the 30 ms clear-to-send
    delay is selected
  - 50 ms; set L on
    (nonswitched or switched line)
  - 150 ms; set L off
    (recommended for a switched
    line or a 2-wire nonswitched line)

Figure 31-21. Switch Settings for Nonswitched Network
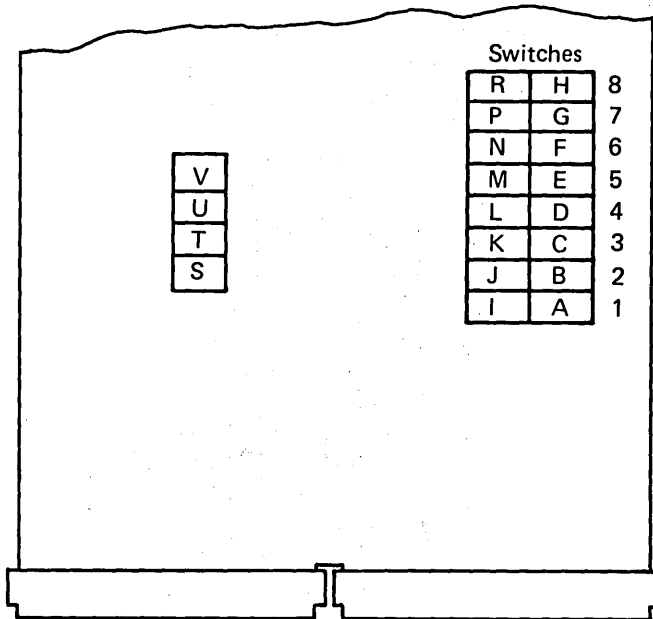
A-A2H2 (line 1); A-A2H4 (line 2)

Set switches N, S, T, U, and V on and switch P off.

Set the transmit level switches A through H and R as shown in the table at right.

The remaining switches are set for:
- 4-wire nonswitched line (set I on and M off)
- 2-wire nonswitched line (set I off and M on) Also attach a jumper from A-A2H2G02 to A-A2H2G09 and a jumper from A-A2H2J05 to A-A2H2J13 (line 1); attach a jumper from A-A2H4G02 to A-A2H4G09 and a jumper from A-A2H4J05 to A-A2H4J13 (line 2).
- Clear-to-send delay of:
  - −30 ms; set K on and J off (recommended for a 4-wire nonswitched line)
  - −80 ms; set K off and J on (use only for a special short 2-wire nonswitched line)
  - −230 ms; set K and J off (recommended for a switched line or a 2-wire nonswitched line)

Note: The clear-to-send delay must always be longer than the echo clamp delay.

Transmit Level

A ● in the table below indicates that a switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	R
0	●								
-1		●							
-2			●						
-3				●					
-4					●				
-5						●			
-6	●						●		
-7		●					●		
-8			●				●		
-9				●			●		
-10					●		●		
-11						●	●		
-12	●							●	
-13		●						●	
-14			●					●	
-15				●				●	
-16					●			●	
-17						●		●	
-18	●								●

- Echo clamp delay of:
  - 0 ms; L can be set on or off because the 0 ms delay is automatically selected if the 30 ms clear-to-send delay is selected.
  - 50 ms; set L on (nonswitched or switched line)
  - 150 ms; set L off (recommended for a switched line or a 2-wire nonswitched line)

Figure 31-22. Switch Settings for World Trade Nonswitched Network

31-310
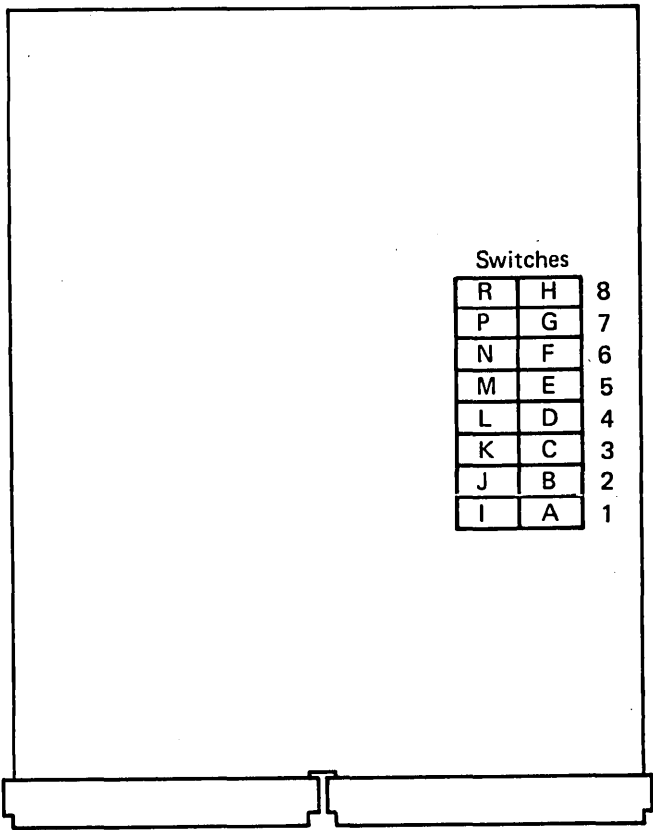
A-A2H2 (line 1); A-A2H4 (line 2)

Set switches I, J, K, N, P on and switches L and M off.
Set the transmit level switches A through H and R as shown in the table at right.

Figure 31-23. Switch Settings for World Trade Public Switched Netwcrk (PSN)

Transmit Level

A ● in the table below indicates that the switch must be on to make a selection. Set the switches to the needed transmit level.

Level in Decibels	Transmit Level Switches								
	A	B	C	D	E	F	G	H	R
0	●								
-1		●							
-2			●						
-3				●					
-4					●				
-5						◒			
-6	●						●		
-7		●					●		
-8			●				●		
-9				●			●		
-10					●		●		
-11						●	●		
-12	●							●	
-13		●						●	
-14			●					●	
-15				●				●	
-16					●			●	
-17						●		●	
-18	●								●

Data Communications   25

31-320   Line Plate Adjustment

The line plate adjustment is needed only when the
network is a World Trade public switched network
(PSN).

The line plates are located under the top cover (see
Figure 31-2). The one on the left side is for line 1, and
the one on the right side is for line 2. The plates are
shipped from the plant with a jumper between U10 and
U11 (see Figure 31-24) which is the jumper location for
the lowest direct current.

DANGER
Voltage is present on the line plate from the
telephone lines.

_____

_____

_____

To adjust the line plate:

1.   For line 1, attach a jumper from A-A2H2B02 (the
     '-data terminal ready' line) to A-A2H2D08
     (ground); for line 2, attach a jumper from
     A-A2H4B02 to A-A2H4D08. Attaching this
     jumper activates the relay on the line plate.

2.   Connect a DC voltmeter across TP1 (+) and TP2
     (-) on the line plate. See Figure 31-24 for the
     locations of TP1 and TP2.

3.   Change the adjustment on the line plate by moving
     the jumper from U11-U10 to U10-U09, U09-U08,
     and so on until the voltage is in the range of 0.5
     Vdc to 1.7 Vdc.

4.   If the installation does not use a handset, jumper
     U2 to U3 on the line plate; if it does use a
     handset, jumper U1 to U2.

5.   Remove the jumpers attached in step 1. The line
     plate is now adjusted.

810 Ohms
660 Ohms
330 Ohms
480 Ohms
150 Ohms
660 Ohms
0 Ohms

U11 U10 U09 U08 U07 U06 U05 U04

TP2
(capacitor lead)

TP1
(diode lead)

Line Plate (PSN coupler)

Transformer

Relay

Line Plate Cable
Connector Pins

8 7 6 5 4 3 2 1

A B

Handset:

Without

With

U1 U2 U3

Non-Japan

TB1

L1
L2
T1
T2

L1
L2

France Only

L1
L2

External Cable

Line Plate	Cable	Telephone Plug
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L2)	White
TB1-9	Telephone 2 (L1)	Red

31

Figure 31-24. World Trade PSN Line Plate and Cable Connections

Data Communications   27

31-340   Transmit Level Limiting Check

The level control circuit of the CBS data coupler (or similar coupler) can be set to a lower signal level than the transmit level on the modem. When this is the case, overloading of the level control circuit causes slow recovery after change of direction, and a possible loss of the received signal. The modem transmit level must be decreased enough to prevent overloading the CBS coupler.

The following steps give the procedure to check transmit level limiting.

1. Connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the CBS coupler interface. Set the meter to Bridging (no terminating resistance).

2. Set the Mode Selector switch to the Proc Run position (CE panel).

3. Set the Address/Data switches to 0000.

4. Set the MSIPL switch to the diskette position (CE panel).

5. Set the CSIPL switch to the diskette position (CE panel).

6. Set all other CE panel switches to their down positions.

7. Insert diskette DIAGB1.

8. Press the Load switch (operator panel).

9. Select the data communications exerciser test (transmit test).

10. Select 16 or 32 as data to be transmitted. Select the Scope Loop A Cmnd as the test run option.

11. If this is a new installation, dial the system from a local telephone. If you are troubleshooting a problem, have your system dialed from the remote system. Leave the telephone handset off the cradle (off the hook).

12. Observe the meter. The transmit signal level meter reading should equal the level of the coupler ± 1 dB. If the reading decreases in less than three seconds, the coupler is limiting the transmit level. If the reading remains constant, that level is being transmitted to the line.

13. If the coupler is limiting the transmit signal level, adjust the transmit level switches on the modem card until the transmit level is below the controlled level in the coupler. (Limiting no longer takes place.) The correct level is one decibel below the lower level reading in step 12. Stop here if this is a new installation.

14. Check to see that another modem receives a suitable signal level when this modem transmits by doing the following:
    a. Have another person at the remote station connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the CBS coupler interface.
    b. Ensure the meter is set to Bridging (no terminating resistance).
    c. Observe the meter. The receive level at the remote station should be 16 dB less than the transmit level. However, an acceptable level could be from -31 dB up to the same level as the transmit level.

31-400   2400 BPS INTEGRATED MODEM

The 2400-bps integrated modems are located on the B-A1 board (line 1), and on the B-A2 board (line 2). The operator panels are located at the top of the cable tower (see Figure 31-2).

31-410   Operator Panel

The following paragraphs describe the indicators and switches located on the 2400-bps operator panel (see Figure 31-25).

Operate Light

When the Test/Operate switch is set to Operate, the Operate light is on for a received mark signal and off for a received space signal.

When the Test/Operate switch is set to T1, T3, or T4, the Operate light turns off for 150 milliseconds when an error (space) occurs.

Signal Light

When the Test/Operate switch is set to Operate, the Signal light turns on when the 'data carrier detect' interface line is active. When the Test/Operate switch is set to T3, this light is off when the modem is not receiving a signal.

Ready Light

When the Test/Operate switch is set to Operate, the Ready light turns on when the 'data set ready' interface line is active. When the Test/Operate switch is set to any test position (T1 through T4), this light is off to inform the operator that the modem is not ready for normal operation.

Talk/Data Switch

This switch is normally set to Data for all operations but is set to Talk when the DAA (data access arrangement) handset is used. On Talk, automatic answering is inhibited and the modem ignores the 'data terminal ready' interface line.
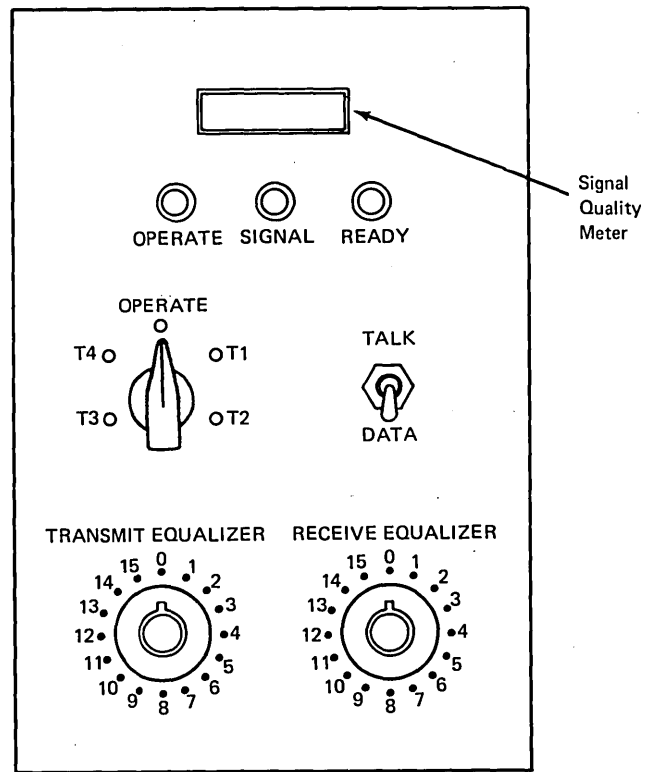
Figure 31-25. Operator Panel for 2400 BPS Modem

Signal Quality Meter

This meter indicates signal quality by a relative reading. The meter is used at installation time to adjust the transmit and receive equalizer switches.

Transmit Equalizer and Receive Equalizer Switches

These are the two equalizer switches for a leased line modem; they are adjusted at installation time by the customer engineer, or they are adjusted by the customer if a change is made to a different leased line. The installation instructions in this manual give the adjustment procedure for these two switches. A point-to-point modem has a receive equalizer only but a multipoint tributary modem has transmit and receive equalizers.

Test/Operate Switch

This switch is normally set to Operate but is set to one of the test positions (T1 through T4) for problem determination. The following paragraphs describe each test position of the Test/Operate switch and Figure 31-26 gives the meaning of each indicator for each position of the Test/Operate switch.

Test 1 (T1, Local Loop)

In this test, the transmit data is internally held to a mark level and the scramble pattern is transmitted. The line drive is internally connected to the receive preamplifier and the transmit pattern is demodulated and descrambled. The result is a constant mark, shown by the Operate light remaining on constantly. If a space occurs (failure), the Operate light turns off for 150 milliseconds.

Test 2 (T2, Local Loop)

This test loops the modem transmit function to the receive function with the data terminal equipment (DTE) controlling the modem interface. Data must be sent and checked by the DTE. The function of the DTE interface test line '-DS wrap interface' is the same as that of the test 2 function.

Test 3 (T3, Transmit)

This is a communications channel test, and should be used only if the local loop test (test 1) was correct. Transmit data is internally held to a mark level and the scramble pattern is transmitted. The remote receiving modem descrambles the data and should generate a constant mark (see test 4).

Test 4 (T4, Receive, Remote Loop)

This is a communications channel test, and should be used only if the local loop test (test 1) was correct. The signal received from the remote modem on test 3 is demodulated and descrambled, and should generate a constant mark. If a space occurs, the Operate light turns off for 150 milliseconds.

A duplex modem on test 4 rescrambles and transmits the data again if the remote loop function from the transmitting modem is available. The transmitting modem (remote from the modem on test 4) can be set on T3 or can be set on Operate with the DTE sending marks; sending spaces indicates errors at the receiving modem.

Note: The DTE interface of the modem is held off by T1, T3, and T4. There is no communication between the DTE and the modem when the interface is held off.

CADUCEE Feature (France only)

The CADUCEE is used only in France. A compromise equalizer is part of the CADUCEE attachment feature. It is disabled in T1, T2, or DTE test operation; it is active in T3 or T4 operation (except at 1200 bps).

Test Operate Switch Positions	Ready Light (On when 'data set ready' is active) (Note 1)	Signal Light (On when 'carrier detect' internal is active)	Operate Light (On for 'receive data' mark)	Signal Quality Meter (Note 2)
Operate	On (Note 3)	On when the receiving signal is above the threshold	On or flickering	0-50
Reset (intermediate positions)	Off	On when the receiving signal is above the threshold	On	0
T1	Off	On (wrap signal)	On (Note 4)	0_+
T2 (or DTE interface 'test' line)	Off (Note 1)	On if the 'request to send' line is active (wrap signal)	Depends on data; off for space, on for mark	0_+
T3 (2-wire system with remote modem on T4)	Off	Off	On	0
T3 (4-wire system with remote modem on T3 or T4)	Off	On (remote signal)	On (Note 4)	0-50
T4 (remote modem on T3)	Off	On (remote signal)	On (Note 4)	0-50

Notes:
1. The 'data set ready' line is active in T2 mode, but the Ready light is off. The DTE interface 'test' line which performs the same function as T2 does not inhibit the Ready light.
2. The signal quality meter should read 0 when the Signal light is off.
3. The Ready light blinks on and off.
4. The scramble pattern is being transmitted with input data clamped to mark. Therefore, the unscrambled data should be a steady mark and the Operate light should be on steady. Test circuits provide a 150 ms off period if even a single space is received so that the erroneous space can be observed.

Figure 31-26. Light Meanings for Test/Operate Switch Positions

The modem lines controlled by the Test/Operate switch are shown in Figure 31-27. See this figure to verify correct operation of the modem by checking each position of the Test/Operate switch. If a failure occurs, see the FSL pages shown in Figure 31-27 as an aid in locating the source of the failure.

FSL Page		FA716	FA716	FA707	FA707	FA707	FA716	FA707	FA707	FA716
	Line 1	FA716	FA716	FA707	FA707	FA707	FA716	FA707	FA707	FA716
	Line 2	FA797	FA797	FA797	FA797	FA797	FA797	FA797	FA797	FA797
Signal Name		-Request To Send Test OP	-Transmit Send Data	-2 Wire	-Wrap Relay	+Equal Out	+Clamp Interface	+Ready AEL	-Force DTR Off	-Force DTR On
Pin	Line 1	B-A1Q4G09	B-A1Q4J06	B-A1K4D09	B-A1K4B09	B-A1K4G07	B-A1Q4D09	B-A1K4D13	B-A1K4B13	B-A1Q4D13
	Line 2	B-A2Q4G09	B-A2Q4J06	B-A2K4D09	B-A2K4B09	B-A2K4G07	B-A2Q4D09	B-A2K4D13	B-A2K4B13	B-A2Q4D13
On/Active (Vdc)		0 to .3v	0 to .3v	0 to .3v	0 to .3v	4.8v to 6.4v	6.0v to 8.1v	6.9v to 9.4v	0 to .3v	0 to .3v
Off/Inactive (Vdc)		5.7v to 7.8v	5.7v to 7.8v	6.9v to 9.4v	10v to 13.2v	0 to .3v	0 to .3v	0 to .3v	10v to 13.2v	10v to 13.2v
Test/Operate Switch Position	Operate	Note 1	Note 2	Note 4	Off	Off	Off	Note 4	Note 4	Off
	Between Operate and T1	Off	Off	Note 4	Off	Off	On	Off	On	Off
	T1	On	Off	Off for 4 wire	On	On	On	Note 4	On	Off
	Between T1 and T2	Off	Off	Note 4	Off	Off	On	Off	On	Off
	T2	Note 1	Note 2	Off for 4 wire	On	On	Off	Note 4	On	Off
	Between T2 and T3	Off	Off	Note 4	Off	Off	On	Off	On	Off
	T3	On	Off	Note 4	Off	On for 1200 bps	On	Note 4	Off	On
	Between T3 and T4	Off	Off	Note 4	Off	Off	On	Off	Off	On
	T4	On for 4 wire	Note 3	Note 4	Off	On for 1200 bps	On	Note 4	Off	On
	Between T4 and Operate	Off	Off	Note 4	Off	Off	On	Off	Off	On

Notes

1. The '-request to send test op' line is active when the '-DS request to send' line B-A1V2B10 (line 1); B-A2V2B10 (line 2) is active.
2. The '-transmit send data' line is active when the '-DS send data space' line B-A1V2B13 (line 1); B-A2V2B13 (line 2) is active.
3. The '-transmit send data' line is active when the '-DS receive data space' line B-A1V2B12 (line 1); B-A2V2B12 (line 2) is active.
4. See FSL page FA707 (line 1); FA792 (line 2).

Figure 31-27. Test/Operate Switch Positions and Modem Lines

31-420   Transmit Level Limiting Check

The level control circuit of the CBS data coupler (or similar coupler) can be set to a lower signal level than the transmit level on the modem. When this is the case, overloading of the level control circuit causes slow recovery after turnaround, and the first part of the received signal might be lost. The modem transmit level (normal, SNBU, and answer tone) must be decreased in amplitude enough to prevent overloading in the CBS coupler.

To check for transmit level limiting:

1. Connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the CBS coupler interface. Set the meter to bridging (no terminating resistance).

2. Set the Test/Operate switch to T4 (receive) and make a telephone connection with a modem that has its Test/Operate switch set to T3 (transmit).

3. Turn the Test/Operate switch from T4 to T3 (transmit) and observe the meter. If the reading goes down from the earlier level (which should be the level on the preamplifier or SNBU card) in less than 3 seconds, the coupler is limiting the transmit level. If the reading remains at the earlier level, that level is being transmitted to the line.

4. If the coupler is limiting the transmit signal level, decrease the amplitude of the preamplifier or SNBU card until the transmit level is below the controlled level in the coupler (limiting no longer takes place). (The correct level is one decibel lower than the level in step 3.) Set the answer tone to the same level.

5. Check to see that another modem receives a suitable signal level when this modem transmits by doing the following:
    a. Set the Test/Operate switch to T3. Have another person set the Test/Operate switch at the remote station to T4.
    b. Have someone at the remote station connect a decibel meter across the DT (data tip) and DR (data ring) terminals of the modem at the CBS coupler interface. The meter must be set to bridging (no terminating resistance).
    c. For best operation, the receive level at the remote station should be 16 dB less than the transmit level. However, an acceptable receive level could be from -31 dB up to the same level as the transmit level.

31-430   Signal Quality Meter Adjustment

If the post-processor card in B-A1N4 (line 1) or B-A2N4 (line 2) is swapped, adjust the signal quality meter as follows:

1. Turn modem power on and turn the Test/Operate switch to T1.

2. Assuming there are no failures in test 1, adjust the potentiometer on the B-A1N4 card (line 1), or B-A2N4 (line 2) until the meter reads above zero (half of the smallest division on the meter scale).

3. Check the meter reading against the measurement made at installation time; the meter readings should be approximately the same. Make this check with the modem in operate mode.

31-440   Dial Tone Detect

Note: The dial tone detect adjustment is optional; make the adjustment only if necessary.

The dial tone detect circuits prevent the dial tone received by a modem from being decoded as random data; these circuits should be activated only if all of the following conditions are present:

* The 2400-bps modem automatically answers incoming calls,

* The data communications feature is set up for automatic operation, and

* The DTE does not time out and does not automatically disconnect when the dial tone is sensed, which causes wrong data to be decoded. For example, assume the DTE is set up for automatic operation and an incoming call is a wrong number. When the other end disconnects, the modem will decode the dial tone as data. Dial tone detect will prevent this error but it will not disconnect the line. Disconnecting the line must be done through programming.

Note: Normally, the dial tone detect circuit will not be activated in the modem. However, if the dial tone detect circuit is adjusted so that the circuit is activated (the adjustment is not correct), the 'receive data' line may be intermittently held to a mark level. This line held to a mark level could occur if the dial tone detect potentiometer is adjusted too far clockwise. Also, the 'receive data' line might be held to a mark level when valid data is being received.

Dial Tone Detect Service Check

To activate the dial tone detect circuit, attach a jumper from B-A1H3D09 to B-A1G2B04 (line 1), or B-A2H3D09 to B-A2G2B04 (line 2).

The dial tone detect service check procedure is as follows:

1. Set the Test/Operate switch to T4.

2. Set the Talk/Data switch to Data.

3. Lift the telephone handset, pull up the Exclusion key, and listen for the dial tone. If there is no dial tone, the last call has not been disconnected, or there is an autoanswer or coupler problem.
    − Disconnect and attempt another call or,
    − Call and request that they disconnect.

    If there is a dial tone:
    − Put the telephone handset back on the cradle.
    − Check to see that the Signal light comes on and that the Operate light starts flashing. (The Operate light should stop flashing and remain on 3 to 10 seconds after the Signal light comes on.)

    If the Operate light stops flashing and remains on in 3 to 10 seconds after the Signal light comes on, the dial tone detect circuit is working correctly. Remove the jumper.

    If the Operate light continues to flash, the dial tone detect adjustment must be made. Also, if the Operate light stops flashing in less than 3 seconds, the potentiometer is adjusted too far clockwise and the dial tone detect adjustment must be made.

Dial Tone Detect Adjustment

Note: It is important that the potentiometer adjustment be made in 20 seconds because on some telephone systems, a message is automatically put on the line after 20 seconds.

To adjust the dial tone detect circuit:

1. Perform the service check as described in the preceding paragraph. (Jumper must be installed.)

2. If the Operate light is not flashing, turn the potentiometer on card H3 counterclockwise until the light begins to flash.

3. Adjust the potentiometer clockwise very slowly until the Operate light stops flashing (is on constant), then turn the potentiometer 1/8 of a turn farther clockwise.

4. Lift the handset and put it back on the cradle. If the Operate light does not stop flashing in 3 to 10 seconds, repeat the adjustment.

If the adjustment cannot be made, swap the H3 card and make the adjustment again.

31-450 Interface Signal Timings

The following timings can aid in determining if the timing circuits are working correctly. These timing circuits are located on the FET (field effect transistor) card (G2), the AEQ/AEL digital card (E2), and the SNBU timing card (K3).

The signals shown here are generated by turning the Test/Operate switch to T1 from a reset position. Sync (minus) the oscilloscope on 'request to send' at Q4G09 to obtain the following signals.

Clear-to-Send Time
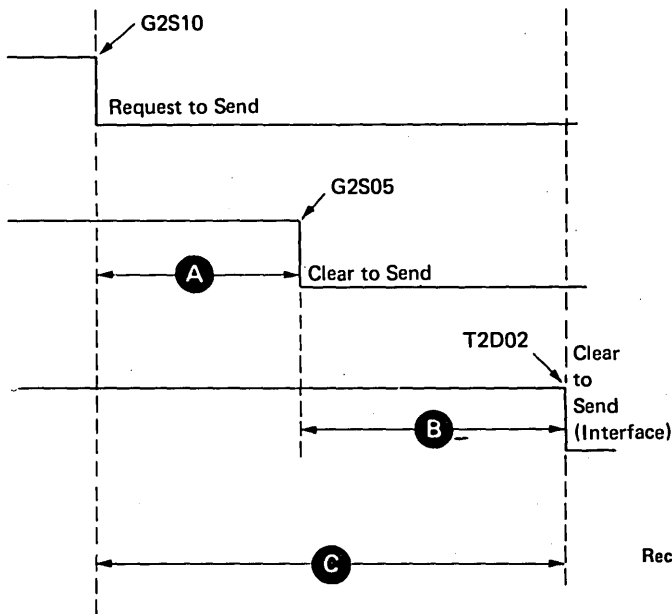
A — Determined by CSCD card jumper options. (see paragraphs 31-471 through 31-477)

B — Extra delay with long initial clear to send; 980 ms (AEQ) or 1,500 ms (SNBU). This delay is 30 ms for SNBU without long initial clear to send.

C — Clear to send delay as seen by DTE.

Receiver Unclamp Time
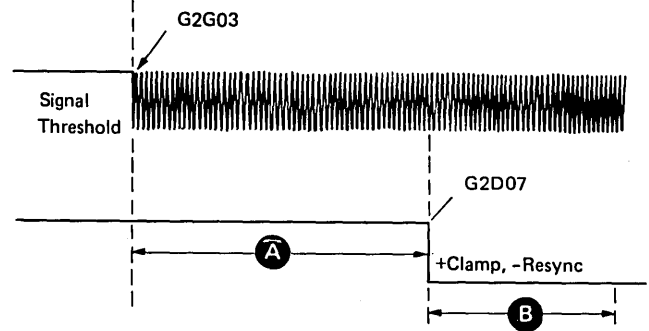
A — Determined by CSCD card jumper options. (see paragraphs 31-471 through 31-477)

B — Extra delay of about 800 ms appears in modems with auto equalizer at G2D07 ('+clamp, -resync') before the signal settles at the '-resync' level.

31-460   Card Check

The following flowchart gives the correct locations of each card needed for a given configuration of the 2400-bps integrated modem. Cards that need jumpers have an X in the square blocks that represent each card. (For line 1, the cards are installed in the B-A1 board. For line 2, the cards are installed in the B-A2 board.) The paragraph number for the correct jumper selection is shown in the flowchart. See the figures in paragraphs 31-471 through 31-477 for the jumper selections.

Start

1

X — Preamp, Q2 (see note 1 and paragraph 31-471).

☐ — Limiter, K4.

X — Transmitter, J4. (paragraph 31-472)

X — Post-Processor, N4. Do signal quality meter adjustment (31-430) after all cards and jumpers are installed.

X — Interface (DTE), T2. (paragraph 31-472)

☐ — Modem Digital Logic (FET), G2. Check that capacitor, part 2772926, is connected between pins G5B07 (+ lead) and H5D08 (- lead). Capacitor is not present if EC 833158 and the E4 card is installed.

X — Test/Operate Logic, Q4. (paragraph 31-473)

X — Basic timing options, K2. (paragraph 31-473)

Yes ◇ No — Is the switched network feature on the machine (do not confuse with SNBU, see note 2)?

A

◇ Yes — Is this a multipoint tributary modem (see note 2)?
No

X — C1 Transmit Equalizer, S4. (paragraph 31-476)

◇ Yes — Is this modem on a point-to-point network?
No

X — C1 Receive Equalizer T4. (paragraph 31-476)

◇ Yes — Is this a multipoint control modem?
No

◇ — Does this have CADUCEE feature?
No   Yes

X — CADUCEE card, P2. (paragraph 31-477)

1 — No such configuration, start over.

B

Notes:
1. The modem is internally set for 0 dbm transmit levels. Attenuate this level by attaching the correct jumper on the Q2 card if a lower level is specified by the common carrier. The transmit level may be marked on the common carrier line coupler box (1000-B, CDT, CBS).
2. For modem with CADUCEE feature (WT):
   a. Switched network feature not on the machine.
   b. If unconditional continuous carry is needed, attach a jumper from K4D11 to T2G03.
   c. This is not a multipoint tributary modem; it is not a point-to-point network. The card installed at P2 is the CADUCEE feature card. Card jumpers are shown in paragraph 31-477.

B
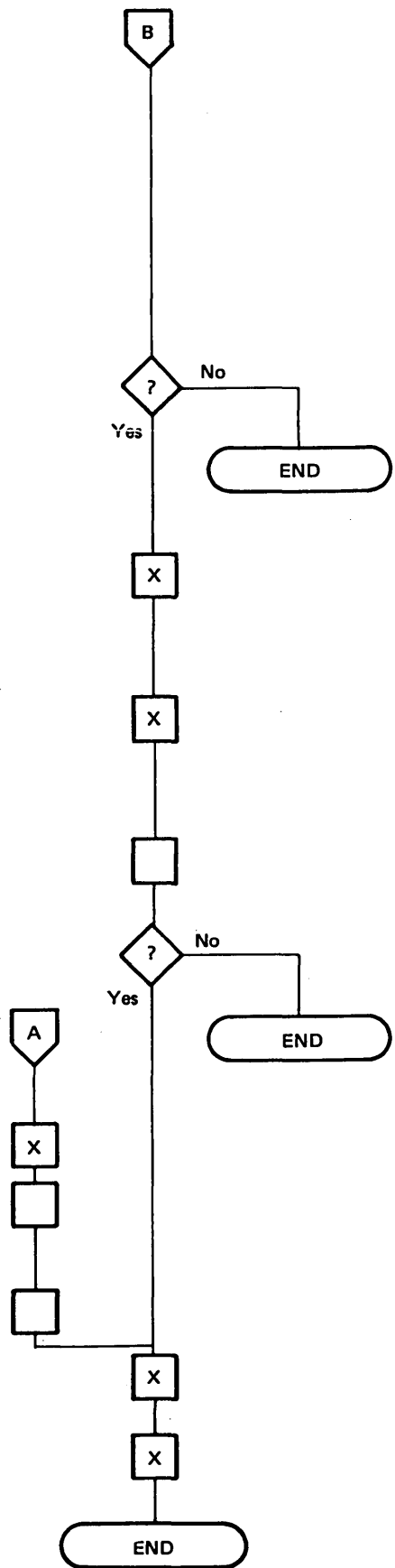
? — **No** → Is the SNBU feature on the machine?

Yes

END

[X] SNBU (standby), M2 (see note 1 and paragraph 31-474). For auto-request-to-send (continuous carrier), add jumper from M2G02 to T2B09.

[X] Standby (SNBU) Timing, K3. (paragraph 31-473)

[ ] Compromise Equalizer, L2.

? — **No** → Is the Automatic Answering option on SNBU?

Yes

END

A

[X] Switched Timing (echo clamp, H3). (paragraph 31-473)

[ ] AEQ Digital Logic, E2. Check that diode (part 2772927) is connected between E2G09 (cathode) and E2J07 (anode). Diode is not present if EC 833158 and the E4 card is installed.

[ ] AEQ Analog, D2.

[X] AA Coupler Interface, S3. (paragraph 31-475)

[X] AA Basic, R2 (see note 1 and paragraph 31-475)

END

Notes:
1. The modem is internally set for 0 dbm transmit levels. Attenuate this level by attaching the appropriate jumper on the Q2 card if a lower level is specified by the common carrier. The transmit level might be marked on the common carrier line coupler box (1000-B, CDT, CBS).
2. For modem with CADUCEE feature (WT):
   a. Switched network feature is not on the machine.
   b. If unconditional continuous carrier is required, attach a jumper from K4D11 to T2G03.
   c. This is not a multipoint tributary modem; it is not a point-to-point network. The card installed at P2 is the CADUCEE feature card. Card jumpers are shown in paragraph 31-477.

31-470   Card Jumpers

The following paragraphs (31-471 through 31-477)
show which jumpers should be attached to the
2400-bps integrated modem cards located on the B-A1
board (line 1) and the B-A2 board (line 2). If a position
on a card does not need a jumper, that position will be
marked as *not used*. Similarly if a position needs a
jumper, that position will be marked *needed*. The
remaining jumper locations are optional and each is
described in the following paragraphs. When attaching
the jumpers to the card, use jumper 816645. If these
jumpers are not available, use any insulated jumper.
Also, the jumper must be connected to the two pins on
opposite sides of the correct letter (vertically or
horizontally) as shown in the figures in paragraphs
31-471 through 31-477.

31-471 Preamplifier Jumpers

Attenuation from 0 decibels (H, J, K — one
location each; L, M, N, P — four locations
each)

```
  0 — M, P
 -1 — H, M, P
 -2 — J, M, P
 -3 — K, M, P
 -4 — L, P
 -5 — H, L, P
 -6 — J, L, P
 -7 — K, L, P
 -8 — M, N
 -9 — H, M, N
-10 — J, M, N
-11 — K, M, N
-12 — L, N
-13 — H, L, N
-14 — J, L, N
-15 — K, L, N
```

Note: Transmit level is jumpered for 0 decibels for
nonswitched lines in the United States and Canada; it is
jumpered for the level indicated on the coupler for
switched lines, and it is jumpered for -6 decibels for
French CADUCEE lines.
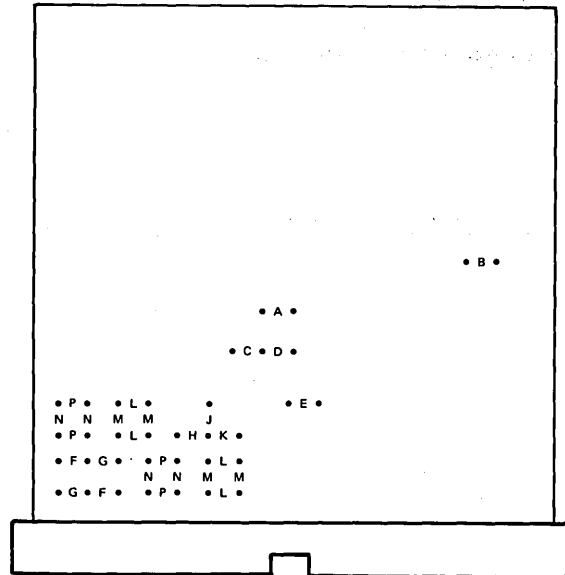
B-A1Q2 (line 1); B-A2Q2 (line 2)

A — Jumper is needed for switched network
(-40 db) or nonswitched network with
SNBU; jumper removed for nonswitched
network without SNBU (-27 db) and for
French CADUCEE networks.

B — Jumper is needed for 4-wire without
SNBU; jumper removed for 2-wire or
SNBU.

C — Not used.

D — Needed.

E — Needed.

F — Needed for 2-wire (two locations).
See the following figure.

G — Needed for 4-wire (two locations).
See the following figure.

Transmit Jumper

● A ●
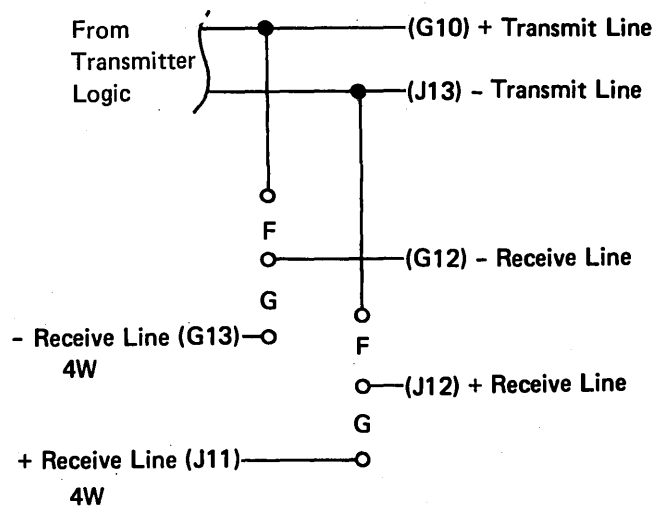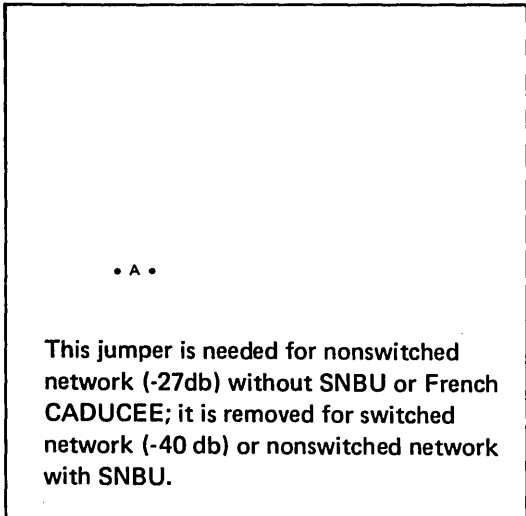
This jumper is needed for nonswitched network (-27db) without SNBU or French CADUCEE; it is removed for switched network (-40 db) or nonswitched network with SNBU.

B-A1J4 (line 1); B-A2J4 (line 2)

Interface Jumpers

● B ● A ● B ● Test

● B ● A ● B ●
Request to   New Sync   Carrier Detect
Send   ●   ●
                      C   A
                      ●   ●
                      A   B Clear to Send
                      ●   ● │ XMT Clock
                      C   A │ │ RCV Clock
                      ●   ● │ │ │ RCV Data
                                              │ │ │ │
                                           ● ● ● ●
                                           A A A A
                                           ● ● ● ●
                                           B B B B
                                           ● ● ● ●
                                           A A A A
                                           ● ● ● ●
Select
Standby   Speed Select   Send Data
  ●   ●   ●
  B   B   B
  ●   ●   ●
  A   A   A
  ●   ●   ●
  B   B   B
  ●   ●   ●
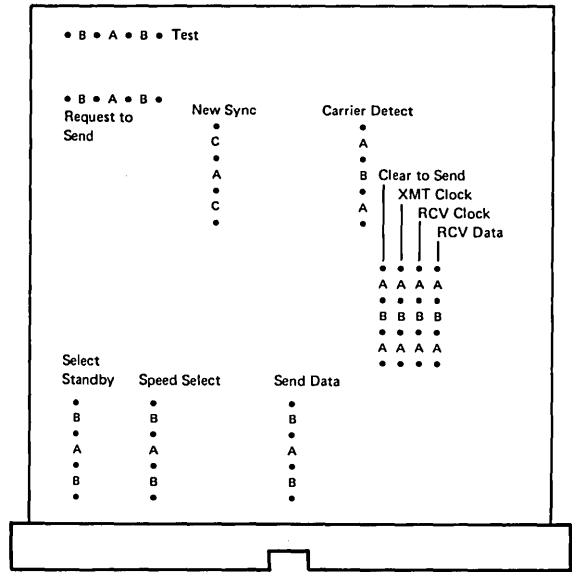
B-A1T2 (line 1); B-A2T2 (line 2)

A — Not used (EIA/CCITT interface)
B — Needed (15 locations)
C — New Sync (installed only for a multipoint control modem that needs New Sync). If New Sync is used, one of the following board jumpers must be installed:
  ● Line 1: 01A-A2J2M04 to 01A-A2Q6B02
  ● Line 2: 01A-A2K2M04 to 01A-A2M6A02

31

Basic Timing Options

```
 .   .        .   .
 C   D        E   F
 .   .        .   .
 A   B        G   H
 .   .        .   .


 .  .    .  .      .  .
 J  P    M  N      N  N
 .  .    .  .      .  .
 K  Q    L  N      N  N
 .  .    .  .      .  .
```

B-A1K2 (line 1)
B-A2K2 (line 2)

Feature Timing Options

```
      . R .      . S .
```

(SNBU timing)
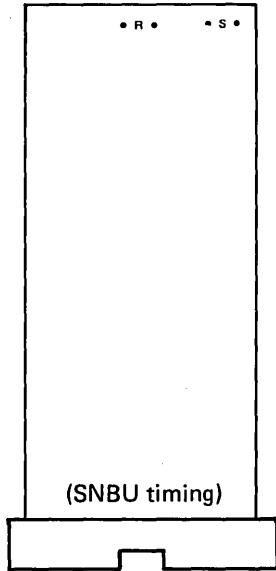
B-A1K3 (line 1)
B-A2K3 (line 2)

Clear to Send Jumpers

A, B — 8.5 ms
A, D — 25 ms
B, C — 75 ms
C, D — 147 ms
L — 75 ms SNBU
M — 147 ms SNBU

Carrier Detect Jumpers

G, H — Needed for every option

Remaining Jumpers

J — 4-wire
K — 2-wire
P — Short carrier detect, no echo clamp
Q — 56 or 123 ms carrier detect, no echo clamp
R — 50 ms echo clamp (100 ms if not strapped)
S — No echo clamp during nonswitched line operation

```
      . R .      . T .      4
```

Switched Timing
(echo clamp)
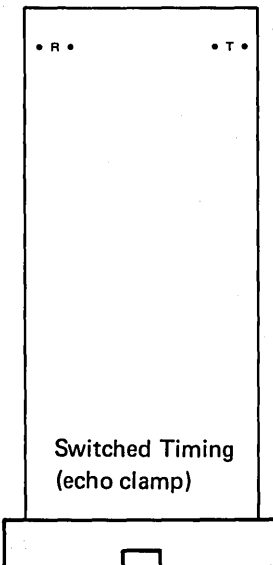
B-A1H3 (line 1)
B-A2H3 (line 2)

Modem	Echo Suppressors?	LL Clear To Send (ms)	SNBU/Switched Network Clear To Send (ms)	Timing Options Strapping
4WLL-SNBU [6,7]	—	8.5[2]		A, B, G, H, J, P
		25		A, D, G, H, J, P
4WLL-SNBU [5,7]	—	8.5[2]	75[1]	A, B, G, H, J, L, R, S
			147	A, B, G, H, J, M, S
		25	75[1]	A, D, G, H, J, L, R, S
			147	A, D, G, H, J, M, S
2WLL-SNBU	NO	75[3]		B, C, G, H, K, Q
		147		C, D, G, H, K, Q
	YES	75[3]		B, C, G, H, K, P
		147		C, D, G, H, K, P
2WLL-SNBU	—	75[3]	75[1]	B, C, G, H, K, L, R
			147	B, C, G, H, K, M, R
		147	147	C, D, G, H, K, M
Switched Network	—		75[3]	B, C, G, H, K, R, T[4]
			147	C, D, G, H, K, T[4]
CADUCEE	—	25		A, D, G, H, J, P

2WLL — 2-wire nonswitched line
4WLL — 4-wire nonswitched line
SNBU — With SNBU
SNBU — Without SNBU

---

[1] Permissible only if SNBU operation is in the local area.
[2] Used only on multipoint tributary modems when 'new sync' is used at the control station.
[3] Used only on short lines, where turnaround is critical and the communications facility characteristics are suitable (minimum echo).
[4] This jumper is installed if any modem in the network does not have the switched network sequence engineering change.
[5] For all except a multipoint tributary modem, the continuous carrier board jumper must be installed (see 31-200 or FSL page AC395).
[6] For all except a multipoint tributary modem, the communication adapter card must be set for continuous carrier (see 31-200).
[7] If New Sync is required (multipoint control modems only), see paragraph 31-472 for required T2 card jumpers and 01A-A2 board jumpers.

Test/Operate Basic Jumpers

• A • B • A •   Data Set Ready

B-A1Q4 (line 1); B-A2Q4 (line 2)
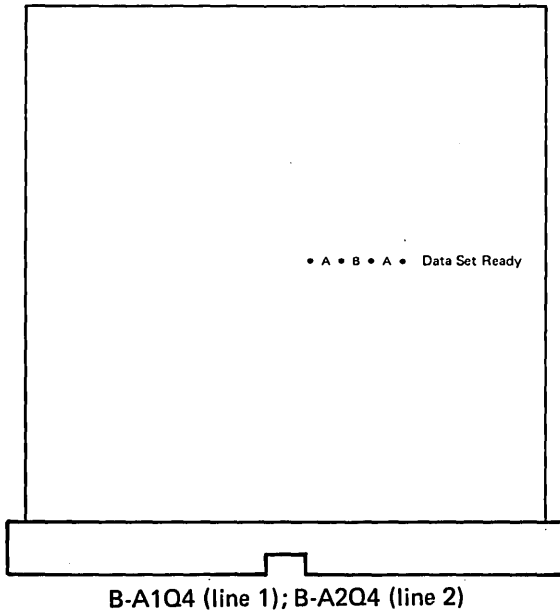
A — Not used (EIA/CCITT interface)
B — Needed

Standby Feature Jumpers

•
D
• E • C •

• A •

• F •   • G •
G G   F   F
• F •   • G •   • B •

• H •   • H •
J   J   J   J
• H •   • H •

B-A1M2 (line 1); B-A2M2 (line 2)
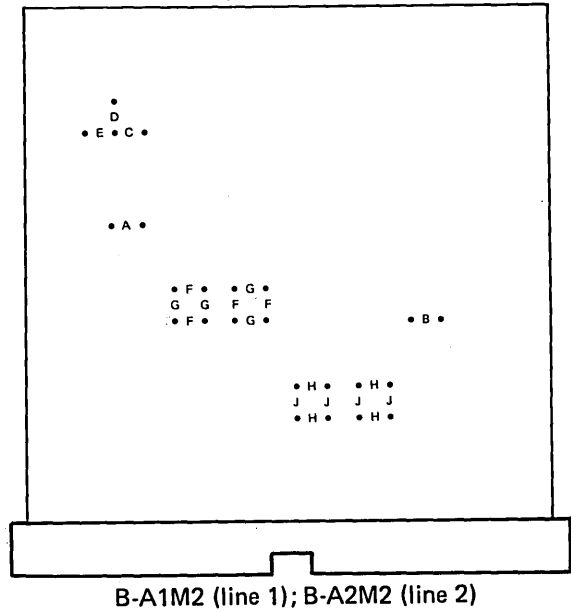
A — Needed

B — Needed for 4-wire (not used for 2-wire nonswitched line)

SNBU Transmit Level Attenuation Jumpers

Note: Transmit level should be marked on coupler.

For jumper locations C, D, and E, attach one jumper; for jumper locations F, G, H, and J, attach all four jumpers.

```
  0 db  —  G, J
 -1 db  —  C, G, J
 -2 db  —  D, G, J
 -3 db  —  E, G, J
 -4 db  —  F, J
 -5 db  —  C, F, J
 -6 db  —  D, F, J
 -7 db  —  E, F, J
 -8 db  —  G, H
 -9 db  —  C, G, H
-10 db  —  D, G, H
-11 db  —  E, G, H
-12 db  —  F, H
-13 db  —  C, F, H
-14 db  —  D, F, H
-15 db  —  E, F, H
```

AA Common Feature Jumpers

```
        •   •   •   •
        B   B   D   D
        • A •   • C •



        •   •
        F   F
        • E •

        •   •
        H   H
        • G •
```

B-A1R2 (line 1); B-A2R2 (line 2)

Answer tone transmit level attenuation from 0 decibels
(level specified on data coupler).

For jumper locations A, C, E, and G, attach
one jumper; for jumper locations B, D, F,
and H, attach both jumpers.

Decibels		Jumper Locations
0	—	A, C, E, G
-1	—	B, C, E, G
-2	—	A, D, E, G
-3	—	B, D, E, G
-4	—	A, C, F, G
-5	—	B, C, F, G
-6	—	A, D, F, G
-7	—	B, D, F, G
-8	—	A, C, E, H
-9	—	B, C, E, H
-10	—	A, D, E, H
-11	—	B, D, E, H
-12	—	A, C, F, H
-13	—	B, C, F, H
-14	—	A, D, F, H
-15	—	B, D, F, H

AA Interface Feature Jumpers

```
         Data
         Terminal
         Ready
          • B • A • B •
      Calling
      Indicator
      • B • A • B •



                   • C • C • C •
```

B-A1S3 (line 1)
B-A2S3 (line 2)

A — Not used

B — Needed (4 locations)

C — Not used

31-475

C1-A Equalizer Basic Jumpers

• G •

• F •

• E •
• D •

•
c
•

•
B
• A •
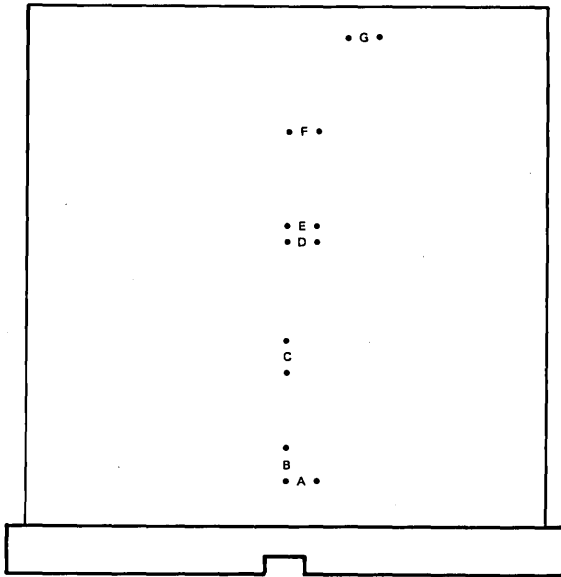
Receive — B-A1T4 (line 1); B-A2T4 (line 2)
Transmit — B-A1S4 (line 1); B-A2S4 (line 2)

A — Not used

B — Needed (amplitude equalization)

C-G — Not used

• A •
• B •

• C •
• D •
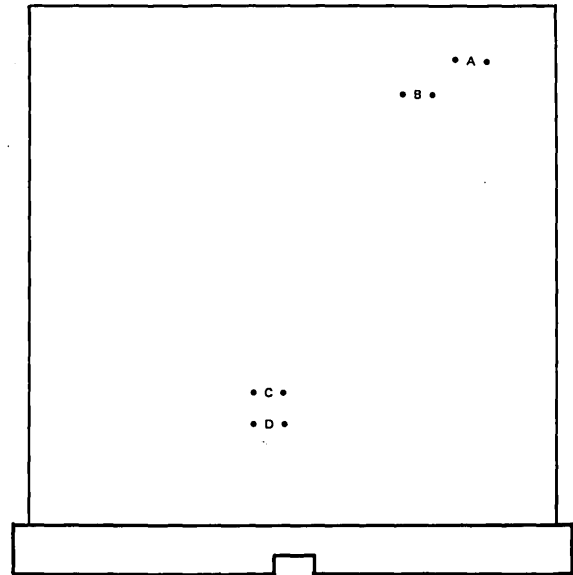
B-A1P2 (line 1); B-A2P2 (line 2)

A - Not used (In the CADUCEE feature, the
0.25 ms delay filter remains active for
equalization.)
B - Needed (disables 0.50 ms delay filter)
C - Not used
D - Needed

31

31-480   Waveshapes

The waveshapes are shown here because they are a reference from the MAPs; the MAPs reference the waveshapes by the associated waveshape number.

The board pin numbers shown with the waveshapes are all on the B-A1 board (line 1) and on the B-A2 board (line 2).

Waveshape 014A
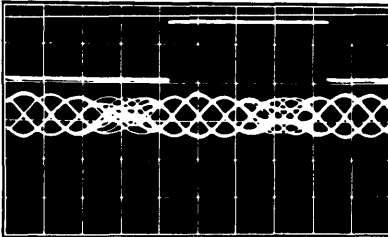
G2S04
Ramp Clock A

Q2D13
Preamp Output—
switched network
or nonswitched line
with SNBU (strapped
for –40 db received
sensitivity; that is,
the A jumper on the
Q2 card is attached
and the A jumper
on the J4 card is
not attached).

Scope settings:
   Triggering to -internal
   Time base to .2 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to 50 mv/div*

Waveshape 014B
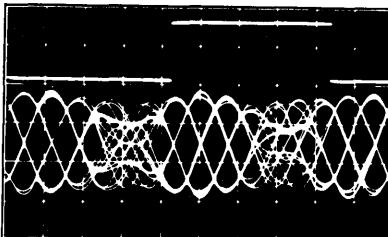
G2S04
Ramp Clock

Q2D13
Preamp Output—
nonswitched line
(strapped for –27 db
receiver sensitivity;
that is, the A jumper
on the J4 card is
attached and the A
jumper on the Q2
card is not attached).

Scope settings:
   Triggering to -internal
   Time base to .2 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to 100 mv/div*

Waveshape 030
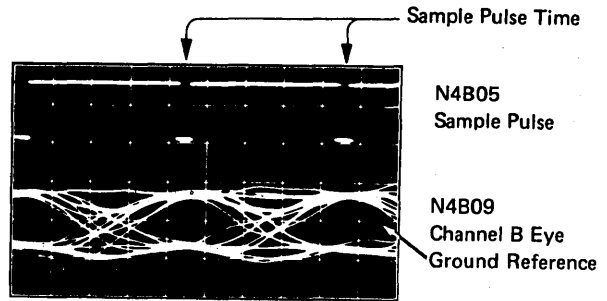
Sample Pulse Time

N4B05
Sample Pulse

N4B09
Channel B Eye
Ground Reference

Scope settings:
   Triggering to -internal
   Time base to .2 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to 2 v/div*

Waveshape 070
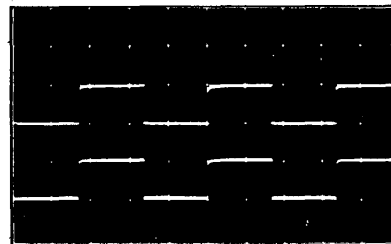
J4J12
Ramp Clock A

J4G10
Ramp Clock B

Scope settings:
   Triggering to -internal
   Time base to .5 ms/div
   Channel 1 to 10 v/div*
   Channel 2 to 10 v/div*

* Use only X1 probe; waveshape may be distorted or not seen when scoping millivolt signals with X10 probe.

Waveshape 072A (see Note)

J4B09
Channel B
Transmit

J4D02
Channel A
Transmit

Scope settings:
   Trigger to − on G2S04
   Time base to .5 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to .5 v/div*

Waveshape 072B (see Note)

J4B09
Channel B
Transmit

J4D02
Channel A
Transmit

Scope settings:
   Trigger to − on G2S04
   Time base to .5 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to .5 v/div*

Note: Observe the oscilloscope carefully. Depending upon how sync actually triggers the sweep, wave forms 072A, 072B, 072C or 072D may be displayed. *A correct wave form always has nine dots vertically, and phase changes always appear as a compressed wave form with four dots omitted.* At 2400 bps, three full cycles appear between phase changes; at 1200 bps, six cycles appear between changes. Phase changes are staggered.

Waveshape 072C (see Note)
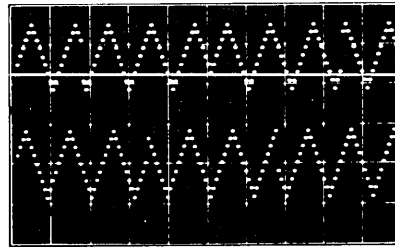
J4B09
Channel B
Transmit

J4D02
Channel A
Transmit

Scope settings:
   Trigger to − on B-A1G2S04
   Time base to .5 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to .5 v/div*

Waveshape 072D (see Note)

J4B09
Channel B
Transmit

J4D02
Channel A
Transmit

Scope settings:
   Trigger to − on G2S04
   Time base to .5 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to .5 v/div*
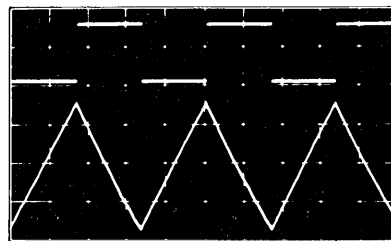
Waveshape 076

G2S04
Ramp Clock A

J4D11
Ramp Test Point

Scope settings:
   Triggering to -internal
   Time base to .5 ms/div
   Channel 1 to .5 v/div*
   Channel 2 to .1 v/div*

(Channel 2 is on AC input.)

31

*   Use only X1 probe; waveshape may be distorted or not seen when scoping millivolt signals with X10 probe.

Waveshape 078
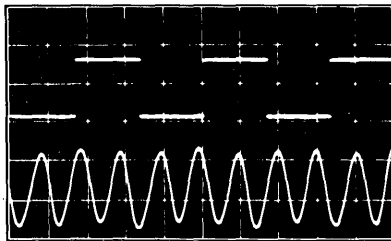
G2S04
Ramp Clock A

J4D05
Analog Transmit
Signal

Scope settings:
Triggering to -internal
Time base to .5 ms/div
Channel 1 to .5 v/div*
Channel 2 to 1 v/div*

Waveshape 081

G2G09
Scrambler Output

Scope settings:
Triggering to -internal
Time base to .5 ms/div
Channel 1 to 2 v/div*

Waveshape 088

G2S04
Ramp Clock A

J4G09 or
S4J09
Line Driver Input

Scope settings:
Triggering to -internal
Time base to .2 ms/div
Channel 1 to .5 v/div*
Channel 2 to 2 v/div*
(Channel 2 is on AC input.)

* Use only X1 probe; waveshape may be distorted or not
seen when scoping millivolt signals with X10 probe.

Waveshape 090

G2S04
Ramp Clock A

Q2B02
Preamp Wrap
Signal Input

Scope settings:
Triggering to -internal
Time base to .2 ms/div
Channel 1 to .5 v/div*
Channel 2 to 5 v/div*

Waveshape 160

Q2D13
Preamp Output
(strapped -27 db on
Q2 and J4)

K4D05
Limiter Input
(strapped -27 db on
Q2 and J4)

Scope settings:
Triggering to — on G2S04
Time base to .2 ms/div

Approximate signal amplitude:
Channel 1, 300 mV (60 mV if strapped -40 db)
Channel 2, 250 mV with C1 equalizer (-27 db)
or automatic equalizer (-40 db)
50 mV with C1 equalizer (-40 db)
60 mV with compromise equalizer
(SNBU wrap) (-40 db)

Waveshape 163

K4D05
Limiter Input
(strapped -27 db
on Q2 and J4)

K4B02
Limiter Output

Scope settings:
Triggering to — on G2S04
Time base to .5 ms/div
Channel 1 as shown in waveshape 160
Channel 2 to 5 v/div*

Waveshape 166

Note: The arrows in this wave form show the relationship between the two signals; channel B signal drops as channel A signal rises.
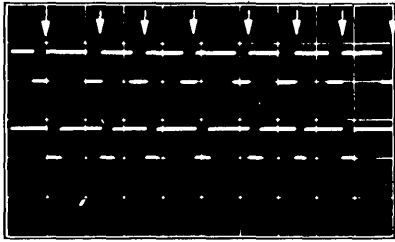
N4D05
Channel A Filter

N4B02
Channel B Filter

Scope settings:
    Triggering to — on G2S04
    Time base to .2 ms/div
    Channel 1 to 1 v/div*
    Channel 2 to 1 v/div*

Waveshape 173A
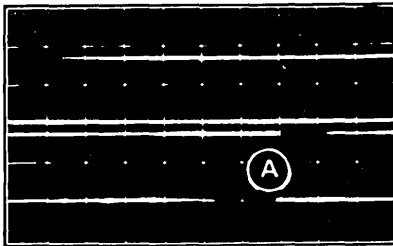
K4B02
Limiter Output

K4D02
Limiter Output
Delayed 450°
(2400 bps)
(shift register
bit 80).

Scope settings:
    Triggering to -internal
    Time base to .1 ms/div
    Channel 1 to 5 v/div*
    Channel 2 to 5 v/div*

Note: Check to see that the signal changes (as marked by **A**).

Waveshape 173B
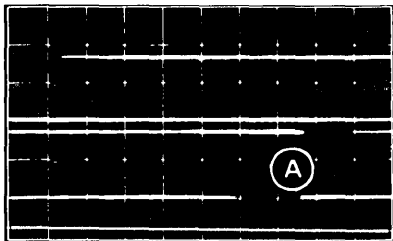
K4B02
Limiter Output

K4D04
Limiter Output
Delayed 990°
(1200 bps)
(shift register
bit 88)

Scope settings:
    Triggering to -internal
    Time base to .1 ms/div
    Channel 1 to 5 v/div*
    Channel 2 to 5 v/div*

Note: Check to see that the signal changes (as marked by **A**).

*   Use only X1 probe; waveshape may be distorted or not seen when scoping millivolt signals with X10 probe.

Waveshape 173C
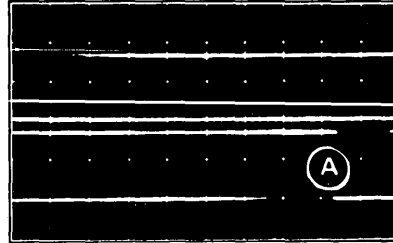
K4B02
Limiter Output

K4B05
Limiter Output
Delayed 540°
(2400 bps) or
1080° (1200 bps)
(shift register bit
96)

Scope settings:
    Triggering to -internal
    Time base to .1 ms/div
    Channel 1 to 5 v/div*
    Channel 2 to 5 v/div*

Note: Check to see that the signal changes (as marked by **A**).

Waveshape 183

Intensity might have to be increased to see a good signal.
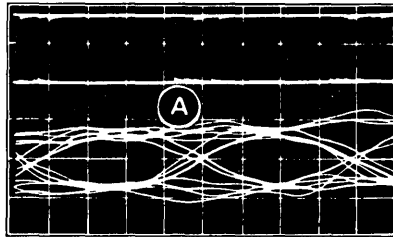
N4D04
Channel A Receive
Data
N4D06
Channel B Receive
Data

N4G02
Channel A Eye
N4B09
Channel B Eye

Scope settings:
    Triggering to — on G2S04
    Time base to .2 ms/div
    Channel 1 to 5 v/div*
    Channel 2 to 2 v/div*

Note: Check to see that the signals change (as marked by **A**).

Waveshape 248
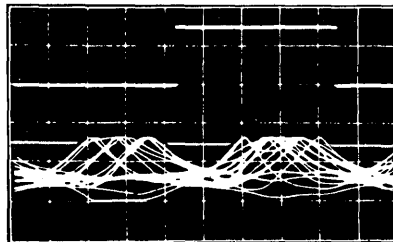
G2S04
Ramp Clock A

D2U05
Channel B Eye
Rectified

Scope settings:
    Triggering to -internal
    Time base to .2 ms/div
    Channel 1 to .5 v/div*
    Channel 2 to 5 v/div*

31-480

Data Communications   47

31-500   DIGITAL DATA SERVICE ADAPTER

The Digital Data Service Adapter cards in A-A2H2 (line 1) and A-A2H4 (line 2) have five jumper locations; attach these jumpers as instructed in Figure 31-28.
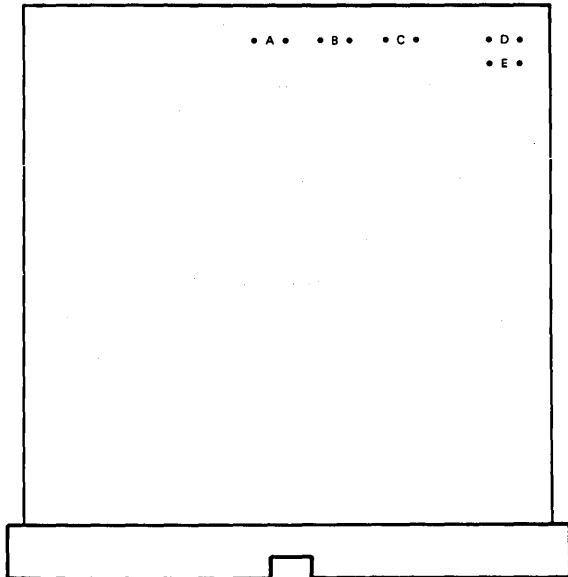
A-A2H2 (line 1); A-A2H4 (line 2)

A — Needed for 2,400 bps Operation (see Note)
B — Needed for 4,800 bps Operation (see Note)
C — Needed for 9,600 bps Operation (see Note)
D — Not used
E — Needed for multipoint operation (disables the channel
      service unit loop-back)
      Not used for point-to-point operation (enables the
      channel service unit loop-back in test mode)

Note: The bits per second rate must be set to the rate specified in the customer's order for service to the common carrier. Clocking is controlled by the common carrier central office.

Figure 31-28. Card Jumpers for the Digital Data Service
                Adapter

31-600   EIA/CCITT INTERFACE

31-610   Card Jumpers

The EIA/CCITT cards in A-A2H2 (line 1) and A-A2H4 (line 2) have 10 jumper locations but none of the jumpers are needed.

If you have a multipoint control modem that needs *new sync,* the following jumpers are added for each line:

Line 1   A-A2H4G08   to   A-A2K1B11
Line 2   A-A2H4G08   to   A-A2K6B02
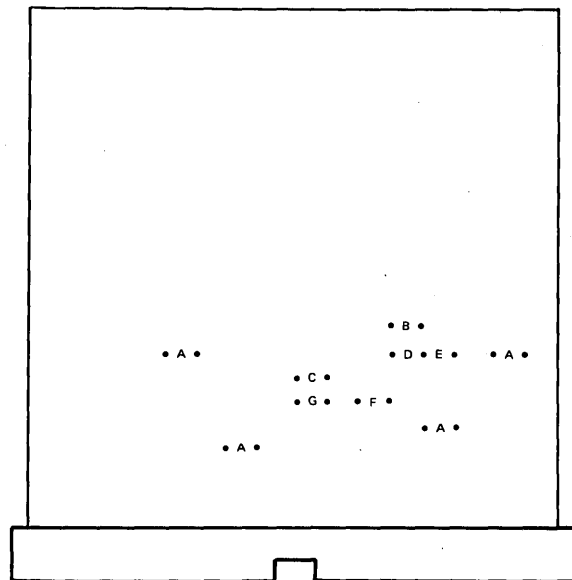
A-A2H2 (line 1); A-A2H4 (line 2)

A — Not used or missing (four locations)
B — Not used
C — Not used
D — Not used
E — Not used
F — Not used
G — Not used

31-620   EIA/CCITT Modem Control Lines

The modem control lines, for the EIA/CCITT interface are active during the up level. These lines and their associated pin numbers are shown in Figure 31-3 and Figure 31-29. The following paragraphs describe eight of these lines.

The 'RTS' (request to send) line controls the transmit and receive functions of the modem. When this line is active, the modem is in transmit mode; when not active, the modem is in receive mode. On a 2-wire nonswitched line, 'RTS' is switched by System/34. On a 4-wire nonswitched line, 'RTS' can be switched by System/34; held permanently on by System/34 or; held permanently on by the modem. On a switched line, 'RTS' is switched by System/34. The 'RTS' line is on during the transmission of each block or frame.

The 'standby' line selects the switched network backup (SNBU) line.

The 'test' line selects the modem wrap function. When the modem wrap test is running, the transmit function of the modem is sent back to the receive function of the modem.

The 'DTR' (data terminal ready) line signals the modem that the terminal is ready to send or receive data. On a switched line, 'DTR' initializes and holds the line connection.

The 'rate' select line selects the bit rate on modems with half speed. When this line is down, half speed is selected.

The 'CTS' (clear to send) line indicates that the modem is ready to transmit data. On a 4-wire nonswitched line, 'CTS' can be active all the time. On a 2-wire nonswitched or switched line, 'CTS' is turned on and off by 'RTS'.

The 'DSR' (data set ready) line indicates that the modem is ready. The modem is ready when power is on, when the modem is connected to the line, and when the modem is not in test mode; all three conditions must be met.

The 'ring indicator' line indicates that the modem is receiving a call.

3

Adapter		EIA/ CCITT Interface Card	Signal	Pin	Modem
	B05	J07	Test (wrap)	18	
	B04	J06	Rate Select	23	
	B02	J02	DTR (data terminal ready)	20	
	D02	G03	RTS (request to send)	4	
	D04	G07	Transmit Data	2	
	B03	G05	Standby	11	
	B09	G08	New Sync*	14	
	B10	G04	Receive Data	3	
	D13	G10	CTS (clear to send)	5	
	B08	J10	Receive Timing	17	
	B13	J09	DSR (data set ready)	6	
	B07	J04	Transmit Timing	15	
	D12	G13	RI (ring indicator)	22	
	D08	J08	Signal Ground	7	
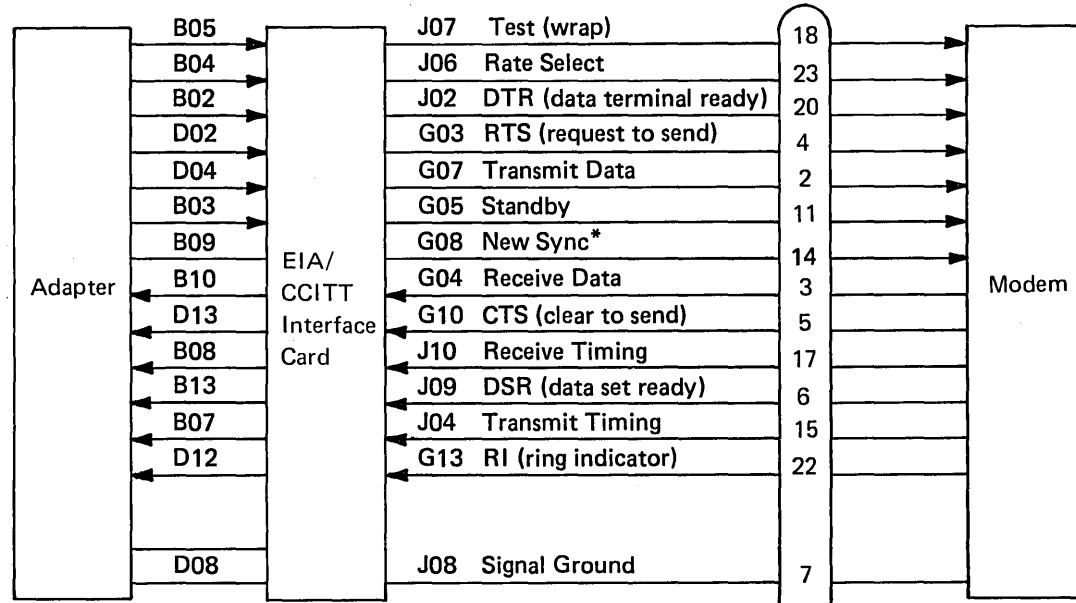
A-A2J2 (line 1)   A-A2H2
A-A2K2 (line 2)   A-A2H4

*New Sync requires a board jumper

Pin numbers of the RS232/CCITT connector

Note: The Cable wrap connector connects the following signals for testing:
DTR to DSR
RTS to RI
Transmit Data to CTS
Rate Select to Transmit Timing
Wrap to Receive Data
Standby to Receive Timing

Figure 31-29. Modem Control Lines for EIA/CCITT Interface

All information pertaining to the IBM 1255 Magnetic Ink
Character Recognition Attachment can be found in the
*IBM System/34 1255 Attachment Feature
Theory/Maintenance Manual,* SY31-0521. The
information that would normally be found in sections 80
and 99 (ERAP and Diagnostic Service Guide) is not
covered in this manual, but is included in the 1255
manual.

40

CONTENTS

4

45-010   INTRODUCTION

The following list is a guide for installing the IBM
System/34. No voltage adjustments are necessary while
installing the system.

- Follow the installation sequence shown in Figure 45-1
  and check off each step as you do it.

- Report any problems that occur while you are
  installing the system. Record these problems on the
  Installation Activity Document, Z130-0080. (Use the
  correct major, minor, and cause codes.) When
  recording problems, use a separate document for
  each work station and for the system unit.

- Always work safely. Observe all the safety rules
  printed in the front of this manual.

- If you are installing a system with an integrated
  modem, you may need either a dB meter (IBM part
  453545), or a multimeter (IBM part 1749231) and a
  dB adapter (IBM part 1749299) for modem
  adjustments. The installation data table (Figure 45-14
  for line 1, Figure 45-15 for line 2, and Figure 45-16
  for MLCA) is used for installing data communications.

The customer must unpack and prepare the IBM 5250
Information Display System work stations. Unpacking
instructions are included with each work station.
Preparation instructions are in the *IBM 5251 Model 1
and 11 Display Station Setup Procedure,* GA21-9286, the
IBM 5252 Dual Display Station Setup Procedure,
GA21-9288, the *IBM 5255 Display Station Model 1
Setup Procedure,* GA09-1624, the *IBM 5255 Display
Station Model 2 Setup Procedure,* GA09-1627, the *IBM
5256 Printer Setup Procedure,* GA21-9290, and the *IBM
5225 Printer Setup Procedure,* GA34-0085. Get a copy
of the *Work Station Network Diagram* from the *IBM
System/34 Installation and Modification Reference
Manual: Program Products and Physical Setup,*
SC21-7689. Have the customer fill out this form while
you continue the installation if he has not already done
so. If the system that you are installing has any data
communications features, fill out the installation data
table (Figure 45-14 for line 1, Figure 45-15 for line 2,
and Figure 45-16 for MLCA). It is important that you do
this because the MAPs contain references to this table.
The table will also aid you in answering configuration
questions and installing data communications features.

The following signal cables are supplied with the
System/34 to attach 5250 work stations to the system:

- One twinaxial cable (IBM part 4236482) is supplied
  for the display station that will be used as the system
  console.

- One twinaxial cable (IBM part 4236482) is supplied
  when an IBM 5225 or 5256 Printer will be used as
  the system printer.

Note: A 5256 printer can be used as the system printer
only when an IBM 5211 Printer is not installed on the
system.

The customer must supply the twinaxial cables for all
other work stations that will be attached to the system.

In order to perform the System/34 system tests
(paragraph 45-600), you will need to use the system
console and the system printer. Before you run these
tests, the customer preparation procedure that does not
need an operational System/34 should be completed for
the display station that will be the system console and
for the 5256 Printer that will be the system printer.

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45

System/34 Installation Sequence	

Step 1 | 45-100 System Preparation and Checks

Unpack and remove any shipping brackets	✓
Check system and power source compatibility.	✓

Step 2 | 45-200 Disk Storage Drives

	Drive A	Drive B

45-210 62EH Disk Storage Drive

	Drive A	Drive B
Unlock spindle	✓	✓
Check drive motor	✓	✓
Check drive belt	✓	✓
Unlock actuator	✓	✓
Check card and cable seating	✓	✓
Check drive motor ground	✓	✓

45-220 62PC Disk Storage Drive

	Drive A	B	C	D
Unlock actuator	✓	✓	✓	✓
Check voltage connectors	✓	✓	✓	✓
Check drive belt	✓	✓	✓	✓
Check belt tensioner	✓	✓	✓	✓
Check card and cable seating	✓	✓	✓	✓
Check drive motor ground	✓	✓	✓	✓

Step 3 | 45-300 Diskette Drive

Check drive pulley for free rotation.	✓
Check card and cable seating.	✓

Figure 45-1 (Part 1 of 3). System/34 Installation Sequence Chart

45-400 Line Printers and Data Communications Cabling

45-405 IBM 3262 Printer

Install, using 3262 installation instructions.	
Connect cables.	
Check adapter card jumpers.	

45-410 IBM 5211 Printer

Install, using 5211 installation instructions.	
Connect cables.	
Check adapter card jumpers.	

45-420 External Modem EIA/CCITT

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.				

45-430 Digital Data Service Adapter

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.*				

45-440 IBM 1200 BPS Integrated Modem

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.				
Route communications cable thru adapter plate				

45-450 IBM 2400 BPS Integrated Modem

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.				
Route communications cable thru adapter plate.				

45-460 IBM 4800 BPS Integrated Modem

	Line 1	Line 2	Line 3	Line 4
Remove communications cable from inside machine.				
Connect communications cable in cable tower.				

45-470 Analog Wideband Adapter

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.				

45-480 Autocall Adapter

	Line 1	Line 2	Line 3	Line 4
Connect communications cable in cable tower.				

*For MLCA installation, this cable goes through tower opening D-B8.

Install all cable retainers and cable tower cover

45

Figure 45-1 (Part 2 of 3). System/34 Installation Sequence Chart

Step 5 | 45-500 IBM 5250 Information Display System

45-510 Twinaxial Signal Cables

Ensure twinaxial cables connected to system output ports.	

45-520 IBM 5251 Display Stations

Ensure twinaxial cables connected to display stations.	
Set address and terminator switches (if present).	

45-525 IBM 5252 Display Stations

Ensure twinaxial cables connected to display stations.	
Set address and terminator switches (if present)	

45-527 IBM 5255 Display Stations

Ensure twinaxial cables connected to display station.	
Set address and terminator switches (if present).	

45-530 IBM 5256 Printer

Ensure twinaxial cable connected to printer.	
Set address and terminator switches (if present).	

45-540 IBM 5225 Printer

Ensure twinaxial cable connected to printer.	
Set address and terminator switches (if present).	

Step 6 | 45-600 System Tests

45-610 Power-on Tests

Power on system and check for failing conditions.	

45-620 IPL Operation from Diskette

Verify that CSIPL/MSIPL works from diskette.	

45-630 System Diagnostics

Verify system configuration.	
Run MDI tests for system unit and base I/O.	

Step 7 | 45-700 Data Communications (first or second communications adapter or MLCA)

	Line 1	Line 2	Line 3	Line 4
45-710 External Modem EIA/CCITT Connection				
45-720 Digital Data Service Adapter				
45-730 IBM 1200 BPS Integrated Modem				
45-740 IBM 2400 BPS Integrated Modem (not used with MLCA)				
45-750 IBM 4800 BPS Integrated Modem (not used with first or second communications adapter)				
45-760 Analog Wideband Adapter (not used with first or second communications adapter)				
45-770 Autocall Adapter (not used with first or second communications adapter)				
45-790 Data Communications Testing				

Step 8 | 45-800 Completing the System Installation

Check CE panel switches.	
Fill out installation logs and IAD.	

Figure 45-1 (Part 3 of 3). System/34 Installation Sequence Chart

6

45-010

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45-100   SYSTEM PREPARATION AND CHECKS

1. Check to ensure that all shipping brackets are removed as described in the unpacking instructions.

2. Open the left side cover and find the voltage label and the power rating plate **A** as shown in Figure 45-2. Ensure that the power supplied by the customer has the same voltage and frequency as that shown on these labels. If the voltage supplied does not match that shown on the labels, change the connections **B** at TB1, TB5, TB6, TB7, TB8, and TB10 as shown in Figure 45-2, and at TB9 located in the rear chassis section for systems with more than two 62PC disk drives.

    Note:
    TB1—Base Ferro (see FSL page YA040)
    TB5—Feature Power Supply A Ferro (see FSL page YA100)
    TB6—Feature Power Supply B Ferro (see FSL page YA120)
    TB7—Feature Power Supply C Ferro (see FSL page YA130)
    TB8—Feature Power Supply D Ferro (see FSL page YA140)
    TB9—Feature Power Supply G Ferro in rear chassis section for systems with more than two 62PC disk drives (see FSL page YA180)
    TB10—Control Supply Ferro (see FSL page YA020)

3. Ensure that the customer's power has a suitable third-wire ground.

4. Ensure that the customer's socket matches the system plug (United States only).

5. With an ohmmeter, check for continuity (less than 5 ohms) from the machine frame to the ground connector on the AC line cord. (This check is to ensure that the machine frame is correctly grounded).

6. Open all containers and check the contents against the bill of material for the shipping group.

TB1, TB5, TB6, TB7, TB8, TB9, or TB10 Taps	One and Two	One and Three	One and Four	Five Ground
50 Hz	200V	220V	235V	—
60 Hz	200V	208V	230V	—

B TB5

Feature Power Supply A

B TB8 Feature Power Supply D

Serial Number Plate

Power Rating Plate

A Voltage Label

Feature Power Supply C

B TB6

B TB7

Feature Power Supply B

Control Supply

B TB1

Base Ferro

Front View

45

Control Supply

B TB10

Figure 45-2. Voltage Label and TB Locations

45-200   DISK STORAGE DRIVES

If the System/34 that you are installing has a 62EH drive, see paragraph 45-210; but if the system has a 62PC drive, see paragraph 45-220

45-210   62EH Disk Storage Drive

See Figure 45-3 and do the following (to both disk drives, if two are installed).

Note: Any time you move the system, ensure that the actuator lock handle Ⓐ is in the On position and the spindle locking arm Ⓓ is in the locked position.

1.   Remove the drive belt cover Ⓕ.

2.   Loosen the two screws that hold the spindle locking arm Ⓓ. Slide the spindle locking arm to the right, so that the long finger becomes the spindle ground. Tighten the two screws.

3.   For old style motor only: If the motor lockscrew Ⓒ was not loosened during the unpacking, loosen the motor lockscrew, press the motor toward the disk, and turn the lockscrew into the disk casting until it is tight. Also, ensure that the motor tension spring Ⓔ is seated in its plastic socket.

     For new style motor only: If the motor lockscrew Ⓒ was not removed during the unpacking, remove the motor lockscrew, and install it into the hole Ⓙ on the rear of the disk casting.

4.   Ensure that the smooth side of the drive belt Ⓖ is toward the pulley Ⓗ, and that the belt does not touch the disk speed transducer.

5.   Reinstall the drive belt cover Ⓕ.

6.   Turn the actuator lock handle Ⓐ from the On (vertical) position to the Off (horizontal) position.

7.   Remove retainer brace Ⓑ to ensure that all cables and cards are seated correctly. Then, reinstall the retainer brace.

8.   With an ohmmeter, check for continuity (less than 5 ohms) from the disk drive(s) A and/or B drive motor frame to the ground connector on the AC line cord. (This check is to ensure that the drive motor(s) is correctly grounded.)

Disk drive packed
and ready to ship

Disk drive unpacked
and ready to operate

Locked

Unlocked

Front View

Front View

Rear View
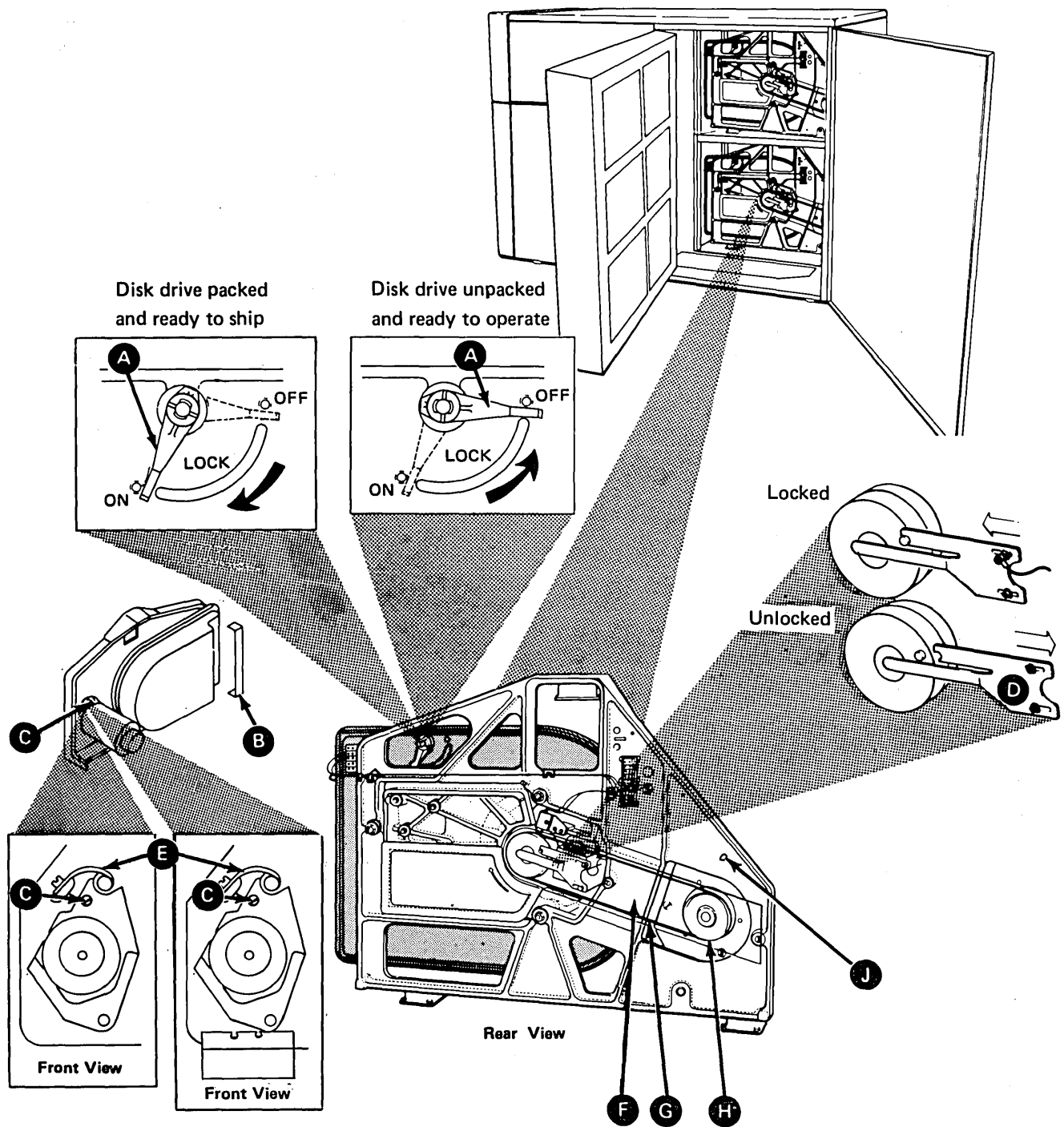
Figure 45-3. 62EH Disk Drive

45-220   62PC Disk Storage Drive

See Figure 45-4 and do the following (to all disk drives that are installed):

Note: When you move the system, ensure that the actuator lock knob **D** is in the locked position (turned fully clockwise).

1. Turn screw **A** counterclockwise and open the card gate.

2. Turn the actuator lock knob **D** counterclockwise (through 120 degrees) until the actuator lock reaches its stop. Ensure that the voltage connectors **C** are seated on the disk board **B**. Close the card gate and tighten the screw **A**.

3. If the disk has a motor lock **V**, loosen the two screws **W**, lift the motor lock, and tighten the two screws.

4. Ensure that the smooth side of the drive belt **F** is against the pulleys **E** and **G**. If not, loosen the two screws **H** and remove the belt guard **J**. Reinstall the belt (smooth side against the pulleys) and reinstall the belt guard.

5. Lift the motor against the belt tensioner spring **P**. When the pin **L** in the shaft **N** is free of the opening **M**, turn the shaft 90 degrees to hold the spring and lower the motor. Ensure that there is no gap at **S**. If there is a gap at **S**, loosen the two screws **K** and place the belt tensioner so that there is no gap at **S** and tighten the screws. Lift the motor against the belt tensioner spring **P**, turn the shaft **N** 90 degrees to place the pin **L** in the opening **M**, and lower the motor.

    Note: The retaining bracket **R** must overlap the motor bracket **Q** as shown.

6. Remove the two screws **U** and the card gate cover **T**. Ensure that all the cables and cards are seated. Reinstall the card gate cover and the two screws.

7. With an ohmmeter, check for continuity (less than 5 ohms) from the disk drive motor frame to the ground connector on the AC line cord. (This check is to ensure that the drive motor is correctly grounded.)
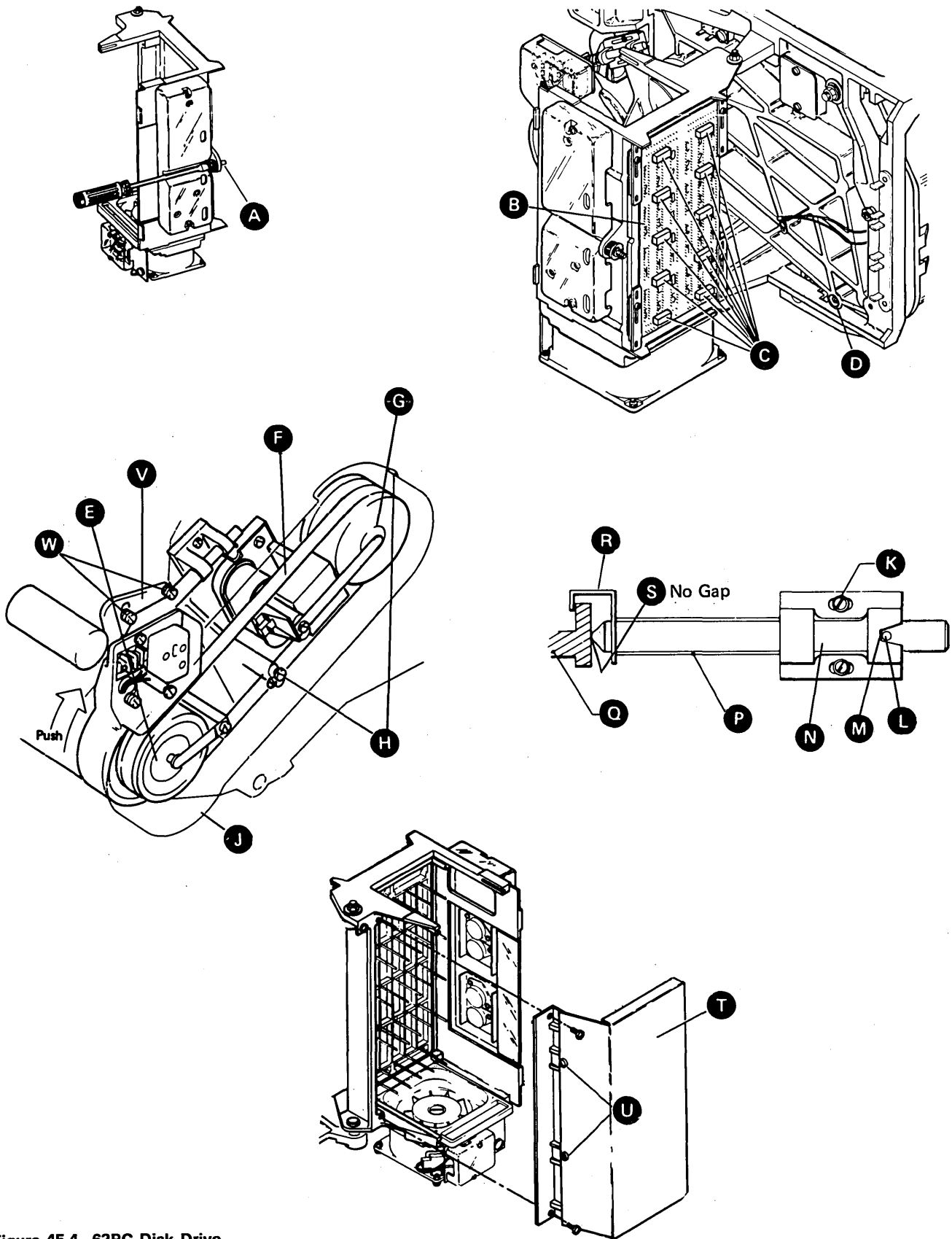
Figure 45-4. 62PC Disk Drive

Push

No Gap

45

45-300   DISKETTE DRIVE

See Figure 45-5 and do the following:

1. Remove the safety cover **C** if it was not removed earlier.

2. Ensure that the diskette drive logic card and all cables and connectors are correctly seated **A**.

3. Turn the drive pulley **B** by hand to ensure that it turns freely.

4. With an ohmmeter, check for continuity (less than 5 ohms) from the diskette drive motor frame to the ground connector on the AC line cord. (This check is to ensure that the drive motor is correctly grounded.)

5. Reinstall the safety cover **C**.

Note: Both the 53FD and the 72MD have a connector that attaches to the read head from the top of the card. For the locations of these cables, see paragraph 25-960 (53FD) or paragraph 27-835 (72MD).
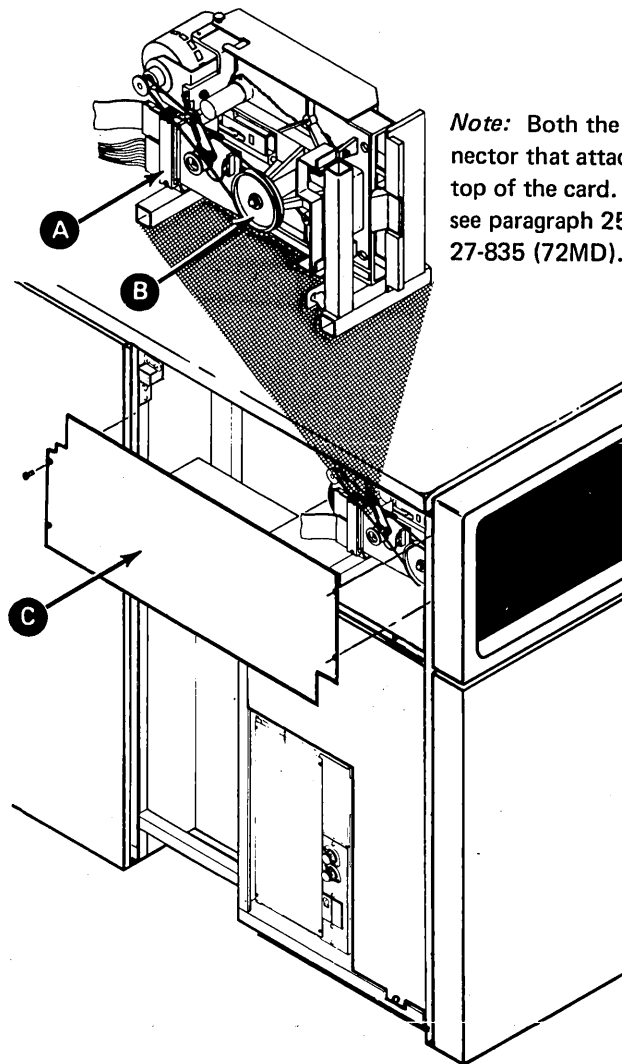
Figure 45-5. Diskette Drive

45-400   LINE PRINTERS AND DATA COMMUNICATIONS CABLES

If the System/34 that you are installing does not have a line printer or data communications, go to paragraph 45-500.

45-405   IBM 3262 Printer

If the System/34 that you are installing does not have a 3262 Printer, go to paragraph 45-410.

1. Unpack and install the 3262 Printer as described in the 3262 Printer unpacking and installation instructions.

2. Remove the cable tower cover and connect the 3262 Printer I/O cables and the ground strap to the cable tower as shown in Figure 45-6. Do not install the cable retainer until all cables are attached to the cable tower.

3. Verify that the jumpers on the 3262 adapter cards (A-A2T2 and A-A2U2) are in the correct locations for the printer being installed. (See paragraph 08-500.)

4. If the System/34 that you are installing does not have data communications, install the cable retainer and reinstall the cable tower cover (Figure 45-6).

5. Go to paragraph 45-500.

45-410   IBM 5211 Printer

If the System/34 that you are installing does not have a 5211 Printer, go to paragraph 45-420.

1. Unpack and install the 5211 Printer as described in the 5211 Printer unpacking and installation instructions.

2. Remove the cable tower cover and connect the 5211 printer I/O cables and the ground strap to the cable tower as shown in Figure 45-6. Do not install the cable retainer until all cables are attached to the cable tower.

3. Verify that the jumpers on the 5211 adapter card (A-A2T2) are in the correct locations for the printer being installed. (See paragraph 07-500.)

4. If the System/34 that you are installing does not have data communications, install the cable retainer and reinstall the cable tower cover (Figure 45-6).

5. Go to paragraph 45-500.

45-420   External Modem EIA/CCITT

If the System/34 that you are installing does not have an external modem, go to paragraph 45-430. If the System/34 that you are installing has an MLCA (multiline communications adapter), go to step 2.

45

1. Attach the communications cable to D-B7 (line 1) or to D-B6 (line 2) as shown in Figure 45-6. The other end of the cable is to be attached later. Go to step 3.

2. Attach the communications cable to D-B6-1 (line 1), D-B6-2 (line 2), D-B7-1 (line 3), or D-B7-2 (line 4) as shown in Figure 45-7. The other end of the cable is to be attached later.

3. If this is the last communications line to be installed, install the cable retainer and reinstall the cable tower cover (Figure 45-6).

4. Go to paragraph 45-430.

45-430   Digital Data Service Adapter

If the System/34 that you are installing does not have a
DDSA (digital data service adapter), go to paragraph
45-440. If the System/34 that you are installing has an
MLCA (multiline communications adapter), go to step 2.

1. Attach the communications cable to D-B7 (line 1)
    or to D-B6 (line 2) as shown in Figure 45-6. The
    other end of the cable is to be attached later. Go
    to step 3.

2. Remove the D-B8 plate (if installed) from the cable
    tower (see Figure 45-7) and pull the
    communications cable through the D-B8 opening.

3. If this is the last communications line to be
    installed, install the cable retainer and reinstall the
    cable tower cover (Figure 45-6).

4. Go to paragraph 45-440.

45-440   IBM 1200 BPS Integrated Modem

If the System/34 that you are installing does not have a
1200-bps integrated modem, go to paragraph 45-450.

1. If the communications cable is not attached to the
    system, attach the cable to the cable tower
    connector D-B7 (line 1) or to D-B6 (line 2) as
    shown in Figure 45-6 (for first or second
    communications adapter). For MLCA, see Figure
    45-7 to attach the cable to the cable tower.

2. If the communications cable is attached to the
    system:
    a. Remove the D-B8 plate (if installed) from the
        cable tower (see Figure 45-6 for first or second
        communications adapter, or Figure 45-7 for
        MLCA).
    b. Pull the communications cable through the
        D-B8 opening.
    c. Reinstall the D-B8 plate (first or second
        communications adapter only) with the cable
        placed in the correct location, as shown in
        Figure 45-6. For MLCA, do not reinstall the
        D-B8 plate.

    The other end of this cable is to be installed later.

    Note: For a first or second communications
    adapter, paragraphs 31-110 through 31-150
    describe the internal connection of the cable that
    is passed through the D-B8 plate. For MLCA, see
    the location section for the line adapter or modem
    to be installed.

3. If this is the last communications line to be
    installed, install the cable retainer and reinstall the
    cable tower cover (Figure 45-6).

4. Go to paragraph 45-450.

45-450   IBM 2400 BPS Integrated Modem

If the System/34 that you are installing does not have a
2400-bps integrated modem, go to paragraph 45-460.

1.   If the communications cable is not attached to the
      system, attach the cable to the cable tower
      connector D-B7 (line 1) or to D-B6 (line 2) as
      shown in Figure 45-6.

2.   If the communications cable is attached to the
      system:
      a. Remove the D-B8 plate from the cable tower
         (see Figure 45-6).
      b. Pull the communications cable through the
         D-B8 opening.
      c. Reinstall the D-B8 plate with the cable placed in
         the location shown in Figure 45-6.

      The other end of this cable is to be installed later.

      Note: Paragraph 31-150 describes the internal
      connection of the cable that is passed through the
      D-B8 plate.

3.   If this is the last communications line to be
      installed, install the cable retainer and reinstall the
      cable tower cover (Figure 45-6).

4.   Go to paragraph 45-460.

45
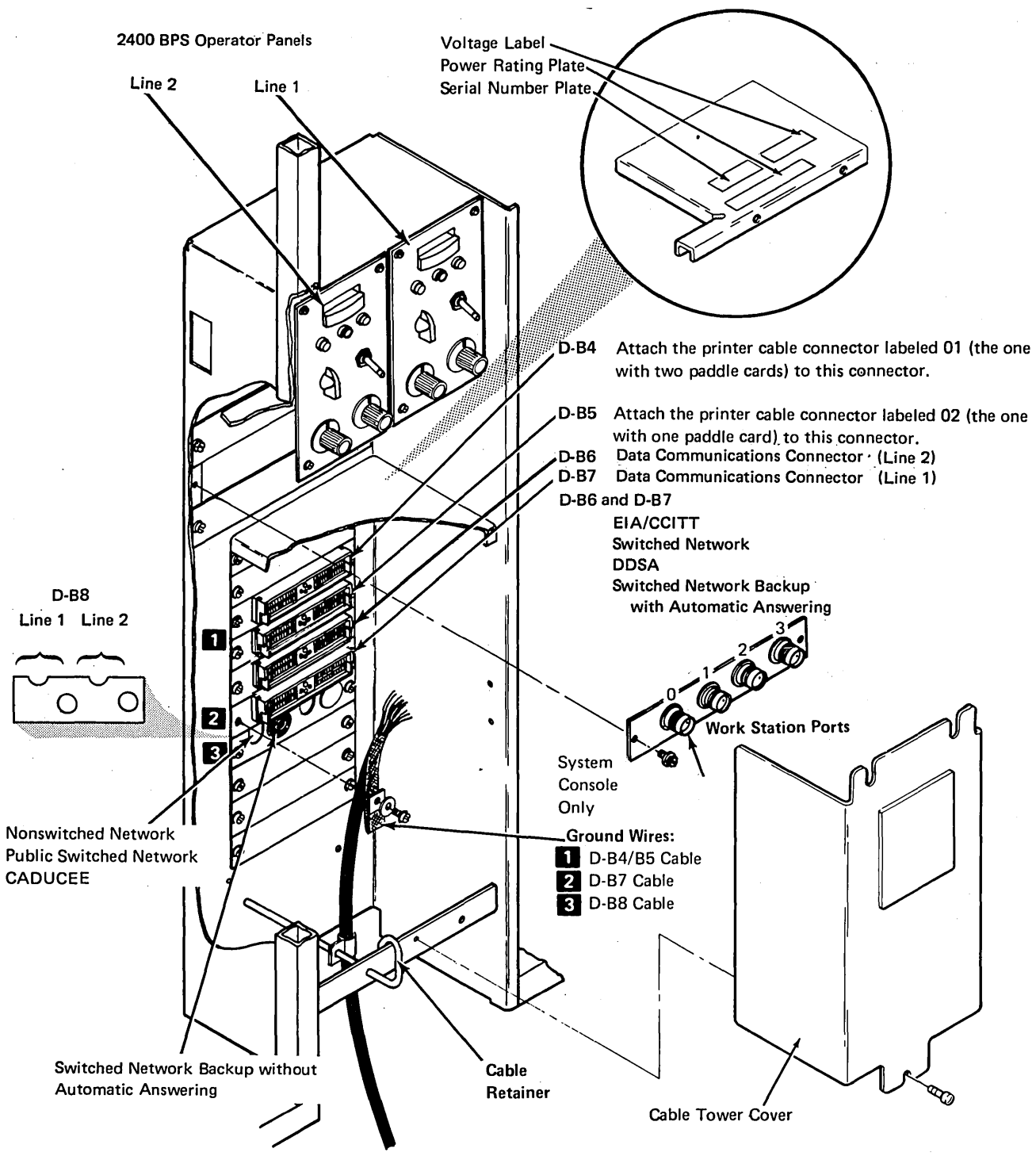
Figure 45-6. 5340 Cable Tower (With First or Second Communications Adapter)

Lighting Protect
Card (nonswitched
line integrated
modems only)

Internal
Cables

D

B

B

D

D-B6-2
or
D-B7-2

D-B6-1
or
D-B7-1

External Cables

Line 1
Line 2
Line 3
Line 4

- Auto Call
- EIA/CCITT
- Integrated Modems for
  Nonswitched Networks
- 1200 BPS Integrated Modem
  for Switched Network
  (not World Trade Public
  Switched Network)
- Analog Wideband

D-B6

D-B7

D-B8

Line 1		Line 2
⊘		⊘
	D-B6-1	D-B6-2

Line 3		Line 4
⊘		⊘
	D-B7-1	D-B7-2

D-B8 is open (no plate)

- DDSA
- 1200 BPS Integrated Modem for World
  Trade Public Switched Network (PSN)
- 4800 BPS Integrated Modem for
  Switched Network

45

Figure 45-7. Cable Tower Locations for MLCA External Cables

45-460 IBM 4800 BPS Integrated Modem

If the System/34 that you are installing does not have a
4800-bps integrated modem, go to paragraph 45-470.

1. If the communications cable is not attached to the
   system, attach the cable to the cable tower
   connector as shown in Figure 45-7.

2. If the communications cable is attached to the
   system, remove the D-B8 plate (if installed), and
   pull the communications cable(s) through the D-B8
   opening. (This plate will not be reinstalled.)

   Note: See paragraph 30-400 for descriptions of
   the internal connections of the cables that go
   through the D-B8 opening.

3. If this is the last communications line to be
   installed, install the cable retainer and reinstall the
   cable tower cover (Figure 45-6).

4. Go to paragraph 45-470.

45-470 Analog Wideband Adapter

If the System/34 that you are installing does not have
an analog wideband adapter, go to paragraph 45-480.

1. Attach the communications cable to D-B6-1 (line
   1), D-B6-2 (line 2), D-B7-1 (line 3), or D-B7-2 (line
   4) as shown in Figure 45-7. The other end of the
   cable is to be attached later.

2. If this is the last communications line to be
   installed, install the cable retainer and reinstall the
   cable tower cover (Figure 45-6).

3. Go to paragraph 45-480.

45-480 Autocall Adapter

If the System/34 that you are installing does not have
an external autocall unit, go to paragraph 45-500.

1. Attach the communications cable to D-B6-1 (line
   1), D-B6-2 (line 2), D-B7-1 (line 3), or D-B7-2 (line
   4) as shown in Figure 45-7. The other end of the
   cable is to be attached later.

2. Install the cable retainer and reinstall the cable
   tower cover (Figure 45-6).

3. Go to paragraph 45-500.

**45-500   IBM 5250 INFORMATION DISPLAY
           SYSTEM**

The *IBM 5251 Model 1 and Model 11 Display Station
Setup Procedure*, GA21-9286, the *IBM 5252 Dual
Display Station Setup Procedure*, GA21-9288, the *IBM
5255 Display Station Model 1 Setup Procedure*,
GA09-1624, the *IBM 5255 Display Station Model 2
Setup Procedures*, GA09-1627, the *IBM 5256 Printer
Setup Procedure*, GA21-9290, and the *IBM 5225 Printer
Setup Procedure*, GA34-0085 (or translated editions for
World Trade) contain instructions that let the customer
prepare work stations that are part of the IBM 5250
Information Display System. If you aid the customer in
preparing any of the 5250 Work Stations, report this
work on the *Installation Activity Document* sent with the
work station.

45-510   Twinaxial Signal Cables

1.   Copy the information on the *Work Station Network
     Diagram* that the customer filled out, onto the form
     attached inside the 5340 system unit near the
     system output ports.

2.   See the *Work Station Network Diagram* and ensure
     that the twinaxial cables are connected to their
     assigned ports as described in paragraphs 45-520
     through 45-530.

45

45-500

45-520   IBM 5251 Display Stations

Ensure that Section I of the *IBM 5251 Model 1 and Model 11 Display Station Setup Procedure,* GA21-9286, has been completed for all 5251 Display Stations that will be used on the system that you are installing.

The IBM 5251 Display Station that will be used as the system console must be connected to port 0 on the 5340. The twinaxial cable that is included in the System/34 shipping group is to be used to attach the system console. All other 5251 Display Stations must be connected to ports 1 through 3, or to another display station or printer (5225 or 5256) that has the Cable Thru feature installed.

To attach a 5251 Display Station as the system console:

1. Connect the twinaxial cable from port 0 on the cable tower in the 5340 System Unit (see Figure 45-6) to the system console.
   a. Insert the cable that comes from port 0 through the opening on the back of the display station.
   b. Connect the cable to socket 1 (see Figure 45-8).

2. If the system console does not have the Cable Thru feature as shown in Ⓐ of Figure 45-8, the installation of the system console is complete.

3. If the system console has a group of four switches and a second cable socket (Cable Thru feature is installed), set the switches as shown in Ⓑ of Figure 45-8.
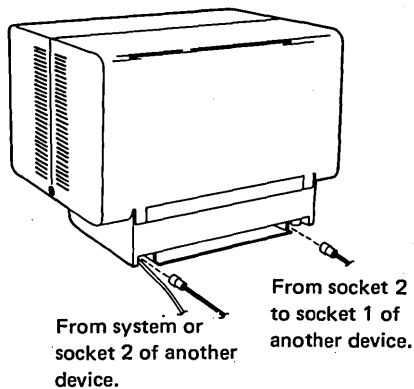
To attach a 5251 Display Station as a work station other than the system console:

1. Connect a twinaxial cable from port 1, 2, or 3 of the 5340 to socket 1 of the display station. This cable may also come from the output socket of another display station or printer (5225 or 5256) that has the Cable Thru feature.
   a. Insert the cable that comes from the 5340 or from another work station through the opening on the back of the display station.
   b. Connect the cable to socket 1 on the front of the display station (see Figure 45-8).

2. If the display station does not have the Cable Thru feature, it must be the last work station on the port.

   Note: Each work station connected to the same port must be assigned a different address (7 is not a valid address). Since a display station without the Cable Thru feature has a station address of 0, no other work station attached to the same port can be assigned an address of 0.

3. If the display station has the Cable Thru feature, set the switches as assigned in the *Work Station Network Diagram* and described in Ⓑ and Ⓒ of Figure 45-8.

From socket 2 to socket 1 of another device.

From system or socket 2 of another device.

A **Without Cable Thru Feature**

Station address is automatically set to 0
and the line is terminated.
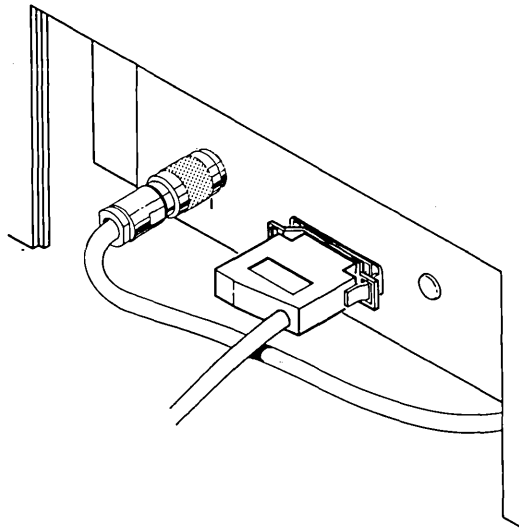
B **With Cable Thru Feature Not Being Used**

(Used for the system console or for the
last station on a port.)

Address and terminator switches are
shown in the correct position for the
system console; that is, the address
switches are set for an address of 0
and the terminator switch is set to 1
to terminate the line. For the last
station on a port, the address switches
can be set to any valid address, and
the terminator switch must be set to 1.
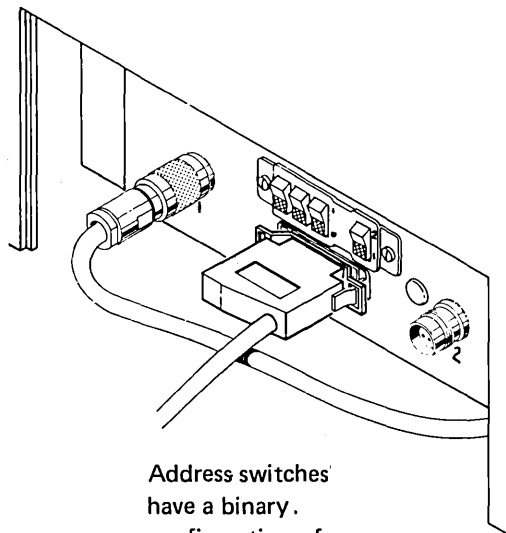
Address switches
have a binary.
configuration of
4, 2, and 1
(left to right).

C **With Cable Thru Feature Being Used**

The address switches are set for an address
of 5 and the terminator switch is set to 2
to permit cable thru.
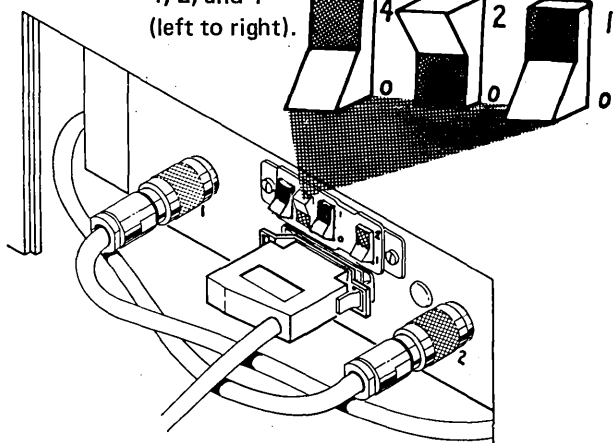
Figure 45-8. 5251 Switches and Cable Connections

45

45-525   IBM 5252 Display Stations

Ensure that Section 1 and Section 2 of the *IBM 5252 Dual Display Station Setup Procedure*, GA21-9288, have been completed for all 5252 Display Stations that will be used on the system that you are installing.

If the IBM 5252 Display Station will be used as the system console, it must be connected to port 0 on the 5340. The twinaxial cable that is included in the System/34 shipping group is to be used to attach the system console. All other 5252 Display Stations must be connected to ports 1 through 3, or to another display station or printer (5225 or 5256) that has the Cable Thru feature installed.

To attach a 5252 Display Station as the system console:

1.   Connect the twinaxial cable from port 0 on the cable tower in the 5340 System Unit (see Figure 45-6) to socket 1 on the system console.

2.   If the system console does not have a terminator switch or any address switches as shown in **Ⓐ** of Figure 45-9, the installation of the system console is complete.

3.   If the system console has a terminator switch, two address switches, and a second cable socket (Cable Thru feature is installed), set the switches as shown in **Ⓑ** of Figure 45-9.

To attach a 5252 Display Station as a work station other than the system console:

1.   Connect a twinaxial cable from port 1, 2, or 3 of the 5340 to socket 1 of the display station. This cable may also come from the output socket of another display station or printer (5225 or 5256) that has the Cable Thru feature.

2.   If the display station does not have the Cable Thru feature, it must be the last work station on the port.

      Note: Each work station connected to the same port must be assigned a different address (addresses of 6 and 7 are not valid for the 5252). Because a display station without the Cable Thru feature has station addresses of 0 and 1, no other work station attached to the same port can be assigned an address of 0 and 1.

3.   If the display station has the Cable Thru feature, set the switches as assigned in the *Work Station Network Diagram* and described in **Ⓑ** and **Ⓒ** of Figure 45-9.

A **Without Cable Thru Feature**
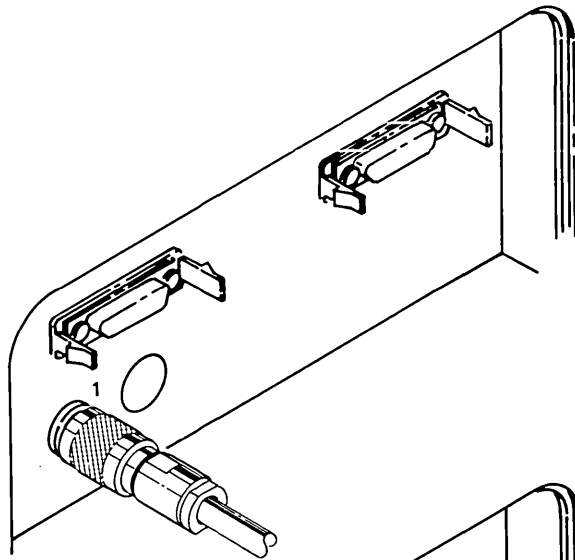
Station address is automatically
set to 0 and 1.

B **With Cable Thru Feature Not Being Used**
(Used for the system console
or for the last station on a
port.)

Address and terminator switches
are shown in the correct position
for the system console: that is,
the address switches are set for
an address of 0 and the terminator
switch is set to 1 to terminate the
line. For the last station on a port,
the address switches can be set to
any valid address, and the terminator
switch must be set to 1.

C **With Cable Thru Feature**
Being Used

The address switches are set for
addresses of 4 and 5; the
terminator switch is set to 2 to
permit cable thru.

45
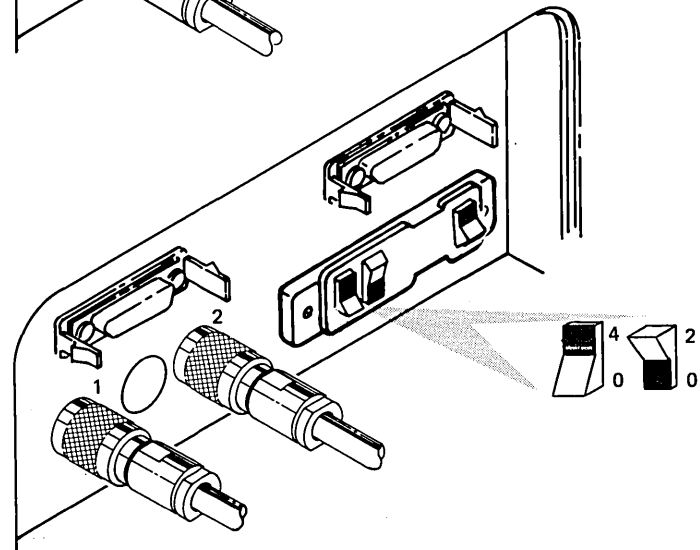
Note: The address switches can be set for addresses
of 0, 2, or 4 for one of the dual stations. The other
station is automatically set for an address of 1, 3, or
5 respectively.

Figure 45-9. 5252 Switches and Cable Connections

45-527   IBM 5255 Display Stations

Ensure that Section 1 and Section 2 of the *IBM 5255 Display Station Model 1 Setup Procedure*, GA09-1624, or *IBM 5255 Display Station Model 2 Setup Procedure*, GA09-1627, have been completed for all 5255 Display Stations that will be used on the system that you are installing.

If the IBM 5255 Display Station will be used as the system console, it must be connected to port 0 on the 5340. The twinaxial cable that is included in the System/34 shipping group is to be used to attach the system console. All other 5255 Display Stations must be connected to ports 1 through 3, or to another display station or printer (5225 or 5256) that has the Cable Thru feature installed.

Note: The IBM 5255 Display Station can be used only when work station control expansion C is installed.

To attach a 5255 Display Station as the system console:

1.   Connect the twinaxial cable from port 0 on the cable tower in the 5240 System Unit (see Figure 45-6) to socket 1 on the system console.

2.   If the system console does not have a terminator switch or any address switches as shown in Ⓐ of Figure 45-10, the installation of the system console is complete.

3.   If the system console has a group of four switches, and a second cable socket (Cable Thru feature is installed), set the switches as shown in Ⓑ and Ⓓ of Figure 45-10.

To attach a 5255 Display Station as a work station other than the system console:

1.   Connect a twinaxial cable from port 1, 2, or 3 of the 5340 to socket 1 of the display station. This cable may also come from the output socket of another work station (display station or printer) that has the Cable Thru feature.

2.   If the display station does not have the Cable Thru feature, it must be the last work station on the port.

      Note: Each work station connected to the same port must be assigned a different address (address 7 is not valid for the 5255). Because a display station without the Cable Thru feature has station addresses of 0, no other work station attached to the same port can be assigned an address of 0.

3.   If the display station has the Cable Thru feature, set the switches as assigned in the *Work Station Network Diagram* and described in Ⓑ, Ⓒ, and Ⓓ of Figure 45-10.

A Without Cable Thru Feature
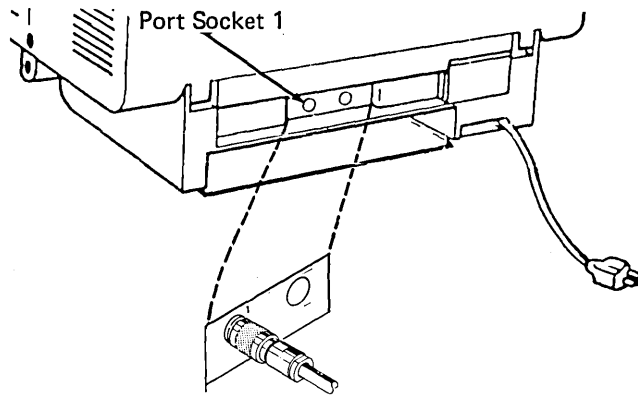
Station address is automatically
set to 0 and 1.

B With Cable Thru Feature Not Being Used
(Used for the system console
or for the last station on a
port.)

Address and terminator switches
are shown in the correct position
for the system console; that is,
the address switches are set for
an address of 0 and the terminator
switch is set to 1 to terminate the
line. For the last station on a port,
the address switches can be set to
any valid address, and the terminator
switch must be set to 1 (see **D**).
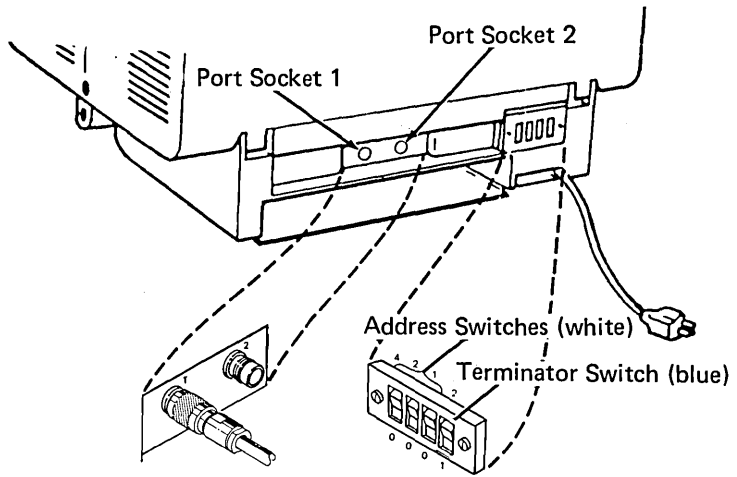
C With Cable Thru Feature
Being Used

The address switches are set for
addresses of 4 and 5; the
terminator switch is set to 2 to
permit cable thru.
For any other station on a port,
the address switches can be set
to any valid address (see **D**).

Port Socket 1

Port Socket 2
Port Socket 1

Address Switches (white)
Terminator Switch (blue)

Port Socket 2
Port Socket 1

Address Switches (white)
Terminator Switch (blue)
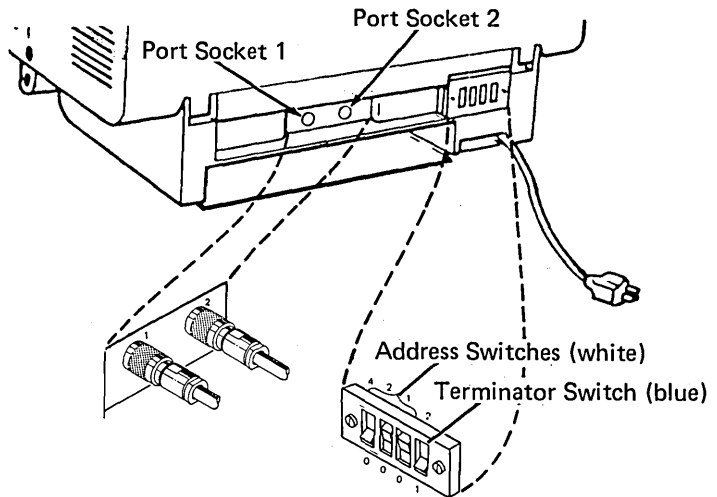
Figure 45-10 (Part 1 of 2). 5255 Switches and Cable Connector

45

Setting the Switches

There are two types of switches to set: address and terminator.
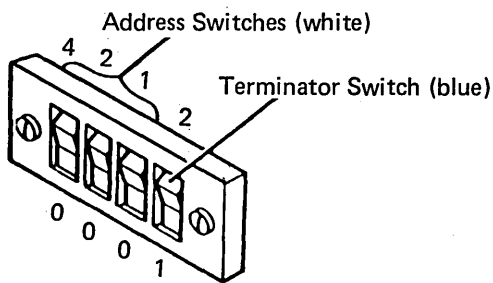
Set the switches:

1. Contact the person responsible for assigning the work station address (for example, your supervisor or system operator). Ask for your work station address, which will be a number from 0 through 6.

2. Set the address switches to the address you have received. Use the table below to determine the settings of the three address switches.

Work Station Addresses	Switches*
∅	
1	
2	
3	
4	
5	
6	
7	

Note: The address switches can be set for addresses of 0, 2, or 4 for one of the dual stations. The other station is automatically set for an address of 1, 3, or 5, respectively.

Figure 45-10 (Part 2 of 2). 5255 Switches and Cable Connector

45-527

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45

45-530   IBM 5256 Printer

If the System/34 that you are installing does not have an IBM 5256 Printer, go to paragraph 45-540.

Ensure that Section I of the *IBM 5256 Printer Setup Procedure*, GA21-9290, has been completed for all 5256 printers that will be used on the system you are installing.

To attach a 5256 Printer to the system:

1.   Connect a twinaxial cable from port 1, 2, or 3 of the 5340 to the bottom cable socket on the rear of the 5256 Printer. This cable may also come from the output of another work station (display station or printer) that has the Cable Thru feature.

2.   If the printer does not have the Cable Thru feature as shown in **A** of Figure 45-11, it must be the last work station on the port. Its address will be 0.

3.   If the printer has the Cable Thru feature, set the switches as assigned in the *Work Station Network Diagram* and described in **B** and **C** of Figure 45-11. (7 is an invalid address.)
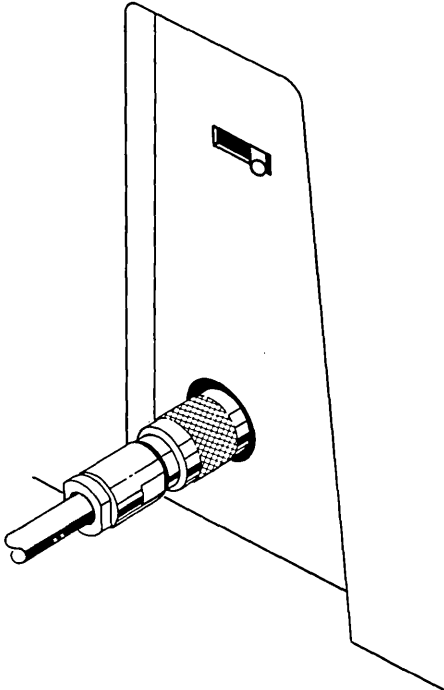
A Without Cable
Thru Feature

B With Cable
Thru Feature
(used for the
last device on
a port)

C With Cable
Thru Feature
Being Used

Station address is automatically
set to 0.
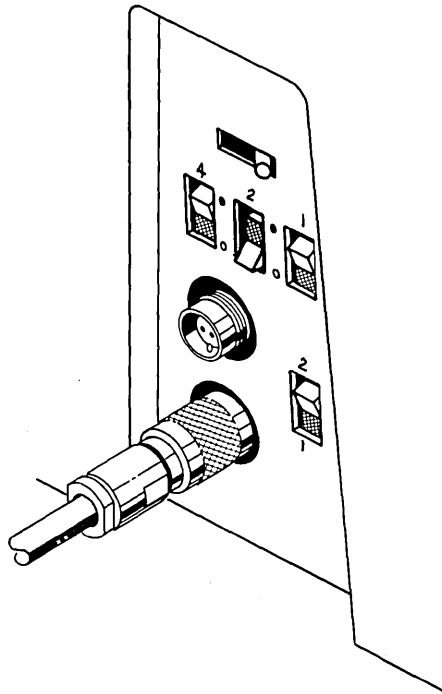
In this example the address
switches are set for an
address of 2; the terminator
switch must be set to
position 1 to terminate the
line.
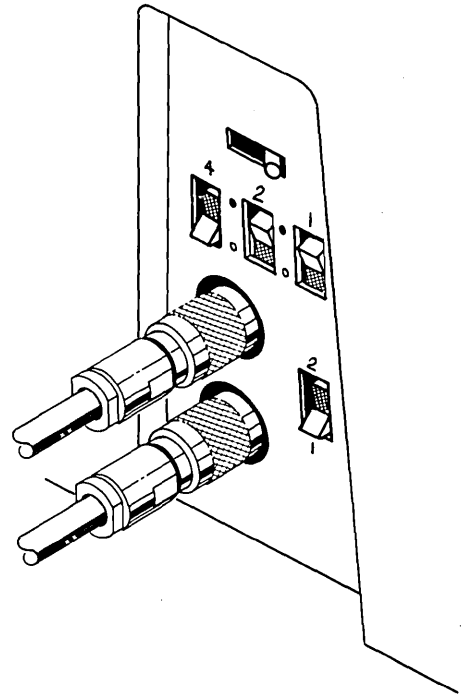
In this example the address
switches are set for an
address of 4; the terminator
switch must be set to
position 2 to permit cable
thru.

45

Figure 45-11. 5256 Switches and Cable Connections

45-530

45-540   IBM 5225 Printer

If the System/34 that you are installing does not have an IBM 5225 Printer, go to paragraph 45-600.

Ensure that Section I of the *IBM 5225 Printer Setup Procedure*, GA34-0085 has been completed for the 5225 Printer that will be used on the system you are installing.

To attach a 5225 Printer to the system.:

1. Connect a twinaxial cable from port 1, 2, or 3 of the 5340 to the left cable socket on the rear of the 5225 Printer. This cable may also come from the output socket of another work station (display station or printer) that has the Cable Thru feature.

2. If the printer does not have the Cable Thru feature as shown in **A** of Figure 45-12, it must be the last work station on the port. Its address will be 0.

3. If the printer has the Cable Thru feature, set the switches as assigned in the *Work Station Network Diagram* and described in **B** and **C** of Figure 45-12. (7 is an invalid address.)
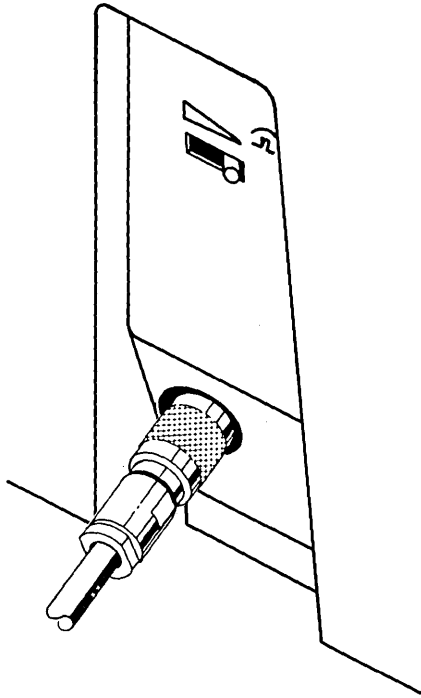
A Without Cable
Thru Feature

B With Cable
Thru Feature
(used for the
last device on
a port)

C With Cable
Thru Feature
Being Used

Station address is automatically
set to 0.

In this example, the address
switches are set for an
address of 0; the terminator
switch must be set to
position 1 to terminate the
line.

In this example, the address
switches are set for an
address of 0; the terminator
switch must be set to
position 2 to permit cable
thru.

45
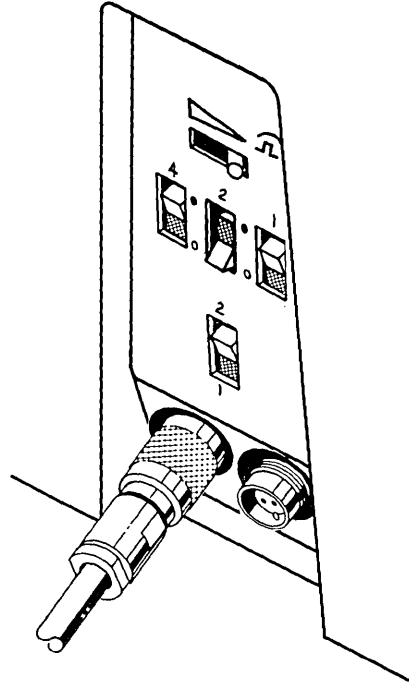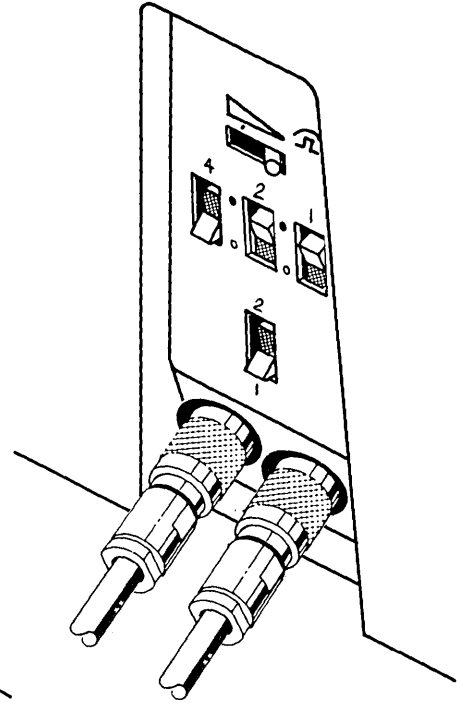
Figure 45-12. 5225 Switches and Cable Connections

45-600   SYSTEM TESTS

The physical installation of the base System/34 is now complete. You are now ready to check operation of the base System/34.

If IBM SSP is installed on your system, SYSTST (system test) can now be run (see paragraph 99-069 of this manual).

CAUTION
Do not install any data communications equipment (paragraph 45-700) until you have completed the tests in paragraphs 45-610 through 45-630. Install the data communications equipment after the testing of the base system is complete.

_____
_____
_____
_____
_____
_____
_____

45-610   Power-On Tests

See Figure 45-13 and perform the following to ensure that the system can be powered on correctly:

1. Ensure that the following switches are in the Off position:
    a. Power switch **G** is in the O position. If the keylock feature is installed, the key should be in the vertical (off) position.
    b. CB1 **H** is down.
    c. IPO switch **E** is in the O position.

2. Connect the power cord to the outlet.

3. Set circuit breaker CB1 **H** to the On (up) position. System power should not come on.

4. Press the Lamp Test switch **D** on the CE panel. The Power Check and Thermal Check indicators on the operator panel should come on. The control supply status indicator on the C-A1C2 card also comes on. (See the note in item 6 following.)

5. Set the IPO switch **E** to I (on). System power should not come on.

6. Set the Power switch **G** to I (on). If the keylock feature is installed, turn the key to the horizontal (on) position. System power should come on. The following indicate that the system powered on correctly:
    – The Power indicator on the operator panel is on.
    – The disk drive is turning.
    – The diskette drive is turning.
    – The gate fans are operating.
    – After power has been on for approximately 1 minute, the disk arm (for each disk drive) seeks to the home position of the disk.
    – When you press the Lamp Test switch **D** on the CE panel, all indicators on the operator panel and CE panel come on.

    Note: The control supply status indicator on the C-A1C2 card (located on the machine base below the CE panel) also comes on.

7. Power on the system console and the system printer.
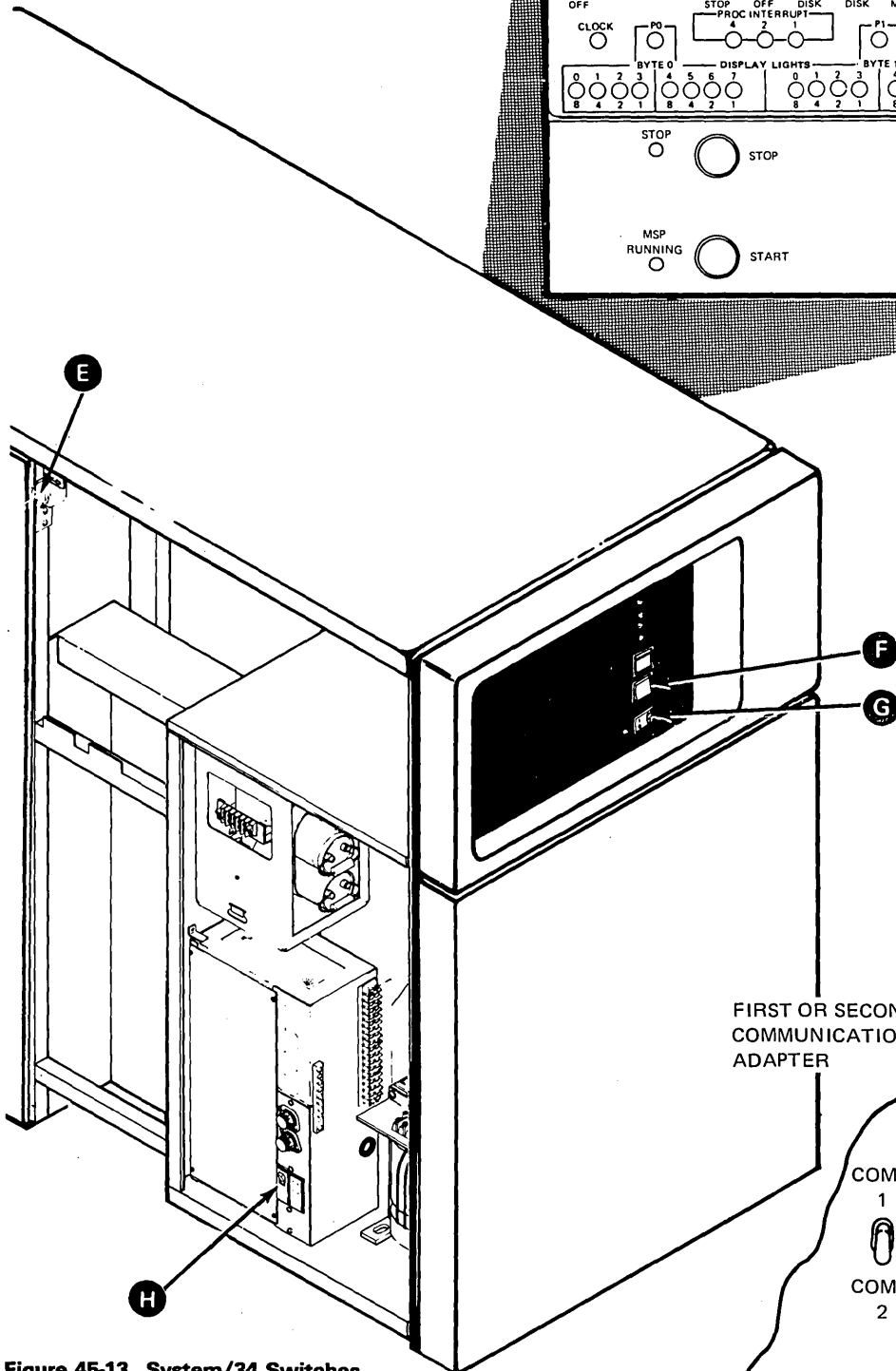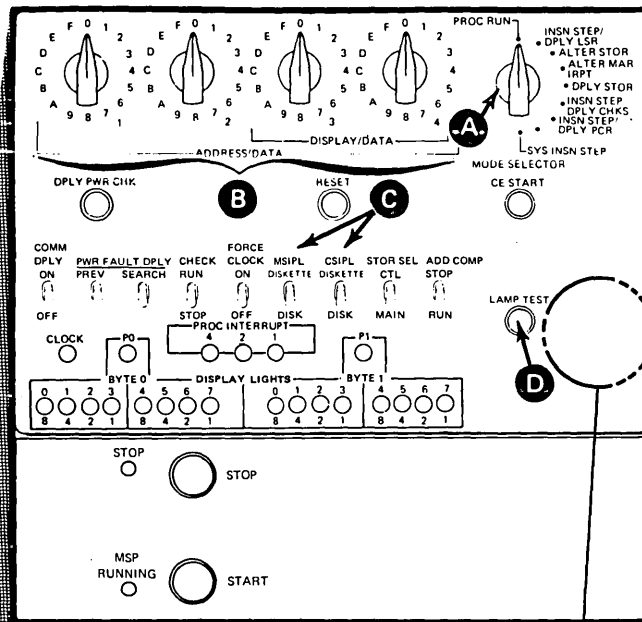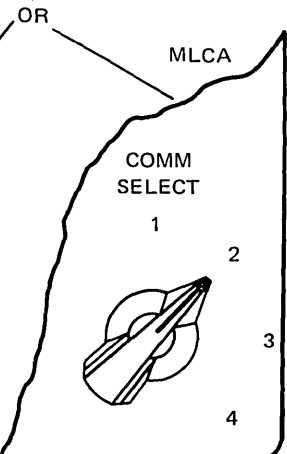
Figure 45-13. System/34 Switches

45-620   Initial Program Load Operation from Diskette

To do an initial program load operation from diskette:

1. Set the CE panel switches as follows (see Figure 45-13):
    a. Set all four Address/Data switches ⓑ to 0000.
    b. Set the CSIPL and MSIPL switches ⓒ to the Diskette position.
    c. Set the Mode Selector switch ⓐ to the Proc Run position.
    d. Set all other CE panel switches to the down position.

2. Insert diskette DIAGB1.

3. Press the Load switch ⓕ on the operator panel.

4. When the initial program load procedure is correctly completed, the Diagnostic Supervisor is loaded and the main menu is displayed on the system console. If there are any check conditions or control storage IPL wrap errors (except 80xx, 82xx, and 10xx checks, which are for data communications), use the maintenance documents to determine the cause.

5. Because the data communications installation is not complete, bypass data communications wrap errors that are displayed at this time by pressing the Enter key on the system console to continue the initial program load sequence.

45-630   System Diagnostics

1. Perform the following to verify that the system configuration is correct:

    Note: If the configuration for the system printer is not correct, you cannot run a list on the printer. Return to the main menu, by pressing the Attn key, and select the PRINTER/DISPLAY option. Then, select the printer messages to system console option and continue with step a.
    a. Select the utilities option from the main menu.
    b. Select the system configuration option from the utilities menu.
    c. List the system configuration and verify that it matches the system you are installing. If data communications is to be installed, use the installation data table that you filled out earlier to answer the configuration questions for this feature now. Use Figure 45-14 for line 1, Figure 45-15 for line 2, or Figure 45-16 for MLCA. You will be instructed to install and test this feature later in the installation (see the machine history located in Volume D, *Field Service Logics*).
    d. If the system configuration must be changed, make the necessary changes and run the CUSTOMIZ routine to move the microcode to the disk. After CUSTOMIZ is complete, do another initial program load operation from DIAGB1 (see paragraph 45-620), then continue with step 2.

2. Press the Attn key on the keyboard of the system console to return to the diagnostic supervisor main menu.

3. Select the MDI test option from the main menu and run the MDI tests for the disk and the system printer.

4. Run the work station controller MDI tests from the CE panel by using the following procedure:
    a. Set the CE panel switches as follows:
       – Address/Data switches to F100
       – CSIPL to Diskette
       – MSIPL to Diskette
       – Mode Selector switch to Proc Run
       – All other CE panel switches to the down position
    b. Insert DIAGB1 and press the Load switch.
    c. When the system stops, set the Mode Selector switch to Insn Step/Dply LSR and display WR0. The work register display should be hex 0001.
    d. Set the Mode Selector switch to Proc Run, insert DIAGB4 and press CE Start.
    e. The tests should complete in 2 or 3 minutes. If the tests do not come to a normal end, see paragraph 99-062 for instructions.

5. Use the following procedure to run the diskette MDI tests:
    a. Set the CE panel switches as follows:
       – Address/Data switches to F800
       – CSIPL and MSIPL switches to Disk
       – Mode Selector switch to Proc Run
       – All other CE panel switches to the down position
    b. Press the Load switch on the operator panel.
    c. Select the MDI MAPs option from the diagnostic supervisor main menu.
    d. Select the DISKETTE option from the diagnostic supervisor menu to run the diskette MDI tests.

6. Go to paragraph 45-800 if the data communications feature is not installed.

7. Do not run the data communications MDI test at this time. You will be instructed to run these tests after you install any data communication equipment.

45-700   DATA COMMUNICATIONS (FIRST OR SECOND COMMUNICATIONS ADAPTER OR MLCA)

If the system that you are installing does not have any data communications features, go to paragraph 45-800.

If you are installing a system with an integrated modem, you may need either a dB meter (tool, IBM part 453545), or a multimeter (tool, IBM part 1749231) and a dB adapter (tool, IBM part 1749299) for modem adjustments.

1. Turn the system power off at the operator panel.

2. Ensure that the installation data tables are filled out for each line on the system. If you are installing the first or second communications adapter, these tables are Figures 45-14 for line 1 and Figure 45-15 for line 2. If you are installing MLCA, the table is Figure 45-16.

3. Set the switches on the communications adapter cards by using the installation data table. See paragraph 31-200 for the first or second communications adapter or paragraph 30-200 for MLCA.

45

LINE 1 DATA COMMUNICATIONS INSTALLATION DATA TABLE (FIRST COMMUNICATIONS ADAPTER)

Serial Number   _____

Installation Date _____

Installing CE   _____

The following information is needed to install data communications and to answer configuration questions correctly. It is important that you fill out this table because the MAPs contain reference to it. Some of the answers will depend on the communications configuration at the remote location.

To answer **A** and **B**, you will need information from the customer or the marketing representative. If necessary, get in touch with the customer or marketing representative at the central site where the order was made.

Enter a check (√) in the box under your answers to the questions in **A** . In sections **B** through **F** , check only the boxes under the questions to which you answer yes.

A COMMUNICATIONS ADAPTER (A-A2J2)

Set the switches on the data communications adapter card in A-A2J2 as instructed in paragraph 31-200; then reinstall the adapter card.

The device address is hex 80 □ or hex 20 □ .

Does the modem need NRZI?
Yes   No   *Note:* NRZI can be used only in conjunction with SDLC. If the customer runs only BSC,
□   □   select No. All data terminal equipment communicating with each other must select the
             same coding option (NRZI or not NRZI). Get in touch with your IBM marketing repre-
             sentative to identify those modems that have pattern sensitive synchronization problems
             and to determine which coding is to be used.

Does the modem use continuous carrier? (This option applies only to point-to-point nonswitched line.)
Yes   No
□   □

Does the modem use half-rate speed? (Even if the system that you are installing is to use half-rate speed, select full-rate speed during the system configuration.)
Yes   No
□   □

Figure 45-14 (Part 1 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

B NETWORK TYPE

Is the network type DDSA?
Yes No
☐ |
    Is the network type switched?
    Yes No
    ☐ |
        Is the network type point-to-point nonswitched?
        Yes No
        ☐ |
            Is the network type multipoint?
            Yes No
            ☐ |
                Is the network type CADUCEE (France only)?
                Yes No
                ☐ |
                    If you answer this question no, one of your previous answers must be wrong. Go back
                    to **B** and check your answers.

                Go to **G** and ensure that the conditions are met.

            Does the customer have SNBU (switched network backup)?
            Yes No
            ☐ |
                Go to **C**

            Does the SNBU have automatic answer?
            Yes No
            ☐ |
            Go to **C**

        Does the customer have SNBU (switched network backup)? [For 2400 bps integrated modem (see
        order card) or external modem (see customer).]
        Yes No
        ☐ |
            Go to **C**

        Does the SNBU have automatic answer?
        Yes No
        ☐ |

Go to **C**

Figure 45-14 (Part 2 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

■ 45

ⒸHARDWARE INSTALLED

The machine history located in Volume D *(Field Service Logics)* specifies the type of hardware installed.

The modem that is attached to the system that you are installing must be compatible with the modem used at the remote location.

Does the system you are installing have EIA/CCITT (interface to external modem)?
Yes No
☐   │
│   Does the system you are installing have a 1200 bps integrated modem?
│   *Note:* The internal clock feature is automatically installed with a 1200 bps integrated modem.
│   Yes No
│   ☐   │
│   Does the system you are installing have a 2400 bps integrated modem?
│   Yes No
│   ☐   │
│   Does the system you are installing have a Digital Data Service Adapter?
│   Yes No
│   ☐   │
│   If you answer this question no, one of your previous answers must be wrong. Go back to
│   Ⓒ and check your answers.
│
│   Go to Ⓓ
│
│   Go to Ⓔ
│
│   Go to Ⓕ
│
Does the system you are installing have the internal clock feature installed?
Yes No
☐   │
├───┘
The data table is complete.

Figure 45-14 (Part 3 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

D **1200 BPS INTEGRATED MODEM (A-A2H2)**

For more information on the 1200 bps integrated modem, see paragraph 31-310.

D-1 Communications Facilities

Note: The internal clock feature is automatically installed with a 1200 bps integrated modem.

Does the customer have two-wire nonswitched line?
Yes No
□ |
    Does the customer have four-wire nonswitched line?
    Yes No
    □ |
        Does the customer have switched network (USA and Canada)?
        Yes No
        □ |
            Does the customer have public switched network (World Trade)?
            Yes No
            □ |
                If you answer this question no, one of your previous answers must be wrong. Go back to
                D and check your answers.

            Go to **D-3**

Go to **D-2**

D-2 Clear-to-Send Delay and Echo Clamp Delay

When used, clear-to-send delay must be longer than the echo clamp delay. The 0 ms echo clamp delay is automatically selected if the 30 ms clear-to-send delay is selected.
Are 230 ms clear-to-send delay and 150 ms echo clamp delay selected (recommended for switched network and two-wire nonswitched line)?
Yes No
□ |
    Are 30 ms clear-to-send delay and 0 ms echo clamp delay selected (recommended for four-wire nonswitched network)?
    Yes No
    □ |
        Are 80 ms clear-to-send delay and 50 ms echo clamp delay selected? (If used, test to verify that the system works correctly. Be aware that network conditions can change which can possibly cause future problems.)
        Yes No
        □ |
            Are 230 ms clear-to-send delay and 50 ms echo clamp delay selected (not recommended)?
            Yes No
            □ |
               If you answer this question no, one of your previous answers must be wrong.
               Go back to **D-2** and check your answers.

Go to **D-3**

D-3 Transmit Level

Transmit level is specified (for a switched line network) by the common carrier, and should be marked on the line coupler box. Enter the transmit level in the space provided.

_____dB is the setting of the transmit level switches.
|
The data table is complete.

Figure 45-14 (Part 4 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

45

E 2400 BPS INTEGRATED MODEM (B-A1)

For more information on the 2400 bps modem, see paragraphs 31-460 and 31-470.

E-**1** Receiver Sensitivity

Is the receiver sensitivity set to -27 dB (for nonswitched line without SNBU)?
Yes   No
☐ |
      Is the receiver sensitivity set to -40 dB (for switched network or nonswitched line with SNBU)?
      Yes   No
      ☐ |
            If you answer this question no, one of your previous answers must be wrong. Go back to **E**-**1** and check your answers.

Go to **E**-**2**

E-**2** Communications Facilities

Does the customer have two-wire with echo suppressors on a nonswitched line without SNBU?
Yes   No
☐ |
      Does the customer have two-wire nonswitched line?
      Yes   No
      ☐ |
            Does the customer have four-wire nonswitched line?
            Yes   No
            ☐ |
                  Does the customer have switched network (USA and Canada)?
                  Yes   No
                  ☐ |
                        If you answer this question no, one of your previous answers must be wrong. Go back to **E**-**2** and check your answers.

Go to **E**-**3**

Figure 45-14 (Part 5 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

(E)-3 Transmit Level

Transmit level is specified (for a switched line network) by the common carrier, and should be marked on the line coupler box.

For a nonswitched line with SNBU, there are two transmit level attenuation settings. (See paragraphs 31-471 and 31-474 for information on these settings.)

Enter the transmit level, that you set with the jumpers, in the space provided.

Does the customer have nonswitched line? 0 db (USA and Canada) _____ db.

Yes No
☐ |
     | Does the customer have switched network? 0 dB to -15 dB ____ dB.
     | Yes No
     | ☐ |
     | | If you answer this question no, one of your previous answers must be wrong. Go back to **(E)-3** and
     | | check your answers.
     |
     | Enter the auto answer tone____dB. 0 dB to -15 dB (same as switched network transmit level). Go to **(E)-4**

Does the customer have switched network backup (SNBU)? 0 dB to -15 dB____dB.

Yes No
☐ |
     | Go to **(E)-4**
     |
Enter the auto answer tone____dB. 0 dB to -15 dB [same as switched network (SNBU) transmit level]. Go to **(E)-4**

Figure 45-14 (Part 6 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)   ■ 45

(E)-4 Clear-to-Send Delay and Echo Clamp Delay

Is the network type nonswitched?
Yes No
☐ |
     Is the network type switched?
     Yes No
     ☐ |
          If you answer this question no, one of your previous answers must be wrong. Go back to **(E)-4** and check your answers.

     Check the clear-to-send delay and the echo clamp delay that apply to the system that you are installing and go to **(E)-6**

     Clear-to-Send Delay   Echo Clamp Delay
     ☐ 75 ms   ☐ 0 ms
     ☐ 147 ms   ☐ 50 ms
                                  ☐ 100 ms

Check the clear-to-send delay that applies to the system that you are installing. (There is no echo clamp delay on a nonswitched line.)

☐ 8.5 ms
☐ 25.0 ms
☐ 75.0 ms
☐ 147.0 ms

If the customer has SNBU, check the clear-to-send delay and the echo clamp delay that apply to the system that you are installing. Go to **(E)-5**

Clear-to-Send Delay   Echo Clamp Delay
☐ 75 ms   ☐ 0 ms
☐ 147 ms   ☐ 50 ms
                             ☐ 100 ms

(E)-5 Continuous Carrier

Does the modem use continuous carrier?
Yes No
☐ |
     Go to **(E)-6**

Is the continuous carrier unconditional (data terminal equipment does not control request to send)?
Yes No
☐ |
     Is SNBU installed and is the continuous carrier controlled by auto request to send (data terminal equipment controls request to send)?
     Yes No
     ☐ |
          If you answer this question no, one of your previous answers must be wrong. Go back to **(E)-5** and check your answers.

(E)-6 The data table is complete.

Figure 45-14 (Part 7 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

F DIGITAL DATA SERVICE ADAPTER (A-A2H2)

Is the network speed 2400 bps?
Yes No
☐ |
      Is the network speed 4800 bps?
      Yes No
      ☐ |
            Is the network speed 9600 bps?
            Yes No
            ☐ |
                  If you answer this question no, one of your previous answers must be wrong. Go back to **F** and check your answers.

Is the disable remote loop-back function jumper installed? (This jumper must be installed for multipoint operation.)
Yes No
☐ |

The data table is complete.

G CADUCEE (France)

With CADUCEE the following are needed:

- 2400 bps integrated modem

- Receiver sensitivity setting of -27 dB

- Four-wire nonswitched line

- Nonswitched line with a clear-to-send delay of 25 ms

- Transmit level setting of -6 dB

- Unconditional continuous carrier (DTE does not control request to send)

45

Note: Do not connect the signal and frame ground in the coffret on the modem if the signal and frame ground are connected at another point in the system.

Figure 45-14 (Part 8 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)

LINE 2 DATA COMMUNICATIONS INSTALLATION DATA TABLE (SECOND COMMUNICATIONS ADAPTER)

Installation Date   _____

Installing CE   _____

The following information is needed to install data communications and to answer configuration questions correctly. It is important that you fill out this table because the MAPs contain reference to it. Some of the answers will depend on the communications configuration at the remote location.

To answer **A** and **B**, you will need information from the customer or the marketing representative. If necessary, get in touch with the customer or marketing representative at the central site where the order was made.

Enter a check (√) in the box under your answers to the questions in **A** . In sections **B** through **F** , check only the boxes under the questions to which you answer yes.

A COMMUNICATIONS ADAPTER (A-A2K2)

    Set the switches on the data communications adapter card in A-A2K2 as instructed in paragraph 31-200; then reinstall the adapter card.

    The device address is hex 80 ☐ or hex 20 ☐ .

    Does the modem need NRZI?

Yes	No	
☐	☐	*Note:* NRZI can be used only in conjunction with SDLC. If the customer runs only BSC, select No. All data terminal equipment communicating with each other must select the same coding option (NRZI or not NRZI). Get in touch with your IBM marketing representative to identify those modems that have pattern sensitive synchronization problems and to determine which coding is to be used.

    Does the modem use continuous carrier? (This option applies only to point-to-point nonswitched line.)
    Yes   No
    ☐   ☐

    Does the modem use half-rate speed? (Even if the system that you are installing is to use half-rate speed, select full-rate speed during the system configuration.)
    Yes   No
    ☐   ☐

Figure 45-15 (Part 1 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

B **NETWORK TYPE**

Is the network type DDSA?
Yes No
☐ |
     Is the network type switched?
     Yes No
     ☐ |
          Is the network type point-to-point nonswitched?
          Yes No
          ☐ |
               Is the network type multipoint?
               Yes No
               ☐ |
                    Is the network type CADUCEE (France only)?
                    Yes No
                    ☐ |
                         If you answer this question no, one of your previous answers must be wrong. Go back
                         to **B** and check your answers.

                    Go to **G** and ensure that the conditions are met.

               Does the customer have SNBU (switched network backup)?
               Yes No
               ☐ |
                    Go to **C**

               Does the SNBU have automatic answer?
               Yes No
               ☐   ┐
               ├───┘
               Go to **C**

          Does the customer have SNBU (switched network backup)? [For 2400 bps integrated modem (see   █ 45
          order card) or external modem (see customer).]
          Yes No
          ☐ |
               Go to **C**

          Does the SNBU have automatic answer?
          Yes No
          ☐   ┐
          ├───┘

Go to **C**

Figure 45-15 (Part 2 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

C HARDWARE INSTALLED

The machine history located in Volume D *(Field Service Logics)* specifies the type of hardware installed.

The modem that is attached to the system that you are installing must be compatible with the modem used at the remote location.

Does the system you are installing have EIA/CCITT (interface to external modem)?
Yes   No
□ |
      | Does the system you are installing have a 1200 bps integrated modem?
      | *Note:* The internal clock feature is automatically installed with a 1200 bps integrated modem.
      | Yes   No
      | □ |
      | Does the system you are installing have a 2400 bps integrated modem?
      | Yes   No
      | □ |
      | Does the system you are installing have a DDSA?
      | Yes   No
      | □ |
      | If you answer this question no, one of your previous answers must be wrong. Go back to
      | **C** and check your answers.
      |
   Go to **D**
      |
         Go to **E**
               |
            Go to **F**
|
Does the system you are installing have the internal clock feature installed?
Yes   No
□   ⌐┘
├──┘
The data table is complete.

Figure 45-15 (Part 3 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

(D) **1200 BPS INTEGRATED MODEM (A-A2H4)**

For more information on the 1200 bps integrated modem, see paragraph 31-310.

(D)·-1- Communications Facilities

Note: The internal clock feature is automatically installed with a 1200 bps integrated modem.

Does the customer have two-wire nonswitched line?
Yes No
☐ │
  Does the customer have four-wire nonswitched line?
  Yes No
  ☐ │
    Does the customer have switched network (USA and Canada)?
    Yes No
    ☐ │
      Does the customer have public switched network (World Trade)?
      Yes No
      ☐ │
        If you answer this question no, one of your previous answers must be wrong. Go back to
        (D) and check your answers.

      Go to **(D)·3**

Go to **(D)·-2**

(D)·2 Clear-to-Send Delay and Echo Clamp Delay

When used, clear-to-send delay must be longer than the echo clamp delay. The 0 ms echo clamp delay is automatically selected if the 30 ms clear-to-send delay is selected.
Are 230 ms clear-to-send delay and 150 ms echo clamp delay selected (recommended for switched network and two-wire nonswitched line)?
Yes No
☐ │
  Are 30 ms clear-to-send delay and 0 ms echo clamp delay selected (recommended for four-wire nonswitched network)?
  Yes No
  ☐ │
    Are 80 ms clear-to-send delay and 50 ms echo clamp delay selected? (If used, test to verify that the system works correctly. Be aware that network conditions can change which can possibly cause future problems.)
    Yes No
    ☐ │
      Are 230 ms clear-to-send delay and 50 ms echo clamp delay selected (not recommended)?
      Yes No
      ☐ │
        If you answer this question no, one of your previous answers must be wrong.
        Go back to **(D)·2** and check your answers.

Go to **(D)·3**

(D)·3 Transmit Level

Transmit level is specified (for a switched line network) by the common carrier, and should be marked on the line coupler box. Enter the transmit level in the space provided.

_____dB is the setting of the transmit level switches.
│
The data table is complete.

Figure 45-15 (Part 4 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

E **2400 BPS INTEGRATED MODEM (B-A2)**

For more information on the 2400 bps modem, see paragraphs 31-460 and 31-470.

E-1 Receiver Sensitivity

Is the receiver sensitivity set to -27 dB (for nonswitched line without SNBU)?
Yes   No
☐ |
       Is the receiver sensitivity set to -40 db (for switched network or nonswitched line with SNBU)?
       Yes   No
       ☐ |
              If you answer this question no, one of your previous answers must be wrong. Go back to **E-1** and check your answers.

Go to **E-2**

E-2 Communications Facilities

Does the customer have two-wire with echo suppressors on a nonswitched line without SNBU?
Yes   No
☐ |
       Does the customer have two-wire nonswitched line?
       Yes   No
       ☐ |
              Does the cutomer have four-wire leased line?
              Yes   No
              ☐ |
                     Does the customer have switched network (USA and Canada)?
                     Yes   No
                     ☐ |
                        If you answer this question no, one of your previous answers must be wrong. Go back to **E-2** and check your answers.

Go to **E-3**

Figure 45-15 (Part 5 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

E-3 Transmit Level

Transmit level is specified (for a switched line network) by the common carrier, and should be marked on the line coupler box.

For a nonswitched line with SNBU, there are two transmit level attenuation settings. (See paragraphs 31-471 and 31-474 for information on these settings.)

Enter the transmit level, that you set with the jumpers, in the space provided.

Does the customer have nonswitched line? 0 dB (USA and Canada) _____ dB.
Yes No
☐ |
    Does the customer have switched network? 0 dB to -15 dB ____ dB.
    Yes No
    ☐ |
        If you answer this question no, one of your previous answers must be wrong. Go back to **E-3** and check your answers.

    Enter the auto answer tone ____ dB. 0 dB to -15 dB (same as switched network transmit level). Go to **E-4**

Does the customer have switched network backup (SNBU)? 0 dB to -15 dB ____ dB.
Yes No
☐ |
    Go to **E-4**

Enter the auto answer tone ____ dB. 0 dB to -15 dB [same as switched network (SNBU) transmit level]. Go to **E-4**

Figure 45-15 (Part 6 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

45

(E)-4 Clear-to-Send Delay and Echo Clamp Delay

Is the network type nonswitched?

Yes No
□ |
    Is the network type switched?

    Yes No
    □ |
        If you answer this question no, one of your previous answers must be wrong. Go back to **(E)-4** and
        check your answers.

    Check the clear-to-send delay and the echo clamp delay that apply to the system that you are installing and go
    to **(E)-6**

    Clear-to-Send Delay   Echo Clamp Delay
    □ 75 ms   □ 0 ms
    □ 147 ms   □ 50 ms
                            □ 100 ms

Check the clear-to-send delay that applies to the system that you are installing. (There is no echo clamp delay on a

nonswitched line.)

□ 8.5 ms
□ 25.0 ms
□ 75.0 ms
□ 147.0 ms

If the customer has SNBU, check the clear-to-send delay and the echo clamp delay that apply to the system that you
are installing. Go to **(E)-5**

Clear-to-Send Delay   Echo Clamp Delay
□ 75 ms   □ 0 ms
□ 147 ms   □ 50 ms
                          □ 100 ms

(E)-5 Continuous Carrier

Does the modem use continuous carrier?

Yes No
□ |
    Go to **(E)-6**

Is the continuous carrier unconditional (data terminal equipment does not control request to send)?

Yes No
□ |
    Is SNBU installed and is the continuous carrier controlled by auto request to send (data terminal equipment
    controls request to send)?

    Yes No
    □ |
        If you answer this question no, one of your previous answers must be wrong. Go back to **(E)-5** and
        check your answers.

(E)-6 The data table is complete.

Figure 45-15 (Part 7 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

F DIGITAL DATA SERVICE ADAPTER (A-A2H4)

Is the network speed 2400 bps?
Yes No
☐　│
　　　Is the network speed 4800 bps?
　　　Yes No
　　　☐　│
　　　　　Is the network speed 9600 bps?
　　　　　Yes No
　　　　　☐　│
　　　　　　　If you answer this question no, one of your previous answers must be wrong. Go back to **F** and
　　　　　　　check your answers.

Is the disable remote loop-back function jumper installed? (This jumper must be installed for multipoint operation.)
Yes No
☐　│

The data table is complete.

G CADUCEE (France)

With CADUCEE the following are needed:

● 2400 bps integrated modem

● Receiver sensitivity setting of -27 dB

● Four-wire nonswitched line

● Nonswitched line with a clear-to-send delay of 25 ms

● Transmit level setting of -6 dB

■ 45

● Unconditional continuous carrier (DTE does not control request to send)

Note: Do not connect the signal and frame ground in the coffret on the modem if the signal and frame ground are connected at another point in the system.

Figure 45-15 (Part 8 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)

MLCA INSTALLATION DATA TABLE

Serial Number_____

Installation date and installing CE:

	Date	CE
Line 1	_____	_____
Line 2	_____	_____
Line 3	_____	_____
Line 4	_____	_____

The following information is needed to install MLCA communications and to answer configuration questions. This table is also to be used as a guide for CEs to determine which communication features are installed on the system and which options were taken at installation time.

It is important to fill out and maintain this table because the MAPs contain reference to it.

You will need information from the customer or marketing representative to answer some of the questions. You may have to contact the customer or marketing representative at the central site where the order was placed.

To complete the table, you should mark an X in the suitable column to indicate which features and options are installed.

Figure 45-16. (Part 1 of 3). MLCA Installation Data Table

Feature or Option	Line 1	Line 2	Line 3	Line 4
Communications Adapter Options (see 30-200)				
• Device address				
– 10				
– 20				
– 40				
– 80				
• Continuous carrier				
– Used				
– Not used				
• Line speed				
– Medium speed ($\leq$ 9600 bps)				
– High speed ($>$ 9600 bps)				
• Rate select interface line				
– Enable				
– Tie down				
• NRZI encoding				
– Enable				
– Disable				
Network Type				
• Digital data				
• Switched				
• Point-to-point nonswitched				
• Multipoint tributary				
• Multipoint control				
Hardware Installed				
• EIA/CCITT adapter				
• 1200-bps integrated modem				
• Digital data service adapter				
• Analog wideband adapter				
• 4800-bps integrated modem A				
• 4800-bps integrated modem B				
• Autocall adapter				
• Communications line clocking				
– Internal clock card (A-B3U2)				
– Modem clocking				
• Autocall (no clocking required)				

45

Figure 45-16. (Part 2 of 3). MLCA Installation Data Table

Feature or Option	Line 1	Line 2	Line 3	Line 4
Digital Data Service Adapter (see 30-500)				
• Mode of operation				
— Local direct attach				
— Point-to-point				
— Multipoint				
• Line speed				
— 2400 bps				
— 4800 bps				
— 9600 bps				
— 56,000 bps				
1200 BPS Integrated Modem (see 30-300)				
• Communications facility				
— 2-wire nonswitched				
— 4-wire nonswitched				
— Switched (U.S. and Canada)				
— Public switched network (World Trade)				
• Clear to send/echo clamp delay				
— 30 ms/0 ms (4-wire nonswitched)				
— 80 ms/50 ms (must be tested)				
— 230 ms/50 ms (not recommended)				
— 230 ms/150 ms (switched or 2-wire nonswitched)				
• Transmit Level (record db level)				
4800 BPS Integrated Modem (see 30-400)				
• Installed as:				
— Modem A				
— Modem B				
• Communications facility				
— 4-wire nonswitched				
— 2-wire switched				
a. Coupler adapter (Canada only)				
b. Incorporated protective coupler (U.S. only)				
c. World Trade coupler				
• First transmission initialization RFS delay				
— Nonswitched				
a. 24 ms (normal)				
b. 50 ms (long)				
— Switched				
a. 923 ms (long/normal)				
b. 708 ms (short)				
• Speed control, nonswitched point-to-point (see 30-460):				
— Local (speed control)				
— Remote (speed control)				
• Transmit level (record db level)				

Figure 45-16. (Part 3 of 3). MLCA Installation Data Table

45-700

45-710 External Modem EIA/CCITT Connection

If the system that you are installing does not have a medium-speed external modem (≤ 9600 bps), go to paragraph 45-720.

1. Check the EIA/CCITT interface card(s) (see Note 1) to see that no jumpers are installed. (There are jumper locations, but no jumpers are needed.)

2. Reinstall the card(s) that were removed in step 1.

3. Attach the cable(s) to the modem(s). (See Note 2.)

4. Go to paragraph 45-790 if no other communications lines are to be installed.

45-720 Digital Data Service Adapter

If the system that you are installing does not have a DDSA (digital data service adapter), go to paragraph 45-730.

1. Install the jumpers on the DDSA card(s) (see Note 1), as instructed in paragraph 31-500, for the first or second communications adapter or paragraph 30-550 for MLCA.

2. Reinstall the card(s) that were removed in step 1.

3. Attach the cable(s) to the channel service units, or the local attach accessory cable adapter (IBM part number 4236967) available for direct attach.

4. Go to paragraph 45-790 if no other communications lines are to be installed.

Notes:
1. The cards to be removed in paragraphs 45-710, 45-720, and 45-730 are located as follows:

   For first or second communications adapter:
   Line 1   A-A2H2
   Line 2   A-A2H4

   For MLCA:
   Line 1   A-B3L2
   Line 2   A-B3M2
   Line 3   A-B3L4
   Line 4   A-B3M4

2. The customer must have the external communications equipment.

45-730 IBM 1200 BPS Integrated Modem

If the system that you are installing does not have a 1200-bps integrated modem, go to paragraph 45-740.

1. Set the switches on the 1200-bps integrated modem card(s) (see Note 1) as instructed in paragraph 31-310 (first or second communications adapter) or 30-350 (MLCA).

2. Reinstall the card(s) that were removed in step 1.

3. Attach the communications cable from the system to the common-carrier equipment. The customer must do this. See paragraph 31-130 (first or second communications adapter) or paragraph 30-300 (MLCA).

4. If your system is connected to a World Trade public switched network, perform the line plate adjustment. See paragraph 31-320 (first or second communications adapter) or paragraph 30-360 (MLCA).

5. Go to paragraph 45-790 if no other communications lines are to be installed.

45-740 IBM 2400 BPS Integrated Modem

If the system you are installing does not have a 2400-bps integrated modem, go to paragraph 45-750.

1. Perform the 2400-bps integrated modem card(s) and jumper(s) check. See paragraphs 31-460 and 31-470. Also perform the signal quality meter adjustment (see paragraph 31-430).

   Note: The modem card part numbers and locations are on FSL (*Field Service Logics*) page AC390. The modem board feature wiring is on FSL page AC395. You need not change any of the feature wiring on this board because this wiring was installed at the factory for your system.

2. The customer must connect the external communications line cable(s) to the common-carrier equipment. See paragraph 31-120.

3. If the installation will use nonswitched lines, do the following procedure. Because the customer must perform this procedure after the installation is complete, show the customer how to do it now. This procedure needs customer or CE aid at the remote location. For *Point-to-Point:*

a. Set the Test/Operate switch on the local modem to the T3 position and the Test/Operate switch on the remote modem to the T4 position. Set the Receive Equalizer switch on the remote modem so that the signal quality meter of the remote modem indicates the minimum signal level obtainable.

b. Set the Test/Operate switch on the local modem to the T4 position and the Test/Operate switch on the remote modem to the T3 position. Set the Receive Equalizer switch on the local modem so that the signal quality meter of the local modem indicates the minimum signal level obtainable.

c. Leave the equalizer switches on both modems set so that each signal quality meter continues to indicate the minimum signal level obtainable. Return both Test/Operate switches to Operate.

For *Multipoint Tributary or Control Station:*

a. Set the Test/Operate switch on the tributary stations modem to the T3 position and the Test/Operate switch on the control stations modem to T4. Set the Transmit Equalizer switch on the tributary stations modem so that the signal quality meter of the control stations modem indicates the minimum signal level obtainable.

b. Set the Test/Operate switch on the tributary stations modem to the T4 position and the Test/Operate switch on the control stations modem to the T3 position. Set the Receive Equalizer switch on the tributary stations modem so that the signal quality meter of the tributary stations modem indicates the minimum signal level obtainable.

c. Leave the equalizer switches on both modems set so that each signal quality meter continues to indicate the minimum signal level obtainable. Return both Test/Operate switches to Operate.

45-750   IBM 4800 BPS Integrated Modem

If the system that you are installing does not have a 4800-bps integrated modem, go to paragraph 45-760.

1. For multipoint networks, set the modem address switches on the modem operator panel (see paragraph 30-440).

2. For nonswitched networks, the modem is always shipped from the factory with the jumpers installed that make it a multipoint control station. If the modem is not to be used as a control station, add or remove jumpers as needed. See Table 30-2 in paragraph 30-460 for the jumpers needed for Model 1 options.

3. For switched networks, see Table 30-3 for the jumpers needed for Model 2 options.

4. The customer must connect the modem's external communications line cable(s) to the common carrier equipment.

5. Set the transmit level switches on the modem cards (see paragraph 30-450) for switched networks. For the U.S. and Canada, perform the *Coupler Transmit Level Adjustment* (see 30-480). For World Trade, perform the *Line Plate Adjustment* (see 30-470).

6. Go to paragraph 45-790 if no other communications lines are to be installed.

45-760   Analog Wideband Adapter

If the system that you are installing does not have an analog wideband adapter, go to paragraph 45-770.

1. Remove the analog wideband adapter card, and check that the jumpers are installed as instructed in paragraph 30-750.

2. Reinstall the card removed in step 1.

3. Attach the cable to the external modem. (The customer must have the external communications equipment available to connect to the system.)

4. The customer must connect the external modem communications line cable to the common carrier equipment.

5. Go to paragraph 45-790 if no other communications lines are to be installed.

45-770   Autocall Adapter

If the system that you are installing does not have an external autocall unit, go to paragraph 45-790.

1. Check the autocall adapter card to see that no jumpers are installed. (The card has jumper locations, but no jumpers are needed.)

2. Reinstall the card(s) that was removed in step 1.

3. Attach the system autocall cable to the external autocall unit or to the external modem that has an integrated autocall unit.

4. Ensure that the board jumper for digit signal is installed (see 30-850).

5. The customer must connect the external modem cable to the common carrier equipment. Also, the customer must connect the autocall unit to the external modem if they are separate units.

6. Go to paragraph 45-790.

45-790   Communications Testing

1. Turn the system power on at the operator panel.

2. Perform an initial program load operation from diagnostic diskette DIAGB1 with all four Address/Data switches set to 0000. (See paragraph 45-620 if necessary.) If there are any check conditions or control storage IPL wrap errors, verify that the communications configuration (and the communications controller, if MLCA) is correct and check the switch settings on the adapter cards (see note) before going to step 3.

Line configuration and adapter switch settings should match the installation data table (Figure 45-14 and Figure 45-15 for the first and second communications adapters or Figure 45-16 for MLCA).

Communications wrap errors are in the format 80XXYYZZ for the first or second communications adapter. XX is the device address, YY is the failing communications line number, and ZZ is wrap module 01. For the MLCA line, wrap errors use the format 828ZXXYY. Z is the line adapter address from the MLCA controller, XX is the line number (01, 02, 03 or 04), and YY is the number of the failing diagnostic test unit. Check the failing lines first. Adapter cards for each communication line should not be swapped, because the switch settings on the cards are different for each communication line.

If you have communication line wrap errors, go to step 3 and run MDI tests on those failing lines first.

If a processor check condition or an MLCA controller wrap error (1080XXYY) occurs (XX = not defined; YY = failing diagnostic test unit), correct the problem before continuing.

Note: Locations of the adapter cards are:

For first and second communications adapter:
Line 1   A-A2J2
Line 2   A-A2K2

For MLCA:
Line 1   A-B3F2
Line 2   A-B3G2
Line 3   A-B3H2
Line 4   A-B3J2

45

3. Select the MDI TEST option from the main menu. Verify that the MDI tests for each communications line installed run without error.

4. For a 1200-bps switched integrated modem, perform the transmit level limiting check in paragraph 31-340 (first or second communications adapter) or paragraph 30-350 (MLCA).

5. If the IBM System Support Program Product (or a similar program product) is installed and a suitable remote station is available, run the communications online test for each communications line installed. See paragraph 99-074 or 99-075 for a description of the online tests. If MLCA is installed, also run diagnostic program COMMTST for data communications line wrap test and MLCA controller wrap test (see paragraph 99-076).

45-800   COMPLETING THE SYSTEM INSTALLATION

1. Ensure that all CE panel switches are in their normal position for the customer to operate the system. The correct switch settings are:
   - Data switches set to 0000.
   - CSIPL and MSIPL switches set to Disk.
   - Mode Selector switch set to Proc Run.
   - All other switches down.

2. If the IBM SSP is not installed, the system cannot perform an MSIPL from disk nor can SYSTST or ERAP procedures be executed. If you are installing the IBM SSP (system support program product), it should be done at this time. See the *IBM System/34 Installation and Modification Reference Manual: Program Products and Physical Setup*, SC21-7689.

   Note: The customer will receive a bill if you perform this service.

3. Fill out any system installation logs used at the site.

4. If communications features are installed and a remote station is available, it is important that you run the communications online test for each communications line installed if the tests have not been run already. To run the online test, see paragraph 99-074 or 99-075.

5. Complete the *Installation Activity Document*.

6. Inform the customer that the system is available for use.

7. Inform the branch office that the installation is complete.

CONTENTS

80

80-100   GENERAL INFORMATION

The error information section of this manual describes how to decode sense bytes and other information that is recorded when an error occurs. For information on how to run ERAP, see paragraph 99-068.

Because each section, 81-000 through 89-000, is assigned to a different device, each section is given a different section number. The number and name of the sections are as follows:

Section	Name
81-000	Main Storage Processor
82-000	Control Processor
83-000	Disk
84-000	Diskette
85-000	Line Printers
86-000	Work Station Controller
87-000	Display Stations
88-000	5256 Serial Printer
89-000	Data Communications

Note: ERAP information for the 1255 Magnetic Character Reader can be found in the *IBM System/34 1255 Attachment Feature Theory/Maintenance,* SY31-0521.

80-111   ERROR RECORDING ANALYSIS PROCEDURE (ERAP)

The primary function of ERAP (error recording analysis procedure) is to display on the display station or on the printer (either line printer or serial printer) the error data that has been recorded for each device on the system.

The data is divided into three classes; I/O counter table, error counter table, and error history table.

I/O Counter Tables: I/O counter tables are used to collect statistics by function and device. These statistics show the number of actions by that device. For example, the number of verifies, writes, read or scan reads, and non-zero seeks for disk drive A.

Note: The I/O counter tables are updated once in each 6 minutes of SSP operation. No error recording is done if errors occur while diagnostic supervisors are running.

Error Counter Tables: An error counter table includes a series of counters with each counter assigned to collect a specific type of error on a device.

Error History Table: An error history table includes a series of fixed length entries with each entry representing an error on that device. The entries are made in the table so that the latest error is first in the table.

The secondary function of error recording analysis procedure is to supply the ability to reset I/O counter and error counter tables. (I/O and error counter tables are reset to zeros when the disk initialize program is run.) The error history table does not reset. When the table is full and another error occurs, the oldest error is removed from the table to make room for the new error.

80-200　ELECTROSTATIC DISCHARGE (ESD) PROBLEMS

Under some local conditions, such as high temperature and low humidity, a machine may receive an ESD (electrostatic discharge) from personnel or from office equipment making contact with the machine covers. Various levels of discharge intensity may cause intermittent system failures that might be displayed in one of the following ways:

- The ERAP may contain several temporary disk errors such as: sector checks, sector sync checks, PLO (phase lock oscillator) checks, CRC (cyclic redundancy checks), off track checks, and disk seek errors.

- Intermittent processor checks may occur that are not associated with specific programs. There will possibly be some hardware checks but normally a software check will be displayed as hexadecimal 1111 in the 08 register of the LSR (local storage register). The checks usually will be hexadecimal 0CXX or hexadecimal 1DXX in the 02 register of the LSR.

- There may be messages to the operator that there is not valid data on the disk. This must be cleared by running the BUILD procedure (see *SSP Procedures* chapter in the *IBM System/34 System Support Reference Manual*, SC21-5155).

If the conditions of the environment are severe and the ESD level is high, even a correctly assembled and adjusted machine may have failures. If the adjustments are correct, possibly the only way to decrease the effect on machine performance is to decrease or remove the source of the static (use antistatic solutions on floor coverings; keep office equipment from rubbing or hitting the system covers, etc).

The following check and adjustment procedures identifies methods of correcting those areas of the machine that are affected by an electrostatic discharge.

80-210　Power Distribution for ESD

Check all of the screws in the power compartment for tightness. If any screw hole is damaged, the suitable changes must be made to correct the damage (swap parts, use nut inserts, or larger size screws). The following screws are of specific importance:
- The screws in the AC and DC terminal blocks and ground plates (see *Section 05* and the *Parts Catalog*).
- *The mounting screws that mount the line filter box (see reference drawing in paragraph 05-220).*

DANGER
Disconnect the line cord before checking the screws holding the line cord.

_____
_____
_____

- The screws holding the line cord wires to the line filters and the filter assembly (see reference drawing in paragraph 05-220).

Ensure that the system frame is correctly grounded to a service ground. This must not be conduit ground at the outlet. Ensure that the AC input voltage is inside the tolerance given. See *IBM System/34 Installation Manual — Physical Planning*, GA21-9242 for correct grounding and voltage information.

Keep power cables in the power supply assemblies and those distributing power to the gates away from covers or external frame parts.

Note: The cables between A-A1 and A-A2 must not touch the disk frame.

Cables to a thermal must follow a path separate from other cables where possible.

80

80-220   Covers and Frame for ESD

Check all of the mechanical mounting screws in the system for tightness. If any screw holes are damaged, use a larger size screw or a nut insert.

Tighten the screws that fasten the internal shields in place behind the customer access cover. The shields cover the diskette area, the power supply assemblies, and the cable tower connection area. See *Mechanical Assembly* in the *Parts Catalog*.

Tighten the screws that hold the ground straps. Place the large washer between the screw head and the strap to force the largest surface area of the ground strap against the frame, cover, or unit. Ground straps are located in the following places:
- From the A and B-gates to the frame at each hinge point.
- From each of the external covers to the frame.
- From each disk assembly casting to the frame.
- From each external I/O device cable to the I/O tower (see paragraph 45-450).

Ensure that the gate latches on the A-gate are adjusted to prevent contact of the latch plates with the end cover.

Check the base of the A-gate assembly to ensure that no metal is rubbing against the frame. If rubbing does occur, adjust the gate assembly away from the frame.

Ensure that the A-gate hinge guards are in the inward position to prevent them from touching the cover. See *A-Gate Assembly* in the *Parts Catalog*.

Adjust the cover latches to hold the covers as close to the frame as possible. See *Covers, Mounting Hardware, and Frame Assembly* in the *Parts Catalog*.

The covers must be adjusted correctly for good pressure contact of the horizontal finger stock **C** and contact of the cover flange **B** to the base at as many points along the flange as possible. See Figure 80-1.

Adjust the vertical finger stock channels **D** on each cover to match with the knife edges **A** that are installed on the frame. Ensure that the back of the vertical finger stock channels makes good surface contact to the cover. See Figure 80-1.

80-230   I/O Devices and Cables for ESD

Ensure that the internal cables are in correct position in the channels and kept away from external covers and the frame parts.

Ensure that the cables between the A-A1 and A-A2 boards do not touch the cover or the vertical post at the hinge point.

You may have to reseat the cards to give better contact points. High resistance contacts can cause electrical noise.

Work Stations

Ensure that the shield on the internal work station cable is correctly grounded at each port position and at the end of the cable that goes into the A-A2 board.

Ensure that the twinaxial cables that connect the system I/O tower to the work stations are tight and in correct position (not made into a coil or hung on a wall, etc).

Ensure that the work stations are correctly grounded to a service ground.

Printers

Ensure that the cables in the line printer are correctly seated for correct system performance when the printer is printing. The extra length of the cable should not be made into a coil and placed inside the printer covers.

Ensure that the line printer is correctly grounded to a service ground.

Ensure that the internal printer cables are against the frame wall (as far across the machine as possible) before they drop down to the I/O cable tower.

Diskette

Correct diskette head alignment is important to the diskette performance.

Keep diskettes in their plastic envelopes except when in use.
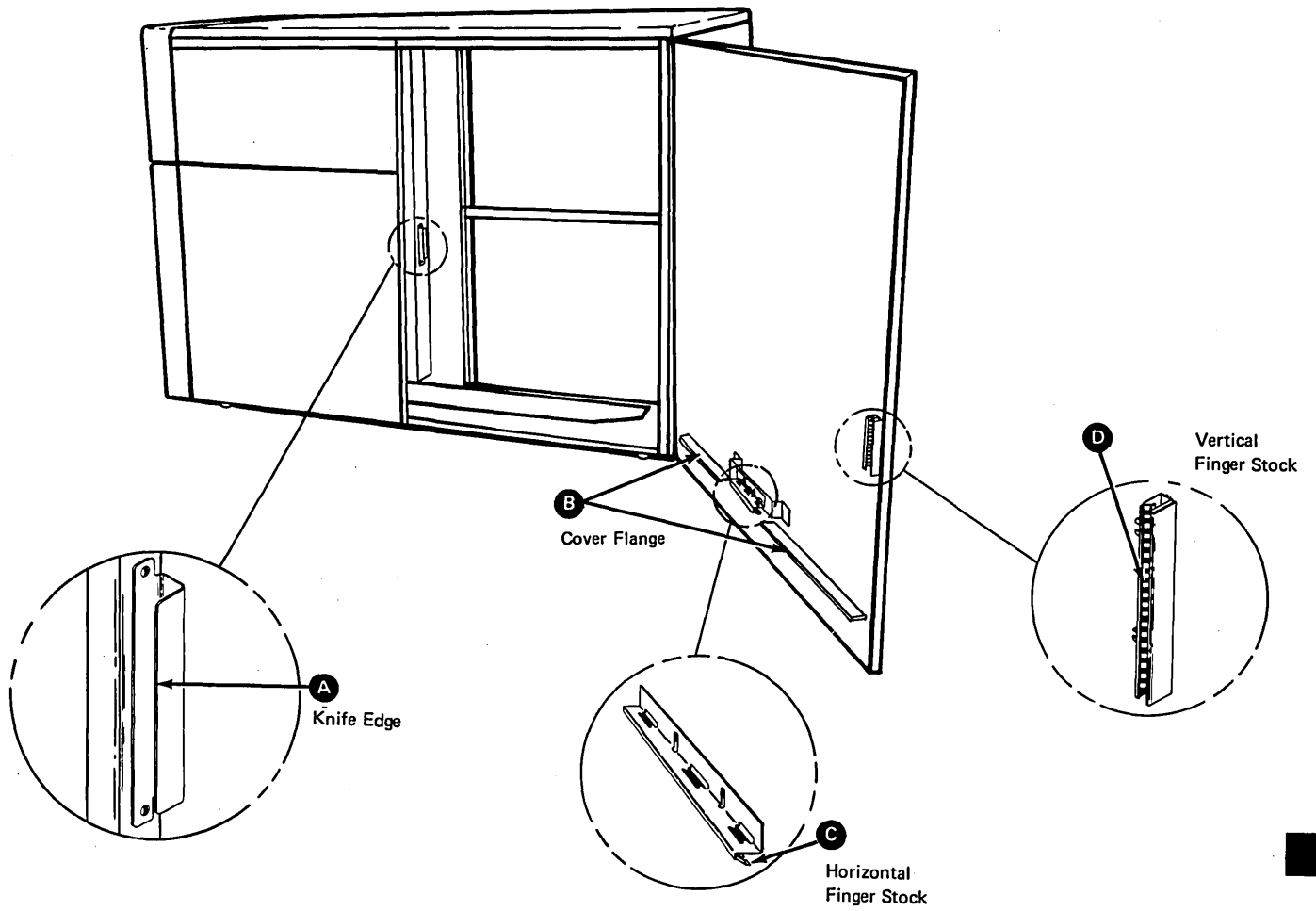
Figure 80-1. Covers and Frames

Knife Edge

Cover Flange

Horizontal
Finger Stock

Vertical
Finger Stock

80

Communications

Ensure that external modems are connected to correctly grounded outlets.

62PC Disk

There are no special ESD needs for the 62PC disk drive.

62EH Disk

The position of disk cables Ⓐ on the gate should be as shown in Figure 80-2. Feature cables should not be placed across disk cables. Each disk cable should not touch any other cable.

Check that the .01 μf capacitors on the A-A2 and A-A3 board from frame ground to card/pin A4B05 (+24 V) and card/pin A5B13 (-24 V).

Ensure that the seek rate of the disk is correctly adjusted. (See paragraph 09-140 for adjustment procedure.)

Ensure that the shield on the servo cable (A2A4 or A3A4 to D-W1B1) is tied to ground at both ends of the cable (see paragraph 09-120).

Check the disk shock mounts for high resistance to ground with the ground strap removed from the frame. (See paragraphs 09-100 and 09-110.)

Ensure that the disk spindle lock/antistatic arm is correctly centered on the disk spindle. (See paragraph 09-070.)

The disk motor antistatic brush must make correct contact and have correct tension. (See paragraph 09-060.)

Ensure that the black ground wire coming from the DC distribution point (see paragraph 05-360) is screwed tight at the disk and the connectors at the A-A2 and A-A3 board are correctly fastened to a D08 pin.
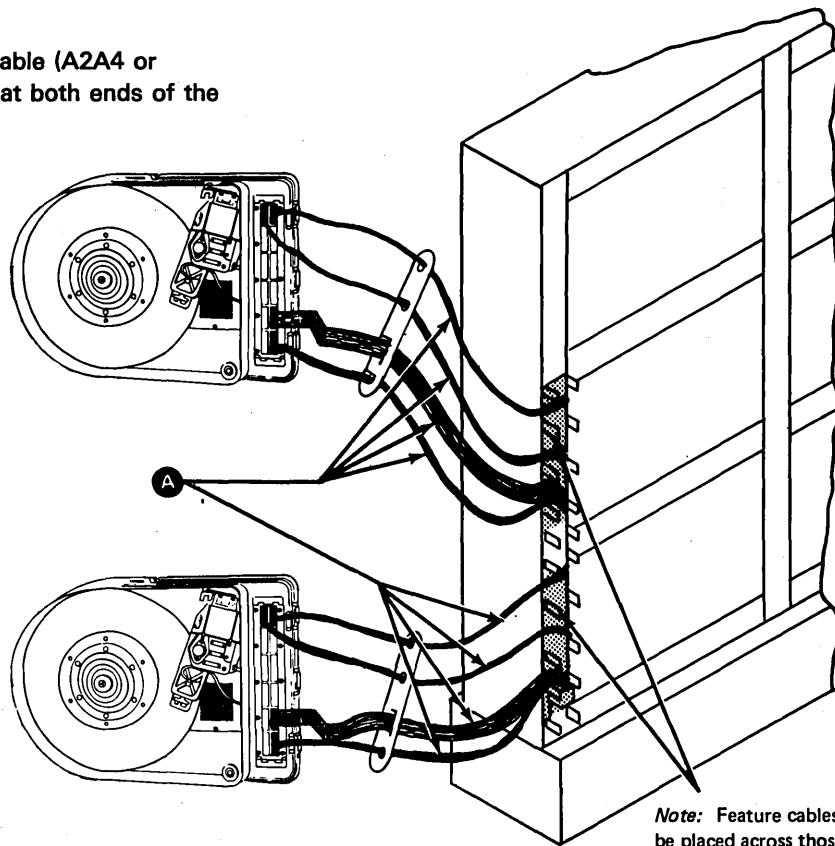
Note: Feature cables must not be placed across those for the disk in the shaded area shown. (The Channel feature cable is to pass under those of the disk.)

Figure 80-2. I/O Devices and Cables

CONTENTS

81

81-010   HOW TO USE MAIN STORAGE PROCESSOR ERROR INFORMATION

Main storage processor error information is used to determine the cause of failures of the main storage processor. These failures may be either intermittent failures or failures that the MAPs do not find.

Run the error recording analysis procedure for the main storage processor, and look at the error information that was recorded. If status byte 2 contains a repeating pattern of hexadecimal values, suspect an intermittent failure. Go to MAP 8101 to determine the failing FRU (field replaceable unit).

If there is not a repeating pattern in status byte 2 of the error history information, go to paragraph 81-200 for a general description of what the recorded information means and where to look for more detail.

81-200   MAIN STORAGE PROCESSOR ERROR HISTORY INFORMATION

An example of the main storage processor error history information that is recorded is shown in the following sample printout.

```
ERROR HISTORY TABLE FOR MAIN STORAGE PROCESSOR
                                ATRS          PROG    STATUS    FAIL.
IAR  ARR  XR1  XR2  OP1  OP2  IR 01 02 OP Q  MR SR   0  2  3   ADDR.   DATE    TIME
•••••••••••••••••••••••••••••• HEX •••••••••••••••••••••••••••••••• YYMMDD HHMMSS
096E 0952 1E58 BD00 BD01 BD00 01 17 17 AF 01  00 01  2B 61 00  00BD01 770413 000009
096E 0952 1E58 BD00 BD02 BD01 01 17 17 AF 02  00 01  2B 61 00  00BD02 770413 000009
096E 0952 1E58 BD00 BD01 BD00 01 17 17 AF 01  00 01  2B 61 00  00BD01 770413 000009
096E 0952 1E28 BD00 BD02 BD01 01 17 17 AF 02  00 01  2B 61 00  00BD02 770413 000303
```



```
                                                                      81-430
                                              81-400   81-420           |
                                        81-380 81-410                   |       Main Storage Failing Address
                                        81-390   |              Status Byte Information
                              81-370     |            Program Status Information
                     81-360    |          Operation Code/Q Code
            81-350    |          Address Translation Register Valves
      81-340  |          Operand 2 Address Register Contents
  81-330   |          Operand 1 Address Register Contents
81-320   |          Index Register 2 Contents
81-310   |          Index Register 1 Contents
  |          Address Recall Register Contents
Instruction Address Register Contents
```

81-300 MAIN STORAGE PROCESSOR SENSE BYTES–GENERAL INFORMATION

The information recorded is that which was present when the error occurred. The amount of information recorded relies on the programs that were running in the system at that time. If the main storage error recovery routine senses a parity check in any of the registers (IAR, ARR, XR1, XR2, Op1, or Op2), the routine fills the register with 7777 to indicate that the register contents are not known.

81-310 INSTRUCTION ADDRESS REGISTER (IAR)

The instruction address register value (also an address translation register if address translation is used) determines where in main storage the next byte of the system instruction is located.

81-320 ADDRESS RECALL REGISTER (ARR)

The ARR (address recall register) contains a main storage address which is used as a pointer. The ARR points to the byte *after* the last Branch instruction that completed a correct branch. Decimal operations (ZAZ, AZ, and SZ) and the ITC (Insert and Test Character) also change the contents of the ARR.

81-330 INDEX REGISTER 1 (XR1)

The XR1 (index register 1) contents are used if the operand addresses are to be determined by indexing using index register 1. The value of the operand address is calculated by adding 1 byte in the instruction being fetched to the index register value.

81-340 INDEX REGISTER 2 (XR2)

The XR2 (index register 2) contents are used if the operand addresses are to be determined by indexing using index register 2. The value of the operand address is calculated by adding 1 byte in the instruction being fetched to the index register value.

81-350 OPERAND 1 (OP1)

The Op1 (operand 1) value (also an address translation register value if address translation is used) determines where in main storage the next byte of operand 1 is located.

81-360 OPERAND 2 (OP2)

The Op2 (operand 2) value (also an address translation register value if address translation is used) determines where in main storage the next byte of operand 2 is located.

81-370 ADDRESS TRANSLATION REGISTERS (ATRs)

If address translation is being used when the error occurred, the log out includes the ATRs (address translation registers) which are necessary to determine the real location in main storage that was being addressed at the time of the error.

81-371 Instruction Translation Register

If address translation is being used during I-FETCH, the instruction translation register (ATRs IR) value is the value of the address translation register that is used with the instruction address register to determine the real location in main storage that was addressed while fetching the instruction.

81-372 Operand 1 Translation Register

If address translation is being used during operand 1 fetch cycles (EB time), ATR 01 register value is the value of the address translation register that is used with the operand 1 address register (Op1) value to determine the real location in main storage that was addressed for operand 1.

81

81-373   Operand 2 Translation Register

If address translation is being used during operand 2
fetch cycles (EA time), the ATR 02 register contains the
value of the address translation register that is used
with the operand 2 address register (Op2) value to
determine the real location in main storage that was
addressed for operand 2.

81-380   OPERATION CODE

This field in the printout contains the operation code of
the instruction that was being executed when the error
occurred that caused the log out.

81-390   Q CODE

This field in the printout contains the Q code of the
instruction that was being executed when the error
occurred that caused the log out.

81-400   PROGRAM MODE REGISTER (PMR)

This register contains information that is used to
determine if address translation was being used when
the error occurred that caused the log out.

Program Mode Register

  Bit 0–off = enable, on = disable task switching
  Bits 1, 2, 3–not used
  Bit 4–translated main storage processor addressing
        during instruction fetch (I) cycles
  Bit 5–translated main storage processor addressing
        during operand 2 fetch (EA) cycles
  Bit 6–translated main storage processor addressing
        during operand 1 fetch (EB) cycles
  Bit 7–privileged mode

81-410   PROGRAM STATUS REGISTER (PSR)

The PSR (program status register) contains information
about the status of the last operation (of the type that
affects the PSR) performed in the main storage
processor.

Program Status Register

  Bits 0, 1–not used
  Bit 2–binary overflow
  Bit 3–test false
  Bit 4–decimal overflow
  Bit 5–high
  Bit 6–low
  Bit 7–equal

81-420   STATUS BYTES

The status bytes contain information about the current state of the system when the error occurred that caused the log out. (See paragraphs 81-421, 81-422, and 81-423.)

81-421   Status Byte 0

Status byte 0 contains information about where in the instruction fetch or execution cycles the main storage processor was when the error occurred.

Status byte 0

    Bit 0–not used
    Bit 1–complement latch set
    Bits 2, 3, 4, 5–encoded next major cycle times
            0000 = Op time
            0001 = Q time
            0010 = IH1/IX1 time
            0011 = IL1 time
            0100 = IH2/IX2 time
            0101 = IL2 time
            1000 = EA time
            1010 = EB time
            1100 = EC time
    Bits 6, 7–encoded last minor times
            11 = MA
            10 = MB
            01 = MD
            00 = MC
Note: Status byte 1 register cannot be sensed.

81-422   Status Byte 2

Status byte 2 contains information about main storage processor checks, and other states of the main storage processor when the error occurred.

Status byte 2

    Bit 0–instruction cannot be executed
    Bit 1–control gate check
    Bit 2–local storage register gate check
    Bit 3–main storage gate check
    Bit 4–first cycle
    Bit 5–recomplement cycle
    Bit 6–main storage processor address checks
    Bit 7–carry trigger

81-423   Status Byte 3

Status byte 3 contains information about main storage checks caused by the main storage processor when the error occurred.

Status byte 3

    Bits 0 through 5 are not used
    Bits 6   7
          0   1   Storage exception check
          1   0   Main storage address check
          1   1   MSAR parity check

81-430   FAILING ADDRESS

The failing address field indicates the real main storage location that was being addressed when the error occurred. When the failing address cannot be determined or when main storage is not being addressed, the failing address field is X'0000'.

Use the chart in MAP 8101 as a cross-reference between the failing address and the probable failing FRU.

81

CONTENTS

82

82-100   HOW TO USE CONTROL PROCESSOR
            ERROR INFORMATION

Control processor error information is used to determine
the cause of failures of the control processor. These
failures may be intermittent failures or solid failures that
the MAPs do not find.

Run the error recording analysis procedure for the
control processor and look at the error information that
has been recorded. If a specific control processor check
byte or port check byte has been recorded frequently in
the latest entries of the table, suspect an intermittent
failure. Go to MAP 8201 to determine the failing field
replaceable unit.

If there is not a frequent pattern associated with the
error history information, go to paragraph 82-200 for a
general description of what the recorded information
means. If more detail is desired, a section number is
given.

82-200   CONTROL PROCESSOR ERROR HISTORY
            INFORMATION

An example of the control processor error history
information that is recorded is shown in the following
sample printout.

```
ERROR HISTORY TABLE FOR CONTROL STORAGE PROCESSOR
        BYT  BYT
PCR IL  0    1    WR0   WR1   WR2   WR3   WR4   WR5   WR6   WR7   MAR   MAB    DATE    TIME
...............................  HEX  ...............................  YYMMDD  HHMMSS
A2  07  3C   00   0800  3CA2  113F  0000  0000  0000  0000  0000  21A5  21AE  770413  111111
A2  07  18   00   0800  18A2  1143  0000  0000  0000  0000  4000  21AF  21A8  770413  111111
22  07  28   00   F3C0  2822  FFFE  0028  21B4  0300  0219  C000  F3B6  21B4  770413  111111
92  07  30   00   0800  3092  1142  0000  0000  0000  0000  2000  21AB  0000  770413  111111
A2  07  3C   00   0800  3CA2  1143  0000  0000  0000  0000  0000  21A2  21AE  770413  094500
9C  04  2C   00   1143  0000  18B8  92F1  C3F1  C3F1  C3F1  C3F1  00E1  00E4  770413  111111
92  07  3C   00   0800  3C92  1141  0000  0000  0000  0000  1000  21A9  21A8  770413  111111
A2  07  10   00   0000  10A2  1143  0000  0000  0000  0000  3000  21CE  21AC  770413  093000
A2  07  20   00   0000  20A2  1141  0000  0000  0000  0000  0000  21CE  21A8  770413  111111
A2  02  A0   A2   00C0  1140  1000  92F1  A191  040A  C3F1  C3F1  0149  0146  770610  102900
```

82-340
82-330
82-320   Port Check Information.
82-310   Processor Check Display Information
              Interrupt Level Encoded
Processor Condition Register   82-350

82-370
82-360
Micro Instruction Address
Back-up Register

Micro Instruction Address Register

Contents of the Work Registers 0,1,2,3,4,5,6, and 7
of present Interrupt Level

82-300 CONTROL PROCESSOR SENSE BYTES–GENERAL INFORMATION

The information recorded is that which was present when the error occurred. The amount of information recorded relies on the programs that were running in the system at that time.

82-310 PROCESSOR CONDITION REGISTER (PCR)

The PCR (processor condition register) contains information about the status of the last operation (of the type that affect the PCR) performed in the control processor.

Processor Condition Register

Bit	Condition
0	Flag
1	Positive
2	Negative
3	Zero
4	Carry
5	High
6	Low
7	Equal

82-320 ILBB (INTERRUPT LEVEL BACKUP BYTE)

The interrupt level backup byte indicates on which hardware interrupt level the control processor was executing when the error occurred that caused the log out.

Interrupt Level Backup Byte	Hardware Interrupt Level
00	5
01	4 or work station controller cycle steal (note 1)
02	Work station controller cycle steal or disk cycle steal (note 2)
03	3
04	2
05	1 or disk cycle steal (note 1)
07	Main level

Notes:
1. See the cycle steal bit in the port check byte to determine if the interrupt was caused by a cycle steal check.
2. Work station controller registers (level 4) are logged.

82

82-330 CONTROL PROCESSOR CHECK BYTE (BYTE 0)

The control processor check byte contains information about the control processor checks that were present when the error occurred that caused the log out.

Control Processor Check Byte

Bit	Condition	
0	Storage data register parity check	
1	Micro-operation register parity check	
2	Storage gate parity check	
3	Arithmetic and logic unit gate parity check	
4, 5	Value	Meaning
	01	Time-out
	10	Not valid control storage address
	11	Control storage address register parity check
6, 7	Value	Meaning
	01	Storage exception
	10	Not valid main storage address
	11	Main storage address register parity check

If the microinstruction address register (paragraph 82-360) contains X'1111', a software-generated processor check occurred. See the description of work register 2 in paragraph 82-350. Also see paragraph 82-340 as an aid in determining any failures that occurred while data was being moved on the channel.

82-340 PORT CHECK BYTE (BYTE 1)

The port check byte contains information about any port checks that were present when the error occurred that caused the log out.

Port Check Byte

Bit	Condition
0	Data bus out parity check
1	Device address not valid
2	Data bus in parity check
3	Input/output time-out check
4	Command bus in or data bus in not zero
5	System bus parity check
6	Cycle steal check
7	Port address not valid

If the microinstruction address register (paragraph 82-360) contains X'1111', a software-generated processor check occurred. See the description of work register 2 in paragraph 82-350.

If bit 6 (cycle steal check) condition is on, also check the other bits to aid in determining the direction data was moved when the failure occurred.

82-350 WORK REGISTERS 0 THROUGH 7

These values represent the contents of work registers 0 through 7 (except WR1) when the error occurred. Since register 1 of the main program level (ILBB = hexadecimal 07) is used during the error log procedure, it no longer contains the same contents as when the error originally occurred.

If the microinstruction address register contains X'1111', a software-generated processor check occurred. Work register 2 contains the information that will aid you in determining what caused the error.

Work Register 2

Work register 2 (high) contains the error message identification code (MIC) in hexadecimal that caused the system to stop, and work register 2 (low) contains the error MIC (in hexadecimal) of any previous error that may have been sensed by the system.

In most cases, the high and low bytes of work register 2 are equal, or the low byte contains X'00'. If the high and low bytes are not equal or if the low byte does not contain X'00', a not normal end condition was sensed and before the error routine was completed, another software-generated processor check was sensed. Also, if the high and low bytes are not equal, look up each error message identification code. The following table gives the message identification codes in hex, the name of the message issuing module, and the error messages for work register 2:

Hex	Dec	Message Issuing Module	Error Message
01	0001	$NULC, $IPW	Module ID not found in control storage library
02	0002	$NULX	Attempt to relocate a module that has no RLDs
03	0003	$NULC	Control storage module link, load address unequal
05	0005	$NU1	Quiesce counter has negative value
06	0006	$NU1	Privileged operation issued in nonprivileged mode
07	0007	$NU1	Control storage register stack area overflow
08	0008	$NUBL/$NUSL	Address translation error logging communication line data
09	0009	$NULX	Address translation error relocating main storage module
0A	0010	$NU2/$NU2A	Invalid disk IOB parameters
0B	0011	$ALT3	Permanent disk read error
0C	0012	$FD1	Disk interrupt timeout check
0E	0014	$CPO	Invalid main storage address or nonprivileged program issued LPMR
0F	0015	$NU1	Invalid main storage operation code
10	0016	$NUAB	Storage dump has been requested . . .
11	0017	$NU1	Address translation error—storage not assigned
14	0020	$NU1	Invalid timer queue element
15	0021	$NUTIX	Address translation error on $TRB parameter list
16	0022	$NUTIX	Invalid system date flag found in system communication area
17	0023	$NUTIX	Nonprivileged program issued timer load request
18	0024	$NUTIX	Invalid type specified with timer request
19	0025	$NUTIX	Nonprivileged program issued multiple wait timer request
1A	0026	$NUTIX	Invalid type specified with timer request
1B	0027	$NUTIX	Negative time value specified with timer request
1C	0028	$NUTIX	Invalid INLINE parameter specified with timer request
1D	0029	$NU2/$NU2A	Disk error—second disk error before first handled

82

Hex	Dec	Message Issuing Module	Error Message
1E	0030	$NU2/$NU2A	Address translation error on disk IOB address
1F	0031	$IPL, $IPS	Permanent diskette error during IPL from diskette
20	0032	$NULC	Address translation error moving main storage program
21	0033	$ALT1/$ALT1A	Disk error—unrecoverable disk operation
22	0034	$ALT1/$ALT1A/ $ALT2A	Disk error—unrecoverable hardware error
23	0035	$ALT1/$ALT1A	Disk error—unrecoverable or invalid sector
24	0036	$ALT2/$ALT2A	Disk error—no alternative sectors available
25	0037	$ALT1, $ALT2/$ALT1A/ $ALT2A/$ALT4A	Disk error—defective disk
26	0038	$ALT3	Disk error—data accessed may be invalid
27	0039	$IOIOCH	Address translation error on diskette IOB address
28	0040	$IOIOCH	Invalid diskette data buffer address
29	0041	$CP0	Dump storage requested by Reset/CE Start
2A	0042	$NUAB2	Error TCB is the command processor TCB
2B	0043	$NUAB2	Error TCB is not on the TCB chain
2C	0044	$NUMSER2	Program size larger than main storage user area
2D	0045	$NUAB2	Error TCB is already in abnormal termination
2E	0046	$ALT3	Disk error—read error during system I/O function
2F	0047	$NUMSER/ $NUMSER2	Main storage 2K-segment error
30	0048	$HC2	Unrecoverable main storage processor error
31	0049	$NUAB2	Disk error—main storage dump not completed
32	0050	$NULC/$MRALD	Disk error—loading control storage module
33	0051	$ALT1/$ALT1A	Invalid disk data buffer address
34	0052	$NU1	Invalid assign SVC or free SVC parameters
35	0053	$NU2/$NU2A	Disk error—loading control storage transient
36	0054	$NU1	Invalid sector address calculated on TWA request
37	0055	$NU2/$NU2A	Nonprivileged program accessing privileged transient
38	0056	$NU1	Dump storage requested by address compare service aid

Hex	Dec	Message Issuing Module	Error Message
39	0057	$WS1	End of TUB chain found by work station IOCH
3A	0058	$WS1	Invalid I/O device address in a work station IOB
3B	0059	$NUWE	Permanent local work station controller error
3C	0060	$NU1	Permanent assign failure
3D	0061	$NU3	Invalid transfer instruction
3E	0062	$MRF	Invalid MICR reader/sorter IOB parameter
3F	0063	$MRF	ATR load error on MICR reader/sorter IOB address
40	0064	$MRF	ATR load error on MICR reader/sorter IOB data buffer address
41	0065	$NURL	ATR load error while logging MICR reader/sorter data
42	0066	$MRF	MICR reader/sorter error recovery block not found
43	0067	$NUWL	Address translation error—logging remote work station data
44	0068	$NU1	Address translation error—executing MOVEI SVC
45	0069	NUER	Invalid ID used on MOVEI SVC
46	0070	$IOIOCH $16IOCH	Invalid diskette sector address
47	0071	$NU3	Machine check during scientific execution
48	0072	$FD2	Invalid disk interrupt
49	0073	$FD2	Disk error—interface parity check
4A	0074	$FD2	Disk error—unrecoverable adapter check
4B	0075	$ALT3	Disk error, but no disk error recovery block found
EA	0234	#DDXL	Unexpected return code while extending a file
EB	0235	#CTEIF	Program check in termination exit routine
EC	0236	#CTECM	No main storage for this task
ED	0237	#SVERP	All console SYSLOG sectors in use—have more messages
EE	0238	#SVWSR	I/O error at system console during MSIPL

82

Hex	Dec	Message Issuing Module	Error Message
F0	0240	#CLSG	Program tried to cancel a noncancelable task
F1	0241	$MARCK	Disk error compressing the system library
F2	0242	#CTEPR	Deallocate or termination found printer specification block with no TUB
F3	0243	#CTEIF	Command processor task or user task has no JCB
F4	0244	#CLSG, #CLST, #CLSW, #CLSP	MICS 3700, 3712, or 3713 not found in ##MSG2 member
F5	0245	#CLSG	MICS 3710 or 3711 not found in ##MSG2 message member
F6	0246	#CLXS	SYSLOG function called before MSIPL completed
F7	0247	#MARXF	SSP module has invalid where-to-go or format index table
F9	0249	#MSNIP	Required SSP module not found during MSIPL
FA	0250	#CTEPR	Format 5 extents partially free during file delete
FB	0251	#CTEPR	Format 5 file count is less than zero
FC	0252	#CTEPR	An AFA format 1 has an invalid file type
FD	0253	#CTEPR	Unexpected return code from diskette VTOC read/write
FE	0254	#CTEPR	Unexpected return code from disk VTOC read/write
FF	0255	#CTEIF	Invalid recursive call to termination

82-360 MICROINSTRUCTION ADDRESS REGISTER (MAR)

The value in the MAR represents the address + 1 of the microinstruction that was being executed when the error occurred that caused the log out.

82-370 MICROINSTRUCTION ADDRESS BACKUP REGISTER (MAB)

This is the address that the MAB contained at the time of the error. The address is that of the next microinstruction *after* the last branch and link microinstruction was executed.

Note: The date and time entries are not logged when the error occurs; however, they are logged when the load operation is performed after the error.

CONTENTS

83

83-010 HOW TO USE DISK ERROR INFORMATION

There are no error log MAPs for the 62EH disk. However, MAP 8301 is the error log MAP for the 62PC disk. Use the following error log descriptions to isolate disk failures.

Four sets of disk MAPs (two for 62EH and two for 62PC) have been supplied to aid in diagnosing solid and intermittent hardware failures. MAP 0101 (system entry) is the entry point for solid failures; MAP 0967 (62EH) and MAP 1058 (62PC) are the entry points for intermittent failures. MAP 0901 (62EH) and MAP 1001 (62PC) are device exercisers that test all parts of the disk. These tests are performed only once and may not be effective for diagnosing intermittent failures.

MAP 0967 (62EH) and MAP 1058 (62PC) give a set of exercisers that are repeated until a failure occurs. The status from the failure indicates the failing unit. These MAPs are used to diagnose intermittent disk failures.

The error recording analysis procedure information can also be used to diagnose failures. Paragraphs 83-311 to 83-387 (62EH) and paragraphs 83-811 to 83-881 (62PC) of this manual describe what each status bit in the disk error recording means and which circuit parts could cause the problem. The *Theory-Diagrams Manual* also contains a detailed description of the check circuits that generate the status bits. See the *Theory-Diagrams Manual* to identify all parts of the circuits in the failing area.

Because the error recording information is stored on the disk, only the intermittent errors are stored. Solid errors will cause the system not to CSIPL or cause a processor check when a program is run. In the case of a processor check, Appendix G of the *Data Area and Diagnostic Aids Manual* describes the procedure for displaying and decoding the error information stored in the work registers.

For systems that have two 62EH drives, if both drives fail in a similar way, the problem is not in either disk enclosure. An exception is when one drive has a brake failure. Then AC power is removed from both drives.

For systems that have more than one 62PC drive, if all drives fail in a similar way, the problem is not in any of the disk enclosures. An exception is when one drive has a brake failure. If either drive A or B has a brake failure, then AC power is removed from both drives A and B (but not drives C and D). If either drive C or D has a brake failure, then AC power is removed from both drives C and D (but not drives A and B).

Note: On 62EH systems, both disk drives and attachments are the same and all parts can be swapped (see paragraph 09-150). On 62PC systems, all disk drives are the same and all parts can be swapped but there is only one attachment.

CAUTION
If the disk drives are swapped, customer data can be destroyed.

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Electrical noise problems may come from inside the System/34 or from external sources. Noise usually causes various types of checks. See paragraph 80-200 for checks and adjustments to aid in preventing ESD (electrostatic discharge).

83

**83-050   I/O COUNTER TABLE
FOR 62EH**

```
I/O COUNTER TABLE FOR DISK DRIVE A (OR B)

DATE LAST RESET            78/02/12

VERIFIES ...........        115654
WRITES ..............       114740
READS OR SCAN READS        1051585
NONZERO SEEKS .......       533972
```

83-100   ERROR COUNTER TABLE FOR 62EH

The error counter table logs all temporary and
permanent errors. A temporary error is described in
paragraph 83-110, and a permanent error is described
in paragraph 83-120.

```
ERROR COUNTER TABLE FOR DISK DRIVE A (OR B)    DATE LAST RESET 08/30/77
```

	TEMPORARY	PERMANENT	DESCRIPTION	MAP
DISK NOT READY CHECKS	0	0	83-311	0922
SECTOR SYNC CHECKS	0	0	83-315	0950
OFF-TRACK CHECKS	10	0	83-317	0955
CYCLIC REDUNDANCY CHECKS	0	0	83-319	0950
DBO PARITY CHECKS	0	0	83-321	0904
WRITE DATA ECHO CHECKS	0	0	83-323	0950
CYCLE STEAL OVERRUNS	0	0	83-325	0950
DATA UNSAFE CHECKS	0	0	83-329	0940
NOT VALID SEEK ADDRESS CHECKS ..	0	0	83-331	0955
ATTACHMENT EQUIPMENT CHECKS	12	0	83-333	0936
NO RECORDS FOUND	4	0	83-335	NONE
SEEK CHECKS	2	0	83-341	0928
SERDES CHECKS	0	0	83-343	0950
WRITE CHECKS	0	0	83-345	0940
CHANNEL TRANSFER CHECKS	0	0	83-347	0905
PLO OUT OF SYNC CHECKS	0	0	83-349	0922
INTERRUPT TIMEOUT CHECKS	2	0	83-351	0939
SECTOR CHECKS	0	0	83-357	0938
SELECT UNSAFE CHECKS	0	0	83-361	0940
WRITE UNSAFE CHECKS	0	0	83-363	0940
BRAKE FAILURE CHECKS	0	0	83-365	0910
SERVO UNSAFE CHECKS	0	0	83-367	0940
NOT VALID I/O BUFFER ADDRESS ...	0	0	83-375	0905

83-110   Temporary Error for 62EH

When an error occurs on an operation, the disk
microcode clears the error and starts the operation
again. The operation can be started up to 16 times and
if the operation completes without error in less than 16
attempts, a temporary error is written in the log.

83-120   Permanent Error for 62EH

When an error occurs on an operation, the disk microcode
clears the error and starts the operation again. The
operation can be started up to 16 times but if the operation
does not complete without error in less than 16 attempts,
a permanent error is written in the log.

Most 62EH permanent errors cause an operator
message to be displayed and/or an end of the job that
started the operation, or the permanent errors cause a
system check halt. However, a permanent CRC check or
a no record found check on a write data operation will
not cause either of these conditions. Instead, an
alternative sector is assigned, and the error is written in
ERAP.

83-200   ERROR HISTORY INFORMATION FOR 62EH

```
ERROR HISTORY TABLE FOR DISK DRIVE A(OR B)
  COMMAND         SENSE BYTES      CUR    PREV    CONTROL FIELD      RETRY
  CODE MDR  0  1  2  3  4  5       CYL    CYL     N  F  C  C  H  S   COUNT   DATE       TIME
 ........................          HEX  ............................         YY/MM/DD  HH:MM:SS
   A2   04  10 16 02 81 01 00      012C   0000    3F 00 01 2C 02 37   10     76/11/16  00 01 18
   A2   04  10 16 02 81 01 00      012C   0000    3F 00 01 2C 02 37   10     76/11/16  00 01 18
   A2   04  10 16 02 81 01 00      012C   0000    3F 00 01 2C 02 37   10     76/11/15  00 00 43
   A2   04  10 16 02 81 01 00      012C   0000    3F 00 01 2C 02 37   10     76/11/15  00 00 43
```

83-491

83-481

83-471   Retry Count

83-461   Sector Address

83-451   Head Address

83-441   Cylinder Address

83-431   Flag Byte

83-421   Multiple Sector Control Byte

Previous Cylinder

83-300   Current Cylinder

0-5 Sense Bytes

83-411

83-400   Command Modifier

Command Code

83-300   DISK SENSE BYTES FOR 62EH

Byte	Bit	Description	Section
	0	Disk not ready check	83-311
	1	Alternative sector processing	83-313
	2	Sector sync check	83-315
0	3	Off track check	83-317
	4	Cyclic redundancy check	83-319
	5	DBO parity check	83-321
	6	Write data echo check	83-323
	7	Cycle steal overruns	83-325
	0	No operation	83-327
	1	Data unsafe check	83-329
	2	Not valid seek address	83-331
1	3	Attachment equipment check	83-333
	4	No records found	83-335
	5	Scan equal hit	83-337
	6	Scan not hit	83-339
	7	Seek check	83-341
	0	SERDES check	83-343
	1	Write check	83-345
	2	Channel transfer check	83-347
2	3	Phase lock oscillator (PLO) out of sync check	83-349
	4	Interrupt time-out check	83-351
	5	Behind home	83-353
	6	ID orientation correct	83-355
	7	Sector check	83-357
	0	Second drive installed	83-359
	1	Select unsafe check	83-361
	2	Write unsafe check	83-363
3	3	Brake failure check	83-365
	4	Servo unsafe check	83-367
	5	Not used	
	6	Not used	
	7	Disk storage size indicator	83-373
	0	Not valid I/O buffer address check	83-375
4	1-5	Not used	
	6, 7	Head select sense bits	83-387
5		Not used	

83-311   Disk Not Ready Checks (DNRDY)

Disk not ready checks indicate the drive is either:

- Not up to speed (speed not ok)

- Failed to recalibrate after the first power up

- Unsafe

- Has a motor or brake failure

Disk not ready checks are reset when the problem is cleared.

Disk not ready checks are part of unit check condition and can occur during any operation. When disk not ready occurs, check the following items:

- When two speed pulses from the speed transducer are over 35 milliseconds apart, disk not ready is indicated. Parts in this circuit are the speed transducer, the D-W1A1 cable to the gate and the A2C4 and A2D2 attachments cards.

- Any unsafe condition causes disk not ready. Repair the indicated unsafe condition to solve this problem.

- The card interlock causes an unsafe condition which will cause disk not ready. An intermittent problem or noise on this line will be set as not ready but *not* set as unsafe.

- Brake failures cause disk not ready. Loose connections in the brake circuit can cause intermittent brake failures which will be set as disk not ready but not as brake failures. However, overcurrent in the brake circuit is set as a brake failure. Parts in this circuit are the DC cable from the power supply to the gate, the DC voltage connectors on the gate, the D-W1A1 cable to the gate, connections to the brake on the file, brake, C4, and D2 attachment cards.

- Several types of intermittent problems in the disk enclosure and servo circuits can cause not ready to be indicated after power up. Check the access speed adjustment (paragraph 09-140) and reseat cards and cables. Use MAP 0967 to diagnose this type of problem.

83-313   Alternative Sector Processing (ALSP)

This sense bit is turned on when the error occurred during the processing of an alternative sector.

83-315   Sector Sync Check (SSCK)

This check indicates that the sync byte was not written correctly or that the attachment did not synchronize to the data. If the sector sync check occurs without cyclic redundancy checks, either the sync byte was not written correctly and the disk should be initialized, or attachment card F2 is failing. After you exchange the F2 card, it may be necessary to initialize the disk.

When both sector sync checks and cyclic redundancy checks occur together, the problem is usually that the hardware is not in sync with the data. See paragraph 83-319 for repair action.

When sector sync checks and sector checks occur together, the problem is usually that the disk needs to be initialized or that a read or scan command was sent to a sector that has an ID written in the wrong position. The only way to determine if an ID is written in the wrong position is to use an oscilloscope to observe the standardized read data.

83-317   Off Track Check (OTCK)

This check indicates that the access arm moved off track during a read, write, or scan operation. Parts in this circuit are the disk enclosure, D-W1A1 cable to the gate, D-W1B1 cable to the gate, B2, B4, C4, D2, and G2 attachment cards.

The most common cause of off track checks are the B2 card or electrical noise.

83-319   Cyclic Redundancy Check (CRC)

The cyclic redundancy check is used to ensure that the data was read correctly from the disk. Many problems that occur while writing or reading the data will cause cyclic redundancy checks.

Cyclic redundancy checks occur when the hardware does not synchronize to the data correctly, when a data bit is wrong, or when reading data that was not written correctly. (Data not written correctly will always cause a check on the same sector.)

The most common causes of cyclic redundancy checks are electrical noise or a failing C2 or F2 attachment card. Other parts in the circuit are the disk enclosure, D-W1B3 card, D-W1A5 card, and D-W1B6 cable.

After repairing the system it may be necessary to initialize the disk.

83-321   DBO Parity Check (PPCK)

This check indicates that bad parity was sensed on the data bus out during cycle steal operations. Reseat the channel crossover cables, reseat the F2 attachment card, or exchange the card and cables.

83-323   Write Data Echo Check

During write operations, this check verifies the operation of the data separator by comparing the write data to read data generated by the data separator. The F2 and C2 cards and the D-W1B6 cable are in this circuit.

83-325   Cycle Steal Overrun (OVRN)

This check ensures the correct number of bytes are sent during cycle steal operations. If both files in a two-drive machine are getting overrun checks, the problem is in the control processor. If only one drive is getting checks, the problem may be loose cards, loose crossover cables, or bad parts. Attachment card F2 or control processor cards can cause this check.

Problems in the disk data channel can also cause intermittent overruns.

83-327   No Operation (NO-OP)

This status bit is set on by microcode if a command is sent when the file is not ready.

83-329   Data Unsafe Check (DUNSF)

Data unsafe is an OR of select unsafe, write unsafe, servo unsafe, or card interlock open. Correct the indicated unsafe condition or, if no other unsafe conditions are indicated, correct the card interlock problem by reseating the cards and cables. See FSL page GV230 for point-to-point wiring in the interlock circuit.

83-331   Not Valid Seek Address Check (INVSK)

This check is set by hardware. The attachment counts the on track pulses to check the position of the access arm. When a seek is made to a track beyond the installed storage size, the check is set. The most probable cause of this check is extra on track pulses. These can be caused by noise, access speed adjustment, or hardware problems.

To repair, perform the access speed adjustment described in paragraph 09-140. Any part in the attachment or the disk drive can cause intermittent checks.

83-333   Attachment Equipment Check

This check is an OR of several other checks. In most cases another check will be indicated with attachment equipment check. The other checks indicate the type of failure occurring.

When only attachment equipment check is on, one of the two following conditions was sensed by the microcode:

- The number of cycle steals was not correct during a read data or write data command (the F2 attachment card is indicated).

- During a read identifier, write identifier, or read data diagnostic command, an extra index pulse occurred (the E2 attachment card is indicated by this condition).

83-335   No Record Found (NRF)

This is a microcode check flag and has no associated hardware.

No record found is normally set to indicate that some hardware check occurred and prevented the read ID of a sector.

No record found set with no other checks indicates the following errors:

- A read data operation could not find a good primary sector during three consecutive index pulses. This could have been caused by a hardware failure when reading the sector ID.

- Alternative sector processing ($ALT) is started and a Read ID is made of the sector to see if it is a bad primary. If the sector does not read as a bad primary, then no record found condition is set and the operation is terminated. Any other error flags are reset and the only indicator is no record found.

- If a bad primary sector was found by alternative sector processing, the alternative sector must be searched for on the alternative sector track. If the alternative sector is not found during one revolution of the disk, then no record found will be set. Any other error indicators will be reset. No record found and alternative sector processing will be the only indicators. This could be caused by an earlier operation that failed to correctly assign an alternative sector.

In any of the preceding examples, use of the disk analyze program will describe the problem.

83-337   Scan Equal Hit (SEHT)

This is a status bit which is normally on. It is used during scan read operations to describe the type of scan hit.

83-339   Scan Not Hit

This is a status bit which is normally on. It is used during scan read operations to indicate scan hit conditions.

83-341   Seek Check

This check bit is set by microcode when a check occurs during a seek operation. The other indicated checks should be used to diagnose the failure.

83-343   Serializer-Deserializer (SERDES) Check

The SERDES (serializer-deserializer) check circuit is used to verify the operation of the F2 card. This check is set when the F2 card is bad or when bad parity is received on the data bus out during cycle steals.

Data bus out parity problems may be corrected by reseating the channel crossover cables.

83-345   Write Check

This check is set when write current is sensed and it should not be on, or when there is no write current when it should be on. Write unsafe should be set concurrently. If write unsafe is not set, exchange the F2 card. Other cards in the circuit are D-W1B3, cable from D-W1B5 to the gate, C2 and D2 cards.

83-347   Channel Transfer Check

This check indicates a data bus in parity check occurred on a cycle steal operation. Parts in the circuit are the F2 card, the channel, and the control processor.

83-349   Phase Lock Oscillator (PLO) Out of Sync Check

This check indicates a problem occurred in the servo system. Noise is the usual cause of intermittent phase lock oscillator out of sync checks. Usually off track checks and sector checks will occur intermittently with the phase lock oscillator out of sync check. Parts in this circuit are the B2, D2, B4, and C4 attachment cards, the D-W1A1 and D-W1B1 cables, and the disk enclosure.

83-351   Interrupt Time-out (ITO) Check

This check occurs when there is no response to an enabled interrupt. The four interrupts that can cause interrupt time-out checks are:

- Data operation end

- Sector pulse

- Index pulse

- Seek operation end

Interrupt time-out check is generated on the E2 card. Other parts include all cards and cables in the servo channel and read channel. Change the D2 and G2 cards first. Also, extra pulses on the 1-second clock line will cause this check.

83-353   Behind Home

This is a status bit that indicates the access arm is in the landing zone. When the access arm is in the landing zone the system must be powered down to recover.

This problem can be caused by seek problems or noise. Use MAP 0928 to diagnose seek problems.

83-355   ID Orientation Correct

This status bit is useful to determine if the recorded check occurred during the ID field or data field during any read, write, or scan operation. If this bit is on, the check occurred during the data field. If the bit is off, the check occurred during the ID field.

83-357   Sector Check

This check can be caused by either of two error conditions:

- Any two sector or index pulses were not 300 bytes apart.

- During a read, write, or scan operation the hardware did not cycle through the complete sector correctly before sensing a sector or index pulse.

The usual cause of this check is extra sector or index pulses caused by noise. However, if the disk is not initialized correctly, a sector check will always occur on the same sector.

Other causes may be a failure on the servo track, B2, D2, E2, and F2 attachment cards.

83-359   Second Drive Installed

This status bit is turned on or off by a feature wire on the F2J12 attachment card pin. Jumper on = bit off = 1 disk drive installed. Jumper off = bit on = 2 disk drives installed.

83-361   Select Unsafe Check

Select unsafe causes data unsafe and disk not ready. It is caused by more than one head being selected during a write operation. Parts of this circuit include the D-W1B3 card, D-W1B5 cable, G2, and D2 attachment cards.

83-363   Write Unsafe Check

This check causes data unsafe and disk not ready. It has two causes:

1.   On a write operation, no current is sensed from the write driver.

2.   Write current is sensed when write is not selected.

Parts of this circuit are the D-W1B5 cable, D-W1B3 card, G2, and D2 attachment cards. Failure 1 is usually caused by no heads being selected because of a loose cable. Failure 2 is usually caused by a damaged W1B3 card.

83-365   Brake Failure Check

This check occurs when an overcurrent or undercurrent is sensed in the brake circuit. This check causes AC power to drop to both drives.

The overcurrent condition causes a latch to set giving a permanent error. To recover, the system must be powered down. The undercurrent condition is not set.

The most common cause is loose cable D-W1A1 to A-A2A4 on the gate or loose voltage connections from the power supply to the input/output board. Also, card C4 of the I/O boards may be failing.

83-367   Servo Unsafe Check

This check causes data unsafe and disk not ready. Servo unsafe is set when either the phase lock oscillator is out of sync or the off track check is set and a write operation is performing. See paragraph 83-349 *Phase Lock Oscillator Out of Sync* or paragraph 83-317 *Off Track Check*.

83-373   Disk Storage Size Indicator

This status bit is turned on or off by a feature wire on the F2P07 attachment card pin. Jumper on = bit off = 9 megabyte. Jumper off = bit on = 13 or 27 megabyte.

83-375   Not Valid I/O Buffer Address Check

This check is a latch on the E2 attachment card that is controlled by microcode. It is set on when the microcode sends an address that is not valid for the data buffer area in storage.

83-387   Head Select Sense Bits

These two bits indicate which head is in use.

Bit 6	Bit 7	Head in Use
0	0	2[1]
0	1	2
1	0	1
1	1	0

[1]This combination is not valid but does select head 2.

83-390   Byte 5

Sense byte 5 is not used.

83-400   COMMAND CODE FOR 62EH

Bits 0 through 3 are always 1010 (hex A) indicating a
disk operation. The other bits describe the operation as
follows:

		Bits 4 5 6 7
Control Commands	Seek Recalibrate	0 0 0 0 0 0 0 0
Read Commands	Data ID Diagnostic Verify	0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1
Write Commands	Data ID	0 0 1 0 0 0 1 0
Scan Read Commands	Equal Low or Equal High or Equal	0 0 1 1 0 0 1 1 0 0 1 1

83-411   COMMAND MODIFIER (MDR) FOR 62EH

The bits of the command modifier mean:

Bit	Description
0	Data field repeat control. Causes the disk data field address to be returned to the first value after each sector is operated on; for example, operate for N+1 sectors on the same disk data field address.
1-3	Not assigned
4	Fast sync extend control. Must be used with disk start input/output read ID and write ID commands to read or write a skewed ID field.
5	Control storage address select. Causes the disk data field address to point to control storage.

6-7	Modifier bits. Describes disk start input/output command functions.

		Bits 6 7
Control Commands	Seek Recalibrate	0 0 0 1
Read Commands	Data ID Diagnostic Verify	0 1 0 1 1 1 1 1
Write Commands	Data ID	0 0 0 1
Scan Read Commands	Equal Low or Equal High or Equal	0 0 0 1 1 0

83-421   CURRENT CYLINDER ADDRESS (CUR CYL) FOR 62EH

The CUR CYL (current cylinder address) is the
hexadecimal address of the cylinder the error written in
the log occurred on.

83-431   PREVIOUS CYLINDER ADDRESS (PREV CYL) FOR 62EH

The PREV CYL (previous cylinder address) is the
hexadecimal address of the cylinder that was used
before the current cylinder.

83-441   MULTIPLE SECTOR CONTROL BYTE (N) FOR 62EH

This byte controls the number of sectors operated on by
the command. For any read, write, scan, or verify, the
number of sectors operated on is one more than the
multiple sector control byte. If all sectors have been
completed, this byte will be hexadecimal FF. If an error
occurs, this byte is the number of sectors left to be
completed.

83-451   FLAG BYTE (F) FOR 62EH

Used to identify or flag a given sector status. All flag bits are needed for F-byte orientations.

Bits	Description
1-4	Not assigned
5	Data field may contain bad data flag bit used by the alternative sector assignment routine to flag data that could not be recovered error free.
6-7	Sector condition bits, assigned meaning:

        00–good primary sector
        10–failing primary sector
        01–good alternative sector
        11–failing alternative sector

83-461   CYLINDER ADDRESS (CC) FOR 62EH

The CC (cylinder address) is a two-byte hexadecimal address. Valid cylinder addresses are:

Storage Size (Megabytes)	Valid Cylinder Addresses
8.6	000 - 202 or hex 00 to C9
13.2	000 - 302 or hex 00 to 12E

83-471   HEAD ADDRESS (H) FOR 62EH

The H (head address) is a single byte hexadecimal address needed by all start input/output commands to address the desired head. An attempt to execute a data operation with a head address that is not valid sets no record found status. Valid heads are 0, 1, and 2.

83-481   SECTOR ADDRESS (S) FOR 62EH

The S (sector address) is a single byte hexadecimal address used to address one of sixty sectors per track.

Logical sector address arrangement starts at index (X) and is skewed by 2 sectors for each head.

     Head 0 X,00,30,01,31..........,58,29,59
     Head 1 X,29,59,00,30,..........,57,28,58
     Head 2 X,28,58,29,59,..........,56,27,57

No record found check is set if a logical sector address cannot be found.

83-491   RETRY COUNT FOR 62EH

This field records the number of times this entry was attempted.

```
I/O COUNTER TABLE FOR DISK DRIVE A (B, C, OR D)

DATE LAST RESET       00/00/00

VERIFIES ...........   296878
WRITES .............   296887
READS OR SCAN READS    296075
NONZERO SEEKS .....    592962
```

83-600   ERROR COUNTER TABLE FOR 62PC

The error counter table logs all temporary and
permanent errors. A temporary error is described in
paragraph 83-610, and a permanent error is described
in paragraph 83-620.

```
ERROR COUNTER TABLE FOR DISK DRIVE A (B, C, OR D)     DATE LAST RESET     00/00/00
                                           TEMPORARY   PERMANENT   DESCRIPTION
                    ADAPTER CHECKS ...................      0          0        83-811
                    CHANNEL OVERRUN CHECKS ..........      0          0        83-813
                    TAG PARITY CHECKS ...............      0          0        83-817
                    CA DATA BUS PARITY CHECKS .......      0          0        83-819
                    FORCED END OPERATIONS ...........      0          0        83-835
                    BRAKE APPLIED CHECKS ............      0          0        83-843
                    TRACK UNAVAILABLE CHECKS .......       0          0        83-845
                    COMMAND CHECKS ..................      0          0        83-847
                    DATA UNSAFE CHECKS .............       0          0        83-849
                    SEEK INCOMPLETE CHECKS .........       0          0        83-851
                    DISK NOT READY CHECKS ..........      0          0        83-855
                    CYCLIC REDUNDANCY CHECKS .......       0          1        83-857
                    COMMON ADAPTER PARITY CHECKS ...      0          0        83-859
                    CHANNEL INTERFACE PARITY CHECKS.      0          0        83-861
                    WRITE GATE RETURN CHECKS .......       0          0        83-863
                    NO RECORDS FOUND ...............       0          0        83-865
                    NOT VALID COMMAND PARAMETER CHKS      0          0        83-867
                    MISSING SECTOR PULSE CHECKS ....      0          0        83-869
                    TIMEOUT CHECKS .................      0          0        83-871
                    DISK NOT ATTACHED CHECKS .......       0          0        83-873
                    NOT VALID I/O BUFFER ADDRESS CHK      0          0        83-875
                    62PC INTERFACE ERRORS ..........      0          0        83-881
```

83

83-610 Temporary Error for 62PC

When an error occurs on an operation, the disk microcode clears the error and starts the operation again. The operation can be started up to 16 times; if the operation completes without error in less than 16 attempts, a temporary error is written in the log.

83-620 Permanent Error for 62PC

When an error occurs on an operation, the disk microcode clears the error and starts the operation again. The operation can be started up to 16 times; however, if the operation does not complete without error in less than 16 attempts, a permanent error is written in the log.

Most 62PC permanent errors cause an operator message to be displayed and/or an end of the job that started the operation, or the permanent errors cause a system check halt. However, a permanent CRC check or a no record found check on a write data operation will not cause either of these conditions. Instead, an alternative sector is assigned, and the error is written in ERAP. In addition, the data is written on the alternative sector, and the operation continues.

The following occurs when a permanent CRC check occurs on a read data operation:

- An alternative sector is always assigned after the first 16 attempts to read, and a permanent error is always written in ERAP.

- An additional 256 attempts are made to read the data.

- If the data is read without error in less than the 256 attempts, no operator message is posted; the data is moved to the alternative sector, and the operation continues.

- If the data is not read without error in less than the 256 attempts, the operation ends, and an operator message is posted.

83-700 ERROR HISTORY INFORMATION FOR 62PC

```
ERROR HISTORY TABLE FOR DISK DRIVE A (B, C, OR D)
COMMAND      SENSE BYTES        DISK   CUR   PREV   CONTROL FIELD    RETRY
CODE MDR  0  1  2  3  4  5    STATUS CYL   CYL   N  F  C  C  H  S COUNT DATE    TIME
........................... HEX .................................YYMMDD HHMMSS
 A1   00   00 85 02 01 00 01  000000 FFFF  0000  00 00 01 63 00 00 10  780725 000003

  |       |                          
83-900   |        83-800       83-912 83-921 
    83-911                              83-931
                                         83-941
                                           83-951
                                              83-961
                                                 83-971
                                                    83-981
                                                       83-991
```
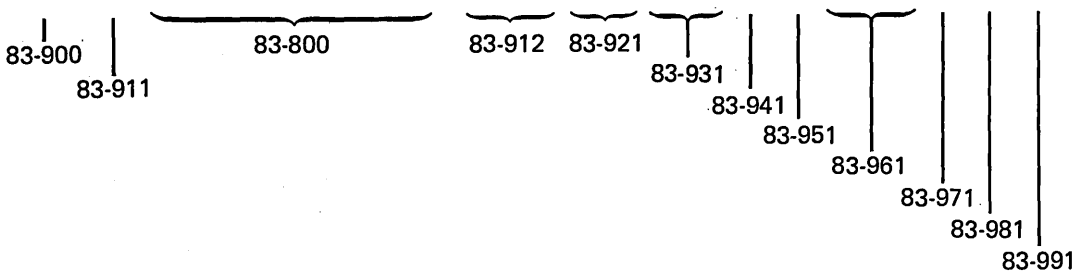
83-800   **DISK SENSE BYTES FOR 62PC**

Byte	Bit	Description	Paragraph
	0	Adapter check	83-811
	1	Channel overrun check	83-813
	2	Parallel DBO parity check	83-815
0	3	Tag parity check	83-817
	4	CA data bus parity check	83-819
	5	Inbound interface error	83-821
	6-7	Not used	
	0	End of operation	83-823
	1	End of track	83-825
	2	Data operation ready	83-827
1	3	Not used	
	4	Scan argument transfer complete	83-829
	5	Any error	83-831
	6-7	File select bits 2 and 1	83-833
	0	Not used	
	1	Forced end operation	83-835
2	2	Read/write/scan busy	83-837
	3	Alternative sector processing	83-839
	4	Not used	
	5-7	File configuration	83-841
	0	Not used but always 1	
	1	Brake applied	83-843
	2	Track unavailable	83-845
3	3	Command error	83-847
	4	Data unsafe	83-849
	5	Seek incomplete	83-851
	6	Home	83-853
	7	Disk not ready	83-855

Byte	Bit	Description	Paragraph
	0	Cyclic redundancy check (CRC)	83-857
	1	Common adapter parity check	83-859
	2	Channel interface parity check	83-861
4	3	Write gate return check	83-863
	4	No record found	83-865
	5	Not valid command parameter	83-867
	6	Missing sector pulse check	83-869
	7	Time-out check	83-871
	0	Disk not attached	83-873
	1	Not valid I/O buffer address	83-875
5	2-4	Not used	
	5	Scan equal hit	83-877
	6	Scan not hit	83-879
	7	62PC interface error	83-881

83

83-811   Adapter Check

This check is the OR of several other checks. The other checks indicate the type of failure. The conditions that set adapter check are:

- Channel overrun check

- Parallel DBO parity check

- Tag parity check

- CA data bus parity check

- Inbound interface error

83-813   Channel Overrun Check

This check indicates that the data rate was not maintained during a cycle steal operation. Adapter check is set concurrently. Parts in the circuit are the A-A2C2, A-A2D2, and A-A2E2 cards, the channel, and the control processor.

83-815   Parallel DBO Parity Check

This check indicates that bad parity was sensed on the data bus during an I/O instruction. This check concurrently sets the DBO processor check and should not appear in the error history table. Reseat the channel crossover cables, reseat the A-A2E2 card, or exchange the card and cables.

83-817   Tag Parity Check

This check indicates that bad parity was sensed by the channel adapter on the common adapter tag bus. Reseat the A-A2C2, A-A2D2, and A-A2E2 cards or exchange the A-A2D2 and A-A2E2 cards.

83-819   CA Data Bus Parity Check

This check indicates that bad parity was sensed by the channel adapter on the CA data bus. Reseat the A-A2C2, A-A2D2, and A-A2E2 cards or exchange the cards.

83-821   Inbound Interface Error

This check indicates that bad parity was sensed by the common adapter either on the tag bus or the CA data bus. Reseat the A-A2D2 and A-A2E2 cards or exchange the cards.

83-823   End of Operation

This is a status bit that is normally on. It indicates that the disk attachment has terminated an operation with or without an error.

83-825   End of Track

This is a status bit that is normally off at operation end time. It indicates that the disk hardware has reached the end of track for a read or write operation. This bit is for microcode use only.

83-827   Data Operation Ready

This is a status bit that is normally off at operation end time. It indicates that the disk hardware has completed the seek part of a read/write/scan operation and is ready to start the data transfer. This bit is for microcode use only.

83-829   Scan Argument Transfer Complete

This is a status bit that is normally off at operation end time. It indicates that the disk hardware has received the 256-byte data field into its buffer for a scan operation. This bit is for microcode use only.

83-831   Any Error

This bit indicates that the common adapter has sensed an error during an operation. The conditions that set this error are:

- CRC check

- Write gate return check

- Common adapter parity check

- Channel interface parity check

- No record found

- Missing sector pulse check

- Timeout error

- Not valid command parameters

- Data unsafe

- Disk not ready

- Disk not attached

- Track unavailable

- Command error

- Seek incomplete

- 62PC interface error

These check conditions indicate the type of failure
occurring.

83-833   File Select Bits 2 and 1

At operation end time, these status bits indicate the file
selected.

	Bit 2	Bit 1
File A	0	0
File B	0	1
File C	1	0
File D	1	1

83-835   Forced End Operation

This bit indicates that the microcode terminated an
operation in a way that was not normal because of an
error. Some other check condition is set concurrently
and indicates the type of failure occurring.

83-837   Read/Write/Scan Busy

This is a status bit that is normally off at operation end
time. It indicates the disk hardware is busy executing a
read/write/scan operation.

83-839   Alternative Sector Processing

This bit indicates that an alternative sector was used
during the operation.

83-841   File Configuration

These are status bits that are normally on at operation
end time. They indicate the size of the disk.

    011 – 65-megabyte file attached
    100 – Disk not attached

If the status bits indicate that the disk is not attached, it
is probably a hardware failure. Check the configuration
jumpers on the A-A2D2 card as instructed in paragraph
10-210. Then reseat the A-A2C2, A-A2D2, and
A-A2E2 cards or exchange the cards.

83-843   Brake Applied

This bit is set if the brake coil is no longer active. It
supplies sense information that the 'brake applied' line
was activated. The system must immediately remove
AC power from the disk drive motor when the line
becomes active.

This line is activated by the PLO going out of
synchronization, caused by loss of disk speed because
of brake failure, a broken belt, or failure of the servo
circuits. Reseat the D2, E2, and F2 cards in the disk
card gate or exchange these cards.

83-845   Track Unavailable

This bit indicates that an attempt was made to seek
beyond cylinder 359. This check may indicate an error
in loading the common adapter or in moving the seek
address to the disk. Reseat the A-A2C2 and A-A2D2
cards and the C2 card in the disk card gate.

83-847   Command Error

This check condition is set when the 62PC senses a
parity error on either the control bus or the disk tag
lines. This problem is generally caused by a loose bus
cable. Reseat the A-A2A5 and E-A1A3 cables. Also
reseat the following cables (if present) for systems with
more than one drive: E-A1A4, E-B1A3, E-B1A4,
E-C1A3, E-C1A4, and E-D1A3. The check can also be
caused by loose or bad cards. Reseat or exchange the
A-A2D2 card and the C2 card in all disk card gates.

83-849   Data Unsafe

Some conditions may occur during read/write operations that may damage customer data. Data unsafe is set by the following conditions:

- Write or read and multiple module selection error

- Write and data servo unsafe

- Write and no write transitions

- Not write and write current detected

- Write and read

- Write and head short circuit to ground indicated

- Write and head selected during a sector pulse or index pulse

- Write and not ready

The parts in the circuit are the A-A2C2 card and the disk enclosure, B2, E2, and F2 cards in the disk card gate.

83-851   Seek Incomplete

This check is set by the disk to indicate that an access attempt failed. It is also set by the common adapter when no interrupt follows an access command. Possible causes of this problem are the actuator card, the disk enclosure, or the D2, E2, and F2 cards in the disk card gate.

83-853   Home

This bit indicates that the read/write heads are in the home position (cylinder 0, head 1 selected). This bit is active only after a recalibrate operation.

83-855   Disk Not Ready

The disk not ready check is set when one of the following conditions occurs:

- The 'brake applied' line is active.

- The 'illegal move' line is active.

- The PLO is out of synchronization.

Use a recalibrate to reset the disk not ready condition except when the 'brake applied' line, which needs a power on cycle, is active.

If a brake applied check occurred with the disk not ready check, see the brake applied check.

If a seek incomplete check occurred with the disk not ready check, see the seek incomplete check.

If the disk not ready check is the only check indicated, reseat or exchange the B2, C2, and D2 cards in the disk card gate.

83-857   Cyclic Redundancy Check (CRC)

The cyclic redundancy check is used to ensure that the data was read correctly from the disk. Many problems that occur while writing or reading the data will cause cyclic redundancy checks.

Cyclic redundancy checks occur when the hardware does not synchronize to the data correctly, when a data bit is wrong, or when reading data that was not written correctly. (Data not written correctly will always cause a permanent check on the same sector.)

The most common cause of a cyclic redundancy check is electrical noise. Parts in the circuit are the disk enclosure, the A-A2C2 card, and the B2 card in the disk card gate.

After repairing the system, it may be necessary to initialize the disk.

83-859   Common Adapter Parity Check

This check indicates that the common adapter sensed wrong parity in its hardware. Reseat the A-A2C2 and A-A2D2 card or exchange the cards.

83-861   Channel Interface Parity Check

This check indicates that wrong parity was sensed on the data bus or tag bus between the common adapter and the channel adapter cards. Reseat the A-A2E2, A-A2D2, and A-A2C2 cards or exchange the A-A2E2 and A-A2D2 cards.

18   83-849

83-863   Write Gate Return Check

This check is set if write current to the disk is not sensed when write gate is on. Reseat the dedicated cable (A-A2A4 for drive A, A-A2Z1 for drive B, A-A2B4 for drive C, or A-A2B5 for drive D). Reseat the A-A2C2 card or the B2 card in the disk card gate.

83-865   No Record Found (NRF)

This check is set when the specified sector could not be found within two index pulses or one full revolution.

No record found is normally set to indicate that some hardware check occurred and prevented an ID hit for a sector. (A permanent NRF usually indicates that an ID was not correctly assigned to a new sector or has been destroyed.)

For temporary NRFs, reseat or exchange the A-A2C2 card and the B2 card in the disk card gate. For permanent NRFs, run disk analyze to locate any bad sectors.

83-867   Not Valid Command Parameters

This check indicates that the common adapter sensed either a not valid command or not valid command parameters. This check generally indicates that the command was not set up correctly. Check the control field in the error history table for not valid command parameters.

83-869   Missing Sector Pulse Check

This check indicates that an index pulse or a sector pulse was not received when expected. The check is set only during a read ID operation, write ID operation, or read diagnostic operation. Failure of the disk D2 or F2 card or a failure on the servo track can cause this check.

83-871   Time-out Check

This error is set by the common adapter if there is no response from the disk in 200 milliseconds or less on a seek operation or in 5 seconds or less on a recalibrate operation. A time-out error is also set if the sequence counter in the common adapter does not advance during a read or write operation, or it is set if the common adapter controller attempts to execute read only storage locations that are not used.

If the error is caused by a time-out of a disk seek or recalibrate operation, the seek incomplete error should be indicated. However, if the seek incomplete error is not indicated, the cause of the problem is probably the A-A2C2 or A-A2D2 card or the disk B2 card.

83-873   Disk Not Attached

This check indicates that the operation sent to the common adapter was for a disk that is not attached, as indicated by the common adapter configuration jumpers. See paragraph 83-841.

83-875   Not Valid I/O Buffer Address

This check indicates that the I/O buffer address was not in the user's area of main storage or that the address did not start on a 8-byte boundary. This check is set by the disk microcode.

83-877   Scan Equal Hit

This is a status bit that is used at operation end time for scan commands. It is used to describe the type of scan hit condition.

83-879   Scan Not Hit

This is a status bit that is used at operation end time for scan commands. It is used to indicate a scan not hit condition.

83-881   62PC Interface Error

This check indicates than an error was sensed by the common adapter on the 62PC interface or a cable continuity check was sensed. It is caused by one of the following errors:

- Bad cable continuity

- Control sample received not set

- Disk interrupt not reset

- Control bus parity check

Reseat the disk cables (A-A2A5, A-A2A4, and A-A2Z1, A-A2B4, and A-A2B5 if present. Also A3, A4, and A5 in the disk card gate), the terminator card (A4 in the disk card gate), the A-A2D2 card, the A-A2C2 card, and C2 in the disk card gate.

83-900   COMMAND CODE FOR 62PC

Bits 0 through 3 are always 1010 (hex A), indicating a disk operation. The other bits describe the operation as follows:

		Bits 4567
Command	Seek	0000
Commands	Recalibrate	0000
Read	Data	0001
Commands	ID	0001
	Diagnostic	0001
	Verify	0001
Write	Data	0010
Commands	ID	0010
Scan Read	Equal	0011
Commands	Low or Equal	0011
	High or Equal	0011

83-911   COMMAND MODIFIER FOR 62PC

The bits of the command modifier mean:

Bit	Description
0	Data repeat control. Causes a single 256-byte field to be used for the requested operation (valid only for read and write data).
1	Suppress read verify–Inhibits the read verify after a write operation (valid only for write data and write ID).
2	Displaced sector–Indicates that the sector to be operated on is moved one sector from its normal location (valid only for read ID, write ID, or read diagnostic).
3	Not used.
4	Fast sync extend control–Must be used with disk start input/output read ID and write ID command to read or write a skewed ID field.
5	Control storage address select–Causes the disk data field address to point to control storage.
6-7	Modifier bits–Describes disk start input/output command function.

		Bits 6 7
Control	Seek	0 0
Commands	Recalibrate	0 1
Read	Data	0 0
Commands	ID	0 1
	Diagnostic	1 0
	Verify	1 1
Write	Data	0 0
Commands	ID	0 1
Scan	Equal	0 0
Read	Low or Equal	0 1
Commands	High or Equal	1 0

83-912   DISK STATUS FOR 62PC

These status bits are used by the disk MDI MAPs to isolate disk problems.

83-921   CURRENT CYLINDER ADDRESS (CUR CYL) FOR 62PC

The CUR CYL (current cylinder address) is the hexadecimal address of the cylinder that the error written in the log occurred on.

83-931   PREVIOUS CYLINDERS ADDRESS (PREV CYL) FOR 62PC

The PREV CYL (previous cylinder address) is the hexadecimal address of the cylinder that was used before the current cylinder.

83-941   MULTIPLE SECTOR CONTROL BYTE (N) FOR 62PC

This byte controls the number of sectors operated on by the command. For any read, write, scan or verify, the number of sectors operated on is one more than the multiple sector control byte. If all sectors have been completed, this byte will be hexadecimal FF. If an error occurs, this byte is the number of sectors left to be completed.

83-951   FLAG BYTE (F) FOR 62PC

Used to identify or flag sector status.

Bit	Description
0	Alternative record 1 may contain bad data. The bit is used by the alternative sector assignment routine to flag data in data field 1 of the sector that could not be recovered error free.
1	Alternative record 2 may contain bad data. The bit is used by the alternative sector assignment routine to flag data in data field 2 of the sector that could not be recovered error free.
2	User assigned defective sector. This bit is used to flag sectors that have been assigned to a new sector by the alternative sector assignment routine. It will be on in the defective primary sector only.
3	Not used.
4	Displaced sector. This bit is used to flag that a sector is moved by one from its normal location.
5	Sector reassigned to the alternative cylinder. This bit indicates that the sector has been assigned to a new sector. (This bit should be on in both the defective primary sector and the assigned alternative sector.)
6	Manufacturing assigned defective sector. This bit is used to flag sectors that were found defective at the factory.
7	Assigned alternative. This bit is used to flag sectors on the alternative cylinder that have been assigned a new sector number.

83-961   CYLINDER ADDRESS (CC) FOR 62PC

The CC (cylinder address) is a 2-byte hexadecimal
address. Valid cylinder addresses are:

  000 - 359 or hex 00 to hex 167

83-971   HEAD ADDRESS (H) FOR 62PC

The H (head address) is a single byte hexadecimal
address needed by all start input/output commands to
address the desired head. An attempt to execute a data
operation with a head address that is not valid sets no
record found status. Valid heads are hexadecimal 0
through A.

83-981   SECTOR ADDRESS (S) FOR 62PC

The S (sector address) is a single byte hexadecimal
address used to address one of the 64 records per
track.

Logical record address arrangement starts sequentially at
index (X) and is skewed by 16 records for each head.

```
Head 0  X,00,01,02,03,........61,62,63
Head 1  X,48,49,50,51,........45,46,47
Head 2  X,32,33,34,35,........29,30,31
Head 3  X,16,17,18,19,........13,14,15
Head 4  X,00,01,02,03,........61,62,63
Head 5  X,48,49,50,51,........45,46,47
Head 6  X,32,33,34,35,........29,30,31
Head 7  X,16,17,18,19,........13,14,15
Head 8  X,00,01,02,03,........61,62,63
Head 9  X,48,49,50,51,........45,46,47
Head A  X,16,17,18,19,........13,14,15
```

No record found check is set if a logical record address
cannot be found.

83-991   RETRY COUNT FOR 62PC

This field records the number of times the entry was
attempted.

CONTENTS

84

84-010 HOW TO USE DISKETTE ERROR INFORMATION

The System/34 uses two levels of diskette attachment cards (level 1 and level 2). The level 1 attachment card can be used for 33FD or 53FD diskette drives. The level 2 attachment card can be used for 33FD, 53FD, or 72MD diskette drives.

Paragraphs 84-200 through 84-430 contain attachment card information for level 1; paragraphs 84-700 through 84-930 contain attachment card information for level 2.

See the *Diskette Plug Chart* on FSL page AC300 to determine which level of attachment card is used.

84-200 ERROR HISTORY INFORMATION SAMPLE FOR LEVEL 1

```
   ERROR HISTORY TABLE FOR DISKETTE
VOLUME  COMMAND  SENSE BYTES RETRY    CYLINDER     CONTROL FIELD
  ID    CODE MDR.  0  1  2  3 COUNT PREV.  START    CYL HD REC SZ      DATE      TIME
       ............................HEX........................   YY/MM/DD HH:MM:SS
XXXXX    1    0    07 00 14 5F   09    02      01      01 00 01   02   77/04/13 11:12:49
```

84-275 — Command Code and Modifier

84-300 — Sense Bytes

84-350 — Retry Count

84-360 — Previous Cylinder

84-370 — Start Cylinder

84-400 — Cylinder Address

84-410 — Head Address

84-420 — Record Address

84-430 — Record Size

84-250   ERROR COUNTER TABLE SAMPLE
FOR LEVEL 1

```
ERROR COUNTER TABLE FOR DISKETTE                          DATE LAST RESET 08/31/77
                                              TEMPORARY  PERMANENT           DESCRIPTION MAP
                 MISSING DATA ADDRESS MARKS .....      0          0            84-310     8402
                 ID CYCLIC REDUNDANCY CHECKS ....      0          0            84-310     8402
                 DATA CYCLIC REDUNDANCY CHECKS ..      5          9            84-310     8402
                 HEAD MISMATCHES ................      0          0            84-310     8402
                 RECORD MISMATCHES ..............      0         20            84-310     8402
                 RECORD LENGTH MISMATCHES .......      0         20            84-310     8402
                 NO OP CONDITIONS ...............      0          0            84-320
                 INVALID CONTROL RECORD CHECKS ..      0          0            84-320     8403
                 WRITE VERIFY MISMATCHES ........      5          9            84-320     8403
                 FAST CHECKS ....................      0          0            84-330     8403
                 WRITE ERRORS ...................      0          0            84-330     8403
                 ID NOT FOUND ...................      0         25            84-330     8403
                 READ OVERRUN CHECKS ............      0          0            84-330     8403
                 UNEXPECTED ERASE CURRENT PRESENT      0          0            84-340     8403
```

84-260   I/O COUNTER TABLE SAMPLE FOR
LEVEL 1

```
I/O COUNTER TABLE FOR DISKETTE

DATE LAST RESET          78/03/27

READS .............      2150
WRITES ............      7814
SEEKS .............     18799
```

84

84-275 COMMAND CODE AND MODIFIER FOR LEVEL 1

Command Code	Meaning
0000	Control Seek
0001	Read Data
0010	Read Data and Control Record
0011	Read ID
0100	Not Used
0101	Write Data and Verify
0110	Write Control Record and Verify
0111	Write ID and Verify

If modifier bit 0 is on, the operation is a MFM operation.

If modifier bit 3 is on, (read operations only) the data is read into control storage.

84-300 SENSE BYTES—GENERAL INFORMATION FOR LEVEL 1

The diskette status (RDSTATUS) transfers current diskette status to the assigned work registers.

Work Register (WR)	Sense Byte
WR1 (H)	Sense byte 0
WR1 (L)	Sense byte 1
WR3 (H)	Sense byte 2
WR3 (L)	Sense byte 3

84-310 Sense Byte 0

If the no operation bit (byte 1, bit 0) is on, bits 0-3 of byte 0 have the following meanings:

Byte	Bits 0 1 2 3	Meaning
0	0 0 0 0	Device address or port address not valid.
	0 0 0 1	Command not valid.
	0 0 1 0	Not ready—non-seek command.
	0 0 1 1	Not ready—seek command.
	0 1 0 0	Errors not reset.
	0 1 0 1	Reject head 1 operation.
	0 1 1 0	Reject MFM operation.
	0 1 1 1	Write gate or erase gate on.

If the no operation bit is off, byte 0 bits have the following meanings:

Byte	Bit	Name	Meaning
0	0	Missing data address mark	Data record not found after an ID field.
	1	ID cyclic redundancy check	Cyclic redundancy check character for the ID field did not compare.
	2	Data cyclic redundancy check	Cyclic redundancy check character for the data field did not compare.
	3	Cylinder mismatch	The cylinder address byte of the ID field and the desired cylinder byte during ID search did not match.
	4	Head mismatch	The head address byte of the ID field and the desired head byte during ID search did not match.
	5	Record mismatch	The record address byte of any ID field and the desired record number during ID search did not match.
	6	Record length mismatch	The record length byte of the ID field and the desired N-byte during ID search did not match.
	7	Seek reverse	The last seek was in a reverse direction.

84-320   Sense Byte 1

Byte	Bit	Name	Meaning
1	0	No op condition	Command could not be executed because of outstanding status.
	1	Invalid control record check	The leftmost byte of a control record contained other than F or D. F = damaged record; D = deleted record.
	2	Write verify mismatch	Data written does not match the main storage data field.
	3	Control address mark found	Control address marker was found when performing a read data operaton.
	4	Error correction invoked	An error correction routine was used because a data address marker was missing or a cyclic redundancy check occurred during a read operation.
	5	Write error	Indicates that either a write overrun, write parity check, missing erase current, or a data unsafe error was found during a write operation.
	6	End of track	Last record on the track has been written or read with some records still waiting.
	7	File busy	Data movement in process.

84-330   Sense Byte 2

Byte	Bit	Name	Meaning
2	0	Fast check	The diskette speed is quicker than the maximum speed of 376 RPM.
	1	Not ready	
	2	Missing erase current	Erase current failed to turn on during a write operation.
	3	ID not found	CHRN address could not be found.
	4	Read overrun check	Minimum data movement rate was not maintained during a data movement.
	5	Data mode	On = FM; off = MFM. This bit will be off only during data movement time of an MFM operation (should never log as *off*).
	6	Write overrun check	Minimum data movement rate was not maintained during a data movement.
	7	Write parity check	The DBO parity and the generated serial write data parity during a write operation did not match.

84-340   Sense Byte 3

Byte	Bit	Name	Meaning
3	0	Unexpected erase current present	Erase current was on while not in write operation.
	1	BPC line off	Diagnostic use only.
	2	Drive type	On = 33FD, off = 53FD
	3	Erase current off	Diagnostic use only.
	4	Head 0 selected	Diagnostic use only.
	5	Diskette type	On = diskette 1, off = diskette 2D.
	6	I/O working off	No device is busy.
	7	Diskette working off	Diskette is not busy.

84

84-350   RETRY COUNT FOR LEVEL 1

This field records the number of times for this retry.

84-360   PREVIOUS CYLINDER (PREV) FOR LEVEL 1

This field contains the hexadecimal address of the cylinder that was used before the start cylinder.

84-370   START CYLINDER FOR LEVEL 1

Hexadecimal address of the cylinder that the diskette operation started on. Diskette I/O operations can cause more than 1 cylinder of data to be moved. If the operation is one that moves 1 cylinder or less, this value will be the same as the CYL byte in the control field.

84-400   CYLINDER ADDRESS (CYL) FOR LEVEL 1

One byte logical binary address. Valid CC addresses are 00-4C. This cylinder is the one that was in use when the error occurred that caused the log entry.

84-410   HEAD ADDRESS (HD) FOR LEVEL 1

One byte binary address needed by all SIO commands to address the desired head. Valid head addresses are 00 and 01.

84-420   RECORD ADDRESS (REC) FOR LEVEL 1

One byte record address. Valid addresses are 01 through 1A or 01 through 08.

84-430   RECORD SIZE (SZ) FOR LEVEL 1

One hexadecimal byte record length indicator used for the record length.

    00 = 128 byte records
    01 = 256 byte records
    02 = 512 byte records
    03 = 1024 byte records

84-700 ERROR HISTORY INFORMATION SAMPLE FOR LEVEL 2

ERROR HISTORY TABLE FOR DISKETTE

VOL ID	SLOT NBR	COMMAND CODE	MDR	SENSE BYTES 0	1	2	3	4	5	RETRY COUNT	CYLINDER PREV	START	COUNTROL CYL	HD	FIELD REC	SZ	DATE YY/MM/DD	TIME HH:MM:SS
								HEX									79/09/13	11:14:06
$INIT	01	1	0	01	00	14	19	90	04	09	00	FF	00	00	07	00	79/09/13	00:00:09
IPLIPL	00	8	0	01	00	44	19	D4	64	03	00	00	00	00	00	00		
IPLIPL	00	1	0	00	00	14	1D	90	04	09	00	01	01	00	01	02		
IPLIPL	00	1	0	00	00	14	1D	90	04	09	00	01	01	00	01	02		
IPLIPL	00	1	0	00	00	14	1D	90	04	09	00	01	01	00	01	02		
IPLIPL	00	8	0	00	00	44	19	D4	64	03	00	00	00	00	00	00		

Field callouts:
- 84-770 Slot Number
- 84-775 Command Code and Modifier
- 84-800 Sense Bytes
- 84-850 Retry Count
- 84-860 Previous Cylinder
- 84-870 Start Cylinder
- 84-900 Cylinder Address
- 84-910 Head Address
- 84-920 Record Address
- 84-930 Record Size

84-750 ERROR COUNTER TABLE SAMPLE FOR LEVEL 2

ERROR COUNTER TABLE FOR DISKETTE   DATE LAST RESET 00/00/00

	TEMPORARY	PERMANENT	DESCRIPTION
MISSING DATA ADDRESS MARKS	0	0	84-810
DATA CYCLIC REDUNDANCY CHECKS ..	0	0	84-810
NO OP CONDITIONS	0	0	84-820
INVALID CONTROL RECORD CHECKS ..	0	0	84-820
WRITE VERIFY MISMATCHES	0	0	84-820
FAST CHECKS	0	0	84-830
WRITE ERRORS	0	0	84-820
ID NOT FOUND	0	4	84-830
BUFFER OVERRUN CHECKS	0	0	84-830
UNEXPECTED ERASE CURRENT PRESENT	0	0	84-840
PARITY CHECKS	0	0	84-842
INVALID COMMAND CHECKS	0	0	84-842
TIMEOUT CHECKS	0	0	84-842
CARRIAGE BED FAILURES	0	0	84-844
PICKER FAILURES	0	0	84-844
FAILURE TO EJECT CHECKS[2]	0	0	84-844
FAILURE TO PICK CHECKS	0	2	84-844
WINDOW MAGNET FAILURES[2]	0	0	84-844
OPERATION OUT OF SEQUENCE ERRORS	0	0	84-844
WRITE/ERASE CURRENT PRESENT.....	0	0	84-844

[1] (bracket grouping UNEXPECTED ERASE CURRENT PRESENT through WRITE/ERASE CURRENT PRESENT)

---

[1]Autoloader errors, only valid for 72MD.
[2]Applies only to machines with old style picker.

84

84-760 I/O COUNTER TABLE SAMPLE FOR LEVEL 2

```
I/O COUNTER TABLE FOR DISKETTE

DATE LAST RESET        78/09/27

READS ...............      703
WRITES ..............       51
SEEKS ...............      383
AUTOLOADER OPERATIONS     5549
```

84-770 SLOT NUMBER (SLOT NBR) FOR LEVEL 2

One-byte data control field to describe the autoloader slot number of the failing diskette. Valid slot numbers are hexadecimal 01 through 17.

84-775 COMMAND CODE AND MODIFIER FOR LEVEL 2

Drive Command

Command Code	Meaning
0000	Control Seek
0001	Read Data
0010	Read Data and Control Record
0011	Read ID
0100	Verify
0101	Write Data and Verify
0110	Write Control Record and Verify
0111	Write ID and Verify

Autoloader Command (72MD only)

Command Code	Meaning
1000	Select Diskette
1001	Eject Diskette
1010	Orient Autoloader
1011	Abort Autoloader

If modifier bit 0 is on, the operation is an MFM operation. If modifier bit 3 is on, (read operations only) the data is read into control storage.

84-800 SENSE BYTES—GENERAL INFORMATION FOR LEVEL 2

The diskette status (RDSTATUS) transmits current diskette status to the assigned work registers.

Work Register (WR)	Sense Byte
WR0 (H)	Sense byte 4
WR0 (L)	Sense byte 5
WR1 (H)	Sense byte 0
WR1 (L)	Sense byte 1
WR3 (H)	Sense byte 2
WR3 (L)	Sense byte 3

84-810   Sense Byte 0

If the no operation bit (byte 1, bit 0) is on, bits 0-3 of
byte 0 have the following meanings:

Byte	Bits 0 1 2 3	Meaning
0	0 0 0 0	Device address or port address not valid.
	0 0 0 1	Command not valid.
	0 0 1 0	Not ready–non-seek command.
	0 0 1 1	Not ready–seek command.
	0 1 0 0	Hardware errors did not reset.
	0 1 0 1	Head 1 selected on a one-sided diskette.
	0 1 1 0	MFM command on a one-sided diskette.
	0 1 1 1	Write gate or during read operation
	1 0 0 0	Autoloader command with a not-valid slot number.
	1 0 0 1	IOB error.
	1 0 1 0	Time-out on data mode operation.

If the no-operation bit is off, byte 0 bits have the
following meanings:

Byte	Bit	Name	Meaning
0	0	Missing data ad- dress mark	Data record not found after an ID field.
	1	Not used	
	2	Data cyclic redundancy check	Cyclic redundancy check character for the data field did not compare.
	3	Cylinder mismatch	The cylinder address byte of the ID field and the desired cylinder byte during ID search did not match.
	4-6	Not used	
	7	Seek reverse	The last seek was in a reverse direction.

84-820   Sense Byte 1

Byte	Bit	Name	Meaning
1	0	No-op condition	Command could not be executed because of out-standing status.
	1	Not valid control record	The leftmost byte of a control record contained other than F or D. (F = damaged record; D = deleted record.)
	2	Write verify mismatch	Data written does not match the main storage data field.
	3	Control address mark found	Control address marker was found when performing a read data operaton.
	4	Error correction invoked	An error correction routine was used because a data address marker was missing or a cyclic redundancy check occurred during a read operation.
	5	Write error	Indicates that an error occurred during a write operation.
	6	End of track	Last record on the track was written or read with some records still waiting.
	7	Channel busy	Data movement in process.

84

84-810

84-830   Sense Byte 2

Byte	Bit	Name	Meaning
2	0	Fast check	The diskette speed is quicker than the maximum speed of 376 RPM (33FD or 53FD) or 738 RPM (72MD).
	1	Not ready	
	2	Missing erase current	Erase current failed to turn on during a write operation.
	3	ID not found	CHRN address could not be found.
	4	Buffer overrun	Minimum data rate was not maintained.
	5	Data mode	On = FM; off = MFM. This bit is off only during data movement time of an MFM operation (should never log as off).
	6	Buffer overrun	Minimum data rate out of the buffer was not maintained.
	7	Not used	

84-840   Sense Byte 3

Byte	Bit	Name	Meaning
3	0	Unexpected erase current present	Erase current was on while not in write operation.
	1	Not used	
	2	Drive type	On = 33FD; off = 53FD or 72MD.
	3	Not used	
	4	Head 0 selected	
	5	Diskette type	On = diskette 1; off = diskette 2D.
	6	Not used	
	7	Diskette not busy	Diskette is not busy.

84-842   Sense Byte 4

Byte	Bit	Name	Meaning
4	0	Autoloader op end	Acceptable end of auto-loader operation if bits 1 and 2 are off.
	1	Autoloader error	Error occurred during an autoloader operation.
	2	Autoloader parity check	Even parity on the autoloader command lines.
	3	Autoloader attached	Diskette drive is a 72MD.
	4	Autoloader command reject	The autoloader command can not be executed.
	5	Autoloader motion check	Error was sensed when a command that causes autoloader to move was executed.
	6	Autoloader invalid command	The autoloader command is not valid.
	7	Autoloader time-out	Op end was not received in the time permitted for an autoloader operation.

84-844   Sense Byte 5

Byte	Bit	Meaning
5	0	Check modifier hex 8
	1	Check modifier hex 4
	2	Check modifier hex 2
	3	Check modifier hex 1
	4	Not used
	5	Oriented latch is set
	6	Cover open switch is activated
	7	Not used

Bits 0 through 3 of sense byte 5 are used to describe bits 1, 4, and 5 of sense byte 4.

Check Modifer Code in Hexadecimal	Description
1	Carriage bed failure (jammed at home).
2	Carriage bed failure (jammed off home).
3	Picker failure (jammed in magazine).
4	Picker failure (jammed in drive).
5	Failure to eject[1].
6	Failure to pick.
7	Window magnet failure[1]. (window jammed open).
8	Window magnet failure[1]. (window jammed closed).
9	Cover open (carriage bed movement not permitted).
A	Not used
B	Operation out of sequence (command rejected).
C	Not oriented (command rejected).
D	Write or erase current present (command rejected).

---

[1] Only for machines with old style picker.

84-850   RETRY COUNT FOR LEVEL 2

This field records the number of times for this retry.

84-860   PREVIOUS CYLINDER (PREV) FOR LEVEL 2

This field contains the hexadecimal address of the cylinder that was used before the start cylinder.

84-870   START CYLINDER FOR LEVEL 2

Hexadecimal address of the cylinder that the diskette operation started on. Diskette I/O operations can cause more than 1 cylinder of data to be moved. If the operation is one that moves 1 cylinder or less, this value will be the same as the CYL byte in the control field.

84-900   CYLINDER ADDRESS (CYL) FOR LEVEL 2

One byte logical binary address. Valid CC addresses are 00-4C. This cylinder is the one that was in use when the error occurred that caused the log entry.

84-910   HEAD ADDRESS (HD) FOR LEVEL 2

One byte binary address needed by all SIO commands to address the desired head. Valid head addresses are 00 and 01.

84-920   RECORD ADDRESS (REC) FOR LEVEL 2

One byte record address. Valid addresses are 01 through A1 or 01 through 08.

84-930   RECORD SIZE (SZ) FOR LEVEL 2

One hexadecimal byte record length indicator used for the record length.

    00 = 128 byte records
    01 = 256 byte records
    02 = 512 byte records
    03 = 1024 byte records

84

CONTENTS

85

85-050   I/O COUNTER TABLE
         SAMPLE FOR 5211


```
I/O COUNTER TABLE FOR LINE PRINTER

DATE CREATED                   00/00/00
NONRESETTABLE LINE COUNT          25634

DATE LAST RESET                00/00/00
RESETTABLE LINE COUNT             25634
```


85-100   ERROR COUNTER TABLE
         SAMPLE FOR 5211


```
ERROR COUNTER TABLE FOR LINE PRINTER                 DATE LAST RESET 00/00/00
                                                          DESCRIPTION MAP
                    PRINTER CONTROLLER UNIT CHECKS .   0       85-101     8501
                    DATA TRANSFER CHECKS ...........   0       85-103     8501
                    FIRE TIER CHECKS ...............   0       85-105     8503
                    PRINT SUBSCAN EMITTER CHECKS ...   0       85-107·    8503
                    ANY HAMMER ON CHECKS ...........   0       85-109     8507
                    HAMMER ECHO CHECKS .............   0       85-111     8507
                    BELT SYNC CHECKS ...............  30       85-113     8503
                    BELT SPEED CHECKS .............    0       85-115     8503
                    TEMP. BELT UP TO SPEED CHECKS ..   0       85-117     8503
                    PERM. BELT UP TO SPEED CHECKS ..   0       85-117     8503
                    PRINTER BUSY TOO OFTEN CHECKS ..   0       85-119     8509
                    PRINTER BUSY TOO LONG CHECKS ...   0       85-121     8509
                    CARRIAGE CHECK 1 ..............   15       85-125     8505
                    CARRIAGE CHECK 2 ..............    0       85-123     8505
                    FORMS JAM CHECKS ..............   43       85-129     8505
                    RIBBON CHECKS .................    0       85-131     8509
                    DATA PARITY CHECKS ...........     0       85-133     8511
                    CABLE INTERLOCK CHECKS ........    0       85-135     8511
                    PRINTER POWER CHECKS ..........    0       85-137     8501
```

85-101   Printer Controller Unit Check

Printer controller unit checks are either caused by a hardware error or a program loop time-out.

85-103   Data Transfer Check

Byte transfer count did not match. While moving data from the system to the printer controller, a byte was lost or an extra byte was sensed.

85-105   Fire Tier Check

Either the 'fire tier' lines were not in a valid condition during 'not print time' or the lines were not in correct sequence during print optioning.

85-107   Print Subscan Emitter Check

An expected transition in the PSS (print subscan) emitter failed to occur.

85-109   Any Hammer On Check

The 'hammer echo return' interface line goes active during 'not print time'.

85-111   Hammer Echo Check

If a hammer-on-echo condition is sensed when the hammer should be off or a hammer-on-echo condition is not sensed when a hammer should be on. The first failing hammer position and the number of additional failing hammer positions are logged in the error history table (status bytes 4 and 5).

85-113   Belt Sync Check

The 'home' pulse occurred when not expected or the 'home' pulse did not occur when expected. For example, a belt sync check is sensed if a 48-character belt is installed but a 64-character belt is needed.

85-115   Belt Speed Check

The 'belt up to speed' interface line goes not active while the 'belt go' interface line is active.

85-117   Belt Up To Speed Check (Temporary/Permanent)

The time between the 'belt go' signal and 'belt up to speed' signal was more than 2.8 seconds. Each error is logged. However, the printer comes to a stop after the second retry.

85-119   Printer Busy Too Often Check

The 'printer busy' signal became active more than three times during the printing of a line.

85-121   Printer Busy Too Long Check

The 'printer busy' signal was active for more than 3 seconds during a print operation.

85-123   Carriage Check 2 (Speed)

A carriage single space operation did not complete inside 34 milliseconds. This error only logs in ERAP if it occurs three times on a single printed page.

85-125   Carriage Check 1 (Sync)

Indicates one of two conditions:

- A 'carriage motion feedback' pulse failed to occur when expected, or

- A 'carriage motion feedback' pulse occurred when not expected.

85-129   Forms Jam Check

The 'forms pulse' interface line has not been sensed in the last 12 lines of carriage motion for six lines per inch or in the last 16 lines of carriage motion for eight lines per inch.

85-131   Ribbon Check

The interface line 'ribbon check' becomes active if the ribbon is not moving or both ribbon reverse switches are made active during the time that the ribbon should be moving.

85-133   Data Parity Check

The data parity check indicates that the printer unit has
sensed even parity on the hammer address bus out
during print time. This check is also known as the
hammer bus out parity check.

85-135   Cable Interlock Check

A cable interlock check condition is recorded when any
interface cable or the cable to the printer operator
control panel is not connected correctly.

85-137   Printer Power Check

This counter indicates how many times the printer lost
power.

85-200   ERROR HISTORY TABLE
SAMPLE FOR 5211

```
                    ERROR HISTORY TABLE FOR LINE PRINTER
              STATUS BYTES                          DATE            TIME
        ............. HEX ..............           YY/MM/DD        HH:MM:SS
        02    00    00    10    00    00           77/04/13        11:13:06
        02    00    00    10    00    00           77/04/13        00:00:09
```

```
         Y     Y     Y     Y     Y     Y
         |     |     |     |     |     | 85-211
         |     |     |     |     | 85-209  |
         |     |     |     | 85-207  |     Printer Status Byte 5
         |     |     | 85-205  |     Printer Status Byte 4
         |     | 85-203  |     Printer Status Byte 3
         | 85-201  |     Printer Status Byte 2
    85-201 |     Printer Status Byte 1
         |     Printer Status Byte 1
    Printer Status Byte 0
```

85-201   Status Byte 0 (With Unit Check On)

When a controller unit check (byte 0, bit 0 is on) occurs, status bytes 1 through 5 are all zeros and bits 1 through 7 of byte 0 have the following meanings:

Bit	Meaning
0	Must be on for bits 1 through 7 to have the following meanings. If this bit is off, see paragraph 85-202.
1	Not used
2,3	Both off = time-out error, either or both on = hardware parity check
4	Not used
5,6	Card jumper status bits. Bit on = no jumper installed, bit off = jumper is in place 00 = Test Level (New cards come with both speed jumpers on.) 01 = 300 lines per minute 10 = Not used 11 = 160 lines per minute
7	CE switches sense bit. Bit on = one or more switches is on

85-202   Status Byte 0 (With Unit Check Off)

When byte 0 bit 0 is not on, the status bytes have the following bit meanings:

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	Controller unit check (If this bit is on, see paragraph 85-201.)	2	8501
1	Unprintable character	16	----
2	Hammer echo check	9	8507
3	Not ready	28	----
4	Belt sync check	13	8503
5	Belt speed check	15	8003
6	Belt up to speed check	14	8503
7	Any hammer on check	5	8507

85-203   Status Byte 1

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	End of forms	22	----
1	Forms jam check	11	8505
2	Throat open	23	----
3	Printer busy too often check	24	8509
4	Printer busy too long check	25	8509
5	Ribbon check	26	8509
6	Cable interlock check	3	8511
7	Data parity check (hammer bus out parity)	27	8511

85-205   Status Byte 2

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	Printer not powered up	7	----
1	Data transfer check	17	8501
2	Data stream reject	19	----
3	Spare		
4	Invalid SCS parameter	21	----
5	Invalid SCS command	20	----
6	Invalid IOB	18	----
7	Printer power check	4	8501

Notes:
1. If more than one error is indicated, find the cause of the highest priority (lowest numbers) first.
2. When no MAP number is indicated, the bit meaning is either:
   a. Self-explanatory (throat open or end of forms)
   b. Information for the user (8 lines per inch or speed = 300 lines per minute)
   c. A program error (invalid IOB, invalid SCS parameter or invalid SCS command)

85-207   Status Byte 3

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	CE switch on	6	----
1	8 lines per inch selected		----
2,3	Printer speed		----
	00 = 160 lines per minute		
	01 = 300 lines per minute		
4	Fire tier check	8	8503
5	Print subscan emitter check	12	8503
6	Carriage check 2 (speed check)	10	8505
7	Carriage check 1 (sync check)	10	8505

Notes:
1. If more than one error is indicated, find the cause of the highest priority (lowest numbers) first.
2. When no MAP number is indicated, the bit meaning is either:
   a. Self-explanatory (throat open or end of forms)
   b. Information for the user (8 lines per inch or speed = 300 lines per minute)
   c. A program error (invalid IOB, invalid SCS parameter or invalid SCS command)

85-209   Status Byte 4

If a hammer echo check (byte 0, bit 2) is on, status byte 4 contains the number (in hexadecimal) of the first failing hammer. Status byte 4 has the highest test priority.

85-211   Status Byte 5

This byte contains the total number (in hexadecimal) of failing hammers when a hammer echo check is sensed.

85-300   PRINTER CONSOLE ERROR LIGHTS DECODE FOR 5211

	Console Lights			Check
Check	Interlock	Forms	Ready	Condition
1	0	0	0	Printer check
1	0	1	0	Carriage check
0	1	0	0	Throat or belt cover open
0	0	1	0	End of forms
0	0	0	0	Not ready
0	0	0	1	If printer error is indicated on the system console, program check

Note: The only console light that remains on is the Ready light. The other lights flash.

85-400   PRINTER ERROR RECOVERY PROCEDURES FOR 5211

See the *IBM System/34 Operator's Guide*, SC21-5158 or the *5211 Printer Models 1 and 2 Component Description and Operator's Guide*, GA24-3658, or both.

85-550   I/O COUNTER TABLE
SAMPLE FOR 3262

```
            I/O COUNTER TABLE FOR LINE PRINTER

        DATE CREATED              00/00/00
        NONRESETTABLE LINE COUNT     25634

        DATE LAST RESET           00/00/00
        RESETTABLE LINE COUNT        25634
```

85-600   ERROR COUNTER TABLE
SAMPLE FOR 3262

```
ERROR COUNTER TABLE FOR LINE PRINTER              DATE LAST RESET 00/00/00
                                                         DESCRIPTION MAP

        PRINTER CONTROLLER UNIT CHECKS . .    55   85-601      8551
        DATA TRANSFER CHECKS . . . . . . .     1   85-603      8551
        FIRE TIER CHECKS . . . . . . . . .     5   85-605      8553
        PRINT SUBSCAN EMITTER CHECKS . . .     0   85-607      8553
        ANY HAMMER ON CHECKS . . . . . . .     3   85-609      8557
        HAMMER ECHO CHECKS . . . . . . . .    12   85-611      8557
        BELT SYNC CHECKS . . . . . . . . .     3   86-613      8553
        BELT SPEED CHECKS  . . . . . . . .     0   85-615      8553
        BELT UP TO SPEED CHECKS  . . . . .     0   85-617      8553
        PRINTER BUSY TOO LONG CHECKS . . .     0   85-612      8559
        CARRIAGE PEDESTAL CHECKS . . . . .    19   85-622      8555
        CARRIAGE CHECK 1 . . . . . . . . .     1   85-623      8555
        CARRIAGE CHECK 3 . . . . . . . . .     0   85-623      8555
        CARRIAGE CHECK 4 . . . . . . . . .     2   85-625      8555
        FORMS JAM CHECKS . . . . . . . . .    35   85-629      8555
        RIBBON CHECKS  . . . . . . . . . .     3   85-631      8559
        DATA PARITY CHECKS . . . . . . . .    24   85-633      8561
        CABLE INTERLOCK CHECKS . . . . . .     3   85-635      8561
        THERMAL CHECK 1  . . . . . . . . .     0   85-636      8563
        THERMAL CHECK 2  . . . . . . . . .     0   85-637      8563
        PRINTER NOT POWERED ON . . . . . .     8   85-369      8551
```

85

85-601　Printer Controller Unit Check

Printer controller unit checks are either caused by a
hardware error or a program loop time-out.

85-603　Data Transfer Check

Byte transfer count did not match. While moving data
from the system to the printer controller, a byte was lost
or an extra byte was sensed.

85-605　Fire Tier Check

Either the 'fire tier' lines were not in a valid condition
during 'not print time' or the lines were not in correct
sequence during print optioning.

85-607　Print Subscan Emitter Check

An expected transition in the PSS (print subscan) emitter
failed to occur.

85-609　Any Hammer On Check

The 'hammer echo return' interface line goes active
during 'not print time'.

85-611　Hammer Echo Check

If a hammer-on-echo condition is sensed when the
hammer should be off or a hammer-on-echo condition is
not sensed when a hammer should be on. The first
failing hammer position and the number of additional
failing hammer positions are logged in the error history
table (status bytes 4 and 5).

85-613　Belt Sync Check

The 'home' pulse occurred when not expected or the
'home' pulse did not occur when expected. For
example, a belt sync check is sensed if a 48-character
belt is installed but a 64-character belt is needed.

85-615　Belt Speed Check

The 'belt up to speed' interface line goes not active
while the 'belt go' interface line is active.

85-617　Belt Up To Speed Check

The belt did not reach running speed in 4.5 seconds
after being turned on.

85-621　Printer Busy Too Long Check

The 'printer busy' signal was active for more than 3
seconds during a print operation.

85-622　Carriage Pedestal Check

This check indicates a short circuit in the carriage
pedestal driver was sensed.

85-623　Carriage Check 1 (Sync)

This check indicates the third (last) carriage advance
pulse after the drop of 'carriage go' was not received by
controller in 10 ms (± 1/2 ms).

85-624　Carriage Check 3 (Speed)

This check indicates that on a carriage skip beyond one
line, any five consecutive 'carriage advance' pulses were
not received inside of 2.7 ms (+ 0, - .7 ms) to 6.6 ms
(+ .6, - 0 ms) while 'carriage go' was active.

85-625　Carriage Check 4 (Acceleration)

This check indicates that the first three 'carriage
advance' pulses after 'carriage go' was activated were
not received in 6.0 ms (± .3 ms).

85-629　Forms Jam Check

The 'forms pulses' interface line has not been sensed in
the last 12 lines of carriage motion for six lines per inch
or in the last 16 lines of carriage motion for eight lines
per inch.

85-631   Ribbon Check

The 'ribbon check' interface line becomes active if the ribbon is not moving or both ribbon reverse switches are made active during the time that the ribbon should be moving.

85-633   Data Parity Check

The data parity check indicates that the printer unit has sensed even parity on the hammer address bus out during print time. This check is also known as the hammer bus out parity check.

85-635   Cable Interlock Check

A cable interlock check condition is recorded when any interface cable or the cable to the printer operator control panel is not connected correctly.

85-636   Thermal Check 1

This check indicates that a thermal switch opened in the printer belt motor, hammer unit blower, or hammer unit.

85-637   Thermal Check 2

This check indicates that a thermal switch opened in the printer power supply or that a circuit breaker has been tripped because of over current.

85-639   Printer Not Powered On

This counter indicates how many attempts the system made to use the printer but the printer was not powered on.

85

85-700　ERROR HISTORY TABLE SAMPLE FOR 3262

```
                ERROR HISTORY TABLE FOR LINE PRINTER
          STATUS BYTES                     DATE         TIME
   ............. HEX .............          YY/MM/DD     HH:MM:SS
   02    00    00    10    00    00         77/04/13     11:13:06
   02    00    00    10    00    00         77/04/13     00:00:09
```

```
    ‿     ‿      ‿      ‿       ‿       ‿
    |     |      |      |       |        85-711
    |     |      |      |       85-709   |
    |     |      |      85-707  |        Printer Status Byte 5
    |     |      85-705 |       Printer Status Byte 4
    |     85-703 |      Printer Status Byte 3
    |     |      Printer Status Byte 2
    85-701 |    
    |     Printer Status Byte 1
Printer Status Byte 0
```

85-701　Status Byte 0 (With Unit Check On)

When a controller unit check (byte 0, bit 0 is on) occurs, status bytes 1 through 5 are all zeros and bits 1 through 7 of byte 0 have the following meanings:

Bit	Meaning
0	Must be on for bits 1 through 7 to have the following meanings. (If this bit is off, see paragraph 85-702.)
1	Not used
2,3	Both off = time-out error, either or both on = hardware parity check
4	Not used
5,6	Card jumper status bits. Bit on = no jumper installed, bit off = jumper is in place
	00 = ⎫
	01 = ⎬ Jumpers are not correctly placed on adapter card
	10 = ⎭
	11 = 650 lines per minute
7	Not used

85-702　Status Byte 0 (With Unit Check Off)

When byte 0 bit 0 is not on, the status bytes have the following bit meanings:

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	Controller unit check (If this bit is on, see paragraph 85-701)	2	8551
1	Unprintable character	17	----
2	Hammer echo check	19	8557
3	Not ready	28	----
4,5	Belt check	15	8553
	01 = Belt up to speed check	15	8553
	10 = Belt sync check	14	8553
	11 = Belt speed check	16	8553
6	Thermal check 1	4	8563
7	Any hammer on check	6	8557

Notes:
1. If more than one error is indicated, find the cause of the highest priority (lowest numbers) first.
2. When no MAP number is indicated, the bit meaning is either:
   a. Self-explanatory (throat open or end of forms)
   b. Information for the user (8 lines per inch or speed = 650 lines per minute
   c. A program error (invalid IOB, invalid SCS parameter or invalid SCS command)

85-703   Status Byte 1

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	End of forms	23	----
1	Forms jam check	12	8555
2	Throat open	24	----
3	Thermal check 2	4	
4	Printer busy too long check	25	8559
5	Ribbon check	26	8559
6	Cable interlock check	3	8561
7	Data parity check (hammer bus out parity)	27	8561

85-705   Status Byte 2

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	Printer not powered up	5	----
1	Data transfer check	18	8551
2	Data stream reject	20	----
3	Spare		
4	Invalid SCS parameter	22	----
5	Invalid SCS command	21	----
6	Invalid IOB	19	----
7	Carriage Pedestal check	10	8555

85-707   Status Byte 3

Bit	Meaning	Priority (Note 1)	MAP (Note 2)
0	CE switch on	7	----
1	8 lines per inch selected		----
2,3	Printer speed 11 = 650 lines per minute		----
4	Fire tier check	8	8553
5	Print subscan emitter check	13	8553
6,7	Carriage check 01 = Carriage check 1 (sync check) 10 = Carriage check 3 (speed check) 11 = Carriage check 4 (acceleration check)	11	8555

Notes:
1. If more than one error is indicated, find the cause of the highest priority (lowest numbers) first.
2. When no MAP number is indicated, the bit meaning is either:
   a. Self-explanatory (throat open or end of forms)
   b. Information for the user (8 lines per inch or speed = 650 lines per minute
   c. A program error (invalid IOB, invalid SCS parameter or invalid SCS command)

85-709   Status Byte 4

If a hammer echo check (byte 0, bit 2) is on, status byte 4 contains the number (in hexadecimal) of the first failing hammer. Status byte 4 has the highest test priority.

85-711   Status Byte 5

This byte contains the total number (in hexadecimal) of failing hammers when a hammer echo check is sensed.

85

85-800   PRINTER CONSOLE ERROR LIGHTS
**   DECODE FOR 3262**

Check	Console Lights Interlock	Forms	Ready	Power	Check Condition
1	0	0	0	1	Printer check
1	0	1	0	1	Carriage check
0	1	0	0	1	Throat or belt cover open
0	0	1	0	1	End of forms
0	0	0	0	1	Not ready
0	0	0	1	1	If printer error is indicated on the system console, program check
0	0	0	0	0	Power off

Note: The only console light that remains on is the Ready light. The other lights flash.

85-900   PRINTER ERROR RECOVERY
**   PROCEDURES FOR 3262**

See the *IBM System/34 Operator's Guide,* SC21-5158.

CONTENTS

86

86-010   HOW TO USE THE WORK STATION
CONTROLLER ERROR INFORMATION

The work station controller error information is used to
determine the cause of failures in the work station
controller. It is possible to use the work station
controller error history tables only for intermittent
problems. The display of the error recording analysis
procedure program needs a working work station
controller.

Run the error recording analysis procedure for the work
station controller and look at the error information that
has been recorded. If a pattern is observed from the
information displayed, go to MAP 8600 for aid in
correcting the problem. If you see no pattern, go to
paragraph 86-200 for a general description of what the
recorded information means.

86-100   ERROR COUNTER TABLE SAMPLE

```
ERROR COUNTER TABLE FOR WORK STATION CONTROLLER        DATE LAST RESET 09/09/77
                                                                DESCRIPTION  MAP
                    WSC DBO/DBI PARITY CHECKS ......     0      86-260       8600
                    WSC STORAGE PARITY CHECKS ......     0      86-280       8600
```

86-200   ERROR HISTORY TABLE SAMPLE

Only those errors that cause a complete failure of the
work station controller are reported here. These errors
cannot be associated with a work station. For more
errors associated with the controller, see section 87
Display Stations or section 88 *5256 and 5225 Matrix
Printers*.

```
ERROR HISTORY TABLE FOR WORK STATION CONTROLLER
              CON/HOST        WSC RETURN
              STATUS           STATUS          DATE         TIME
              ......... HEX .........       YY/MM/DD     HH:MM:SS
                08                05          77/06/10    11:46:28
                08                02          77/06/10    00:10:46
                0C                00          77/06/10    10:33:32
               \___/             \___/
               86-250            86-250
```

86-250   Sense Bytes—General

Controller/Host Status Byte

Bits	Description	
0-2	Programming errors—displayed, but not logged in ERAP	
3	Work station controller data bus out or data bus in parity check	(86-260)
4	Operation check (Ignore an operation check condition if bit 3 or bit 5 or bit 7 is on)	(86-270)
5	Storage parity check	(86-280)
6	Ignore	
7	Long time-out check	(86-290)

WSC Return Status Byte   Description

WSC Return Status Byte	Description
00	Check first byte for bits 3, 5 or 7.
01	A time-out occurred in one of the serial interface subroutines while sending a frame to a work station.
02	A time-out occurred on a cycle steal.
03, 04	Not assigned.
05	No internal microcode interrupts have occurred in 30 ms.

86-260   WSC Data Bus Out or Data Bus In Parity Check

A parity error was sensed on the work station controller data bus out or data bus in. The controller is stopped and the system is informed of the problem. The system console indicates a console check after the error is recorded and all display stations go blank.

86-270   Operation Check

If bit 3, 5, or 7 is on, ignore an Operation Check condition. A hardware failure was sensed by the work station controller microcode. The second byte in the error log entry contains a code which specifies the reason for the operation check.

WSC Return Status Byte   Description

WSC Return Status Byte	Description
00	Check first byte for bits 3, 5, or 7.
01	A time-out occurred in one of the serial interface subroutines while sending a frame to a work station.
02	A time-out occurred on a cycle steal.
03, 04	Not assigned.
05	No internal microcode interrupts have occurred in 30 ms.

86-280   WSC Storage Parity Check

A parity check was sensed on the controller storage bus out.

86-290   Long Time-out

The work station controller microcode failed to reset the timer in 7 seconds. This is a general indicator of a work station controller microcode problem.

86

4

CONTENTS

87

87-010   HOW TO USE DISPLAY STATION ERROR INFORMATION

Use the display station error information to determine
the cause of failure in the display station or work station
controller. Use these tables for correcting intermittent or
solid problems with the device or controller or both.
Run the error recording analysis procedure for the work
station controller and look at the error information that
has been recorded. If you observe a pattern from the
information displayed, go to MAP 8700 for aid in
correcting the problem. If you see no pattern, go to
paragraph 87-200 for a general description of what the
recorded information means.

87-050   I/O COUNTER TABLE SAMPLE

```
I/O COUNTER TABLE FOR DISPLAY STATION        W1/  C000

        DATE LAST RESET            78/02/12

        NUMBER OF SVCS                63597



I/O COUNTER TABLE FOR DISPLAY STATION        W2/  C010

        DATE LAST RESET            00/00/00

        NUMBER OF SVCS                  715
```

87-100   ERROR COUNTER TABLE SAMPLE

```
ERROR COUNTER TABLE FOR DISPLAY STATION          W1/   C000 DATE LAST RESET 00/00/00
                                                             DESCRIPTION      MAP
                     RECEIVE PARITY CHECKS ..........      0    87-380
                     LINE PARITY CHECKS .............      0    87-420


ERROR COUNTER TABLE FOR DISPLAY STATION          W2/   C010 DATE LAST RESET 00/00/00
                                                             DESCRIPTION      MAP
                     RECEIVE PARITY CHECKS ..........      0    87-380
                     LINE PARITY CHECKS .............      U    87-420
```

87-200   ERROR HISTORY TABLE SAMPLE

Errors that do not cause complete failure of the work
station controller and can be associated with a specific
work station appear in this log. There are some errors
that are not recorded but are only displayed on the
system console. If these bits are on, they will be
described.

For a description of the error code field, see the *IBM
5251 MAPs and MIM*, SY31-0461.

```
                  ERROR HISTORY TABLE FOR DISPLAY STATION          W1/   C000
ERROR   CONT/HOST        CABLE    STATUS            DEVICE   STATUS
CODE     STATUS          CONT      DEVICE             0         1          DATE        TIME
        ....................... BINARY ......................       YY/MM/DD    HH:MM:SS
0101    0000 0000   0010 0000   0000 0000   0000 0000 0000 0000    77/06/05    13:44:04
0191    0000 0000   0000 0000   1000 0000   0000 0000 0000 0000    77/06/04    20:37:19
0101    0000 0000   0010 0000   0000 0000   0000 0000 0000 0000    77/06/04    19:51:22
```



```
                                                                        87-250
                                                                          |
                                                          87-240     Device Status 1
                                                            |
                                            87-230     Device Status 0
                                              |
                            87-220     Device/Cable Status Byte
                              |
            87-210     Controller/Cable Status Byte
              |
Controller/Host Status Byte
```

87
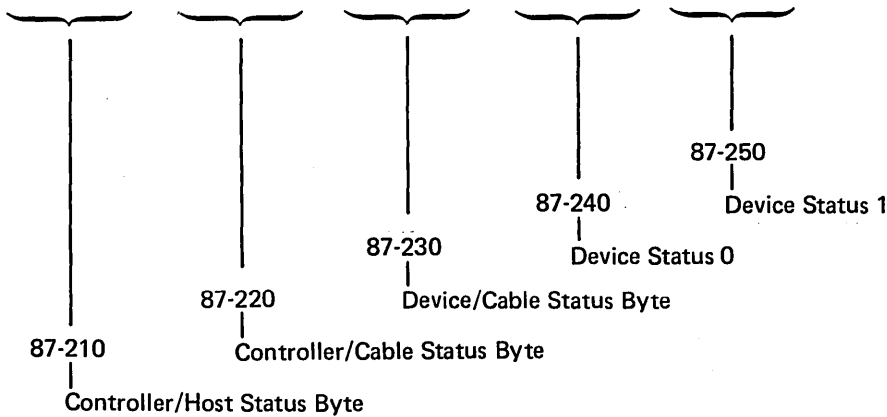
```
                  ERROR HISTORY TABLE FOR DISPLAY STATION          W2/   C010
ERROR   CONT/HOST        CABLE   STATUS            DEVICE   STATUS
CODE     STATUS          CONT     DEVICE             0         1          DATE        TIME
        ....................... BINARY ......................       YY/MM/DD    HH:MM:SS
```

87-210 Controller/Host Status Byte

Bit   **Description**

0	Data stream reject (not recorded)	(87-310)
1	Work station control field error (not recorded) .	(87-320)
2	Resources temporarily not available (not recorded)	(87-330)
3	Work station controller data bus out or data bus in parity check	(87-340)
4	Operation check	(87-340)
5	Work station controller storage parity check	(87-340)
6	Ignore	
7	Long time-out	(87-340)

87-220 Controller/Cable Status Byte

Bit   **Description**

0	Screen format error (not recorded)	(87-350)
1	No response time-out	(87-360)
2	Transmit activity check	(87-370)
3	Activate command failure	(87-375)
4	Receive parity check	(87-380)
5	Receive length check	(87-390)
6	Ignore	
7	Even/odd time-out	(87-400)

87-230 Device/Cable Status Byte

Bit   **Description**

0	Work station busy	(87-410)
1	Device line parity check	(87-420)
2	Ignore	
3	Outstanding status (not an error)	(87-420)
4,5,6	Exception conditions	(87-420)
7	Even/odd response indicator (not an error)	(87-420)

87-240 Device Status 0

More than one purpose	(87-440)

87-250 Device Status 1

Bit   **Description**

0,1,2,3	Scan code	(87-450)
4	Master modified data tag	(87-460)
5,6,7	Not assigned	

87-310 Data Stream Reject

This error is not recorded so the cause of this input into the logs is some other bit that may be on.

If this bit is on it may give more information about the problem. Device status byte 0 contains more information on this error.

Data Stream Reject

Device Status Byte 0

Code   **Description**

01	Premature end of data stream.
02	Row or column address not valid for set buffer address, insert cursor, or repeat to address end. Orders: −Row = 0 or > 24 (12) −Column = 0 or > 80
03	Repeat-to-address end address is less than present address counter.
04	Escape character missing or invalid command code.
05	Field length specified was zero.
06	Input field specified out of sequence.
07	Invalid Restore command data (Restore data sent to wrong device.)
08	Input field was past end of screen.
09	Format table overflow
0A	Data written past end of screen.
0B	Start of Header Byte count is not equal to 3.
0C	Roll command parameter error: −Roll size = 0 −Top line = 0 −Bottom line > 24 (12) −Roll size > bottom line minus top line −Top line > = bottom line
0D	Too many field control words specified for input field.
0E, 0F	Not assigned.

87-320   Work Station Control Field Error Information

This error is not recorded so the cause of this input into the logs is some other bit that may be on.

If this bit is on it may give more information about the problem. Device status byte 0 contains more information on this error.

Work Station Control Field Error

Device Status Byte 0

Code	Description
01	Command modifier not valid in work station control field.
02	Byte count not valid in work station control field.
03	Device address not found in system parameter list.
04	-Byte count decreased past zero on Data Transmit. -Byte count is not zero after read input field command executed. -Read Input Field sent to work station with no format table.
05-0F	Not assigned.

87-330   Resources Temporarily Not Available

Device Status Byte 0

Code	Description
01	Not used.
02	Work station specified as not operational by work station controller (hung busy, response not valid to poll).
03	Device offline (not in session).
04	Not used.
05	Display in operator error mode.
06	Keyboard not locked on Read Command.
07	Terminal not powered on.
08	Not used.
09	-Save or Restore Screen command is not preceded by Save or Restore Table command. -Commands other than Clear Unit, Save/Restore Table, Save or Restore Screen are sent after Save or Restore Table is executed.
0A-0F	Not assigned.

87-350   Screen Format Error Information

Screen Format Error

Device Status Byte 0

Code	Description
01	Read Input Fields command sensed one of the following: -Field was 0 bytes in length -Field has no ending attribute -Signed numeric field was 1 byte in length -Field was > 80 characters when specified, but < 80 characters when read -Field was = < 80 characters when specified, but > 80 characters when read
02	Resequence error in format table -Resequence number = 0 -Resequence number specified a field larger than number of fields on screen
03	Check digit processing sensed errors -Field > 32 characters long
04-0F	Not assigned

87-360   No Response Time-Out (Not Recorded)

A work station that was powered on and Mode Set stopped responding to poll commands. The attempts to try again were completed before the error was reported.

87-370   Transmit Activity Check

The poll of this work station failed in one of the following ways:

1. Failed to go out the line driver or,

2. The checking circuit failed.

Communication with the work station is not possible until this condition is fixed.

87-375   Activate Command Failure

Activate commands are used to move large amounts of data to and from terminals. Activate command failures are caused by a noisy line or a terminal failure.

87-380   Receive Parity Check

The work station response to the poll command was found to have a parity check after all attempts to try again were completed.

87-390   Receive Length Check

The work station responded to a poll or a read activate command with data of a wrong length.

87-400   Even/Odd Time-Out

The work station has not switched response levels in 450 milliseconds.

87-410   Work Station Busy

The work station has taken too long to process a command sent by the work station controller.

87-420   Work Station Response Conditions

See the definition of these bits in the *Data Areas and Diagnostic Aids Manual*, LY21-0049, or in the publication for the terminal.

87-440   Device Status 0

Device status 0 has more than one purpose; if data stream reject, work station control field error, resources temporarily not available, or screen format error is on, it will give more information for each of these. See each error for these specifications.

Other meanings for this byte are specified by values in the device code of device status byte 1 (see 87-450).

87-450   Device Status 1

Used to specify meaning of device status 0.

X '2X'   Scan code not valid (device status 0 contains the invalid code)
X 'X8'   Master modify data tag bit on

87-460   Master Modified Data Tag

This in not necessarily an error. Indicates that one or more of the fields on the display station was changed from the keyboard.

6   87-375

CONTENTS

88

88-010   HOW TO USE 5256 AND 5225 PRINTER
ERROR INFORMATION

The work station printer error information is used to determine the cause of failure in the printer or work station controller. These tables may be used for correction of intermittent or solid problems with the device or controller, or both.

Run the error recording analysis procedure for the work station controller and look at the error information that was recorded. If you observe a pattern from the information displayed, go to MAP 8800 for aid in correcting the problem. If you see no pattern, go to paragraph 86-200 for a general description of what the recorded information means.

88-050   I/O COUNTER TABLE SAMPLE

```
I/O COUNTER TABLE FOR MATRIX PRINTER   P2/   CO30

        DATE LAST RESET           78/02/12
        NUMBER OF SVCS                 846
```

88-100   ERROR COUNTER TABLE SAMPLE

```
ERROR COUNTER TABLE FOR MATRIX PRINTER P2/   CO30          DATE LAST RESET 00/00/00
                                                               DESCRIPTION        MAP
                    RECEIVE PARITY CHECKS ..........    0      88-370
                    LINE PARITY CHECK ..............    0      88-400
```

88-200   ERROR HISTORY TABLE SAMPLE

Errors that do not cause complete failure of the work
station controller and can be associated with a specific
work station appear in this log. There are some errors
that are not recorded but are only displayed on the
system console. If these bits are on, they will be
described.

For a description of the error code field, see the *IBM
5256 MAPs and MIM, SY31-0462, or the IBM 5225
MAPs and MIM, SY34-0060.*

```
                 ERROR HISTORY TABLE FOR MATRIX PRINTER P2/   CO30
ERROR CONT/HOST     CABLE   STATUS           DEVICE   STATUS
CODE    STATUS      CONT    DEVICE              0        1          DATE        TIME
      .......................... BINARY  .....................   YY/MM/DD   HH:MM:SS
0238  0000 0000   0000 0000  0000 0001   0000 0000   0000 0001   77/04/18   22:23:19
0238  0000 0000   0000 0000  0000 0001   0000 0000   0000 0001   77/04/18   22:22:53
0238  0000 0000   0000 0000  0000 0001   0000 0000   0000 0001   77/04/18   16:20:39
0238  0000 0000   0000 0000  0000 0000   0000 0000   0000 0001   77/04/18   10:08:20
```

88-250 and 88-260

88-240   Device Status 1

88-230   Device Status 0

88-220   Device/Cable Status Byte

88-210   Controller/Cable Status Byte

Controller/Host Status Byte
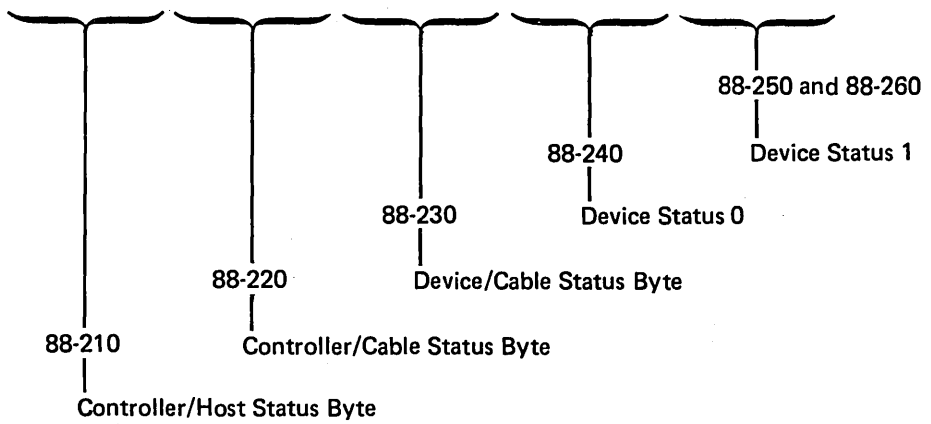
88-210   Controller/Host Status Byte

Bit	Description	
0	Data stream reject (not recorded)	(88-310)
1	Control field error (not recorded)	(88-320)
2	Resources temporarily not available (not recorded)	(88-330)
3	Work station controller, data bus out, data bus in parity check	(88-340)
4	Operation check	(88-340)
5	Work station controller storage parity check	(88-340)
6	Ignore	
7	Long time-out	(88-340)

88-220   Controller/Cable Status Byte

Bit	Description	
0	Not logged	
1	No response time-out	(88-350)
2	Transmit activity check	(88-360)
3	Activate command failure	(88-365)
4	Receive parity check	(88-370)
5	Receive length check	(88-380)
6	Ignore	
7	Even/odd time-out	(88-390)

88-230   Device/Cable Status Byte

Bit	Description	
0	Station busy	(87-395)
1	Device line parity check	(88-400)
2	Unit not available	(88-410)
3	Outstanding status (not an error)	(88-400)
4,5,6	Exception conditions	(88-400)
7	Even/odd response indicator (not an error)	(88-400)

88-240   Device Status 0

Bit	Description	
0	SCS (SNA character string) command not valid	(88-420)
1	SCS (SNA character string) parameter not valid	(88-430)
2	Buffer full (not logged)	(88-432)
3	Print complete (not logged)	(88-434)
4	Cancel (not logged)	(88-436)
5	Printer not ready (5256 only)	(88-440)
6	End of forms	(88-450)
7	Unprintable character	(88-460)

88-250   Device Status 1 (5256)

Bit	Description	
0	Wire check	(88-470)
1	Slow speed check	(88-480)
2	Fast speed check	(88-490)
3	Emitter sequence check	(88-500)
4	No emitters	(88-510)
5	Overrun check	(88-520)
6	Forms stopped	(88-530)
7	Forms position check	(88-540)

4

88-260   Device Status 1 (5225)

Value		Description	
0001	0001	Printer processor check	(88-550)
0011	0001	Control/sense card check	(88-560)
0011	0010	Servo power amp check	(88-570)
0011	0100	Servo amp card, servo power amp, or actuator carrier motor check	(88-580)
0011	0101	Actuator carrier motor overcurrent	(88-590)
0011	0110	Actuator carrier emitters check	(88-600)
0011	1000	Actuator carrier speed check	(88-610)
0011	1001	Undetermined	(88-620)
0100	0001	Control/sense card check	(88-630)
0100	0010	Servo power amp check	(88-640)
0100	0011	Servo amp card, servo power amp, or forms motor check	(88-650)
0100	0101	Forms overcurrent	(88-660)
0100	0110	Forms emitters check	(88-670)
0100	1000	Forms speed check	(88-680)
1000	0001	High voltage check	(88-690)
1000	0011	Dot image generator check	(88-700)
1000	0100	Wire latch card check	(88-710)
1000	0101	Pedestal check	(88-720)
1000	0110	Actuator group jumpers check	(88-730)
1000	0111	Timer check	(88-740)
1000	1000	Ribbon jam	(88-745)
1000	1001	Ribbon card check	(88-750)

88-310   Data Stream Reject

This error is not recorded so the cause of this input into the logs is some other bit that may be on.

88-320   Work Station Control Field Error Information

This error is not recorded so the cause of this input into the logs is some other bit that may be on.

If this bit is on, it may give more information about the problem. Device status byte 0 contains more information on this error.

Device Status Byte 0

Code	Description
01	Command modifier not valid in work station control field
02	Byte count not valid in work station control field
03	Device address not found in work station parameter list
04	Reserved for work stations
05-0F	Not assigned

88-330   Resources Temporarily Not Available

Device Status Byte 0

Code	Description
01	Data stream sent to printer and printer buffer is not available.
02	Work station specified as not operational by work station controller (hung busy, response not valid to poll).
03	Device offline (not in session).
04	Printer needs initialization data.
05-0F	Not used.

88-350   No Response Time-Out

A work station that was powered on and Mode Set stopped responding to poll commands. All attempts to receive were completed before the error was reported.

88

88-360   Transmit Activity Check

The poll of this work station either failed to go out the line driver or the checking circuit failed.

Communications with the terminal are not possible until this condition is fixed.

88-365   Activate Command Failure

Activate commands are used to move large amounts of data to and from terminals. An activate command failure is caused by a noisy line or a terminal failure.

88-370   Receive Parity Check

The work station response to the poll command was found to have a parity check after all attempts to receive were completed.

88-380   Receive Length Check

The work station has responded to a poll or a read activate command with data of the wrong length.

88-390   Even/Odd Time-Out

The terminal has not switched response levels in 8 seconds.

88-395   Station Busy

The station has taken too long to process a command sent by the work station controller.

88-400   Line Parity Check

A parity check has been sensed at the printer.

88-410   Unit Not Available

Indicates that the 5225 or 5256 Printer is not ready (solid error or Stop key).

**88-420   SCS (SNA Character String)
              Command Not Valid**

Programming error—user program output data stream.

**88-430   SCS (SNA Character String)
              Parameter Not Valid**

Programming error—user program output data stream.

88-432   Buffer Full

Both print buffers are full.

88-434   Print Complete

Both print buffers and the line image buffer are empty.

88-436   Cancel

The Cancel key on the printer has been pressed.

88-440   Printer Not Ready (5256 Only)

Power is over or under voltage.

88-450   End of Forms

The printer is out of paper.

88-460   Unprintable Character

A character (which cannot be printed) in the data stream may or may not stop printing because of the option set in the data stream at the printer.

88-470   Wire Check

The wire driver was on too long.

88-480   Slow Speed Check

The print head moved too slowly.

88-490   Fast Speed Check

The print head moved too quickly.

88-500   Emitter Sequence Check

The controller did not sense an emitter pulse.

88-510   No Emitters

The head stopped.

88-520   Overrun Check

Emitter pulses were quicker than the controller could handle them.

88-530   Forms Stopped

Forms jammed.

88-540   Forms Position Check

Forms moved, but not under control of the printer.

88-550   Printer Processor Check

The control processor in the printer is not operational.

88-560   Control/Sense Card Check

An error was sensed in the printer control and sense card when the actuator carrier was moved.

88-570   Servo Power Amp Check

An error was sensed in the printer servo card when the actuator carrier was moved.

88-580   Servo Amp Card, Servo Power Amp, or Actuator Carrier Motor Check

An error was sensed in the servo amp card, the servo power amp, or in the actuator carrier motor in the printer.

88-590   Actuator Carrier Motor Overcurrent

Too much current was sensed in the printer actuator carrier motor.

88-600   Actuator Carrier Emitters Check

One or more actuator carrier emitters were not sensed.

88-610   Actuator Carrier Speed Check

The speed of the actuator carrier was either too quick or too slow.

88-620   Undetermined

An error was sensed while the actuator carrier was moving. (The source of the error is not known.)

88-630   Control/Sense Card Check

An error was sensed in the printer control and sense card while the forms were moving.

88-640   Servo Power Amp Check

An error was sensed in the printer servo card while the forms were moving.

88-650   Servo Amp Card, Servo Power Amp, or Forms Motor Check

An error was sensed in the servo amp card, the servo power amp, or the forms motor in the printer.

·88

88-660   **Forms Overcurrent**

Too much current was sensed in the printer forms
motor.

88-670   **Forms Emitter Check**

One or more forms emitters were not sensed.

88-680   **Forms Speed Check**

The speed of the printer forms was either too quick or
too slow.

88-690   **High Voltage Check**

The high voltage in the printer was not in tolerance.

88-700   **Dot Image Generator Check**

An error was sensed in the printer dot image generator
card.

88-710   **Wire Latch Card Check**

An error was sensed in the printer wire latch card.

88-720   **Pedestal Check**

An error was sensed in the printer wire latch card.

88-730 **Actuator Group Jumpers Check**

A wrong actuator group jumper configuration was
sensed.

88-740   **Timer Check**

An error was sensed in the printer timer.

88-745   **Ribbon Jam**

Either the print ribbon jammed or an error occurred in
the print ribbon card.

88-750   **Ribbon Card Check**

An error was sensed in the print ribbon card.

CONTENTS

89

89-010   INTRODUCTION

If your customer is using the MRJE (MULTI-LEAVING
remote job entry) program, it will add one to the data
communications I/O counter each time MRJE uses an
I/O operation. If an MRJE error occurs, a value of one
is added to the suitable data communications error
counter. However, MRJE errors do not add to the data
communications error history table.

89-050   I/O COUNTER TABLE FOR BSC

```
I/O COUNTER TABLE FOR BSC LINE    1 (2, 3, OR 4)

DATE LAST RESET                           78/02/12

                                CURRENT      HISTORY
TEXT BLOCKS TRANSMITTED ......      0            0
TEXT BLOCKS RECEIVED .........      0            0
```

89-100   ERROR HISTORY TABLE FOR BSC

```
ERROR HISTORY TABLE FOR BSC LINE 1 (2, 3, OR 4)
COMMAND   COMMAND   SENSE      RETRY    COMPLETION  TERMINAL
 CODE      MDR      BYTE       COUNT       CODE     ADDRESS     DATE       TIME
............................. HEX ........................... YY/MM/DD   HH MM SS
  84        00       00        0E          56        0000     77/08/22   13:41:18

89-110     89-120    89-130    89-140     89-150     89-160
```

89-110   Command Code

Bits	Meaning
0-3	Attachment address (8)
4 5 6 7	
0 0 0 0	Control command (see 89-120)
0 0 1 0	Receive initial delayed command
0 0 1 1	Receive initial command
0 1 0 0	Transmit-receive overlay command (1)
0 1 0 1	Transmit-receive initial command (see 89-120)
0 1 1 0	Transmit-receive command (2) or transmit only command (see 89-120 if MLCA installed)
1 0 0 0	Enable auto monitor (MLCA only)

Notes:
1. The received record will write over the transmit
   buffer.
2. The receive part in the buffer must follow (be next to)
   the transmit part of the buffer.

89-120   Command Modifier

If the command code is hex 80 (control command), the
command modifier is:

    Hex 04 = start 2-second time-out
    Hex 80 = disable command
    Hex C0 = enable command

If the command code is hex 85 (transmit-receive initial),
the command modifier is:

    Hex 00 = monitor mode
    Hex 01 = control mode

If the command code is hex 86 (MLCA only), the
command modifier is:

    Hex 00 = transmit-receive command
    Hex 02 = transmit only command

89-130   Sense Byte

Bit	Meaning
0	Receive time-out
1	Block check
2	Transmit adapter check
3	Receive adapter check
4	Invalid ASCII character
5	Abortive disconnect
6	Data set not ready
7	Receive time-out data mode

89-140   Retry Count

This number is the number of times that this error was attempted before it was written in the log as a permanent error.

89-150   Completion Codes

Code	Meaning	Code	Meaning
21	Operation unsuccessful	36	Data set not ready/connection lost
22	Invalid switched line ID received	4B	Invalid ASCII
23	Data lost-buffer exceeded	4D	Invalid request
24	Abort received	4E	Delay count exceeded
25	Abort disconnect received	4F	Permanent error
26	Delay count exceeded	50	No response
27	Command rejected due to abort request	51	Data check
28	Operation canceled	52	Lost data
31	Unexpected response from remote system	53	Lost connection
32	Data check	54	Invalid response
33	Invalid response received	55	Adapter check
34	Adapter check	56	Forward abort
35	Receive time-out error	57	EOT check

89-160   Terminal Address

This 2-byte field contains the Poll/Address character in hexadecimal.

89-162   ERROR COUNTER TABLE FOR BSC

ERROR COUNTER TABLE FOR BSC LINE 1 (2,3,OR 4)	DATE LAST RESET 31/01/77		
	CURRENT	HISTORY	DESCRIPTION
NEGATIVE ACKNOWLEDGMENTS RECEIVED	0	0	89-164
DATA CHECKS	0	0	89-166
FORWARD ABORTS	0	0	89-168
ABORTS RECEIVED	0	0	89-170
ADAPTER CHECKS DURING TRANSMISSION	0	0	89-172
ADAPTER CHECKS WHILE RECEIVING	0	0	89-174
INVALID RESPONSES RECEIVED	0	0	89-176
*ENQUIRIES RECEIVED AS AFFIRMATIVE ACK ..	0	0	89-178
LOST DATA ERRORS	0	0	89-180
DISCONNECT TIME-OUTS	0	0	89-182
RECEIVE TIME-OUTS	0	0	89-184
*TRANSMISSION TIME-OUTS	0	0	89-186

*MRJE does not update these counters

89-164   Negative Acknowledgments (NAK) Received

NAK (negative acknowledgment) received is a control character that indicates the remote station sensed a transmission control block error.

89-166   Data Checks

The block check character that the local station generated for a message did not match the block check character that was generated and sent by the remote station.

89-168   Forward Aborts

Your station sent an EOT (end of transmission) in response to an NAK (negative acknowledgment) from the remote station.

89-170   Aborts Received

End of transmission (EOT) was sent by the remote station in response to receiving a message test.

89-172   Adapter Checks During Transmission

The adapter did not move a character from main storage to the adapter quick enough for the line speed.

89-174   Adapter Checks While Receiving

The adapter did not move a character from the adapter to main storage quick enough for the line speed.

89-176   Invalid Responses Received

A response from the remote station was not the type of response expected by the local station.

89-178   Enquires Received as Affirmative Acknowledgment (ACK)

This is the number of enquires except those received because of WACKS (wait before transmitting positive acknowledgment).

89-180   Lost Data Errors

The length of a received message is larger than the length of the receive data buffer.

89-182   Disconnect Time-outs

The switched network line was disconnected because no valid transmissions were received in 3.25 seconds or less.

89-184   Receive Time-outs

Another block of data was expected from the remote station. The data was not received in 3.25 seconds or less.

89-186   Transmission Time-outs

No acknowledgment was received from the remote station after a message was sent to it.

89-190   I/O COUNTER TABLE FOR SDLC

```
        I/O COUNTER TABLE FOR SDLC LINE  1 (2,3,OR 4)
        DATE LAST RESET            00/00/00
                                   CURRENT      HISTORY
I-FRAMES TRANSMITTED ...........      0            0
I-FRAMES RETRANSMITTED .........      0            0
I-FRAMES RECEIVED ..............      0            0
TOTAL FRAMES TRANSMITTED .......      0            0
TOTAL FRAMES RECEIVED ..........      0            0
```

89-200   ERROR HISTORY TABLE FOR SDLC

```
ERROR HISTORY TABLE FOR SDLC LINE  1 (2,3,OR 4)
   COMMAND   SENSE   INFORMATION   CONTROL   STATION    LINE Q
    CODE     BYTE 0    BYTE 1       FIELD    ADDRESS    HEADER     DATE       TIME
 ....................... HEX .....................    YY/MM/DD   HH:MM:SS
      82       08        00          04        11         5C      77/06/30   23:11:57
      85       20        00          08        14         5C      77/06/15   12:05:00
    ‿‿‿      ‿‿‿       ‿‿‿         ‿‿‿       ‿‿‿        ‿‿‿
    89-210   89-220    89-230      89-240    89-250     89-260
```

89-210	**Command Code**
Bits	**Meaning**
0-3	Attachment address (8)
4 5 6 7	
0 0 0 0	Control command
	Command modifier
	Hex 80 = disable
	Hex C0 = enable
0 0 1 0	Transmit command (poll/final bit on)
0 0 1 1	Receive initial command only
0 1 0 0	Transmit final command
0 1 0 1	Transmit only command
0 1 1 0	Transmit initial command only
0 1 1 1	Receive delayed command
	MLCA only
1 0 0 0	Start poll receive ready (primary)
1 0 0 1	Start poll receive not ready (primary)
1 1 1 1	Stop poll (primary)
1 1 1 1	Stop auto response (secondary)

89-220	**Sense Byte 0**
Bit	**Meaning**
0	Time-out
	a. If primary station, 16-second nonproductive time-out
	b. If secondary station, 32-second inactivity time-out
1	Frame check (see 89-310)
2	Adapter check (overrun/underrun) (see 89-350)
3	Buffer overrun (receive) (see 89-380)
4	Invalid frame (see 89-320)
5	Lost data set ready (see 89-330)
6	Data set not ready (see 89-390)
7	Primary station idle time-out (see 89-360)

89

89-230   Sense Byte 1

| Sense byte 1 is not used.

89-240   Control Field

Format	Control Field Bit Configuration 0 1 2	3	4 5 6 7	Command/Response Description
I	Nr	P/F	Ns 0	Sequenced Information Frame
S	Nr	P/F	0 0 0 1	Receive Ready
	Nr	P/F	0 1 0 1	Receive Not Ready
NS	0 1 0	P	0 0 1 1	Disconnect
	0 1 0	F	0 0 1 1	Request Disconnect
	0 1 1	F	0 0 1 1	Unnumbered Acknowledge
	1 0 0	P	0 0 1 1	Set Normal Response Mode
	1 1 1	P/F	0 0 1 1	Test
	1 0 0	F	0 1 1 1	Frame Reject
	1 0 1	P/F	1 1 1 1	Exchange Identification
	0 0 0	F	1 1 1 1	Disconnected Mode

Notes:
1. I = information, S = supervisory, and NS = nonsequenced.
2. Nr is the sequence number of the next expected frame.
   Ns is the sequence number of the last frame that was sent.
3. P/F is either the poll bit from the primary station or the
   final bit from the secondary station.
4. If errors occur on receive operations, the control field byte
   may not be valid.

89-250   Station Address

If your System/34 is the primary station, the address in
this field is the address of the secondary station.

If your System/34 is the secondary station, the address
in this field is the address of your station.

89-260   Line Q Header

5C	=	High priority line using device address 80
5E	=	Low priority line using device address 20
60	=	Low priority line using device address 10
62	=	Low priority line using device address 40

89-300 ERROR COUNTER TABLE FOR SDLC

ERROR COUNTER TABLE FOR SDLC LINE 1 (2,3,OR 4)	DATE LAST RESET 00/00/00		
	CURRENT	HISTORY	DESCRIPTION
CRC ERRORS	0	0	89-310
INVALID FRAMES RECEIVED	0	0	89-320
LOST DATA SET READY	0	0	89-330
NONPRODUCTIVE RECEIVE TIME-OUTS.........	0	0	89-340
ADAPTER CHECKS	0	0	89-350
IDLE DETECT TIME-OUTS....................	0	0	89-360
FRAME SEQUENCE ERRORS	0	0	89-370

89-310 CRC Errors

The frame check character that the local station calculated did not match the frame check character that was generated and sent by the remote station.

89-320 Invalid Frames Received

After a start flag is sensed, an invalid frame error is written in the log if:

- A second flag is received in less than 32 bits.

- A flag is received that is not on a byte boundary.

- An abort sequence (11111111) is received.

- An idle sequence (11111111 11111111) is received between starting and ending flags.

- A frame was received that was longer than the length specified in the bind.

89-330 Lost Data Set Ready

On a switched network, the modem was ready and went not ready. Because of this, the 'data set ready' line goes not active and communication is terminated.

89-340 Nonproductive Receive Time-outs

Another frame was expected from the remote station. The frame was not received.

89-350 Adapter Checks (Overrun)

Transmit = no character was loaded into the buffer before it was time to send that character. Receive = A character was received before the preceding character was moved from the buffer.

89-360 Idle Detect Time-outs

The inactivity timer is used by the adapter to prevent long periods (32 seconds) of no activity on switched lines. The timer runs for both switched and nonswitched lines, but the operation terminates on a switched line only at the end of the inactivity time-out period.

89-370 Frame Sequence Errors

The Nr-Ns count received was not as expected.

89-380 Receive Buffer Overrun

A message is longer than the receive buffer length.

89-390 Data Set Not Ready

The modem or adapter is not ready to transmit or receive.

89

89-405   How to Use MLCA Controller Error Information

The controller error information aids in determining the cause of failures of the control processor. These failures may be intermittent failures or solid failures that the MAPs do not find.

Run the error recording analysis procedure for the MLCA controller and look at the error information that has been recorded. If a specific controller check byte and a specific channel check byte have been recorded frequently in the latest entries of the table, suspect an intermittent failure. Go to MAP 8901 to determine the failing field-replaceable unit (FRU).

If there is no frequent pattern associated with the error history information, go to paragraph 89-410 of this maintenance manual for a general description of what the recorded information means. If more detail is desired, a section number is given.

89-410   Error History Table Sample

An example of the controller error history information that is recorded is shown in the following sample printout.

```
        PRESS ENTER TO VIEW NEXT DISPLAY.        ENTER C TO RETURN TO MAIN MENU
ERROR HISTORY TABLE FOR MLCA CONTROLLER
        BYT BYT
PCR IL   0   1    WR0   WR1   WR2   WR3   WR4   WR5   WR6   WR7   MAR   MAB     DATE      TIME
                                    HEX                                        YYMMDD   HHMMSS
22  07  08  00  0000  0000  FFFF  0000  1004  C122  3E51  0000  013C  34BC   800516   123420
22  07  08  00  7FF0  0000  FFFF  3922  1004  0000  3E61  0000  013C  3922   800516   132514
22  07  08  00  62F0  0000  FFFF  0008  1004  A318  3E6D  0000  013C  35B2   800516   132618
22  07  08  00  14F0  0000  FFFF  39F2  1004  336A  3E65  0000  013C  336A   800516   124114
22  07  08  00  7AF0  0000  FFFF  0082  1004  30EF  3E71  0000  013C  350E   800516   123721
22  07  08  00  79F0  0000  FFFF  0082  1004  30ED  3E79  0000  013C  350E   800516   123416
22  07  08  00  0000  0000  FFFF  0000  1004  C122  3E69  0000  013C  34BC   800516   123935
22  07  08  00  62F0  0000  FFFF  0008  1004  A318  3E5D  0000  013C  35B2   800516   133914
22  07  08  00  79F0  0000  FFFF  0082  1004  30ED  3E79  0000  013C  350E   800516   102114
22  07  08  00  FF10  0000  FFFF  0000  1004  0005  3E59  0000  013C  2723   800516   100424
22  07  08  00  62F0  0000  FFFF  7AF4  1004  30E5  3E79  0000  013C  3697   800515   123514
22  07  08  00  0000  0000  FFFF  0000  1004  C122  3E69  0000  013C  34BC   800515   132508
22  07  08  00  8000  0000  FFFF  0000  1004  C122  3E71  0000  013C  34BC   800515   123512
22  07  08  00  62F0  0000  FFFF  78F4  1004  30E1  3E69  0000  013C  3697   800515   000130
22  07  08  00  62F0  0000  FFFF  7BF4  1004  30E7  3E7D  0000  013C  3697   800515   132526
22  07  08  00  7FF0  0000  FFFF  3922  1004  0000  3E61  0000  013C  3922   800515   123957
*************************************** END OF TABLE ***************************************
```

| 89-460
| 89-450 |
| 89-440 | Channel Check Information   89-470
89-430 | MLCA Controller Check Information |
| Interrupt Level Backup Encoded   Contents of work registers
Processor Condition Register   0 through 7 of the interrupt
level indicated by the interrupt
level backup byte

| 89-490
89-480 |
Microinstruction Address
Backup Register
Microinstruction Address Register
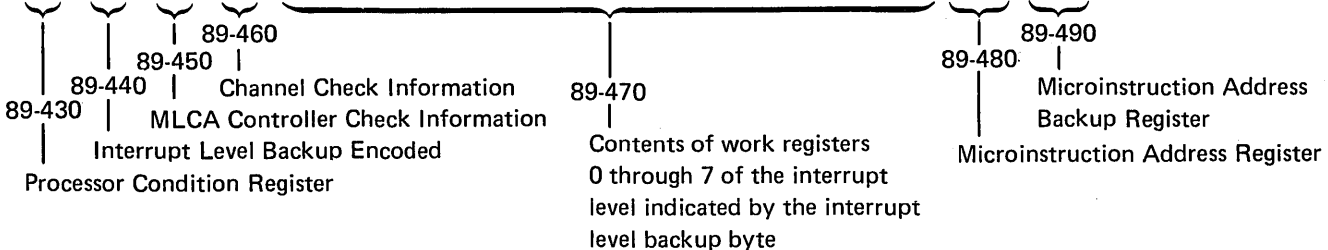
89-420   Sense Bytes–General Information

The information recorded is that which was present when the error occurred.

89-430   Processor Condition Register (PCR)

The processor condition register contains information about the status of the last operation (of the type that affect the PCR) performed in the controller. The bits in the register mean the following:

Bit	Condition
0	Flag
1	Positive
2	Negative
3	Zero
4	Carry
5	High
6	Low
7	Equal

89-440   ILBB (Interrupt Level Backup Byte)

The interrupt level backup byte indicates on which hardware interrupt level the controller was executing when the error occurred that caused the log out. The bits of the backup byte have the following meanings:

Byte	Hardware Interrupt Level
00	5
01	4
02	Cycle steal (level 1 registers are written in the log)
03	3
04	2
05	1
07	Main program level

Note: If channel error byte bits 1 and 6 (invalid device address and cycle steal check) are on, the information contained in the ILBB is not valid. If channel error byte bits 0 and 6 (DBO parity check and cycle steal check) are on, the information contained in the ILBB is not valid. An invalid ILBB causes the values of the registers to be not valid.

89-450   Controller Check Byte (Byte 0)

The controller check byte contains information about the controller checks that were present when the error occurred that caused the log out. The bits of the controller check byte are specified as follows:

Bit	Condition
0	Storage data register parity check
1	Micro-operation register parity check
2	Register parity check–checks parity on the storage gates during move operations and ALU-associated operations.
3	Register parity check–checks parity on the storage gates during some data move operations and ALU-associated operations.
4, 5	MLCA controller storage address status as follows:

0, 0	No problems have occurred with the storage address.
0, 1	A time-out check has occurred.
1, 0	The control storage address is not valid.
1, 1	An MLCA control store SAR parity check has occurred.

Bit	Condition
6, 7	Not used.

89-460   Channel Check Byte (Byte 1)

The channel check byte contains information about any channel checks that were present when the error occurred that caused the log out. The bits of the channel check byte are described as follows:

Bit	Condition
0	Data bus out parity check
1	Device address not valid
2	Data bus in parity check
3	Input/output time-out check
4	Not used
5	System bus out parity check
6	Cycle steal operation
7	Not used

89

89-470   Work Registers 0 through 7

These values represent the contents of work registers 0
through 7 of the interrupt level indicated by the interrupt
level backup byte.

89-480   Microinstruction Address Register (MAR)

The MAR of the interrupt level indicated by the interrupt
level backup byte is recorded. The value in the MAR
represents the address +1 of the microinstruction that
was being executed when the error occurred that caused
the log out.

**89-490   Microinstruction Address Backup Register
            (MAB)**

This is the address that the MAB (of the interrupt level
indicated by the interrupt level backup byte) contained at
the time of the check. The address is of the next
microinstruction to be executed after the next return
microinstruction executed on the interrupt level. Usually,
the MAP contains the address of the next
microinstruction after the last branch and link
microinstruction executed on the interrupt level.

89-495   Date and Time

The date and time recorded in the error history table are
the date and time that the check information was
recorded. This time is the data and time that the check
occurred.

89-500   AUTOCALL UNIT

**89-505   How to Use the Autocall Error
            Information**

Autocall error information aids in determining the cause
of failures of the autocall unit. These failures may be
intermittent failures or solid failures that the MAPs do
not find.

Run the error recording analysis procedure for the
autocall unit and look at the error information that has
been recorded. If there is no frequent pattern
associated with the error history information, go to
paragraph 89-510 of this maintenance manual for a
general description of what the recorded information
means. If more detail is desired, a section number is
given.

89-510   **Error History Table Sample**

An example of the controller error history table that is
recorded for autocall is shown in the following sample
printout.

```
ERROR HISTORY TABLE FOR AUTOCALL UNIT PORT  3
STATUS  RETRY  LINE/ACU                        PHONE
 BYTE   COUNT   NUMBER    PROTOCOL             NUMBER              DATE       TIME
••••••••••••••   HEX ••••••••••••••                               YY/MM/DD  HH:MM:SS
  42      01      13         80       60828                       80/05/13  11:19:24
  42      01      13         80       60828                       80/05/13  11:17:40
  42      01      13         80       60825                       80/05/13  09:52:16
*********************************** END OF TABLE *************************************
```

89-520   **Status Byte**

The status byte indicates the status of the autocall unit
at the time the error occurred. The following
hexadecimal codes may appear in the status byte to
indicate autocall status:

Code   **Status Condition**

Cx   The autocall unit has received a command
            that is not valid. The variable x indicates the
            4 low-order bits of the command.

EB   The autocall unit has received a telephone
            number with a length of zero.

EC   Data Terminal Ready (DTR) is off for the
            communications line.

xy   The general format for the autocall status
            byte. The variable x can have the following
            meanings:
            '1' DLO error
            '2' ACR error
            '3' PND error
            '4' DSC error
            '5' PWI error

            The variable y can have the following
            meanings:
            '0' Indicated signal was off before the
                 first digit was received.
            '1' Indicated signal was off between
                 digits.
            '2' Indicated signal was off after last
                 digit.
            'C' Indicated signal was on before first
                 digit.
            'D' Indicated signal was on between
                 digits.
            'E' Indicated signal was on after last
                 digit.

89

89-530   Protocol Byte

The protocol byte specifies the transmission protocol
being used at the time the error occurred. Six
hexadecimal codes are valid. These codes and their
meanings are:

Code   Protocol

'80'   Batch BSC
'81'   SNA33/SDLC Tributary
'82'   MRJE
'83'   Primary SDLC
'84'   SNA44/SDLC Tributary
'85'   Interactive BSC

89-540   I/O Counter Table Sample

```
              I/O  COUNTER  TABLE  FOR  AUTOCALL  UNIT  PORT   3
                   DATE  LAST  RESET              80/05/13
                   PHONE  CALL  ATTEMPTS              9
*************************************** END OF TABLE ****************************************
```

89-550   Error Counter Table Sample

The autocall error counter table keeps track of the
number of errors that occur in each of several groups
during operation of the autocall unit. The format of this
table is shown by the following example:

```
 ERROR  COUNTER  TABLE  FOR  AUTOCALL  UNIT  PORT    3          DATE  LAST  RESET    80/05/13
                         DATA LINE OCCUPIED ERRORS .......      0
                         ABANDON LINE AND RETRY ERRORS ..       0
                         PRESENT NEXT DIGIT ERRORS .......      0
                         DISTANT STATION CONNECTED ERRORS       3
                         POWER INDICATE ERRORS ...........      0
*************************************** END OF TABLE ****************************************
```

CONTENTS

99

99-005   DIAGNOSTIC OVERVIEW

There are many diagnostic programs for the System/34. Some programs (wrap tests) run automatically when a load operation is performed, some are for your use with MAPs (MDIs and TUs), and others are for you to use when you are free-lancing (utilities, exercisers, and special diagnostic programs).

Note: Diagnostic information for the 1255 Magnetic Character Reader can be found in the *IBM System/34 1255 Attachment Feature Theory/Maintenance Manual,* SY31-0521.

Wrap Tests

Each time a load operation is performed from the disk or the DIAGB1 diskette, the wrap tests are executed to ensure that the various parts of the System/34 are working correctly. Wrap tests check the CP (control processor), the MSP (main storage processor) and the controllers and/or attachment circuits that are associated with the devices. (See paragraph 99-015 *CSIPL Switch Options.*) Little device testing is done by the wrap tests.

MDIs and TU Tests

The MDI program runs TU tests against a controller and attachment and then runs TU tests against the device. TU tests are routines that are written to test specific functions of the devices and attachments. For example, one TU test might determine that the print belt is up to speed on the 5211 Printer, and another might determine that a register in the attachment can be set and reset. Each time a TU test executes, it passes result bytes to the MDI supervisor program. The result bytes are used by the MDI supervisor to select the next TU test to be run. If all of the TU tests run by the MDI supervisor pass acceptable results (no errors) to the MDI supervisor, the sequence of TUs that are run is known as the *good machine path.* If any of the TU tests passes results that indicate that something is wrong, the MDI supervisor branches out of the good machine path and runs other TU tests that may aid in specifying the cause of the error.

MAPs are used with the MDIs. When the MDI supervisor program needs your aid (look at a light, probe a point, answer a question), it can either send you to a printed MAP (hard copy) or display the instruction or question on the system console (soft copy MAP).

In addition to the wrap tests and MDI diagnostics, there are diagnostic programs such as utilities, exercisers, and some special tests (MSP mini-MDIs and MDI special).

Diagnostic Utilities

See paragraph 99-055 for descriptions:

- System Configure

- System Customiz

- Display Sector

- Print Sector

- EC Update Copy and Diskette Analyze

- Program Patch

- System Records List

- Disk Analyze

- Disk Initialize

- Data Communications TRAP Print

Diagnostic Exercisers

See paragraphs 99-080 and 99-085 for descriptions:

- MSP

- Disk

- Diskette

- 3262

- 5211

- Data Communications

- 5225, 5251, 5252, and 5256

Special Diagnostic Program

In addition to wrap tests, utilities, and exercisers, there are some special-purpose diagnostic programs. These programs are for you to use when you are free-lancing (troubleshooting, but not following the MAPs).

- MSP exerciser (99-085)

- MDI-system instruction step (99-090)

- MDI special (99-090)

- MSP mini-MDI (99-095)

- Controller display/dump (99-067)

- System test (99-069)

- ERAP (99-068)

- TU select (99-064) from the CE panel for the work station attachment

- Work station and line printer step or stop on error modes (99-066)

- Work station attachment MDIs from CE panel (99-062)

99-010   CSIPL DIAGNOSTICS (WRAP TESTS)

The purpose of the CSIPL diagnostics (wrap tests) is to automatically test most of the system logic each time the Load key is pressed. When the CSIPL diagnostics find an error, either the Processor Check light turns on or the system console displays an error code that identifies the failing device. (See paragraph 99-020 for CSIPL wrap test error codes.)

99-015   CSIPL SWITCH OPTIONS

The Address/Data switches are normally set to 0000 during a CSIPL operation. This setting causes most of the system logic to be tested during each load. The following is a list of the switch settings that cause looping, bypassing, partial loading and stopping during CSIPL from diskette DIAGB1. Exceptions are:

1.   0000, FF00, and FFXX options work when the CSIPL operation is from disk or diskette DIAGB1.

2.   F800 option works from disk only.

99

Address/ Data Switches	Option	Address/ Data Switches	Option
FF00	Bypass tests that need UDT configuration data and wraps (no UDT on B1 diskette).	F181	Bypass all wrap tests, execute work station attachment TU select, and print results. (See paragraph 99-064.)
FFXX	Bypass wrap tests for the device with an ID of XX. (See paragraph 99-060 for a list of device IDs.)	F180	Bypass all wrap tests, execute work station attachment MDIs, and print results. (See paragraph 99-062.)
	Note: Specifying 01, 10, CA, E1, or E3 as the device ID does not cause the corresponding wrap test to be bypassed. Therefore, do not specify one of these IDs.	F101	Bypass all wrap tests, execute work station attachment TU select, and store results in work registers. (See paragraph 99-064.)
FEXX	Loop on CSIPL routine XX and bypass errors (except errors in routines that test control or main storage). (See paragraph 99-020 for a list of valid routine (XX) numbers.)	F100	Bypass all wrap tests, execute work station attachment MDIs, and store results in work registers. (See paragraph 99-062.)
FDXX	Loop on CSIPL routine XX (routines 9 through 64). (See paragraph 99-020 for XX values.)	EEXX	Load and loop the MSP MINI-MDI test specified by XX. (See paragraph 99-095 for XX values.)
FC02	Loop on control processor loads 1 and 2, and bypass errors.	EE00	Load and execute all the main storage processor MINI-MDI tests. (See paragraph 99-095.)
FC01	Loop on control processor load 1 and bypass errors.	0000	Normal position—run wrap tests on all areas of the System/34 that are in the UDT configuration.
FB02	Loop on control processor load 2 and stop on errors.		
FB01	Loop on control processor load 1 and stop on errors.		
FA01	Stop after the first load of control storage and permit changing of the Address/Data switches to FB01, FB02, FC01, or FC02.		
FA02	Stop after the second load of control storage and permit changing of the Address/Data switches to FB01, FB02, FC01, or FC02.		
F800	Load the diagnostic supervisor from disk. (Use this option to read diskette MDI tests from the disk.)		

4

99-020   CSIPL WRAP TEST ERROR CODES

Control Processor Wrap Error Codes

If, during the CSIPL procedure, the system processor checks with the display lights byte 0 bits P0, 0, 1, and 2 off (ignore bit 3) and bits 4, 5, 6, or 7 on, this is an indication that the CP (control processor) failed in one of its bring-up diagnostic routines. To determine which routine failed (for routine numbers of 09 or larger), display WR3(L). In this register will be the number that identifies the failing routine.

To determine what function was being performed by each routine, see the following chart.

Routine #

WR3L Contents	Description
00	Branch and addressing test–tests ability to do an unconditional branch to a selected address.
01	Conditional branching–tests all conditional branches assuming system is at a reset condition.
02	Conditional branching by setting bits on in the condition register with the SBN, SBF, load PCR instructions. Display light–byte 0–bit 2 is turned off at the end of this routine.
03	Test mask instruction–tests TM instruction using SBN and SBF.
04	Tests high selection of WR1–uses SBN, SBF, TM, and conditional branching instructions to test selecting high-order byte of WR1.
05	Load immediate (LI)–uses TM and conditional branching to test LI.

WR3L Contents	Description
06	Compare immediate (CI).
07	Branch and link (BAL) and return (RETRN).
08	Microprocessor Sense (MPS) of Address/Data switches 1 and 2 into WR1(H). Microprocessor Sense (MPS) of Address/Data switches 3 and 4 into WR1(H). *Note:* Starting with routine 09, the routine number is stored in WR3(L).
09	Decrement register by X'01' (DEC) using LA1 instruction.
10	Increment register by X'01' (INC).
11	Decrement register by X'01' (DEC) using LA2 instruction.
12	Add registers 2 bytes + 1 byte (AR).

99

WR3L Contents	Description
13	Add registers 2 bytes + 2 bytes (AR).
14	Subtract registers 2 bytes - 2 bytes (SR).
15	Load register from direct area of control storage (L).
16	Store register to direct area of control storage (ST).
17	Load register from control storage (LC).
18	Store register from control storage (STC).
19	Basic port tests - load and sense port register with all 256 data bytes. Sense port error byte and test for X'00'.

Second load is done here. If the load device gets a processor check, WR3(L) contains hexadecimal 90.

WR3L Contents	Description
20	Reset display light - byte 0 - bit 3: MPLF reset carry Reset carry/set equal MPLF PCRWRNX Load PCR MPS WRN(X),PCR Sense PCR
21	Subtract immediate (SI).
22	Logical arithmetic 2 (LA2) increment register (INC).
23	Logical OR function (LA1) byte-by-byte.
24	Logical AND function (LA1) byte-by-byte.
25	Shift left logical 1 byte (SLL).
26	Logical exclusive OR (XR) byte-by-byte.
27	Logical AND complemented (NCR).
28	Logical OR complemented (OCR).

WR3L Contents	Description
29	Add registers - 1 byte (AR).
30	Subtract registers - 1 byte (SR).
31	Add registers with carry - 1 byte (ACYR).
32	Subtract registers with borrow - 1 byte (SCYR).
36	Exclusive OR - 2 bytes with 2 bytes (XR).
37	OR - 2 bytes with 2 bytes (OR).
38	AND - 2 bytes with 2 bytes (AND).
39	AND - 2 bytes with complemented 2 bytes (NCR).
40	OR - 2 bytes with complemented 2 bytes (OCR).
41	Shift 2 bytes left (SLLD).
42	Subtract register (SR) - 1 byte from 2 bytes.
43	Subtract with borrow (SCYR).
44	Add 2 bytes with carry (ACYR).
45	Move zone R2 to zone R1 (MZZ); move zone R2 to numeric R1 (MZN).
46	Hexadecimal branch using numeric field of register (HBN); hexadecimal branch using zone field of register (HBZ).
47	Shift right 1 byte (SRL); shift right 2 bytes (SRLD).
48	Load and store test of direct area of the second page of control store.
49	Move register instruction (MVR) move WR1 (0000) to WR0-WR7, MAB, MAR(MC), and MAB(MC). Then test the results. Move WR1 (FFFF) to WR0-WR7, MAB, MAR(MC), and MAB(MC). Then test results.

6

99-020

WR3L Contents	Description
50	Zero and add register (ZAR).
51	I/O service request latch (set, reset), go latch (set, reset), sense console status byte for these latches.
53	Move MPLF and MPS Tests: MPS Constat — Step mode MPS Cpuerr — Sense CPU error byte MPLF resetflg — Reset flag latch MPLF setflg — Set flag latch
55	I/O clocks test: stop, reset, sense clocks = X'FFF' start, run for 1024 microseconds, stop, sense reset, sense clocks = X'FFFF' start, run for 65536 microseconds, sense
57	Not valid control storage address check.
58	Force ALU gate parity check.
59	Force SAR parity check, storage gate parity check, and ALU gate parity check.
60	Force ALU gate parity check, force SDR parity check, and storage gate parity check.
61	Port tests: Perform port command with not valid port address. Force not valid port in port error byte. Force not valid device address in port error byte. Force system bus out parity check by setting even parity in the port.
62	Test the I/O storage command.
63	Control storage test - part 1.
64	Control storage test - part 2. At end of this routine, reset display light byte 0 - bit 4.

Third load is done here. If the load device gets a processor check, display light - byte 0 - bit 5 remains on and WR3L contains hexadecimal 90.

WR3L Contents	Description
71	Reset display light - byte 0 - bit 5 sense of PSR, status byte 0 and status byte 2.
72	Load PSR and status byte 2.
73	Load and sense LSR registers with their addresses, X'FF', X'00', and X'01'.
74	Sense status byte 3.
75	Load and sense program mode register (PMR) and control mode register (CMR).
76	Not valid main storage address check.
77	Address translation register (ATR) ripple test.
78	Storage exception test.
79	Main storage test: Write and sense X'E0' Write and sense X'01' Write and sense X'AA' Write and sense X'55' Write and sense X'FF' Reset display light - byte 0 - bit 6.

When the control processor routines are complete, all CE byte 0 lights are reset (off) except bit 7. When all device wrap tests are complete, byte 0, bit 7 is reset (off) also.

To loop on the failing control storage routine for diagnostic purposes, do a Load operation from diskette DIAGB1 and use the CSIPL switch options FEXX and FDXX (where XX is the desired routine number). See CSIPL switch options (paragraph 99-015) for a more detailed description of the switch settings and what they do.

99

Main Storage Processor Wrap Error Codes

Note: Wrap errors are not valid until the disk is ready.

02000001 to 02000008	Main storage tests run before the wrap tests. Each 2K block of main storage is tested. (See MAP 0190 for details.)
02000009	No-op (with service request enabled) did not update the IAR correctly.
0200000A	Unconditional branch (with service request enabled) did not update the IAR correctly.
0200000B	Conditional branch test failed.
0200000C	Load PSR and branch on condition failed.
0200000D	Load PSR and jump on condition failed.
0200000E	Compare logical immediate test failed.
0200000F	Compare logical character test failed.
02000010	Set bits on or off test failed.
02000011	Move immediate test failed.
02000012	Move character test failed.
02000013	Test bits on or off failed.
02000014	Move hexadecimal character test failed.
02000015	Load/store register test failed.
02000016	Branch and change ARR with NSI test failed.
02000017	Load address test failed.
02000018	Add test failed.
02000019	Add logical characters test failed (CP compare).
0200001A	Add logical characters test failed (MSP compare).
0200001B	Add zoned test failed (CP compare) (POS).
0200001C	Add zoned test failed (CP compare) (NEG).
0200001D	Add zoned test failed (MSP compare) (POS).
0200001E	Subtract zoned test failed.
0200001F	Subtract logical characters test failed.
02000020	Zero and add zoned test failed.
02000021	Indexed addressing test failed.
02000022	Edit mode test failed.
02000023	Insert and test character test failed.
02000024	Load program mode register failed.
02000025	Move characters with bad parity test failed.
02000026	ATR with bad parity test failed.

1255 Magnetic Character Reader Wrap Error Code

525000XX	See the *IBM System/34 1255 Attachment Feature Theory/Maintenance,* SY31-0521.

Data Communications Wrap Error Codes

First or Second Communications Adapter

80800101 80200101	Test line 1 adapter card and internal modem (if installed and in the UDT configuration)
80200201 80800201	Test line 2 adapter card and internal modem (if installed and in the UDT configuration)

MLCA

8288XXYY	High priority line
828ZXXYY	Low priority line
828ZXXYY	Low priority line
828ZXXYY	Low priority line

- Failing TU
- Line number is 01, 02, 03, or 04
- Communication line adapter address from MLC controller
- Controller address
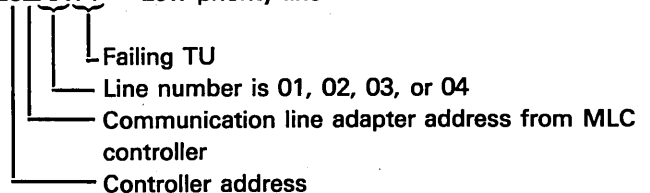
MLCA Controller

108000YY	MLCA controller failure

where YY = Failing TU:

01	PPI initial address load
02	Load/sense PPI data buffers
06	Attachment processor program load
12	Arithmetic instruction tests
16	Storage tests
21	SILSB test
22	Load and sense data register
23	Internal wrap COR bits 0-3
24	Internal wrap COR bits with interrupt
26	Timer test with interrupt
28	Inhibit and reset interrupts
34	Force overrun condition
36	Force DBO parity check
FA	CSIPL transmit/receive test
FB	CSIPL modem data wrap test

Disk Wrap Error Codes

62EH Disk Drives

Note: X = A or B for disk drive A or B.

A0X00001	Attachment test
A0X00002	Interrupt test
A0X00003	Testing read ID command on cylinder 0
A0X00004	Testing seek function to the CE cylinder
A0X00005	Write and read data
A0X00006	Test scan command
A0X00007	Seek from CE cylinder back to cylinder 0
A0X00008	Load common BAL routines
A0X00009	Test read ID on CE cylinder

62PC Disk Drives

A1A00X01	Channel adapter tests
A1A00X02	Common adapter reset and verify disk is ready
A1A00X03	Common adapter tests
A1A00X04	Seek tests
A1A00X05	Read, write, and scan tests

Note: X = 0 for disk drive A
X = 1 for disk drive B
X = 2 for disk drive C
X = 3 for disk drive D

Work Station Attachment Wrap Error Codes

If a wrap error occurs while the work station attachment or the system console is being tested, the Console Check light comes on and the System/34 will probably not display a wrap error code on the system console.

Generally, when the work station attachment or system console wrap tests sense an error, the Processor Check and Console Check lights are on and all 3 Proc Interrupt lights are off. When this occurs, display WR2 and WR3 to see if the failing wrap error code was stored in the work registers.

If WR2 and WR3 do not contain the wrap error code, display control storage locations 07A0 and 07A1 for the first failing wrap error code, 07A2 and 07A3 for the second, and so on.

Work Station Attachment Wrap Error Codes

CAC00001	Channel and adapter reset tests
CAC0003A	Register tests
CAC0003B	PCR tests
CAC0003C	PCR tests
CAC0003D	PCR tests
CAC00047	Storage addressing test
CAC00048	Storage data test
CAC0004B	Storage data test
CAC00053	Controller microinterrupt test
CAC000A3	Line drivers test

System Console Wrap Error Codes

C0C00001	Channel and adapter reset tests
C0C0000B	Data bus test
C0C0000D	IAR/SAR increment test
C0C0000E	Controller busy test
C0C0000F	System microinterrupt test
C0C000A4	Poll system console (address 0,0)

99

System/34 Diagnostic Service Guide   9

Diskette Wrap Error Codes

If your system stops during a CSIPL operation from the DIAGB1 diskette or disk and displays one of the following diskette wrap error codes, select the TU Select option from the main menu to aid in specifying the cause of the wrap error.

When the system stops with the diskette wrap error displayed, do the following:

1. Record the wrap error code.

2. Press the Enter key to complete the load operation.

3. Select TU Select from the main menu.

4. Enter the last two digits of the diskette wrap error code when the TU Select program requests a TU Test number.

5. If an error occurs, the TU test result byte is displayed.

6. Select the MDI option from the main menu and run all the TUs for the diskette. (CSIPL must be from disk for MDIs to run.)

Level 1 Attachment Card Wrap Error Codes

D0D00001	Command decode test 1
D0D00002	Command decode test 2
D0D00003	JIO command decode test
D0D00005	Head load latch test
D0D00006	Inner tracks latch test
D0D00007	Head select test
D0D00032	Index counter test
D0D00071	Seek lines test
D0D00091	Data path test

Level 2 Attachment Card Wrap Error Codes

D1D00001	Configuration sense test
D1D00002	Command decode test 1
D1D00007	Head load latch test
D1D00017	Autoloader control lines test
D1D00022	Read bit ring test
D1D00023	Cylinder not match test
D1D00029	ID hit (data field) test

3262 Printer Wrap Error Codes

If your system stops during a CSIPL operation from the DIAGB1 diskette and displays one of the following printer wrap error codes, select the TU Select option from the main menu to aid in specifying the cause of the wrap error.

When the system stops with the printer wrap error displayed, do the following:

1. Record the wrap error code.

2. Press the Enter key to complete the load operation.

3. Select TU Select from the main menu.

4. Enter the last two digits of the printer wrap error code when the TU Select program requests a TU test number.

5. If an error occurs, a TU test result byte is displayed.

6. If more information is needed or no errors occur, select the MDI option from the main menu to run all the TUs for the 3262 Printer.

E2E00001	Jump I/O test
E2E00005	Adapter interrupt test
E2E00006	Controller status test
E2E00008	Controller DBO/DBI wrap (control strobe)
E2E00009	Adapter command reject
E2E0000A	131-ms time-out test
E2E0001E	Storage addressing test
E2E0002B	ALU zero/nonzero/carry test
E2E00030	Main/auxiliary register select test
E2E0004E	Load and store using DAR test
E2E00062	Printer sense test
E2E00063	Error register sense test
E2E00065	Switch register sense test
E2E00066	Data parity check test
E2E00068	Contactor test
E2E0006F	Diagnostic register wrap test
E2E00079	Carriage interrupt test
E2E0007A	PCR/interrupt test
E2E00080	DMA storage switch test
E2E0008D	Data transfer system test
E2E0008F	Subscan storage addressing test
E2E00096	Belt up to speed test
E2E000A0	State hardware reset test

5211 Printer Wrap Error Codes

If your system stops during a CSIPL operation from the DIAGB1 diskette and displays one of the following printer wrap error codes, select the TU Select option from the main menu to aid in specifying the cause of the wrap error.

When the system stops with the printer wrap error displayed, do the following:

1. Record the wrap error code.

2. Press the Enter key to complete the load operation.

3. Select TU Select from the main menu.

4. Enter the last two digits of the printer wrap error code when the TU Select program requests a TU test number.

5. If an error occurs, a TU test result byte is displayed.

6. If more information is needed or no errors occur, select the MDI option from the main menu to run all the TUs for the 5211 Printer.

E0E00004	Adapter interrupt test
E0E00005	Controller status test
E0E00007	Controller DBO/DBI wrap
E0E00008	Adapter command reject
E0E0000A	Controller time-out test
E0E0002C	Controller storage addressing
E0E0002B	Controller ALU test
E0E00030	Main/auxiliary register select
E0E0004E	Load and store using DAR test
E0E00060	Print data wrap
E0E00062	Printer sense test
E0E00063	Printer error sense test
E0E00065	Printer switch sense test
E0E00067	Data parity check test
E0E00068	Printer contactor test
E0E0006F	Printer diagnostic wrap
E0E00070	Fire tier test
E0E00074	Print data strobe test
E0E00075	Timer interrupt test
E0E00076	Printer control wrap
E0E00079	Carriage interrupt test
E0E0007A	PCR/interrupt test
E0E00096	Belt up to speed test

When the Control Processor routines are complete, all CE byte 0 lights except bit 7 are reset (off). When all *device* wrap tests are complete, byte 0, bit 7 is reset also.

99

99-030 SYSTEM CLOCK STOP HALT CODES

If the diagnostic supervisor is not able to display a message on the system console, the supervisor stores a halt code in WR0 and stops the system clock.

To display WR0, do the following:

1. Set XX00 into the Address/Data switches.

2. Set the Mode Selector switch to Insn Step/Dply LSR.

3. Read the hexadecimal halt code in the CE byte 0 and 1 lights.

WR0 Contents

Halt
Code   Meanings

0001   Work station attachment MDI test halt:
        Diagnostic supervisor needs DIAGB4 diskette for the work station attachment tests. Insert DIAGB4 and press the CE Start switch.

0002   Work station TU select halt:
        The diagnostic supervisor needs the DIAGB4 diskette to be inserted in the diskette drive and the ID of a TU test to be run.

        1. Insert DIAGB4.

        2. Set the TU ID into the Address/Data switches. For example, to run the work station network analysis program TC0C1, set C0C1 into the Address/Data switches.

        3. Set the Mode Selector switch to Proc Run to loop on the TU test, or

        Set the Mode Selector switch to Sys Insn Step to run the test and stop.

        4. Press the CE Start switch to start the test.

Halt
Code   Meanings

0003   Work station attachment TU select test result halt:
        The diagnostic supervisor has run a TU test and set up work registers as follows:
        WR3 = TU ID
        WR6 (H) = TU test result byte 1
        WR6 (L) = TU test result byte 2
        WR7 (H) = TU test result byte 3 (if used)
        WR7 (L) = TU test result byte 4 (if used)

        Press the CE Start switch to run the TU test again.

0005   Current diskette does not have the work station attachment diagnostics on it. Insert DIAGB4 and press CE Start.

0010   Work station attachment device MDI test halt:
        The diagnostic supervisor has stopped when executing the work station attachment MDI tests. Display WR1 and WR2 and see the hard copy MAPs for a description of the halt.
        WR1 = MDI MAP ID
        WR2 = MDI MAP step number

0030   A diskette error occurred and work station attachment functional code is not loaded. Correct the diskette error and press CE Start to try the MDI again.

0031   A printer error occurred while work station tests were running. Correct the printer error and press CE Start to try the MDI again.

0080   Diagnostic supervisor needs DIAGB1 or DIAGB4 diskette to load the work station attachment functional microcode again.

99-040 DIAGNOSTIC SUPERVISORS

There are two diagnostic supervisors; one for concurrent
maintenance and the other for dedicated maintenance.
The concurrent supervisor runs concurrently with
customer jobs under control of the SSP (system support
program product).

Note: The concurrent supervisor cannot be run if SMF
(system measurement facility) is active.

1255 tests, display tests, printer online tests, and the
MLCA, BSCA, and SDLC online tests are the only
diagnostics that can be run concurrently with customer
jobs. (To run the BSCA online tests, see paragraph
99-075; to run the SDLC online tests, see paragraph
99-074; to run the MLCA online test, see paragraph
99-076.) The run time for concurrent tests is longer than
the run time for tests running under the dedicated
supervisor because more than one program is being run.

	Loaded From	Into	By	Device Needed
Dedicated	Diskette or disk	Control storage	CSIPL from diskette DIAGB1 or CSIPL from disk with F800 in the Data/Address switches	All of the system
Concurrent supervisor	Diskette	Main storage along with SSP	Enter CONCR option menu	Failing device and controller, 14K MS, diskette drive and display

99

99-041   Concurrent Maintenance

DANGER

If you are performing maintenance on the printer, have the operator take the printer offline to prevent the printer from being activated by an external source.

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_____
_____
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CAUTION

To protect customer data, if the printer spool function is being used, have the operator do the following:

• Stop printing from the printer spool file.

• Change (vary command) the printer to offline.

If the printer spool function is not being used, have the operator do the following:

• Stop the job queue.

• Change (vary command) the printer to offline.

• Restart the job queue.

If SMF (system measurement facility) is active, terminate SMF.

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To load the concurrent supervisor, enter CONCR at the SSP command menu and follow the directions displayed on the system console. The program reads the supervisor from DIAGB1, the 5211 tests from DIAGB3, the 3262 tests from DIAGB3N, or the 1255 tests from DIAGB6.

To terminate a test running under the concurrent supervisor, do the following:

1. Press the Attn key.

2. Select option 4.

3. Press the Enter key twice.

Repeat the preceding steps until the desired concurrent display appears on the screen. (The program goes back one display each time the sequence is repeated. You can go back to the main concurrent menu using this method.)

Terminate concurrent maintenance by either of the following methods:

• If the main concurrent menu is displayed, select option 0 and press the Enter key.

• If the main concurrent menu is not displayed, press the Attn key, select option 2, and press the Enter key. (Under some conditions the Enter key may have to be pressed twice.)

Both methods return the system console to SSP command mode.

The operator may now do the following:

• Change (vary command) the printer to online.

• Start the printer spool function again.

99-043   Dedicated Maintenance

The dedicated supervisor controls device testing when
all of the system is dedicated to maintenance.

Note: If the diskette is not operational, you can do a CSIPL
to select the diagnostic supervisor from disk and then read
the diskette MDI tests from disk. See *99-015 CSIPL Switch
Options* (F800). Also see *45-630 System Diagnostics* for a
step-by-step procedure.

Two functions to remember about the dedicated
supervisor are:

- When the system does not have an operational
  printer, the system console is selected as the output
  device.

- When any I/O error that is not expected occurs on
  devices that are not being tested, it is best to restart.

After the diagnostic supervisor is loaded, the following
main menu is displayed:

1.   MDI MAPs (failure location using the MDI tests).

2.   EXERCISERS (no failure location—see paragraph
      99-080).

3.   PRINTER/DISPLAY (select system console or
      system printer as the system output device).

4.   TU SELECT (run selected TU tests).

5.   MDI SPECIAL (MDI free-lance tool—see paragraph
      99-090).

6.   UTILITIES (System Configure, System Customiz,
      Disk Analyze, and so on—see paragraph 99-055).
      The utilities are not available if the disk is the load
      device.

99

99-045   DIAGNOSTIC DISKETTE INFORMATION

The following diagnostic diskettes are shipped with a base system.

- DIAGA0 contains an alternative sector listing for the disks.

- DIAGA1 contains module replacements and patches used with the EC update copy utility to update microcode releases.

- DIAGB1 contains CSIPL diagnostics (wrap tests):
  - MSP diagnostics
  - System configuration (microcode for the devices that ship with your system)
  - The diagnostic supervisors
  - System test
  - Some utility programs

- DIAGB2 contains MDI diagnostics and exerciser programs for the diskette.

- DIAGB3 contains MDI diagnostics and exerciser programs for the 5211 Printer.

- DIAGB3N contains MDI diagnostics and exerciser programs for the 3262 Printer.

  Note: If you have either a 3262 or 5211 Printer attached, one diagnostic diskette (either DIAGB3 or DIAGB3N) is shipped.

- DIAGB4 contains MDI diagnostics for the work station attachment.

- DIAGB7 contains MDI diagnostics, exerciser programs and the Initialize and Analyze Utility programs for the disk.

  Note: There are different part numbers for the 62EH and the 62PC diagnostic diskettes.

- DIAGF1, DIAGF2, and DIAGFA contain functional microcode (I/O microcode and nucleus microcode used to support SSP); system configure, system customiz, system records list, program patch, EC update copy utilities; and the Data Communications TRAP print utility.

If your system has a data communications feature, DIAGB5 or DIAGB5ML contains MDI diagnostics, exerciser programs, and online tests for that feature.

If your system has a 1255 attached, DIAGB6 contains MDI diagnostics for the 1255 Magnetic Character Reader.

If the diskette is not operational, you can do a CSIPL to select the diagnostic supervisor from disk and then read the diskette MDI tests from disk. See *99-015 CSIPL Switch Options* (F800). Also see *45-630 System Diagnostics* for a step-by-step procedure.

99-050 DISPLAY STATION DIAGNOSTIC MESSAGE FORMATS

Diagnostic supervisor messages can display up to 12 lines. The screen is divided into left and right halves with a center margin.

The left half of the screen displays the main points of information; the right half of the screen is used to display additional information.

The bottom line of the screen generally contains the following information.

MDI = XXXX is the ID of the MAP that is executing.

STEP = NNN is the MDI MAP step number that is being executed.

TXXNN T = The test is an MDI test that passes results to the diagnostic supervisor.

or

QXXNN Q = The test is an MDI test that has a question that cannot be answered by the TU test and needs a response from you.

XX = Device ID.
NN = Test number.

SEC = Expected length of time (in seconds) that the test should run.

99-055 DIAGNOSTIC UTILITIES

Generally, the descriptions of the utilities assume that you will select the display on the system console as your output device.

System Configure Utility

The diagnostic diskettes that are shipped with each System/34 contain diagnostic tests for many devices.

System Configure means that you are instructing the system what size or type of devices were shipped with your specific system.

During the configuration process, a table is assembled that contains an entry for each device that is on your system.

The table name is UDT (unit definition table). Each UDT entry contains device ID, address, and configuration data that specifies the size or type of the unit. List the UDT (option 1 or 2) before you change an entry so that you have a printout of your specific configuration.

Once the UDT table is assembled, your specific configuration is written on the DIAGB1 diskette. (The DIAGB1, DIAGB3, (or DIAGB3N) and DIAGB4 diskettes are assembled to your hardware configuration.)

99

System Customiz Utility

The system customiz utility reads the functional and diagnostic microcode from the DIAGXX diskettes and writes it on the disk. As part of this process, the utility makes a number of automatic checks to record the identification of the microcode and to ensure the microcode is free of errors. The following paragraphs describe the checks and what to do to make them useful.

Prerequisite List

Correct system operation relies on the system hardware, the software, and the microcode being at compatible levels. Before starting to move any microcode to the disk, the system customiz utility displays the list of prerequisites that is stored on the DIAGF1 diskette. The list of prerequisites aids you in determining if the system hardware and SSP are at the correct level to use the microcode.

You must verify the compatibility of the system and the new microcode; the utility does not check this, but only supplies the list. If the prerequisites are not installed, cancel the system customiz utility by pressing the Attn key. When you cancel the utility, the existing system microcode is not changed.

Patch Checks

The system customiz utility checks for two types of patches: controlled patches (those patches sent to you from IBM engineering) and free-lance patches (those patches generated and installed in the field). There is a table for each type.

Controlled Patch Table: The utility checks this table and, using flags, indicates any patches that are on the disk but not on the diskettes. The program displays:

- The patch number

- The module ID of all affected modules

- The diskette ID of the source

- The date the patch was installed

- A message that says the patch will be destroyed if the system customiz utility continues

You have the option to continue with the system customiz utility and install the patch again later, or to cancel the utility and leave the system microcode as it was.

Free-lance Patch Table: The system customiz utility checks this table and displays the patches on the table by showing the module ID and the date the patch was installed. Because the utility always destroys free-lance patches, you must obtain, and later install again, any patch that is destroyed if the patch is critical to the operation of the system. If the patch is not available, you can cancel the utility by pressing the Attn key. The system microcode is not changed when you cancel the utility at this time.

Diskette Level Checks

Before moving any microcode from a DIAGXX diskette to the disk, the system customiz utility checks the part number of the diskette with the part number specified in the microcode level table as the diskette to be used. The microcode level table is on the DIAGF1 diskette (see *Microcode Level Table* later in this section). If you inserted an incorrect diskette the results of that action change with the type of diskette you inserted:

- DIAGB1, DIAGB2, or DIAGFA—the utility adds an exception part number to the disk copy of the microcode level table, and displays a warning message.

- DIAGF1 or DIAGF2—the utility stops because this is a hard error. The microcode on the disk is not changed.

Error Log Tables

System customiz keeps the old error log tables to ensure that the error data is not destroyed. (If an initialized disk is being customized, new error log tables are assembled, and the utility instructs you to enter the present date as the date the disk was customized.)

Record Keeping on the Disk

System customiz moves the microcode level table from the DIAGF1 diskette to the disk. When the diskettes you are using have part numbers that are not on the table (exceptions), the utility records their part numbers in an exception list. The disk-controlled patch table is built by making a chain of the patch tables from the DIAGB1, DIAGB2, DIAGF1, DIAGF2, and DIAGFA diskettes. The utility clears the free-lance patch table.

Control Store Directory

At the end of the system customiz program, all the microcode needed for the operation of the system has been loaded on the disk. At the same time, a control store directory is made, which includes the module ID, location, and other data that pertains to each disk microcode module. The control store directory is used by all higher level programs to locate and load microcode from the disk.

Control Store Library Space

Additional control store library space may be needed on disk when specific System/34 features are installed. System customiz will expand the library space, as well as move and store the VTOC for you. After one of these features is installed, you must back up the disk before running system customiz. (The program itself will display two warning messages before doing the expansion.) Once system customiz has been run, you must load the SSP again.

When specific features are removed from a system, the size of control store library can be decreased. System customiz will also perform this function. You must load the SSP again when system customiz is complete.

99

Display Sector Utility (Disk or Diskette)

This utility displays (on the system console) a hexadecimal dump of a selected sector from a disk or a diagnostic diskette. The utility supplies operator prompting.

Print Sector Utility (Disk or Diskette)

This utility supplies a hexadecimal dump to the system printer of 1 to 99 sectors from a disk or a diagnostic diskette. The utility supplies operator prompting.

EC Update Copy Utility

The EC update copy utility supplies the ability to:

• Copy all of a diskette

• Initialize a diskette

• Analyze a diskette

• Read and print diskette ID fields

• Exchange (*module replace*) the modules on a diagnostic diskette

Each of the abilities is an option in the EC update copy utility, and each option causes some changes to the control records.

Diskette Copy Option

This option permits you to completely copy the System/34 DIAGXX diskettes. The program copies only the System/34 DIAGXX diskettes. The diskette being made must be:

• A diskette initialized to the System/34 diagnostic format

• An existing System/34 DIAGXX diskette having the same diskette ID and a sequence number that is equal to or smaller than that of the diskette being copied

  Note: Copying the DIAGB2 diskette does not copy the alignment tracks to the new diskette.

Diskette Initialize Option

Use this option to initialize an IBM Diskette 1 to the System/34 diagnostic format. This format includes 77 cylinders (tracks). The first cylinder is formatted as a single 4096-byte sector, and all the other cylinders are formatted as eight sectors, each containing 512 bytes. The initializing process writes all sector IDs and address markers but clears all data bytes to zero. When initialization is complete, the utility automatically starts the analyze option.

Diskette Analyze Options

The first option checks all the sectors on a DIAGXX diskette for:

• Bad sector IDs and address markers

• Errors in data comparisons

• CRC errors

Note: A single error causes the analyze option to stop.

The errors this option checks for are in one of two classes: device failures or diskette failures. A device failure is one caused by something wrong with the diskette drive; for example, bad read/write head alignment or some type of electronic failure. Diskettes with device failure errors on them can be used, but they must be initialized again. The initialization destroys all the data on the diskette. If the data on the diskette must be kept, copy the diskette before initializing it.

A diskette failure is caused by a bad area on the diskette recording surface. Do not attempt to use a diskette having a diskette failure; it cannot be used for any purpose.

The second option (microcode release 5.0 or later) analyzes any diskette written in an IBM format. The option will display or print errors as they occur, does not stop or do the operation again, and analyzes the complete diskette.

A third option (microcode release 7.0 or later) is available for attachment level 2 drives. This option reads and prints ID fields (one per track) from any diskette written using an IBM format.

Module Replacement Option

This option exchanges (*module replace*) modules on the diagnostic diskettes. You can also move patches from the DIAGA1 diskette to the correct diagnostic diskettes using the patch utility. An engineering change is still needed for module replacement, but the EC is installed by using a special DIAGA1 diskette that contains modules for several DIAGXX diskettes. This prevents having to send out new diskettes for each EC.

The DIAGA1 diskette contains:

• The modules to be moved to the DIAGXX diskettes

• A table of diskette IDs and part numbers that identify the DIAGXX diskettes to be updated

• A table that identifies the diskette ID and status of the modules—new, deleted, or exchanged (*module replace*).

• A table of stored patches to be put on the DIAGXX diskettes

In operation, this option instructs you to insert the DIAGA1 diskette and then copies all the data from the DIAGA1 diskette to the disk. The option updates the various diagnostic diskettes as follows:
  - Gives you the option to update each diskette
  - Exchanges (*module replace*), deletes, or adds modules
  - Moves entries to the diskette patch table if the ID in the entry is A1

The option changes the module arrangement on each updated diskette so that free space on the diskette can be collected in one area. All updated diskettes have their EC number, part number, and patch information changed to show that the diskette is at the present level of release.

99

Program Patch Utility (Disk or Diskette)

The program patch utility has four uses. These uses:

- Permit you to install controlled patches on both the disk and the DIAGXX diskettes

- Give you a way to store controlled patches on a DIAGA1 diskette

- Enable you to install free-lance patches on a disk

- Enable you to put on DIAGXX diskette patches that are stored on a DIAGA1 diskette

The following paragraphs describe several types of microcode checking that are used for controlling errors.

Controlled Patch Option

The program patch utility uses the following control information to ensure that the patch is installed correctly:

- A patch number that pertains to no other patch

- The number of any patch that is a prerequisite to the new patch

- The diskette ID of the source of the microcode patch

- The part number of the diskette to be updated

You must enter each item on the list as part of the preparatory information.

When you enter a valid patch number for which there is a prerequisite patch, the utility searches the correct patch table for the prerequisite patch number. If the utility does not find the number, the prerequisite patch has not been installed. An error message appears on the display instructing you to install the prerequisite patch. The utility will not continue until you have installed the prerequisite patch.

The utility also verifies a correct installation by comparing the diskette ID and part number with the microcode level table (for a patch on a disk), or with the EC level record for a patch on a diskette. If the comparison does not verify an exact match, an error message is displayed.

Before entering the data for a patch, you must enter the header. The information contained in the header is:

- The module ID or name

- The offset

The header and each following part of the patch contain a checksum. Using the checksums, the utility automatically verifies your entries. After you have entered all of the patch data, enter a final checksum that must match the checksum of the complete patch. If this final checksum does not match, an error message is displayed.

If you are installing the new patch on a diskette, the utility makes another check to ensure that you inserted the correct diskette. When all the checks are correct, the patch is installed on the disk or diskette.

At the end of this operation, the utility makes an entry in the controlled patch table on the disk or diskette on which you installed the patch. The new entry is written at the start of the table. The table is a stack, and when a new entry is added to the table, all the earlier entries are pushed down. If the new entry causes the earliest entry to be lost from the table, the entry that will be lost is displayed on the system console.

If you are installing a patch on a diskette, you will be given an option to install the same patch on a similar diskette without having to enter the information again. If you are installing a patch on a disk, you will be given an option to install the patch on a DIAGXX diskette without having to enter the information again.

Store Patch on DIAGA1 Option

This option is the same as the diskette-controlled patch option except that when you have correctly entered the patch, it is not installed on a module but, instead, is stored on a DIAGA1 diskette in a special format. You can store several patches for any combination of DIAGXX diskettes.

99-055

Application of Stored Patches Option

This option permits the application of patches (patches that were stored) to a diskette using the store patch option. The program prompts for a DIAGA1 diskette; then the IDs of all diskettes that patches are stored for are displayed. Any DIAGXX diskette can then be inserted and all selected patch applications made. The patch table on the diskette is then updated with the correct entries.

Free-lance Patch Utility

CAUTION
Carefully use this utility. You can easily destroy diagnostic microcode, programming microcode, or customer information. Do not attempt to make a free-lance patch unless you have access to the microcode printouts.

You can only install a patch on a module that has a module ID; that is, a disk-based microcode module that is identified by a control store directory entry. Before you can enter a patch, you must enter the following information as a header:

- The module ID

- A code (C or M) to show where the patch is being installed:
  - C (control storage microcode)
  - M (main storage or controller microcode)

- The present date (to be used as the date the patch was installed)

Now you can enter the data for the patch. You do this by entering:

- An offset into the module

- The present contents of the module

- The new data

At the end of the operation, the utility makes an entry in the free-lance patch table. The new entry is written at the start of the table. The table is a stack, and when a new entry is added to the table, all the earlier entries are pushed down. If the new entry causes the first entry to be lost from the table, the entry that will be lost is displayed on the system console.

99

System Records List Utility

Using the options supplied by this utility, you can get access to all of the control records described in this section. The utility uses either the system console or the system printer as an output device. The program guides you by giving prompts. The following paragraphs describe the procedure used by the utility.

1. Select the output device.

2. Select disk-based control records, diskette-based control records, or cancel. If cancel is selected, the program goes backward one step to change the selection of the output device. At times you may need to compare records on both the disk and the diskette. The program automatically returns to this step after a list or display of each record is completed so that the selection can be changed.

3. The selection in step 2 determines the next steps:

    •   If disk-based control records were selected, select one of five records:
        − The control store directory
        − The prerequisite list
        − The microcode level table
        − The controlled patch table
        − The free-lance patch table or select cancel, which takes the program back to step 2.

    •   If diskette-based control records were selected, select one of five records:
        − The EC level record
        − The controlled patch table
        − The diskette VTOC
        − The prerequisite list
        − The microcode level table or select cancel, which takes the program back to step 2.

        When the diskette-based control records are selected, a prompt to insert the diskette that contains the records needed is displayed. Because the prerequisite list and the microcode level table are on only the DIAGF1 diskette, the program assumes that DIAGF1 has already been inserted. If, however, the diskette is not in the diskette drive, the program prompts you to insert it.

4. The program does the next step. Using the system records list, the program locates, reads, and formats the correct record for output.

    •   If the printer is selected in step 1, all of the record prints out, and the program returns to step 2.

    •   If the display is selected in step 1, the record appears on the system console, 10 lines at a time. If the record needs more than 10 lines, page through the display by using the following commands:
        − F (forward)
        − B (backup)

        or use the scroll keys to page through the display, or select the cancel, which takes the program back to step 2.

The records selected are described in the following paragraphs. The order in which these records appear is disk-based, diskette-based, and records common to both disks and diskettes.

Disk-Based Records

Control Store Directory: This table identifies and addresses all the microcode modules that are permanent parts of the system. The directory starts at location 5555=003D; the disk model or capacity does not make any difference. The directory is variable in length, being made of 8-byte entries up to a maximum length of 10 sectors.

Free-lance Patch Table: This table is a history of the free-lance patches installed on the disk. Because these patches cannot be completely described, the table only shows which modules have patches installed on them. The table is one sector long and has space for 50 patches. The table is a stack; therefore, any entry at the start of the table pushes all the earlier entries down. If the table is full, a new entry causes the earliest entry to be lost.

The module ID for this table is X'F030'.

Diskette-Based Records

Diskette VTOC: Every DIAGXX diskette contains a VTOC (volume table of contents). The VTOC contains a list of the names of every module on the diskette and various items of status information about each module. Entries to the VTOC are a fixed length of 64 bytes. The table sector length is variable up to a maximum of twenty-four 512-byte sectors. The starting sector address of the VTOC (CCSS) appears in bytes 6 and 7 of the CCSS.

EC Level Record: This is a 12-byte record that appears on all DIAGXX diskettes. The record contains five items of status information about the original level of the diskette:

- The diskette ID

- The part number

- The EC number

- The EC sequence number

- The number of the last patch that was included in the EC

This record starts at a fixed location on each of the DIAGXX diskettes:

- DIAGB1; byte number 37 of CCSS = 0A01.

- DIAGB2, DIAGF1, DIAGF2; byte number 37 of CCSS = 0102.

Records Common to Disk and Diskette

Prerequisite List: This list shows the microcode level relative to the level of the software and the hardware. The list is at the start of the disk sector having the module ID X'F010'. On the DIAGF1 diskette, the list is included in the first eight bytes of the sector having the module name $LEVEL.

Microcode Level Table: This table is on the disk and the DIAGF1 diskette. The table contains the 4-digit release level number of the microcode and the last patch that was included in that release. The last patch on the list means that all earlier patches were also included in the release. The table contains the following items:

- The diskette ID

- The diskette part numbers

- The EC sequence numbers for the diskette included in the release

An exception entry is made when a diskette other than those specified is used to customize the system. No exceptions are permitted for the DIAGF1 and DIAGF2 diskettes.

The Compatibility Table is an addition to the microcode level table and includes a list of part numbers of diskettes that can be used for diagnostics.

The microcode level table is included in the same sector with the prerequisite list.

Controlled Patch Table: This table is contained on the disk and all the DIAGXX diskettes. The table has a variable format and is used to show which of the controlled (not free-lance) patches have been installed on the disk or diskette. The format changes because the length of the patches changes. The limits of the record are a 9-byte minimum length and a 27-byte maximum length.

The table appears on diskettes with the module name $PATCH and on disks with the module ID X'F020'.

99

62PC Disk Analyze Utility

The 62PC disk analyze utility has two options.

Option 1: Analyze Disk Surface

This option takes approximately 12 minutes to run, and verifies the following functions of the disk surface:

- The identification (ID) fields can be read and are properly written.

- The alternative sectors are properly assigned.

- All usable data records can be read without errors.

- The servo signals from the disk servo surface can keep the heads on track.

Messages from option 1 can either be displayed on the system console or be printed on the system printer. If the messages are displayed on the system console, up to seven messages can be displayed at one time. These messages can not be displayed again after the Enter key is pressed. Two format options are supplied for messages at the system console:

- The first option displays only error messages.

- The second option displays reassigned defect messages and error messages.

If the messages are printed on the system printer, three format options are supplied:

- The first option prints only error messages.

- The second option prints reassigned defect messages and error messages.

- The third option prints displaced defects, reassigned defect messages and error messages.

99-055

Sample Message

```
   LOCATION           EXPECTED ID   ACTUAL ID            DESCRIPTION           ALTERNATIVE
SS  HD   CYL            FFSSH@CC      FFSSH@CC      '*' INDICATES AN ERROR       FFSSH@CC

1D  04  0015           08381015      0E001166       MFG REASSIGNED DEFECT       05381015
```

Field	Description

LOCATION

SS   The position of the record on the track as follows (see 83-981):

Message	*Position Definition*
NO RECORD FOUND	Logical record number (Hex 00-3F)
UNREADABLE RECORD FIELD	Logical record number (Hex 00-3F)
DISK SERVO SURFACE DEFECT	Field is not used
All other messages	Physical sector number (Hex 00-20)

HD   The current head (Hex 0-A). Valid for all messages (see 83-971).

CYL   The current cylinder (Hex 000-167). Valid for all messages (see 83-961).

EXPECTED ID   The ID that the utility expected to find on the disk for the sector (see 83-951). This field is not used for the following messages:

       DISK SERVO SURFACE DEFECT
       UNREADABLE RECORD FIELD
       NO RECORD FOUND

ACTUAL ID   The ID that was found on the disk for the sector (see 83-951). This field is not used for the following messages:

       DISK SERVO SURFACE DEFECT
       UNREADABLE RECORD FIELD
       NO RECORD FOUND
       NO ID FOUND

For a displaced defect that can not be read, this field contains:

       FFFFFFFF

DESCRIPTION   The message text. See *Output Messages* later in this section.

ALTERNATIVE   The assigned alternative sector. Valid only for the following messages:

       USER REASSIGNED DEFECT
       MFG REASSIGNED DEFECT
       ALTERNATIVE DATA NOT RELIABLE

99

Option 1 of the utility has three types of output messages: error, reassigned defect, and displayed defect. The text of the message appears in the Description column of the message printed by the utility (see *Sample Message* earlier in this section). The following table defines the text of each message.

Message	Type	Description	Corrective Action
			CAUTION The following utilities can destroy customer data.
SECTOR ID ERROR	Error	The actual ID did not match the expected ID, or a CRC check occurred while reading the ID.	Run the 62PC Disk initialize utility or the 62PC Disk analyze utility option 2.
NO RECORD FOUND	Error	The record ID did not match any of the ID's read.	Run the 62PC Disk initialize utility.
ALTERNATIVE DATA NOT RELIABLE	Error	Bit 0 or 1 in the alternative sector ID is on, indicating that a CRC check occurred while recovering data from the defective sector.	Have the customer run the SSP Build procedure ($BUILD) to verify or correct the data.
UNREADABLE RECORD FIELD	Error	A CRC check occurred when reading a data field.	Run the 62PC disk initialize utility.
DISK SERVO SURFACE DEFECT	Error	The servo signals from the disk servo surface do not keep the heads on track.	Run the 62PC disk MDIs to determine the cause of this error.
UNREADABLE ID	Error	The utility could not read a sector ID.	1. Run the 62PC disk MDIs. 2. If no error is found, run the analyze utility again. 3. Compare the two analyze utility printouts. If the unreadable ID is in the same physical location (cylinder, head, and sector), the disk unit is the likely cause. Replace the disk unit. If the ID is not in the same physical location, an intermittent hardware failure is the likely cause. Run the disk intermittent MAPs (see MDI 1058).
MFG REASSIGNED DEFECT	Reassigned Defect	A defective sector has been assigned to a sector on the alternative cylinder during the making of the disk.	No action required.

Message	Type	Description	Corrective Action
USER REASSIGNED DEFECT	Reassigned Defect	A defective sector has been assigned to a sector on the alternative cylinder by the 62PC initialize utility or the system support program (SSP).	No action required.
DISPLACED DEFECT	Displaced Defect	This is the first defective sector on the track that was found when the disk was made. This sector and all following sectors are moved one sector from their original position. If the ID can not be found (a valid condition for a displaced defect), the Actual ID field contains: FFFFFFFF	No action required.
DEFECTIVE ALTERNATIVE SECTOR	Displaced Defect	A sector on the alternative cylinder is bad and can not be used.	No action required.

99

62PC Disk Analyze Error Handling

Option 1 of the utility checks the disk drive for error conditions. If it finds any errors, it takes the following action:

- If it finds an error described by one of the utility messages, it displays or prints the correct message.

- Any other error is caused by a hardware failure. The utility stops, and then displays the error information.

When the utility stops in a way that is not normal, the error that caused the stop can be either a hardware detected error or a program (utility) detected error. A hardware detected error is a hardware failure that was detected by the disk attachment. For this type of error the utility displays the error information in the disk ERAP format (see section 82) when it stops.

A program detected error is a hardware failure that was not detected by the check detection circuits, but that the utility found. When one of these errors occurs, the utility displays one of the following messages:

Message	Required Action
INTERRUPT TIME-OUT (byte 1, bit 0)	Record the error information and run the 62PC disk MDIs to find the error.
INVALID DISK INTERRUPT (byte 1, bit 1)	Record the error information and run the 62PC MDIs to find the error.
MESSAGE MODULE NOT FOUND (byte 1, bit 2)	The DIAGB7PC diskette does not have a required program. Order a new DIAGB7PC diskette.

Option 2: Read/Write One Track of ID Fields

CAUTION
The use of the following option (option 2) can destroy customer data.

_____

_____

_____

Option 2 of the 62PC disk analyze utility reads and displays one track of IDs. This option can be used to correct sector ID errors found using option 1. Perform the following steps to correct sector ID errors:

1. Use option 1 of this utility to analyze the disk. Select the printer as the output device using the format that provides a list of the displaced defects, reassigned defects, and errors. The resulting output appears like that shown in figure 99-1.

2. Look at the column of the output that is labeled Description. In that column find the SECTOR ID ERROR. This information is used to correct the ID error.

3. Use option 2 and enter the cylinder (CYL) and head (HD) of the failing sector. (In figure 99-1, the cylinder of the Sector ID Error is 002E and the head is 01.)

4. The utility reads the track of IDs from the disk and displays them in the format shown in figure 99-2.

5. The SS column in the option 1 output (figure 99-1) is the number of IDs from the beginning of the track to the ID in error (must be between hex 00 and 20). Count this number of IDs in the list of IDs from option 2. That ID should be the same as the ID in the Actual ID column of the option 1 output. (in the example, the SS value of 1D for the Sector ID Error in figure 99-1 locates an ID value of 0028042E in figure 99-2.)

6. Follow the instructions given by option 2 to replace the ID value with the correct value (the correct value is in the Expected ID column of the option 1 output—0828042E for the example).

```
---------------------------------------------------------------------------------
   LOCATION         EXPECTED ID  ACTUAL ID          DESCRIPTION           ALTERNATIVE
SS  HD   CYL         FFSSH@CC    FFSSH@CC   '*' INDICATES AN ERROR          FFSSH@CC
---------------------------------------------------------------------------------


20  00  0000        00400000    02400000    DISPLACED DEFECT
20  00  0040        00400040    02400040    DISPLACED DEFECT
10  00  0076        00200076    0A400076    DISPLACED DEFECT
1C  00  007C        0038007C    0A40007C    DISPLACED DEFECT
09  00  00AB        001200AB    0A4000AB    DISPLACED DEFECT
04  00  00DD        000800DD    0A4000DD    DISPLACED DEFECT
0F  00  012A        001E012A    0A40012A    DISPLACED DEFECT
17  00  0164        002E0164    0A400164    DISPLACED DEFECT
20  00  0166        00400166    02400166    DISPLACED DEFECT


1C  01  0009        00280409    0A400409    DISPLACED DEFECT
12  01  0013        00140413    0A400413    DISPLACED DEFECT
14  01  0022        00180422    0A400422    DISPLACED DEFECT
1C  01  002E        0028042E    0A40042E    DISPLACED DEFECT
1D  01  002E        0828042E    0028042E    *SECTOR ID ERROR
20  01  0040        00400440    02400440    DISPLACED DEFECT
```

Sector ID
Error Information

Enter Cylinder and Head
Values to Option 2

Number of ID from
Start of Track

Figure 99-1. Option 1 Output Example

```
0030042E  0032042E  0034042E  0036042E     ID'S FROM  HEAD 01 CYLINDER 002E
0038042E  003A042E  003C042E  003E042E
0000042E  0002042E  0004042E  0006042E     ENTER 'R' ON THE COMMAND LINE TO
0008042E  000A042E  000C042E  000E042E     REPLACE THE ID'S
0010042E  0012042E  0014042E  0016042E
0018042E  001A042E  001C042E  001E042E     ENTER 'C' ON THE COMMAND LINE TO
0020042E  0022042E  0024042E  0026042E     CANCEL.
0A40042E  [0028042E] 082A042E  082C042E
082E042E                                   ANY UNREADABLE ID'S ARE SHOWN AS
X  ----- ENTER 'R' OR 'C'                  FFFFFFFF.
MDI A1J1 STEP    14      10 SEC    TA1J1
```

Sector ID Error Information

Figure 99-2. Track of IDs Example

99

62PC Disk Initialize Utility

CAUTION
Both options of disk initialization will destroy all data on the disk. The customer must copy all the data he wants to keep before disk initialization is started.

_____
_____
_____
_____
_____

Note: Always run the disk MDIs before either option of the initialize utility to verify that the hardware operates correctly.

Systems with three or four 62PC disk drives have two DIAGA0 diskettes. The DIAGA0 diskette containing the defective sector information for disk drives C and D is marked with a C/D in the lower right corner of the label.

Option 1: Initialization

This option initializes the disk drive using the information for the disk drive contained on the DIAGA0 diskette. It removes all user assigned defects and ID errors. Option one takes approximately seven minutes per drive and does the following:

- Writes all IDs on the disk using the defective sector information from the DIAGA0 diskette.

- Writes zeros in the data fields of all usable sectors.

- Reassigns defective sectors that are not defined by DIAGA0 diskette as follows:
  - If the new defective sector is the only defect on its track, it is assigned as a displaced defect.
  - If it is not the only defect, it is assigned as a user reassigned defect. (User reassigned defects can be on the disk after running initialization.)

  Note: See the 62PC section of the Theory-Diagrams manual for information about displaced and reassigned defects.

- Detects error conditions and takes action as defined in *62PC Initialize Error Handling* later in this description.

Option 2: Build the DIAGA0 Diskette (Organize)

This option is used for disk drives that have not been initialized, or for disk drives for which the DIAGA0 diskette has been lost. On systems with three or four 62PC disk drives, verify that you are using the correct DIAGA0 diskette for the drive selected. The option takes approximately 17 minutes per drive and does the following:

- Builds a new alternative cylinder for the drive at cylinder 358 (hex 166).

- Creates a DIAGA0 diskette that has the defective sector information for the disk drive.

- Writes all IDs on the disk again using the defective sector information from the DIAGA0 diskette.

- Writes zeros in the data fields of all usable sectors.

- Detects error conditions and takes action as defined in *62PC Initialize Error Handling*.

Note: When building a new DIAGA0 diskette for drives C and D, mark the new DIAGA0 diskette with C/D in the lower right corner of the label.

62PC Initialize Error Handling

Both options of the utility check the disk drive for errors or hardware failures, and take the following action for detected problems:

- If a CRC check occurs while verifying IDs or data fields, the utility assigns an alternative sector. The utility continues to run unless the alternative track is full.

- If a No Record Found check occurs while verifying data fields, the utility assigns an alternative sector. The utility continues to run unless the alternative track is full.

- All other errors are caused by hardware failures. The utility stops and displays the error result bytes in the disk ERAP format (see section 83).

The utility stops abnormally for hardware errors detected by it or by the hardware. If the disk attachment detects a hardware failure, the error status is displayed in the disk ERAP format. Record this information and then run the 62PC MDIs to find the error.

If the utility finds a hardware failure that was not detected by the disk attachment, it displays the error status in the disk ERAP format. The utility can detect the following hardware failures:

- Interrupt time-out (byte 1, bit 0). Record the error information and run the 62PC MDIs to find the error.

- Invalid disk interrupt (byte 1, bit 1). Record the error information and run the 62PC MDIs to find the error.

- Alternative track full (byte 1, bit 1). More than 32 defects were found and assigned to the alternative track on one surface. To find the error:
  - Run the 62PC MDIs.
  - If no error is found, use the 62PC disk analyze utility (option 1) to analyze the disk and run the failing procedure again.
  - If it fails again, run the analyze utility again.
  - Compare the two analyze utility printouts. If the defects (both manufacturer assigned and user assigned) are in the same physical locations (cylinder, head and sector), the disk unit is the likely cause. Replace the disk unit. If the defects are not in the same physical locations, an intermittent hardware failure is the likely cause. Run the disk intermittent MAPs (see MDI 1058).

- Unreadable ID (byte 1, bit 3). The utility could not write an ID in at least one sector because of a utility found error or a hardware failure. To find the error:
  - Run the 62PC MDIs.
  - If no error is found, use the 62PC disk analyze utility (option 1) to analyze the disk and run the failing procedure again.
  - If it fails again, run the analyze utility again.
  - Compare the two analyze utility printouts. If the unreadable ID is in the same physical location (cylinder, head and sector), the disk unit is the likely cause. Replace the disk unit. If the ID is not in the same physical location, an intermittent hardware failure is the likely cause. Run the disk intermittent MAPs (see MDI 1058).

99

62EH Disk Analyze Utility

The 62EH disk analyze utility:

- Reads IDs of all sectors on the selected disk drive and checks for any errors.

- Reads data fields of all sectors that have no ID errors.

- Lists all sectors that have an active flag and any sectors that contain errors.

Two types of messages are associated with the 62EH disk analyze utility: information type messages and error messages. The information type messages and a description of each are:

- *Assigned Alternative* (sector ID flag byte = X'01'): Indicates that a sector on the alternative track is assigned to a defective primary sector.

- *Defective Primary* (sector ID flag byte = X'02'): Indicates that a primary sector is defective and that the sector ID indicates the assigned alternative sector ID.

- *Defective Secondary* (sector ID flag byte = X'03'): Indicates that a sector on the alternative track is not usable.

The error messages and a description of each are:

- *Sector ID Field Error*: Indicates any of the following:
  - An ID was not as expected.
  - A status error occurred on a read ID operation.
  - A primary sector ID was defective (identified by an active sector ID flag), but an alternative sector was not assigned to the primary sector.
  - An alternative sector ID was assigned (identified by an active sector ID flag), but a primary sector was not assigned to the alternative sector.

- *Read Data Error*: Indicates that a CRC check or some other check occurred during a read data operation or that the data field is missing a sync byte.

- *Read ID Proc Interrupt Error*: Indicates that a machine check occurred during a read ID operation or that an ID field is missing a sync byte.

- *Alt Sector Data Not Verified*: An alternative sector ID flag byte of X'05' indicates that data was read from a sector with CRC checks. Use the build program to verify the data.

- *Read Data Proc Interrupt Error*: Indicates any of the following:
  - A machine check occurred during a read data operation.
  - A sync byte is missing from a data field.
  - A data field was not written again after an extended ID was exchanged with a normal ID.

- *Sector Must Not be Defective*: Indicates an active sector ID flag on cylinder 0 or on cylinder 1, or it indicates that sector 30 (X'1E') on the CE cylinder is defective.

62EH Disk Initialize Utility

CAUTION
Disk initialization will destroy all data on the disk. The customer must copy all the data he wants to keep before disk initialization is started.

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Options 1 and 2

- Write sector IDs on all sectors and write zeros in all usable data fields of all sectors with a valid ID flag byte of either X'00' or X'01'.

- Flag defective sectors and assign and write alternative sector IDs for all primary sectors with an active sector ID flag.

- Use DIAGAO diskette for record of defective sectors:
  - Use the defective sectors record from the DIAGAO diskette for initialization if the serial number of the selected disk drive is on the DIAGAO diskette record.
  - Generate the defective sector record for the DIAGAO diskette if the serial number of the selected disk drive is not on the DIAGAO diskette record, and then initialize the selected disk drive.
    a. If the selected disk drive is not initialized in System/34 format, all sector IDs are read and any sector ID flags are used to generate the defective sector list for the DIAGAO diskette and to initialize the disk drive.
    b. If the selected disk drive is initialized in System/34 format, the alternative track IDs are read and all active sector ID flags are shown on a printout or display for review. If the list is not in error, use the list for generating the DIAGAO diskette record and for initializing the selected disk drive. If the list is in error, enter the defective sectors from the keyboard.

    Note: The original list of all defective sectors is on a label(s) on the disk enclosure.

    c. If the DIAGAO diskette is lost, the DIAGB7 diskette can be used to complete the initialization, and a temporary DIAGAO diskette record will be generated on the DIAGB7 diskette.

Options 3 and 4

These options update the DIAGAO diskette record for the selected disk drive after all defective sector IDs are entered from the keyboard. However, there is no disk drive initialization with these options.

Options 5 and 6

Options 5 and 6 are the same as options 3 and 4 except that after the DIAGAO diskette record is updated, the selected disk drive is initialized.

Data Communications TRAP Print Utility

The TRAP utility program works with a stereo tape recorder (part 2439634), which is a branch office tool. The recorder is used to record data from the data communications line to magnetic tape. The TRAP utility program interprets and prints the recorded data.

In order to use the TRAP utility program to print the contents of a recorded tape, you need a dedicated System/34 under control of the diagnostic supervisor (not SSP). The System/34 does *not* need to have data communications feature installed to print the contents of the tape.

The TRAP utility is on the DIAGF1 diskette and is selected through the utility option on the diagnostic supervisor main option menu. The TRAP utility will print the data in binary, hexadecimal, and EBCDIC formats. If the data is in ASCII format, use the binary printout to translate the data; or transmit the data to a Datascope[1] which can translate the data for you.

_____
[1] Datascope is a trademark of the Spectron Corporation.

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99-060   LIST OF DEVICE IDs

01 = control processor

02 = main storage processor

10 = attachment controller 2 (MLCA)

C0 = system console

CA = work station attachment

D0 = diskette drive (level 1 attachment)

D1 = diskette drive (level 2 attachment)

A0 = disk drive(s) (62EH)

A1 = disk drive(s) (62PC)

E0 = printer (5211)

E1 = printer (5256)

E2 = printer (3262)

E3 = printer (5225)

52 = magnetic character reader

80 = data communications (first or second
     communications adapter only)

82 = MLCA communication lines

99-062   HOW TO RUN WORK STATION ATTACHMENT MDIs FROM THE CE PANEL

Work station attachment MDIs are run from the CE panel. Generally, you will run them in automatic mode first. There are approximately 90 TU tests in the good machine path. If they all run and pass good results (no failures) to the MDI processor, the run time is from 1 to 3 minutes. TC0A5 is the last TU test in the *Good Machine Path*. You can verify that the tests ran without errors by displaying WR3(H) when the system stops. If the work register contains hexadecimal A5, the MDIs did not branch out of the good machine path and have normally completed the MDI.

If the system console is operational when the attachment MDIs complete, TU test TC0A5 displays a message on the console that indicates the diagnostics ran without errors.

If the controller tests do not normally complete the MDI, see MAP 1198 for more diagnosis.

There are four ways to run the controller MDIs from the CE panel:

1. *Automatic mode*—Set the Address/Data switches to F100 and set the Mode Selector switch to Proc Run. The MDIs either automatically run all TU tests in the good machine path, and Stop with TU results in work registers if there is a failure; or stop when the good machine path has been normally completed (see *Procedure for Using Automatic Mode*).

2. *Automatic mode with printed error results*—Set the Address/Data switches to F180 and the Mode Selector switch to Proc Run. The MDIs run in automatic mode, and if a TU test finds a failure, the line printer prints a message that will identify the failing FRU or points to a hard MAP for more diagnostics (see *Procedure for Using Automatic Mode*).

3. *Step mode*—Set the Address/Data switches to F100 and the Mode Selector switch to Sys Insn Step. Each time you press the CE Start switch, a TU test in the good machine path runs, and the system stops with TU results in work registers (see *Procedure for Using Step Mode*).

4. *Step mode with printed TU test results*—Set the Address/Data switches to F180 and the Mode Selector switch to Sys Insn Step. Each time you press the CE Start switch, a TU test in the good machine path runs, and the system stops with a TU description and the results are printed on the line printer (see *Procedure for Using Step Mode*).

Procedure for Using Automatic Mode

1. Set the CE panel switches as follows:
   a. CSIPL to Diskette
   b. MSIPL to Diskette
   c. Mode Selector to Proc Run
   d. All other CE Panel switches to the down position

2. Set F100 into the Address/Data switches and load from DIAGB1.

   Note: If you set F180 into the Address/Data switches, the MDIs run automatically and the line printer will identify a FRU if there is a failure or points to a hard-copy MAP for more diagnostics.

3. When the system stops with hexadecimal 0001 in WR0, set the Mode Selector switch to Proc Run, insert DIAGB4 and press CE Start.

4. If the system stops before being normally terminated and WR3(H) does not contain X'A5', display WR1 for the hexadecimal MAP ID number; WR2 for the hexadecimal step number; and WR3(H) for the test ID.

   If the system continues to run and the System In Use and all Processor Interrupt lights are on, go to step 3 of MAP 1198.

5. Find the MAP and step numbers in the hard-copy MAPs and follow the instructions given.

Procedure for Using Step Mode

1. Set the CE Panel switches as follows:
   a. CSIPL to Diskette
   b. MSIPL to Diskette
   c. Mode Selector to Proc Run
   d. All other CE Panel switches to the down position.

2. Set F100 into the Address/Data switches and load from DIAGB1.

3. When the system stops with hexadecimal 0001 in WR0, insert DIAGB4, set the Mode Selector switch to Sys Insn Step, and press the CE Start switch.

4. Each time you press CE Start, the next TU test runs, and the system stops. Since there are approximately 90 TU tests in the good machine path, run time will be 1 to 3 minutes. Each time the system stops, work registers 0 through 7 contain the following information:

   WR0 = 0010 (MDI halt ID)
   WR1 = MDI MAP ID
   WR2 = MDI step number

The following register contents are additional information and not needed by the MAPs:

   WR3 (H) = TU ID (last two digits)
   WR4 = Expected TU result bytes 1 and 2
   WR5 = Expected TU result bytes 3 and 4
   WR6 = Received TU result bytes 1 and 2
   WR7 = Received TU result bytes 3 and 4

   (See paragraph 99-999 for TU result byte bit meanings.)

Step Mode with printed TU test results:

This procedure can be used only on systems with a line printer.

1. Set the CE Panel switches as follows:
   a. CSIPL to Diskette
   b. MSIPL to Diskette
   c. Mode Selector to Proc Run
   d. Comm Display to Off

2. Set F180 into the Address/Data switches and load from DIAGB1.

3. When the system stops with hexadecimal 0001 in WR0, insert DIAGB4, set the Mode Selector switch to Sys Insn Step, and press CE Start. Each time you press CE Start, the next TU test runs, and the system stops. The TU test description and results are printed.

When the last TU test in the good machine path runs, the printer repeats the same MAP and step numbers each time you press the CE Start key, and the system console (if operational) displays a message that the diagnostics ran without errors.

99-064 HOW TO RUN TU SELECT FOR THE WORK STATION ATTACHMENT FROM THE CE PANEL

The purpose of the TU select program is to enable you to select any TU test, run it (or loop it), and observe the results of the test.

Two main procedures are available: standard and alternate.

Standard Procedure

Use the alternate procedure with the following exception:

Dial F181 into the Address/Data switches (instead of F101). The test results will print on the line (belt) printer.

Alternate Procedure

1. Set the CE panel switches as follows:
   a. CSIPL to Diskette
   b. MSIPL to Diskette
   c. Mode Selector to Proc Run
   d. Comm Display to Off

2. Dial F101 into the Address/Data switches and load from DIAGB1.

3. System stops with hexadecimal 0002 in WR0.

4. Insert DIAGB4, and set the TU ID (last 4 digits) into the Address/Data switches.

5. Set Mode Selector switch to Proc Run if you want to loop on the TU test; or set Mode Selector switch to Sys Insn Step if you want to run the test and stop.

6. Press CE Start.

7. If your option was to run the test and stop, when the system stops, the test results are in WR6 and WR7. (See paragraph 99-999 for bit meanings in result bytes.) Use the following procedure to display the test results.
   a. Set the Mode Selector switch to Insn Step/Disp LSR.
   b. Set the Data switches to X'06' to read the first 2 bytes.
   c. Set the Data switches to X'07' to read the second 2 bytes.

Notes:
1. Once a test is either looping or in run mode, you can switch to the other mode by turning the Mode Selector switch to the correct position and pressing CE Start:

   Mode Selector = Proc Run–Loop the selected test.
   Mode Selector = Sysn Insn Step–Run the test and stop.
2. In order to run a test different than the test selected in step 4 of this procedure, repeat steps 1 through 6 and enter the ID of the new test to be executed.

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99-065   HOW TO RUN DEVICE TU SELECT

The purpose of device TU select is to enable you to select any TU test, run it (or loop), and observe the results of the test.

The device TU select is selected from the diagnostic supervisor main option menu. The next display shows all the devices that have TU select programs that can be executed. Once a device has been selected and the correct diagnostic diskette has been inserted, the select menu for that device is displayed.

To run the device TU select, do the following:

1. Enter the last two digits of the TU ID to be run. These digits can be determined by doing a scroll through the TU select menus until the desired TU is located.

2. The program responds with a description of the TU and the meaning of the TU result byte. You can either scroll the description and meaning or press Enter to continue.

3. The TU is then loaded into control storage and the run option is displayed. You can then either execute the TU once and display the results or loop on the TU, displaying the result bytes.

Note: Pressing the Attn key causes the preceding option to be returned.

99-066 I/O STEP OR STOP ON ERROR MODES FOR WORK STATIONS AND LINE PRINTERS

I/O Step Mode Under SSP Control

The purpose of the I/O step mode is to permit you to step the commands going to the work station or system printer controller. When using the I/O step mode on the work station controller, the selected terminal number that I/O step mode is to work with, must be entered (C000 for the system console on cable 0, C010 for a terminal on cable 1, C020 for a terminal on cable 2, etc). Since the line printer controller has only one device, the printer is activated by entering E000 (5211) or E200 (3262). All other devices on the system will operate normally.

Using I/O step mode, it is possible to step any specific terminal through the sequence of *gets* and *puts* that set up a screen (or print a few lines). The terminal unit block, station parameter list, and field format table (described in the *Data Areas and Diagnostic Aids Manual*) may be observed (by using the various display features under Alter/Display) and decisions made on the correct function of the operation.

To set up I/O step mode:

1.   Press the Stop key to go into alter/display mode.

2.   Select I/O step:
     a. Choose option 9 on menu and press the Field Exit key.
     b. Select I/O step mode option and enter device/unit address:

     Work station C0XY X = cable address
                        Y = station address
     3262 Line Printer E200
     5211 Line Printer E000
     c. Press the Enter key.

3.   Press the Field Exit key to exit alter/display mode.

Each time a *get* or *put* is sent to the device, the alter/display option menu is displayed on the system console. Press the Field Exit key to continue to the next *get* or *put*.

I/O Stop on Error Mode Under SSP Control

I/O stop on error mode permits you to set up a specific display station, work station printer, or the system printer to stop executing more I/O commands (*Gets* and *Puts*) as soon as an error is found. All other processing will continue normally. The Alter/Display option menu appears each time an I/O error occurs.

After the stop on error occurs, the critical control areas of the system may be looked at through the various options of the Alter/Display function. These areas are described in the *Theory/Diagrams* and *Functions Reference Manuals*.

To set up I/O stop on error mode:

1.   Press the Stop key to go into alter/display mode.

2.   Select I/O Stop on Error:
     a. Select option 9 of the alter/display option menu and press the Field Exit key
     b. Select I/O Stop on Error
     c. Enter device/unit address:

     Work station C0XY X = cable address
                        Y = station address
     3262 Printer E200
     5211 Printer E000
     d. Press the Enter key

3.   Press the Field Exit key to exit alter/display mode.

99

99-067   I/O CONTROLLER DISPLAY/DUMP UNDER SSP CONTROL

I/O Controller Display

Option 8 of the alter/display option menu permits the display of storage in any I/O controller attached to the system. The alter/display options are described in the *Theory/Diagrams, Data Areas and Diagnostic Aids,* and the *Functions Reference Manuals.*

To start this option:

1.   Press the Stop key to go into alter/display mode.

2.   Select I/O controller display
      a. Select option 8 on the menu and press the Field Exit key
      b. Enter:
         – D for display
         – Starting address (4 digits)
         – Controller
           C0 = work station controller
           E0 = line printer controller

3.   With this option, the display may be moved through storage by entering the new address at the cursor location (4 digits).

      To terminate this option, move the cursor to the position *after* the 4-digit address and enter an E.

4.   Press the Field Exit key to exit alter/display mode.

Note: When you exit from alter/display mode after interrupting the line printer controller with an 8 option, various registers and counters are set to zero or initialized. You cannot continue executing the interrupted printer program.

I/O Controller Dump

A dump of the I/O controllers is written on the disk when a system dump occurs.

To dump the system to disk:

1.   Press the System Reset key.

2.   Press the CE Start key.

3.   Permit 2 seconds for the dump to complete.

To print the controller portions of the dump:

1.   Set the MSIPL and CSIPL switches to Disk.

2.   Press the Load key.

3.   Enter sign-on information and press the Enter key twice.

4.   Enter the command DUMP IOC and follow the prompts.

99-068   HOW TO RUN ERROR RECORDING ANALYSIS PROCEDURE (ERAP)

1.   Enter ERAP at the SSP command menu and select the desired option.

2.   Press the Field Exit key.

3.   Follow the directions that are displayed.

See paragraph 80-111 for information on how to interpret ERAP displays and printouts.

99-069 HOW TO RUN SYSTEM TEST (SYSTST)

System Test is an exerciser that runs in *dedicated* mode under control of SSP. The following parts of the System/34 can be tested:

- Disks

- Diskette

  Note: Any standard formatted scratch diskette can be used.

- Display stations.

  Note: Only local display stations can be tested, and all display stations must be signed off except the system console.

- Printers (local printers only).

- Magnetic Character Reader (see the *IBM System/34 1255 Attachment Feature Theory/Maintenance* manual, SY31-0521).

  Note: The magnetic character reader test is a stand-alone concurrent exerciser.

- Main storage processor (MSP)

Local display stations that are not signed on by a user are the only displays that can be tested. Default is to the requested terminal if all other displays selected are signed on or powered off.

(MSP testing is automatic. When the MSP is not doing I/O operations, it is executing logical and arithmetic instructions under control of the system test program.)

Enter SYSTST at the SSP command menu to start system test. Before the program requests which devices you want to test, it runs a series of failure locating tests on the work station controller. If an error occurs during the controller tests, 5 bytes of sense information are displayed. These 5 bytes of sense information, described in paragraph 87-200, are as follows:

- Byte 1 = Controller/host status

- Byte 2 = Controller/cable status

- Byte 3 = Device/cable status

- Byte 4 = Not used

- Byte 5 = Device status byte 0

  Note: Device status byte 1 is not used and is not displayed.

After the controller tests are complete, devices are selected and the test can begin. If a data compare error occurs, the system console displays a data not compare message. Data not compare errors are the only type of errors that the system test error counters log. If a non-recoverable error occurs on a device, SYSTST is terminated. You can get more information on errors that occur while system test is running by running ERAP.

(See paragraph 99-068 for how to run ERAP.)

Note: Starting with Release 6.0 of the DIAGB1 diskette, the SYSTST Display Results option swaps SYSTST to the disk and loads ERAP. Terminating ERAP causes SYSTST to be loaded again and the selection status remains the same. The SSP must be a Release 4.0 or later to perform this function.

If you operate the system console along with the line printer and the line printer has a forms problem, the Message Waiting indicator on the system console will come on. Use the following procedure to display the message and then restart SYSTST:

1. Press the Attn key.

2. Press Sys Req and then the Enter key.

3. The last line on the display screen is the message that was waiting.

4. After you correct the printer forms problem, press the Sys Req and Enter keys again.

5. Select option 0, restart SYSTST.

Press the Attn key and select option 4 to halt SYSTST.

99

99-070 DATA COMMUNICATIONS DIAGNOSTIC PROGRAMS

This major section contains the following information:

- 99-071 Summary of Data Communications Diagnostic Programs

- 99-072 Data Communications Fault Locating Tests

- 99-073 Data Communications Stand-alone Tests

- 99-074 SDLC Online and Utilities Test

- 99-075 BSCA Online Test

- 99-076 MLCA Concurrent Wrap Test and Trace Dump Driver Program (COMMTST)

- 99-077 Data Communications Tables

Service Procedure for MLCA

You should use the following procedures and aids for maintenance on MLCA in the sequence shown.

1. Concurrent hardware maintenance

2. Dedicated hardware maintenance

3. Undirected and/or microcode maintenance

The procedure used relies on the type of problem, the system being available, and the level of remote site support.

Concurrent Hardware Maintenance

The following aids are available for support of concurrent hardware maintenance for MLCA:

1. Wrap test for MLCA communications adapters and IBM modems

2. MLCA controller wrap test

3. BSC and SDLC online test

4. MLCA microcode data trace

The primary method used to isolate problems to a subsystem (MLCA controller, communications adapter, IBM modem, communications network, or remote device) is the concurrent use of wrap modules and/or online test and/or microcode data trace. During normal operation, SDLC or BSC programs can start the wrap tests to test the MLCA controller, storage, communications adapter, and IBM modem when a permanent error condition is present. In some cases, this method can isolate the problem to a field-replaceable unit (FRU). These wrap tests can also be selected by you or the customer in a concurrent mode through the use of the COMMTST program. The adapter and the modem wrap test operate concurrently with the microcode, therefore leaving the other lines operating.

If the MLCA controller is the failing unit, none of the communications lines will work; however, the controller wrap test can run concurrently with the remainder of the system. If a problem occurs and you cannot isolate the problem through these concurrent methods, then dedicated hardware maintenance is needed. If the concurrent tests using the wrap tests can sense no problem, the problem is either with the network or a remote device, or an MLCA problem is indicated.

To isolate external problems, the online tests aid in troubleshooting network or remote device problems in concurrent mode without any interference to other communications lines. In addition, microcode data traces aid in locating logic problems, both in high-level software and the remote device, by supplying information on the data exchanges between the system and the remote device.

To isolate difficult MLCA problems, you may need to use the dedicated hardware maintenance procedure.

Dedicated Hardware Maintenance

Dedicated hardware maintenance is used when a problem cannot be sensed by the concurrent tests, or when you need to isolate FRUs. The following aids are available to support dedicated hardware maintenance:

1. CSIPL checkout (diagnostic tests)

2. MDI (MAP diagnostic integration) for problem location in MLCA controller

3. MDI for problem location in MLCA communications adapters, line adapters, cables, and IBM modems

4. Hard MAPs

5. SDLC and BSC online test (loaded under control of SSP)

The primary method used to isolate problems is to run MDIs. Using this method, you can load a diagnostic control program (DCP) that performs a supervisor function to permit selecting the MLCA diagnostic programs by selecting from prompts displayed on the system console.

The MDI modules then execute and select test units (TUs) to perform tests and to instruct you to make adjustments to switches, install jumpers, or report failures, or to direct you into hard MAPs to isolate the problem. Always test the MLCA controller before testing communications line hardware. For most problems, you can isolate a FRU using hard MAPs.

For solid IMPL problems and processor checks, use the CSIMPL module to isolate between the MLCA controller and other communications hardware. You *must* use the system entry MAPs correctly to isolate an FRU.

Undirected Maintenance

The following items aid you in performing undirected maintenance on the MLCA and the associated communications system:

1. Field service logics

2. Stand-alone tests

3. Intermittent failure replacement list

4. Error logs

5. Trap print utility

Microcode Maintenance

Microcode logic errors could cause MLCA to operate not correctly. The following aids are available to support the diagnostic of these and other programming errors:

1. Microcode data trace

2. Microcode queue trace

3. System trace of SVCs

4. MLCA controller storage dump

5. System main/control storage dump

6. Alter/display system storage

Use a microcode trouble report (MTR) to report any microcode problem that occurs.

99

99-071 Summary of Data Communications Diagnostic Programs

Failure Locating Tests (MDI)

Function: Test data communication logic and isolate failure to logic card, internal clock card (if this feature installed), modem interface cables or modem. If the IBM integrated modem is installed, the modem card or cards are isolated. If an external IBM modem is installed, failure locating tests indicate only that the modem is failing.

Locations of Programs: DIAGB5 (first or second communications adapter) DIAGB5ML (MLCA)

Type of Program: Diagnostics written in microcode operate under the diagnostic supervisor.

Data Communications Stand-alone Tests

Function: To aid you in the free-lance mode of operation. These are independent tests that are not included in the data communications MAPs and must be selected by you from the diagnostic supervisor under the exerciser, TU select, or utility option.

Locations of Programs: DIAGB5 (first or second communications adapter) DIAGB5ML (MLCA)

Type of Program: Diagnostics written in microcode operate under the diagnostic supervisor.

SDLC Online Test

The SDLC online test is also known as the SDLC link test.

Function: Operate and test the communications adapter, modem and all of the communications link to verify the system integrity and analyze difficult communications problems.

Location of Program: DIAGB5 (first or second communications adapter) DIAGB5ML (MLCA)

Name of Program: SDLCTST

Type of Program: Written in main storage code and operates under SSP (system support program product).

Note: When a customer uses a communication line for only BSC, the SDLC online test can also be run on the same communication line to devices that support the SDLC online test. However, it is important that the NRZI switch on the adapter card be set to the correct position for SDLC operation so that both devices in the communications link are using the same encoding; that is, they are both using NRZI or they are not using NRZI. (See paragraph 30-200 (MLCA) or 31-200 (first or second communications adapter) for the setting of the NRZI switch on the adapter card.) After the test is complete, the NRZI switch must be set to its original position.

BSCA Online Test

Function: Operate and test the communications adapter, modem and all of the communications link to verify system integrity and analyze difficult communications problems.

Location of Program: DIAGB5 (first or second
                        communications adapter)
                        DIAGB5ML (MLCA)

Name of Program: BSCATST

Type of Program: Written in main storage code and operates under SSP (system support program product).

Note: When a customer uses a communication line for only SDLC, the BSC online test can also be run on the same communication line to devices that support the BSC online test. The NRZI switch on the adapter card does not have to be set to any specific position because the microcode disables the NRZI function for BSC.

MLCA Concurrent Wrap Test and Trace Dump Driver Program (COMMTST)

Function: Permit wrap tests for the communications line and the MLCA controller, and supply programs to print traced data and commands.

Location of Program: DIAGB5ML

Name of Program: COMMTST

Type of Program: Written in main storage code and operates under SSP (system support program product). Runs concurrently with other system operations.

99-072   Data Communications Failure Locating Tests

These tests are on diskette DIAGB5 (first or second communications adapter) or DIAGB5ML (MLCA) and are used to isolate failures either in the data communication logic card, internal clock card (if installed), interface cable, or the modem. Access the tests by using the diagnostic supervisor main menu. If the modem is an IBM integrated modem, the test combined with the MAPs isolates the failure to a modem part or group of modem parts within the modem.

The tests are described in the prompting menu. You can get more details about a specific test by selecting that test under the TU select option of DCP.

99

99-073 Data Communications Stand-alone Tests and Utilities

The stand-alone tests found under the exerciser or TU select option are for your use when you desire some additional information from the system, or when you have reached the point where some free-lance troubleshooting is necessary. The MAPs may also direct you to use these tests.

Transmit Stand-alone Test

Transmit of X'00', X'FF', X'55', X'7E', X'16', or X'32'.

Description: For free-lance troubleshooting, this is a test that transmits data (specified by you) to the modem and to the communications line. The exerciser option permits several modes of running the test. Use the Halt After Each Cmd or Scope Loop option to run the test. The Halt After Each Cmd option will post an error. The Scope Loop option can be used to cause a continuous transmission of data. Press the Attn key to terminate the test.

The test permits 2 minutes for Clear to Send to come back from the modem before timing out; the test will then post an error in Halt After Each Cmd mode or restart the test in loop mode.

If this test is being used on a switched network, you should dial and make a telephone connection after the test is executing. You have 2 minutes to dial and make a connection before the test will time out and post an error or restart. In Halt After Each Cmd mode on a switched network, starting the test again will drop the line.

Bit Rate Stand-alone Test

Description: Measure the modem clock speed in bits per second while transmitting data through the modem at full rate. Results are shown on the system console.

Run the test only in Halt After Each Cmd mode. The test can be used on modems that supply their own clock function and on DDSA. For the first or second communications adapter, the results of the test are changed to the nearest 100 bits. For MLCA, the results are accurate to ± 25 bps. This test cannot be used for line speeds larger than or equal to 10,000 bps.

Error Condition: If the test takes longer than 5 seconds, an error condition is present and you should check the modem and cable attachments to the modem.

DDSA Remote Loop-Back Stand-alone Test

Access the DDSA remote loop-back stand-alone test by selecting the TU select option of the diagnostic supervisor main menu. The test unit used is T8080 (first or second communications adapter) on DIAGB5 or T82A0 (MLCA) on DIAGB5ML.

Directions for running this test are given in MAP 3801 for first or second communications adapter and MAP 3074 for MLCA. This test wraps alternate 1's and 0's through a remote system or device that is in wrap mode. Output is in the form:

XX XX XX XX
                ↑
                is the hexadecimal number of
                alternate 1's and 0's transmitted
                and received correctly.

A no-error condition results in a display of:

00   00   (for MLCA)

    or

00   00   00   64   (for first or second
                        communications adapter).

Data Communication Trap Print Program

The trap print program prints the data that has been recorded on a CE trap. The output is a formatted and/or binary printed list of the data that was trapped on the communication line. SDLC header information is formatted to read easily.

The recorded information can be in one of the following formats:

- BSC

- SDLC

- SDLC/NRZI

This program is loaded from diagnostic diskette DIAGF1 and runs under control of the diagnostic supervisor through the utility option.

The data read from the trap is loaded into storage buffer and can be printed again with the same or different options. To terminate the program and return to DCP, press the Attn key. To change Address switch settings while the program is running, always turn the Mode Selector switch to the Insn Step/Dply LSR position, then change the Address switch. Set the Mode Selector switch to the Proc Run position and press the CE Start key on the CE panel.

LPDA Local/Remote Status Report Tests (MLCA only)

These tests are used for the IBM 3863, 3864, and 3865 modems and integrated types, such as the System/34 4800 BPS Integrated Modem, that support LPDA commands.

Access the tests by selecting the TU select option from the diagnostic supervisor main menu. Diagnostic diskette DIAGB5ML contains the test units (T8296 and T8298).

Directions for running these tests are given in MAP 303H.

99

99-074   SDLC Online Test

The SDLC online test is a standard test program used to communicate between most SDLC systems or devices attached to your system.

The corresponding online test must be loaded in the remote system. See the other system diagnostic user's guide for loading and operating procedures.

Note: To run this test for a remote work station, the remote work station's control unit must be powered on but not in use (not online).

Purpose of program:

- Verify correct operation for all of the communications link.

- Supply remote site support.

- Analyze difficult communications problems.

The online test has two routines: a requester station routine and a responder station routine. The requester station routine is used when the system is to be used to transmit a selected test message. The test message is sent by the requester station the number of times specified by you. The message or frame content is determined by the XX value entered before starting the test if the station is a requester station. The station address loaded into the configuration program is the address of the responder station. This address must be changed through the scan/alter SDLC configuration option to match the address of the remote terminal when communicating with work stations.

The test TYPE numbers and the data they represent are described in Step 8 under *Operating Procedures for SDLC Online Test Requester Station Routine* later in this section. The transmission sequence is shown in this section. The requester station transmits the specified message and expects to receive the same data (except for message 07 - transmit only).

The responder routine is used to support other systems that are transmitting a test.

When the responder station routine is selected, it will go into a receive condition waiting for a test message. When one is received, it is transmitted back as received. A time-out will terminate this sequence.

If your system is the requester, the other system must have a responder routine available. If your system is the responder, the other system must have a requester routine loaded.

Note: The SDLC online test does not change the error recording area on the disk that is normally updated when customer programs are executed.

Online Test Sequence

The requester station sends a test command frame (with or without data) to the responder station. The responder station returns all that it received to the requester station. This sequence repeats for as many times as you specified in the YY value.

How to Terminate the Online Test

Requester: The online test is terminated after all frames (as specified by you) are received and the terminate option is selected (option 4 for the first or second communications adapter, or option 2 for MLCA) or by the Attn key and option 2.

Note: If you want to terminate the SDLC online test, do so only when this option menu is displayed, when the test (specified by message number xx) has completed, or when an error is displayed. Any attempt to terminate the test at any other time could result in a system hang condition.

When on a switched network, using the ATTN key and option 2 to stop the program (instead of the program's normal termination option) may not disconnect the telephone line. Reload the online test and select the normal termination option to disconnect the telephone line.

Responder: By the Attn key and option 2.

Note: The inactivity time-out will not cause the online test to disconnect the switched line connection.

Online Test Frame Format

PAD   F   A   C   DD   BC   BC   F

Where:

PAD = X'AA' for modem clock functions
    = X'0000' for internal clock functions (2 bytes)

F   = X'7E' – Flag character

A   = X'**' – ** represents secondary station
              address

C   = X'??' – ?? represents control field. (See
              SDLC Control Characters later
              in this section for control
              field character definitions.)

DD =   Optional data determined by XX value

BC =   Frame check character

F   = X'7E' – Flag character

*Operating Procedures for SDLC Online Test Requester
Station Routine*

Step 1. Configuration must have been done earlier.

Step 2.

Note: If the customer is using the system (but not
data communications on the desired line), skip this
step and go to step 3.

If the customer is not using the system, perform the
following steps:
a. Set the CSIPL and MSIPL switches (CE panel) to
   Disk and press the Load key (operator panel).
b. Enter the required information at the system
   console to load the SSP.

Step 3. Enter SDLCTST on the command screen and
press the Enter key.

Step 4.

If the system uses the first or second communications
adapter (not MLCA), perform the following steps:
a. Insert DIAGB5 diskette and press the Enter key.
b. Set the Comm Dply switch (CE panel) to the On
   position.
c. If two communications lines are installed, set the
   Comm 1/Comm 2 switch (CE panel) to the position
   of the communications line you are testing.
d. Select the code most often used by the customer.
   If you do not know that code, select the secondary
   code.

   Note: For World Trade, selecting the primary code
   does not supply an answer tone; selecting the
   secondary code does supply an answer tone.

If the system uses MLCA (not the first or second
communications adapter), perform the following steps:
a. Insert DIAGB5ML diskette and press the Enter key.
b. Set the Comm Dply switch (CE panel) to the On
   position.
c. Set the Comm Select switch (CE panel) to the line
   you are testing.
d. Select the option for the correct line number.

Step 5. If you want to terminate the test at this time,
see the preceding paragraph, *How to Terminate the
Online Test,* in this section.

Step 6. At this time, you can select program options.
(See *SDLC Online Test Options* later in this section.) If
necessary, change the station address to match the
station address of the called responder station. Make
the change through the scan/alter SDLC
configuration option. For the remote work station
address, see the remote work station network
diagram, or see the remote work station configuration
display.

99

Step 7. The other station should be ready with the same or similar *SDLC Responder Station Routine* loaded. For systems with the first or second communications adapter, perform the following steps:
a. Select 1 (Requester Station Routine) and press the Enter key.
b. Enter the two-digit message type number (XX) (see Figure 99-3) and press the Enter key.

For systems with MLCA, perform the following steps:
a. Select 1 (Continue Test) and press the Enter key.
b. Enter the two-digit message type number (XX) (see Figure 99-3) and press the Enter key.

XX
Value   Content of Message

00	Data entered by operator (requester station sends message from storage that you have entered into storage.)
01	All 256 characters (EBCDIC)
02	A-Z, 0-9 (36 EBCDIC characters)
03	40 X'AA's and 40 X'55's (80 EBCDIC characters)
04	256 X'00's
05	256 X'FF's
06	X'F3' (SDLC TEST command)
07	Transmit only all 256 characters
08	Random data of specified block size
09	Repeated character (block size)
10	Transmit only data entered (you enter the data message into storage)

Note: If no data is entered, the message number (XX) will default to 06, and the repeat number (YY) to 01. (To end the test and return to the main menu, type E and press the Enter key.)

Figure 99-3. Message Numbers for SDLC Online Test

Step 8. Making the telephone connection for the test is different for switched and nonswitched lines and for telephone systems either in the United States and Canada, or in other World Trade countries. Select from the following procedures for making the telephone connection.

U.S. and Canada—Switched:
a. Press the Enter key (ignore the dialing message for World Trade countries).
b. Enter the two-digit repeat number (YY), but do not press the Enter key. A YY count of 00 defaults to one transmission.
c. Put the telephone in talk mode and dial the other system.

d. Wait for the 3-second answer tone (when calling systems with autoanswer) or for the operator at the other system to answer the phone.
e. After the answer tone ends or after the operator at the other system goes to data mode, put your telephone in data mode and/or put the handset on the cradle (on the hook).
f. When the Data Set Ready indicator appears (a few seconds after going to data mode), press the Enter key.

Other Countries—Switched:
a. Put the telephone in talk mode and dial the other system.
b. Wait for the 3-second answer tone (when calling systems with autoanswer) or for the operator at the other system to answer the phone. The other system should now be in (or go to) data mode.
c. Press the Enter key. The Data Set Ready indicator should appear in a few seconds.
d. Put the handset on the cradle (on the hook).
e. Enter the two-digit repeat number (YY). A YY count of 00 defaults to one transmission.
f. Press the Enter key.

All Countries—Not Switched:
a. Enter the two-digit repeat number (YY). A YY count of 00 defaults to one transmission.
b. Press the Enter key.

Step 9. The test should start.

On a switched network, if there is a delay before the link is connected, the program may try more times than its retry count and then terminate the program. In this case, re-enter the XX and YY numbers and press the Enter key when the link is finally connected. Stations on a switched network can disconnect the line within approximately 25 seconds if there is no action on the line, or if too much time occurs between making the connection and the first transmission.

Step 10. While the link test is being executed, the CE panel communications indicators (receive data and send data) should flash on and off. For the first or second communications adapter only, the interrupt, the interrupt level 2 light should flash on and off.

The only expected output during the running of the requester routine is one of the following:

• Error messages

• SDLC test option menu (test ran error free)

Note: Do not terminate the test before the error message is displayed or before the end of the test.

Step 11. When the menu appears again, the test has completed without errors, and the program is ready for another message type to be selected or the program to be terminated.

To terminate the online test, type E and press the Enter key. This returns to the SDLC main menu. Then select option 4 (first or second communications adapter) or option 2 (MLCA) to terminate the test and return to the SSP.

See *How to Interpret SDLC Online Test Error Messages* later in this section for a description of error messages.

Operating Procedures for Online Test Responder Station Routine

Steps 1-6: Follow steps 1 through 6 as described for SDLC online test requester station (*Operating Procedures for SDLC Online Test Requester Station Routine*).

For World Trade countries with a switched connection, make the telephone connection now (see step 8 of the *Operating Procedures for SDLC Online Test Requester Station Routine*).

Step 7: The other station should be available with the same or similar SDLC online test requester routine loaded.

For the first or second communications adapter only:

Select 2 – Responder Station Routine and press the Enter key.

For MLCA only:

Select 1 – continue test.

Step 8: The other station should now start its test. (If switched and not World Trade, dial the station and start the test.) The test should start at this time. The CE panel communications indicators (receive data and send data) should flash repeatedly if the test is running correctly. The interrupt level 2 light will flash also.

Step 9: The test continues until an error occurs. Or, the responder continues to send back each frame it receives until it terminates.

Step 10: If you want the SDLC program terminated (return to SSP), press the Attn key and select option 2 or 3. This returns to the SSP command menu. This procedure will terminate the test and also disconnect the line if this is a switched network. This procedure is needed on a switched line before another connection can be made.

1. Scan or Alter Communication Feature
    Configuration (option 1 for first or second
    communications adapter, option 3 for MLCA).

    Selecting this option lets you check the present
    configuration of the communications feature. You
    can alter the configuration data (in storage) at the
    same time. However, if you change the
    configuration data by option 1, this changes the
    preceding configuration only for the time during
    this program. If the program is loaded again, the
    configuration goes back to the original
    configuration.

    Station Address (one hexadecimal byte)?

    This display determines the local station address.
    This data is used only for the running of the SDLC
    online test.

    Line Configuration?

    1—Multipoint
    2—Point-to-point nonswitched
    3—Switched line

    The configuration should not normally be changed.
    It can be changed to match characteristics of an
    alternate modem, or to permit testing of an SNBU
    (switched network backup) line if one is available.

    Answer Tone?

    (World Trade switched line option.) This display
    makes reference to those switched lines that need
    an answer tone generated by the adapter.

    Communications Line?

    This display determines the network that is
    selected to be tested on the local station.

Switched Network Backup?

Switched network backup (SNBU) makes reference
to a switched line that can be used when the
nonswitched line has a failure, and if an SNBU
modem is installed or available. Selection of this
option selects the SNBU line instead of the
nonswitched line. For MLCA, the SNBU feature
can be selected only if you have an external
modem that has the SNBU feature installed.

Line Speed?
    1—Half
    2—Full

You can select either of two transmission rates. If
the 2400-bps integrated modem is installed (2-line
communications only), either 2400- or 1200-bps
transmission rate can be selected by the entry
above. Similarly, if the 1200-bps integrated
modem is installed, either 1200- or 600-bps
transmission rate can be selected. Also, if the
4800-bps integrated modem is installed (MLCA
only), either 4800- or 2400-bps transmission rate
can be selected. This entry determines the bps
rate for the online test. If the modem does not
have the half-speed function, it must specify full
rate.

Clocking?
    1—Internal
    2—Modem

This display requests the type of clock function
used by the modem. The internal clock feature is
an oscillator card (A-A2Q2 for the first or second
communications adapter or A-B3U2 for MLCA)
that supplies clock pulses for modems that need
business machine clocking. It is important that this
display question be answered correctly for correct
operation.

2. Specify message block size (option 2 for first or second communications adapter) (option 4 for MLCA).

   Size can be 0001-0100 (256 decimal).

   This option permits transmitting data of any block size between 1 and 256. This block size will be used only if XX message 08 or 09 is selected.

3. Data Field Entry (option 3 for first or second communications adapter) (option 5 for MLCA)

   Enter up to 15 hexadecimal bytes. The first byte will be the control byte. Only messages XX=00, XX=09, and XX=10 use this data.

   This option permits you to specify the data you want transmitted. For message XX=00, the entered data is sent exactly as entered.

4. Additional Options

   First or Second Communications Adapter (Option 4)?

   Selecting 1 - *enable print* will print the data transmitted and the data received if an error is recognized. If the printer spool function is active, the data will be written to disk and can be printed later.

   Selecting 2 - *loop on first message selected* used only by the requester routine. If this option is selected, the first message type and the repeat count that you select is automatically used for the next test as soon as the preceding sequence has completed.

   With this option you can set the test to run repeatedly without any interrupts.

   Selecting 3 - Same as selecting both 1 and 2.

   MLCA?
Option 1	Continue test
Option 2	Terminate test
Option 6	Enable printing (for a description, see Selecting 1)
Option 7	Loop on first message selected (for a description, see Selecting 2)
Option 8	Enable print and loop on message (same as selecting option 6 and 7)

   Note: Options are reset by reloading the online test.

How to Interpret SDLC Online Test Error Messages

If option 1, 3, or 4 was selected, an error will terminate the online test and an error display will occur.

Error Statistics Table:

FMS RECVD	Total number of frames received.
VALID FMS RECVD	Total number of valid frames received.
BCC ERRORS	Total number of BCC checks.
BUFFER OVERRUNS	A message is longer than the receive modem buffer length.
ADAPTER CHKS	Total number of adapter checks.
INVALID FMS	Total number of not valid frames.

A list of error messages is contained under *Error Messages for Online Test*.

99

Sample error printout:

BCC CHECK
****ERROR*****
XX IS 02 YY IS 07
CURRENT YY IS 04

(See the preceding error statistics table.)

Data compare error

Data transmitted was
F3C1C2C3C4C5C6C7C8C9D1D2D3D4D5D6
D7D8D9E2E3E4E5E6E7E8E9F0F1F2F3F4
F5F6F7F8F9

Data received was
F3C1C2C3C4C5C6C7C8C9D1D2D3D4D5D6
D7D8D9E2E3E4E5E6E7E8E9F0F1F2F3F4F5
F6F7F8FD

Notes:
1. All preceding error outputs make reference to the last transmit and receive operations performed.
2. If the error message fills the screen, press the Enter key to view the remainder of the message.

BCC Check indicates possible line hit. Data Compare Error indicates data received was not as expected. Then the data from the last transmit and receive instruction is printed.

Because message 02 should be 36 characters (A-Z, 0-9 starting with C byte), the last data byte F9 was probably changed to FD by noise on line (line hit).

Error Messages for Online Test

TIMEOUT CHECK	Time-out occurred.
BCC CHECK	BCC check.
INVALID FRAME	Flag detected off boundary or not valid characters.
ADAPTER CHECK ON RECEIVE	SDLC hardware error.
ADAPTER CHECK ON TRANSMIT	SDLC hardware error.
ABORTIVE DISCONNECT CHECK	Data Set Ready was made not active.
DATA SET READY DROPPED	Data Set Ready not on.
NO UDT EXISTS CONFIGURE THE SYSTEM	Data communications is not in the UDT configuration.
NO RESPONSE AFTER 90 SECS	No response received after 90 seconds.
XX OR YY INVALID	XX or YY values entered from keyboard are not correct.
DATA COMPARE ERROR	Expected data messages did not compare with data received.

SDLC Control Characters

Format	Control Field Bit Configuration 0 1 2	3	4 5 6 7	Command/Response Description
I	Nr	P/F	Ns 0	Sequenced Information Frame
S	Nr	P/F	0 0 0 1	Receive Ready
	Nr	P/F	0 1 0 1	Receive Not Ready
NS	0 1 0	P	0 0 1 1	Disconnect
	0 1 0	F	0 0 1 1	Request Disconnect
	0 1 1	F	0 0 1 1	Unnumbered Acknowledge
	1 0 0	P	0 0 1 1	Set Normal Response Mode
	1 1 1	P/F	0 0 1 1	Test
	1 0 0	F	0 1 1 1	Frame Reject
	1 0 1	P/F	1 1 1 1	Exchange Identification
	0 0 0	F	1 1 1 1	Disconnected Mode

Notes:
1. I = Information, S = Supervisor control function, and NS = Nonsequenced.
2. Nr is the sequence number of the next expected frame. Ns in the sequence number of the last frame that was sent.
3. P/F is either the poll bit from the primary station, or the last bit from the secondary station.
4. If errors occur on receive operations, the control field byte may not be valid.

56   99-074

99-075   BSCA Online Test

Operating Procedures for BSCA Online Requester

This test is sometimes known as link requester or over-the-line test.

Step 1. Configuration of the communications feature must have been done earlier.

Step 2. If the customer is not using the System/34, set the CSIPL and MSIPL switches to Disk, press the Load key, and then go to step 3. If the customer is using the System/34 (but not data communications on the desired line), go to step 3.

Step 3. Enter the following on the command screen:

Type BSCATST and press the Enter key.

Step 4. Insert DIAGB5 diskette (first or second communications adapter) or DIAGB5ML diskette (MLCA) and press the Enter key.

Set the Comm Dply switch (on CE panel) to the On position. If two communications lines are installed, set the Comm 1/Comm 2 switch (on CE panel) to the position of the communications line you are testing. If MLCA is installed, set the Comm Select switch (on CE panel) to the line you are testing.

For the MLCA, select the option from the display screen for the correct line number. For a description of any options selected in the following steps, see *BSCA Online Test Options* later in this section.

Step 5. If you want to terminate the test now, type 4 (first or second communications adapter) or type 3 (MLCA) and press the Enter key. If you want to terminate the test later, press the Attn key and select option 2.

Note: If you want to terminate the BSCA online test, do so only when this option menu is displayed, when the test (specified by message number XX) has completed, or when an error is displayed. Any attempt to terminate the test at any other time could result in a system hang condition.

When on a switched network, using the ATTN key and option 2 to stop the program (instead of the program's normal termination option) may not disconnect the telephone line. Reload the online test and select the normal termination option to disconnect the telephone line.

If *Printer Spool Function* is active when you press the Print key on the keyboard, the display is written to the *Printer Spool File.*

Step 6. At this time, you may select test options if desired or needed. The following conditions need an option to be selected:

- The system is a multipoint tributary (an address must be entered).

- An ID (verified identification) is needed.

- A configuration change is needed for this test. For the first or second communications adapter, select option 4; or for MLCA, select the option from the display screen.

    (See *BSC Online Test Options* later in this section for more details.)

Step 7. The other station should be ready with the same or similar BSCA online responder loaded.

Select 1 - *Requester Routine* and press the Enter key.

Note: For 1200 integrated modems on World Trade switched networks, dial the telephone number as indicated in step 8 at this time. Do not hang up until after step 7 is completed.

Select a line code EBCDIC or ASCII. (Default is EBCDIC.)

Step 8. Determine message type number wanted (see Table 6 in 99-077).

Enter 2-digit message type number and 2-digit repeat number. (These numbers are decimal.) For all leased modems and 1200 integrated modems on World Trade switched networks, press the Enter key and go to step 9. Do not press the Enter key if this is a switched network. Press the Enter key if this is a nonswitched or multipoint network.

If the BSCA is point-to-point switched, the telephone number must be dialed. Put the telephone in talk mode and dial the other system. If the other system has autoanswer, you should hear a high frequency tone for 3 seconds. After the tone ends or after the person on the other end goes to data mode, put your telephone in data mode and/or put the handset on the cradle (on the hook). Press the Enter key. The Data Set Ready indicator should appear a few seconds after going to data mode.

99

Step 9. For point-to-point switched networks, and for multipoint networks the test should start.

Note: Some error outputs may occur on switched networks before the link is connected (time-outs or data set not ready).

On a switched network, if there is a delay before the link is connected, the program may recognize the link as not being connected, and try more times than its retry count. The program then will terminate and post errors. In this case, enter again the XX and YY numbers and press the Enter key when the link is connected.

Step 10. While the requester routine is being executed, the CE panel indicator lights Transmit Space and Receive Space should pulse (flash on and off). Also, interrupt level 2 light should pulse.

The only expected output during the running of the requester routine follows:

A. Output of the XX and YY values selected:

XX is_____ YY is_____

(This is displayed immediately after entry and before communication is started.)

B. Output after test is complete:

TEST COMPLETED

Any output other than the preceding are error messages.

Step 11. When TEST COMPLETED occurs, the test is complete and the program is ready for another message type to be selected or the program to be terminated.

If you want the BSCA online test to be terminated, type END and press the Enter key. This returns to the BSCA Online Test menu. Select the terminate option to terminate the test and return to SSP (see step 5 for test termination).

See *How to Interpret BSCA Online Test Error Messages* for a description of the messages.

Operating Procedures for Online Responder

This test is sometimes known as *link responder* or *over-the-line responder* test.

Steps 1-6. These steps are the same as BSCA online requester (see *Operating Procedures for BSCA Online Requester*).

Step 7. Select 2 - *Responder Routine*, and press the Enter key. Select a line code EBCDIC or ASCII.

Step 8. The other station should now start the online requester test (if switched, the other station dials and starts the test). The test should start at this time (the BSCA CE panel indicators Transmit Space and Receive Space should flash repeatedly if the test is running correctly). (The interrupt level 2 light will also flash.)

Step 9. The only output (except errors) during the running of the responder routine follows:

A. XX is _____ YY is _____

This is an output of the message type and number of times repeated as sent by other station. This is after the test is complete.

B. A TEST COMPLETED output indicates test is complete.

Step 10. When TEST COMPLETED is reached, the responder program goes back to a receive instruction and waits for the next test request by the other system. If no more tests are requested by the other system, no ENQ during receive and no data received messages will print.

Note: On switched lines, when the operation is completed ensure that the telephone line is disconnected (to terminate the call).

If you want the BSCA program to be terminated (return to SSP), press the Attn key and select option 2 or option 3. This procedure terminates the test and also disconnects the line if switched network. This procedure is needed on a switched line before another connection can be made.

BSCA Online Test Options

1. Scan or Alter BSCA Configuration (option 1 for first or second communication adapter) (option 4 for MLCA).

    Selecting this option lets you check the present configuration of the BSCA. You can change the configuration data (in storage) at the same time. However, if you alter the configuration data, this changes the preceding BSCA configuration only for the time of this program. If the program is loaded again, the configuration changes back to the original configuration. This changing of the configuration data does not affect any other program.

    World Trade? Y or N

    Line Configuration?

    This line configuration display determines the basic type of communications network for the system.

    1-MULTIPOINT TRIBUTARY

    2-POINT-TO-POINT NONSWITCHED

    3-SWITCHED LINE

    The configuration should not normally be changed unless an alternate modem is available, or to permit testing of a nonswitched line on an SNBU (switched network backup) configuration.

    Switched Network Backup? (SNBU)

    Switched network backup (SNBU) makes reference to a switched line that can be used when the nonswitched line has a failure, and if a SNBU modem is installed or available. Selection of this option selects the SNBU line instead of the nonswitched line (the standby line). For the MLCA, the SNBU feature can be selected only if you have an external modem that has the SNBU feature installed.

    Line Speed?
    1-Half
    2-Full

You can select either of two transmission rates. If the 2400-bps integrated modem is installed (2-line communications only), either 2400- or 1200-bps transmission rate can be selected by the entry above. Similarly, if the 1200-bps integrated modem is installed, either 1200- or 600-bps transmission rate can be selected. Also, if the 4800-bps integrated modem is installed (MLCA only), either 4800- or 2400-bps transmission rate can be selected. This entry determines the bps rate for the link test. If the modem does not have the half-speed function, it must specify full rate.

Communication Line?

This display determines the network that is selected to be tested on the local station.

Answer Tone?

(World Trade switched line option.) This display makes reference to these switched lines that need an answer tone generated by the adapter.

Clocking?
    1-Internal
    2-Modem

This display requests the type of clock function used by the modem. The internal clock feature is an oscillator card (A-A2Q2 for first or second communications adapter or A-B3U2 for MLCA) that supplies clock function pulses for modems that need business machine clocking. This card must be installed for internal clock selection. It is important that this display question be answered correctly for proper operation.

99

2. ID or Multipoint Address Entry (option 2 for first or second communications adapter; option 5 for MLCA).

Selecting this option allows entry of an ID (if required) or up to 15 bytes. Or if the system is a multipoint tributary station, 2 bytes of address must be entered. (Both entries are hexadecimal.) The BSCA configuration determines if the data entered is either an ID or an address.

Note: If you are going to use this procedure to run with a system that needs an ID, use the following ID sequence:

For EBCDIC, enter: 61F(N)F(N)F(N)61(SS)(SS)(SS) 61F(X)F(X)F(X)F(X) (no spaces)

For ASCII, enter: 2F3(N)3(N)3(N)2F(SS)(SS)(SS) 2F3(X)3(X)3(X)3(X) (no spaces)

(N)(N)(N) = Your branch office number in hexadecimal.

(SS)(SS)(SS) = Security code in hexadecimal.

(X)(X)(X)(X) = The machine type (5340) in hexadecimal.

Note: To translate the security code characters to hexadecimal, use an ASCII or EBCDIC conversion chart. These charts can be found in Appendix F of the *IBM System/34 Functions Reference,* SA21-9243, or Appendix J of the *IBM System/34 System Data Areas and Diagnostic Aids Manual,* LY21-0049.

3. Message 00 or 01 Data Entry (option 3 for first or second communications adapter) (option 6 for MLCA).

This special type of message permits you to enter any data as a test message.

The message can be up to 15 bytes long and must include the frame control characters (STX, ETX, or DLE STX, DLE ETX).

If you do not enter any data for message 00 or 01, it will default to STX X'40' ETX for both messages.

The transmission sequence for message type 00 and 01 are shown in tables 1, 2, and 3.

4. Additional Options:

First or Second Communications Adapter (option 4)?

Select 1 - *Enable Printing* will enable any error data outputs during the BSCA Online test. Outputs indicate error conditions. If printed output is not enabled, error headings and error data are displayed. This option is used by both requester and responder routines.

Select 2 - *Loop On First Message Selected* is used only by the requester routine. If this option is selected, the first message type (XX value) and the repeat count (YY value) selected by you are automatically used for the next test as soon as the preceding sequence has completed.

With this option, you can set the BSCA to run repeatedly without any interrupts.

Select 3 - Same as selecting both 1 and 2.

MLCA?

Option 1	Requester routine
Option 2	Responder routine
Option 3	Terminate test
Option 7	Enable printing (for a description, see Select 1)
Option 8	Loop on first message selected (for a description, see Select 2)
Option 9	Enable print and loop on message (same as selecting both options 7 and 8)

Note: Options are reset by loading the online test again.

How to Interpret BSCA Online Test Error Messages

A list of error messages is under *Error Messages for BSCA Online Test*. To determine the problem, compare the output to the line control tables 1 through 5 of the message type selected.

Example 1

Sample error output:

```
XX IS 01 YY IS 10
**** ERROR *****
CURRENT YY IS 10
SENT RFT EXP ACK1
```

Looking at the line control (Table 2) for message 01 point-to-point and the output that no ACK1 was received after sending our RFT (request-for-test) message (SOH% etc) indicates communication took place (we sent ENQ and received an acknowledgment of ACK0 from the other station) but then a failure occurred. Current YY is ____ means the present condition of the YY counter (its value is decreased after each receive operation).

Example 2

Sample error output:

```
XX IS 14 YY IS 07
CRC/LRC/VRC CHECK
**** ERROR *****
XX IS 14 YY IS 07
CURRENT YY IS 04
DATA COMPARE ERROR
DATA TRANSMITTED WAS
1061
DATA RECEIVED WAS
02C1C2C3C4C5C6C7C8C9D1D2D3D4D5D6
D7D8D9E2E3E4E5E6E7E8E9F0F1F2F3F4
F5F6F7F8FD03
```

Note: All preceding error output makes reference to the last transmit and receive operation performed.

The output CRC/LRC/VRC CHECK indicates possible line hit. DATA COMPARE ERROR indicates data received was not as expected. Then the data from the last transmit and receive instruction is printed. Data transmitted is 1061 (ACK1) which is a positive response to the last block of received data. Since message 14 should be 36 characters (A-Z, 0-9 framed by STX and ETX), the last data byte F9 was probably changed to FD by noise on the line (line hit).

99

Error Messages for BSCA Online Test

Messages for both requestor and responder routines

3 SECOND TIMEOUT CHECK . . . . .3.25 sec timeout occurred.
CRC/LRC/VRC CHECK. . . . . .BCC check.
INVALID ASCII CHECK . . . . .Character received or transmitted was not 00-7F.
ABORTIVE DISCONNECT CHECK. . . . . .Data set ready was dropped.
DATA SET READY IS OFF . . . . .Data set ready not on.
OVERRUN . . . . .Hardware error.

Messages for requester routine

WRONG POLL SEQ . . . . .Either poll address or ENQ was not present during multipoint
                          receive initial.
XX OR YY INVALID . . . . .XX or YY values entered are not applicable.
DATA COMPARE ERROR. . . . . .Expected data messages did not compare with actual received.
SENT RFT EXP ACK1. . . . . .Sent RFT messages (SOH% etc) but ACK1 was not replied.
SENT 10 RFTS RCVD 10 NAKS. . . . . .10 RFT messages were sent but NAK was received each time.
WRONG SELECTION SEQ. . . . . .Either selection address or ENQ was not present (multipoint selection).
SENT ENQ NO ACK0 . . . . .No ACK0 reply was received after ENQ was sent.
RCVD NAK EXPTD ACK0/1 . . . . .Sent message and received NAK.
EXP ACK0/1 . . . . .Sent message but received invalid response.
GOT EOT BUT YY NOT YET 0 . . . . .Receive EOT but message count is not yet zero.
NO EOT RCVD BUT YY IS 0 . . . . .Message count is zero but no EOT was received.
SENT EOT EXP ENQ . . . . .Sent EOT but no ENQ was sent to start line bid.

Messages for responder routine

YY IS ZERO BUT NO EOT RECEIVED . . . . . .Message count is zero but no EOT was received.
INVALID XX VALUE. . . . . .The message number obtained from the RFT message was invalid.
INVALID YY VALUE. . . . . .The message count obtained from the RFT message was invalid.
SENT ACK1 RECEIVED NO EOT. . . . . .After sending ACK1 in reply to RFT no EOT was received.
SENT MESSAGE RECEIVED NAK . . . . .A NAK was received after transmitting message.
SENT ENQ RECEIVED NO ACK0. . . . . .After receiving RFT and EOT sent EOT but no ACK0 was received.
DATA COMPARE ERROR. . . . . .Expected data message did not compare with actual received.
WRONG SELECTION SEQUENCE . . . . .Either selection address or ENQ was not present (multipoint selection).
NO ENQ DURING RECEIVE . . . . .During first receive operation no ENQ was received.
NO RESPONSE AFTER SENDING ACK0. . . . .After replying ACK0 to initial ENQ nothing was received.
INVALID RFT RECEIVED . . . . .The request for test message received contained invalid format.
SENT MESSAGE EXP ACK0/1 . . . . .After sending message an invalid response was detected.
25 WACKS RECEIVED . . . . .A delay at the other station has caused WACKS to be sent.
NO EOT AFTER RFT . . . . .An EOT was expected after the other station sent RFT.
INVALID DATA RECEIVED. . . . . .No valid ENQ character was detected after receiving data.
EXP ENQ NOT RECD AFTER DELAY . . . . . . .Expected ENQ not received after 33 seconds.
TERMINATED AFTER 3 TIMEOUTS . . . . .ENQ received, but nothing followed it within 3 timeouts.
NO DATA RECEIVED. . . . . .Data was expected on the line, but none came within timeout.
NO DATA TRANSMITTED . . . . .Expected to send data, but none was sent.

99-076   MLCA Concurrent Wrap Test and Trace Dump Driver Program (COMMTST)

Function: Permits the running of three programs under option control:

Option	Description
1.	Line wrap test
2.	Controller wrap test
3.	Print CE trace
4.	Print automatic trace
5.	End test

See selected program descriptions for more details.

Location of Program: DIAGB5ML

Name of Program: COMMTST

Type of Program: Written in main storage code and operates under SSP. Program runs concurrently with other system operations. For restrictions, see selected options.

Line Wrap Test (COMMTST Option 1, MLCA Only)

CAUTION
If this line is DDSA and a tributary on a multipoint line, running this test can cause up to one second of errors on the network.

_____
_____
_____
_____

This wrap test ($MLWR) tests the communications adapter card, the line adapter card (if DDSA), and the IBM connected modem. This test indicates either failure of hardware or no failure found, but the test is not as complete as the MDI test.

When this test is selected, a part of the wrap test code moves the receive/transmit data traces and command queue traces (stored in the controller) for all four communications lines, from the MLCA controller to a disk storage area. These traces can be read from disk and displayed by using COMMTST option 3 or 4 (MLCA trace dump program).

This test is automatically selected by BSC and SDLC programs when a communications line has a permanent error. In this case, the traces are moved to disk area $MLTA and are displayed by using COMMTST option 4.

This test can also be selected by you in a concurrent mode through the use of COMMTST. The test can be run only on a line that is not in use. It runs concurrently with other system operations and while other communications lines are in use. It is to be used when the system is not available for dedicated maintenance, or when some testing is wanted before the complete system is taken down.

To start the test, enter COMMTST when the SSP command display appears, and insert diskette DIAGB5ML. Select option 1. Traces that are stored in the controller storage are moved to disk storage area $MLTC and can be read from disk and displayed by using COMMTST option 3.

This program can be used when troubleshooting a suspected microcode problem, a lost frame problem, or a wrong command problem. First, run the failing program or exerciser on a communications line; then, select this test to run on a not used line. The receive/transmit data traces and command queue traces for all four lines can then be displayed by using COMMTST option 3.

Note: In Japan, set the Modem Cable switch to the Test position before running the line wrap test. Set the Modem Cable switch to the operate position when the line wrap test is complete.

Controller Wrap Test (COMMTST Option 2)

This program ($MLXX) tests the MLCA controller and controller storage. This test indicates either failure of hardware or no failure found, but the test is not as complete as the MDI test.

When this test is selected, a part of the code moves the transferred data traces, command queue traces, and the MLCA controller check status, for all four communications lines, from the MLCA controller to a disk storage area. The controller check status is also moved to this disk area. These traces and status bytes can be read from disk and displayed by using COMMTST option 3 or 4 (MLCA trace dump program).

This test is selected automatically when an MLCA controller check is sensed. The traces are then moved to disk area $MLTA and are displayed by using COMMTST option 4.

This test can also be selected by you in a concurrent mode through the use of COMMTST. The test can be used only if no communications lines are in use or enabled. The test runs concurrently with other system operations; use it when the system is not available for dedicated maintenance or when some testing is wanted before the complete system is taken down.

To start the test, enter COMMTST when the SSP command display appears and insert diskette DIAGB5ML. Select option 2. Traces generated during the test are moved to disk storage area $MLTC and can be read from disk and displayed by using COMMTST option 3.

Note: When this test is selected by you, the error transient will automatically post a system message that an MLCA controller check has occurred. Ignore this message.

Print CE Trace or Print Automatic Trace (COMMTST Options 3 and 4)

This program reads from disk and prints stored MLCA receive/transmit data traces, command queue traces, and MLCA controller check status.

Note: For a description of trace dump data areas, see the *Data Areas and Diagnostic Aids Manual,* LY21-0049.

During normal operation, microcode stores the following information for each communication line:

• For BSC, the first 3 bytes and the last byte of the latest 101 transmit and/or receive messages

• For SDLC, the first 12 bytes of the latest 39 transmit and/or receive messages

• Status byte of the IOB if there is an error. If there is no error, hexadecimal FF is stored for a transmitted message and hexadecimal 00 is stored for a received message

When an MLCA controller check occurs, microcode also stores controller check status.

Option 3 reads data from disk area $MLTC. The traces were written to storage by the data communications line wrap test (COMMTST option 1), or the MLCA controller wrap test (COMMTST option 1 or 2).

Option 4 reads data from disk area $MLTA. These traces were written when a communications line had a permanent error and the line wrap test was run automatically, or when an MLCA controller error was sensed and a good controller wrap test was run automatically (no check condition prevented traces from being moved to disk storage).

Note: For option 4, the date the traces were moved to storage compares to the last entry in the line or controller ERAP table.

Table 1. Online test transmission sequence for message
type XX = 00 point-to-point

Requester	Responder
ENQ	
	ACK0
SOH	
% 0 YY 0	
STX	
ETX	
	ACK1
(DLE)	
STX	
TEXT	
(DLE)	
ETX	
	ACK0/1 (See Note 1.)
TEXT and	
CONTROL	
CHARACTERS	
REPEATED	
YY-1 TIMES	
	ACK0/1
	REPEATED
	YY-1 TIMES (See Note 1.)
EOT	

Notes:
1. System/34 sends only even acknowledgments
   (ACK0) when receiving data, but will receive either
   even acknowledgments or odd acknowledgments
   (ACK0 or ACK1) to data it sends.
2. System/34 can only be a requester on a multipoint
   network.

Table 1A. Online test transmission sequence for
message type XX = 00 multipoint (See Note 2.)

Requester	Responder
	EOT
	POLL
	ENQ
SOH	
% 00 YY 0	
STX	
ETX	
	ACK1
(DLE)	
STX	
TEXT	
(DLE)	
ETX	
	ACK0/1 (See Note 1.)
TEXT and	
CONTROL	
CHARACTERS	
REPEATED	
YY-1 TIMES	
	ACK0/1
	REPEATED
	YY-1 TIMES (See Note 1.)
EOT	

99

Table 2. Online test transmission sequence for message type XX = 01 point-to-point

Requester	Responder
ENQ	
	ACK0
SOH	
% 1 YY 0	
(DLE)	
STX	
TEXT	
(DLE)	
ETX	
	ACK1
EOT	
	ENQ
ACK0	
	(DLE)
	STX
	TEXT
	(DLE)
	ETX
ACK0/1	
(See Note 1.)	TEXT and
	CONTROL
	CHARACTERS
	REPEATED
	YY-1 TIMES
ACK0/1	
REPEATED	
YY-1 TIMES	
(See Note 1.)	EOT

If the system is the requester, the message (text) must have been put in storage earlier.

Notes:
1. System/34 sends only even acknowledgments (ACK0) when receiving data, but will receive either even acknowledgments or odd acknowledgments (ACK0 or ACK1) to data it sends.
2. System/34 can only be a requester on a multipoint network.
3. System/34 in responder mode for message 01 can receive messages of 296 bytes, but can transmit messages of only 285 bytes.

Table 3. Online test transmission sequence for message type XX = 01 multipoint (See Note 2.)

Requester	Responder
	EOT POLL
	ENQ
SOH	
% 1 YY N	
ADDR	
(DLE)	
STX	
TEXT	
(DLE)	
ETX	
	ACK1
EOT	
	EOT
	ADDRESS
	ENQ
ACK0	
	(DLE)
	STX
	TEXT
	(DLE)
	ETX
ACK0/1	
(See Note 1.)	TEXT AND
	CONTROL
	CHARACTERS
	REPEATED
	YY-1 TIMES
ACK0/1	
REPEATED	
YY-1 TIMES	
	EOT

If the system is the requester, the message (text) must have been put in storage earlier.

Table 4. Online test transmission sequence
for message type XX = 02-19 point-to-point

Requester	Responder
ENQ	
	ACK0
SOH	
% XX YY NN	
STX	
ETX	
	ACK1
EOT	
	ENQ
ACK0	
	STX
	TEXT
	ETX
	REPEATED
	YY TIMES
ACK0/1	
REPEATED	
YY TIMES	
(See Note 1.)	EOT

Text is specified by XX.
(See Table 6.)

Notes:
1. System/34 sends only even acknowledgments (ACK0)
   when receiving data, but will receive either even
   acknowledgments or odd acknowledgments (ACK0 or
   ACK1) to data it sends.
2. System/34 can only be a requester on a multipoint
   network.

Table 5. Online test transmission sequence
for message type XX = 02-19 multipoint (See Note 2.)

Requester	Responder
.	EOT
	POLL
	ENQ
SOH	
% XX YY N	
ADDR	
STX	
ETX	
	ACK1
EOT	
	EOT
	ADDRESS
	ENQ
ACK0	
	(DLE)
	STX
	TEXT
	(DLE)
	ETX
	REPEATED
	YY TIMES
ACK0/1	
REPEATED	
YY TIMES	
(See Note 1.)	EOT

Text is specified by XX.
(See Table 6.)

99

Table 6. Message Numbers for BSCA Online Test.

Code Type or Feature	Transparency Mode	Applicable Messages
Requester Routine		
Multipoint	YES or NO	00, 01, 02, 04, 14, 15, 16, 19
EBCDIC	YES	00, 01, 02, 04, 14, 15, 16, 19
EBCDIC	NO	00, 01, 04, 14, 15, 16
ASCII	NO	00, 01, 05, 06
Responder Routine		
Multipoint		No applicable messages
EBCDIC	YES	00, 01, 02, 04, 14, 15, 16, 19, 20, 21 & 22
EBCDIC	NO	00, 01, 04, 14, 15, 16
ASCII	NO	00, 01, 05, 06

XX Value (message number)	Content of Message
00	Requester sends message from storage (you must put message in storage)
01	Requester receives message from storage (you must put message in storage)
02	256 EBCDIC characters (transparent)
04	245 EBCDIC characters (all EBCDIC except DLC)
05	117 ASCII characters (all ASCII except DLC)
06	36 ASCII characters: A-Z, 0-9
14	36 EBCDIC characters: A-Z, 0-9
15	80 EBCDIC characters: 74 X'00' and 6 SYNS
16	80 EBCDIC characters: 40 AA and 40 X'55'
19	290 EBCDIC characters: 280 X'00' and 10 SYNS (transparent)
20	80 EBCDIC characters: A-Z, 0-9 and 00 through 3F (transparent)
21	120 EBCDIC characters: A-Z, 0-9, and 00 through 53 (transparent)
22	144 EBCDIC characters: A-Z, 0-9, and 00 through 6B (transparent)

99-077

Table 7. Communications Control Characters

Name of Function	Functional Mnemonic	EBCDIC Code	ASCII Code
Start of heading.	SOH	01	01
Start of text.	STX	02	02
End of transmission block.	ETB	26	17
End of text.	ETX	03	03
End of transmission.	EOT	37 pad (see note)	04 pad (see note)
Attn.	ENQ	2D	05
Negative acknowledge.	NAK	3D pad (see note)	15 pad (see note)
Synchronous idle.	SYN	32	16
Data link escape.	DLE	10	10
End of intermediate transmission block.	ITB	1F	1F
Even acknowledge.	ACK0	1070	1030
Odd acknowledge.	ACK1	1061	1031
Wait before transmit positive acknowledge.	WACK	106B	103B
Mandatory disconnect.	DISC	1037	1004
Reverse interrupt.	RVI	107C	103C
Temporary text delay.	TTD	022D	0205
Transparent start of text.	XSTX	1002	
Transparent intermediate block.	XITB	101F	
Transparent end of text.	XETX	1003	
Transparent end of transmission block.	XETB	1026	
Transparent synchronous idle.	XSYN	1032	
Transparent block cancel.	XENQ	102D	
Transparent TTD.	XTTD	1002102D	
Data DLE in transparent mode.	XDLE	1010	

Note: Pad is 4 low-order bits of 1's (more bits may optionally be on).

99

99-080   HOW TO RUN DEVICE EXERCISERS

This exerciser program does not include the option to exercise the work station controller, the 5251 and 5252 display stations, or the 5256 and 5225 printers. An online diagnostic is available to exercise these units under SSP control. See the *IBM 5251 Display Station Maintenance Information Manual*, SY31-0461–Online Diagnostics.

The device exercisers are selected from the diagnostic supervisor main option menu. The next display shows all devices that have exerciser programs. After selecting a device and inserting the correct diskette, the command menu for that device is displayed.

1. Select commands from the command menu to assemble a table of commands.

2. The program then displays the selected commands and requests if you want the data fields option menu. (This is used for moving data to and from disk or diskette and is not valid for other devices.)

3. The program requests if you want to set options (scope loops, delay between commands, loop on command table) along with executing the selected commands.

4. The program then executes the table of commands.

Note: The Attn key can be used to interrupt your table of commands and change options, data fields, or your sequence of tests.

99-085   HOW TO RUN THE MAIN STORAGE PROCESSOR EXERCISER

The MSP (main storage processor) exerciser is selected from the exerciser option menu. There are three programs or functions that can be performed.

1. *Sense/Load MSP Registers*–This program will sense and display the contents of all the registers in the MSP. Some of the registers can also be loaded with new data. This permits you to preset registers such as the IAR (instruction address register) or the index registers (XR1 and XR2) to new values.

2. *Sense/Load Address Translation Registers (ATRs)*–This program will sense and display the contents of all the ATRs. The contents of the task ATRs can also be changed.

3. *Enter Main Storage Processor Instructions*–With this program you can enter system instructions and any necessary data into main storage. The instructions are entered in machine language in hexadecimal (see *MSP Instruction Execution* in the *5340 System Unit Theory Diagrams Manual*).

Ignore the following displays:

- A display that requests a need for preset data fields.

- A display that permits option selections (for example, halt on error, step mode, loop on command table).

- A display that inquires if you need a printed list of the commands. These displays are displayed by the exerciser supervisor program and are not valid for the MSP exerciser.

After you enter your last system instruction, the program will add an SVC (F4) instruction. The SVC is used to branch back to the op-code of your first instruction if you select *Loop Program and Sync Scope*, or to stop the MSP if you select *Run Program Once*.

The option *Set CP Interference* causes the control processor to frequently interrupt (or interfere with) your MSP program. This option is a good interrupt exerciser, but you would not want to select *Set CP Interference* if you want a tight scope loop.

Scope Loop Sync Point: If you select *Loop Program and Sync Scope,* you can sync your scope by using the following procedure:

1. Set the Address/Data switches to 0050.

2. Set the Stor Sel switch to Ctl.

3. Set the Add Comp switch to Run.

4. Attach the scope sync lead to A1K2D12.

5. The 'Address Compare Sync' line will trigger your scope sweep just before the fetch cycle of the first system instruction.

99-090   FREE-LANCING WITH MDIs–SYSTEM INSTRUCTION STEP AND MDI SPECIAL

There are two ways to free-lance with the MDI tests:

- System instruction step.

- MDI special.

System Instruction Step:

1. Set the CSIPL and MSIPL switches to Diskette (or to Disk when free-lancing with diskette MDIs), insert DIAGB1, and press the Load key.

2. When the main menu is displayed, set the Mode Selector switch to Sys Insn Step.

3. Press the CE Start key (starts the control processor clock).

4. Select MDI option.

5. Select a device to test.

6. Insert the correct diskette.

7. Observe the next menu (a description of all MDI tests for the device).

8. Select the MDI to run.

9. The next menu requests the starting step number. Select the step. (Step 1 is recommended.)

10. MDI starts executing when you press the Enter key.

Note: With the Mode Selector switch in Sys Insn Step, the MDI executes in step mode. With the Mode Selector switch in Proc Run, the MDI executes with no stops. You can change the mode of executing the MDI test at any time by changing the Mode Selector switch.

MDI special:

CAUTION
If a not valid step number or no step number is entered, a system processor check may occur.

_____
_____
_____

1. Before using this option, do the following:
   a. Figure out the MDI path to test using the preceding free-lance method.
   b. Record the MDI ID (IDID) and step numbers (NNN) for use in step 4.

2. Select MDI special from main menu.

3. Select a device to test.

4. Enter 4-digit MDI ID (IDID) and step numbers (NNN) to start and end executing the MDI test.

5. Select L or S option.

   L = Loop on selected MDI path
   S = Execute path once and return to MDI special menu.

   If you do not select either L or S, the default is to loop.

   Note: The L/S (loop/stop) option is valid only when the executed MDI reaches ending MAP/Step ID.

6. Select Y or N option.

   Y = Stop on yes answer
   N = Stop on no answer
   X = Do not check answer

99

For intermittent failures, you can use the MDI special program to loop on the *Good Machine Path* until a failure occurs.

1. Select MDI special from the main menu.

2. Select the failing device.

3. Enter the *Good Machine Path* starting and ending MAP ID (IDID) and step numbers (NNN) (see note).

4. Select the loop option.

5. Select stop on a no answer.

When a failure occurs, the system stops and displays the failing MAP ID, step numbers, and the TU ID of the TU test that sensed the error.

Choose the TU Select option from the main menu to loop on the TU test until another failure occurs. Use the result bytes from the TU test to aid in specifying the cause of the failure.

Note: How to determine the starting and ending MAP and step numbers in a *Good Machine Path*:

Good Machine Path starting MAP and step numbers:

1–Select MDIs from the main menu.

2–Select a device, insert the correct diskette, and press the Enter key.

3–The first display shows you the starting MAP and step numbers for the good machine path. For example, the starting MAP and step numbers for the 62EH disk are 0901 001.

Good Machine Path ending MAP and step numbers:

1–Select MDI Special from the main menu.

2–Enter the starting MAP and step, no ending MAP or step, X, and stop on a no answer.

3–When you press the Enter key, the *Good Machine Path* will be followed until the MDI test is normally completed.

4–The system stops with the ending MAP and step numbers displayed. For example, the ending numbers for the 62EH disk are 0902 059.

Because the starting and ending steps contain programmed halts that need your input, you can bypass those halts by entering 0901 003 and 0902 057 as starting and ending MAP and step numbers. This will let the system run the MAPs continuously until a failure occurs.

99-095 FREE-LANCING THE MAIN STORAGE PROCESSOR USING THE MSP MINI-MDI

The MSP mini-MDI tests the MSP hardware used to access main storage. It does this in three basic steps. The first step ensures a correct data path to and from main storage. The second step tests main storage to ensure that there are no out-of-parity bytes and that storage addressing is working correctly. The third step loads a system instruction into main storage and causes the MSP to execute this instruction. The various MSP registers and main storage are checked to verify the instruction executed correctly.

The MSP mini-MDI has three options that can be used for free-lance:

1. Run all tests again without having to load the MSP mini-MDIs again.
2. Step through the tests one test at a time.
3. Loop on one specific test.

To load the MSP mini-MDI:

1. Insert the DIAG B1 diskette.

2. Set the CSIPL and MSIPL switches to the Diskette position.

3. Set the Address/Data switches to EE00.

4. Press the Load key.

When the MSP mini-MDI is normally terminated, the display directs you to MAP 0190, Entry Point B.

To run the tests again without loading the MSP mini-MDI again, press the Enter key on the system console.

To step through the test, set the Address/Data switches to EE00 and press the Reset key and CE Start switch on the CE panel after the MSP mini-MDI has been loaded. Each time the Enter key on the system console is pressed, the next test name to be executed is displayed. When the Enter key is pressed again, the test will run and the received results are displayed. This continues until an error is detected or until all tests have been run.

To loop on one specific test, press the Reset key on the CE panel, set the Address/Data switches to EEXX and press the CE Start key. The MSP mini-MDI will loop on the test indicated by XX. (XX is the rightmost two digits of the test name. See the following list for a description of each test.) When the MSP mini-MDI is looping on a test, a control storage address compare stop can be done by changing the Address/Data switches to the address and putting the Add Comp switch in the Stop position. To stop looping and run the MAP again, press the CE Reset key, set the Address/Data switches to EEFF, and press the CE Start key.

XX Value	Description
01	Issue check reset and sense status byte 3.
02	Sense CPU error byte.
03	Issue check reset, disable checks, and test MSAR low.
05	Load BMR with X'00' and sense the BMR.
06	Load BMR with X'55' and sense the BMR.
07	Load BMR with X'AA' and sense the BMR.
08	Load CMR with X'00' and sense the CMR.
09	Load CMR with X'55' and sense the CMR.
10	Load CMR with X'AA' and sense the CMR.
11	Load PMR with X'00' and sense the PMR.
12	Load PMR with X'55' and sense the PMR.
13	Load PMR with X'AA' and sense the PMR.
14	Load CCR with X'00' and sense the CCR.
15	Load CCR with X'55' and sense the CCR.
16	Load CCR with X'AA' and sense the CCR.
17	Load ACR(L) with X'00' and sense the ACR(L).
18	Load ACR(L) with X'55' and sense the ACR(L).
19	Load ACR(L) with X'AA' and sense the ACR(L).
20	Load ACR(H) with X'00' and sense the ACR(H)
21	Load ACR(H) with X'55' and sense the ACR(H).
22	Load ACR(H) with X'AA' and sense the ACR(H).
23	Load ACRE with X'00' and sense the ACRE.
24	Load ACRE with X'55' and sense the ACRE.
25	Storage Control Card register single addressing test.

XX Value	Description
26	Load and sense the address translation registers (ATRs) with their addresses.
27	Address translation register (ATR) ripple test.
28	Load ACRE with X'AA' and sense the ACRE.
29	Load and sense main store with X'FF'. Test run in translated mode.
30	Load and sense main store with X'00'. Test run in translated mode.
31	Load and sense main store with X'01'. Test run in translated mode.
32	Issue an MSP reset and sense the PSR.
33	Load the MSP PSR with X'3C' and sense.
34	Sense the MSP Q register.
35	Load and sense MSP OP 2 high byte with X'00'.
36	Load and sense MSP OP 2 high byte with X'FF'.
38	Load and sense MSP PSR with X'00'.
39	Initialize OP 1 high to X'AA', XR1 high to X'55' and sense OP 1 high.
40	Initialize OP 1 high to X'AA', IAR high to X'55' and sense OP 1 high.
41	Initialize OP 1 high to X'AA', OP 2 high to X'55' and sense OP 1 high.
42	Load main store with X'FF' and sense. Test run in translated mode.
43	Load MSP PSR with X'01'. Check for SDR P-check.

XX Value	Description
45	Main store 1 address–1 byte test. This test is run in translated mode. Addressing is from highest to lowest.
46	Main store 1 address–1 byte test. This test is run in translated mode. Addressing is from lowest to highest.
47	Main store 1 address–1 byte test. This test is run in real mode. Addressing is from highest to lowest.
48	Main store 1 address–1 byte test. This test is run in real mode. Addressing is from lowest to highest.
49	BMR 16K–byte hardware switch test. This test is run in real mode.
50	BMR 16K–byte hardware switch test. This test is run in real mode.
51	BMR 16K–byte hardware switch test. This test is run in translated mode.
52	BMR 16K–byte hardware switch test. This test is run in translated mode.
53	Reserved.
54	Load BMR with X'03' ARR with X'AA'. Sense BMR and test for X'03'.
55	Sense MSP PSR.
56	Load and sense OP 2 low byte with X'00'.
57	Load and sense OP 2 low byte with X'FF'.
58	Initialize OP 2 low to X'55', OP 2 high to X'AA', and sense OP 1 low.
59	Load MSP PSR with X'FF' and sense.
60	Sense all MSP registers and ATRs.
61	Store bad parity into address X'00' of the MSP registers.

XX Value	Description
62	Reset the MSP and sense status byte 2.
63	Main storage not valid address check test. This test uses real addressing.
64	Main storage not valid address check test. This test uses translated addressing.
65	Load main storage address 0000 with X'80' and sense data.
66	Reserved.
68	ATR storage exception test.
69	Main storage data path flow test.
6A	Main storage data path flow test (extended).
70	ATR utilization test.
72	Main store 16K block address selection test. Lowest address to highest.
73	Main store 16K block address selection test. Highest address to lowest.
74	Issue MSP reset and sense status bytes 0 and 1.
75	Execute a not valid OP with the MSP and check results in status bytes 0 and 2.
76	Execute a not valid OP with the MSP and check results in status bytes 0 and 2.

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XX Value	Description	XX Value	Description
77	Execute a not valid OP with the MSP and check results in status bytes 0 and 2 and checks the data in the LCRR.	90	Execute a Move Character instruction in the MSP and stop after EA time. The instruction is in indexed mode.
78	Execute a Move Character instruction in the MSP and stop after the OP byte has been executed.	92	Execute a Move Character instruction in the MSP. PMR is set to EB translated.
79	Execute a Move Character instruction in the MSP and stop after the 0 byte has been executed.	93	Execute a Move Character instruction in the MSP. PMR is set to EA translated.
80	Execute a Move Character instruction in the MSP and stop after the first byte of operand 1 has been executed.	94	Execute a Move Character instruction in the MSP. PMR is set to I translated.
81	Execute a Move Character instruction in the MSP and stop after the second byte of operand 1 has been executed.	95	Execute a Move Character instruction in the MSP. PMR is set to all translated mode.
82	Execute a Move Character instruction in the MSP and stop after the high byte of operand 2 has been executed.	96	Storage protection test.
		97	Execute a Move Character instruction where operand 2 points to an address containing bad parity. MSP is in check mode.
83	Execute a Move Character instruction in the MSP and stop after the low byte of operand 2 has been executed.	98	Execute a Move Character instruction and access main store from CP while instruction is operating.
84	Execute a Move Character instruction in the MSP and stop after the EA cycle has been executed.	99	Execute a Move Character instruction where operand 2 points to an address containing bad parity. MSP not in check mode.
85	Execute a Move Character instruction in the MSP and stop when completed. The MVC results are then checked.	A0	Load bad parity into an ATR and use this ATR while executing an MSP instruction.
86	Execute a Move Character instruction in the MSP and stop after OP time. The instruction is in indexed mode.	A1	Load bad parity into the low byte of the IAR and execute an MSP instruction.
		A2	Load bad parity into the high byte of the IAR and execute an MSP instruction.
88	Execute a Move Character instruction in the MSP and stop after 0 time. The instruction is in indexed mode.	A3	Execute an MSP instruction using ATRs 0 and 31.
89	Execute a Move Character instruction in the MSP and stop after IX1 time. The instruction is in indexed mode.		

99-999 TU TEST DESCRIPTIONS FOR THE
WORK STATION ATTACHMENT

This section of the maintenance manual is a printout
that describes all the TU tests for the work station
attachment. The printout is supplied so you can use it
with paragraph 99-064 *How to Run TU Select for the
Work Station Attachment from the CE Panel.*

If a display station is not operational, it cannot display
the available TU tests. For that reason, the test
descriptions are in *hard copy.*

The printout has a short description of what each TU
test does, and has the meanings of significant bits in
the result bytes that are passed from the TU test to
work registers 6 and 7. (See paragraph 99-062 for
instructions on *How to Run Work Station Attachment
MDIs from the CE Panel.*)

Test Number	Description
TC001	ADAPTER RESET
TC002	DIAGNOSTIC MODE ENABLE/DISABLE
TC003	DIAG SET CS XFER ERROR
TC004	U-INTERRUPT REQUEST ENABLE
TC005	SET SERVICE REQUEST
TC006	SET COMMAND PENDING
TC007	CONTROLLER LOAD SET/RESET
TC008	SINGLE CYCLE SET/RESET
TC009	CONTROLLER RESET SET/RESET
TC00A	JIO FUNCTIONS
TC00B	CONTROLLER DBO/DBI WRAP
TC00C	U-INTERRUPT REQUEST SET
TC00D	X-SAR BIT 2, CONTROLLER LOAD
TC00E	CONTROLLER BUSY
TC00F	CONTROLLER TO CHANNEL
TC010	CONTROLLER OP CHECK LATCH
TC011	CONT DBO/DBI PARITY LATCH
TC012	COMMAND PENDING SENSE TEST
TC013	SERVICE REQUIRED
TC014	CYCLE STEAL TRANSFER
TC020	CONTROLLER 4-BIT BUS
TC031	CONTROLLER DAR SELECT
TC032	CONTROLLER DAR DATA (5)
TC033	CONTROLLER DAR DATA (A)
TC034	CONTROLLER REG/AUX REGS SELECT
TC035	CONTROLLER REG SELECTION
TC036	CONTROLLER REG DATA (5)
TC037	CONTROLLER REG DATA (A)
TC038	CONTROLLER AUX REG SELECTION
TC039	CONTROLLER AUX REG DATA (5)
TC03A	CONTROLLER AUX REG DATA
TC03B	CONTROLLER ALU
TC03C	CONTROLLER ALU
TC03D	CONTROLLER ALU
TC03E	CONTROLLER ALU
TC03F	CONTROLLER ALU
TC040	CONTROLLER ALU TEST
TC041	CONTROLLER ALU TEST
TC042	CONTROLLER ALU TEST
TC043	CONTROLLER ALU TEST
TC044	CONTROLLER ALU TEST
TC045	CONTROLLER ALU TEST
TC046	CONTROLLER ALU TEST
TC047	CONTROLLER MEMORY ADDRESSING
TC048	CONTROLLER MEMORY TEST
TC04B	MEMORY TEST (000-255)

Test Number	Description
TC051	CONTROLLER BRANCH AND LINK TEST
TC052	CONTROLLER BRANCH AND LINK TEST
TC053	CONTROLLER BRANCH AND LINK TEST
TC054	CONTROLLER BRANCH AND LINK TEST
TC055	CONTROLLER LONG TIME-OUT TEST
TC056	CONTROLLER LONG TIME-OUT TEST
TC057	CONTROLLER LONG TIME-OUT TEST
TC058	CONTROLLER BRANCH VIA DAR TEST
TC059	CONTROLLER, AI, AND ACYR TEST
TC05A	CONTROLLER, SR, AND SCYR TEST
TC05B	CONTROLLER SRS, AND SIS TEST
TC05C	CONTROLLER AND CR TEST
TC05D	CONTROLLER NR TEST
TC05E	CONTROLLER NI TEST
TC05F	CONTROLLER AND NRH TEST
TC060	CONTROLLER NIH TEST
TC061	CONTROLLER, CR, AND NRS TEST
TC062	CONTROLLER, CR, AND NRS TEST
TC063	CONTROLLER, CR, AND NRHS TEST
TC064	CONTROLLER, CR, AND NIHS TEST
TC065	CONTROLLER OR TEST
TC066	CONTROLLER OI TEST
TC067	CONTROLLER ORH TEST
TC068	CONTROLLER OIH TEST
TC069	CONTROLLER XR TEST
TC06A	CONTROLLER XI TEST
TC06B	CONTROLLER XRH TEST
TC06C	CONTROLLER XIH TEST
TC06D	CONTROLLER CYCLE STEAL TEST
TC06E	CONTROLLER CYCLE STEAL TEST
TC06F	CONTROLLER CYCLE STEAL TEST
TC070	CONTROLLER CYCLE STEAL TEST
TC071	CONTROLLER CYCLE STEAL TEST
TC072	CONTROLLER CYCLE STEAL TEST
TC073	CONTROLLER CYCLE STEAL TEST
TC074	CONTROLLER CYCLE STEAL TEST
TC075	CONTROLLER CYCLE STEAL TEST
TC0A1	CONTROLLER P-CHK U-INT
TC0A2	SERDES SHIFT TEST
TC0A3	DRIVER/RECEIVER ACTIVITY CHECK
TC0A4	W/S CONSOLE POLL
TC0A5	W/S MDI VALID STOP DISPLAY
TC0C0	WORK STATION TRANSMIT
TC0C1	W/S NETWORK ANALYSIS PROGRAM
TC0W1	WORK STATION WRAP INITIALIZATION
TC0W2	LATOM MACRO SUBROUTINE

99

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>>>>>>>>>>>> TC001
ADAPTER RESET                          TC001

THIS PROGRAM ISSUES ADAPTER RESET AND
SENSES REGISTERS 1, 2 AND 3. THE
PROGRAM COMPARES THE RESULTS WITH A
STANDARD, LOGS ANY DEVIATIONS AND
REPORTS THE ERROR.


RESULT BYTE 1
0-3 NOT USED
4     SENSE BYTE 1 IN ERROR
5     SENSE BYTE 2 IN ERROR
6     SENSE BYTE 3 IN ERROR
7     ADAPTER RESET FAILED

RESULT BYTE 2
0-7 SENSE BYTE 1 RETURNS
    ANY BIT ON INDICATES ERROR


RESULT BYTE 3
0-7 SENSE BYTE 2 RETURNS
    ANY BIT ON INDICATES ERROR

RESULT BYTE 4
0-7 SENSE BYTE 3 RETURNS
    ANY BIT ON INDICATES ERROR




>>>>>>>>>>>> TC002
DIAGNOSTIC MODE ENABLE/DISABLE   TC002


PROGRAM SETS THE 'DIAGNOSTIC MODE'
LATCH, AND RESETS THE LATCH, AND THE
ADAPTER RESETS THE LATCH AND REPORTS
THE RESULTS.


RESULT BYTE 1
0-3 NOT USED
4     ENABLE DIAGNOSTIC MODE FAILED
5     DISABLE DIAGNOSTIC MODE FAILED
6     NOT USED
7     ADAPTER RESET FAILED (RESET
      DIAGNOSTIC MODE INDICATOR)

RESULT BYTE 2
0-7 NOT USED




>>>>>>>>>>>> TC003
DIAG SET CS XFER ERROR            TC003

PROGRAM SETS THE 'CS XFER ERROR'
LATCH, AND RESETS THE LATCH, AND THE
ADAPTER RESETS THE LATCH AND REPORTS
THE RESULTS.


RESULT BYTE 1
0-3 NOT USED
4     DIAG SET CS XFER FAILED
5-6 NOT USED
7     ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED
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>>>>>>>>>>>> TC004
U-INTERRUPT REQUEST ENABLE        TC004

TESTS THE ABILITY OF THE PROCESSING
UNIT TO ENABLE AND DISABLE THE
'U-INTERRUPT REQUEST' LATCH. THE
PROGRAM SETS THE LATCH, RESETS, AND
SETS, AND THE ADAPTER RESETS THE LATCH
AND REPORTS THE RESULTS.


RESULT BYTE 1
0-3 NOT USED

4     ENABLE U-INT REQ FAILED
5     DISABLE U-INT REQ FAILED
6     HOT INTERRUPT SERVICED
7     ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED




>>>>>>>>>>>> TC005
SET SERVICE REQUEST               TC005

TESTS THE ABILITY OF THE PROCESSING
UNIT TO SET AND RESET THE SERVICE
REQUEST LATCH. THE PROGRAM SETS,
RESETS, SETS, AND THE ADAPTER RESETS
THE LATCH AND REPORTS THE RESULTS.


RESULT BYTE 1
0-3 NOT USED
4     SET SERVICE REQUEST FAILED
5-6 NOT USED
7     ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED




>>>>>>>>>>>> TC006
SET COMMAND PENDING               TC006

TESTS THE ABILITY OF THE PROCESSING
UNIT TO SET AND RESET THE 'COMMAND
PENDING' LATCH. THE PROGRAM SETS,
RESETS, SETS, AND THE ADAPTER RESETS
THE LATCH AND REPORTS THE RESULTS.


RESULT BYTE 1
0-3 NOT USED
4     SET COMMAND PENDING FAILED
5-6 NOT USED
7     ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED
```

>>>>>>>>>>>>> TC007
CONTROLLER LOAD SET/RESET   TC007

TESTS THE ABILITY OF THE PROCESSING
UNIT TO SET AND RESET THE 'CONTROLLER
LOAD' LATCH. THE PROGRAM SETS,
RESETS, SETS, AND THE ADAPTER RESETS
THE LATCH AND REPORTS THE RESULTS.

RESULT BYTE 1
0-3 NOT USED
4   SET LOAD MODE FAILED
5   RESET LOAD MODE FAILED
6   NOT USED
7   ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC008
SINGLE CYCLE SET/RESET   TC008

TESTS THE ABILITY OF THE PROCESSING
UNIT TO SET AND RESET THE 'SINGLE
CYCLE' LATCH. THE PROGRAM SETS,
RESETS, SETS, AND THE ADAPTER RESETS
THE LATCH AND REPORTS THE RESULTS.

RESULT BYTE 1
0-3 NOT USED
4   SET CONTROLLER SINGLE CYCLE
     FAILED
5   RESET CONTROLLER SINGLE CYCLE
     FAILED
6   NOT USED
7   ADAPTER RESET FAILED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC009
CONTROLLER RESET SET/RESET   TC009

TESTS THE ABILITY OF THE PROCESSING
UNIT TO SET AND RESET THE 'CONTROLLER
RESET' LATCH. THE PROGRAM SETS,
RESETS, SETS, AND THE ADAPTER RESETS
THE LATCH AND REPORTS THE RESULTS.

RESULT BYTE 1
0-3 NOT USED
4   SET CONTROLLER RESET FAILED
5   RESET CONTROLLER RESET FAILED
6   NOT USED
7   ADAPTER RESET FAILED TO SET BIT

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC00A
JIO FUNCTIONS   TC00A

TESTS THE JIO FUNCTIONS AVAILABLE TO
THE CPU. THE PROGRAM EXERCISES THE
JIO'S AND COMPARES THE RESULTS WITH A
STANDARD AND REPORTS THE RESULTS.

RESULT BYTE 1
0-3 NOT USED
4   'NOT ANY ERROR' JIO FAILED
5   'CONTROLLER ERROR' JIO FAILED
6   DIAGNOSTIC TRUE JIO FAILED
7   DIAGNOSTIC FALSE JIO FAILED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC00B
CONTROLLER DBO/DBI WRAP   TC00B

THIS TEST PROGRAM SENDS 'AA', '55' AND
'FE' OUT THE DBO LINES AND COMPARES
THE RETURN FROM THE DBI LINES. ANY
MISCOMPARE IS FLAGGED AND THE BIT
POSITIONS THAT DO NOT COMPARE ARE
PLACED IN WR6 (H), THE DATA IN
WR6 (L), AND THE ERROR DETECTED CODE
IN WR7 (L).

RESULT BYTE 1
0-4 NOT USED.
5   BAD STATUS RETURNED ON IOS
6   BAD DATA RETURNED FROM LOOP
7   NOT USED.

RESULT BYTE 2
0-7 LINES FAILING

RESULT BYTE 3
0-7 NOT USED

RESULT BYTE 4
0-7 DATA SENT TO CONTROLLER

>>>>>>>>>>>>> TC00C
U-INTERRUPT REQUEST SET   TC00C

TESTS THE ABILITY OF THE PROCESSING
UNIT TO CAUSE AN INTERRUPT TO LEVEL 4
AND RETURN TO LEVEL 0. THE PROGRAM
SETS UP AN INTERRUPT ROUTINE, WHICH
CAUSES THE INTERRUPT, TRACKS THE
INTERRUPT THROUGH LEVEL 4 AND BACK TO
LEVEL 0, AND REPORTS ANY DEVIATION.

RESULT BYTE 1
0-3 NOT USED
4   DIAG SET U-INT REQ FAILED
5   DIAG RESET U-INT REQ FAILED
6   LEVEL 4 INT NOT FROM WORK STATION
7   NOT USED

RESULT BYTE 2
0-7 NOT USED

99

>>>>>>>>>>>>> TC00D
X-SAR BIT 2, CONTROLLER LOAD   TC00D

THIS TEST LOADS A NO-OP TO THE
CONTROLLER MEMORY, WHICH FILLS. WHEN
IT REACHES THE MAXIMUM OF STORAGE
CAPABILITIES, X-SAR BIT 2 COMES ON.
THIS TESTS THE ABILITY OF CONTROLLER
MEMORY TO BE ADDRESSED TO ITS MAXIMUM.

RESULT BYTE 1
0   X-SAR BIT 2 FAILED TO SET
     AT PROPER TIME, CONTROLLER LOAD
     NOT COMPLETED PROPERLY.
1   X-SAR BIT 2 ON AT WRONG TIME,
     CONTROLLER LOAD NOT COMPLETED
     PROPERLY.
2   X-SAR BIT 2 FAILED TO RESET,
     CONTROLLER LOAD NOT COMPLETED
     PROPERLY.

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC00E
CONTROLLER BUSY   TC00E

THIS TEST CAUSES THE CONTROLLER
TO SET AND RESET THE 'CONTROLLER BUSY'
LATCH AND THE CHANNEL TO SENSE THE
RESULTS.

RESULT BYTE 1
0   CONTROLLER BUSY BIT HOT
1   CONTROLLER FAILED TO SET
     CONTROLLER BUSY LATCH
2   CONTROLLER FAILED TO RESET
     CONTROLLER BUSY LATCH
3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC00F
CONTROLLER TO CHANNEL   TC00F
U-INTERRUPT REQUEST

TESTS THE ABILITY OF THE CONTROLLER,
WHICH CAUSES AN INTERRUPT IN THE
PROCESSING UNIT. THIS TEST CAUSES THE
CONTROLLER TO INTERRUPT THE CHANNEL
IN ENABLE AND DISABLE MODE AND REPORTS
THE RESULTS.

RESULT BYTE 1
0   INTERRUPT NOT FROM WORK STATION
1   CONTROLLER INT. REQ. FAILED
2   CHANNEL RESET INT. REQ. FAILED
3   HOT INT. REQ. FROM CONTROLLER
4   DISABLE INTERRUPT FAILED
5-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC010
CONTROLLER OP CHECK LATCH   TC010

TESTS THE ABILITY OF THE CONTROLLER
TO SET AND RESET THE 'OP CHECK' LATCH.
THIS TEST CAUSES THE CONTROLLER
TO SET AND RESET THE 'CONTROLLER OP
CHECK' LATCH AND THE CHANNEL TO SENSE
AND REPORTS THE RESULTS.

RESULT BYTE 1
0   CONTROLLER OP CHECK HOT
1   CONTROLLER FAILED TO SET
     CONTROLLER OP CHECK LATCH
2   CONTROLLER FAILED TO RESET
     CONTROLLER OP CHECK LATCH
3   JIO 'NOT ANY CHECK' FAILED
     ON 'OP CHECK' LATCH SET
4   JIO 'NOT ANY CHECK' FAILED
     ON 'OP CHECK' LATCH RESET
5-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC011
CONT DBO/DBI PARITY LATCH   .   TC011

TESTS THE ABILITY OF THE CONTROLLER
TO SET AND RESET THE 'CONT DBO/DBI P'
LATCH. THIS TEST CAUSES THE
CONTROLLER TO SET AND RESET THE 'CONT
DBO/DBI P' LATCH AND THE CHANNEL TO
SENSE AND REPORTS THE RESULTS.

RESULT BYTE 1
0   CONTROLLER DBO/DBI PARITY
     CHECK HOT
1   CONTROLLER FAILED TO SET
     CONTROLLER DBO/DBI PARITY
     CHECK LATCH
2   CONTROLLER FAILED TO RESET
     CONTROLLER DBO/DBI PARITY
     CHECK LATCH
3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC012
COMMAND PENDING SENSE TEST   TC012

TESTS THE ABILITY OF THE CONTROLLER
TO SENSE THE 'COMMAND PENDING' LATCH
SET BY THE PROCESSING UNIT.
THIS TEST CAUSES THE CONTROLLER
TO SENSE THE COMMAND PENDING BIT
WHEN IT IS SET BY THE PROCESSING UNIT.
THE CONTROLLER SENDS THE RESULTS TO
WSCH AND THE CPU ANALYZES AND
REPORTS THE RESULTS.

RESULT BYTE 1
0   COMMAND PENDING BIT HOT
1   SET COMMAND PENDING FAILED
2   CONTROLLER FAILED TO RESET
     COMMAND PENDING LATCH
3   CONTROLLER FAILED TO SENSE
     COMMAND PENDING LATCH
4-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC013
SERVICE REQUIRED   TC013

THIS TEST CAUSES THE CONTROLLER
TO SENSE THE SERVICE REQUIRED BIT ON
WHEN SET BY THE CHANNEL. THE
CONTROLLER DBO SENDS THE ANALYZED AND
REPORTED RESULTS BACK TO THE CHANNEL.

RESULT BYTE 1
0   SERVICE REQUIRED BIT HOT
1   SET SERVICE REQUIRED FAILED
2   CONTROLLER FAILED TO RESET
     SERVICE REQUIRED
3   CONTROLLER FAILED TO SENSE
     SERVICE REQUIRED
4-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC014
CYCLE STEAL TRANSFER   TC014

THIS TEST CAUSES THE CONTROLLER TO
SENSE THE CYCLE STEAL TRANSFER CHECK
SET BY THE CHANNEL AND TO REPORT
ITS STATUS TO THE CHANNEL VIA THE
CONTROLLER DBO. THE CHANNEL ANALYZES
AND REPORTS THE RESULTS.

RESULT BYTE 1
0   CYCLE STEAL XFER CHECK BIT HOT
1   SET CYCLE STEAL XFER CHECK FAILED
2   CONTROLLER FAILED TO RESET
     CYCLE STEAL TRANSFER CHECK
3   CONTROLLER FAILED TO SENSE
     CYCLE STEAL TRANSFER CHECK
4-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC020
CONTROLLER 4-BIT BUS   TC020

THIS TEST PASSES AN 'A' AND A '5' AND
AN 'A' RETURNS WITH A STORED PATTERN
OF '5A'. ANY MISCOMPARE IS A
NONFUNCTIONING BIT.

RESULT BYTE 1

0-7 BITS FAILING TO
    RESPOND

RESULT BYTE 2

0-7 COMPARE DATA

>>>>>>>>>>>> TC031
CONTROLLER DAR SELECT   TC031

THIS TEST LOADS EACH DAR ADDRESS
IN EACH DAR AND THEN SENDS THIS
VALUE BACK TO THE CONTROL STORE
PROGRAM FOR VERIFICATION.

RESULT BYTE 1
0   DAR SELECT TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC032
CONTROLLER DAR DATA (5)   TC032

THIS TEST LOADS A DATA
PATTERN OF '5' IN EACH DAR AND
THEN SENDS THIS VALUE BACK TO
THE CONTROL PROGRAM FOR
VERIFICATION.

RESULT BYTE 1
0   DAR DATA TRANSFER TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC033
CONTROLLER DAR DATA (A)   TC033

THIS TEST LOADS A DATA
PATTERN OF 'A' IN EACH DAR
AND THEN SENDS THIS VALUE BACK
TO THE CONTROL STORE PROGRAM
FOR VERIFICATION.

RESULT BYTE 1
0   DAR DATA TRANSFER TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

99

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>>>>>>>>>>>>> TC034
CONTROLLER REG/AUX REGS SELECT    TC034

THIS TEST SELECTS REGS AND AUX
REGS BY USE OF THE 'WIOR'
COMMAND. THE PROGRAM SENSES
THE STATUS OF THE REG SELECTION
AND THIS VALUE IS SENT TO THE
PROCESSOR FOR VERIFICATION.




RESULT BYTE 1

0-3 NOT USED

4     AUX REGS NOT SELECTED
      CORRECTLY

5     PRIMARY REG SENSE BIT NOT
      ON AFTER ADAPTER RESET

6     PRIMARY REG SENSE BIT ON
      AFTER SELECTING AUX REGS

7     PRIMARY REG SENSE BIT NOT
      ON AFTER SELECTING PRIMARY
      REGS

RESULT BYTE 2

0-7 NOT USED




>>>>>>>>>>>>> TC035
CONTROLLER REG SELECTION          TC035

THIS TEST WRITES EACH REG
ADDRESS IN EACH REG AND THEN
SENDS THIS VALUE BACK TO THE
CONTROL STORE PROGRAM FOR
VERIFICATION.




RESULT BYTE 1
0     REG SELECT TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED
```

```
>>>>>>>>>>>>> TC036
CONTROLLER REG DATA (5)           TC036

THIS TEST LOADS A DATA PATTERN
OF '5' IN EACH REG AND THEN
SENDS THIS VALUE BACK TO THE
CONTROL STORE PROGRAM FOR
VERIFICATION.




RESULT BYTE 1
0     REG DATA TRANSFER TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED




>>>>>>>>>>>>> TC037
CONTROLLER REG DATA (A)           TC037

THIS TEST LOADS A DATA PATTERN
OF 'A' IN EACH REG AND THEN
SENDS THIS VALUE BACK TO THE
CONTROL STORE PROGRAM
FOR VERIFICATION.




RESULT BYTE 1
0     REG DATA TRANSFER TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED




>>>>>>>>>>>>> TC038
CONTROLLER AUX REG SELECTION      TC038

THIS TEST WRITES EACH AUX REG
ADDRESS IN ITSELF AND THEN
SENDS THIS VALUE BACK TO
THE CONTROL STORE PROGRAM
FOR VERIFICATION.




RESULT BYTE 1
0     AUX REG SELECT TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED
```

>>>>>>>>>>>> TC039
CONTROLLER AUX REG DATA (5)   TC039

THIS TEST LOADS A DATA PATTERN
OF '5' IN EACH AUX REG AND
THEN SENDS THIS VALUE BACK TO
THE CONTROL STORE PROGRAM FOR
VERIFICATION.

RESULT BYTE 1
0   AUX REG DATA TRANSFER
     TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC03A
CONTROLLER AUX REG DATA   TC03A

THIS TEST LOADS A DATA PATTERN
OF 'A' IN EACH AUX REG, THEN
SENDS THIS VALUE BACK TO THE
CONTROL STORE PROGRAM FOR
VERIFICATION.

RESULT BYTE 1
0   AUX REG DATA TRANSFER
     TEST FAILED

1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC03B
CONTROLLER ALU   TC03B

TEST SETTING OF ALU ZERO
INDICATION WITH CONTROL STORE
SENSE INSTRUCTION: THIS TEST
GENERATES A ZERO CONDITION IN
THE ALU. THE CONTROL STORE
PROGRAM SENSES THIS CONDITION
AND CHECKS FOR ALU ZERO ON, ALU
NON-ZERO, AND ALU CARRY OFF.

RESULT BYTE 1
0   ALU ZERO INDICATION NOT ON
1   ALU CARRY INDICATION NOT OFF
2   ALU NONZERO INDICATION
     NOT OFF

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC03C
CONTROLLER ALU   TC03C

TEST SETTING OF ALU NONZERO
INDICATION WITH CONTROL STORE
SENSE INSTRUCTION: THIS TEST
GENERATES A NONZERO CONDITION
IN THE ALU. THE CONTROL STORE
PROGRAM SENSES THIS CONDITION
AND CHECKS ALU NONZERO IS ON,
AND ALU ZERO AND ALU CARRY ARE
OFF.

RESULT BYTE 1
0   ALU NONZERO INDICATION
     NOT ON
1   ALU ZERO INDICATION
     NOT OFF
2   ALU CARRY INDICATION
     NOT OFF

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC03D
CONTROLLER ALU   TC03D

TEST SETTING OF ALU CARRY
INDICATION WITH CONTROL STORE
SENSE INSTRUCTION: THIS TEST
GENERATES A CARRY CONDITION IN
THE ALU. THE CONTROL STORE
PROGRAM SENSES THIS CONDITION
AND CHECKS ALU CARRY IS ON, AND
ALU NONZERO AND ALU ZERO ARE
OFF.

RESULT BYTE 1
0   ALU CARRY INDICATION
     NOT ON
1   ALU NON-ZERO INDICATION
     NOT OFF
2   ALU ZERO INDICATION
     NOT ON

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC03E
CONTROLLER ALU   TC03E

TEST SETTING OF ALU CARRY AND
NONZERO INDICATION WITH CONTROL
STORE SENSE INSTRUCTION:
THIS TEST GENERATES CARRY AND
NONZERO CONDITIONS IN THE ALU.
THE CONTROL STORE PROGRAM SENSES
THESE CONDITIONS AND CHECKS IF
BOTH ARE ON AND IF ALU ZERO IS
OFF.

RESULT BYTE 1
0   ALU CARRY AND NONZERO NOT ON
1   ALU ZERO INDICATION NOT OFF

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

99

>>>>>>>>>>>> TC03F
CONTROLLER ALU   TC03F

TEST SETTING OF ALU ZERO AND
NONZERO INDICATIONS WITH
CONTROL STORE SENSE INSTRUCTION:
THIS TEST GENERATES ZERO AND
NONZERO CONDITIONS IN THE ALU.
THE CONTROL STORE PROGRAM SENSES
THESE CONDITIONS AND CHECKS IF
BOTH ARE ON AND IF ALU CARRY IS
OFF.

RESULT BYTE 1
0   ALU ZERO AND NONZERO NOT ON
1   ALU CARRY INDICATION NOT OFF

3-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC040
CONTROLLER ALU TEST   TC040

TEST SETTING OF ALU CARRY,
ZERO, AND NON ZERO INDICATIONS
WITH CONTROL STORE SENSE
INSTRUCTION: THIS TEST WILL
GENERATE CARRY, ZERO, AND NON
ZERO CONDITIONS IN CONTROLLER
ALU. THE CONTROL STORE PROGRAM
SENSES THESE CONDITIONS AND
CHECKS FOR THEM ALL BEING ON.

RESULT BYTE 1
0-6 NOT USED
7   ALU ZERO, NONZERO, AND
     CARRY INDICATIONS NOT ON

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC041
CONTROLLER ALU TEST   TC041

TEST SETTING OF ALU ZERO
INDICATION: THIS PROGRAM TESTS THAT
ALL BRANCHES THAT SHOULD BRANCH,
DO, AND THAT ALL BRANCHES THAT
SHOULD NOT BRANCH, DO NOT. THIS
TEST WILL GENERATE A ZERO CONDITION
IN THE CONTROLLER ALU. THEN THE
PROGRAM CHECKS ALL BRANCH CONDITIONS
WITH AN ERROR BIT PASSED TO THE
CONTROL STORE PROGRAM TO INDICATE
THE RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC042
CONTROLLER ALU TEST   TC042

TEST SETTING OF ALU NON ZERO
INDICATION: THIS PROGRAM TESTS
THAT ALL BRANCHES THAT SHOULD
BRANCH, DO, AND THAT ALL BRANCHES
THAT SHOULD NOT BRANCH, DO NOT:
THIS TEST GENERATES A NON ZERO
CONDITION IN THE CONTROLLER ALU.
THEN THE PROGRAM CHECKS ALL BRANCH
CONDITIONS WITH AN ERROR BIT PASSED
TO THE CONTROL STORE PROGRAM TO
INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC043
CONTROLLER ALU TEST   TC043

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS: THIS PROGRAM
TESTS THAT ALL BRANCHES THAT
SHOULD BRANCH, DO, AND THAT ALL
BRANCHES THAT SHOULD NOT BRANCH,
DO NOT: THIS TEST GENERATES ZERO
AND CARRY CONDITIONS IN THE
CONTROLLER ALU. THEN THE PROGRAM
CHECKS ALL BRANCH CONDITIONS WITH
AN ERROR BIT PASSED TO THE CONTROL
STORE PROGRAM TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC044
CONTROLLER ALU TEST   TC044

TEST SETTING OF ALU NON ZERO
AND CARRY INDICATIONS: THIS
PROGRAM TESTS THAT ALL BRANCHES
THAT SHOULD BRANCH, DO, AND THAT
ALL BRANCHES THAT SHOULD NOT BRANCH,
DO NOT: THIS TEST GENERATES NON ZERO
AND CARRY CONDITIONS IN THE CONTROLLER
ALU. THEN THE PROGRAM CHECKS ALL
BRANCH CONDITIONS WITH AN ERROR BIT
PASSED TO THE CONTROL STORE PROGRAM
TO INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC045
CONTROLLER ALU TEST   TC045

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS: THIS PROGRAM
TESTS THAT ALL BRANCHES THAT SHOULD
BRANCH, DO, AND THAT ALL BRANCHES
THAT SHOULD NOT BRANCH, DO NOT:
THIS TEST GENERATES ZERO AND NON
ZERO CONDITIONS IN THE CONTROLLER
ALU. THEN THE PROGRAM CHECKS ALL
BRANCH CONDITIONS WITH AN ERROR BIT
PASSED TO THE CONTROL STORE PROGRAM
TO INDICATE THE RESULTS OF THE
TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC046
CONTROLLER ALU TEST   TC046

TEST SETTING OF ALU ZERO, NON
ZERO, AND CARRY CONDITIONS:
THIS PROGRAM TESTS THAT ALL
BRANCHES THAT SHOULD BRANCH,
DO, AND THAT ALL BRANCHES THAT
SHOULD NOT BRANCH, DO NOT. THIS
TEST GENERATES ZERO, NON ZERO AND
CARRY CONDITIONS IN THE CONTROLLER
ALU. THEN THE PROGRAM CHECKS ALL
BRANCH CONDITIONS WITH AN ERROR BIT
PASSED TO THE CONTROL STORE PROGRAM
TO INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC047
CONTROLLER MEMORY ADDRESSING   TC047

THIS TEST WRITES ALL LOCATIONS OF RAM
CONTROLLER MEMORY WITH THE XR RESULT
OF ITS OWN ADDRESS HI AND LO BYTES.
THE CONTROLLER THEN READS THE TEST
LOCATION AND COMPARES THE XR RESULT
OF LOCATION HI AND LOW BYTES WITH THE
VALUE READ. ANY VALUE OTHER THAN ZERO
INDICATES AN ERROR.

RESULT BYTE 1

0-7 HI-ORDER BYTES OF
     FAILING ADDRESS

RESULT BYTE 2

0-7 LO-ORDER BYTES OF
     FAILING ADDRESS

>>>>>>>>>>>> TC048
CONTROLLER MEMORY TEST   TC048

TESTS THE CONTROLLER MEMORY FROM
HEX 2000 TO THE END OF INSTALLED
MEMORY.

RESULT BYTE 1

0-7 HI-ORDER BYTES OF
     FAILING ADDRESS

RESULT BYTE 2

0-7 LO-ORDER BYTES OF
     FAILING ADDRESS

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>>>>>>>>>>>>> TC04B
MEMORY TEST (000-255)   TC04B

TESTS CONTROLLER MEMORY FROM
0000 TO 0255.
THE CONTROLLER INTERRUPTS THE
PROCESSOR SO THAT THE STATUS OF THE
TEST MAY BE VERIFIED.

RESULT BYTE 1

0-7 HI-ORDER BYTES OF
    FAILING ADDRESS

RESULT BYTE 2

0-7 LO-ORDER BYTES OF
    FAILING ADDRESS

>>>>>>>>>>>>> TC051
CONTROLLER BRANCH AND LINK TEST   TC051

THIS TEST PERFORMS A BRANCH AND LINK
FROM PROGRAM LEVEL 1, CHECKING THAT
THE BRANCH DOES BRANCH AND THAT THE
RETURN INSTRUCTION RETURNS TO THE
ADDRESS IMMEDIATELY AFTER THE BRANCH
AND LINK INSTRUCTION.

RESULT BYTE 1
0-4 NOT USED

5   UNKNOWN ERROR

6   RETRN INSTRUCTION DID NOT
     RETURN

7   BRANCH AND LINK INSTRUCTION
     DID NOT BRANCH

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC052
CONTROLLER BRANCH AND LINK TEST   TC052

THIS TEST PERFORMS A BRANCH AND LINK
FROM PROGRAM LEVEL 1 TO PROGRAM LEVEL
2, AND THEN PERFORMS ANOTHER BRANCH
AND LINK TO PROGRAM LEVEL 3. IT THEN
CHECKS THAT EACH BRANCH DOES BRANCH
AND THAT EACH RETURN INSTRUCTION
RETURNS TO THE ADDRESS IMMEDIATELY
AFTER THE BRANCH AND LINK INSTRUCTION.

RESULT BYTE 1
0-1 NOT USED
2   CONTROLLER FAILED TO INTERRUPT
     SYSTEM
3   UNKNOWN ERROR
4   RETRN INSTRUCTION DID NOT
     RETURN FROM PROGRAM LEVEL 3
5   BRANCH AND LINK INSTRUCTION
     DID NOT BRANCH TO PROGRAM
     LEVEL 3
6   RETRN INSTRUCTION DID NOT
     RETURN FROM PROGRAM LEVEL 2
7   BRANCH AND LINK INSTRUCTION
     DID NOT BRANCH TO PROGRAM
     LEVEL 2

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC053
CONTROLLER BRANCH AND LINK TEST   TC053

THIS TEST GENERATES A CONTROLLER
INTERRUPT AND TESTS FOR ITS CORRECT
OPERATION.

RESULT BYTE 1
0-2 NOT USED

3   UNKNOWN ERROR

4-6 NOT USED

7   NO LONG TIME-OUT INTERRUPT
     OCCURRED AT THE EXPIRATION
     OF THE TIME VALUE

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC054
CONTROLLER BRANCH AND LINK TEST   TC054

THIS TEST GENERATES A CONTROLLER
INTERRUPT AND TESTS FOR ITS CORRECT
OPERATION.

RESULT BYTE 1
0-2 NOT USED

3   UNKNOWN ERROR

4-6 NOT USED

7   NO LONG TIME-OUT INTERRUPT
     OCCURRED AT THE EXPIRATION
     OF THE TIME VALUE

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC055
CONTROLLER LONG TIME-OUT TEST   TC055

THIS TEST ENABLES THE LONG TIME-OUT
AND DELAY, AND EXPECTS THE CONTROLLER
TO INTERRUPT THE PROCESSOR.

RESULT BYTE 1
0-2 NOT USED

3   UNKNOWN ERROR

4-6 NOT USED

7   LONG TIME-OUT DID NOT CAUSE
     A CONTROLLER INTERRUPT

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC056
CONTROLLER LONG TIME-OUT TEST   TC056

THIS TEST ENABLES AND DISABLES THE
LONG TIME-OUT AND EXPECTS NO LONG
TIME-OUT INTERRUPT TO THE PROCESSOR.

RESULT BYTE 1
0-2 NOT USED

3   UNKNOWN ERROR

4-6 NOT USED

7   LONG TIME-OUT CAUSED A CONT-
     ROLLER INTERRUPT AFTER A DIS-
     ABLE LONG TIME-OUT WAS GIVEN

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC057
CONTROLLER LONG TIME-OUT TEST   TC057

THIS TEST ENABLES AND RESETS THE
LONG TIME-OUT AND EXPECTS NO LONG
TIME-OUT INTERRUPT TO THE PROCESSOR.

RESULT BYTE 1
0-2 NOT USED

3   UNKNOWN ERROR

4-6 NOT USED

7   LONG TIME-OUT CAUSED A
     CONTROLLER INTERRUPT AFTER
     A RESET LONG TIME-OUT WAS GIVEN

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC058
CONTROLLER BRANCH VIA DAR TEST   TC058

THIS TEST PERFORMS A SERIES OF
BRANCH INSTRUCTIONS USING THE
VALUE IN THE DAR AS THE BRANCH
TO ADDRESS.

RESULT BYTE 1
0-3 NOT USED

4   UNKNOWN ERROR

5   BRANCH WENT TO INCORRECT
     LOCATION

6   BRANCH VIA DAR (BR) TO
     LOCATION 0AAA DID NOT BRANCH

7   BRANCH VIA DAR (BR) TO
     LOCATION 0554 DID NOT BRANCH

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC059
CONTROLLER, AI, AND ACYR TEST   TC059

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'AI'
INSTRUCTION: THIS PROGRAM TESTS
THAT THE 'ACYR' INSTRUCTION USES
THE CARRY BIT AND THEN RESETS IT.
THE PROGRAM ALSO TESTS THAT ALL
INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT. THE
PROGRAM PASSES ERROR CODES TO THE
PROCESSOR TO INDICATE THE RESULTS
OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
1   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
2   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-6 NOT USED

7   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT

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>>>>>>>>>>>>>> TC05A
CONTROLLER, SR, AND SCYR TEST   TC05A

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'SR'
INSTRUCTION: THIS PROGRAM TESTS
THAT THE 'SCYR' INSTRUCTION USES
THE CARRY BIT AND THEN RESETS IT.
IT ALSO TESTS THAT ALL INSTRUCTIONS
THAT SHOULD BRANCH, DO, AND THAT
ALL INSTRUCTIONS THAT SHOULD NOT
BRANCH, DO NOT. THE PROGRAM PASSES
ERROR CODES TO THE PROCESSOR TO
INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
1   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
2   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-6 NOT USED

7   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT

>>>>>>>>>>>>>> TC05B
CONTROLLER SRS, AND SIS TEST   TC05B

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE
'AR' AND 'SRS' INSTRUCTIONS: THIS
PROGRAM TESTS THAT THE 'SIS'
INSTRUCTION ADDS THE CARRY
INDICATION WITHOUT RESETTING
THE ZERO AND NON ZERO INDICATIONS.
ALSO, IT TESTS THAT ALL BRANCHES
THAT SHOULD BRANCH, DO, AND THAT
ALL BRANCHES THAT SHOULD NOT BRANCH,
DO NOT. THE PROGRAM PASSES ERROR
CODES TO THE PROCESSOR TO INDICATE
THE RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2

0-5 NOT USED
6   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD

>>>>>>>>>>>>>> TC05C
CONTROLLER AND CR TEST   TC05C

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'CR'
INSTRUCTION: THIS PROGRAM TESTS
THAT ALL INSTRUCTIONS THAT SHOULD
BRANCH, DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THIS PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON NEGATIVE (BN)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>>> TC05D
CONTROLLER NR TEST   TC05D

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'NR'
INSTRUCTION: THIS PROGRAM TESTS
THAT ALL INSTRUCTIONS THAT SHOULD
BRANCH, DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THIS PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG NOT ZERO AFTER 'AND'
     FUNCTION USING 1 AND 0
5   'Y' REG IS ZERO AFTER 'AND'
     FUNCTION USING 1 AND 1
6   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT

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>>>>>>>>>>>>> TC05E
CONTROLLER NI TEST                    TC05E

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'NI'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THIS PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.


RESULT BYTE 1
0    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1    BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3    BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6    BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4    'Y' REG NOT ZERO AFTER 'AND'
     FUNCTION USING 1 AND 0
5    'Y' REG IS ZERO AFTER 'AND'
     FUNCTION USING 1 AND 1
6    BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
```

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>>>>>>>>>>>>> TC05F
CONTROLLER AND NRH TEST               TC05F

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'NRH'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THIS PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.


RESULT BYTE 1
0    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1    BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3    BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6    BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4    'Y' REG IS ZERO AFTER
     'AND INHIBIT'
     FUNCTION USING 1 AND 0
5    'Y' REG IS ZERO AFTER
     'AND INHIBIT'
     FUNCTION USING 1 AND 1
6    BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
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99

>>>>>>>>>>>>> TC060
CONTROLLER NIH TEST   TC060

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'NIH'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
      DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
      DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
      DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
      DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
      DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
      DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
      DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
      DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG IS ZERO AFTER
      'AND IMMEDIATE INHIBIT'
      FUNCTION USING 1 AND 0
5   'Y' REG IS ZERO AFTER
      'AND IMMEDIATE INHIBIT'
      FUNCTION USING 1 AND 1
6   BRANCH ON ZERO (BZ)
      DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
      DID BRANCH AND SHOULD NOT

>>>>>>>>>>>>> TC061
CONTROLLER, CR, AND NRS TEST   TC061

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'CR'
INSTRUCTION: THIS PROGRAM TESTS THAT
THE 'NRS' INSTRUCTION ADDS THE NON
ZERO CONDITION. IT ALSO TESTS THAT
ALL INSTRUCTIONS THAT SHOULD
BRANCH, DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
      DID NOT BRANCH AND SHOULD
4   BRANCH ON NEGATIVE (BN)
      DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
      DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
      DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
      DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>>> TC062
CONTROLLER, CR, AND NRS TEST   TC062

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'CR'
INSTRUCTION: THIS PROGRAM TESTS
THAT THE 'NRS' INSTRUCTION ADDS THE
NON ZERO CONDITION. IT ALSO TESTS
THAT ALL INSTRUCTIONS THAT SHOULD
BRANCH, DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3   BRANCH ON NOT ZERO (BNZ)
      DID NOT BRANCH AND SHOULD
4   BRANCH ON NEGATIVE (BN)
      DID BRANCH AND SHOULD NOT
5   BRANCH ON CARRY (BCY)
      DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
      DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
      DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

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>>>>>>>>>>>>> TC063
CONTROLLER, CR, AND NRHS TEST      TC063
```

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'CR'
INSTRUCTION: THIS PROGRAM TESTS
THAT THE 'NRHS' INSTRUCTION ADDS THE
NON ZERO CONDITION. IT ALSO TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-1 NOT USED
2   'Y' REG IS ZERO AFTER
     'AND INHIBIT SUMMARY' INST
3   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
4   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
5   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

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>>>>>>>>>>>>> TC064
CONTROLLER, CR, AND NIHS TEST      TC064
```

TEST SETTING OF ALU ZERO AND
CARRY INDICATIONS WITH THE 'CR'
INSTRUCTION: THIS PROGRAM TESTS
THAT THE 'NIHS' INSTRUCTION ADDS THE
NON ZERO CONDITION. IT ALSO TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0-1 NOT USED
2   'Y' REG IS ZERO AFTER
     'AND INHIBIT SUMMARY' INST
3   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
4   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
5   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

```
>>>>>>>>>>>>> TC065
CONTROLLER OR TEST                 TC065
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TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'OR'
INSTRUCTION. THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG NOT ZERO AFTER 'OR'
     FUNCTION USING 0 AND 0
5   'Y' REG IS ZERO AFTER 'OR'
     FUNCTION USING 0 AND 1
6   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT

99

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'OI'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG NOT ZERO AFTER 'OI'
     FUNCTION USING 0 AND 0
5   'Y' REG IS ZERO AFTER 'OI'
     FUNCTION USING 0 AND 1
6   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'ORH'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG NOT ZERO AFTER 'ORH'
     FUNCTION USING 0 AND 0
5   'Y' REG NOT ZERO AFTER 'ORH'
     FUNCTION USING 0 AND 1
6   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT

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>>>>>>>>>>>>>> TC068                              >>>>>>>>>>>>>> TC069
CONTROLLER OIH TEST                 TC068         CONTROLLER XR TEST                  TC069

TEST SETTING OF ALU ZERO AND                      TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'OIH'               NON ZERO INDICATIONS WITH THE 'XR'
INSTRUCTION: THIS PROGRAM TESTS THAT              INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,              ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS THAT                DO, AND THAT ALL INSTRUCTIONS THAT
SHOULD NOT BRANCH, DO NOT.                        SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO                 THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE                     THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.                              RESULTS OF THE TEST.


RESULT BYTE 1                                     RESULT BYTE 1
0    BRANCH ON NEGATIVE (BN)                      0    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD
1    BRANCH ON NOT ZERO (BNZ)                     1    BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD
2    BRANCH UNCONDITIONAL (B)                     2    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD
3    BRANCH ON NOT ZERO (BNZ)                     3    BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT                         DID BRANCH AND SHOULD NOT
4    BRANCH ON CARRY (BCY)                        4    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT                         DID BRANCH AND SHOULD NOT
5    BRANCH ON NEGATIVE (BN)                      5    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD
6    BRANCH ON ZERO (BZ)                          6    BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD
7    BRANCH UNCONDITIONAL (B)                     7    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD                         DID NOT BRANCH AND SHOULD


RESULT BYTE 2                                     RESULT BYTE 2
0-3 NOT USED                                      0-3 NOT USED
4    'Y' REG NOT ZERO AFTER 'OIH'                 4    'Y' REG NOT ZERO AFTER 'XR'
     FUNCTION USING 0 AND 0                            FUNCTION USING 1 AND 1
5    'Y' REG NOT ZERO AFTER 'OIH'                 5    'Y' REG IS ZERO AFTER 'XR'
     FUNCTION USING 0 AND 1                            FUNCTION USING 0 AND 1
6    BRANCH ON ZERO (BZ)                          6    BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT                         DID BRANCH AND SHOULD NOT
7    BRANCH ON CARRY (BCY)                        7    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT                         DID BRANCH AND SHOULD NOT
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>>>>>>>>>>>>> TC06A                                >>>>>>>>>>>>> TC06B
CONTROLLER XI TEST              TC06A              CONTROLLER XRH TEST             TC06B

TEST SETTING OF ALU ZERO AND                       TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'XI'                 NON ZERO INDICATIONS WITH THE 'XRH'
INSTRUCTION: THIS PROGRAM TESTS                    INSTRUCTION: THIS PROGRAM TESTS THAT
THAT ALL INSTRUCTIONS THAT SHOULD                  ALL INSTRUCTIONS THAT SHOULD BRANCH,
BRANCH, DO, AND THAT ALL INSTRUCTIONS              DO, AND THAT ALL INSTRUCTIONS THAT
THAT SHOULD NOT BRANCH, DO NOT.                    SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO                  THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE                      THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.                               RESULTS OF THE TEST.


RESULT BYTE 1                                      RESULT BYTE 1
0    BRANCH ON NEGATIVE (BN)                       0    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD
1    BRANCH ON NOT ZERO (BNZ)                      1    BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD
2    BRANCH UNCONDITIONAL (B)                      2    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD
3    BRANCH ON NOT ZERO (BNZ)                      3    BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT                          DID BRANCH AND SHOULD NOT
4    BRANCH ON CARRY (BCY)                         4    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT                          DID BRANCH AND SHOULD NOT
5    BRANCH ON NEGATIVE (BN)                       5    BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD
6    BRANCH ON ZERO (BZ)                           6    BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD
7    BRANCH UNCONDITIONAL (B)                      7    BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD                          DID NOT BRANCH AND SHOULD


RESULT BYTE 2                                      RESULT BYTE 2
0-3 NOT USED                                       0-3 NOT USED
4    'Y' REG NOT ZERO AFTER 'XI'                   4    'Y' REG NOT ZERO AFTER 'XRH'
     FUNCTION USING 1 AND 1                             FUNCTION USING 1 AND 1
5    'Y' REG IS ZERO AFTER 'XI'                    5    'Y' REG IS ZERO AFTER 'XRH'
     FUNCTION USING 0 AND 1                             FUNCTION USING 0 AND 1
6    BRANCH ON ZERO (BZ)                           6    BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT                          DID BRANCH AND SHOULD NOT
7    BRANCH ON CARRY (BCY)                         7    BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT                          DID BRANCH AND SHOULD NOT
```

>>>>>>>>>>>>>> TC06C
CONTROLLER XIH TEST   TC06C

TEST SETTING OF ALU ZERO AND
NON ZERO INDICATIONS WITH THE 'XIH'
INSTRUCTION: THIS PROGRAM TESTS THAT
ALL INSTRUCTIONS THAT SHOULD BRANCH,
DO, AND THAT ALL INSTRUCTIONS
THAT SHOULD NOT BRANCH, DO NOT.
THE PROGRAM PASSES ERROR CODES TO
THE PROCESSOR TO INDICATE THE
RESULTS OF THE TEST.

RESULT BYTE 1
0   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
1   BRANCH ON NOT ZERO (BNZ)
     DID NOT BRANCH AND SHOULD
2   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD
3   BRANCH ON NOT ZERO (BNZ)
     DID BRANCH AND SHOULD NOT
4   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT
5   BRANCH ON NEGATIVE (BN)
     DID NOT BRANCH AND SHOULD
6   BRANCH ON ZERO (BZ)
     DID NOT BRANCH AND SHOULD
7   BRANCH UNCONDITIONAL (B)
     DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-3 NOT USED
4   'Y' REG NOT ZERO AFTER 'XIH'
     FUNCTION USING 1 AND 1
5   'Y' REG IS ZERO AFTER 'XIH'
     FUNCTION USING 0 AND 1
6   BRANCH ON ZERO (BZ)
     DID BRANCH AND SHOULD NOT
7   BRANCH ON CARRY (BCY)
     DID BRANCH AND SHOULD NOT

>>>>>>>>>>>> TC06D
CONTROLLER CYCLE STEAL TEST   TC06D

TEST SETTING AND RESETTING OF
THE CONTROLLER SENSE BIT FOR
CYCLE STEAL TO MAIN STORE OR
CONTROL STORE: THE STATUS OF
THE CONTROLLER SENSE BIT IS
SENT TO THE HOST SYSTEM FOR
VERIFICATION OF CORRECT STATUS.
IT ALSO TESTS THE LOADING OF THE
CBI BIT FIELD WITH '5' AND 'A'.
THE PROGRAM SENSES THE VALUE LOADED
AND THEN SENDS IT TO THE PROCESSOR
FOR VERIFICATION.

RESULT BYTE 1
0-2 NOT USED

3   CBI BITS 0 AND 2 NOT ON AND
     CBI BITS 1 AND 3 NOT OFF

4   CBI BITS 1 AND 3 NOT ON AND
     CBI BITS 0 AND 2 NOT OFF

5   AFTER ISSUING SELECT C/S TO
     MAIN STORE, THE SENSE CONT-
     ROLLER SENSE BIT FOR C/S TO
     MAIN STORE WAS NOT ON.

6   AFTER ISSUING SELECT C/S TO
     CONTROL STORE, THE SENSE
     CONTROLLER SENSE BIT FOR C/S
     TO MAIN STORE WAS NOT OFF.

7   AFTER ISSUING AN ADAPTER
     RESET TO THE CONTROLLER,
     THE CONTROLLER SENSE BIT
     FOR C/S TO MAIN STORE WAS
     NOT ON

RESULT BYTE 2
0-7 NOT USED

>>>>>>>>>>>> TC06E
CONTROLLER CYCLE STEAL TEST   TC06E

THIS PROGRAM TESTS THE CYCLE
STEALING OF 1 BYTE OF DATA FROM
THE CONTROLLER TO THE HOST CONTROL
STORE.

RESULT BYTE 1
0-4 NOT USED
5   CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE DATA
     XFER FROM CONTROLLER TO HOST
6   DATA ADDRESS IN WR4IL4
     INCREMENTED AFTER A 1 BYTE
     DATA TRANSFER WHEN IT
     SHOULD NOT
7   DATA WAS NOT TRANSFERED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE CONTROLLER TO THE HOST
     CONTROL STORE

RESULT BYTE 2
0-7 NOT USED

99

>>>>>>>>>>>>> TC06F
CONTROLLER CYCLE STEAL TEST   TC06F

THIS PROGRAM TESTS THE CYCLE STEALING
OF 6 BYTES OF DATA FROM THE CONTROLLER
TO THE HOST CONTROL STORE.

RESULT BYTE 1
0-4 NOT USED
5   CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE DATA
     XFER FROM CONTROLLER TO HOST
6   DATA ADDRESS IN WR5IL4 WAS
     INCREMENTED AFTER A 1 BYTE
     DATA TRANSFER WHEN IT WAS
     NOT SUPPOSED TO
7   DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE CONTROLLER TO THE HOST
     CONTROL STORE

RESULT BYTE 2
0-7 NOT USED

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>>>>>>>>>>>>> TC070
CONTROLLER CYCLE STEAL TEST          TC070

THIS PROGRAM TESTS THE CYCLE
STEALING OF 1 BYTE OF DATA FROM
THE CONTROLLER TO THE HOST MAIN
STORE.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE DATA
     XFER FROM CONTROLLER TO HOST
6    DATA ADDRESS IN WR4IL4
     INCREMENTED AFTER A 1 BYTE
     DATA TRANSFER WHEN SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE CONTROLLER TO THE HOST
     MAIN STORE

RESULT BYTE 2
0-7 NOT USED


>>>>>>>>>>>>> TC071
CONTROLLER CYCLE STEAL TEST          TC071

THIS PROGRAM TESTS THE CYCLE STEALING
OF 6 BYTES OF DATA FROM THE CONTROLLER
TO THE HOST MAIN STORE.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE DATA
     XFER FROM CONTROLLER TO HOST
6    DATA ADDRESS IN WR5IL4
     INCREMENTED AFTER A 1 BYTE
     DATA TRANSFER WHEN SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE CONTROLLER TO THE HOST
     MAIN STORE

RESULT BYTE 2
0-7 NOT USED


>>>>>>>>>>>>> TC072
CONTROLLER CYCLE STEAL TEST          TC072

THIS PROGRAM TESTS THE CYCLE STEALING
OF 1 BYTE OF DATA FROM THE HOST
CONTROL STORE TO THE CONTROLLER.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE
     DATA XFER FROM HOST TO
     CONTROLLER
6    DATA ADDRESS IN WR4IL4
     INCREMENTED AFTER A 1 BYTE DATA
     TRANSFER WHEN IT SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE HOST CONTROL STORE
     TO THE CONTROLLER

RESULT BYTE 2
0-7 NOT USED
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>>>>>>>>>>>>> TC073
CONTROLLER CYCLE STEAL TEST          TC073

THIS PROGRAM TESTS THE CYCLE STEALING
OF 6 BYTES OF DATA FROM THE HOST
CONTROL STORE TO THE CONTROLLER.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE
     DATA XFER FROM HOST TO
     CONTROLLER
6    DATA ADDRESS IN WR5IL4
     INCREMENTED AFTER A 1 BYTE DATA
     TRANSFER WHEN IT SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE HOST CONTROL STORE
     TO THE CONTROLLER

RESULT BYTE 2
0-7 NOT USED


>>>>>>>>>>>>> TC074
CONTROLLER CYCLE STEAL TEST          TC074

THIS PROGRAM TESTS THE CYCLE STEALING
OF 1 BYTE OF DATA FROM THE HOST
MAIN STORE TO THE CONTROLLER.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE
     DATA XFER FROM HOST TO
     CONTROLLER
6    DATA ADDRESS IN WR6IL4
     INCREMENTED AFTER A 1 BYTE DATA
     TRANSFER WHEN IT SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE HOST MAIN STORE
     TO THE CONTROLLER

RESULT BYTE 2
0-7 NOT USED


>>>>>>>>>>>>> TC075
CONTROLLER CYCLE STEAL TEST          TC075

THIS PROGRAM TESTS THE CYCLE STEALING
OF 6 BYTES OF DATA FROM THE HOST MAIN
STORE TO THE CONTROLLER.

RESULT BYTE 1
0-4 NOT USED
5    CYCLE STEAL TRANSFER CHECK
     SENSE BIT ON AFTER A 1 BYTE
     DATA XFER FROM HOST TO
     CONTROLLER
6    DATA ADDRESS IN WR7IL4
     INCREMENTED AFTER A 1 BYTE DATA
     TRANSFER WHEN IT SHOULD NOT
7    DATA WAS NOT TRANSFERRED
     CORRECTLY AFTER A 1 BYTE
     CYCLE STEAL OF DATA FROM
     THE HOST MAIN STORE
     TO THE CONTROLLER

RESULT BYTE 2
0-7 NOT USED
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99

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>>>>>>>>>>>>> TC0A1                                  >>>>>>>>>>>>> TC0A4
CONTROLLER P-CHK U-INT            TC0A1              W/S CONSOLE POLL                 TC0A4

THIS TEST FORCES A MEMORY CHECK BY                  THIS PROGRAM POLLS THE WORK STATION
ATTEMPTING TO READ FROM NONEXISTENT                 CONTROL CONSOLE AND REPORTS ANY
STORAGE. THE TEST ALSO ANALYZES                     ERRORS OR CHECKS ENCOUNTERED.
THE U-INTERRUPT IN THE CHANNEL TO
VERIFY THE ABILITY OF THE CONTROLLER
TO REPORT A MEMORY PARITY CHECK.


RESULT BYTE 1                                       RESULT BYTE 1
                                                    0    PROPER RESPONSE RECEIVED
0    INTERRUPT NOT FROM WS                          1    GO LATCH FAILED TO RESET
1    HOT INTERRUPT REQ FROM                         2    TRANSMIT FAILED
     CONTROLLER                                     3    RECEIVE ENABLE FAILED
2    NO INTERRUPT TAKEN                             4    NO RESPONSE
3    'NOT ANY CHECK' JIO FAILED                     5    NO EOB
4    NO 'MEMORY P CHK' REPORTED                     6    RECEIVER NOT DISABLED AFTER EOB
5-7 NOT USED                                        7    MULTIFRAME RESPONSE

RESULT BYTE 2                                       RESULT BYTE 2
0-7 CONTENTS OF SENSE BYTE 2                         0    SERIAL PARITY CHECK
     'CONTROLLER CHECK BYTE'                         1    CONTROLLER FAILURE
                                                    2-7 NOT USED

                                                    RESULT BYTES 3 AND 4
                                                        LAST FRAME RETURNED FROM TERMINAL

>>>>>>>>>>>>> TC0A2
SERDES SHIFT TEST                 TC0A2

THIS TEST CHECKS THE CONTROLLER'S                   >>>>>>>>>>>>> TC0A5
ABILITY TO SHIFT DATA INTO AND OUT OF               W/S MDI VALID STOP DISPLAY        TC0A5
THE SHIFT REGISTERS. IT ALSO CHECKS
THE INTERRUPT AND CONTROLLER STOP                   THIS PROGRAM CAUSES A 'VALID STOP'
FUNCTIONS OF THE DIAGNOSTIC SHIFT                   MESSAGE TO BE DISPLAYED ON THE
COMMAND.                                            SYSTEM CONSOLE CRT AT THE END OF THE
                                                    WORK STATION DIAGNOSTIC PGM RUN.
RESULT BYTE 1
0    BAD STATUS ON DATA XFER
1    BAD DATA ON 'AA' DATA LOAD
2    BAD DATA ON 'AA' COMMAND LOAD
3    BAD DATA ON SHIFTED 'AA' DATA                  RESULTS
4    BAD DATA ON SHIFTED 'AA' CMD
5    BAD DATA ON '55' DATA LOAD                     THERE ARE NO RESULTS TO REPORT FROM
6    BAD DATA ON '55' COMMAND LOAD                  THIS TEST UNIT.
7    BAD DATA ON SHIFTED '55' DATA

RESULT BYTE 2
0    BAD DATA ON SHIFTED '55' DATA                  >>>>>>>>>>>>> TC0C0
1-7 NOT USED.                                       WORK STATION TRANSMIT            TC0C0

                                                    THIS UTILITY TRANSMITS THE DATA SET
                                                    INTO CE PANEL SWITCHES 2, 3 AND 4 TO
                                                    THE DEVICE ON THE CABLE ADDRESS SET
                                                    ON CE SWITCH 1.
>>>>>>>>>>>>> TC0A3                                  CE PANEL SWITCH 1 -> CABLE ADDRESS
DRIVER/RECEIVER ACTIVITY CHECK    TC0A3             CE PANEL SWITCH 2-4-> DATA

THE DRIVER/RECEIVER ACTIVITY REGISTERS
ARE CAUSED TO INCREMENT THEIR COUNT
AND ANY THAT FAIL TO INCREMENT ARE                  WORK STATION TRANSMIT UTILITY
REPORTED IN ERROR.
                                                    THIS IS NOT A FUNCTIONAL TEST
                                                    THERE ARE NO RESULTS TO REPORT.
RESULT BYTE 1                                       REGISTER 6(H) HIGH NIBBLE HAS THE
0    CABLE ADDRESS 0 FAILED TEST                    CABLE ADDRESS OF THE WORK STATION
1    CABLE ADDRESS 1 FAILED TEST                    BEING ADDRESSED.
2    CABLE ADDRESS 2 FAILED TEST                    REGISTER 6, NIBBLES 1, 2, AND 3
3    CABLE ADDRESS 3 FAILED TEST                    HAVE THE DATA BEING SENT TO THE WORK
4-7 NOT USED                                        STATION BEING TESTED.

RESULT BYTE 2
0-7 NOT USED
                                                    >>>>>>>>>>>>> TC0C1
                                                    W/S NETWORK ANALYSIS PROGRAM     TC0C1

                                                    THIS PROGRAM CATEGORIZES AND REPORTS
                                                    ALL POLLING PROBLEMS ENCOUNTERED
                                                    WHILE POLLING ALL VALID ADDRESSES
                                                    ON THE WORK STATION CONTROLLER BUS.


                                                    RESULTS ARE PRESENTED IN GRAPH FORM
                                                    ON THE SYSTEM CONSOLE CRT
```

electrostatic discharge (ESD)
problems 80-200
  covers and frame for ESD 80-220
  I/O devices and cables for ESD 80-230
  power distribution for ESD 80-210
enclosure, disk
  62EH 09-020
  62PC 10-030
error codes, wrap 99-020
error counter table
  communications
    autocall 89-550
    BSC 89-162
    SDLC 89-300
  disk
    62EH 83-100
    62PC 83-600
  diskette
    level 1 84-250
    level 2 84-750
  display stations 87-100
  line printers
    3262 85-600
    5211 85-100
  matrix printers (5225, 5256) 88-100
  work station controller 86-100
error history table
  communications
    autocall 89-510
    BSC 89-100
    MLCA controller 89-410
    SDLC 89-200
  control processor 82-200
  disk
    62EH 83-200
    62PC 83-700
  diskette
    level 1 84-200
    level 2 84-700
  display stations 87-200
  line printers
    3262 85-700
    5211 85-200
  main storage processor 81-200
  matrix printers (5225, 5256) 88-200
  work station controller 86-200
error information
  communications 89-000
  control processor 82-000
  disk 83-000
  diskette 84-000
  display station 87-000
  main storage processor 81-000
  work station controller 86-000
  5211 printer 85-000
  5256 printer 88-000
error recording 80-100
error recording and analysis procedure
(ERAP) 80-111
  how to run ERAP 99-068

exerciser programs
  device 99-080
  MSP 99-085
external modem EIA/CCITT
connection 45-710
E10 power connector (location) 05-360

F

fan assembly, card gate, 62PC 10-130
fault locating tests (data
communications) 99-072
feature distribution assembly 05-360
feature Power Supply-A 05-610
feature Power Supply-B 05-620
feature Power Supply-C 05-630
features, locations of 02-070
field service logic manual
(description) 01-034
file control card, 33FD 23-290
filter assembly, base +5V 05-335
filter assembly, multilevel 05-333
filters, locations
  line filter L-1 05-220, 05-230
first or second communications
adapter 31-000
  adapter card 31-200
  CADUCEE 31-477
  diagnostic programs 99-070
  digital data service
  adapter 31-500
    card jumpers 31-500
    installation 45-700, 45-720
  EIA/CCITT 31-600
    card jumpers 31-610
    installation 45-700, 45-710
    modem control lines 31-620
  EIA/CCITT locations 31-110
  error information 89-000
  installation 45-720
  introduction 31-010
  locations 31-100
    digital data service adapter 31-140
    EIA/CCITT adapter 31-110
    external cables 31-150
    1200 bps integrated modem 31-130
    2400 bps integrated modem 31-120
  1200 bps integrated modem 31-300
    card switch settings 31-310
    installation 45-700, 45-730
    line plate adjustment 31-320
    transmit level limiting check 31-340
  2400 bps integrated modem 31-400
    card check 31-460
    card jumpers 31-470
    dial tone detect 31-440
    installation 45-700, 45-740

S

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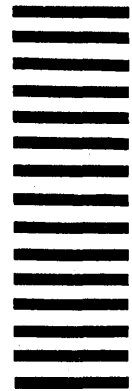
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