Sixth Edition (January 1981)

This is a major revision of, and obsoletes, SY31-0457-4. Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change or addition. Changes are periodically made to the information herein; these changes will be reported in technical newsletters or in new editions of this publication.

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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 System Data Areas and Diagnostic Aids Manual, LY21-0049
- 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.
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99-000 SYSTEM/34 DIAGNOSTIC SERVICE GUIDE
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 CARD

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, 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
01-000 Introduction to Maintenance

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01-020 Maintenance Analysis Procedures (Volume A)
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01-032 Theory Diagrams Manual (Volume C)
01-034 Field Service Logics (Volume D)
01-070 MAP and Maintenance Manual Section Numbering
01-080 MAP Numbering
01-090 Maintenance Manual Numbering
01-100 How to Use the System/34 MAPs and Maintenance Manual
01-110 Rules for Using MAPs
01-120 Probing Information When Using MAPs
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

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)

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.

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.

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.

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.

Example:

*09-050A

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:

09-050

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.

01-070  Introduction to Maintenance  3
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.
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 Logic 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.
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02-020 How to Prepare the Probe for Use
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02-035 What the Probe Lights Mean
02-040 Machine Voltage Levels
02-045 How to Check the Probe for Correct Operation
02-070 Features
02-080 Special Tools
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.

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.

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).

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.

Input Voltage Ranges

- MPUL (+60V) (most positive up level)
- LPUL (+2.16V ± .180V) (least positive up level)
- MPDL (+.95V ± .180V)
- OV
- LPDL (-60V)

Indicating Lights

<table>
<thead>
<tr>
<th>Region</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>B</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>C</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

VTL and Dutchess Input Voltage Ranges

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.
What the Probe Lights Mean

<table>
<thead>
<tr>
<th>Condition</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP light ON</td>
<td>The point being probed is at the up level (1).</td>
</tr>
<tr>
<td>DOWN light OFF</td>
<td>The point being probed is at the down level (0).</td>
</tr>
<tr>
<td>UP light OFF</td>
<td>The point being probed is pulsing at a frequency of more than 30 pulses per second.</td>
</tr>
<tr>
<td>DOWN light ON</td>
<td></td>
</tr>
<tr>
<td>UP light Flashing</td>
<td>The point being probed is pulsing at a frequency of less than 30 pulses per second.</td>
</tr>
<tr>
<td>DOWN light Flashing</td>
<td></td>
</tr>
<tr>
<td>UP light Flashing</td>
<td>The point being probed has a series of narrow positive pulses with a frequency of less than 30 pulses per second.</td>
</tr>
<tr>
<td>DOWN light ON</td>
<td>The point being probed has a series of narrow negative pulses with a frequency of less than 30 pulses per second.</td>
</tr>
<tr>
<td>UP light ON</td>
<td></td>
</tr>
<tr>
<td>DOWN light Flashing</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Input Levels</th>
<th>Output Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPUL +5.5V (most positive up level)</td>
<td>MPUL (most positive up level)</td>
</tr>
<tr>
<td>LPUL +2.0V (least positive up level)</td>
<td>+5.5V</td>
</tr>
<tr>
<td>(most positive down level)</td>
<td>+2.4V</td>
</tr>
<tr>
<td>(least positive down level)</td>
<td>LPUL (least positive up level)</td>
</tr>
<tr>
<td>MPDL +0.8V</td>
<td>(most positive down level)</td>
</tr>
<tr>
<td>LPDL 0.0V</td>
<td>MPDL +0.4V</td>
</tr>
<tr>
<td>VTL and Dutchess INPUT/OUTPUT Requirements</td>
<td>LPDL 0.0V</td>
</tr>
<tr>
<td></td>
<td>VTL Dutchess</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Voltage (V)</th>
<th>Current (I)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Up</td>
<td>V = 12V, I = -10 pA</td>
<td>Normal Up Level</td>
<td></td>
</tr>
<tr>
<td>Maximum Down</td>
<td>V = 0.3V, I = 2.3 mA</td>
<td>Normal Down Level</td>
<td></td>
</tr>
<tr>
<td>Minimum Up</td>
<td>V = 1.2V, I = 100 pA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Up Level</td>
<td>V = 3V, I = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Down Level</td>
<td>V = 0.0V, I = 2.5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Down</td>
<td>V = 0.5V, I = 1.6 mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Output Specifications**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Voltage (V)</th>
<th>Current (I)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Up</td>
<td>V = 9V, I = -5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Up Level</td>
<td>V = 3V, I = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Down (Saturation)</td>
<td>V = 0.3V, I = -22 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Down</td>
<td>V = 0, I = 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 D08 pin (ground). 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.
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.

**Data Communications for 2400 bps Modem (first or second communications line adapter only)**
- Cable Tower (D-gate)
  - 3262 or 5211 Printer 01D
  - Data Communications 01D
  - 5251 Display Stations
  - 5226 Printers
  - 5256 Printers

**Maximum Configuration Features (Left Side View)**
Maximum Configuration Features
(Right Side View)
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).

Reference Information
• 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).

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.
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05-680 Feature Power Supply G
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05-710 Power Supply Voltage Tolerance Chart
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).

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.
**POWER LOCATIONS**

**Connector Pin Locations**

<table>
<thead>
<tr>
<th>Connector J2, J7, and J8:</th>
<th>Connectors J2, J7, and J8:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Position</td>
<td>4-Position</td>
</tr>
<tr>
<td>Board Connector</td>
<td>Cable Connector</td>
</tr>
<tr>
<td>Pin Side</td>
<td>Pin Side</td>
</tr>
<tr>
<td>P/N 1473910</td>
<td>P/N 1847528</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connectors J4, J9, and C-B1J2</th>
<th>Connectors J4, J9, and C-B1J2</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-Position</td>
<td>6-Position</td>
</tr>
<tr>
<td>Board Connector</td>
<td>Cable Connector</td>
</tr>
<tr>
<td>Pin Side</td>
<td>Pin Side</td>
</tr>
<tr>
<td>P/N 1295112</td>
<td>P/N 1847530</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connectors J10, J20, and C-B1J1</th>
<th>Connectors J10, J20, and C-B1J1</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Position</td>
<td>9-Position</td>
</tr>
<tr>
<td>Board Connector</td>
<td>Cable Connector</td>
</tr>
<tr>
<td>Pin Side</td>
<td>Pin Side</td>
</tr>
<tr>
<td>P/N 1473911</td>
<td>P/N 1847532</td>
</tr>
</tbody>
</table>

**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                  |

**CAUTION**

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

---

**Locator**

---

**05-200 Power**
Connector C-B1J6
48-Position
Dual Line
Board Connector
Pin Side
P/N 813329

Diagram showing pin and connector layout.
Feature Power Supply G C-B1 Connector Locations

05-260

CB1 Board

C-B1J5

C-B1J6

C-B1J7

C-B1J3

C-B1J4

C-B1J1

C-B1J2
**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.

---

**Fuse Chart**

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Size</th>
<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB-1</td>
<td>20A</td>
<td>5565214</td>
</tr>
<tr>
<td>F301</td>
<td>4.5A</td>
<td>2495471</td>
</tr>
<tr>
<td>F302</td>
<td>0.3A</td>
<td>254628</td>
</tr>
<tr>
<td>F201</td>
<td>1.25A</td>
<td>252592</td>
</tr>
<tr>
<td>F202</td>
<td>1.25A</td>
<td>252592</td>
</tr>
<tr>
<td>F203</td>
<td>2.0A</td>
<td>92734</td>
</tr>
<tr>
<td>F204</td>
<td>1.25A</td>
<td>252592</td>
</tr>
<tr>
<td>F401</td>
<td>7A</td>
<td>2495463</td>
</tr>
</tbody>
</table>

---

**Available only in some 50 Hz countries**

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

Fuse Chart

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Size</th>
<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>F101</td>
<td>1A</td>
<td>855253</td>
</tr>
<tr>
<td>F102</td>
<td>.3A</td>
<td>855229</td>
</tr>
<tr>
<td>F103</td>
<td>4A</td>
<td>111257</td>
</tr>
<tr>
<td>F104</td>
<td>1A</td>
<td>855253</td>
</tr>
</tbody>
</table>
See FSL page YA020.

C-5 Control Supply
Ferro Capacitor

TB10

J21-9, 10 and 11
J21 Goes to power logic board and the AC box.

J21-1

J21-3

J21-4

J21-5

J21-6

J21-7

J21-8

J21-9

J21-10

J21-11

J21-12

J21-13

IPO Switch

To K1 and K2

Power

F101

F102

F103

F104

Ferro
Common

200V

208V

220V

230V

235V
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
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.

Note: For connector pin locations, see 05-210.
See FSL page YA040.
See FSL pages YA080 and YA090

Base Distribution Assembly

DC Ground

+5 Vdc Base

O/C Sense Plate

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

*Or regulator

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

Additional Fault Codes

<table>
<thead>
<tr>
<th>7F</th>
<th>6A</th>
<th>66</th>
<th>E1</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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).

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.

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.
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.
### Type of Failure

<table>
<thead>
<tr>
<th>Priority Fault Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 0 1</td>
<td>Feature Sense Card or Cable Missing (hex 9)</td>
</tr>
<tr>
<td>1 0 1 0</td>
<td>Over Voltage (hex A)</td>
</tr>
<tr>
<td>1 1 0 0</td>
<td>Over Current (hex C)</td>
</tr>
<tr>
<td>1 1 1 0</td>
<td>Under Voltage (hex E)</td>
</tr>
</tbody>
</table>

### Additional Fault Codes

<table>
<thead>
<tr>
<th>Additional Fault Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 1</td>
<td>Feature Sense Card or Cable Missing (hex 1)</td>
</tr>
<tr>
<td>0 0 1 0</td>
<td>Over Voltage (hex 2)</td>
</tr>
<tr>
<td>0 1 0 0</td>
<td>Over Current (hex 4)</td>
</tr>
<tr>
<td>0 1 1 0</td>
<td>Under Voltage (hex 6)</td>
</tr>
</tbody>
</table>

### 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)
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).

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.
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.

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:

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

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

Power Logic Board C-A1 Locations (card side)
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.

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

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.

Note: For connector pin locations, see 05-210.
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.
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.
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.
05-690 Feature Power Supply G (Second Level)

TB9

1

Common

2

200 Vac
(50 or 60 Hz)

3

208 Vac/60 Hz
220 Vac/50 Hz

4

230 Vac/60 Hz
235 Vac/50 Hz

5

C1

50 Hz only

C-B1J1

+5 Vdc Filter

+12 Vdc Filter

-12 Vdc Filter

-4 Vdc Filter

+24 Vdc Filter

C-B1J2

C-B1J3/J4

B03, B04, D03

B02

*B12, D12

D02

B13, D13

B06, D06

B05, D05

*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*

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Base</th>
<th>Reg</th>
<th>Feature A</th>
<th>Feature B</th>
<th>Feature C</th>
<th>Feature D</th>
<th>Feature G</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4 Vdc</td>
<td>-3.92</td>
<td>-3.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-4.16</td>
<td>-4.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+5 VDC</td>
<td>4.69</td>
<td>4.65</td>
<td>5.52</td>
<td>5.52</td>
<td>5.50</td>
<td>5.52</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.52</td>
<td>5.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-5 VDC</td>
<td>-4.70</td>
<td>-4.625</td>
<td>-5.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-5.50</td>
<td>-5.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+6 Vdc</td>
<td>5.64</td>
<td>5.64</td>
<td>6.60</td>
<td>6.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+8.5 Vdc</td>
<td>7.86</td>
<td>7.86</td>
<td>9.35</td>
<td>9.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+12 Vdc</td>
<td>11.10</td>
<td>11.10</td>
<td>13.20</td>
<td>13.20</td>
<td>11.04</td>
<td>13.20</td>
<td></td>
</tr>
<tr>
<td>+24 Vdc</td>
<td>22.08</td>
<td>22.56</td>
<td>26.40</td>
<td>26.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-24 Vdc</td>
<td>-22.08</td>
<td>-22.08</td>
<td>-26.40</td>
<td>-26.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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
07-100  Locations
07-200  Maintenance
07-300  Top Card Connectors
07-400  Internal Cables
07-500  Card Jumpers
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.

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 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.

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
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 - 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
CONTENTS

08-010  Introduction
08-100  Locations
08-200  Maintenance
08-300  Top Card Connectors
08-400  Internal Cables
08-500  Card Jumpers
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.
08-200 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 08-1 through 08-3.

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

08-300 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 33 on the right side of the connector and 02 through 33 on the left side of the connector.

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.

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.

Figure 08-2. Printer Attachment Top Card Connectors
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.

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
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.

Figure 08-4. Printer Adapter Cards Jumpering

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.

A — Needed for the 650 lines per minute printer.
B — Must be removed for the 650 lines per minute printer.
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09-020  Disk Enclosure
09-030  Disk Drive Motor
09-035  Motor Start Relay
09-040  Brake Coil Assembly
09-050  Brake Assembly
09-060  Motor Antistatic Brush
09-070  Spindle Antistatic Brush
09-080  Disk Speed Transducer
09-090  Motor Tension Spring
09-100  Shock Mount (Top One)
09-110  Shock Mounts (Bottom Two)
09-120  Cable and Card Locations
09-130  Card Sockets
09-140  Actuator (Access) Speed Adjustment
09-150  Disk Configuration Change
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 0 (operator panel).
2. Set CB1 off (see paragraph 05-310 for the location of CB1).
3. Remove the disk enclosure card socket cover by pressing the top of the cover.
4. Release the cable straps.
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 by moving the handle to ON.
7. Remove the belt guard by loosening the two screws and lifting it off.
8. Loosen the two screws 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.
12. Remove the safety cover on TB1.
13. Disconnect the disk speed transducer at TB1 — terminal 7 (black wire) and terminal 8 (white wire).
14. Unscrew the transducer cable clamp.
15. Disconnect the two wires from TB2.
16. Disconnect the disk enclosure ground wire.
17. Ensure the disk enclosure holding clip is engaged.
18. Remove three nuts and spring washers.
19. Lift the disk enclosure holding clip. Note the three disk enclosure locating guides; 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.
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.

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.
09-030 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 E 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 G.
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 I 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 Q; push the lugs into the groove of the pivot. Put the blade of a screwdriver on top of the clip M, 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.
Old Style Motor Replacement

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

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 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 and tighten the pivot.

5. Place the blade of a screwdriver into the roller 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 – terminal 1 (blue wire), terminal 2 (white wire), and terminal 3 (green/yellow wire).

8. Install the brake wires on TB1 – 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 that hold the brake cable.

11. 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.

12. Loosen the two screws 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. Slide the belt guard all the way to the left and tighten the screws.

17. Unlock the actuator lock by moving the handle to OFF.
New Style Motor Removal

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

1. Set Power to 0 (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).
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.

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.
**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.

---

Red Wire from Motor
Black Wire from Motor
Black Wire from TB1
**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 G 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 J that hold the brake cable.
11. Remove the screw I 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 C, and remove the brake coil assembly from the brake housing.
Replacement

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

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

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

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

5. Install the brake pad and spring on the motor shaft.

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

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

7. Install the three screws 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 that hold the brake and AC cable.

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

11. Install the motor antistatic brush.

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 B 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 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 ± 0.006 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) – 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.


*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 \( \text{a} \) 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 \( \text{f} \).

30. Unlock the actuator by moving the handle \( \text{a} \) to OFF.
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.

---

Replacement and Adjustment

1. Install the spindle locking arm with the spindle antistatic brush centered over the center A 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 D.

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

---

Removal

1. Set Power to O (operator panel).

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

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

4. Remove the two screws B 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.
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 0 (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.
7. Lift the motor and pivot it toward the disk enclosure to release tension on the belt, and remove the belt.
8. Remove the safety cover and remove the disk speed transducer wires from TB1 - terminal 7 (black wire) and terminal 8 (white wire).
9. Remove the disk speed transducer assembly by removing the two screws.

RePlicatIon and AdjusTmenT

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

1. Loosen the transducer clamp screw. Ensure the tab on the transducer is in the notch in the bracket.
2. Install the transducer assembly with the two mounting screws.
3. Adjust the transducer for a gap of 0.152 mm ± 0.051 mm (0.006 inch ± 0.002 inch) by moving the transducer in the clamp.
4. Tighten the transducer clamp screw.
5. Connect the transducer cable to TB1 - 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 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 6 by moving the handle to OFF.
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 0 (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 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 and lift up.
7. Open the tension spring a small amount and press the screw 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 in the spring.
3. Press the screw into the hole C.
4. Install the roller (old style), circular edge first, into the tension spring.
5. Place the blade of a screwdriver under roller 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.
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 \textbullet\ to ON.
3. Remove the belt guard by loosening the two screws \textbullet\ and lift the belt guard \textbullet\ off.
4. Loosen the two screws \textbullet\ 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 \textbullet.

7. Remove the four bracket mounting screws \textbullet\ (two on each side).
8. Remove the top screw \textbullet.
9. Slide the bracket out and remove the four shock mount bolts, nuts, and washers \textbullet.

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 \textbullet.
2. Install the top screw \textbullet.
3. Position the shock mount bracket in the machine up against the locating brackets \textbullet.
4. While holding the bracket to the top of the machine against the locating brackets \textbullet, install the four bracket mounting screws \textbullet.
5. Loosen the two screws \textbullet\ 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 \textbullet. Slide the belt guard all the way to the left and tighten the screws \textbullet.
10. Unlock the actuator by moving the handle \textbullet\ to OFF.
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 0 (operator panel).
2. Lock the actuator with the actuator lock A by moving the handle to ON.
3. Remove the belt guard F by loosening the two screws J and lift the belt guard off.
4. Loosen the two screws K 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 L that hold the shock mount to the machine frame.
8. Remove the top screw G 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 G.
2. Install the screws and washers H that hold the shock mount to the machine frame.
3. Loosen the two screws K 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 F. Slide the belt guard all the way to the left and tighten the screws J.
8. Unlock the actuator by moving the handle A to OFF.
DANGER
220 Vac is present on ACTB3 and ACTB4.

Motor
Brake

Motor
Brake

Speed
Transducer

Data Heads
0 and 1
Servo head and data head 2 are located on back of disk.

Test Socket D-W1A4

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

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

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

For example, ground pin is D-W1A4D08.

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

Ground

Preamp servo signal A
Preamp servo signal B

-Write transitions
-One head selected
-4V supply
+4V supply
-Select head 2
-Select head 1
-Select head 0
-Read select
-24V
-Write select
+Write gate 1
+Write current on
+6V
Card interlock line
-24V
+Data transmission line
+Data transmission line

To A-A2A4

To A-A2Y1

To A-A2A5

Serial
Write Data

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

09-120  CABLE AND CARD LOCATIONS
From D-W1A1
Servo Control and
24V Brake

From D-W1B1
Servo Head

A-A2A5 (see Note)

From D-W1B5
Tape Cable

A-A2Y1 (see Note)
A-A2B2 (see Note) Servo Head Position and Track Following Detect,
Phase Lock Oscillator

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

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

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

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

A-A2G2 (see Note)
File Fast Access Control

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

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

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.

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

D-W1

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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.


   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.
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.
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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.

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.

10-020 SUBFRAME

Removing the Subframe

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

1. Set Power to 0 (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.

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

10. Reinstall the card gate (see paragraph 10-180).

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).

1. Set Power to 0 (operator panel).

2. Place the subframe B 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.
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.

1. Set Power to 0 (operator panel).
2. Turn the screw \( \text{H} \) counterclockwise and open the card gate.
3. Turn the actuator lock knob \( \text{M} \) clockwise (through 120 degrees until the actuator lock reaches its stop) to lock the actuator.
4. Remove the two cable clamp screws \( \text{E} \) and remove the cable clamp and the attached card gate cover \( \text{A} \). 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 \( \text{F} \).
7. Loosen the two screws (one for each board retainer) in the board retainers \( \text{F} \) and slide the board retainers up to release the actuator cable \( \text{N} \) from the card gate.
8. Disconnect voltage connector VC9 \( \text{D} \).
9. Loosen the two screws \( \text{T} \) and \( \text{V} \) and remove the belt guard \( \text{W} \).
10. Lift the motor \( \text{U} \) against the force of the belt tensioner \( \text{R} \), remove the belt \( \text{S} \); then lower the motor until it is on its stop.
11. Disconnect the brake coil \( \text{K} \), trimmer board \( \text{D} \), and ground \( \text{A} \) 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.

12. Remove the lower (long) \( \text{L} \) and two upper disk enclosure mounting nuts \( \text{G} \) and \( \text{G} \).
13. Remove the disk enclosure \( \text{B} \) 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 \( \text{B} \) on the system frame, pass the cables through the subframe and tighten the three mounting nuts \( \text{G} \), \( \text{G} \), and \( \text{L} \) (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.

3. Connect the brake coil \( \text{K} \), trimmer board \( \text{D} \), and ground \( \text{A} \) connectors.
4. Lift the motor \( \text{U} \) against the force of the belt tensioner \( \text{R} \), reinstall the belt \( \text{S} \) 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 \( \text{W} \) and tighten the two screws \( \text{T} \) and \( \text{V} \).
6. Connect voltage connector VC9 \( \text{D} \).
7. Place the cable **A** under the two board retainers **B** to attach the actuator cable **M** to the card gate; then tighten the screws.

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

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 **G** to reinstall the cable clamp and the attached card gate cover **J**.

11. Turn the actuator lock knob **K** 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.)
10-040  DRIVE BELT

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

Removing the Drive Belt

1. Set Power to 0 (operator panel).
2. Loosen the two screws G and G and remove the belt guard E.
3. Lift the motor E against the force of the belt tensioner A, and remove the belt E; 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 E 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 B. When the pin K in the shaft P is free of the opening I, 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 G and tighten the screws I.
   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 D must overlap the motor bracket L.
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. When the pin in the shaft is free of the opening, turn the shaft 90 degrees to hold the spring, and lower the motor.

3. Remove the two screws and the belt tensioner.

Reinstalling the Drive Belt Tensioner

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

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

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

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

Note: The belt tensioner bracket must overlap the motor bracket.
Removing the Motor Antistatic Brush

1. Set Power to O (operator panel).
2. Loosen the two screws A and B and remove the belt guard C.
3. Remove the screw and the motor antistatic brush C.

Reinstalling the Motor Antistatic Brush

1. Locate the screw through the antistatic brush C, 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 D and tighten the two screws A and B.
Removing the Spindle Antistatic Brush

1. Set Power to 0 (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 C 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 and the cover C.
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 A 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.
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.
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 A and B and remove the belt guard C.
4. Lift the motor H against the belt tensioner spring D. 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 F and the belt tensioner.
6. Remove the screw J and the cover E from TB1.
7. Disconnect the two system wires B and the AC ground wire A.
8. Remove the pivot pin clip H 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 A into their holes and slide the assembly away from the disk enclosure.
3. Reinstall the pivot pin clip H.
4. Lift the motor H against the force of the belt tensioner spring D, reinstall the belt F 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 F 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 H against the belt tensioner spring V 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 G and tighten the screw.
10. Reinstall the belt guard F and tighten the screws D and G.
Removing the Brake Assembly and Coil

**CAUTION**
Do not turn the disk spindle pulley \( C \) counterclockwise; head and disk damage can occur.

1. Set Power to 0 (operator panel).
2. Loosen the two screws \( A \) and \( B \) 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 \( C \) from the brake coil \( G \).
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 \( C \) to terminals 1 and 2 on the coil \( G \).
3. Adjust the brake.
   a. Place a 0.25 millimeter (0.010 inch) gauge \( K \) between the armature casting \( L \) and the solenoid \( M \), slide the brake assembly toward the disk enclosure spindle pulley \( P \), and tighten the two holding screws \( B \).
   b. Remove the gauge \( K \).
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 \( E \) and tighten the two screws \( A \) and \( H \).
Removing the Shock Mounts

**CAUTION**
Do not remove more than one shock mount at a time unless the disk enclosure has been removed.

1. Set Power to 0 (operator panel).
2. Turn screw \( \text{C} \) counterclockwise and open the card gate.
3. Turn the actuator lock knob \( \text{H} \) clockwise (through 120 degrees) until the actuator lock reaches its stop.
4. Remove the four sets of screws \( \text{C} \), washers \( \text{D} \), and nuts \( \text{E} \) and remove the single screw \( \text{A} \) and washer \( \text{B} \).
5. Remove the shock mount \( \text{F} \).

Reinstalling the Shock Mounts

1. Slide the shock mount \( \text{F} \) into position.
2. Reinstall and tighten the single screw \( \text{A} \) and washer \( \text{B} \) and the four sets of screws \( \text{C} \), washers \( \text{D} \), and nuts \( \text{E} \).
3. Turn the actuator lock knob \( \text{H} \) counterclockwise (through 120 degrees) until the actuator lock reaches its stop.
4. Close the card gate and tighten the screw \( \text{E} \).
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 A and the card gate cover B.
4. Remove the two screws D and the cover E from TB2.
5. Disconnect the fan supply wires G.
6. Remove the ground screw F and ground wire.
7. Turn the screw C counterclockwise and open the card gate.
8. Press down on the fan retainer J at the rear of the card gate and slide the fan assembly H from the card gate.

Reinstalling the Card Gate Fan Assembly
1. Align the fan assembly H on the bottom of the card gate and slide together until the fan retainer J latches on the rear of the card gate.
2. Close the card gate and tighten the screw C.
3. Reinstall the ground wire with its screw F.
4. Connect the fan wires G.
5. Locate the screws D through the cover E and tighten.
6. Reinstall the card gate cover B using the two screws A.
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 0 (operator panel).

2. Remove the two cable clamp screws A and remove the cable clamp and the attached card gate cover B.

3. Disconnect the cables C (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 D counterclockwise and open the card gate.

5. Remove the cable strap E from the cable guide F.

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 E and reinstall the cable strap F.

2. Close the card gate and tighten the screw G.

3. Plug in the cables C (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 A to reinstall the cable clamp and the attached card gate cover B.
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 A.
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 B, 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 G and H, 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.
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 0 (operator panel).
2. Remove the two cable clamp screws and remove the cable clamp and the attached card gate cover G.
3. Turn the screw G 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 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 D 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 D 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.
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 E 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.
Drive Belt Tensioner

1. Set Power to 0 (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 0 (operator panel) before pressing the thermal reset.

Press the thermal reset A to reset the motor.
Voltages

1. Set Power to 0 (operator panel).
2. Turn the screw A counterclockwise and open the card gate.
3. Set Power to 1 (operator panel).
4. Use the following charts for the locations to check the voltages.
5. Set Power to 0 (operator panel).
6. Close the card gate and tighten the screw A.
### 62PC Voltages Supplied by the System/34

<table>
<thead>
<tr>
<th>Card Name</th>
<th>Card Plug Position</th>
<th>Voltage (±10%)**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-12</td>
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<tr>
<td>Data Channel</td>
<td></td>
<td>B2</td>
</tr>
<tr>
<td>Logic 1</td>
<td></td>
<td>C2</td>
</tr>
<tr>
<td>Logic 2</td>
<td></td>
<td>D2</td>
</tr>
<tr>
<td>Servo 1</td>
<td></td>
<td>E2</td>
</tr>
<tr>
<td>Servo 2</td>
<td></td>
<td>F2</td>
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<table>
<thead>
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<th>Cable Name</th>
<th>Card Plug Position</th>
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</thead>
<tbody>
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<td></td>
<td>-12</td>
</tr>
<tr>
<td>Actuator</td>
<td></td>
<td>A2</td>
</tr>
<tr>
<td>Bus In</td>
<td></td>
<td>A3</td>
</tr>
<tr>
<td>Bus Out*</td>
<td></td>
<td>A4</td>
</tr>
<tr>
<td>Dedicated</td>
<td></td>
<td>A5</td>
</tr>
</tbody>
</table>

*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).
<table>
<thead>
<tr>
<th>Card Name</th>
<th>Card Plug Position</th>
<th>Voltage (±10%)**</th>
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</thead>
<tbody>
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<td></td>
<td>-8</td>
</tr>
<tr>
<td>Data Channel</td>
<td>B2</td>
<td></td>
</tr>
<tr>
<td>Logic 1</td>
<td>C2</td>
<td></td>
</tr>
<tr>
<td>Logic 2</td>
<td>D2</td>
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<tr>
<td>Servo 1</td>
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<td>S04</td>
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<tr>
<td>Servo 2</td>
<td>F2</td>
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<th>Card Plug Position</th>
<th>Voltage (±10%)**</th>
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<td>-8</td>
</tr>
<tr>
<td>Actuator</td>
<td>A2</td>
<td>B10</td>
</tr>
<tr>
<td>Bus In</td>
<td>A3</td>
<td></td>
</tr>
<tr>
<td>Bus Out*</td>
<td>A4</td>
<td></td>
</tr>
<tr>
<td>Dedicated</td>
<td>A5</td>
<td></td>
</tr>
</tbody>
</table>

*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 Disk Drive Board (E-A1, E-B1, E-C1, or E-D1)

**Voltage Cross-Over Cable Locations**
(Pin Side)

*Note: All four jumpers may not be present.*
CABLE AND CARD LOCATIONS

Brake Cable
+24V
+24V
+12V
+5V
-4V
-12V
—Power Good—From power supply logic
Ground—From power supply logic
—Brake Applied—To power supply logic

From Power Supplies

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.

Bus Cable

Drive From
A A-A2A5
B E-A1A4
C E-B1A4
D E-C1A4

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

Drive From
A A-A2A4
B A-A2Z1
C A-A2B4
D A-A2B5

Last Drive Terminator
A E-A1A4
B E-B1A4
C E-C1A4
D E-D1A4

Bus Cable

Disk Enclosure Cable
E-A1A2
(see Note)

To Disk Enclosure
(through base casting)

Line Name
002 Head Select A
003 Head Select B
004 Chip Select 3
005 Chip Select 1
006 Motor Safety
007 Center Tap
008 Not Used
009 Servo Driver Tap
010 -8 V Servo Write Current
011 -6 V Servo Write Data A
012 * Data Select Gated
013

Note: If drives B, C, or D are installed, the line names are the same, but the board locations 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)

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.
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 I 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 K.

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.
For Drives C and D Only
10-400  MAP SCOPE PICTURE 1

D2J09 + Shift Reg Clock

D2J10 + Enable Sample Servo

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
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11-010 Introduction
11-100 Locations
11-200 Maintenance
11-300 Top Card Connectors
11-400 Cables
11-500 Cable Quality Check
11-510 Cable Checking Introduction
11-520 Cable Quality Check Procedure
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.

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.

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

Note: The top card connectors are not shown.

Figure 11-1. Work Station Attachment Card Locations
• 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, 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.
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.
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.
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):

- Tektronix¹ 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.

¹Trademark 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 workstation.

Note: A change of more than 10 percent of the transmitted signal level usually indicates a 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.

Calculations for determining distance in feet and meters are:

\[ D_f = t \times 324.7 \text{ feet} \]
\[ D_m = t \times 99 \text{ meters} \]

The following calculation is set for the transmitted signal above (assuming that the B time base is set for 0.2 \( \mu \)s).

\[ t = 6.8 \text{ divisions} \times 0.2 \, \mu \text{s} = 1.36 \, \mu \text{s} \]

\[ 1.36 \, \mu \text{s} \times 324.7 \text{ feet} = 441.6 \text{ feet} \]
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:

   ![Diagram of resistor assembly]

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.

Delayed Sweep (B)

0.2 Volts

AC

CH1

Auto Trig

LEVEL to Full Counterclockwise

Clockwise (9.5)

B starts after delay time.

Figure 11-6. Setting Oscilloscope Switches

T-Connector on B Gate

Times-1 Probe

Coaxial Cable with BNC Ends

Ground Lead

Signal Lead

Shield

Phase B

Phase Y

Figure 11-7. Connecting the Oscilloscope
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.

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.

Same as 1 in A but with the B time base now set to 0.2 μs.

A change in the signal level caused by a short circuit cable 170 meters (560 feet) from the end of the cable being checked.

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.

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
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13-010  Introduction
13-020  Removal and Replacement
13-030  Panel Layout and Indicator Decal
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 0 (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 0 (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.
13-030 PANEL LAYOUT AND INDICATOR

CE Panel

- DPLY PWR CHK
- RESET
- CE START

COMM DPLY
- ON
- OFF
- CLOCK
- PD
- BYTE 0
- DISPLAY LIGHTS
- BYTE 1

MSP RUNNING
- START

CE Subpanel

FIRST OR SECOND COMMUNICATIONS ADAPTER

MLCA

COMM SELECT
- 1
- 2
- 3
- 4

13-030 CE Panels 3
CONTENTS

15-100  Control Processor
15-110  Card Locations and Uses
15-200  Main Storage Processor
15-210  Card Locations and Uses

15-000  Processing Unit
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
15-110  CARD LOCATIONS AND USES

The control processor cards and the hardware on each card are as follows for each of the two levels:

A-A1 (Level 1)

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.

A-A1 (Level 2)
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
**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
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
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 0 (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.
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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.
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.
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 A, and open the front right side cover and remove screw E. Remove the panel assembly.
4. Remove the ground wire C.
5. Remove the 4 side panel screws D and the side panel.
6. Turn the locks G; 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 F when the 33FD and mounting frame are reinstalled.

8. To reinstall, reverse the above procedure.
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 E.
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 D.
5. Remove collet assembly E, spring, and washer G.
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.
Removal and Replacement

1. Set Power to 0 (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 0 (operator panel).
2. Remove the 33FD from the machine (see paragraph 23-100); then set Power to 1 (operator panel).
3. Insert a diskette.
4. Activate the head load coil by installing a jumper between the ground A 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 E.
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.
HEAD AND PRESSURE PAD CLEANING

CAUTION
Use only the materials in the following list to clean the head and the pressure pad.

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Note: If the pressure pad needs replacement, order bill of material 2200751, 33FD pressure pad field replacement procedure.

1. Set Power to 0 (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.
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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  and leadscrew wheel .

6. Remove the covers (see paragraph 23-130).

7. Loosen the clamping screws on the upper and lower stops .

8. Remove the two screws and the bottom bearing .

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.

CAUTION
Do not lose the spring when you remove the shaft. Note the bend in the spring, so you can reinstall it the same way.
**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 \( B \) 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.
LEADScrew CLEANING

CAUTION
Use only the indicated materials to clean the leadscrew.

1. Set Power to 0 (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 0 (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.
6. Remove the drive pulley.

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. 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.
HUB ASSEMBLY

Removal and Replacement

1. Set Power to 0 (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 and pulley.

6. Remove the hub.

7. Remove the three screws, that hold the bearing, the back bearing, and the spacers.

8. Remove three bearing screws and bearing, G.

9. To reinstall, reverse above procedure. Check the belt path. If necessary to adjust, see paragraph 23-200.

CAUTION

The front bearing 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.

DRIVE PULLEY

Removal

1. Set Power to 0 (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the drive belt.

4. Loosen the setscrew and remove drive pulley, H.

5. Position the pulley on the shaft.

6. Align the setscrew with flat surface of the shaft and tighten.

7. Reinstall the belt.

8. Check the belt path. If necessary to adjust, see paragraph 23-200.

9. Install the 33FD in the machine.

BELT PATH

The belt must be tracking in the center of the drive pulley and hub pulley.

Adjustment

1. Set Power to 0 (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 and slide assembly in or out to adjust. Screw 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 0 (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 O.
4. Loosen the mounting screw and move the phototransistor assembly A 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 B and leadscrew wheel J.
6. With the stepper motor wheel and leadscrew wheel in position as in view S, insert a 0.51 mm (0.020 inch) thickness gauge between the wheels B in view S. Tighten screw J 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 G. Clamp it into place with the thumbscrew and turn the CE tool so it touches surface D.
9. Turn the leadscrew by holding the upper limit stop C; adjust for gap E. This gap is a number on the front of the head assembly F. 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 S; then tighten the leadscrew wheel clamping screw I. The top of the clamping collar should be approximately even with the top of the metal clamping surface of the leadscrew wheel T.

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 setting.

12. Adjust the phototransistor so that the raised edge touches the 33FD alignment tool, 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.

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.
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 d 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.
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 C.

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.

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.
Removal and Replacement

1. Set Power to 0 (operator panel).

2. Remove the 33FD from the machine (see paragraph 23-100).

3. Remove the five leads from the connector.

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.
Adjustment

1. Set Power to 0 (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.

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 F.

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).
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.

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 0 (operator panel).
2. Remove the 33FD from the machine (see paragraph 23-100).
3. Seek to track O.
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 A 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 0 (operator panel).
2. Remove the 33FD from the machine (see paragraph 23-100).
3. Seek to track O.
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.
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 A.
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 B, located on the cover, under the pressure pad arm C.
**File Control Card**

**Removal and Replacement**

1. Set Power to 0 (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.

---

### File Card Pin Assignment

<table>
<thead>
<tr>
<th>Name</th>
<th>Color</th>
<th>Old Style File Card Test Pin</th>
<th>New Style File Card Test Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stepper Motor MC-0 (track 0)</td>
<td>White</td>
<td>B03</td>
<td>TPB2</td>
</tr>
<tr>
<td>Stepper Motor MC-1 (track 1)</td>
<td>Red</td>
<td>D02</td>
<td>TPA1</td>
</tr>
<tr>
<td>Stepper Motor MC-2 (track 2)</td>
<td>Yellow</td>
<td>B04</td>
<td>TPB3</td>
</tr>
<tr>
<td>Stepper Motor MC-3 (track 3)</td>
<td>Black</td>
<td>B02</td>
<td>TPB1</td>
</tr>
<tr>
<td>Stepper Common +24 Vdc</td>
<td>Blue</td>
<td>D05</td>
<td>TPA11</td>
</tr>
<tr>
<td>Head Magnet +24 Vdc</td>
<td>Yellow</td>
<td>D04</td>
<td>TPA11</td>
</tr>
<tr>
<td>Head Load</td>
<td>Black</td>
<td>B05</td>
<td>TPB4</td>
</tr>
<tr>
<td>LED Return</td>
<td>Black</td>
<td>D06</td>
<td></td>
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<tr>
<td>LED Current</td>
<td>Yellow</td>
<td>D07</td>
<td>TPA2</td>
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<td>Phototransistor Return</td>
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<td>B08</td>
<td>TPB5</td>
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<td>Erase Current</td>
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<td>B10</td>
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<td>Head Ground and Shield</td>
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<td>D08</td>
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<td>+ Access 0/1</td>
<td></td>
<td>G02</td>
<td>TPB8</td>
</tr>
<tr>
<td>+ Access 1/2</td>
<td></td>
<td>G03</td>
<td>TPB9</td>
</tr>
<tr>
<td>+ Access 2/3</td>
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<td>TPB10</td>
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<tr>
<td>+ Access 3/4</td>
<td></td>
<td>G05</td>
<td>TPB11</td>
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<tr>
<td>+ Raw Read Data</td>
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<td>G07</td>
<td>TPB12</td>
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<td>+ Head Engage</td>
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<td>G10</td>
<td>TPB13</td>
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<td>TPA6</td>
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<td>TPA7</td>
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<td>+5 Vdc</td>
<td></td>
<td>J03</td>
<td>TPB7</td>
</tr>
<tr>
<td>-5 Vdc</td>
<td></td>
<td>J11</td>
<td>TPA12</td>
</tr>
<tr>
<td>Ground</td>
<td></td>
<td>J08</td>
<td>TPA10/TPA3</td>
</tr>
</tbody>
</table>
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 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.

New Style File Control Card

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.
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.

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.

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.
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.*

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Old Style File Card</th>
<th>New Style File Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
<td></td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
<td></td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
<td></td>
</tr>
<tr>
<td>Times per division</td>
<td>0.1 ms/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 1 probe²</td>
<td>Preamp TP1</td>
<td>TPA-4 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe²</td>
<td>Preamp TP2</td>
<td>TPA-5 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U07 (+MS address compare)</td>
<td></td>
</tr>
</tbody>
</table>

²The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.  
²See 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.
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.

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.

### Table: Oscilloscope Setup

<table>
<thead>
<tr>
<th>Setting</th>
<th>Old Style File Card</th>
<th>New Style File Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A sweep mode</td>
<td>Normal</td>
<td>TPA-4 (preamp TP1)</td>
</tr>
<tr>
<td>Channel A level</td>
<td>+</td>
<td>TPA-5 (preamp TP2)</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
<td></td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
<td></td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
<td></td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
<td></td>
</tr>
<tr>
<td>Times per division</td>
<td>0.1 ms/cm</td>
<td></td>
</tr>
<tr>
<td>Channel 1 probe</td>
<td>Preamp TP1</td>
<td></td>
</tr>
<tr>
<td>Channel 2 probe</td>
<td>Preamp TP2</td>
<td></td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
<td></td>
</tr>
</tbody>
</table>

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.
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).

Use the default option to execute the commands.

Press the Attn key (3 times) to return to the diskette exerciser test 1 command menu.

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).

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
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<td>25-790</td>
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<td>25-800</td>
<td>Light-Emitting Diode and Phototransistor Alignment</td>
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<td>25-840</td>
<td>Phototransistor Amplifier Service Check</td>
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<td>25-895</td>
<td>Control Card Test Pins</td>
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<td>Control Card Socket and Connector Pins</td>
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<td>25-980</td>
<td>Control Card Logic Pins</td>
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<td>25-990</td>
<td>Cable and Card Locations</td>
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<td>25-991</td>
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<td>25-997</td>
<td>Head Wear Service Check for Level 1 Attachments</td>
</tr>
<tr>
<td>25-998</td>
<td>Head Wear Service Check for Level 2 Attachments</td>
</tr>
</tbody>
</table>
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.
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
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.
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.
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.
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.
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).
This page is intentionally left blank.
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.
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 A 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 B.
    - Remove the jumper A.
    - Set Power to O (operator panel).
    - Go to 25-490, step 5.
11. Remove the timing pin A.
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 A.
20. Reinstall the wiper assembly.
    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).
Note: See paragraph 25-950 for control card test pins.

Jumper:

<table>
<thead>
<tr>
<th>Cylinder 40</th>
<th>Cylinder 39</th>
</tr>
</thead>
<tbody>
<tr>
<td>THP 11</td>
<td>TPB 10</td>
</tr>
<tr>
<td>--to--</td>
<td>--to--</td>
</tr>
<tr>
<td>TPA 13</td>
<td>TPA 13</td>
</tr>
</tbody>
</table>

Timing Pointer

Timing Block

CAUTION
Factory Adjustment Only

0.508 mm (0.020 inch)

No Gap at Cylinder 39

Timing Pointer

Timing Block

Head/Carriage Assembly

See Step 15
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 7.
4. Insert a strip of clean paper between the heads to prevent the head surfaces from touching.
5. Measure the gap 6 between the stepper motor pulley and the casting. Write the measurement here.
   Gap is:________
6. Loosen the clamp screw 2 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 6.
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 1 (operator panel).
11. Install a jumper A from TPA13 (ground) to THP11 (-align access 0).
12. Make the gap 6 the same size as the gap recorded in step 5 and tighten the clamp screw 2. (Ensure that the timing pin passes freely through the stepper motor pulley into the timing slot in the casting.)
13. Remove the timing pin 6.
14. Loosen the two band clamping screws 6.
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 6 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 6. (Ensure that the drive band is straight.)
Nate: See paragraph 25-950 for control card test pins.

Jumper:

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<tr>
<th>Cylinder 40</th>
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<td>THP 11</td>
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<td>TPA 13</td>
<td>TPA 13</td>
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Note: See paragraph 25-950 for control card test pins.
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.
Note: See paragraph 25-950 for control card test pins.

Jumper:

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<td>TPA 13</td>
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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 25-430).

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 B 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 C 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).

---

**Note:** See paragraph 25-950 for control card test pins.
Carriage Assembly
Solenoid (de-activated)
Bail
Stop
Setscrew
Carriage Assembly
3/32 to 4/32 inch
Read/Write Heads
Carriage Tab
Bail Assembly
Cover Assembly
Bail Stop Setscrew
Solenoid (activated)
Strip of Clean Paper
Carriage Assembly
Plunger
Read/Write Heads
Carriage Tab
Bail Assembly
0.4 ± 0.13 mm
(0.015 ± 0.005 inch)
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 G to activate the head load solenoid.

**DANGER**
The solenoid case becomes hot after continuous use.

7. Loosen the solenoid locking screw E.

8. Turn the solenoid in the casting for a 0.4 ± 0.13 millimeter (0.015 ± 0.005 inch) gap G 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 F.

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 H 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)

Solenoid

Power Cable

Note: Turn the solenoid clockwise to decrease this gap.

Carriage Assembly
Strip of Clean Paper
Read/Write Heads
Carriage Tab
0.4 ± 0.13 mm (0.015 ± 0.005 inch)

Solenoid (activated)
Plunger

Solenoid (de-activated)

Carriage Assembly
Plunger
Bail Assembly

Jumper:
TPB13 (head load) → to → TPA13 (ground)

Note: See paragraph 25-950 for control card test pins.
25-540  SOLENOID AND BAIL REMOVAL
(MACHINES WITH 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 solenoid leads (G) from the taper pin terminal block (F). (Remember the cable path for the replacement procedure.)

6. Remove the bail return spring (E).

7. 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.)

8. Remove the plunger from the bail.

9. Loosen the solenoid locking screw (A).

10. Remove the head load solenoid by turning it counterclockwise.

25-545  SOLENOID AND BAIL REPLACEMENT
(MACHINES WITH 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 (E) of the carriage arm.

4. Reinstall the bail return spring (E).

5. Carefully place and connect the solenoid leads (G) to the taper pin terminal block (F).

6. Set Power to I (operator panel).

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 E.
8. Remove the two screws H and the two connector covers.
9. Remove the solenoid leads I 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.

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 E. 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 P.
7. Connect the cable to location A2 G.
8. Set Power to I (operator panel).
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.

BELT TRACKING ADJUSTMENT

1. Remove the diskette drive (see paragraph 25-130).

2. Loosen the idler locking screw and the drive pulley set screw E).

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).


BELT REMOVAL

1. Set Power to O (operator panel).

2. Release the idler tension by hand and remove the drive belt.

BELT REPLACEMENT

1. Install the belt, ensuring that the idler is in place as shown A.

2. Set Power to I (operator panel).


DRIVE MOTOR REMOVAL

1. Remove the diskette drive (see paragraph 25-130).

2. Disconnect the drive motor power cable.

DRIVE MOTOR REPLACEMENT

1. Reinstall the drive pulley on the new motor. Ensure that the set screw is on the flat surface of the motor shaft.

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.
Drive Motor and Bracket Assembly

Hub Pulley

Idler Pulley

CAUTION: Not replaceable in the field.

Power Cable

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 and remove the drive pulley.

25-630  DRIVE PULLEY REPLACEMENT
1. Install the drive pulley on the motor shaft with the set screw 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.
3. Remove the locking screw and the idler assembly.

25-650  IDLER ASSEMBLY REPLACEMENT
1. Install the idler assembly and the locking screw (do not tighten).
2. Reinstall the idler spring.
3. Go to 25-590.
CAUTION
Not replaceable in the field.
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.

6. Remove the two screws and the two connector covers.

7. Remove the stepper motor leads from the cable connector by pushing down on the terminal tabs with a small screwdriver.

8. Remove the wiper assembly.

9. Loosen the two mounting screws. Push the idler assembly against spring tension and tighten the screws.

10. Remove the clamp screw and the band clamp.

11. Carefully remove the drive band ends from the pulley pin.

12. Measure the gap between the stepper motor pulley and the casting. Write the measurement here.

   Gap is:

13. Loosen the clamp screw and remove the stepper motor pulley.

14. Remove the three stepper motor mounting screws and remove the motor.

CAUTION
While performing the following steps, be careful not to damage the drive band.
1. Install the stepper motor using the three mounting screws A. (Position the motor cable toward the diskette drive control card.)

2. Insert the stepper motor leads K 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 M.

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 E. Reinstall the band clamp (with the notch facing away from the stepper motor) and screw E. (Do not tighten the screw.)

7. Loosen the two mounting screws A and let spring tension position the idler.

8. Tighten the mounting screws and center the drive band on the idler pulley as shown F.

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 A 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 E. (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 A 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.
Note: See paragraph 25-950 for control card test pins.

Jumper:

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Center Drive Band

Band Clamp

Drive Band Pulley

Pulley Clamp

D02 Blue
D03 Orange
D04 Yellow

B02 Red
B05 Black

25-690
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 (Keep the screw loose so the motor shaft can turn inside the pulley.)

2. Carefully reinstall the drive band ends on the pulley pin. Reinstall the band clamp (with the notch facing away from the stepper motor) and screw (Do not tighten the screw.)

3. Loosen the two mounting screws and let spring tension position the idler.

4. Tighten the mounting screws and center the drive band on the idler pulley as shown.

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.

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 from TPA13 (ground) to THP11 (-align access 0).

12. Make the gap between the pulley and the casting the same as the gap that was recorded in 25-700, step 9.

13. Tighten the clamp screw.

14. Remove the timing pin.

15. Remove jumper A.

16. Tighten the band clamp screw. (Ensure that the drive band is straight.)

17. Turn the stepper motor pulley by hand and check that the drive band is centered 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.

Note: See paragraph 25-950 for control card test pins.

Jumper:

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Idler Assembly

Center Drive Band

25-710
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 □.
4. Turn the stepper motor pulley by hand and check that the drive band is centered □ 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 □.
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 □.
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 □ and the clamp.
8. Loosen the two mounting screws □ 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 □.
10. Place the head/carriage assembly by hand to about cylinder 40 and check to see that the band mounting slots □ 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 □.
14. Loosen the band clamp screw □.
15. Place the stepper motor pulley to center the mounting slots and tighten the clamp screws □ and □.
16. Move the head/carriage assembly by hand to about cylinder 40.
17. Reinstall the clamp and the two clamp screws □ (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.
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.)

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.
25-790  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.

   **Channel A sweep mode**
   **Channel A level**
   **Channel A coupling**
   **Channel A slope**
   **Channel A source**
   **Trigger Mode**
   **Channel 1 volts/division**
   **Channel 1 input**
   **Times per division**
   **Channel 1 probe to B**

   ![Channel A settings 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 occurring each 166.7 ± 4.2 milliseconds. Pulse amplitude should be between 2.4 and 4.2 Vdc.

5. Remove the jumper A.

6. Remove the diskette.

---

**Diagram:**

![Diagram of diskette connections and oscilloscope setup]

**Note:** See paragraph 25-950 for control card test pins.

40  25-790
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).
1. Set Power to I (operator panel).

2. Connect the negative probe of a multimeter to the ground test pin 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.
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.

4. Remove two screws and the connector covers.

5. Remove the two 33FD light-emitting diode leads and the two 53FD light-emitting diode leads by pushing down on tabs with a small screwdriver.

6. Remove the light-emitting diode cable from the three retainers. (Remember the cable path for the replacement procedure.)

7. Remove the four mounting screws and the guide.

8. Remove the two light-emitting diode mounting screws and nuts and remove the light-emitting diode assembly.

1. Install the light-emitting diode assembly, two mounting screws and nuts on the guide (do not tighten). Pass the wires through the guide locating slots.

2. Reinstall the guide and the four mounting screws.

3. Follow the cable path through three retainers and insert the two 33FD light-emitting diode leads (leads have a tube around them) and the two 53FD leads into the diskette drive control cable connector. Ensure that the locking tabs on the terminals lock in the connector slots.

4. Reinstall the cable connector covers and the two screws.

5. Plug the cable into location A2 on the diskette drive control card socket.

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 1 (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 3.

9. While observing at the multimeter, touch the other end of the jumper to the +5 Vdc test pin • 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 4.

11. Set Power to 0 (operator panel).

12. Remove the jumper.

13. Remove the diskette.

14. Connect the drive motor power cable.
TPB15
+5 Vdc

TPB16
53FD PTX

TPA14
33FD PTX

TPB9
+Index

TPA6
Ground
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 and the guide.

4. Disconnect the diskette drive control cable from location A2.

5. Remove the two screws and the connector covers.

6. Remove the two 33FD phototransistor leads and the two 53FD phototransistor leads by pushing down on tabs with a small screwdriver.

7. Remove the phototransistor mounting screw 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 (away from leads) and reinstall screw and washer.

2. Follow the cable path and insert the two 33FD phototransistor leads (leads have a tube around them) and the two 53FD leads into the diskette drive control cable connector. Ensure that the locking tabs on the terminals lock in connector slots.

3. Reinstall the connector covers and the two screws.

4. Plug the connector into location A2 of the diskette drive control card socket.

5. Reinstall the guide and the four mounting screws.

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.
CONTROL CARD TEST PINS

Early EC Level Card

Location A2

Location A1

A

THP1 +Diskette Loaded
THP2 +Predrive MC-3
THP3 +Predrive MC-2
THP4 +Predrive MC-1
THP5 +Predrive MC-0
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 +Erase Current Sense
TPA8 +24 Vdc
TPA9 -5 Vdc
TPA10 MC-1
TPA11 MC Common
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
A
- Diskette Inserted
- Hd Ld Osc (see note)
+14 Vdc
Ground
+53FD Index
+33FD Index
Diff Read A
Diff Read B
- High Gain
- Align Access 0
- High Current
Preamp TP1
Preamp TP2
- High Gain A
- High Gain B

B
- Write Data
+Erase Gate
+Write Gate
+ Inner Tracks
+ Select Head 1
Ground
+ Current Enabled
+24 Vdc
-5 Vdc
MC-1
+HD Load Solenoid
33FD LED Voltage
Ground
33FD PTX

C
- Access 0
- Access 1
- Access 2
- Access 3
- File Data
+ Diskette Sense
+ Head Engage
+ Switch Filter
+ Index
MC-3
MC-0
MC-2
- Head Load
53FD LED Voltage
+5 Vdc
53FD PTX

Note: A jumper must be installed from THP2 (- Hd Ld Osc) to THP4 (Ground).
CONTROL CARD SOCKET AND CONNECTOR PINS

Note: Maple block causes B and D pin reversal.

CONTROL CARD LOGIC PINS

Notes:
1. +Erase Current Sense (Early EC Level Card).
2. +Current Enabled (Late EC Level Card).
3. Drives with the late EC level card may not have the two resistors and the capacitor.
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 (cylinder1, 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.

1The 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.
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.

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>+</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>0.1 ms/cm</td>
</tr>
<tr>
<td>Channel 1 probe^2</td>
<td>THP-13 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe^2</td>
<td>THP-14 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
</tr>
</tbody>
</table>

   ^1The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

   ^2See 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.
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.

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>+</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>0.1 ms/cm</td>
</tr>
<tr>
<td>Channel 1 probe 2</td>
<td>THP-13 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe 2</td>
<td>THP-14 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
</tr>
</tbody>
</table>

   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.
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).

Use the default option to execute the commands.

Press the Attn key (3 times) to return to the diskette exerciser test 1 command menu.

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).

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.
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:

   \[ \text{INIT b \_ FORMAT} \]

2. Set up an oscilloscope as follows:

   \[ \text{Note: Use a Tektronix 453, 454, or a similar oscilloscope with X10 probes.} \]

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>+</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>20 µs/cm</td>
</tr>
<tr>
<td>Channel 1 probe (^1)</td>
<td>THP-13 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe (^1)</td>
<td>THP-14 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>TPB-9 (+index)</td>
</tr>
</tbody>
</table>

\(^1\) 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.

\[ \text{Head Resolution} = \frac{2.2 \times 100}{4} = 55 \]
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:
      \[ \text{INITb,,FORMAT} \]

2. Set up an oscilloscope as follows:
   Note: Use a Tektronix 453, 454, or a similar oscilloscope with X10 probes.

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
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<tbody>
<tr>
<td>Channel A level</td>
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</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>20 (\mu)s/cm</td>
</tr>
<tr>
<td>Channel 1 probe(^1)</td>
<td>THP-13 (preampl TP1)</td>
</tr>
<tr>
<td>Channel 2 probe(^1)</td>
<td>THP-14 (preampl TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
</tr>
</tbody>
</table>

\(^1\) 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:
      \[
      \text{FF FF FF FF FF FF FF FF} \\
      \text{to:} \\
      \text{AA AA AA FF FF AA AA} \\
      \text{and the @@@@S on line 11 to:} \\
      @@@@M
      \]
   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.

\[
\begin{align*}
\text{FF} & = 2.4 \text{cm} \\
\text{AA} & = 4.2 \text{cm}
\end{align*}
\]

Head Resolution \( \frac{2.4}{4.2} \times 100 = 57 \)
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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.
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.
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.
1. Set Power to O (operator panel).

2. Open the front left side cover and remove screw \( \text{A} \), open the front right side cover and remove screw \( \text{E} \). Remove the panel assembly.

3. Loosen the two front safety shield screws and remove the two rear safety shield screws \( \text{A} \) 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 \( \text{H} \) and slide the 72MD unit forward and place the 72MD unit \( \text{C} \) on top of the 5340 system unit.

   *Note: The cable straps must be removed.*

7. Open the heat sink assembly \( \text{H} \) and disconnect the DC power cable \( \text{E} \) 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 \( \text{F} \) to the operated position.

9. To reinstall, reverse the above procedure.

---

1. Set Power to O (operator panel).

2. Open the front left side cover and remove screw \( \text{A} \), open the front right side cover and remove screw \( \text{E} \). Remove the panel assembly.

3. Loosen the two front safety shield screws and remove the two rear safety shield screws \( \text{A} \) 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 \( \text{H} \) 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 \( \text{F} \) to the operated position.

7. To reinstall, reverse the above procedure.
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 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.
Removing the AC Drive Motor

1. Remove power and the 72MD unit (see paragraph 27-200).
2. Disconnect the AC drive motor power cable A.
3. Remove the drive belt B.
4. Remove the two motor mounting clamps C.
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).
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 to the rubber bed stop pad with end of the adjusting tool. (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).

7. [Diagram showing the adjustment process]
Removing the Carriage Bed Stop

1. Remove the carriage bed assembly (see paragraph 27-300).

2. Remove the two mounting screws from the carriage bed casting stabilizer guide rail and remove the rail. (Remove both rails if the 72MD has the old style tray.)

3. Remove the two bed stop assembly mounting screws.

4. Lift the carriage bed casting assembly (old style tray only) and remove the bed stop assembly.

Reinstalling the Carriage Bed Stop

1. Locate the bed stop assembly on the base casting and reinstall the two mounting screws. (Do not tighten the screws.)

2. Place the carriage bed casting assembly on the monorail (old style tray only) and reinstall the carriage bed casting stabilizer guide rail and screws. (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).
27-245  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 E. 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 2 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).
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 A.
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 A 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 B 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).
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 from each of the carriage bed stabilizer guide rails and remove the rails.

3. Remove the four screws to remove the carriage assembly from the carriage bed belt yoke.

4. Remove the monorail from the V-slots in the base casting.

5. Remove the diskette drive assembly bezel (see paragraph 27-665).

6. Loosen the three belt tension bracket screws.

7. Turn the stepper motor against the belt tension spring to release belt tension and tighten bracket screw.

8. Remove the belt shield.

9. Lift the carriage bed belt yoke and attached belt from the base.

10. Remove the belt from around the stepper motor pulley.

Reinstalling the Carriage Bed Belt

1. Reinstall the belt around the stepper motor pulley.

2. Locate the carriage bed belt yoke and attached belt on the base.

3. Reinstall the belt shield.

4. Loosen the tightened bracket screw to permit the spring to set the tension.

5. Tighten the three belt tension bracket screws.

6. Reinstall the diskette drive assembly bezel (see paragraph 27-665).

7. Place the ends of the monorail into the V-slots in the base casting.

8. Attach the carriage bed belt yoke to the carriage assembly using the four screws.

9. Reinstall the two carriage bed stabilizer guide rails and the mounting screws.

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).
27-260 CARRIAGE BED ORIENT SWITCH
SERVICE CHECK

1. Place the 72MD unit in the service position (see paragraph 27-200).
2. Set Power to 1 (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 1 (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 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).
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.
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.
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 and center the indicator slot on 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 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 A from the driver board.

4. Visually align I/O slot 1 with the drive diskette guide.

5. Locate the picker carriage assembly F near the picker carriage detent assembly E.

6. Power on by connecting J1 A 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 B to the drive motor or connector J1 A 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 C that fasten the carriage stepper motor D to the motor plate.

5. Locate the picker carriage assembly F near the picker carriage detent assembly E.

6. Connect J1 A 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 C.

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).
Note: The old style picker is shown here. See Detail for new style picker.
Removing the Carriage Bed Assembly

1. Remove power and the 72MD unit (see paragraph 27-200).
2. Remove the four mounting screws A.
3. Lift the carriage bed assembly E from the carriage bed casting B. (Be careful not to damage the locating pins C 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 E in the slots in the housing F and place the carriage bed assembly locating pins C on the carriage bed assembly D. Fasten the carriage bed assembly with the four mounting screws A (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).
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).
Removing the Magazine Pressure Roll Housing

1. Place the 72MD in the service position (see paragraph 27-205).

2. Loosen the four screws in the magazine pressure roll housing and remove the housing from the supports and (Be careful not to damage the four diskette I/O slot guide wires).

Reinstalling the Magazine Pressure Roll Housing

1. Locate the magazine pressure roll housing on the supports and.

2. Insert the four diskette I/O slot guide wires into the carriage bed and the magazine pressure roll housing.

3. Place the adjusting tool (part 2462583 for old style picker, part 2462612 for new style picker) between the magazine pressure roll housing (on the surface of the guide rail) 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. (Ensure that the magazine pressure roll housing is parallel to the carriage bed as you tighten the screws.)

4. Place the adjusting tool between the magazine pressure roll housing and the carriage bed near the support and tighten the two screws on the right end of the magazine pressure roll housing.

5. Return the 72MD unit from the service position (see paragraph 27-205).
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 I.

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 R.

   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 P 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 R.

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.
27-405  PICKER/CAM TIMING SERVICE CHECK

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Turn the cam A clockwise until it touches the cam stop pin A.

3. Check that the belt pin D aligns with the timing indicator G 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 E 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 C.

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 F until the pin D on the belt aligns with the timing indicator G on the casting. Place the notches C 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 D 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).
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).
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.
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 \(A\).

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).

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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 \(A\) 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 \(B\) 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 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 G in the detent O 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 G.

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 A.

3. Remove the detent assembly B.

Reinstalling the Picker Carriage Detent

1. Place the detent A 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).
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 move the gauge 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.
DC Cable

100-400 grams

Less than or equal to 60 grams
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 B up.

7. Pivot the stripper assembly out of the way and install the adjusting tool C (part 2462583 for old style picker, part 2462612 for new style picker) with one end between the solid finger D and the spring finger E of the picker and against the picker diskette stop G.

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).
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).
**27-465 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 from the driver board connector J3.

5. Probe test pin THP-5 (-picker extended).

6. Insert the adjusting tool (part 2462583 for old style picker, part 2462612 for new style picker) into I/O slot 1 and locate the picker stop against one end of the tool and the carriage bed 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 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 from driver board connector J4.

3. Locate the carriage bed assembly so that I/O slot 1 aligns with the diskette guide in the drive.

4. Disconnect the picker drive stepper motor cable from driver board connector J3.

5. Set Power to I (operator panel).

6. Insert the adjusting tool (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 against one end of the tool and the carriage bed against adjusting surface 1.

7. Probe test pin THP-5 (-picker extend).

8. Loosen the sensor mounting screw and adjust the sensor so that the output is minus (-).

9. Tighten the sensor mounting screw. 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 to driver board connector J4 and the picker drive stepper motor cable to driver board connector J3.

11. Reinstall the 72MD unit (see paragraph 27-200).
Note: See paragraph 27-820 for control card test pins.
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 E from the bottom of the sensor F and remove the sensor.

Reinstalling the Picker Rest Sensor

1. Locate the picker rest sensor F 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 \( \text{A} \) from driver board connector J3 and the carriage bed stepper motor cable \( \text{B} \) from driver board connector J4.

4. Align the carriage bed assembly \( \text{K} \) I/O slot 1 with the diskette guide.

5. Connect the carriage bed stepper motor cable \( \text{G} \) to driver board connector J4.

6. Insert the adjusting tool \( \text{J} \) (part 2462583 for old style picker, part 2462612 for new style picker) in I/O slot 1 (use adjusting surface \( \text{2} \) and the diskette guide).

7. Turn the picker/cam by hand to place the picker stop \( \text{C} \) against the tool.

8. Connect the picker/cam stepper motor cable \( \text{H} \) 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 \( \text{C} \) using the adjusting tool. The tool should touch at \( \text{E} \). 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 \( \text{L} \) on the picker carriage.

3. Loosen the collar \( \text{E} \) on the stepper motor pulley and set the gap between the stepper motor pulley flange and the picker carriage \( \text{D} \) to 1.68 ± 0.13 millimeters (0.066 ± 0.005 inch).

4. Tighten the collar \( \text{E} \).

5. Place the carriage bed \( \text{K} \) to where I/O slot 1 aligns with the drive diskette guide.

6. Disconnect connector plug J3 \( \text{A} \).

7. Set power to I (operator panel).

8. Insert the picker tool \( \text{J} \) into I/O slot 1 and place the picker stop \( \text{C} \) near the tool. Connect connector plug J3 \( \text{H} \). Loosen the collar \( \text{E} \) and carefully turn the pulley until one end of the tool touches the picker stop \( \text{C} \) and the other end touches the back of I/O slot 1 \( \text{G} \). (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 \( \text{E} \).

10. Remove the tool \( \text{J} \).

11. Check the gap from step 3.

12. Perform the picker rest service check (see paragraph 27-465).
Note: The old style picker is shown here. See Detail for new style picker.
1. Remove power and the 72MD unit (see paragraph 27-200).

2. Disconnect the stepper motor cable A 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

- Picker Motor (M11-D11)
- Auto Step 0 (M05-D05)
- Auto Step 1 (M06-D06)
- Auto Step 2 (M07-D07)
- Auto Step 3 (M08-D08)
- Bed Motor (M12-D12)

Stepper Motor Operating Voltage
+24 V (J1-1)

Stepper Motor Detent Voltage
+5 V (J1-3)

Blue/White
2

White
4

Blue
6

Red
1

Black
3

Red/White
5

Blue/White
2

White
4

Blue
6

Red
1

Black
3

Red/White
5

Picker/Cam Motor

Carriage Bed Motor

27-490

72MD Diskette Magazine Drive
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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27-500 STRIPPER REMOVAL AND REPLACEMENT

Removing the Stripper
1. Remove the picker/cam bezel assembly (see paragraph 27-425).
2. Remove the two screws \( C \) from the stripper magnet bracket assembly \( E \) and remove the assembly.
3. Remove the holding clip \( E \) 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 \( \pm 0.5 \) 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.
Removing the Stripper Magnet and Switch Assembly

1. Remove the picker/cam bezel (see paragraph 27-425).
2. Remove the two screws \( \mathbb{E} \) from the stripper magnet bracket assembly \( \mathbb{E} \) and remove the assembly.

Reinstalling the Stripper Magnet and Switch Assembly

1. Reinstall the stripper magnet bracket assembly \( \mathbb{E} \) using the two mounting screws \( \mathbb{F} \). (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).

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 \( \mathbb{A} \) into the drive by hand.
6. Probe test point TPB-17 \( \mathbb{A} \) (-window open).
7. Check that the switch output (-window open) is minus (-) with the stripper \( \mathbb{C} \) held tightly against the diskette.
8. Remove the diskette \( \mathbb{A} \) and check that the output is plus (+).
9. Reinstall the safety shield using the four screws.
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 (window open) tp THP-1 (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 I. 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 G (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).
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 between the heads to keep the head surfaces from touching.

3. Remove the two screws and the wiper assembly.

4. Turn the stepper motor pulley to cylinder 40. Use the timing pin to verify the alignment but remove the timing pin before going to the next step.

5. Disconnect the AC power cable 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 (head reference) to THP-1 (ground).

7. Set Power to I (operator panel).

8. Insert the timing pin 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.
   - Remove the jumper.
   - Power down.
   - Go to paragraph 27-605, step 5.

10. Remove the timing pin.

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 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 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 using the two screws.

21. Remove the paper from between the heads.

22. Reinstall the picker/cam casting assembly (see paragraph 27-400).

23. Connect the drive motor power cable A.

Note: See paragraph 27-820 for control card test pins.
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 and the wiper assembly.
4. Remove the diskette drive bezel (see paragraph 27-665).
5. Measure and record the gap between the stepper motor pulley and the casting.
6. Loosen the clamp screw 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.
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 (head reference) to THP-1 (ground).
10. Set Power to I (operator panel).
11. Make the gap the same size as the gap recorded in step 5 and tighten the clamp screw T. (Ensure that the timing pin G passes freely through the stepper motor pulley into the timing slot in the casting.)
12. Remove the timing pin G.
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.
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. (Put light finger pressure to the top of the carriage to hold the thickness gauge in place.)
20. Tighten the band clamp screws. (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

Front Limit (76) Rear Limit (00)

0.508 mm (0.020 inch)

Note: See paragraph 27-820 for control card test pins.
Removing the Head/Carriage

1. Remove the picker/cam casting assembly (see paragraph 27-400).

2. Remove the two screws \( \text{a} \) and the wiper assembly \( \text{c} \).

3. Carefully remove the head cable \( \text{e} \) 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 \( \text{d} \) and the clamp \( \text{f} \).

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 \( \text{k} \) and remove the lower guide rod \( \text{l} \).

9. Carefully lift and turn the head/carriage assembly \( \text{b} \) to remove it from the guide rod \( \text{m} \). (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 \( \text{u} \), the retainer \( \text{t} \), and the block \( \text{s} \), 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 \( \text{a} \) 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 \( \text{u} \), the retainer \( \text{t} \), and the block \( \text{s} \), and reinstall them on the replacement assembly if they are not already installed.

3. Carefully reinstall the head/carriage assembly \( \text{e} \) on the guide rod \( \text{k} \) and then place the head/carriage assembly at the back limit (cylinder 00).

4. Reinstall the lower guide rod \( \text{d} \) and tighten the screw \( \text{l} \). (Ensure that the guide rod notch \( \text{m} \) is aligned with the screw and the guide rod \( \text{k} \) 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 \( \text{a} \) and the two band clamp screws \( \text{c} \). (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 before going to the next step.

10. Install a jumper from THP-2 (head reference) to THP-1 (ground).

11. Set Power to I (operator panel).

12. Insert the timing pin 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.
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 D 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.
Reinstalling the Head/Carriage Stepper Motor

1. Reinstall the stepper motor using the three mounting screws. (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 and the two screws.

4. Reinstall the stepper motor pulley. (Keep the clamp screw loose so that the motor shaft can turn inside the pulley.)

5. Carefully reinstall the drive band ends on the pulley pin as shown. Reinstall the band clamp (with the notch facing away from the stepper motor) and the screw. (Do not tighten the screw.)

6. Loosen the two idle mounting screws and let the spring tension place the idler.

7. Tighten the mounting screws and center the drive band on the idler pulley as shown.

8. Reinstall the control card and mounting assembly (see paragraph 27-840).

9. Carefully reinstall the head cable on the control card.

10. Turn the stepper motor pulley to cylinder 40 and insert a timing pin.

11. Disconnect the AC power to the drive motor.

12. Install a jumper from THP-2 (head reference) to THP-1 (ground).

13. Set Power to I (operator panel).

14. Make the gap 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.

16. Remove the timing pin.

17. Remove the jumper.

18. Tighten the band clamp screw. (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.

DANGER
Voltage is still present at the power connector when the head/carriage stepper motor is disconnected and power is on.
Note: See paragraph 27-820 for control card test pins.
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 and the wiper assembly.

3. Loosen the two idler mounting screws, push the idler assembly against the spring tension, and tighten the screws.

4. Remove the clamp screw and the band clamp from the pulley.

5. Carefully remove the drive band ends from the pulley pin.

6. Measure and record the gap between the stepper motor pulley and the casting.

7. Loosen the clamp screw and remove the stepper motor pulley and the clamp.

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, clamp, and clamp screw. (Keep the screw loose so that the motor shaft can turn inside the pulley.)

2. Carefully reinstall the drive band ends on the pulley pin as shown, reinstall the band clamp (with the notch facing away from the stepper motor), and the screw. (Do not tighten the screw.)

3. Loosen the two idler mounting screws and let the spring tension place the idler.

4. Tighten the idler mounting screws. (Center the drive band on the idler pulley.)

5. Turn the stepper motor by hand to cylinder 40 and insert a timing pin.

6. Disconnect the AC power to the drive motor.

7. Install a jumper from THP-2 (head reference) to THP-1 (ground).

8. Set Power to I (operator panel).

9. Make the gap 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.

11. Remove the timing pin.

12. Remove the jumper.

13. Tighten the band clamp screw. (Ensure that the drive band is straight.)

14. Set Power to 0 (operator panel).

15. Turn the stepper motor pulley 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.
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).
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 L and the wiper assembly K.

4. Move the head/carriage assembly C toward the hub to its front limit (cylinder 76).

5. Remove the two band clamp screws M and the clamp.

6. Loosen the two idler mounting screws B and let the spring tension place the idler A. Tighten the mounting screws.

7. Turn the stepper motor pulley by hand a few times to center the drive band E on the idler pulley D.

8. Place the head/carriage assembly C at cylinder 40. Check to see that the band mounting slots N 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 F.
      - Place the head/carriage at approximately cylinder 40.
      - Turn the stepper motor pulley to center the mounting slots N and then tighten the clamp screw F.
      - Repeat step 9.

11. Move the head/carriage assembly C toward the hub to its front limit (cylinder 76).

12. Reinstall the clamp and the two clamp screws M. (Do not tighten.)


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 L and the wiper assembly K.

3. Move the head/carriage assembly C toward the hub to its front limit (cylinder 76).

4. Loosen the two idler mounting screws B, push the idler assembly A against the spring tension, and then tighten the mounting screws B.

5. Remove the two band clamp screws M and the clamp and place the head/carriage assembly at the back limit (cylinder 00).

6. Remove the clamp screw F and the clamp G.

7. Carefully remove the drive band ends H from the pulley pin J and remove the band.

Reinstalling the Drive Band

1. Place the drive band E around the idler assembly D.

2. Carefully install the drive band ends H on the pulley pin J as shown.

3. Reinstall the band clamp A (with the notch facing away from the stepper motor) and the clamp screw F. (Ensure that the drive band is straight.)

4. Go to paragraph 27-630, step 6.
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).
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 E.
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.
7. Note: Ensure that the diskette is stopped by the stop E and not the switch.
8. Reinstall the picker/cam casting assembly (see paragraph 27-400). Do not reinstall the 72MD unit at this time.
10. 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.
11. 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).

Note: See paragraph 27-820 for control card test pins.
27-653 HEAD LOAD BAIL ASSEMBLY SERVICE CHECK AND ADJUSTMENT

1. Remove the 72MD unit (see paragraph 27-200).

2. Turn the cam counter clockwise until the cam stops.

3. Move the head carriage assembly in both directions as far as it will go and ensure that there is always a gap between the bail assembly and the head carriage tabs.

4. If the gap is not correct, turn the bail adjusting screw until the bail assembly just touches the head carriage tab.

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 and the head carriage tab.

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 between the heads.

3. Loosen the clamp screw on the head load bail pivot shaft.

4. Slide the pivot shaft out and remove the bail assembly.

Reinstalling the Head Load Bail Assembly

1. Reinstall the head load bail assembly and pivot shaft. (Ensure that the bail is on the correct side of the head carriage tab.)

2. Tighten the clamp screw on the head load bail pivot shaft.

3. Remove the strip of paper from between the heads.

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 on the collet assembly pivot shaft.

3. Slide the pivot shaft out.

4. Remove the collet assembly.

Reinstalling the Collet Assembly

1. Reinstall the collet assembly.

2. Reinstall the pivot shaft.

3. Tighten the clamp screw on the collet assembly pivot shaft.

4. Reinstall the picker/cam casting assembly (see paragraph 27-400).
Old Style Bail Assembly

New Style Bail Assembly

Wrench Position Without Access Hole
Picker Cam Casting
Access Hole
Wrench

0.25 to 0.5 mm (0.010 to 0.020 in.)
Removing the Diskette Drive Bezel

1. Remove the two mounting screws \textcolor{red}{A} from the bezel.

2. Remove the bezel \textcolor{red}{B}.

Reinstalling the Diskette Drive Bezel

Reinstall the bezel \textcolor{red}{B} using the two mounting screws \textcolor{red}{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 P from the driver board bracket O 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 F to the diskette in switch.
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 O using the three screws F.
8. Connect the drive motor AC cable E.
9. Reinstall the picker/cam casting assembly (see paragraph 27-400).
Note: See paragraph 27-820 for control card test pins.
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 \( \bullet \) that are located on the picker/cam casting assembly.
4. Insert the alignment pins \( \circ \) to align the LED assembly \( \circ \) to the PTX assembly \( \circ \). (Insert the pins from the diskette drive assembly side.)
5. Tighten the two LED mounting screws \( \bullet \).
6. Remove the alignment pins \( \circ \).
7. Reinstall the diskette drive bezel (see paragraph 27-665)
8. Return the 72MD from the service position (see paragraph 27-205).

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 \( \text{H} \) (ground) on the control card.
   For the new style picker, connect the negative probe of a multimeter to test pin TPA-13 \( \text{H} \) (ground) on the control card.
5. Set the multimeter scale to 5 Vdc and connect the positive probe to test pin TPA-2 \( \text{H} \) (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 \( \text{H} \) (33FD LED anode).
8. Check for a voltage level of 1 Vdc to 2 Vdc.

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 \( \bullet \) and the clamp \( \bullet \) 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 \( \bullet \) and nuts from the LED assembly.
6. Remove the LED assembly \( \bullet \).

Reinstalling the Index Sense LED Assembly

1. Reinstall the index sense LED assembly \( \bullet \) on the casting and fasten it with the two mounting screws \( \bullet \) 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 \( \circ \) to align the LED assembly \( \circ \) and the PTX assembly \( \circ \) and tighten the two screws \( \bullet \). 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 \( \bullet \), and the two screws \( \bullet \) on the picker/cam casting.
6. Reinstall the drive assembly bezel (see paragraph 27-665).
7. Reinstall the 72MD unit (see paragraph 27-200).
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.
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 and driver board connector J3.

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 (+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 (+index) on the control card.
7. For the old style picker, connect the negative probe of the multimeter to test pin TPA-12 (ground).
   For the new style picker, connect the negative probe of the multimeter to test pin TPA-13 (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 (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 ( +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 ( +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 (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 and driver board connector J3.
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.
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) from the control card.

4. Remove the two screws and the two connector covers.

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 from the PTX assembly.

7. Remove the PTX assembly.

Reinstalling the Index Sense PTX Assembly

1. Reinstall the PTX assembly on the casting and fasten it with the two mounting screws.

2. Loosen the two mounting screws for the LED assembly 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 and align the LED assembly to the PTX assembly and tighten the two screws.

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 and the two screws.

7. Connect the diskette drive stepper motor/sensor cable (A1) to the control card.

8. Reinstall the diskette drive assembly bezel (see paragraph 27-665).

9. Reinstall the 72MD unit (see paragraph 27-200).
**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 FFOO (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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27-800 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 (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 FBOO (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 (single step picker) to THP-1 (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.

6. For the old style picker, probe test pin TPB-23 (=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 (=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 (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 (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.

DANGER
Parts of the driver board become hot after continuous use.
### TEST POINTS

<table>
<thead>
<tr>
<th>Read/Write Control Line</th>
<th>Picker Motor Test Point</th>
<th>Bed Motor Test Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Step 0</td>
<td>D6-A</td>
<td>D12-A</td>
</tr>
<tr>
<td>Auto Step 1</td>
<td>D8-A</td>
<td>D10-A</td>
</tr>
<tr>
<td>Auto Step 2</td>
<td>D7-A</td>
<td>D13-A</td>
</tr>
<tr>
<td>Auto Step 3</td>
<td>D9-A</td>
<td>D11-A</td>
</tr>
</tbody>
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### Condition of Stepper Motor Phases at:

<table>
<thead>
<tr>
<th>Cyl</th>
<th>Cyl</th>
<th>Cyl</th>
<th>Cyl</th>
<th>Cyl</th>
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<td>40</td>
<td>41</td>
<td>42</td>
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<td>1</td>
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<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>X</td>
</tr>
</tbody>
</table>

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

---

**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 (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 (single step bed) to THP-1 (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.

6. For the old style picker, probe test pin TPB-24 (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 (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 (ground). With the positive probe measure the voltage at point A on diodes 010, 011, 012, and 013. 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 (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.

DANGER

Parts of the driver board become hot after continuous use.
**TEST POINTS**

<table>
<thead>
<tr>
<th>Read/Write Control Line</th>
<th>Picker Motor Test Point</th>
<th>Bed Motor Test Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Step 0</td>
<td>D6-A</td>
<td>D12-A</td>
</tr>
<tr>
<td>Auto Step 1</td>
<td>D8-A</td>
<td>D10-A</td>
</tr>
<tr>
<td>Auto Step 2</td>
<td>D7-A</td>
<td>D13-A</td>
</tr>
<tr>
<td>Auto Step 3</td>
<td>D9-A</td>
<td>D11-A</td>
</tr>
</tbody>
</table>

**Condition of Stepper Motor Phases at:**

<table>
<thead>
<tr>
<th>Cyl</th>
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<th>Cyl</th>
<th>Cyl</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>41</td>
<td>42</td>
<td>43</td>
<td>44</td>
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<tr>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>X</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>X</td>
</tr>
</tbody>
</table>

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.
Removing the Driver Board Assembly

1. Remove power and the 72MD unit (see paragraph 27-200).

2. If the two driver board shipping bolts are still in place, remove them.

3. Release the gate spring latch and open the driver board gate assembly.

4. Disconnect the DC cable J1e.

5. Disconnect the control card cable J2e.

6. Disconnect the two stepper motor cables J3G and J4G.

7. Remove the driver board ground strap.

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 J3e and J4f.

3. Connect the control card cable J2d.

4. Connect the DC cable J1c.

5. Connect the driver board ground strap.

6. Close the driver board gate until the spring latch engages.

7. Reinstall the 72MD unit (see paragraph 27-200).
Removing the Control Card

1. Set Power to 0 (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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### Machines with Old Style Picker

<table>
<thead>
<tr>
<th>TPA-1</th>
<th>33FD LED anode</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA-2</td>
<td>53FD LED anode</td>
</tr>
<tr>
<td>TPA-3</td>
<td>Head motor MC-2 (yellow)</td>
</tr>
<tr>
<td>TPA-4</td>
<td>Head motor MC-3 (blue)</td>
</tr>
<tr>
<td>TPA-5</td>
<td>+Write data/+500 kHz osc.</td>
</tr>
<tr>
<td>TPA-6</td>
<td>+Erase gate</td>
</tr>
<tr>
<td>TPA-7</td>
<td>+Write gate</td>
</tr>
<tr>
<td>TPA-8</td>
<td>+Inner tracks/+command 5</td>
</tr>
<tr>
<td>TPA-9</td>
<td>+Head select/+command P</td>
</tr>
<tr>
<td>TPA-10</td>
<td>+Erase current sense/+status C</td>
</tr>
<tr>
<td>TPA-11</td>
<td>+5 volts</td>
</tr>
<tr>
<td>TPA-12</td>
<td>Ground</td>
</tr>
<tr>
<td>TPA-13</td>
<td>+24 volts</td>
</tr>
<tr>
<td>TPA-14</td>
<td>-5 volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TPB-1</th>
<th>33FD PTX emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPB-2</td>
<td>53FD PTX emitter</td>
</tr>
<tr>
<td>TPB-3</td>
<td>Picker PTX collector</td>
</tr>
<tr>
<td>TPB-4</td>
<td>Picker LED anode</td>
</tr>
<tr>
<td>TPB-5</td>
<td>Head motor MC-0 (orange)</td>
</tr>
<tr>
<td>TPB-6</td>
<td>Head motor MC-1 (red)</td>
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<tr>
<td>TPB-7</td>
<td>+Access 0/+command 0</td>
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<tr>
<td>TPB-8</td>
<td>+Access 1/+command 1</td>
</tr>
<tr>
<td>TPB-9</td>
<td>+Access 2/+command 2</td>
</tr>
<tr>
<td>TPB-10</td>
<td>+Access 3/+command 3</td>
</tr>
<tr>
<td>TPB-11</td>
<td>+enable autoloader</td>
</tr>
<tr>
<td>TPB-12</td>
<td>+File data/xxxx</td>
</tr>
<tr>
<td>TPB-13</td>
<td>+Switch filter/+command 4</td>
</tr>
<tr>
<td>TPB-14</td>
<td>+Index</td>
</tr>
<tr>
<td>TPB-15</td>
<td>-Diskette In</td>
</tr>
<tr>
<td>TPB-16</td>
<td>-Bed orient switch</td>
</tr>
<tr>
<td>TPB-17</td>
<td>-Window open</td>
</tr>
<tr>
<td>TPB-18</td>
<td>+Auto step 0</td>
</tr>
<tr>
<td>TPB-19</td>
<td>+Auto step 1</td>
</tr>
<tr>
<td>TPB-20</td>
<td>+Auto step 2</td>
</tr>
<tr>
<td>TPB-21</td>
<td>+Auto step 3</td>
</tr>
<tr>
<td>TPB-22</td>
<td>-Window magnet</td>
</tr>
<tr>
<td>TPB-23</td>
<td>-Picker motor</td>
</tr>
<tr>
<td>TPB-24</td>
<td>-Bed motor</td>
</tr>
<tr>
<td>TPB-25</td>
<td>+Cover open</td>
</tr>
</tbody>
</table>

### Diagram

- **Read/Write Head Cable Connector**
- **HD1 CTR TAP**
- **HD0 CTR TAP**
- **TPB-1**
- **TPB-25**
- **TPA-14**
- **TPA-1**
# Machines with New Style Picker

<table>
<thead>
<tr>
<th>TPA-1</th>
<th>33FD LED anode</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA-2</td>
<td>53FD LED anode</td>
</tr>
<tr>
<td>TPA-3</td>
<td>+24 volts</td>
</tr>
<tr>
<td>TPA-4</td>
<td>Head motor MC-2 (yellow)</td>
</tr>
<tr>
<td>TPA-5</td>
<td>Head motor MC-3 (blue)</td>
</tr>
<tr>
<td>TPA-6</td>
<td>+Write data/+500 kHz osc.</td>
</tr>
<tr>
<td>TPA-7</td>
<td>+Erase gate</td>
</tr>
<tr>
<td>TPA-8</td>
<td>+Write gate</td>
</tr>
<tr>
<td>TPA-9</td>
<td>+Inner tracks/+command 5</td>
</tr>
<tr>
<td>TPA-10</td>
<td>+Head select/+command P</td>
</tr>
<tr>
<td>TPA-11</td>
<td>+Erase current sense/+status C</td>
</tr>
<tr>
<td>TPA-12</td>
<td>XXXX/+status D</td>
</tr>
<tr>
<td>TPA-13</td>
<td>Ground</td>
</tr>
<tr>
<td>TPA-14</td>
<td>-5 volts</td>
</tr>
<tr>
<td>TPA-15</td>
<td>+5 volts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TPB-1</th>
<th>33FD PTX emitter</th>
</tr>
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<tbody>
<tr>
<td>TPB-2</td>
<td>53FD PTX emitter</td>
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<tr>
<td>TPB-3</td>
<td>Picker PTX collector</td>
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<td>TPB-4</td>
<td>Picker LED anode</td>
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<td>TPB-5</td>
<td>Head motor MC-0 (orange)</td>
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<td>TPB-6</td>
<td>Head motor MC-1 (red)</td>
</tr>
<tr>
<td>TPB-7</td>
<td>+Access 0/+command 0</td>
</tr>
<tr>
<td>TPB-8</td>
<td>+Access 1/+command 1</td>
</tr>
<tr>
<td>TPB-9</td>
<td>+Access 2/+command 2</td>
</tr>
<tr>
<td>TPB-10</td>
<td>+Access 3/+command 3</td>
</tr>
<tr>
<td>TPB-11</td>
<td>+enable autoloader</td>
</tr>
<tr>
<td>TPB-12</td>
<td>+File data/XXXX</td>
</tr>
<tr>
<td>TPB-13</td>
<td>+Diskette 2/status B</td>
</tr>
<tr>
<td>TPB-14</td>
<td>XXXX/+status A</td>
</tr>
<tr>
<td>TPB-15</td>
<td>+Switch filter/+command 4</td>
</tr>
<tr>
<td>TPB-16</td>
<td>+Index</td>
</tr>
<tr>
<td>TPB-17</td>
<td>-Bed orient switch</td>
</tr>
<tr>
<td>TPB-18</td>
<td>+Auto step 0</td>
</tr>
<tr>
<td>TPB-19</td>
<td>+Auto step 1</td>
</tr>
<tr>
<td>TPB-20</td>
<td>+Auto step 2</td>
</tr>
<tr>
<td>TPB-21</td>
<td>+Auto step 3</td>
</tr>
<tr>
<td>TPB-22</td>
<td>-Picker motor</td>
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<tr>
<td>TPB-23</td>
<td>-Bed motor</td>
</tr>
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<td>TPB-24</td>
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<table>
<thead>
<tr>
<th>THP-1</th>
<th>Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>THP-2</td>
<td>Head reference (CE mode)</td>
</tr>
<tr>
<td>THP-3</td>
<td>Single step picker</td>
</tr>
<tr>
<td>THP-4</td>
<td>Single step bed</td>
</tr>
<tr>
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<td>Picker extended</td>
</tr>
<tr>
<td>THP-6</td>
<td>-AGC out</td>
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<tr>
<td>THP-7</td>
<td>+AGC out</td>
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<tr>
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<td>Control voltage</td>
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<tr>
<td>THP-10</td>
<td></td>
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<tr>
<td>THP-11</td>
<td></td>
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<tr>
<td>THP-12</td>
<td>+14.3 volts</td>
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<tr>
<td>THP-13</td>
<td></td>
</tr>
<tr>
<td>THP-14</td>
<td>-VGA in preamp TP-1</td>
</tr>
<tr>
<td>THP-15</td>
<td>+VGA in preamp TP-2</td>
</tr>
<tr>
<td>THP-16</td>
<td>Ground</td>
</tr>
</tbody>
</table>

---

**Diagram:**

- **Read/Write Head Cable Connector**
- **HD0 CTR TAP**
- **HD1 CTR TAP**
- **TPB-1**
- **TPB-24**
- **TPA-14**
- **TPA-1**

---

27-820

72MD Diskette Magazine Drive 107
### 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**: +5 Volts (reserved)
- **D03**: 33FD LED Anode
- **D04**: 33FD LED Cathode
- **D05**: 53FD LED Anode
- **D06**: 53FD LED Cathode
- **D07**: Ground (reserved)
- **D09**: Head Motor Common (+24 volts)
- **D10**: Head Motor Phase 2
- **D11**: 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**: XXXX/+Status A
- **G11**: +Switch Filter/+Command 4
- **G12**: +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 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**: -Set Clock Latch
- **S13**: -Scan In
- **U02**: +5 Volts (reserved)
- **U04**: -Reset Clock Head Latches
- **U05**: Ground (reserved)
- **U06**: -Reset Clock/Head Latches
- **U07**: Ground (reserved)
- **U08**: -Reset Clock/Head Latches
- **U09**: Ground (reserved)
- **U10**: Ground (reserved)
- **U11**: Ground (reserved)
- **U12**: Ground (reserved)
- **U13**: Ground (reserved)

---

1 Applies only to machines with the old style picker.
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.
27-830  CONTROL CARD SOCKET
AND CONNECTOR PINS

Diagram showing various parts labeled with letters such as S13, P13, M13, G13, B02, B13, D13, D02, and more, with connections indicated by wires and connectors.
CONTROL CARD HEAD CABLE PINS

Head 1
- Read/Write (white)
- Center tap R/W (blue)
- Read/Write (black)
- Erase (red)
- Erase (yellow)
- Cable Shield Gnd (black)

Head 0
- Read/Write (black)
- Erase (yellow)
- Erase (red)
- Center tap R/W (blue)
- Read/Write (white)
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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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 (single step bed) to THP-1 (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 (bed motor) for a down level.
   For the new style picker, probe test pin TPB-23 (bed motor) for a down level.

6. Probe test pins TPB-18, 19, 20, and 21 (+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:

<table>
<thead>
<tr>
<th>Cyl 40</th>
<th>Cyl 41</th>
<th>Cyl 42</th>
<th>Cyl 43</th>
<th>Cyl 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td>Down</td>
<td>Down</td>
<td>Up</td>
<td>Up</td>
</tr>
<tr>
<td>Up</td>
<td>Up</td>
<td>Down</td>
<td>Down</td>
<td>Up</td>
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<tr>
<td>Down</td>
<td>Up</td>
<td>Up</td>
<td>Down</td>
<td>Down</td>
</tr>
<tr>
<td>Down</td>
<td>Down</td>
<td>Up</td>
<td>Up</td>
<td>Down</td>
</tr>
</tbody>
</table>

Up level = 5 Vdc
Down level = Ground

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.
27-850 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 (single step picker) to THP-1 (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 (–picker motor) for a down level.
   For the new style picker, probe test pin TPB-22 (–picker motor) for a down level.

6. Probe test pins TPB-18, 19, 20, and 21 (+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

<table>
<thead>
<tr>
<th>Read/Write Control Lines</th>
<th>Test Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Step 0</td>
<td>TPB-18</td>
</tr>
<tr>
<td>Auto Step 1</td>
<td>TPB-19</td>
</tr>
<tr>
<td>Auto Step 2</td>
<td>TPB-20</td>
</tr>
<tr>
<td>Auto Step 3</td>
<td>TPB-21</td>
</tr>
</tbody>
</table>

#### Condition of Stepper Motor Phases at:

<table>
<thead>
<tr>
<th>Cyl 40</th>
<th>Cyl 41</th>
<th>Cyl 42</th>
<th>Cyl 43</th>
<th>Cyl 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td>Down</td>
<td>Down</td>
<td>Up</td>
<td>Up</td>
</tr>
<tr>
<td>Up</td>
<td>Up</td>
<td>Down</td>
<td>Down</td>
<td>Up</td>
</tr>
<tr>
<td>Down</td>
<td>Up</td>
<td>Up</td>
<td>Down</td>
<td>Down</td>
</tr>
<tr>
<td>Down</td>
<td>Down</td>
<td>Up</td>
<td>Up</td>
<td>Down</td>
</tr>
</tbody>
</table>

Up level = 5 Vdc  
Down level = Ground

**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.
27-900 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 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.
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.

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.

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>+</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>50 µs/cm</td>
</tr>
<tr>
<td>Channel 1 probe²</td>
<td>THP-14 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe²</td>
<td>THP-15 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
</tr>
</tbody>
</table>

¹The volts/division setting may have to be changed as the signal output is different between the inner and outer cylinders.

²See 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.

![Oscilloscope Screen Image](image)

1 Track

Damaged Area
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:

   \texttt{INIT b, FORMAT}

2. Set up an oscilloscope as follows:

   \textit{Note:} Use a Tektronix 453, 454, or a similar oscilloscope with X10 probes.

<table>
<thead>
<tr>
<th>Channel A sweep mode</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A level</td>
<td>+</td>
</tr>
<tr>
<td>Channel A coupling</td>
<td>DC</td>
</tr>
<tr>
<td>Channel A slope</td>
<td>+</td>
</tr>
<tr>
<td>Channel A source</td>
<td>External</td>
</tr>
<tr>
<td>Trigger</td>
<td>Normal</td>
</tr>
<tr>
<td>Mode</td>
<td>Add</td>
</tr>
<tr>
<td>Channel 1 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 2 volts/division</td>
<td>5 mV/cm</td>
</tr>
<tr>
<td>Channel 1 input</td>
<td>AC</td>
</tr>
<tr>
<td>Channel 2 input</td>
<td>AC</td>
</tr>
<tr>
<td>Invert</td>
<td>Pull out</td>
</tr>
<tr>
<td>Times per division</td>
<td>10 \mu s/cm</td>
</tr>
<tr>
<td>Channel 1 probe \textsuperscript{1}</td>
<td>THP-14 (preamp TP1)</td>
</tr>
<tr>
<td>Channel 2 probe \textsuperscript{1}</td>
<td>THP-15 (preamp TP2)</td>
</tr>
<tr>
<td>Connect trigger to</td>
<td>A-A1Q2U02 (+MS address compare)</td>
</tr>
</tbody>
</table>

\textsuperscript{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.

   FF=2.4cm

   Head Resolution = \( \frac{2.4}{4.2} \times 100 = 57 \)
CONTENTS

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30-100  Locations
30-110  External Cables
30-200  Adapter Card
30-300  1200 BPS Integrated Modem
30-310  Locations
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30-360  Line Plate Adjustment
30-370  Couplers and Transmit Level Limiting Check
30-400  4800 BPS Integrated Modem (3864 compatible)
30-405  Locations
30-410  Operator Panel
30-414  Test Diagnostics Operation
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30-500  Digital Data Service Adapter
30-510  Locations
30-550  Card Jumpers
30-600  EIA/CCITT Adapter
30-610  Locations
30-650  Card Jumpers
30-660  EIA/CCITT Modem Control Lines
30-700  Analog Wideband Adapter
30-710  Locations
30-750  Card Jumpers
30-800  Autocall Adapter
30-810  Locations
30-820  Autocall Control Lines
30-850  Card Jumpers
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.
Figure 30-1. MLCA Attachment Location on A-Gate
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

Figure 30-2. Cable Tower and Line Plates
Card Locations

B3-C2 MLCA Controller Channel    Attachment Controller 2
B3-D2 MLCA Controller Data Flow
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

*C 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
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)

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)
The cable tower locations of the external cables are shown in Figure 30-7. See the individual line adapter sections for internal cable locations.

**Figure 30-7. Cable Tower Locations for External Cables**
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

<table>
<thead>
<tr>
<th>Switch</th>
<th>Condition</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Not continuous carrier (set off for DDSA or autocall).</td>
</tr>
<tr>
<td>2</td>
<td>On</td>
<td>The line speed is equal to or less than 9600 bps (set on for autocall).</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>The line speed is greater than 9600 bps (analog wideband or 56K-bps DDSA).</td>
</tr>
<tr>
<td>3</td>
<td>On</td>
<td>Enable rate select interface lead for EIA, autocall, analog wideband, or 4800-bps integrated modem (allows microcode control over the rate select interface lead).</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>For DDSA or 1200-bps integrated modem.</td>
</tr>
<tr>
<td>4</td>
<td>On</td>
<td>Not NRZI coding.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>NRZI coding used.</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Device address selection</th>
<th>Jumper adapter microinterrupt request to interrupt level</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 6 Device Address</td>
<td>Jumper (see note)</td>
</tr>
<tr>
<td>off off 10</td>
<td>A-B3XXJ09 to A-B3C2M05</td>
</tr>
<tr>
<td>off on 20</td>
<td>A-B3XXJ09 to A-B3C2M05</td>
</tr>
<tr>
<td>on on 40</td>
<td>A-B3XXJ09 to A-B3C2M05</td>
</tr>
<tr>
<td>on off 80</td>
<td>A-B3XXJ09 to A-B3C2P05</td>
</tr>
</tbody>
</table>

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).
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.

![Diagram of internal cable connections](image)

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 30-9. 1200 BPS Integrated Modem—Switched Network (Line 1)
External Cable

<table>
<thead>
<tr>
<th>Line Plate</th>
<th>Cable</th>
<th>Telephone Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-6</td>
<td>Handset 2 (T2)</td>
<td>Black</td>
</tr>
<tr>
<td>TB1-7</td>
<td>Handset 1 (T1)</td>
<td>Yellow</td>
</tr>
<tr>
<td>TB1-8</td>
<td>Telephone 1 (L2)</td>
<td>White</td>
</tr>
<tr>
<td>TB1-9</td>
<td>Telephone 2 (L1)</td>
<td>Red</td>
</tr>
</tbody>
</table>

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)
Figure 30-11. 1200 BPS Integrated Modem—Nonswitched Network (Line 1)

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.
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.

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

<table>
<thead>
<tr>
<th>Transmit Level Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>-1</td>
</tr>
<tr>
<td>-2</td>
</tr>
<tr>
<td>-3</td>
</tr>
<tr>
<td>-4</td>
</tr>
<tr>
<td>-5</td>
</tr>
<tr>
<td>-6</td>
</tr>
<tr>
<td>-7</td>
</tr>
<tr>
<td>-8</td>
</tr>
<tr>
<td>-9</td>
</tr>
<tr>
<td>-10</td>
</tr>
<tr>
<td>-11</td>
</tr>
<tr>
<td>-12</td>
</tr>
<tr>
<td>-13</td>
</tr>
<tr>
<td>-14</td>
</tr>
<tr>
<td>-15</td>
</tr>
<tr>
<td>-16</td>
</tr>
<tr>
<td>-17</td>
</tr>
<tr>
<td>-18</td>
</tr>
</tbody>
</table>

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
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:

<table>
<thead>
<tr>
<th>Line</th>
<th>A-B3L2G02 to A-B3L2G09</th>
<th>A-B3L2J05 to A-B3L2J13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 2</td>
<td>A-B3M2G02 to A-B3M2G09</td>
<td>A-B3M2J05 to A-B3M2J13</td>
</tr>
<tr>
<td>Line 3</td>
<td>A-B3L4G02 to A-B3L4G09</td>
<td>A-B3L4J05 to A-B3L4J13</td>
</tr>
<tr>
<td>Line 4</td>
<td>A-B3M4G02 to A-B3M4G09</td>
<td>A-B3M4J05 to A-B3M4J13</td>
</tr>
</tbody>
</table>

- 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).
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).

- 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).

*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
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)**
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.)
Figure 30-16. World Trade PSN Line Plate and Cable Connections

<table>
<thead>
<tr>
<th>Line Plate</th>
<th>Cable</th>
<th>Telephone Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-6</td>
<td>Handset 2 (T2)</td>
<td>Black</td>
</tr>
<tr>
<td>TB1-7</td>
<td>Handset 1 (T1)</td>
<td>Yellow</td>
</tr>
<tr>
<td>TB1-8</td>
<td>Telephone 1 (L2)</td>
<td>White</td>
</tr>
<tr>
<td>TB1-9</td>
<td>Telephone 2 (L1)</td>
<td>Red</td>
</tr>
</tbody>
</table>
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-B3L2D02 to A-B3L2D08
   - Line 2: A-B3M2D02 to A-B3M2D08
   - Line 3: A-B3L4D02 to A-B3L4D08
   - Line 4: A-B3M4D02 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

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>Jumper to Be Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5-2</td>
<td>F</td>
</tr>
<tr>
<td>2-3.5</td>
<td>E (F)</td>
</tr>
<tr>
<td>3.5-4</td>
<td>E (C)</td>
</tr>
<tr>
<td>4-6</td>
<td>E (C,D)</td>
</tr>
<tr>
<td>6-8</td>
<td>C (E,D,B)</td>
</tr>
<tr>
<td>8-9</td>
<td>C (E,D,B,A)</td>
</tr>
<tr>
<td>9-14</td>
<td>D (E,C,B,A)</td>
</tr>
<tr>
<td>11-25</td>
<td>B (C,D,A)</td>
</tr>
<tr>
<td>26-37</td>
<td>A (D,B)</td>
</tr>
<tr>
<td>37-50</td>
<td>A (B)</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Data Tip</th>
<th>Data Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td>A-B3L2D06 A-B3L2D08</td>
</tr>
<tr>
<td>Line 2</td>
<td>A-B3M2D06 A-B3M2D08</td>
</tr>
<tr>
<td>Line 3</td>
<td>A-B3L4D06 A-B3L4D08</td>
</tr>
<tr>
<td>Line 4</td>
<td>A-B3M4D06 A-B3M4D08</td>
</tr>
</tbody>
</table>

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).
30-370  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.
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 both 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.
Figures 30-17 through 30-19 show the locations of the major parts used with the 4800-bps integrated modem.

Note: For Modem B locations, see paragraph 30-100.

Figure 30-17. 4800 BPS Integrated Modem—Nonswitched Network (Modem A)
Note: For Modem B locations, see paragraph 30-100.

Figure 30-18. (Part 1 of 4). 4800 BPS Integrated Modem-Switched Network (Modem A)
Figure 30-18. (Part 2 of 4). 4800 BPS Integrated Modem-Switched Network (Modem A) (Canada Only)
Figure 30-18. (Part 3 of 4). 4800 BPS Integrated Modem–Switched Network (Modem A) (U.S. Only)
World Trade Coupler

To
A-B3U4

Through D-B8 on Cable Tower

External Cable

<table>
<thead>
<tr>
<th>Line Plate</th>
<th>Cable</th>
<th>Telephone Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-6</td>
<td>Handset 2 (T2)</td>
<td>Black</td>
</tr>
<tr>
<td>TB1-7</td>
<td>Handset 1 (T1)</td>
<td>Yellow</td>
</tr>
<tr>
<td>TB1-8</td>
<td>Telephone 1 (L2)</td>
<td>White</td>
</tr>
<tr>
<td>TB1-9</td>
<td>Telephone 2 (L1)</td>
<td>Red</td>
</tr>
</tbody>
</table>

Figure 30-18. (Part 4 of 4). 4800 BPS Integrated Modem—Switched Network (Modem A) (World Trade)
Figure 30-19. 4800 BPS Integrated Modem Processor Card LED Locations
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.

---

**Table 30-1**

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATE TEST</td>
<td>Operate test and reset modem.</td>
</tr>
<tr>
<td>DATA QUALITY</td>
<td>Data quality indicator.</td>
</tr>
<tr>
<td>CARRIER DETECT</td>
<td>Carrier detect indicator.</td>
</tr>
<tr>
<td>MODEM CHECK</td>
<td>Modem check indicator.</td>
</tr>
<tr>
<td>MANUAL TESTS</td>
<td>Manual tests.</td>
</tr>
<tr>
<td>OPERATE LAMP</td>
<td>Operate lamp.</td>
</tr>
<tr>
<td>RLB</td>
<td>Receive line busy.</td>
</tr>
<tr>
<td>LLB</td>
<td>Local line busy.</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>Address switch.</td>
</tr>
<tr>
<td>OPERATE LINE 1</td>
<td>Operate line 1.</td>
</tr>
<tr>
<td>OPERATE LINE 2</td>
<td>Operate line 2.</td>
</tr>
<tr>
<td>OPERATE LINE 3</td>
<td>Operate line 3.</td>
</tr>
<tr>
<td>OPERATE LINE 4</td>
<td>Operate line 4.</td>
</tr>
<tr>
<td>LAMP</td>
<td>Lamp.</td>
</tr>
<tr>
<td>RLB</td>
<td>Receive line busy.</td>
</tr>
<tr>
<td>LLB</td>
<td>Local line busy.</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>Address switch.</td>
</tr>
</tbody>
</table>

**Note:** Address switches installed only on nonswitched modem (used only with multipoint).

---

Figure 30-20. Operator Panel for 4800 BPS Integrated Modem

---

**Note:** Only two integrated modems can be installed on a system.
Table 30-1. 4800 BPS Integrated Modem Operator Panel Controls/Indicators

<table>
<thead>
<tr>
<th>Controls/Indicators</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate</td>
<td>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.</td>
</tr>
<tr>
<td>Test</td>
<td>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.</td>
</tr>
<tr>
<td>Data Quality</td>
<td>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.</td>
</tr>
<tr>
<td>Good</td>
<td>This indicator is on when data errors are not probable.</td>
</tr>
<tr>
<td>Poor</td>
<td>This indicator is on when data errors are probable.</td>
</tr>
<tr>
<td>Carrier Detect</td>
<td>This indicator is on when the Carrier Detect signal is present.</td>
</tr>
<tr>
<td>Modem Check</td>
<td>This indicator is on when the modem has sensed an error during transmission (see Figure 30-19 to isolate the LEDs to a FRU).</td>
</tr>
<tr>
<td>LLB</td>
<td>Local Loop Back Test. Not used.</td>
</tr>
<tr>
<td>RLB</td>
<td>Remote Loop Back Test. Not used.</td>
</tr>
<tr>
<td>Lamp</td>
<td>When this switch is set to Lamp, all of the operator panel indicators should come on.</td>
</tr>
<tr>
<td>Operate</td>
<td>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).</td>
</tr>
<tr>
<td>LTT</td>
<td>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.</td>
</tr>
<tr>
<td>RT</td>
<td>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).</td>
</tr>
<tr>
<td>ST</td>
<td>Self Test. When this switch is set to ST, the modem generates a test pattern that checks the operation of the local modem.</td>
</tr>
<tr>
<td>Address switches</td>
<td>Used in multipoint networks only (see 30-440, Setting the Modem Address).</td>
</tr>
</tbody>
</table>
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.
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).

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.

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

Model 2 Switched Network
Modem A A-B3N2
Modem B A-B3R2

Switch Setting

Note: 1 = switch in On position,
0 = switch in Off position.

<table>
<thead>
<tr>
<th>Digital Code</th>
<th>Output Level (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1 1 1</td>
<td>-0</td>
</tr>
<tr>
<td>0 1 1 1</td>
<td>-1</td>
</tr>
<tr>
<td>1 0 1 1</td>
<td>-2</td>
</tr>
<tr>
<td>0 0 1 1</td>
<td>-3</td>
</tr>
<tr>
<td>1 1 0 1</td>
<td>-4</td>
</tr>
<tr>
<td>0 1 0 1</td>
<td>-5</td>
</tr>
<tr>
<td>1 0 0 1</td>
<td>-6</td>
</tr>
<tr>
<td>0 0 0 1</td>
<td>-7</td>
</tr>
<tr>
<td>1 1 1 0</td>
<td>-8</td>
</tr>
<tr>
<td>0 1 1 0</td>
<td>-9</td>
</tr>
<tr>
<td>1 0 1 0</td>
<td>-10</td>
</tr>
<tr>
<td>0 0 1 1</td>
<td>-11</td>
</tr>
<tr>
<td>1 1 0 0</td>
<td>-12</td>
</tr>
<tr>
<td>0 1 0 0</td>
<td>-13</td>
</tr>
<tr>
<td>1 0 0 0</td>
<td>-14</td>
</tr>
<tr>
<td>0 0 0 0</td>
<td>-15</td>
</tr>
</tbody>
</table>

Figure 30-21. 4800 BPS Integrated Modem Front End Card Transmit Level Switches
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.
### Table 30-2. Model 1 Option Jumpers (Nonswitched)

<table>
<thead>
<tr>
<th>Option</th>
<th>Modem A</th>
<th>Modem B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Configurations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multipoint Control</td>
<td>A-B3N2P07</td>
<td>A-B3N2D08</td>
</tr>
<tr>
<td>Multipoint Tributary</td>
<td>A-B3N2P07</td>
<td>A-B3N2D08</td>
</tr>
<tr>
<td>Point-to-Point (4-wire)</td>
<td>A-B3N2P09</td>
<td>A-B3N2J08</td>
</tr>
<tr>
<td></td>
<td>Remove multipoint control jumper above</td>
<td>Remove multipoint control jumper above</td>
</tr>
<tr>
<td>Speed Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Speed Control</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
</tr>
<tr>
<td></td>
<td>(primary or multipoint control modem) (see Note 1)</td>
<td></td>
</tr>
<tr>
<td>Remote Speed Control</td>
<td>A-B3N2P09</td>
<td>A-B3N2D08</td>
</tr>
<tr>
<td></td>
<td>(secondary or multipoint tributary modem) (see Note 1)</td>
<td></td>
</tr>
<tr>
<td>Initialization RFS Delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 ms (normal)</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
</tr>
<tr>
<td>50 ms (long) (see Note 2)</td>
<td>A-B3N2P11</td>
<td>A-B3N2P08</td>
</tr>
<tr>
<td>Carrier Detect Sensitivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Receive Level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above -32 dBm (normal position for U.S. and World Trade above -32 dBm)</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
</tr>
<tr>
<td>Below -32 dBm (World Trade below -32 dBm)</td>
<td>A-B3N2P13</td>
<td>A-B3N2U08</td>
</tr>
</tbody>
</table>

**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)

<table>
<thead>
<tr>
<th>Option</th>
<th>Modem A From</th>
<th>Modem A To</th>
<th>Modem B From</th>
<th>Modem B To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point-to-Point (2-wire) CCITT</td>
<td>A-B3N2P09</td>
<td>A-B3N2D08</td>
<td>A-B3R2P09</td>
<td>A-B3R2D08</td>
</tr>
<tr>
<td>Point-to-Point (2-wire) U.S.</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
</tr>
<tr>
<td>Initialization RFS Delay Long (normal)</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
<td>No jumpers needed</td>
</tr>
<tr>
<td></td>
<td>A-B3N2P11</td>
<td>A-B3N2P08</td>
<td>A-B3R2P11</td>
<td>A-B3R2P08</td>
</tr>
</tbody>
</table>

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.

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.

- 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
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.

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
The EIA/CCITT cards have 10 jumper locations, but none of the jumpers is needed.

If you have a multipoint control modem that needs new sync, the following jumpers are added for each line:

<table>
<thead>
<tr>
<th>Line</th>
<th>Jumpers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td>A-B3L2G08 to A-B3V2D13</td>
</tr>
<tr>
<td>Line 2</td>
<td>A-B3M2G08 to A-B3V3D13</td>
</tr>
<tr>
<td>Line 3</td>
<td>A-B3L4G08 to A-B3V4D13</td>
</tr>
<tr>
<td>Line 4</td>
<td>A-B3M4G08 to A-B3V5D13</td>
</tr>
</tbody>
</table>

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
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.

---

Figure 30-26. Modem Control Lines for EIA/CCITT Interface

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.

<table>
<thead>
<tr>
<th>System/34 Communications Adapter Signals (see Note 1)</th>
<th>Analog Wideband Adapter Card</th>
<th>External Modem Signals (see Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Request to Send</td>
<td>- Transmit Data Space</td>
<td>+Request to Send</td>
</tr>
<tr>
<td>+Transmit Data Space</td>
<td>- Wrap (cable wrap only)</td>
<td>- Transmit Data Space</td>
</tr>
<tr>
<td>- Data Set Ready</td>
<td>+Transmit Timing</td>
<td>+Wrap</td>
</tr>
<tr>
<td>+Receive Data</td>
<td>- Receive Timing</td>
<td></td>
</tr>
<tr>
<td>- Carrier Detect</td>
<td>- Carrier Detect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

+5.5 V — Most positive up level
+2.4 V — Least positive up level

Most positive down level — +0.8 V
Least positive down level — 0.0 V

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

+5.5 V — Most positive up level
+2.4 V — Least positive up level

Most positive down level — +0.8 V
Least positive down level — 0.0 V

Current at up level = 10 milliamperes maximum
Current at down level = sink 4.8 milliamperes maximum

Figure 30-29. Normal Output Signals
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.

Note: If the wideband adapter is installed on line 2, 3, or 4, see Figures 30-5 and 30-7 for hardware locations.
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.)

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
30-800 AUTOCALL 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.

### Figure 30-33. Autocall Control Lines

- **Call Request**
  - Y
  - 4
  - DTR
- **Data Line Occupied**
  - Y
  - 22
  - DSR
- **Digit Signal (NB2)**
  - Y
  - 15
  - STBY
- **Distant Station Connected**
  - Y
  - 13
  - CD
- **Digit Signal (NB1)**
  - Y
  - 14
  - RATE
- **Receive Timing**
  - Y
  - 8
  - RCLK
- **Digit Signal (NB8)**
  - Y
  - 17
  - WRAP
- **Power Indication**
  - Y
  - 11
  - RI
- **Digit Signal (NB4)**
  - Y
  - 18
  - NSYNC
- **Abandon Call and Retry**
  - Y
  - 3
  - RDATA
- **Digit Present**
  - Y
  - 2
  - RTS
- **Present Next Digit**
  - Y
  - 5
  - CTS

### 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

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

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31-200 Adapter Card
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31-420 Transmit Level Limiting Check
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31-440 Dial Tone Detect
31-450 Interface Signal Timings
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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.
Figure 31-1. Data Communications Card Locations on A-Gate

- IBM 1200 BPS Integrated Modem
  or
  Electronic Industries Association Adapter Card
  or
  Digital Data Service Adapter

- IBM 1200 BPS Integrated Modem
  or
  Electronic Industries Association Adapter Card
  or
  Digital Data Service Adapter

- Communications Adapter Card (Line 1)
- Communications Adapter Card (Line 2)
- Internal Clock
Line Plates for World Trade Public Switched Network or COMTB1 COMTB2

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
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.

1, 8, 9, 10, 12, 13, 14, 16, 19, 21, 24, and 25 are not used

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.

![Diagram of 2400 BPS Integrated Modem](image)

Figure 31-4. 2400 BPS Integrated Modem–Switched Network (Line 1)
Figure 31-5. 2400 BPS Integrated Modem—Switched Network (Line 2)
Figure 31-6. 2400 BPS Integrated Modem—Nonswitched Network (Line 1)
Figure 31-7. 2400 BPS Integrated Modem—Nonswitched Network (Line 2)
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)
Figure 31-12. 2400 BPS Integrated Modem–CADUCEE (France Only)–Line 1

- Adapter
- A-A2 Board
- 2400 BPS Integrated Modem
- B-A1 Board
- Operator Panel
- Located on Cable Tower
- External Cable
- To CADUCEE Coffret
- Through D-88-1 on Cable Tower.

Connections:

- 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
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).

Figure 31-14. 1200 BPS Integrated Modem—Switched Network
Figure 31-15. 1200 BPS Integrated Modem—World Trade Public Switched Network (PSN)
Figure 31-16. 1200 BPS Integrated Modem—Nonswitched Network
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
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
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.

### Switch Condition Meaning

<table>
<thead>
<tr>
<th>Switch</th>
<th>Condition</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On</td>
<td>Continuous carrier (the ‘request to send’ line is always on).&lt;br&gt;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).</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Not continuous carrier (set off for DDSA and for switched networks)</td>
</tr>
<tr>
<td>2</td>
<td>On</td>
<td>For EIA, 2400 BPS modem, and for enable rate select.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>For DDSA, 1200 BPS modem, and for disable rate select.</td>
</tr>
<tr>
<td>3</td>
<td>On</td>
<td>Not NRZI coding</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>NRZI coding used&lt;br&gt;&lt;br&gt;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:&lt;br&gt;- The NRZI switch setting must match the option chosen in the configuration for diagnostics to work correctly.&lt;br&gt;- If the customer is operating with only BSC or with DDSA, select not NRZI (switch 3 is set on).&lt;br&gt;- BSC microcode disables the NRZI function regardless of the switch setting.&lt;br&gt;- Only SDLC uses NRZI but the selection of NRZI depends on the following:&lt;br&gt;  - 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.</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If switch 4 is off, the device address 20 and the interrupt request bit 2 (bit 2 = DBI 2) are used by the adapter.</td>
</tr>
</tbody>
</table>

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).
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.

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
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 or:
  - 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
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.

---

**Figure 31-22. Switch Settings for World Trade Nonswitched Network**
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.

Figure 31-23. Switch Settings for World Trade Public Switched Network (PSN)
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.
Figure 31-24. World Trade PSN Line Plate and Cable Connections

<table>
<thead>
<tr>
<th>Line Plate</th>
<th>Cable</th>
<th>Telephone Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-6</td>
<td>Handset 2 (T2)</td>
<td>Black</td>
</tr>
<tr>
<td>TB1-7</td>
<td>Handset 1 (T1)</td>
<td>Yellow</td>
</tr>
<tr>
<td>TB1-8</td>
<td>Telephone 1 (L2)</td>
<td>White</td>
</tr>
<tr>
<td>TB1-9</td>
<td>Telephone 2 (L1)</td>
<td>Red</td>
</tr>
</tbody>
</table>
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.

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).
<table>
<thead>
<tr>
<th>Test Operate Switch Positions</th>
<th>Ready Light (On when 'data set ready' is active) (Note 1)</th>
<th>Signal Light (On when 'carrier detect' internal is active)</th>
<th>Operate Light (On for 'receive data' mark)</th>
<th>Signal Quality Meter (Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate</td>
<td>On (Note 3)</td>
<td>On when the receiving signal is above the threshold</td>
<td>On or flickering</td>
<td>0-50</td>
</tr>
<tr>
<td>Reset (intermediate positions)</td>
<td>Off</td>
<td>On when the receiving signal is above the threshold</td>
<td>On</td>
<td>0</td>
</tr>
<tr>
<td>T1</td>
<td>Off</td>
<td>On (wrap signal)</td>
<td>On (Note 4)</td>
<td>0+</td>
</tr>
<tr>
<td>T2 (or DTE interface 'test' line)</td>
<td>Off (Note 1)</td>
<td>On if the 'request to send' line is active (wrap signal)</td>
<td>Depends on data; off for space, on for mark</td>
<td>0+</td>
</tr>
<tr>
<td>T3 (2-wire system with remote modem on T4)</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>0</td>
</tr>
<tr>
<td>T3 (4-wire system with remote modem on T3 or T4)</td>
<td>Off</td>
<td>On (remote signal)</td>
<td>On (Note 4)</td>
<td>0-50</td>
</tr>
<tr>
<td>T4 (remote modem on T3)</td>
<td>Off</td>
<td>On (remote signal)</td>
<td>On (Note 4)</td>
<td>0-50</td>
</tr>
</tbody>
</table>

**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**
31-414 Test/Operate Diagnostics

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.

<table>
<thead>
<tr>
<th>FSL Page</th>
<th>Line 1 FA716</th>
<th>FA716</th>
<th>FA707</th>
<th>FA716</th>
<th>FA707</th>
<th>FA716</th>
<th>FA707</th>
<th>FA716</th>
<th>FA707</th>
<th>FA716</th>
<th>FA707</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 2</td>
<td>FA797</td>
<td>FA797</td>
<td>FA797</td>
<td>FA797</td>
<td>FA797</td>
<td>FA797</td>
<td>FA797</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Signal Name**
- Request To Send Test OP
- Transmit Send Data
- Wrap Relay
- Equal Out
- Clamp Interface
- Ready AEL
- Force DTR

**Pin**

|--------|-------|------------|------------|------------|------------|------------|------------|------------|------------|

**On/Active (Vdc)**
- 0 to .3v
- 4.8v to 6.4v
- 6.0v to 8.1v
- 6.9v to 9.4v
- 10v to 13.2v

**Off/Inactive (Vdc)**
- 5.7v to 7.8v
- 6.9v to 9.4v
- 10v to 13.2v
- 10v to 13.2v

**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.
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.
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.

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.

31-460
Is the SNBU feature on the machine?

Yes

SNBU (standby), M2 (see note 1 and paragraph 31-474). For auto-request-to-send (continuous carrier), add jumper from M2G02 to T2B09.

Standby (SNBU) Timing, K3. (paragraph 31-473)

Compromise Equalizer, L2.

No

Is the Automatic Answering option on SNBU?

Yes

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.

AA Coupler Interface, S3. (paragraph 31-475)

AA Basic, R2 (see note 1 and paragraph 31-475)

No

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.
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)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>M</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>H</td>
<td>M</td>
<td>P</td>
</tr>
<tr>
<td>-2</td>
<td>J</td>
<td>M</td>
<td>P</td>
</tr>
<tr>
<td>-3</td>
<td>K</td>
<td>M</td>
<td>P</td>
</tr>
<tr>
<td>-4</td>
<td>L</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>-5</td>
<td>H</td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>-6</td>
<td>J</td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>-7</td>
<td>K</td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>-8</td>
<td>M</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>-9</td>
<td>H</td>
<td>M</td>
<td>N</td>
</tr>
<tr>
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<td>M</td>
<td>N</td>
</tr>
<tr>
<td>-12</td>
<td>L</td>
<td>N</td>
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</tr>
<tr>
<td>-13</td>
<td>H</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>-14</td>
<td>J</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>-15</td>
<td>K</td>
<td>L</td>
<td>N</td>
</tr>
</tbody>
</table>

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.
**31-472 Transmit and Interface Jumpers**

**Transmit Jumper**

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**

- **Test**
- **Send**
- **Carrier Detect**

<table>
<thead>
<tr>
<th><em>B</em></th>
<th><em>A</em></th>
<th><em>B</em></th>
<th><em>C</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- **Clear to Send**
- **XMT Clock**
- **RCV Clock**
- **RCV Data**

<table>
<thead>
<tr>
<th>Select</th>
<th>Standby</th>
<th>Speed Select</th>
<th>Send Data</th>
</tr>
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<tbody>
<tr>
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<td>*</td>
<td>*</td>
<td>*</td>
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</tr>
<tr>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

- **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
### Basic Timing Options

| * * * * * * | * * * * * * |
| - - - - - - | - - - - - - |
| C D E F | G H |
| A B G H | - - |

| J P M N N N | K L N N N |
| - - - - - - | - - - - - - |

- B-A1K2 (line 1)
- B-A2K2 (line 2)

### Feature Timing Options

| * R * | * S * |
| - - - - - - | - - - - - - |

- B-A1K3 (line 1)
- B-A2K3 (line 2)

(SNBU timing)

---

### Switched Timing (echo clamp)

| * R * | * T * |
| - - - - - - | - - - - - - |

- B-A1H3 (line 1)
- B-A2H3 (line 2)

---

### Modem Options

<table>
<thead>
<tr>
<th>Modem</th>
<th>Echo Suppressors?</th>
<th>LL Clear To Send (ms)</th>
<th>SNBU/Switched Network Clear To Send (ms)</th>
<th>Timing Options Strapping</th>
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</thead>
<tbody>
<tr>
<td>4WLL-SNBU</td>
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<td>8.5</td>
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<td>8.5</td>
<td>75</td>
<td>A, B, G, H, J, L, R, S</td>
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<td></td>
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<tr>
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<td>75</td>
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<td></td>
<td>147</td>
<td>A, D, G, H, J, M, S</td>
<td></td>
</tr>
</tbody>
</table>

### 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

### SNBU Timing Jumpers

- B-A1K1 (line 1)
- B-A2K1 (line 2)

---

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 01 A-A2 board jumpers.

---

31-473
Test/Operate Basic Jumpers

A - Not used (EIA/CCITT interface)
B - Needed

31-474 SNBU Jumpers

Standby Feature Jumpers

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
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.

<table>
<thead>
<tr>
<th>Decibels</th>
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<tbody>
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</tr>
<tr>
<td>-15</td>
<td>B, D, F, H</td>
</tr>
</tbody>
</table>
31-476 Nonswitched Line, Multipoint, or Point-to-Point Jumpers

C1-A Equalizer Basic Jumpers

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

31-477 CADUCEE Feature Card Jumpers

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
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

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

Scope settings:
- Triggering to -internal
- Time base to .2 ms/div
- Channel 1 to .5 v/div*
- Channel 2 to 100 mv/div*

* Use only X1 probe; waveshape may be distorted or not seen when scoping millivolt signals with X10 probe.
Waveshape 072A (see Note)

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)

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)

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 072D (see Note)

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

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.)

* Use only X1 probe; waveshape may be distorted or not seen when scoping millivolt signals with X10 probe.
**Waveshape 078**

![Waveshape 078](image)

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**

![Waveshape 081](image)

Scope settings:
- Triggering to -internal
- Time base to .5 ms/div
- Channel 1 to 2 v/div*

**Waveshape 088**

![Waveshape 088](image)

Scope settings:
- Triggering to -internal
- Time base to .2 ms/div
- Channel 1 to 2 v/div*

**Waveshape 090**

![Waveshape 090](image)

Scope settings:
- Triggering to -internal
- Time base to .2 ms/div
- Channel 1 to .5 v/div*
- Channel 2 to 5 v/div*

* Use only X1 probe; waveshape may be distorted or not seen when scopeing millivolt signals with X10 probe.

**Waveshape 160**

![Waveshape 160](image)

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**

![Waveshape 163](image)

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 waveform show the relationship between the two signals; channel B signal drops as channel A signal rises.

- **Scope settings:**
  - Triggering to — on G2S04
  - Time base to .2 ms/div
  - Channel 1 to 1 v/div*
  - Channel 2 to 1 v/div*

N4D05
Channel A Filter

N4B02
Channel B Filter

Waveshape 173A

- **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

- **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

- **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.

Waveshape 248

- **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).
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

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

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.
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 '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.

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'.

Figure 31-29. Modem Control Lines for EIA/CCITT Interface

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
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.
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45-740 IBM 2400 BPS Integrated Modem

45-750 IBM 4800 BPS Integrated Modem

45-760 Analog Wideband Adapter

45-770 Autocall Adapter

45-790 Communications Testing

45-800 Completing the System Installation
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.
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

45-210 62EH Disk Storage Drive
- 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
- 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
<table>
<thead>
<tr>
<th>Step 4</th>
<th>45-400 Line Printers and Data Communications Cabling</th>
</tr>
</thead>
</table>
| 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 | Connect communications cable in cable tower.  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-430 Digital Data Service Adapter | Connect communications cable in cable tower.*  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-440 IBM 1200 BPS Integrated Modem | Connect communications cable in cable tower.  
| | Route communications cable thru adapter plate  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-450 IBM 2400 BPS Integrated Modem | Connect communications cable in cable tower.  
| | Route communications cable thru adapter plate  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-460 IBM 4800 BPS Integrated Modem | Remove communications cable from inside machine.  
| | Connect communications cable in cable tower.  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-470 Analog Wideband Adapter | Connect communications cable in cable tower.  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |
| 45-480 Autocall Adapter | Connect communications cable in cable tower.  
| | Line 1  
| | Line 2  
| | Line 3  
| | Line 4 |

*For MLCA installation, this cable goes through tower opening D-88.

Figure 45-1 (Part 2 of 3). System/34 Installation Sequence Chart
### Step 5

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-510</td>
<td>Twinaxial Signal Cables. Ensure twinaxial cables connected to system output ports.</td>
</tr>
<tr>
<td>45-520</td>
<td>IBM 5251 Display Stations. Ensure twinaxial cables connected to display stations. Set address and terminator switches (if present).</td>
</tr>
<tr>
<td>45-525</td>
<td>IBM 5252 Display Stations. Ensure twinaxial cables connected to display stations. Set address and terminator switches (if present).</td>
</tr>
<tr>
<td>45-527</td>
<td>IBM 5255 Display Stations. Ensure twinaxial cables connected to display station. Set address and terminator switches (if present).</td>
</tr>
<tr>
<td>45-530</td>
<td>IBM 5256 Printer. Ensure twinaxial cable connected to printer. Set address and terminator switches (if present).</td>
</tr>
<tr>
<td>45-540</td>
<td>IBM 5225 Printer. Ensure twinaxial cable connected to printer. Set address and terminator switches (if present).</td>
</tr>
</tbody>
</table>

### Step 6

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-620</td>
<td>IPL Operation from Diskette. Verify that CSIPL/MSIPL works from diskette.</td>
</tr>
<tr>
<td>45-630</td>
<td>System Diagnostics. Verify system configuration. Run MDI tests for system unit and base I/O.</td>
</tr>
</tbody>
</table>

### Step 7

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-710</td>
<td>Data Communications (first or second communications adapter or MLCA).</td>
</tr>
<tr>
<td>45-720</td>
<td>External Modem EIA/CCITT Connection</td>
</tr>
<tr>
<td>45-730</td>
<td>Digital Data Service Adapter</td>
</tr>
<tr>
<td>45-740</td>
<td>IBM 1200 BPS Integrated Modem</td>
</tr>
<tr>
<td>45-750</td>
<td>IBM 2400 BPS Integrated Modem (not used with MLCA)</td>
</tr>
<tr>
<td>45-760</td>
<td>IBM 4800 BPS Integrated Modem (not used with first or second communications adapter)</td>
</tr>
<tr>
<td>45-770</td>
<td>Analog Wideband Adapter (not used with first or second communications adapter)</td>
</tr>
<tr>
<td>45-780</td>
<td>Autocall Adapter (not used with first or second communications adapter)</td>
</tr>
<tr>
<td>45-790</td>
<td>Data Communications Testing</td>
</tr>
</tbody>
</table>

### Step 8

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-810</td>
<td>Completing the System Installation. Check CE panel switches. Fill out installation logs and IAD.</td>
</tr>
</tbody>
</table>

Figure 45-1 (Part 3 of 3). System/34 Installation Sequence Chart
This page is intentionally left blank.
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.
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

Rear View

Figure 45-3. 62EH Disk 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 A is in the locked position (turned fully clockwise).

1. Turn screw A counterclockwise and open the card gate.

2. Turn the actuator lock knob A counterclockwise (through 120 degrees) until the actuator lock reaches its stop. Ensure that the voltage connectors E 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 K 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 A must overlap the motor bracket C 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
45-300 DISKETTE DRIVE

See Figure 45-5 and do the following:

1. Remove the safety cover if it was not removed earlier.

2. Ensure that the diskette drive logic card and all cables and connectors are correctly seated.

3. Turn the drive pulley 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.

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.

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.
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.

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.
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.
2400 BPS Operator Panels

Line 2
Line 1

Voltage Label
Power Rating Plate
Serial Number Plate

D-B8 and D-B7
EIA/CCITT
Switched Network
DDSA
Switched Network Backup
with Automatic Answering

D-B4 Attach the printer cable connector labeled 01 (the one with two paddle cards) to this connector.

D-B5 Attach the printer cable connector labeled 02 (the one with one paddle card) to this connector.

D-B6 Data Communications Connector (Line 2)
D-B7 Data Communications Connector (Line 1)

Figure 45-6. 5340 Cable Tower (With First or Second Communications Adapter)
Figure 45-7. Cable Tower Locations for MLCA External Cables

- Auto Call
- 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
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.

45-480 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.

45-470 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.
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.
Ensuring 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 A 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 B of Figure 45-8.

To attach a 5251 Display Station as a workstation 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 workstation 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 workstation on the port.

   Note: Each workstation 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 workstation 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 C and D of Figure 45-8.
**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.

**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*
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 2 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 3 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 3 and 4 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.

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
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 A 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 B and C 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 D, G, and H 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).

Figure 45-10 (Part 1 of 2). 5255 Switches and Cable Connector
Setting the Switches

There are two types of switches to set: address and terminator.

Address Switches (white)

Set the switches:

1. Contact the person responsible for assigning the workstation address (for example, your supervisor or system operator). Ask for your workstation 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.

<table>
<thead>
<tr>
<th>Work Station Addresses</th>
<th>Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø</td>
<td>![Switch Setting for Ø]</td>
</tr>
<tr>
<td>1</td>
<td>![Switch Setting for 1]</td>
</tr>
<tr>
<td>2</td>
<td>![Switch Setting for 2]</td>
</tr>
<tr>
<td>3</td>
<td>![Switch Setting for 3]</td>
</tr>
<tr>
<td>4</td>
<td>![Switch Setting for 4]</td>
</tr>
<tr>
<td>5</td>
<td>![Switch Setting for 5]</td>
</tr>
<tr>
<td>6</td>
<td>![Switch Setting for 6]</td>
</tr>
<tr>
<td>7</td>
<td>![Switch Setting for 7]</td>
</tr>
</tbody>
</table>

*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
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 4 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 5 and 6 of Figure 45-11. (7 is an invalid address.)
Without Cable Thru Feature

Station address is automatically set to 0.

With Cable Thru Feature (used for the last device on a port)

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.

With Cable Thru Feature Being Used

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.

Figure 45-11. 5256 Switches and Cable Connections
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.

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  is in the 0 position. If the keylock feature is installed, the key should be in the vertical (off) position.
   b. CB1  is down.
   c. IPO switch  is in the 0 position.

2. Connect the power cord to the outlet.

3. Set circuit breaker CB1  to the On (up) position. System power should not come on.

4. Press the Lamp Test switch  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  to I (on). System power should not come on.

6. Set the Power switch  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  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 \( \text{A} \) to 0000.
   b. Set the CSIPL and MSIPL switches \( \text{C} \) to the Diskette position.
   c. Set the Mode Selector switch \( \text{A} \) 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 \( \text{F} \) 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.

---

**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.
# LINE 1 DATA COMMUNICATIONS INSTALLATION DATA TABLE (FIRST COMMUNICATIONS ADAPTER)

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>__________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Date</td>
<td>__________________________</td>
</tr>
<tr>
<td>Installing CE</td>
<td>__________________________</td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

*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.)

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

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.)

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

---

*Figure 45-14 (Part 1 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)*
Figure 45-14 (Part 2 of 8). Line 1 Data Communications Installation Data Table (First 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?
Yes No

Note: The internal clock feature is automatically installed with a 1200 bps integrated modem.

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 C and check your answers.

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 45-14 (Part 3 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)
1200 BPS INTEGRATED MODEM (A-A2H2)

For more information on the 1200 bps integrated modem, see paragraph 31-310.

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-1** and check your answers.

Go to **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**

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.
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)
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
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

<table>
<thead>
<tr>
<th>Clear-to-Send Delay</th>
<th>Echo Clamp Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 ms</td>
<td>0 ms</td>
</tr>
<tr>
<td>147 ms</td>
<td>50 ms</td>
</tr>
<tr>
<td>100 ms</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Clear-to-Send Delay</th>
<th>Echo Clamp Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 ms</td>
<td>0 ms</td>
</tr>
<tr>
<td>147 ms</td>
<td>50 ms</td>
</tr>
<tr>
<td>100 ms</td>
<td></td>
</tr>
</tbody>
</table>

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.

The data table is complete.

Figure 45-14 (Part 7 of 8). Line 1 Data Communications Installation Data Table (First Communications Adapter)
### DIGITAL DATA SERVICE ADAPTER (A-2H2)

- Is the network speed 2400 bps?
  - Yes
  - No

If the network speed 2400 bps?
- Is the network speed 4800 bps?
  - Yes
  - No

If the network speed 4800 bps?
- 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.

### 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)

*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

Does the SNBU have automatic answer?
- Yes
- No

Does the customer have SNBU (switched network backup)? [For 2400 bps integrated modem (see order card) or external modem (see customer).]
- Yes
- No

Does the SNBU have automatic answer?
- Yes
- No

Figure 45-15 (Part 2 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)
**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?

- Yes
- No

*Note:* The internal clock feature is automatically installed with a 1200 bps integrated modem.

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)
1200 BPS INTEGRATED MODEM (A-A2H4)

For more information on the 1200 bps integrated modem, see paragraph 31-310.

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 and check your answers.

Go to D - 3

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

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.
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

If you answer this question no, one of your previous answers must be wrong. Go back to **E-1** and check your answers.

**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 leased line?

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.

Figure 45-15 (Part 5 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)
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 3-3 and check your answers.

Enter the auto answer tone ____ dB. 0 dB to -15 dB (same as switched network transmit level). Go to 3-4

Does the customer have switched network backup (SNBU)? 0 dB to -15 dB ____ dB.
Yes  No

Enter the auto answer tone ____ dB. 0 dB to -15 dB [same as switched network (SNBU) transmit level]. Go to 3-4

Figure 45-15 (Part 6 of 8). Line 2 Data Communications Installation Data Table (Second Communications Adapter)
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-5.

<table>
<thead>
<tr>
<th>Clear-to-Send Delay</th>
<th>Echo Clamp Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 ms</td>
<td>0 ms</td>
</tr>
<tr>
<td>147 ms</td>
<td>50 ms</td>
</tr>
<tr>
<td></td>
<td>100 ms</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Clear-to-Send Delay</th>
<th>Echo Clamp Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 ms</td>
<td>0 ms</td>
</tr>
<tr>
<td>147 ms</td>
<td>50 ms</td>
</tr>
<tr>
<td></td>
<td>100 ms</td>
</tr>
</tbody>
</table>

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.

The data table is complete.
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 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.

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)

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:

<table>
<thead>
<tr>
<th>Line</th>
<th>Date</th>
<th>CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Feature or Option</th>
<th>Line 1</th>
<th>Line 2</th>
<th>Line 3</th>
<th>Line 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communications Adapter Options (see 30-200)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Device address</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Continuous carrier</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Line speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Medium speed ((\leq 9600 \text{ bps}))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High speed ((&gt; 9600 \text{ bps}))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rate select interface line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Tie down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• NRZI encoding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Disable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Network Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Digital data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Switched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Point-to-point nonswitched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Multipoint tributary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Multipoint control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hardware Installed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• EIA/CCITT adapter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 1200-bps integrated modem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Digital data service adapter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Analog wideband adapter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 4800-bps integrated modem A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 4800-bps integrated modem B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Autocall adapter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communications line clocking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Internal clock card (A-B3U2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Modem clocking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Autocall (no clocking required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 45-16. (Part 2 of 3). MLCA Installation Data Table
<table>
<thead>
<tr>
<th>Feature or Option</th>
<th>Line 1</th>
<th>Line 2</th>
<th>Line 3</th>
<th>Line 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Digital Data Service Adapter (see 30-500)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mode of operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Local direct attach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Point-to-point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Multipoint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Line speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2400 bps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 4800 bps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 9600 bps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 56,000 bps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1200 BPS Integrated Modem (see 30-300)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communications facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2-wire nonswitched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 4-wire nonswitched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Switched (U.S. and Canada)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Public switched network (World Trade)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Clear to send/echo clamp delay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 30 ms/0 ms (4-wire nonswitched)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 80 ms/50 ms (must be tested)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 230 ms/50 ms (not recommended)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 230 ms/150 ms (switched or 2-wire nonswitched)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Transmit Level (record db level)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4800 BPS Integrated Modem (see 30-400)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Installed as:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Modem A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Modem B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communications facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 4-wire nonswitched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2-wire switched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Coupler adapter (Canada only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Incorporated protective coupler (U.S. only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. World Trade coupler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• First transmission initialization RFS delay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Nonswitched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. 24 ms (normal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. 50 ms (long)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Switched</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. 923 ms (long/normal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. 708 ms (short)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Speed control, nonswitched point-to-point (see 30-460):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Local (speed control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Remote (speed control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Transmit level (record db level)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 45-16. (Part 3 of 3). MLCA Installation Data Table
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 Logs) 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:

<table>
<thead>
<tr>
<th>Line</th>
<th>Card Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A-A2J2</td>
</tr>
<tr>
<td>2</td>
<td>A-A2K2</td>
</tr>
</tbody>
</table>

For MLCA:

<table>
<thead>
<tr>
<th>Line</th>
<th>Card Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A-B3F2</td>
</tr>
<tr>
<td>2</td>
<td>A-B3G2</td>
</tr>
<tr>
<td>3</td>
<td>A-B3H2</td>
</tr>
<tr>
<td>4</td>
<td>A-B3J2</td>
</tr>
</tbody>
</table>
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.


6. Inform the customer that the system is available for use.

7. Inform the branch office that the installation is complete.
CONTENTS

80-100  General Information
80-111  Error Recording Analysis Procedure (ERAP)
80-200  Electrostatic Discharge (ESD) Problems
80-210  Power Distribution for ESD
80-220  Covers and Frame for ESD
80-230  I/O Devices and Cables for ESD
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:

<table>
<thead>
<tr>
<th>Section</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>81-000</td>
<td>Main Storage Processor</td>
</tr>
<tr>
<td>82-000</td>
<td>Control Processor</td>
</tr>
<tr>
<td>83-000</td>
<td>Disk</td>
</tr>
<tr>
<td>84-000</td>
<td>Diskette</td>
</tr>
<tr>
<td>85-000</td>
<td>Line Printers</td>
</tr>
<tr>
<td>86-000</td>
<td>Work Station Controller</td>
</tr>
<tr>
<td>87-000</td>
<td>Display Stations</td>
</tr>
<tr>
<td>88-000</td>
<td>5256 Serial Printer</td>
</tr>
<tr>
<td>89-000</td>
<td>Data Communications</td>
</tr>
</tbody>
</table>

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 OCXX 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.
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 and contact of the cover flange to the base at as many points along the flange as possible. See Figure 80-1.

Adjust the vertical finger stock channels on each cover to match with the knife edges 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.

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
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

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<thead>
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<th>Code</th>
<th>Description</th>
</tr>
</thead>
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<td>How to Use Main Storage Processor Error Information</td>
</tr>
<tr>
<td>81-200</td>
<td>Main Storage Processor Error History Information</td>
</tr>
<tr>
<td>81-300</td>
<td>Main Storage Processor Sense Bytes—General Information</td>
</tr>
<tr>
<td>81-310</td>
<td>Instruction Address Register (IAR)</td>
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<td>81-320</td>
<td>Address Recall Register (ARR)</td>
</tr>
<tr>
<td>81-330</td>
<td>Index Register 1 (XR1)</td>
</tr>
<tr>
<td>81-340</td>
<td>Index Register 2 (XR2)</td>
</tr>
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<td>81-350</td>
<td>Operand 1 (Op1)</td>
</tr>
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<td>81-360</td>
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<td>81-370</td>
<td>Address Translation Registers (ATRs)</td>
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<td>Instruction Translation Register</td>
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<td>Operand 1 Translation Register</td>
</tr>
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<td>81-373</td>
<td>Operand 2 Translation Register</td>
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<td>81-410</td>
<td>Program Status Register (PSR)</td>
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<td>81-420</td>
<td>Status Bytes</td>
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<td>81-422</td>
<td>Status Byte 2</td>
</tr>
<tr>
<td>81-423</td>
<td>Status Byte 3</td>
</tr>
<tr>
<td>81-430</td>
<td>Failing Address</td>
</tr>
</tbody>
</table>
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.

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.

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<thead>
<tr>
<th>IAR</th>
<th>ARR</th>
<th>XR1</th>
<th>XR2</th>
<th>OP1</th>
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<th>IR</th>
<th>01</th>
<th>02</th>
<th>OP</th>
<th>Q</th>
<th>MR</th>
<th>SR</th>
<th>0</th>
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<th>3</th>
<th>ADDR</th>
<th>DATE</th>
<th>TIME</th>
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<tr>
<td>096E</td>
<td>0952</td>
<td>1E58</td>
<td>BD00</td>
<td>BD01</td>
<td>BD00</td>
<td>01</td>
<td>17</td>
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<td>AF</td>
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<td>00</td>
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<td>2B</td>
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<td>0952</td>
<td>1E58</td>
<td>BD00</td>
<td>BD02</td>
<td>BD01</td>
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<td>AF</td>
<td>01</td>
<td>00</td>
<td>01</td>
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<td>00BD01</td>
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<td>1E28</td>
<td>BD00</td>
<td>BD02</td>
<td>BD02</td>
<td>01</td>
<td>17</td>
<td>17</td>
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<table>
<thead>
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<p>| ERROR HISTORY TABLE FOR MAIN STORAGE PROCESSOR |</p>
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<tr>
<th>ATRS</th>
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<th>STATUS</th>
<th>FAIL.</th>
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</thead>
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<tr>
<td>IAR</td>
<td>ARR</td>
<td>XR1</td>
<td>XR2</td>
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81-320 | Index Register 1 Contents |
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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.
81-373 **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.
CONTENTS

82-100  How to Use Control Processor Error Information
82-200  Control Processor Error History Information
82-300  Control Processor Sense Bytes—General Information
82-310  Processor Condition Register (PCR)
82-320  ILBB (Interrupt Level Backup Byte)
82-330  Control Processor Check Byte (Byte 0)
82-340  Port Check Byte (Byte 1)
82-350  Work Registers 0 through 7
82-360  Microinstruction Address Register (MAR)
82-370  Microinstruction Address Backup Register (MAB)
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.

CONTROL PROCESSOR ERROR HISTORY INFORMATION

An example of the control processor error history information that is recorded is shown in the following sample printout.

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</table>
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 affects the PCR) performed in the control processor.

**Processor Condition Register**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Flag</td>
</tr>
<tr>
<td>1</td>
<td>Positive</td>
</tr>
<tr>
<td>2</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>Zero</td>
</tr>
<tr>
<td>4</td>
<td>Carry</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Equal</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Interrupt Level Backup Byte</th>
<th>Hardware Interrupt Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>5</td>
</tr>
<tr>
<td>01</td>
<td>4 or work station controller cycle steal (note 1)</td>
</tr>
<tr>
<td>02</td>
<td>Work station controller cycle steal or disk cycle steal (note 2)</td>
</tr>
<tr>
<td>03</td>
<td>3</td>
</tr>
<tr>
<td>04</td>
<td>2</td>
</tr>
<tr>
<td>05</td>
<td>1 or disk cycle steal (note 1)</td>
</tr>
<tr>
<td>07</td>
<td>Main level</td>
</tr>
</tbody>
</table>

**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.
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**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Storage data register parity check</td>
</tr>
<tr>
<td>1</td>
<td>Micro-operation register parity check</td>
</tr>
<tr>
<td>2</td>
<td>Storage gate parity check</td>
</tr>
<tr>
<td>3</td>
<td>Arithmetic and logic unit gate parity check</td>
</tr>
<tr>
<td>4, 5</td>
<td>Value Meaning</td>
</tr>
<tr>
<td>01</td>
<td>Time-out</td>
</tr>
<tr>
<td>10</td>
<td>Not valid control storage address</td>
</tr>
<tr>
<td>11</td>
<td>Control storage address register parity check</td>
</tr>
<tr>
<td>6, 7</td>
<td>Value Meaning</td>
</tr>
<tr>
<td>01</td>
<td>Storage exception</td>
</tr>
<tr>
<td>10</td>
<td>Not valid main storage address</td>
</tr>
<tr>
<td>11</td>
<td>Main storage address register parity check</td>
</tr>
</tbody>
</table>

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.

**Port Check Byte**

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Data bus out parity check</td>
</tr>
<tr>
<td>1</td>
<td>Device address not valid</td>
</tr>
<tr>
<td>2</td>
<td>Data bus in parity check</td>
</tr>
<tr>
<td>3</td>
<td>Input/output time-out check</td>
</tr>
<tr>
<td>4</td>
<td>Command bus in or data bus in not zero</td>
</tr>
<tr>
<td>5</td>
<td>System bus parity check</td>
</tr>
<tr>
<td>6</td>
<td>Cycle steal check</td>
</tr>
<tr>
<td>7</td>
<td>Port address not valid</td>
</tr>
</tbody>
</table>

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.

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:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Dec</th>
<th>Module</th>
<th>Error Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>0001</td>
<td>$NULC, $IPW</td>
<td>Module ID not found in control storage library</td>
</tr>
<tr>
<td>02</td>
<td>0002</td>
<td>$NULX</td>
<td>Attempt to relocate a module that has no RLDs</td>
</tr>
<tr>
<td>03</td>
<td>0003</td>
<td>$NULC</td>
<td>Control storage module link, load address unequal</td>
</tr>
<tr>
<td>05</td>
<td>0005</td>
<td>$NU1</td>
<td>Quiesce counter has negative value</td>
</tr>
<tr>
<td>06</td>
<td>0006</td>
<td>$NU1</td>
<td>Privileged operation issued in nonprivileged mode</td>
</tr>
<tr>
<td>07</td>
<td>0007</td>
<td>$NU1</td>
<td>Control storage register stack area overflow</td>
</tr>
<tr>
<td>08</td>
<td>0008</td>
<td>$NUBL/$NUSL</td>
<td>Address translation error logging communication line data</td>
</tr>
<tr>
<td>09</td>
<td>0009</td>
<td>$NULX</td>
<td>Address translation error relocating main storage module</td>
</tr>
<tr>
<td>0A</td>
<td>0010</td>
<td>$NU2/$NU2A</td>
<td>Invalid disk IOB parameters</td>
</tr>
<tr>
<td>0B</td>
<td>0011</td>
<td>$ALT3</td>
<td>Permanent disk read error</td>
</tr>
<tr>
<td>0C</td>
<td>0012</td>
<td>$FD1</td>
<td>Disk interrupt timeout check</td>
</tr>
<tr>
<td>0E</td>
<td>0014</td>
<td>$CPO</td>
<td>Invalid main storage address or nonprivileged program issued LPMR</td>
</tr>
<tr>
<td>0F</td>
<td>0015</td>
<td>$NU1</td>
<td>Invalid main storage operation code</td>
</tr>
<tr>
<td>10</td>
<td>0016</td>
<td>$NUAB</td>
<td>Storage dump has been requested . . .</td>
</tr>
<tr>
<td>11</td>
<td>0017</td>
<td>$NU1</td>
<td>Address translation error--storage not assigned</td>
</tr>
<tr>
<td>14</td>
<td>0020</td>
<td>$NU1</td>
<td>Invalid timer queue element</td>
</tr>
<tr>
<td>15</td>
<td>0021</td>
<td>$NUTIX</td>
<td>Address translation error on $TRB parameter list</td>
</tr>
<tr>
<td>16</td>
<td>0022</td>
<td>$NUTIX</td>
<td>Invalid system date flag found in system communication area</td>
</tr>
<tr>
<td>17</td>
<td>0023</td>
<td>$NUTIX</td>
<td>Nonprivileged program issued timer load request</td>
</tr>
<tr>
<td>18</td>
<td>0024</td>
<td>$NUTIX</td>
<td>Invalid type specified with timer request</td>
</tr>
<tr>
<td>19</td>
<td>0025</td>
<td>$NUTIX</td>
<td>Nonprivileged program issued multiple wait timer request</td>
</tr>
<tr>
<td>1A</td>
<td>0026</td>
<td>$NUTIX</td>
<td>Invalid type specified with timer request</td>
</tr>
<tr>
<td>1B</td>
<td>0027</td>
<td>$NUTIX</td>
<td>Negative time value specified with timer request</td>
</tr>
<tr>
<td>1C</td>
<td>0028</td>
<td>$NUTIX</td>
<td>Invalid INLINE parameter specified with timer request</td>
</tr>
<tr>
<td>1D</td>
<td>0029</td>
<td>$NU2/$NU2A</td>
<td>Disk error--second disk error before first handled</td>
</tr>
<tr>
<td>Hex</td>
<td>Dec</td>
<td>Message Issuing Module</td>
<td>Error Message</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>1E</td>
<td>0030</td>
<td>$NU2/$NU2A</td>
<td>Address translation error on disk IOB address</td>
</tr>
<tr>
<td>1F</td>
<td>0031</td>
<td>$IPL, $IPS</td>
<td>Permanent diskette error during IPL from diskette</td>
</tr>
<tr>
<td>20</td>
<td>0032</td>
<td>$NULC</td>
<td>Address translation error moving main storage program</td>
</tr>
<tr>
<td>21</td>
<td>0033</td>
<td>$ALT1/$ALT1A</td>
<td>Disk error—unrecoverable disk operation</td>
</tr>
<tr>
<td>22</td>
<td>0034</td>
<td>$ALT1/$ALT1A/$ALT2A</td>
<td>Disk error—unrecoverable hardware error</td>
</tr>
<tr>
<td>23</td>
<td>0035</td>
<td>$ALT1/$ALT1A</td>
<td>Disk error—unrecoverable or invalid sector</td>
</tr>
<tr>
<td>24</td>
<td>0036</td>
<td>$ALT2/$ALT2A</td>
<td>Disk error—no alternative sectors available</td>
</tr>
<tr>
<td>25</td>
<td>0037</td>
<td>$ALT1,$ALT2A/$ALT2A/ALT4A</td>
<td>Disk error—defective disk</td>
</tr>
<tr>
<td>26</td>
<td>0038</td>
<td>$ALT3</td>
<td>Disk error—data accessed may be invalid</td>
</tr>
<tr>
<td>27</td>
<td>0039</td>
<td>$IOIOCH</td>
<td>Address translation error on diskette IOB address</td>
</tr>
<tr>
<td>28</td>
<td>0040</td>
<td>$IOIOCH</td>
<td>Invalid diskette data buffer address</td>
</tr>
<tr>
<td>29</td>
<td>0041</td>
<td>$CP0</td>
<td>Dump storage requested by Reset/CE Start</td>
</tr>
<tr>
<td>2A</td>
<td>0042</td>
<td>$NUAB2</td>
<td>Error TCB is the command processor TCB</td>
</tr>
<tr>
<td>2B</td>
<td>0043</td>
<td>$NUAB2</td>
<td>Error TCB is not on the TCB chain</td>
</tr>
<tr>
<td>2C</td>
<td>0044</td>
<td>$NUMSER2</td>
<td>Program size larger than main storage user area</td>
</tr>
<tr>
<td>2D</td>
<td>0045</td>
<td>$NUAB2</td>
<td>Error TCB is already in abnormal termination</td>
</tr>
<tr>
<td>2E</td>
<td>0046</td>
<td>$ALT3</td>
<td>Disk error—read error during system I/O function</td>
</tr>
<tr>
<td>2F</td>
<td>0047</td>
<td>$NUMSER/$NUMSER2</td>
<td>Main storage 2K-segment error</td>
</tr>
<tr>
<td>30</td>
<td>0048</td>
<td>$HC2</td>
<td>Unrecoverable main storage processor error</td>
</tr>
<tr>
<td>31</td>
<td>0049</td>
<td>$NUAB2</td>
<td>Disk error—main storage dump not completed</td>
</tr>
<tr>
<td>32</td>
<td>0050</td>
<td>$NULC/$MRALD</td>
<td>Disk error—loading control storage module</td>
</tr>
<tr>
<td>33</td>
<td>0051</td>
<td>$ALT1/$ALT1A</td>
<td>Invalid disk data buffer address</td>
</tr>
<tr>
<td>34</td>
<td>0052</td>
<td>$NU1</td>
<td>Invalid assign SVC or free SVC parameters</td>
</tr>
<tr>
<td>35</td>
<td>0053</td>
<td>$NU2/$NU2A</td>
<td>Disk error—loading control storage transient</td>
</tr>
<tr>
<td>36</td>
<td>0054</td>
<td>$NU1</td>
<td>Invalid sector address calculated on TWA request</td>
</tr>
<tr>
<td>37</td>
<td>0055</td>
<td>$NU2/$NU2A</td>
<td>Nonprivileged program accessing privileged transient</td>
</tr>
<tr>
<td>38</td>
<td>0056</td>
<td>$NU1</td>
<td>Dump storage requested by address compare service aid</td>
</tr>
<tr>
<td>Hex</td>
<td>Dec</td>
<td>Message Issuing Module</td>
<td>Error Message</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>-------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>39</td>
<td>0057</td>
<td>$WS1</td>
<td>End of TUB chain found by work station IOCH</td>
</tr>
<tr>
<td>3A</td>
<td>0058</td>
<td>$WS1</td>
<td>Invalid I/O device address in a work station IOB</td>
</tr>
<tr>
<td>3B</td>
<td>0059</td>
<td>$NUWE</td>
<td>Permanent local work station controller error</td>
</tr>
<tr>
<td>3C</td>
<td>0060</td>
<td>$NU1</td>
<td>Permanent assign failure</td>
</tr>
<tr>
<td>3D</td>
<td>0061</td>
<td>$NU3</td>
<td>Invalid transfer instruction</td>
</tr>
<tr>
<td>3E</td>
<td>0062</td>
<td>$MRF</td>
<td>Invalid MICR reader/sorter IOB parameter</td>
</tr>
<tr>
<td>3F</td>
<td>0063</td>
<td>$MRF</td>
<td>ATR load error on MICR reader/sorter IOB address</td>
</tr>
<tr>
<td>40</td>
<td>0064</td>
<td>$MRF</td>
<td>ATR load error on MICR reader/sorter IOB data buffer address</td>
</tr>
<tr>
<td>41</td>
<td>0065</td>
<td>$NUURL</td>
<td>ATR load error while logging MICR reader/sorter data</td>
</tr>
<tr>
<td>42</td>
<td>0066</td>
<td>$MRF</td>
<td>MICR reader/sorter error recovery block not found</td>
</tr>
<tr>
<td>43</td>
<td>0067</td>
<td>$NUWNL</td>
<td>Address translation error—logging remote work station data</td>
</tr>
<tr>
<td>44</td>
<td>0068</td>
<td>$NU1</td>
<td>Address translation error—executing MOVEI SVC</td>
</tr>
<tr>
<td>45</td>
<td>0069</td>
<td>NUER</td>
<td>Invalid ID used on MOVEI SVC</td>
</tr>
<tr>
<td>46</td>
<td>0070</td>
<td>$IOIOCH, $16IOCH</td>
<td>Invalid diskette sector address</td>
</tr>
<tr>
<td>47</td>
<td>0071</td>
<td>$NU3</td>
<td>Machine check during scientific execution</td>
</tr>
<tr>
<td>48</td>
<td>0072</td>
<td>$FD2</td>
<td>Invalid disk interrupt</td>
</tr>
<tr>
<td>49</td>
<td>0073</td>
<td>$FD2</td>
<td>Disk error—interface parity check</td>
</tr>
<tr>
<td>4A</td>
<td>0074</td>
<td>$FD2</td>
<td>Disk error—unrecoverable adapter check</td>
</tr>
<tr>
<td>4B</td>
<td>0075</td>
<td>$ALT3</td>
<td>Disk error, but no disk error recovery block found</td>
</tr>
<tr>
<td>EA</td>
<td>0234</td>
<td>#DDXL</td>
<td>Unexpected return code while extending a file</td>
</tr>
<tr>
<td>EB</td>
<td>0235</td>
<td>#CTEIF</td>
<td>Program check in termination exit routine</td>
</tr>
<tr>
<td>EC</td>
<td>0236</td>
<td>#CTECM</td>
<td>No main storage for this task</td>
</tr>
<tr>
<td>ED</td>
<td>0237</td>
<td>#SVERP</td>
<td>All console SYSLOG sectors in use—have more messages</td>
</tr>
<tr>
<td>EE</td>
<td>0238</td>
<td>#SVWSR</td>
<td>I/O error at system console during MSIPL</td>
</tr>
<tr>
<td>Hex</td>
<td>Dec</td>
<td>Message Issuing Module</td>
<td>Error Message</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>F0</td>
<td>0240</td>
<td>#CLSG</td>
<td>Program tried to cancel a noncancelable task</td>
</tr>
<tr>
<td>F1</td>
<td>0241</td>
<td>$MARCK</td>
<td>Disk error compressing the system library</td>
</tr>
<tr>
<td>F2</td>
<td>0242</td>
<td>#CTEPR</td>
<td>Deallocation or termination found printer specification block with no TUB</td>
</tr>
<tr>
<td>F3</td>
<td>0243</td>
<td>#CTEIF</td>
<td>Command processor task or user task has no JCB</td>
</tr>
<tr>
<td>F4</td>
<td>0244</td>
<td>#CLSG, #CLST, #CLSW, #CLSP</td>
<td>MICS 3700, 3712, or 3713 not found in ##MSG2 member</td>
</tr>
<tr>
<td>F5</td>
<td>0245</td>
<td>#CLSG</td>
<td>MICS 3710 or 3711 not found in ##MSG2 message member</td>
</tr>
<tr>
<td>F6</td>
<td>0246</td>
<td>#CLXS</td>
<td>SYSLOG function called before MSIPL completed</td>
</tr>
<tr>
<td>F7</td>
<td>0247</td>
<td>#MARXF</td>
<td>SSP module has invalid where-to-go or format index table</td>
</tr>
<tr>
<td>F9</td>
<td>0249</td>
<td>#MSNIP</td>
<td>Required SSP module not found during MSIPL</td>
</tr>
<tr>
<td>FA</td>
<td>0250</td>
<td>#CTEPR</td>
<td>Format 5 extents partially free during file delete</td>
</tr>
<tr>
<td>FB</td>
<td>0251</td>
<td>#CTEPR</td>
<td>Format 5 file count is less than zero</td>
</tr>
<tr>
<td>FC</td>
<td>0252</td>
<td>#CTEPR</td>
<td>An AFA format 1 has an invalid file type</td>
</tr>
<tr>
<td>FD</td>
<td>0253</td>
<td>#CTEPR</td>
<td>Unexpected return code from diskette VTOC read/write</td>
</tr>
<tr>
<td>FE</td>
<td>0254</td>
<td>#CTEPR</td>
<td>Unexpected return code from disk VTOC read/write</td>
</tr>
<tr>
<td>FF</td>
<td>0255</td>
<td>#CTEIF</td>
<td>Invalid recursive call to termination</td>
</tr>
</tbody>
</table>

**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.
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83-100 Error Counter Table for 62EH
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83-200 Error History Information for 62EH
83-300 Disk Sense Bytes for 62EH
83-310 Disk Not Ready Checks (DNRDY)
83-313 Alternative Sector Processing (ALSP)
83-315 Sector Sync Check (SSCK)
83-317 Off Track Check (OTCK)
83-319 Cyclic Redundancy Check (CRC)
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83-325 Cycle Steal Overrun (OVRN)
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Flag Byte (F) for 62EH
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Adapter Check
Channel Overrun Check
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Tag Parity Check
CA Data Bus Parity Check
Inbound Interface Error
End of Operation
End of Track
Data Operation Ready
Scan Argument Transfer Complete
Any Error
File Select Bits 2 and 1
Forced End of Operation
Read/Write/Scan Busy
Alternative Sector Processing
File Configuration
Brake Applied
Track Unavailable
Command Error
Data Unsafe
Seek Incomplete
Home
Disk Not Ready
Cyclic Redundancy Check (CRC)
Common Adapter Parity Check
Channel Interface Parity Check
Write Gate Return Check
No Record Found (NRF)
Not Valid Command Parameters
Missing Sector Pulse Check
Time-out Check
Disk Not Attached
Not Valid I/O Buffer Address
Scan Equal Hit
Scan Not Hit
62PC Interface Error
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>83-900</td>
<td>Command Code for 62PC</td>
</tr>
<tr>
<td>83-911</td>
<td>Command Modifier for 62PC</td>
</tr>
<tr>
<td>83-912</td>
<td>Disk Status for 62PC</td>
</tr>
<tr>
<td>83-921</td>
<td>Current Cylinder Address (CUR CYL) for 62PC</td>
</tr>
<tr>
<td>83-931</td>
<td>Previous Cylinder Address (PREV CYL) for 62PC</td>
</tr>
<tr>
<td>83-941</td>
<td>Multiple Sector Control Byte (N) for 62PC</td>
</tr>
<tr>
<td>83-951</td>
<td>Flag Byte (F) for 62PC</td>
</tr>
<tr>
<td>83-961</td>
<td>Cylinder Address (CC) for 62PC</td>
</tr>
<tr>
<td>82-971</td>
<td>Head Address (H) for 62PC</td>
</tr>
<tr>
<td>83-981</td>
<td>Sector Address (S) for 62PC</td>
</tr>
<tr>
<td>83-991</td>
<td>Retry Count for 62PC</td>
</tr>
</tbody>
</table>
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 83-83 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.
## I/O COUNTER TABLE FOR 62EH

### I/O COUNTER TABLE FOR DISK DRIVE A (OR B)

<table>
<thead>
<tr>
<th>DATE LAST RESET</th>
<th>78/02/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERIFIES</td>
<td>115654</td>
</tr>
<tr>
<td>WRITES</td>
<td>114740</td>
</tr>
<tr>
<td>READS OR SCAN READS</td>
<td>1051585</td>
</tr>
<tr>
<td>NONZERO SEEKS</td>
<td>533972</td>
</tr>
</tbody>
</table>

## 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)

<table>
<thead>
<tr>
<th>TEMPORARY</th>
<th>PERMANENT</th>
<th>DESCRIPTION</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISK NOT READY CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-311</td>
</tr>
<tr>
<td>SECTOR SYNC CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-315</td>
</tr>
<tr>
<td>OFF-TRACK CHECKS</td>
<td>10</td>
<td>0</td>
<td>83-317</td>
</tr>
<tr>
<td>CYCLIC REDUNDANCY CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-319</td>
</tr>
<tr>
<td>DBO PARITY CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-321</td>
</tr>
<tr>
<td>WRITE DATA ECHO CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-323</td>
</tr>
<tr>
<td>CYCLE STEAL OVERRUNS</td>
<td>0</td>
<td>0</td>
<td>83-325</td>
</tr>
<tr>
<td>DATA UNSAFE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-329</td>
</tr>
<tr>
<td>NOT VALID SEEK ADDRESS CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-331</td>
</tr>
<tr>
<td>ATTACHMENT EQUIPMENT CHECKS</td>
<td>12</td>
<td>0</td>
<td>83-333</td>
</tr>
<tr>
<td>NO RECORDS FOUND</td>
<td>4</td>
<td>0</td>
<td>83-335</td>
</tr>
<tr>
<td>SEEK CHECKS</td>
<td>2</td>
<td>0</td>
<td>83-341</td>
</tr>
<tr>
<td>SERDES CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-343</td>
</tr>
<tr>
<td>WRITE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-345</td>
</tr>
<tr>
<td>CHANNEL TRANSFER CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-347</td>
</tr>
<tr>
<td>PLO OUT OF SYNC CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-349</td>
</tr>
<tr>
<td>INTERRUPT TIMEOUT CHECKS</td>
<td>2</td>
<td>0</td>
<td>83-351</td>
</tr>
<tr>
<td>SECTOR CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-357</td>
</tr>
<tr>
<td>SELECT UNSAFE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-361</td>
</tr>
<tr>
<td>WRITE UNSAFE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-363</td>
</tr>
<tr>
<td>BRAKE FAILURE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-365</td>
</tr>
<tr>
<td>SERVO UNSAFE CHECKS</td>
<td>0</td>
<td>0</td>
<td>83-367</td>
</tr>
<tr>
<td>NOT VALID I/O BUFFER ADDRESS</td>
<td>0</td>
<td>0</td>
<td>83-375</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th>COMMAND CODE</th>
<th>SENSE BYTES</th>
<th>CUR CYL</th>
<th>PREV CYL</th>
<th>CONTROL FIELD</th>
<th>RETRY COUNT</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2 04</td>
<td>10 16 02 81 01 00</td>
<td>01 2C 00 00 3F 00 01 2C 02 37 10 76/11/16 00 01 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 04</td>
<td>10 16 02 81 01 00</td>
<td>01 2C 00 00 3F 00 01 2C 02 37 10 76/11/16 00 01 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 04</td>
<td>10 16 02 81 01 00</td>
<td>01 2C 00 00 3F 00 01 2C 02 37 10 76/11/15 00 00 43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2 04</td>
<td>10 16 02 81 01 00</td>
<td>01 2C 00 00 3F 00 01 2C 02 37 10 76/11/15 00 00 43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 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.

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Description</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Disk not ready check</td>
<td>83-311</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Alternative sector processing</td>
<td>83-313</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Sector sync check</td>
<td>83-315</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Off track check</td>
<td>83-317</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Cyclic redundancy check</td>
<td>83-319</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>DBO parity check</td>
<td>83-321</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Write data echo check</td>
<td>83-323</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Cycle steal overruns</td>
<td>83-325</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>No operation</td>
<td>83-327</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Data unsafe check</td>
<td>83-329</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Not valid seek address</td>
<td>83-331</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Attachment equipment check</td>
<td>83-333</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>No records found</td>
<td>83-335</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Scan equal hit</td>
<td>83-337</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Scan not hit</td>
<td>83-339</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Seek check</td>
<td>83-341</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>SERDES check</td>
<td>83-343</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Write check</td>
<td>83-345</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Channel transfer check</td>
<td>83-347</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Phase lock oscillator (PLO) out of sync check</td>
<td>83-349</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Interrupt time-out check</td>
<td>83-351</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Behind home</td>
<td>83-353</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>ID orientation correct</td>
<td>83-355</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Sector check</td>
<td>83-357</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Second drive installed</td>
<td>83-359</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Select unsafe check</td>
<td>83-361</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Write unsafe check</td>
<td>83-363</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Brake failure check</td>
<td>83-365</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Servo unsafe check</td>
<td>83-367</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Disk storage size indicator</td>
<td>83-373</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>Not valid I/O buffer address check</td>
<td>83-375</td>
</tr>
<tr>
<td>1-5</td>
<td></td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>6, 7</td>
<td></td>
<td>Head select sense bits</td>
<td>83-387</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Bit 6</th>
<th>Bit 7</th>
<th>Head in Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

1This 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:

<table>
<thead>
<tr>
<th>Bits</th>
<th>4 5 6 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Seek</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>Commands Recalibrate</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>Read Data</td>
<td>0 0 0 1</td>
</tr>
<tr>
<td>Commands ID</td>
<td>0 0 0 1</td>
</tr>
<tr>
<td>Diagnostic Verify</td>
<td>0 0 0 1</td>
</tr>
<tr>
<td>Write Data</td>
<td>0 0 1 0</td>
</tr>
<tr>
<td>Commands ID</td>
<td>0 0 1 0</td>
</tr>
<tr>
<td>Scan Read Equal</td>
<td>0 0 1 1</td>
</tr>
<tr>
<td>Commands Low or Equal</td>
<td>0 0 1 1</td>
</tr>
<tr>
<td>High or Equal</td>
<td>0 0 1 1</td>
</tr>
</tbody>
</table>

83-411 COMMAND MODIFIER (MDR) FOR 62EH

The bits of the command modifier mean:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>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.</td>
</tr>
<tr>
<td>1-3</td>
<td>Not assigned</td>
</tr>
<tr>
<td>4</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>Control storage address select. Causes the disk data field address to point to control storage.</td>
</tr>
</tbody>
</table>

6-7 Modifier bits. Describes disk start input/output command functions.

<table>
<thead>
<tr>
<th>Bits</th>
<th>6 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Seek</td>
<td>0 0</td>
</tr>
<tr>
<td>Commands Recalibrate</td>
<td>0 1</td>
</tr>
<tr>
<td>Read Data</td>
<td>0 1</td>
</tr>
<tr>
<td>Commands ID</td>
<td>0 1</td>
</tr>
<tr>
<td>Diagnostic Verify</td>
<td>1 1</td>
</tr>
<tr>
<td>Write Data</td>
<td>0 0</td>
</tr>
<tr>
<td>Commands ID</td>
<td>0 1</td>
</tr>
<tr>
<td>Scan Read Equal</td>
<td>0 0</td>
</tr>
<tr>
<td>Commands Low or Equal</td>
<td>0 1</td>
</tr>
<tr>
<td>High or Equal</td>
<td>1 0</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Not assigned</td>
</tr>
<tr>
<td>5</td>
<td>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.</td>
</tr>
<tr>
<td>6-7</td>
<td>Sector condition bits, assigned meaning:</td>
</tr>
<tr>
<td></td>
<td>00—good primary sector</td>
</tr>
<tr>
<td></td>
<td>10—failing primary sector</td>
</tr>
<tr>
<td></td>
<td>01—good alternative sector</td>
</tr>
<tr>
<td></td>
<td>11—failing alternative sector</td>
</tr>
</tbody>
</table>

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.

83-461  CYLINDER ADDRESS (CC) FOR 62EH

The CC (cylinder address) is a two-byte hexadecimal address. Valid cylinder addresses are:

<table>
<thead>
<tr>
<th>Storage Size (Megabytes)</th>
<th>Valid Cylinder Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.6</td>
<td>000 – 202 or hex 00 to C9</td>
</tr>
<tr>
<td>13.2</td>
<td>000 – 302 or hex 00 to 12E</td>
</tr>
</tbody>
</table>
### I/O COUNTER TABLE FOR 62PC

**I/O COUNTER TABLE FOR DISK DRIVE A (B, C, OR D)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Last Reset</th>
<th>Description</th>
</tr>
</thead>
</table>
| 00/00/00 | 00/00/00 | 83-550

**Description**

- **Verifies**
  - 296878
- **Writes**
  - 296887
- **Reads or Scan Reads**
  - 296075
- **Nonzero Seeks**
  - 592962

### 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)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Temporary</th>
<th>Permanent</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter Checks</td>
<td>0</td>
<td>0</td>
<td>83-811</td>
</tr>
<tr>
<td>Channel Overrun Checks</td>
<td>0</td>
<td>0</td>
<td>83-813</td>
</tr>
<tr>
<td>Tag Parity Checks</td>
<td>0</td>
<td>0</td>
<td>83-817</td>
</tr>
<tr>
<td>CA Data Bus Parity Checks</td>
<td>0</td>
<td>0</td>
<td>83-819</td>
</tr>
<tr>
<td>Forced End Operations</td>
<td>0</td>
<td>0</td>
<td>83-835</td>
</tr>
<tr>
<td>Brake Applied Checks</td>
<td>0</td>
<td>0</td>
<td>83-843</td>
</tr>
<tr>
<td>Track Unavailable Checks</td>
<td>0</td>
<td>0</td>
<td>83-845</td>
</tr>
<tr>
<td>Command Checks</td>
<td>0</td>
<td>0</td>
<td>83-847</td>
</tr>
<tr>
<td>Data Unsafe Checks</td>
<td>0</td>
<td>0</td>
<td>83-849</td>
</tr>
<tr>
<td>Seek Incomplete Checks</td>
<td>0</td>
<td>0</td>
<td>83-851</td>
</tr>
<tr>
<td>Disk Not Ready Checks</td>
<td>0</td>
<td>0</td>
<td>83-855</td>
</tr>
<tr>
<td>Cyclic Redundancy Checks</td>
<td>0</td>
<td>1</td>
<td>83-857</td>
</tr>
<tr>
<td>Common Adapter Parity Checks</td>
<td>0</td>
<td>0</td>
<td>83-859</td>
</tr>
<tr>
<td>Channel Interface Parity Checks</td>
<td>0</td>
<td>0</td>
<td>83-861</td>
</tr>
<tr>
<td>Write Gate Return Checks</td>
<td>0</td>
<td>0</td>
<td>83-863</td>
</tr>
<tr>
<td>No Records Found</td>
<td>0</td>
<td>0</td>
<td>83-865</td>
</tr>
<tr>
<td>Not Valid Command Parameter CHKS</td>
<td>0</td>
<td>0</td>
<td>83-867</td>
</tr>
<tr>
<td>Missing Sector Pulse Checks</td>
<td>0</td>
<td>0</td>
<td>83-869</td>
</tr>
<tr>
<td>Timeout Checks</td>
<td>0</td>
<td>0</td>
<td>83-871</td>
</tr>
<tr>
<td>Disk Not Attached Checks</td>
<td>0</td>
<td>0</td>
<td>83-873</td>
</tr>
<tr>
<td>Not Valid I/O Buffer Address CHK</td>
<td>0</td>
<td>0</td>
<td>83-875</td>
</tr>
<tr>
<td>62PC Interface Errors</td>
<td>0</td>
<td>0</td>
<td>83-881</td>
</tr>
</tbody>
</table>
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.

83-700  ERROR HISTORY INFORMATION FOR 62PC

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.
<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Description</th>
<th>Paragraph</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Adapter check</td>
<td>83-811</td>
</tr>
<tr>
<td>1</td>
<td>Channel overrun check</td>
<td>83-813</td>
</tr>
<tr>
<td>2</td>
<td>Parallel DBO parity check</td>
<td>83-815</td>
</tr>
<tr>
<td>0</td>
<td>3  Tag parity check</td>
<td>83-817</td>
</tr>
<tr>
<td>4</td>
<td>CA data bus parity check</td>
<td>83-819</td>
</tr>
<tr>
<td>5</td>
<td>Inbound interface error</td>
<td>83-821</td>
</tr>
<tr>
<td>6-7</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>End of operation</td>
<td>83-823</td>
</tr>
<tr>
<td>1</td>
<td>End of track</td>
<td>83-825</td>
</tr>
<tr>
<td>2</td>
<td>Data operation ready</td>
<td>83-827</td>
</tr>
<tr>
<td>1</td>
<td>3  Not used</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Scan argument transfer complete</td>
<td>83-829</td>
</tr>
<tr>
<td>5</td>
<td>Any error</td>
<td>83-831</td>
</tr>
<tr>
<td>6-7</td>
<td>File select bits 2 and 1</td>
<td>83-833</td>
</tr>
<tr>
<td>0</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Forced end operation</td>
<td>83-835</td>
</tr>
<tr>
<td>2</td>
<td>Read/write/scan busy</td>
<td>83-837</td>
</tr>
<tr>
<td>3</td>
<td>Alternative sector processing</td>
<td>83-839</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>5-7</td>
<td>File configuration</td>
<td>83-841</td>
</tr>
<tr>
<td>0</td>
<td>Not used but always 1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Brake applied</td>
<td>83-843</td>
</tr>
<tr>
<td>2</td>
<td>Track unavailable</td>
<td>83-845</td>
</tr>
<tr>
<td>3</td>
<td>Command error</td>
<td>83-847</td>
</tr>
<tr>
<td>4</td>
<td>Data unsafe</td>
<td>83-849</td>
</tr>
<tr>
<td>5</td>
<td>Seek incomplete</td>
<td>83-851</td>
</tr>
<tr>
<td>6</td>
<td>Home</td>
<td>83-853</td>
</tr>
<tr>
<td>7</td>
<td>Disk not ready</td>
<td>83-855</td>
</tr>
</tbody>
</table>

83-800 DISK SENSE BYTES FOR 62PC

0  Cyclic redundancy check 83-857 (CRC)
1  Common adapter parity check 83-859
2  Channel interface parity check 83-861
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 83-877
5  Scan equal hit 83-877
6  Scan not hit 83-879
7  62PC interface error 83-881
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.

<table>
<thead>
<tr>
<th>Bit 2</th>
<th>Bit 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>File A</td>
<td>0 0</td>
</tr>
<tr>
<td>File B</td>
<td>0 1</td>
</tr>
<tr>
<td>File C</td>
<td>1 0</td>
</tr>
<tr>
<td>File D</td>
<td>1 1</td>
</tr>
</tbody>
</table>

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.

83-839 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.
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.

83-861  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.
This check indicates that 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:

<table>
<thead>
<tr>
<th>Command/Commands</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seek</td>
<td>0000</td>
</tr>
<tr>
<td>Recalibrate</td>
<td>0000</td>
</tr>
<tr>
<td>Data ID</td>
<td>0001</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>0001</td>
</tr>
<tr>
<td>Verify</td>
<td>0001</td>
</tr>
<tr>
<td>Data ID</td>
<td>0010</td>
</tr>
<tr>
<td>Data ID</td>
<td>0010</td>
</tr>
<tr>
<td>Equal</td>
<td>0011</td>
</tr>
<tr>
<td>Low or Equal</td>
<td>0011</td>
</tr>
<tr>
<td>High or Equal</td>
<td>0011</td>
</tr>
</tbody>
</table>

**83-911 COMMAND MODIFIER FOR 62PC**

The bits of the command modifier mean:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Data repeat control. Causes a single 256-byte field to be used for the requested operation (valid only for read and write data).</td>
</tr>
<tr>
<td>1</td>
<td>Suppress read verify—Inhibits the read verify after a write operation (valid only for write data and write ID).</td>
</tr>
<tr>
<td>2</td>
<td>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).</td>
</tr>
<tr>
<td>3</td>
<td>Not used.</td>
</tr>
<tr>
<td>4</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>Control storage address select—Causes the disk data field address to point to control storage.</td>
</tr>
<tr>
<td>6-7</td>
<td>Modifier bits—Describes disk start input/output command function.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Command/Commands</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Seek</td>
<td>0 0</td>
</tr>
<tr>
<td>Commands Recalibrate</td>
<td>0 1</td>
</tr>
<tr>
<td>Read Data ID</td>
<td>0 0</td>
</tr>
<tr>
<td>Commands ID</td>
<td>0 1</td>
</tr>
<tr>
<td>Diagnostic Verify</td>
<td>0 1</td>
</tr>
<tr>
<td>Write Data ID</td>
<td>0 1</td>
</tr>
<tr>
<td>Write ID</td>
<td>0 1</td>
</tr>
<tr>
<td>Scan Low or Equal</td>
<td>0 0</td>
</tr>
<tr>
<td>Read High or Equal</td>
<td>1 0</td>
</tr>
<tr>
<td>Commands</td>
<td>1 0</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>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.</td>
</tr>
<tr>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>Not used.</td>
</tr>
<tr>
<td>4</td>
<td>Displaced sector. This bit is used to flag that a sector is moved by one from its normal location.</td>
</tr>
<tr>
<td>5</td>
<td>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.)</td>
</tr>
<tr>
<td>6</td>
<td>Manufacturing assigned defective sector. This bit is used to flag sectors that were found defective at the factory.</td>
</tr>
<tr>
<td>7</td>
<td>Assigned alternative. This bit is used to flag sectors on the alternative cylinder that have been assigned a new sector number.</td>
</tr>
</tbody>
</table>
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

84-010  How to Use Diskette Error Information
84-200  Error History Information Sample for Level 1
84-250  Error Counter Table Sample for Level 1
84-260  I/O Counter Table Sample for Level 1
84-275  Command Code and Modifier for Level 1
84-300  Sense Bytes—General Information for Level 1
        Sense Byte 0
        Sense Byte 1
        Sense Byte 2
        Sense Byte 3
84-350  Retry Count for Level 1
84-360  Previous Cylinder (PREV) for Level 1
84-370  Start Cylinder for Level 1
84-400  Cylinder Address (CYL) for Level 1
84-410  Head Address (HD) for Level 1
84-420  Record Address (REC) for Level 1
84-430  Record Size (SZ) for Level 1

84-700  Error History Information Sample for Level 2
84-750  Error Counter Table Sample for Level 2
84-760  I/O Counter Table Sample for Level 2
84-770  Slot Number (SLOT NBR) for Level 2
84-775  Command Code and Modifier for Level 2
84-800  Sense Bytes—General Information for Level 2
        Sense Byte 0
        Sense Byte 1
        Sense Byte 2
        Sense Byte 3
        Sense Byte 4
        Sense Byte 5
84-850  Retry Count for Level 2
84-860  Previous Cylinder (PREV) for Level 2
84-870  Start Cylinder for Level 2
84-900  Cylinder Address (CYL) for Level 2
84-910  Head Address (HD) for Level 2
84-920  Record Address (REC) for Level 2
84-930  Record Size (SZ) for Level 2
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

<table>
<thead>
<tr>
<th>Command Code and Modifier</th>
<th>HEX</th>
<th>Cylinder Address</th>
<th>Start Cylinder</th>
<th>Previous Cylinder</th>
<th>Retry Count</th>
<th>Record Address</th>
<th>Record Size</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>84-275</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84-410</td>
<td>84-430</td>
<td>77/04/13 11:12:49</td>
</tr>
<tr>
<td>Sense Bytes</td>
<td>07 00 14 5F 09 02 01 01 00 01 02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84-400</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84-370</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84-360</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>84-350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 84-250  ERROR COUNTER TABLE SAMPLE FOR LEVEL 1

**ERROR COUNTER TABLE FOR DISKETTE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Temporary</th>
<th>Permanent</th>
<th>Description</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing Data Address Marks</td>
<td>0</td>
<td>0</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>ID Cyclic Redundancy Checks</td>
<td>0</td>
<td>0</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>Data Cyclic Redundancy Checks</td>
<td>5</td>
<td>9</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>Head Mismatches</td>
<td>0</td>
<td>0</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>Record Mismatches</td>
<td>0</td>
<td>20</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>Record Length Mismatches</td>
<td>0</td>
<td>20</td>
<td>84-310</td>
<td>8402</td>
</tr>
<tr>
<td>No Op Conditions</td>
<td>0</td>
<td>0</td>
<td>84-320</td>
<td></td>
</tr>
<tr>
<td>Invalid Control Record Checks</td>
<td>0</td>
<td>0</td>
<td>84-320</td>
<td>8403</td>
</tr>
<tr>
<td>Write Verify Mismatches</td>
<td>5</td>
<td>9</td>
<td>84-320</td>
<td>8403</td>
</tr>
<tr>
<td>Fast Checks</td>
<td>0</td>
<td>0</td>
<td>84-330</td>
<td>8403</td>
</tr>
<tr>
<td>Write Errors</td>
<td>0</td>
<td>0</td>
<td>84-330</td>
<td>8403</td>
</tr>
<tr>
<td>ID Not Found</td>
<td>0</td>
<td>25</td>
<td>84-330</td>
<td>8403</td>
</tr>
<tr>
<td>Read Overrun Checks</td>
<td>0</td>
<td>0</td>
<td>84-330</td>
<td>8403</td>
</tr>
<tr>
<td>Unexpected Erase Current Present</td>
<td>0</td>
<td>0</td>
<td>84-340</td>
<td>8403</td>
</tr>
</tbody>
</table>

**DATE LAST RESET 08/31/77**

### 84-260  I/O COUNTER TABLE SAMPLE FOR LEVEL 1

**I/O COUNTER TABLE FOR DISKETTE**

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reads</td>
<td>2150</td>
</tr>
<tr>
<td>Writes</td>
<td>7814</td>
</tr>
<tr>
<td>Seeks</td>
<td>18799</td>
</tr>
</tbody>
</table>

**DATE LAST RESET 78/03/27**
### 84-275 COMMAND CODE AND MODIFIER FOR LEVEL 1

<table>
<thead>
<tr>
<th>Command Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>Control Seek</td>
</tr>
<tr>
<td>0001</td>
<td>Read Data</td>
</tr>
<tr>
<td>0010</td>
<td>Read Data and Control Record</td>
</tr>
<tr>
<td>0011</td>
<td>Read ID</td>
</tr>
<tr>
<td>0100</td>
<td>Not Used</td>
</tr>
<tr>
<td>0101</td>
<td>Write Data and Verify</td>
</tr>
<tr>
<td>0110</td>
<td>Write Control Record and Verify</td>
</tr>
<tr>
<td>0111</td>
<td>Write ID and Verify</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>WR</th>
<th>Sense Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR1 (H)</td>
<td>Sense byte 0</td>
</tr>
<tr>
<td>WR1 (L)</td>
<td>Sense byte 1</td>
</tr>
<tr>
<td>WR3 (H)</td>
<td>Sense byte 2</td>
</tr>
<tr>
<td>WR3 (L)</td>
<td>Sense byte 3</td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Byte Bits</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0</td>
<td>Device address or port address not valid.</td>
</tr>
<tr>
<td>0 0 1</td>
<td>Command not valid.</td>
</tr>
<tr>
<td>0 1 0</td>
<td>Not ready–non-seek command.</td>
</tr>
<tr>
<td>0 1 1</td>
<td>Not ready–seek command.</td>
</tr>
<tr>
<td>0 1 0 1</td>
<td>Errors not reset.</td>
</tr>
<tr>
<td>0 1 1 0</td>
<td>Reject head 1 operation.</td>
</tr>
<tr>
<td>0 1 1 1</td>
<td>Reject MFM operation.</td>
</tr>
<tr>
<td></td>
<td>Write gate or erase gate on.</td>
</tr>
</tbody>
</table>

If the no operation bit is off, byte 0 bits have the following meanings:

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0</td>
<td>Missing data ad-</td>
<td>Data record not found after an ID field.</td>
</tr>
<tr>
<td></td>
<td>dress mark</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ID cyclic</td>
<td>Cyclic redundancy check character for the ID field did not compare.</td>
</tr>
<tr>
<td></td>
<td>redundancy check</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Data cyclic</td>
<td>Cyclic redundancy check character for the data field did not compare.</td>
</tr>
<tr>
<td></td>
<td>redundancy check</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cylinder mismatch</td>
<td>The cylinder address byte of the ID field and the desired cylinder byte during ID search did not match.</td>
</tr>
<tr>
<td>4</td>
<td>Head mismatch</td>
<td>The head address byte of the ID field and the desired head byte during ID search did not match.</td>
</tr>
<tr>
<td>5</td>
<td>Record mismatch</td>
<td>The record address byte of any ID field and the desired record number during ID search did not match.</td>
</tr>
<tr>
<td>6</td>
<td>Record length mismatch</td>
<td>The record length byte of the ID field and the desired N-byte during ID search did not match.</td>
</tr>
<tr>
<td>7</td>
<td>Seek reverse</td>
<td>The last seek was in a reverse direction.</td>
</tr>
</tbody>
</table>
### Sense Byte 1

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0</td>
<td>No op condition</td>
<td>Command could not be executed because of outstanding status.</td>
</tr>
<tr>
<td>1</td>
<td>Invalid control check</td>
<td>The leftmost byte of a control record contained other than F or D. F = damaged record; D = deleted record.</td>
</tr>
<tr>
<td>2</td>
<td>Write verify mismatch</td>
<td>Data written does not match the main storage data field.</td>
</tr>
<tr>
<td>3</td>
<td>Control address mark found</td>
<td>Control address marker was found when performing a read data operation.</td>
</tr>
<tr>
<td>4</td>
<td>Error correction invoked</td>
<td>An error correction routine was used because a data address marker was missing or a cyclic redundancy check occurred during a read operation.</td>
</tr>
<tr>
<td>5</td>
<td>Write error</td>
<td>Indicates that either a write overrun, write parity check, missing erase current, or a data unsafe error was found during a write operation.</td>
</tr>
<tr>
<td>6</td>
<td>End of track</td>
<td>Last record on the track has been written or read with some records still waiting.</td>
</tr>
<tr>
<td>7</td>
<td>File busy</td>
<td>Data movement in process.</td>
</tr>
</tbody>
</table>

### Sense Byte 2

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 0</td>
<td>Fast check</td>
<td>The diskette speed is quicker than the maximum speed of 376 RPM.</td>
</tr>
<tr>
<td>1</td>
<td>Not ready</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Missing erase current</td>
<td>Erase current failed to turn on during a write operation.</td>
</tr>
<tr>
<td>3</td>
<td>ID not found</td>
<td>CHRN address could not be found.</td>
</tr>
<tr>
<td>4</td>
<td>Read overrun check</td>
<td>Minimum data movement rate was not maintained during a data movement.</td>
</tr>
<tr>
<td>5</td>
<td>Data mode</td>
<td>On = FM; off = MFM.</td>
</tr>
<tr>
<td>6</td>
<td>Write overrun check</td>
<td>Minimum data movement rate was not maintained during a data movement.</td>
</tr>
<tr>
<td>7</td>
<td>Write parity check</td>
<td>The DBO parity and the generated serial write data parity during a write operation did not match.</td>
</tr>
</tbody>
</table>

### Sense Byte 3

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0</td>
<td>Unexpected erase current</td>
<td>Erase current was on while not in write operation.</td>
</tr>
<tr>
<td>1</td>
<td>BPC line off</td>
<td>Diagnostic use only.</td>
</tr>
<tr>
<td>2</td>
<td>Drive type</td>
<td>On = 33FD, off = 53FD</td>
</tr>
<tr>
<td>3</td>
<td>Erase current off</td>
<td>Diagnostic use only.</td>
</tr>
<tr>
<td>4</td>
<td>Head 0 selected</td>
<td>Diagnostic use only.</td>
</tr>
<tr>
<td>5</td>
<td>Diskette type</td>
<td>On = diskette 1, off = diskette type 2D.</td>
</tr>
<tr>
<td>6</td>
<td>I/O working off</td>
<td>No device is busy.</td>
</tr>
<tr>
<td>7</td>
<td>Diskette working off</td>
<td>Diskette is not busy.</td>
</tr>
</tbody>
</table>
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
### ERROR HISTORY INFORMATION

#### SAMPLE FOR LEVEL 2

<table>
<thead>
<tr>
<th>ID</th>
<th>NBR</th>
<th>CODE</th>
<th>MDR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>COUNT</th>
<th>PREV</th>
<th>START CYL</th>
<th>HD</th>
<th>REC</th>
<th>SZ</th>
<th>YY/MM/DD</th>
<th>HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$INIT</td>
<td>01</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>0</td>
<td>04</td>
<td>09</td>
<td>0</td>
<td>FF</td>
<td>00</td>
<td>0</td>
<td>0</td>
<td>07</td>
</tr>
<tr>
<td>IPLIPL</td>
<td>00</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>9</td>
<td>D</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>IPLIPL</td>
<td>00</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>D</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>IPLIPL</td>
<td>00</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>D</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>IPLIPL</td>
<td>00</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>9</td>
<td>D</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>03</td>
</tr>
</tbody>
</table>

84-750  ERROR COUNTER TABLE SAMPLE

#### FOR LEVEL 2

| ERROR COUNTER TABLE FOR DISKETTE
<table>
<thead>
<tr>
<th>DATE</th>
<th>LAST</th>
<th>SET</th>
<th>00/00/00</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MISSING DATA ADDRESS MARKS</td>
<td>0</td>
<td>0</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>DATA CYCLIC REDUNDANCY CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>NO OP CONDITIONS</td>
<td>0</td>
<td>0</td>
<td>84-820</td>
<td></td>
</tr>
<tr>
<td>INVALID CONTROL RECORD CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-820</td>
<td></td>
</tr>
<tr>
<td>WRITE VERIFY MISMATCHES</td>
<td>0</td>
<td>0</td>
<td>84-820</td>
<td></td>
</tr>
<tr>
<td>FAST CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>WRITE ERRORS</td>
<td>0</td>
<td>0</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>ID NOT FOUND</td>
<td>0</td>
<td>4</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>BUFFER OVERRUN CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-830</td>
<td></td>
</tr>
<tr>
<td>UNEXPECTED ERASE CURRENT PRESENT</td>
<td>0</td>
<td>0</td>
<td>84-840</td>
<td></td>
</tr>
<tr>
<td>PARITY CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-842</td>
<td></td>
</tr>
<tr>
<td>INVALID COMMAND CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-842</td>
<td></td>
</tr>
<tr>
<td>TIMOUT CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-842</td>
<td></td>
</tr>
<tr>
<td>CARRIAGE BED FAILURES</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>PICKER FAILURES</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>FAILURE TO EJECT CHECKS</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>FAILURE TO PICK CHECKS</td>
<td>0</td>
<td>2</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>WINDOW MAGNET FAILURES</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>OPERATION OUT OF SEQUENCE ERRORS</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
<tr>
<td>WRITE/ERASE CURRENT PRESENT</td>
<td>0</td>
<td>0</td>
<td>84-844</td>
<td></td>
</tr>
</tbody>
</table>

1. Autoloader errors, only valid for 72MD.
2. Applies only to machines with old style picker.
# I/O Counter Table Sample for Level 2

The I/O counter table for diskette includes the following counters:

- **Reads**
- **Writes**
- **Seeks**
- **AutoLoader Operations**

The date last reset is 7/9/27.

## 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.

## Command Code and Modifier for Level 2

### Drive Command

<table>
<thead>
<tr>
<th>Command Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>Control Seek</td>
</tr>
<tr>
<td>0001</td>
<td>Read Data</td>
</tr>
<tr>
<td>0010</td>
<td>Read Data and Control Record</td>
</tr>
<tr>
<td>0011</td>
<td>Read ID</td>
</tr>
<tr>
<td>0100</td>
<td>Verify</td>
</tr>
<tr>
<td>0101</td>
<td>Write Data and Verify</td>
</tr>
<tr>
<td>0110</td>
<td>Write Control Record and Verify</td>
</tr>
<tr>
<td>0111</td>
<td>Write ID and Verify</td>
</tr>
</tbody>
</table>

### Autoloader Command (72MD only)

<table>
<thead>
<tr>
<th>Command Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Select Diskette</td>
</tr>
<tr>
<td>1001</td>
<td>Eject Diskette</td>
</tr>
<tr>
<td>1010</td>
<td>Orient AutoLoader</td>
</tr>
<tr>
<td>1011</td>
<td>Abort AutoLoader</td>
</tr>
</tbody>
</table>

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.
84-810 Sense Byte 0

If the no operation bit (byte 1, bit 0) is on, bits 0-3 of byte 0 have the following meanings:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bits</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Device address or port address not valid.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Command not valid.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Not ready–seek command.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Not ready–seek command.</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Hardware errors did not reset.</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Head 1 selected on a one-sided diskette.</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>MFIM command on a one-sided diskette.</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>Write gate or during read operation</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Autoloader command with a not-valid slot number.</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>IOB error.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Time-out on data mode operation.</td>
</tr>
</tbody>
</table>

If the no-operation bit is off, byte 0 bits have the following meanings:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Missing data address mark</td>
<td>Data record not found after an ID field.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Data cyclic redundancy check</td>
<td>Cyclic redundancy check character for the data field did not compare.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Cylinder mismatch</td>
<td>The cylinder address byte of the ID field and the desired cylinder byte during ID search did not match.</td>
</tr>
<tr>
<td></td>
<td>4-6</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Seek reverse</td>
<td>The last seek was in a reverse direction.</td>
</tr>
</tbody>
</table>

84-820 Sense Byte 1

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>No-op</td>
<td>Command could not be executed because of outstanding status.</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Not valid</td>
<td>The leftmost byte of a control record contained other than F or D. (F = damaged record; D = deleted record.)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Write</td>
<td>Data written does not match verify the main storage data field.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Control</td>
<td>Control address marker was found when performing a read data operation.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Error</td>
<td>An error correction routine was used because a data address marker was missing or a cyclic redundancy check occurred during a read operation.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Write error</td>
<td>Indicates that an error occurred during a write operation.</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>End of track</td>
<td>Last record on the track was written or read with some records still waiting.</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Channel busy</td>
<td>Data movement in process.</td>
</tr>
</tbody>
</table>
### 84-830 Sense Byte 2

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 0</td>
<td>Fast check</td>
<td>The diskette speed is quicker than the maximum speed of 376 RPM (33FD or 53FD) or 738 RPM (72MD).</td>
</tr>
<tr>
<td>1</td>
<td>Not ready</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Missing erase</td>
<td>Erase current failed to turn on during a write operation.</td>
</tr>
<tr>
<td>3</td>
<td>ID not found</td>
<td>CHRN address could not be found.</td>
</tr>
<tr>
<td>4</td>
<td>Buffer overrun</td>
<td>Minimum data rate was not maintained.</td>
</tr>
<tr>
<td>5</td>
<td>Data mode</td>
<td>On = FM; off = MFM. This bit is off only during data movement time of an MFM operation (should never log as off).</td>
</tr>
<tr>
<td>6</td>
<td>Buffer overrun</td>
<td>Minimum data rate out of the buffer was not maintained.</td>
</tr>
<tr>
<td>7</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>

### 84-840 Sense Byte 3

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 0</td>
<td>Unexpected erase</td>
<td>Erase current was on while not in write operation.</td>
</tr>
<tr>
<td>1</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drive type</td>
<td>On = 33FD; off = 53FD or 72MD.</td>
</tr>
<tr>
<td>3</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Head 0 selected</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Diskette type</td>
<td>On = diskette 1; off = diskette 2D.</td>
</tr>
<tr>
<td>6</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Diskette not busy</td>
<td>Diskette is not busy.</td>
</tr>
</tbody>
</table>

### 84-842 Sense Byte 4

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 0</td>
<td>Autoloader op end</td>
<td>Acceptable end of autoloader operation if bits 1 and 2 are off.</td>
</tr>
<tr>
<td>1</td>
<td>Autoloader error</td>
<td>Error occurred during an autoloader operation.</td>
</tr>
<tr>
<td>2</td>
<td>Autoloader parity check</td>
<td>Even parity on the autoloader command lines.</td>
</tr>
<tr>
<td>3</td>
<td>Autoloader attached</td>
<td>Diskette drive is a 72MD.</td>
</tr>
<tr>
<td>4</td>
<td>Autoloader command reject</td>
<td>The autoloader command can not be executed.</td>
</tr>
<tr>
<td>5</td>
<td>Autoloader motion check</td>
<td>Error was sensed when a command that causes autoloader to move was executed.</td>
</tr>
<tr>
<td>6</td>
<td>Autoloader invalid command</td>
<td>The autoloader command is not valid.</td>
</tr>
<tr>
<td>7</td>
<td>Autoloader time-out</td>
<td>Op end was not received in the time permitted for an autoloader operation.</td>
</tr>
</tbody>
</table>
### Sense Byte 5

<table>
<thead>
<tr>
<th>Byte Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Check modifier hex 8</td>
</tr>
<tr>
<td>1</td>
<td>Check modifier hex 4</td>
</tr>
<tr>
<td>2</td>
<td>Check modifier hex 2</td>
</tr>
<tr>
<td>3</td>
<td>Check modifier hex 1</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
</tr>
<tr>
<td>5</td>
<td>Oriented latch is set</td>
</tr>
<tr>
<td>6</td>
<td>Cover open switch is activated</td>
</tr>
<tr>
<td>7</td>
<td>Not used</td>
</tr>
</tbody>
</table>

Bits 0 through 3 of sense byte 5 are used to describe bits 1, 4, and 5 of sense byte 4.

### Check Modifier Code in Hexadecimal

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Carriage bed failure (jammed at home).</td>
</tr>
<tr>
<td>02</td>
<td>Carriage bed failure (jammed off home).</td>
</tr>
<tr>
<td>03</td>
<td>Picker failure (jammed in magazine).</td>
</tr>
<tr>
<td>04</td>
<td>Picker failure (jammed in drive).</td>
</tr>
<tr>
<td>05</td>
<td>Failure to eject.</td>
</tr>
<tr>
<td>06</td>
<td>Failure to pick.</td>
</tr>
<tr>
<td>07</td>
<td>Window magnet failure (window jammed open).</td>
</tr>
<tr>
<td>08</td>
<td>Window magnet failure (window jammed closed).</td>
</tr>
<tr>
<td>09</td>
<td>Cover open (carriage bed movement not permitted).</td>
</tr>
<tr>
<td>A</td>
<td>Not used</td>
</tr>
<tr>
<td>B</td>
<td>Operation out of sequence (command rejected).</td>
</tr>
<tr>
<td>C</td>
<td>Not oriented (command rejected).</td>
</tr>
<tr>
<td>D</td>
<td>Write or erase current present (command rejected)</td>
</tr>
</tbody>
</table>

### Retry Count for Level 2

This field records the number of times for this retry.

### Previous Cylinder (Prev) for Level 2

This field contains the hexadecimal address of the cylinder that was used before the start cylinder.

### 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.

### 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.

### 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.

### Record Address (REC) for Level 2

One byte record address. Valid addresses are 01 through A1 or 01 through 08.

### 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

---

1. Only for machines with old style picker.
## CONTENTS

<table>
<thead>
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<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>85-135</td>
<td>Cable Interlock Check</td>
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<td>85-137</td>
<td>Printer Power Check</td>
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<td>85-200</td>
<td>Error History Table Sample for 5211</td>
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<tr>
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<td>Status Byte 0 (With Unit Check On)</td>
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<tr>
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<td>Status Byte 0 (With Unit Check Off)</td>
</tr>
<tr>
<td>85-203</td>
<td>Status Byte 1</td>
</tr>
<tr>
<td>85-205</td>
<td>Status Byte 2</td>
</tr>
<tr>
<td>85-207</td>
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<tr>
<td>85-209</td>
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<td>Printer Console Error Lights Decode for 5211</td>
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</tr>
<tr>
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<td>Any Hammer On Check</td>
</tr>
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<td>85-611</td>
<td>Hammer Echo Check</td>
</tr>
<tr>
<td>85-613</td>
<td>Belt Sync Check</td>
</tr>
<tr>
<td>85-615</td>
<td>Belt Speed Check</td>
</tr>
<tr>
<td>85-617</td>
<td>Belt Up to Speed Check (Temporary/Permanent)</td>
</tr>
<tr>
<td>85-621</td>
<td>Printer Busy Too Long Check</td>
</tr>
<tr>
<td>85-622</td>
<td>Carriage Pedestal Check</td>
</tr>
<tr>
<td>85-623</td>
<td>Carriage Check 1 (Sync)</td>
</tr>
<tr>
<td>85-624</td>
<td>Carriage Check 3 (speed)</td>
</tr>
<tr>
<td>85-625</td>
<td>Carriage Check 4 (Acceleration)</td>
</tr>
<tr>
<td>85-629</td>
<td>Forms Jam Check</td>
</tr>
<tr>
<td>85-631</td>
<td>Ribbon Check</td>
</tr>
<tr>
<td>85-633</td>
<td>Data Parity Check</td>
</tr>
<tr>
<td>85-635</td>
<td>Cable Interlock Check</td>
</tr>
<tr>
<td>85-636</td>
<td>Thermal Check 1</td>
</tr>
<tr>
<td>85-637</td>
<td>Thermal Check 2</td>
</tr>
<tr>
<td>85-639</td>
<td>Printer Not Powered On</td>
</tr>
<tr>
<td>85-700</td>
<td>Error History Table Sample for 3262</td>
</tr>
<tr>
<td>85-701</td>
<td>Status Byte 0 (With Unit Check On)</td>
</tr>
<tr>
<td>85-702</td>
<td>Status Byte 0 (With Unit Check Off)</td>
</tr>
<tr>
<td>85-703</td>
<td>Status Byte 1</td>
</tr>
<tr>
<td>85-705</td>
<td>Status Byte 2</td>
</tr>
<tr>
<td>85-707</td>
<td>Status Byte 3</td>
</tr>
<tr>
<td>85-709</td>
<td>Status Byte 4</td>
</tr>
<tr>
<td>85-711</td>
<td>Status Byte 5</td>
</tr>
<tr>
<td>85-800</td>
<td>Printer Console Error Lights Decode for 3262</td>
</tr>
<tr>
<td>85-900</td>
<td>Printer Error Recovery Procedures for 3262</td>
</tr>
</tbody>
</table>
## I/O COUNTER TABLE
### SAMPLE FOR 5211

**I/O COUNTER TABLE FOR LINE PRINTER**

<table>
<thead>
<tr>
<th>Description</th>
<th>DATE LAST RESET 00/00/00</th>
<th>DESCRIPTION</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE CREATED</td>
<td>00/00/00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NONRESETTABLE LINE COUNT</td>
<td>25634</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DATE LAST RESET</td>
<td>00/00/00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESETTABLE LINE COUNT</td>
<td>25634</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## ERROR COUNTER TABLE
### SAMPLE FOR 5211

**ERROR COUNTER TABLE FOR LINE PRINTER**

<table>
<thead>
<tr>
<th>Description</th>
<th>DATE LAST RESET 00/00/00</th>
<th>DESCRIPTION</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINTER CONTROLLER UNIT CHECKS</td>
<td>0</td>
<td>85-101</td>
<td>8501</td>
</tr>
<tr>
<td>DATA TRANSFER CHECKS</td>
<td>0</td>
<td>85-103</td>
<td>8501</td>
</tr>
<tr>
<td>FIRE TIER CHECKS</td>
<td>0</td>
<td>85-105</td>
<td>8503</td>
</tr>
<tr>
<td>PRINT SUBSCAN EMITTER CHECKS</td>
<td>0</td>
<td>85-107</td>
<td>8503</td>
</tr>
<tr>
<td>ANY HAMMER ON CHECKS</td>
<td>0</td>
<td>85-109</td>
<td>8507</td>
</tr>
<tr>
<td>HAMMER ECHO CHECKS</td>
<td>0</td>
<td>85-111</td>
<td>8507</td>
</tr>
<tr>
<td>BELT SYNC CHECKS</td>
<td>30</td>
<td>85-113</td>
<td>8503</td>
</tr>
<tr>
<td>BELT SPEED CHECKS</td>
<td>0</td>
<td>85-115</td>
<td>8503</td>
</tr>
<tr>
<td>TEMP. BELT UP TO SPEED CHECKS</td>
<td>0</td>
<td>85-117</td>
<td>8503</td>
</tr>
<tr>
<td>PERM. BELT UP TO SPEED CHECKS</td>
<td>0</td>
<td>85-119</td>
<td>8503</td>
</tr>
<tr>
<td>PRINTER BUSY TOO OFTEN CHECKS</td>
<td>0</td>
<td>85-121</td>
<td>8509</td>
</tr>
<tr>
<td>PRINTER BUSY TOO LONG CHECKS</td>
<td>0</td>
<td>85-125</td>
<td>8505</td>
</tr>
<tr>
<td>CARRIAGE CHECK 3</td>
<td>15</td>
<td>85-127</td>
<td>8505</td>
</tr>
<tr>
<td>CARRIAGE CHECK 2</td>
<td>0</td>
<td>85-129</td>
<td>8505</td>
</tr>
<tr>
<td>FORMS JAM CHECKS</td>
<td>43</td>
<td>85-131</td>
<td>8509</td>
</tr>
<tr>
<td>RIBBON CHECKS</td>
<td>0</td>
<td>85-133</td>
<td>8511</td>
</tr>
<tr>
<td>DATA PARITY CHECKS</td>
<td>0</td>
<td>85-135</td>
<td>8511</td>
</tr>
<tr>
<td>CABLE INTERLOCK CHECKS</td>
<td>0</td>
<td>85-137</td>
<td>8501</td>
</tr>
<tr>
<td>PRINTER POWER CHECKS</td>
<td>0</td>
<td>85-139</td>
<td>8501</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>STATUS BYTES</th>
<th>HEX</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 00 00 10 00 00</td>
<td>77/04/13</td>
<td>11:13:06</td>
<td></td>
</tr>
<tr>
<td>02 00 00 10 00 00</td>
<td>77/04/13</td>
<td>00:00:09</td>
<td></td>
</tr>
</tbody>
</table>

- Printer Status Byte 0
- Printer Status Byte 1
- Printer Status Byte 2
- Printer Status Byte 3
- Printer Status Byte 4
- Printer Status Byte 5
- 85-201
- 85-203
- 85-205
- 85-207
- 85-209
- 85-211
### 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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Must be on for bits 1 through 7 to have the following meanings. If this bit is off, see paragraph 85-202.</td>
<td>2</td>
<td>8501</td>
</tr>
<tr>
<td>1</td>
<td>Not used</td>
<td>13</td>
<td>8003</td>
</tr>
<tr>
<td>2,3</td>
<td>Both off = time-out error, either or both on = hardware parity check</td>
<td>15</td>
<td>8003</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
<td>14</td>
<td>8503</td>
</tr>
<tr>
<td>5,6</td>
<td>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</td>
<td>11</td>
<td>8511</td>
</tr>
<tr>
<td>7</td>
<td>CE switches sense bit. Bit on = one or more switches is on</td>
<td>22</td>
<td>----</td>
</tr>
</tbody>
</table>

### 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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Controller unit check (If this bit is on, see paragraph 85-201.)</td>
<td>2</td>
<td>8501</td>
</tr>
<tr>
<td>1</td>
<td>Unprintable character</td>
<td>13</td>
<td>8503</td>
</tr>
<tr>
<td>2</td>
<td>Hammer echo check</td>
<td>14</td>
<td>8503</td>
</tr>
<tr>
<td>3</td>
<td>Not ready</td>
<td>15</td>
<td>8003</td>
</tr>
<tr>
<td>4</td>
<td>Belt sync check</td>
<td>16</td>
<td>----</td>
</tr>
<tr>
<td>5</td>
<td>Belt speed check</td>
<td>17</td>
<td>8501</td>
</tr>
<tr>
<td>6</td>
<td>Belt up to speed check</td>
<td>18</td>
<td>----</td>
</tr>
<tr>
<td>7</td>
<td>Any hammer on check</td>
<td>19</td>
<td>----</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP (Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CE switch on</td>
<td>6</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>8 lines per inch selected</td>
<td>8</td>
<td>---</td>
</tr>
<tr>
<td>2.3</td>
<td>Printer speed</td>
<td>00 = 160 lines per minute</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 = 300 lines per minute</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>Fire tier check</td>
<td>8</td>
<td>8503</td>
</tr>
<tr>
<td>5</td>
<td>Print subscan emitter check</td>
<td>12</td>
<td>8503</td>
</tr>
<tr>
<td>6</td>
<td>Carriage check 2 (speed check)</td>
<td>10</td>
<td>8505</td>
</tr>
<tr>
<td>7</td>
<td>Carriage check 1 (sync check)</td>
<td>10</td>
<td>8505</td>
</tr>
</tbody>
</table>

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)

85-211 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

<table>
<thead>
<tr>
<th>Check</th>
<th>Console Lights</th>
<th>Check Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interlock</td>
<td>Printer check</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Carriage check</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>Throat or belt</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>End of forms</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>Not ready</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>If printer error</td>
</tr>
</tbody>
</table>

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.
### I/O COUNTER TABLE
**SAMPLE FOR 3262**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Created</td>
<td>00/00/00</td>
<td></td>
</tr>
<tr>
<td>Nonresettable line count</td>
<td>25634</td>
<td></td>
</tr>
<tr>
<td>Date Last Reset</td>
<td>00/00/00</td>
<td></td>
</tr>
<tr>
<td>Resettable line count</td>
<td>25634</td>
<td></td>
</tr>
</tbody>
</table>

### ERROR COUNTER TABLE
**SAMPLE FOR 3262**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printer controller unit checks</td>
<td>55</td>
<td>85-601</td>
</tr>
<tr>
<td>Data transfer checks</td>
<td>1</td>
<td>85-603</td>
</tr>
<tr>
<td>Fire tier checks</td>
<td>5</td>
<td>85-605</td>
</tr>
<tr>
<td>Print subscan emitter checks</td>
<td>0</td>
<td>85-607</td>
</tr>
<tr>
<td>Any hammer on checks</td>
<td>3</td>
<td>85-609</td>
</tr>
<tr>
<td>Hammer echo checks</td>
<td>12</td>
<td>85-611</td>
</tr>
<tr>
<td>Belt sync checks</td>
<td>3</td>
<td>85-613</td>
</tr>
<tr>
<td>Belt speed checks</td>
<td>0</td>
<td>85-615</td>
</tr>
<tr>
<td>Belt up to speed checks</td>
<td>0</td>
<td>85-617</td>
</tr>
<tr>
<td>Printer busy too long checks</td>
<td>0</td>
<td>85-612</td>
</tr>
<tr>
<td>Carriage pedestal checks</td>
<td>39</td>
<td>85-622</td>
</tr>
<tr>
<td>Carriage check 1</td>
<td>1</td>
<td>85-623</td>
</tr>
<tr>
<td>Carriage check 3</td>
<td>0</td>
<td>85-623</td>
</tr>
<tr>
<td>Carriage check 4</td>
<td>2</td>
<td>85-625</td>
</tr>
<tr>
<td>Forms jam checks</td>
<td>35</td>
<td>85-629</td>
</tr>
<tr>
<td>Ribbon checks</td>
<td>3</td>
<td>85-631</td>
</tr>
<tr>
<td>Data parity checks</td>
<td>24</td>
<td>85-633</td>
</tr>
<tr>
<td>Cable interlock checks</td>
<td>3</td>
<td>85-635</td>
</tr>
<tr>
<td>Thermal check 1</td>
<td>0</td>
<td>85-636</td>
</tr>
<tr>
<td>Thermal check 2</td>
<td>0</td>
<td>85-637</td>
</tr>
<tr>
<td>Printer not powered on</td>
<td>8</td>
<td>85-369</td>
</tr>
</tbody>
</table>
Printer controller unit checks are either caused by a hardware error or a program loop time-out.

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.

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.

An expected transition in the PSS (print subscan) emitter failed to occur.

The 'hammer echo return' interface line goes active during 'not print time'.

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).

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.

The 'belt up to speed' interface line goes not active while the 'belt go' interface line is active.

The belt did not reach running speed in 4.5 seconds after being turned on.

The 'printer busy' signal was active for more than 3 seconds during a print operation.

This check indicates a short circuit in the carriage pedestal driver was sensed.

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).

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.

This check indicates that the first three 'carriage advance' pulses after 'carriage go' was activated were not received in 6.0 ms (± .3 ms).

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.
### ERROR HISTORY TABLE SAMPLE FOR 3262

<table>
<thead>
<tr>
<th>STATUS BYTES</th>
<th>HEX</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 00 00 10 00 00</td>
<td>77/04/13</td>
<td>11:13:06</td>
<td></td>
</tr>
<tr>
<td>02 00 00 10 00 00</td>
<td>77/04/13</td>
<td>00:00:09</td>
<td></td>
</tr>
</tbody>
</table>

#### 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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Must be on for bits 1 through 7 to have the following meanings. (If this bit is off, see paragraph 85-702.)</td>
</tr>
<tr>
<td>1</td>
<td>Not used</td>
</tr>
<tr>
<td>2,3</td>
<td>Both off = time-out error, either or both on = hardware parity check</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
</tr>
<tr>
<td>5,6</td>
<td>Card jumper status bits. Bit on = no jumper installed, bit off = jumper is in place</td>
</tr>
<tr>
<td>00</td>
<td>Jumpers are not correctly placed on adapter card</td>
</tr>
<tr>
<td>01</td>
<td>10 =</td>
</tr>
<tr>
<td>11</td>
<td>= 650 lines per minute</td>
</tr>
<tr>
<td>7</td>
<td>Not used</td>
</tr>
</tbody>
</table>

#### 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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Controller unit check</td>
<td>2</td>
<td>8551</td>
</tr>
<tr>
<td></td>
<td>(If this bit is on, see paragraph 85-701)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Unprintable character</td>
<td>17</td>
<td>----</td>
</tr>
<tr>
<td>2</td>
<td>Hammer echo check</td>
<td>19</td>
<td>8557</td>
</tr>
<tr>
<td>3</td>
<td>Not ready</td>
<td>28</td>
<td>----</td>
</tr>
<tr>
<td>4,5</td>
<td>Belt check</td>
<td>15</td>
<td>8553</td>
</tr>
<tr>
<td></td>
<td>01 = Belt up to speed check</td>
<td></td>
<td>8553</td>
</tr>
<tr>
<td></td>
<td>10 = Belt sync check</td>
<td>14</td>
<td>8553</td>
</tr>
<tr>
<td></td>
<td>11 = Belt speed check</td>
<td>16</td>
<td>8553</td>
</tr>
<tr>
<td>6</td>
<td>Thermal check 1</td>
<td>4</td>
<td>8563</td>
</tr>
<tr>
<td>7</td>
<td>Any hammer on check</td>
<td>6</td>
<td>8557</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>End of forms</td>
<td>23</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>Forms jam check</td>
<td>12</td>
<td>8555</td>
</tr>
<tr>
<td>2</td>
<td>Throat open</td>
<td>24</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Thermal check 2</td>
<td>4</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>Printer busy too long check</td>
<td>25</td>
<td>8559</td>
</tr>
<tr>
<td>5</td>
<td>Ribbon check</td>
<td>26</td>
<td>8559</td>
</tr>
<tr>
<td>6</td>
<td>Cable interlock check</td>
<td>3</td>
<td>8561</td>
</tr>
<tr>
<td>7</td>
<td>Data parity check</td>
<td>27</td>
<td>8561</td>
</tr>
</tbody>
</table>

### 85-705 Status Byte 2

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Printer not powered up</td>
<td>5</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>Data transfer check</td>
<td>18</td>
<td>8551</td>
</tr>
<tr>
<td>2</td>
<td>Data stream reject</td>
<td>20</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Spare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Invalid SCS parameter</td>
<td>22</td>
<td>---</td>
</tr>
<tr>
<td>5</td>
<td>Invalid SCS command</td>
<td>21</td>
<td>---</td>
</tr>
<tr>
<td>6</td>
<td>Invalid IOB</td>
<td>19</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>Carriage Pedestal check</td>
<td>10</td>
<td>8555</td>
</tr>
</tbody>
</table>

### 85-707 Status Byte 3

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
<th>Priority</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CE switch on</td>
<td>7</td>
<td>---</td>
</tr>
<tr>
<td>1</td>
<td>8 lines per inch selected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,3</td>
<td>Printer speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Printer speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Carriage check 1 sync</td>
<td>11</td>
<td>8555</td>
</tr>
<tr>
<td>6</td>
<td>Carriage check 3 speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Carriage check 4 acceleration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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.
### 85-800 PRINTER CONSOLE ERROR LIGHTS
### DECODE FOR 3262

<table>
<thead>
<tr>
<th>Check</th>
<th>Interlock</th>
<th>Forms</th>
<th>Ready</th>
<th>Power</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 Printer check</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1 Carriage check</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 Throat or belt cover open</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1 End of forms</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1 Not ready</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1 If printer error is indicated on the system console, program check</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0 Power off</td>
</tr>
</tbody>
</table>

**Note:** The only console light that remains on is the Ready light. The other lights flash.

---

See the IBM System/34 Operator’s Guide, SC21-5158.
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86-010  How to Use the Work Station Controller
        Error Information
86-100  Error Counter Table Sample
86-200  Error History Table Sample
86-250  Sense Bytes-General
86-260  WSC Data Bus Out or Data Bus In Parity
        Check
86-270  Operation Check
86-280  WSC Storage Parity Check
86-290  Long Time-out
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.

ERROR COUNTER TABLE SAMPLE

ERROR COUNTER TABLE FOR WORK STATION CONTROLLER

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DATE LAST RESET 09/09/77</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSC DB0/DBI PARITY CHECKS</td>
<td>0 86-260 8600</td>
</tr>
<tr>
<td>WSC STORAGE PARITY CHECKS</td>
<td>0 86-280 8600</td>
</tr>
</tbody>
</table>

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 5255 and 5225 Matrix Printers.

ERROR HISTORY TABLE FOR WORK STATION CONTROLLER

<table>
<thead>
<tr>
<th>CON/HOST STATUS</th>
<th>WSC RETURN STATUS</th>
<th>DATE YY/MM/DD</th>
<th>TIME HH:MM:SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>08</td>
<td>05</td>
<td>77/06/30</td>
<td>11:46:28</td>
</tr>
<tr>
<td>08</td>
<td>02</td>
<td>77/06/30</td>
<td>00:10:46</td>
</tr>
<tr>
<td>08</td>
<td>00</td>
<td>77/06/30</td>
<td>10:33:32</td>
</tr>
</tbody>
</table>
86-250  Sense Bytes—General

Controller/Host Status Byte

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Programming errors—displayed, but not logged in ERAP</td>
</tr>
<tr>
<td>3</td>
<td>Work station (86-260) controller data bus out or data bus in parity check</td>
</tr>
<tr>
<td>4</td>
<td>Operation check (86-270) (Ignore an operation check condition if bit 3 or bit 5 or bit 7 is on)</td>
</tr>
<tr>
<td>5</td>
<td>Storage parity check (86-280)</td>
</tr>
<tr>
<td>6</td>
<td>Ignore (86-290)</td>
</tr>
<tr>
<td>7</td>
<td>Long time-out check (86-290)</td>
</tr>
</tbody>
</table>

WSC Return

<table>
<thead>
<tr>
<th>Status Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Check first byte for bits 3, 5, or 7.</td>
</tr>
<tr>
<td>01</td>
<td>A time-out occurred in one of the serial interface subroutines while sending a frame to a work station.</td>
</tr>
<tr>
<td>02</td>
<td>A time-out occurred on a cycle steal.</td>
</tr>
<tr>
<td>03, 04</td>
<td>Not assigned.</td>
</tr>
<tr>
<td>05</td>
<td>No internal microcode interrupts have occurred in 30 ms.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Status Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Check first byte for bits 3, 5, or 7.</td>
</tr>
<tr>
<td>01</td>
<td>A time-out occurred in one of the serial interface subroutines while sending a frame to a work station.</td>
</tr>
<tr>
<td>02</td>
<td>A time-out occurred on a cycle steal.</td>
</tr>
<tr>
<td>03, 04</td>
<td>Not assigned.</td>
</tr>
<tr>
<td>05</td>
<td>No internal microcode interrupts have occurred in 30 ms.</td>
</tr>
</tbody>
</table>

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.
## CONTENTS

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<th>Description</th>
</tr>
</thead>
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</tr>
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<td>87-100</td>
<td>Error Counter Table Sample</td>
</tr>
<tr>
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<td>Error History Table Sample</td>
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<td>Device/Cable Status Byte</td>
</tr>
<tr>
<td>87-240</td>
<td>Device Status 0</td>
</tr>
<tr>
<td>87-250</td>
<td>Device Status 1</td>
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<tr>
<td>87-310</td>
<td>Data Stream Reject</td>
</tr>
<tr>
<td>87-320</td>
<td>Work Station Control Field Error Information</td>
</tr>
<tr>
<td>87-330</td>
<td>Resources Temporarily Not Available</td>
</tr>
<tr>
<td>87-350</td>
<td>Screen Format Error Information</td>
</tr>
<tr>
<td>87-360</td>
<td>No Response Time-out (Not Recorded)</td>
</tr>
<tr>
<td>87-370</td>
<td>Transmit Activity Check</td>
</tr>
<tr>
<td>87-375</td>
<td>Activate Command Failure</td>
</tr>
<tr>
<td>87-380</td>
<td>Receive Parity Check</td>
</tr>
<tr>
<td>87-390</td>
<td>Receive Length Check</td>
</tr>
<tr>
<td>87-400</td>
<td>Even/Odd Time-out</td>
</tr>
<tr>
<td>87-410</td>
<td>Work Station Busy</td>
</tr>
<tr>
<td>87-420</td>
<td>Work Station Response Conditions</td>
</tr>
<tr>
<td>87-440</td>
<td>Device Status 0</td>
</tr>
<tr>
<td>87-450</td>
<td>Device Status 1</td>
</tr>
<tr>
<td>87-460</td>
<td>Master Modified Data Tag</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>DATE LAST RESET</th>
<th>78/02/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF SVCS</td>
<td>63597</td>
</tr>
</tbody>
</table>

I/O COUNTER TABLE FOR DISPLAY STATION    W2/ C010

<table>
<thead>
<tr>
<th>DATE LAST RESET</th>
<th>00/00/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF SVCS</td>
<td>715</td>
</tr>
</tbody>
</table>
87-100  ERROR COUNTER TABLE SAMPLE

ERROR COUNTER TABLE FOR DISPLAY STATION  W1/  CO00  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/  CO10  DATE LAST RESET 00/00/00

DESCRIPTION  MAP
RECEIVE PARITY CHECKS 0  87-380
LINE PARITY CHECKS 0  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/  CO00

<table>
<thead>
<tr>
<th>CODE</th>
<th>CONT/HOST</th>
<th>CABLE STATUS</th>
<th>DEVICE STATUS</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0101</td>
<td>0000 0000</td>
<td>0010 0000</td>
<td>0000 0000</td>
<td>77/06/05</td>
<td>13:44:04</td>
</tr>
<tr>
<td>0191</td>
<td>0000 0000</td>
<td>0000 0000</td>
<td>1000 0000</td>
<td>77/06/04</td>
<td>20:37:19</td>
</tr>
<tr>
<td>0101</td>
<td>0000 0000</td>
<td>0010 0000</td>
<td>0000 0000</td>
<td>77/06/04</td>
<td>19:51:22</td>
</tr>
</tbody>
</table>

Controller/Cable Status Byte
87-210
Controller/Host Status Byte

87-250  Device Status 1
87-240  Device Status 0
87-220  Device/Cable Status Byte

ERROR HISTORY TABLE FOR DISPLAY STATION  W2/  CO10

<table>
<thead>
<tr>
<th>CODE</th>
<th>CONT/HOST</th>
<th>CABLE STATUS</th>
<th>DEVICE STATUS</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
</table>

87-100  Display Station  3
87-210  Controller/Host Status Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Data stream reject (not recorded) (87-310)</td>
</tr>
<tr>
<td>1</td>
<td>Work station control field error (not recorded)</td>
</tr>
<tr>
<td>2</td>
<td>Resources temporarily not available (not recorded) (87-330)</td>
</tr>
<tr>
<td>3</td>
<td>Work station controller data bus out or data bus in parity check (87-340)</td>
</tr>
<tr>
<td>4</td>
<td>Operation check (87-340)</td>
</tr>
<tr>
<td>5</td>
<td>Work station controller storage parity check (87-340)</td>
</tr>
<tr>
<td>6</td>
<td>Ignore</td>
</tr>
<tr>
<td>7</td>
<td>Long time-out (87-340)</td>
</tr>
</tbody>
</table>

87-220  Controller/Cable Status Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Screen format error (not recorded) (87-350)</td>
</tr>
<tr>
<td>1</td>
<td>No response time-out (87-360)</td>
</tr>
<tr>
<td>2</td>
<td>Transmit activity check (87-370)</td>
</tr>
<tr>
<td>3</td>
<td>Activate command failure (87-375)</td>
</tr>
<tr>
<td>4</td>
<td>Receive parity check (87-380)</td>
</tr>
<tr>
<td>5</td>
<td>Receive length check (87-390)</td>
</tr>
<tr>
<td>6</td>
<td>Ignore</td>
</tr>
<tr>
<td>7</td>
<td>Even/odd time-out (87-400)</td>
</tr>
</tbody>
</table>

87-230  Device/Cable Status Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Work station busy (87-410)</td>
</tr>
<tr>
<td>1</td>
<td>Device line parity check (87-420)</td>
</tr>
<tr>
<td>2</td>
<td>Ignore</td>
</tr>
<tr>
<td>3</td>
<td>Outstanding status (not an error) (87-420)</td>
</tr>
<tr>
<td>4,5,6</td>
<td>Exception conditions (87-420)</td>
</tr>
<tr>
<td>7</td>
<td>Even/odd response indicator (not an error) (87-420)</td>
</tr>
</tbody>
</table>

87-240  Device Status 0

| More than one purpose (87-440) |

87-250  Device Status 1

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1,2,3</td>
<td>Scan code (87-450)</td>
</tr>
<tr>
<td>4</td>
<td>Master modified data tag (87-460)</td>
</tr>
<tr>
<td>5,6,7</td>
<td>Not assigned</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Premature end of data stream.</td>
</tr>
<tr>
<td>02</td>
<td>Row or column address not valid for set buffer address, insert cursor, or repeat to address end. Orders: -Row = 0 or &gt; 24 (12) -Column = 0 or &gt; 80</td>
</tr>
<tr>
<td>03</td>
<td>Repeat-to-address end address is less than present address counter.</td>
</tr>
<tr>
<td>04</td>
<td>Escape character missing or invalid command code.</td>
</tr>
<tr>
<td>05</td>
<td>Field length specified was zero.</td>
</tr>
<tr>
<td>06</td>
<td>Input field specified out of sequence.</td>
</tr>
<tr>
<td>07</td>
<td>Invalid Restore command data (Restore data sent to wrong device.)</td>
</tr>
<tr>
<td>08</td>
<td>Input field was past end of screen.</td>
</tr>
<tr>
<td>09</td>
<td>Format table overflow</td>
</tr>
<tr>
<td>0A</td>
<td>Data written past end of screen.</td>
</tr>
<tr>
<td>0B</td>
<td>Start of Header Byte count is not equal to 3.</td>
</tr>
<tr>
<td>0C</td>
<td>Roll command parameter error:</td>
</tr>
<tr>
<td></td>
<td>-Roll size = 0</td>
</tr>
<tr>
<td></td>
<td>-Top line = 0</td>
</tr>
<tr>
<td></td>
<td>-Bottom line &gt; 24 (12)</td>
</tr>
<tr>
<td></td>
<td>-Roll size &gt; bottom line line minus top line</td>
</tr>
<tr>
<td></td>
<td>-Top line &gt; = bottom line</td>
</tr>
<tr>
<td>0D</td>
<td>Too many field control words specified for input field.</td>
</tr>
<tr>
<td>0E, 0F</td>
<td>Not assigned.</td>
</tr>
</tbody>
</table>
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.
88-000 5256 and 5225 Matrix Printers

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>88-010</th>
<th>How to Use 5256 and 5225 Printer Error Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>88-050 I/O Counter Table Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-100 Error Counter Table Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-200 Error History Table Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-210 Controller/Host Status Byte</td>
<td>88-220</td>
<td>Controller/Cable Status Byte</td>
</tr>
<tr>
<td>88-230 Device/Cable Status Byte</td>
<td>88-240</td>
<td>Device Status 0</td>
</tr>
<tr>
<td>88-250 Device Status 1 (5256)</td>
<td>88-260</td>
<td>Device Status 1 (5225)</td>
</tr>
<tr>
<td>88-310 Data Stream Reject</td>
<td>88-320</td>
<td>Work Station Control Field Error Information</td>
</tr>
<tr>
<td>88-330 Resources Temporarily Not Available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-350 No Response Time-out</td>
<td>88-360</td>
<td>Transmit Activity Check</td>
</tr>
<tr>
<td>88-365 Activate Command Failure</td>
<td>88-370</td>
<td>Receive Parity Check</td>
</tr>
<tr>
<td>88-380 Receive Length Check</td>
<td>88-380</td>
<td>Receive Length Check</td>
</tr>
<tr>
<td>88-390 Even/Odd Time-out</td>
<td>88-395</td>
<td>Station Busy</td>
</tr>
<tr>
<td>88-400 Line Parity Check</td>
<td>88-410</td>
<td>Unit Not Available</td>
</tr>
<tr>
<td>88-420 SCS (SNA Character String) Command Not Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-430 SCS (SNA Character String) Parameter Not Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-432 Buffer Full</td>
<td>88-434</td>
<td>Print Complete</td>
</tr>
<tr>
<td>88-436 Cancel</td>
<td>88-440</td>
<td>Printer Not Ready (5256 Only)</td>
</tr>
<tr>
<td>88-450 End of Forms</td>
<td>88-460</td>
<td>Unprintable Character</td>
</tr>
<tr>
<td>88-470 Wire Check</td>
<td>88-480</td>
<td>Slow Speed Check</td>
</tr>
<tr>
<td>88-490 Fast Speed Check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 88-500 Emitter Sequence Check                                          | 88-510| No Emitters                                       |
| 88-520 Overrun Check                                                  | 88-530| Forms Stopped                                    |
| 88-540 Forms Position Check                                           | 88-560| Printer Processor Check                          |
| 88-550 Control/Sense Card Check                                       | 88-560| Control/Sense Card Check                         |
| 88-570 Servo Power Amp Check                                          | 88-580| Servo Amp Card, Servo Power Amp, or Servo Power Amp |
| 88-590 Actuator Carrier Motor Overcurrent                             | 88-600| Actuator Carrier Emitteds Check                   |
| 88-610 Actuator Carrier Speed Check                                    | 88-620| Undetermined                                     |
| 88-630 Control/Sense Card Check                                       | 88-640| Servo Power Amp Check                            |
| 88-650 Servo Amp Card, Servo Power Amp, or Servo Power Amp, or Actuator Carrier Motor Overcurrent |        |                                                    |
| 88-660 Forms Motor Check                                              | 88-670| Forms Speed Check                                |
| 88-680 High Voltage Check                                             | 88-690| Forms Overcurrent                                |
| 88-700 Dot Image Generator Check                                      | 88-710| Wire Latch Card Check                            |
| 88-720 Pedestal Check                                                 | 88-730| Actuator Group Jumpers Check                     |
| 88-740 Timer Check                                                    | 88-745| Ribbon Jam                                       |
| 88-750 Ribbon Card Check                                              |        |                                                    |
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/ C030

<table>
<thead>
<tr>
<th>DATE LAST RESET</th>
<th>78/02/32</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF SVCS</td>
<td>846</td>
</tr>
</tbody>
</table>

**88-100  ERROR COUNTER TABLE SAMPLE**

ERROR COUNTER TABLE FOR MATRIX PRINTER P2/ C030

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECEIVE PARITY CHECKS</td>
<td>88-370</td>
</tr>
<tr>
<td>LINE PARITY CHECK</td>
<td>88-400</td>
</tr>
<tr>
<td>DATE LAST RESET 00/00/00</td>
<td>0</td>
</tr>
</tbody>
</table>
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, SY31-0452, or the IBM 5225 MAPs and MIM, SY34-0060.

<table>
<thead>
<tr>
<th>ERROR CODE</th>
<th>CONT/HOST CODE STATUS</th>
<th>CABLE STATUS</th>
<th>DECODE STATUS</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0238</td>
<td>0000 0000</td>
<td>0000 0000</td>
<td>0000 0010000000000 0000 001</td>
<td>77/04/18</td>
<td>22:23:19</td>
</tr>
<tr>
<td>0238</td>
<td>0000 0000</td>
<td>0000 0000</td>
<td>0000 00100000000000 0000 001</td>
<td>77/04/18</td>
<td>22:22:53</td>
</tr>
<tr>
<td>0238</td>
<td>0000 0000</td>
<td>0000 0000</td>
<td>0000 00100000000000 0000 001</td>
<td>77/04/18</td>
<td>16:20:39</td>
</tr>
<tr>
<td>0238</td>
<td>0000 0000</td>
<td>0000 0000</td>
<td>0000 00100000000000 0000 001</td>
<td>77/04/18</td>
<td>10:08:20</td>
</tr>
</tbody>
</table>

88-200 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

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Data stream reject (not recorded) (88-310)</td>
</tr>
<tr>
<td>1</td>
<td>Control field error (not recorded) (88-320)</td>
</tr>
<tr>
<td>2</td>
<td>Resources temporarily not available (not recorded) (88-330)</td>
</tr>
<tr>
<td>3</td>
<td>Work station controller, data bus out, data bus in parity check (88-340)</td>
</tr>
<tr>
<td>4</td>
<td>Operation check (88-340)</td>
</tr>
<tr>
<td>5</td>
<td>Work station controller storage parity check (88-340)</td>
</tr>
<tr>
<td>6</td>
<td>Ignore</td>
</tr>
<tr>
<td>7</td>
<td>Long time-out (88-340)</td>
</tr>
</tbody>
</table>

### 88-220 Controller/Cable Status Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not logged</td>
</tr>
<tr>
<td>1</td>
<td>No response time-out (88-350)</td>
</tr>
<tr>
<td>2</td>
<td>Transmit activity check (88-360)</td>
</tr>
<tr>
<td>3</td>
<td>Activate command failure (88-365)</td>
</tr>
<tr>
<td>4</td>
<td>Receive parity check (88-370)</td>
</tr>
<tr>
<td>5</td>
<td>Receive length check (88-380)</td>
</tr>
<tr>
<td>6</td>
<td>Ignore</td>
</tr>
<tr>
<td>7</td>
<td>Even/odd time-out (88-390)</td>
</tr>
</tbody>
</table>

### 88-230 Device/Cable Status Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Station busy (87-395)</td>
</tr>
<tr>
<td>1</td>
<td>Device line parity check (88-400)</td>
</tr>
<tr>
<td>2</td>
<td>Unit not available (88-410)</td>
</tr>
<tr>
<td>3</td>
<td>Outstanding status (not an error) (88-400)</td>
</tr>
<tr>
<td>4,5,6</td>
<td>Exception conditions (88-400)</td>
</tr>
<tr>
<td>7</td>
<td>Even/odd response indicator (not an error) (88-400)</td>
</tr>
</tbody>
</table>

### 88-240 Device Status 0

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SCS (SNA character string) command not valid (88-420)</td>
</tr>
<tr>
<td>1</td>
<td>SCS (SNA character string) parameter not valid (88-430)</td>
</tr>
<tr>
<td>2</td>
<td>Buffer full (not logged) (88-432)</td>
</tr>
<tr>
<td>3</td>
<td>Print complete (not logged) (88-434)</td>
</tr>
<tr>
<td>4</td>
<td>Cancel (not logged) (88-436)</td>
</tr>
<tr>
<td>5</td>
<td>Printer not ready (5256 only) (88-440)</td>
</tr>
<tr>
<td>6</td>
<td>End of forms (88-450)</td>
</tr>
<tr>
<td>7</td>
<td>Unprintable character (88-460)</td>
</tr>
</tbody>
</table>

### 88-250 Device Status 1 (5256)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Wire check (88-470)</td>
</tr>
<tr>
<td>1</td>
<td>Slow speed check (88-480)</td>
</tr>
<tr>
<td>2</td>
<td>Fast speed check (88-490)</td>
</tr>
<tr>
<td>3</td>
<td>Emitter sequence check (88-500)</td>
</tr>
<tr>
<td>4</td>
<td>No emitters (88-510)</td>
</tr>
<tr>
<td>5</td>
<td>Overrun check (88-520)</td>
</tr>
<tr>
<td>6</td>
<td>Forms stopped (88-530)</td>
</tr>
<tr>
<td>7</td>
<td>Forms position check (88-540)</td>
</tr>
</tbody>
</table>
88-260 Device Status 1 (5225)

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>Printer processor check (88-550)</td>
</tr>
<tr>
<td>0011</td>
<td>Control/sense card check (88-560)</td>
</tr>
<tr>
<td>0011</td>
<td>Servo power amp check (88-570)</td>
</tr>
<tr>
<td>0012</td>
<td>Servo amp card, servo power amp, or actuator carrier motor check (88-580)</td>
</tr>
<tr>
<td>0011</td>
<td>Actuator carrier motor (88-590) overcurrent</td>
</tr>
<tr>
<td>0011</td>
<td>Actuator carrier emitters check (88-600)</td>
</tr>
<tr>
<td>0011</td>
<td>Actuator carrier speed (88-610) check</td>
</tr>
<tr>
<td>0011</td>
<td>Undetermined (88-620)</td>
</tr>
<tr>
<td>0100</td>
<td>Control/sense card check (88-630)</td>
</tr>
<tr>
<td>0100</td>
<td>Servo power amp check (88-640)</td>
</tr>
<tr>
<td>0100</td>
<td>Servo amp card, servo power amp, or forms motor check (88-650)</td>
</tr>
<tr>
<td>0100</td>
<td>Forms overcurrent (88-660)</td>
</tr>
<tr>
<td>0100</td>
<td>Forms emitters check (88-670)</td>
</tr>
<tr>
<td>0100</td>
<td>Forms speed check (88-680)</td>
</tr>
<tr>
<td>1000</td>
<td>High voltage check (88-690)</td>
</tr>
<tr>
<td>1000</td>
<td>Dot image generator check (88-700)</td>
</tr>
<tr>
<td>1000</td>
<td>Wire latch card check (88-710)</td>
</tr>
<tr>
<td>1000</td>
<td>Pedestal check (88-720)</td>
</tr>
<tr>
<td>1000</td>
<td>Actuator group jumpers check (88-730)</td>
</tr>
<tr>
<td>1000</td>
<td>Timer check (88-740)</td>
</tr>
<tr>
<td>1000</td>
<td>Ribbon jam (88-745)</td>
</tr>
<tr>
<td>1000</td>
<td>Ribbon card check (88-750)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Command modifier not valid in work station control field</td>
</tr>
<tr>
<td>02</td>
<td>Byte count not valid in work station control field</td>
</tr>
<tr>
<td>03</td>
<td>Device address not found in work station parameter list</td>
</tr>
<tr>
<td>04</td>
<td>Reserved for work stations</td>
</tr>
<tr>
<td>05-0F</td>
<td>Not assigned</td>
</tr>
</tbody>
</table>

88-330 Resources Temporarily Not Available

Device Status Byte 0

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Data stream sent to printer and printer buffer is not available.</td>
</tr>
<tr>
<td>02</td>
<td>Work station specified as not operational by work station controller (hung busy, response not valid to poll).</td>
</tr>
<tr>
<td>03</td>
<td>Device offline (not in session).</td>
</tr>
<tr>
<td>04</td>
<td>Printer needs initialization data.</td>
</tr>
<tr>
<td>05-0F</td>
<td>Not used.</td>
</tr>
</tbody>
</table>

88-350 No Response Time-Out

A work station that was powered on and Menu Set stopped responding to poll commands. All attempts to receive were completed before the error was reported.

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.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>88-360</td>
<td>Transmit Activity Check</td>
<td>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.</td>
</tr>
<tr>
<td>88-365</td>
<td>Activate Command Failure</td>
<td>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.</td>
</tr>
<tr>
<td>88-370</td>
<td>Receive Parity Check</td>
<td>The work station response to the poll command was found to have a parity check after all attempts to receive were completed.</td>
</tr>
<tr>
<td>88-380</td>
<td>Receive Length Check</td>
<td>The work station has responded to a poll or a read activate command with data of the wrong length.</td>
</tr>
<tr>
<td>88-390</td>
<td>Even/Odd Time-Out</td>
<td>The terminal has not switched response levels in 8 seconds.</td>
</tr>
<tr>
<td>88-395</td>
<td>Station Busy</td>
<td>The station has taken too long to process a command sent by the work station controller.</td>
</tr>
<tr>
<td>88-400</td>
<td>Line Parity Check</td>
<td>A parity check has been sensed at the printer.</td>
</tr>
<tr>
<td>88-410</td>
<td>Unit Not Available</td>
<td>Indicates that the 5225 or 5256 Printer is not ready (solid error or Stop key).</td>
</tr>
<tr>
<td>88-420</td>
<td>SCS (SNA Character String) Command Not Valid</td>
<td>Programming error—user program output data stream.</td>
</tr>
<tr>
<td>88-430</td>
<td>SCS (SNA Character String) Parameter Not Valid</td>
<td>Programming error—user program output data stream.</td>
</tr>
<tr>
<td>88-432</td>
<td>Buffer Full</td>
<td>Both print buffers are full.</td>
</tr>
<tr>
<td>88-434</td>
<td>Print Complete</td>
<td>Both print buffers and the line image buffer are empty.</td>
</tr>
<tr>
<td>88-436</td>
<td>Cancel</td>
<td>The Cancel key on the printer has been pressed.</td>
</tr>
<tr>
<td>88-440</td>
<td>Printer Not Ready (5256 Only)</td>
<td>Power is over or under voltage.</td>
</tr>
<tr>
<td>88-450</td>
<td>End of Forms</td>
<td>The printer is out of paper.</td>
</tr>
<tr>
<td>88-460</td>
<td>Unprintable Character</td>
<td>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.</td>
</tr>
<tr>
<td>88-470</td>
<td>Wire Check</td>
<td>The wire driver was on too long.</td>
</tr>
</tbody>
</table>
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.
88-660  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.
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<td>Error Counter Table Sample</td>
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</table>
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.

I/O COUNTER TABLE FOR BSC

<table>
<thead>
<tr>
<th>I/O COUNTER TABLE FOR BSC LINE</th>
<th>2 (2, 3, OR 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE LAST RESET</td>
<td>78/02/12</td>
</tr>
<tr>
<td>TEXT BLOCKS TRANSMITTED</td>
<td>CURRENT HISTORY</td>
</tr>
<tr>
<td>TEXT BLOCKS RECEIVED</td>
<td>0</td>
</tr>
</tbody>
</table>

ERROR HISTORY TABLE FOR BSC

<table>
<thead>
<tr>
<th>ERROR HISTORY TABLE FOR BSC LINE</th>
<th>1 (2, 3, OR 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND CODE</td>
<td>MDR BYTE COUNT</td>
</tr>
<tr>
<td>COMMAND SENSE RETRY COMPLETION</td>
<td>CODE ADDRESS</td>
</tr>
<tr>
<td>TERMINAL</td>
<td>DATE TIME</td>
</tr>
<tr>
<td>84</td>
<td>00 00 00 0E 56</td>
</tr>
<tr>
<td>89-110</td>
<td>89-120 89-130 89-140 89-150 89-160</td>
</tr>
<tr>
<td>89-110</td>
<td>89-120 89-130 89-140 89-150 89-160</td>
</tr>
</tbody>
</table>

Command Code

<table>
<thead>
<tr>
<th>Bits</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>Attachment address (8)</td>
</tr>
<tr>
<td>4567</td>
<td></td>
</tr>
<tr>
<td>0000</td>
<td>Control command (see 89-120)</td>
</tr>
<tr>
<td>0010</td>
<td>Receive initial delayed command</td>
</tr>
<tr>
<td>0011</td>
<td>Receive initial command</td>
</tr>
<tr>
<td>0100</td>
<td>Transmit-receive overlay command (1)</td>
</tr>
<tr>
<td>0101</td>
<td>Transmit-receive initial command (see 89-120)</td>
</tr>
<tr>
<td>0110</td>
<td>Transmit-receive command (2) or transmit only command (see 89-120</td>
</tr>
<tr>
<td></td>
<td>if MLCA installed)</td>
</tr>
<tr>
<td>1000</td>
<td>Enable auto monitor (MLCA only)</td>
</tr>
</tbody>
</table>

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.

Command Modifier

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>start 2-second time-out</td>
</tr>
<tr>
<td>80</td>
<td>disable command</td>
</tr>
<tr>
<td>00</td>
<td>enable command</td>
</tr>
</tbody>
</table>

If the command code is hex 85 (transmit-receive initial), the command modifier is:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>monitor mode</td>
</tr>
<tr>
<td>01</td>
<td>control mode</td>
</tr>
</tbody>
</table>

If the command code is hex 86 (MLCA only), the command modifier is:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>transmit-receive command</td>
</tr>
<tr>
<td>02</td>
<td>transmit only command</td>
</tr>
</tbody>
</table>

If the command code is hex 80 (control command), the command modifier is:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>start 2-second time-out</td>
</tr>
<tr>
<td>80</td>
<td>disable command</td>
</tr>
<tr>
<td>00</td>
<td>enable command</td>
</tr>
</tbody>
</table>

If the command code is hex 85 (transmit-receive initial), the command modifier is:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>monitor mode</td>
</tr>
<tr>
<td>01</td>
<td>control mode</td>
</tr>
</tbody>
</table>

If the command code is hex 86 (MLCA only), the command modifier is:

<table>
<thead>
<tr>
<th>Hex</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>transmit-receive command</td>
</tr>
<tr>
<td>02</td>
<td>transmit only command</td>
</tr>
</tbody>
</table>
89-130  Sense Byte

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Receive time-out</td>
</tr>
<tr>
<td>1</td>
<td>Block check</td>
</tr>
<tr>
<td>2</td>
<td>Transmit adapter check</td>
</tr>
<tr>
<td>3</td>
<td>Receive adapter check</td>
</tr>
<tr>
<td>4</td>
<td>Invalid ASCII character</td>
</tr>
<tr>
<td>5</td>
<td>Abortive disconnect</td>
</tr>
<tr>
<td>6</td>
<td>Data set not ready</td>
</tr>
<tr>
<td>7</td>
<td>Receive time-out data mode</td>
</tr>
</tbody>
</table>

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

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<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Operation unsuccessful</td>
</tr>
<tr>
<td>22</td>
<td>Invalid switched line ID received</td>
</tr>
<tr>
<td>23</td>
<td>Data lost-buffer exceeded</td>
</tr>
<tr>
<td>24</td>
<td>Abort received</td>
</tr>
<tr>
<td>25</td>
<td>Abort disconnect received</td>
</tr>
<tr>
<td>26</td>
<td>Delay count exceeded</td>
</tr>
<tr>
<td>27</td>
<td>Command rejected due to abort request</td>
</tr>
<tr>
<td>28</td>
<td>Operation canceled</td>
</tr>
<tr>
<td>31</td>
<td>Unexpected response from remote system</td>
</tr>
<tr>
<td>32</td>
<td>Data check</td>
</tr>
<tr>
<td>33</td>
<td>Invalid response received</td>
</tr>
<tr>
<td>34</td>
<td>Adapter check</td>
</tr>
<tr>
<td>35</td>
<td>Receive time-out error</td>
</tr>
<tr>
<td>36</td>
<td>Data set not ready/connection lost</td>
</tr>
<tr>
<td>4B</td>
<td>Invalid ASCII</td>
</tr>
<tr>
<td>4D</td>
<td>Invalid request</td>
</tr>
<tr>
<td>4E</td>
<td>Delay count exceeded</td>
</tr>
<tr>
<td>4F</td>
<td>Permanent error</td>
</tr>
<tr>
<td>50</td>
<td>No response</td>
</tr>
<tr>
<td>51</td>
<td>Data check</td>
</tr>
<tr>
<td>52</td>
<td>Lost data</td>
</tr>
<tr>
<td>53</td>
<td>Lost connection</td>
</tr>
<tr>
<td>54</td>
<td>Invalid response</td>
</tr>
<tr>
<td>55</td>
<td>Adapter check</td>
</tr>
<tr>
<td>56</td>
<td>Forward abort</td>
</tr>
<tr>
<td>57</td>
<td>EOT check</td>
</tr>
</tbody>
</table>

89-160  Terminal Address

This 2-byte field contains the Poll/Address character in hexadecimal.
ERROR COUNTER TABLE FOR BSC

ERROR COUNTER TABLE FOR BSC LINE 1 (2, 3, OR 4)  

<table>
<thead>
<tr>
<th>Description</th>
<th>Current</th>
<th>History</th>
<th>31/01/77</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEGATIVE ACKNOWLEDGMENTS RECEIVED</td>
<td>0</td>
<td>0</td>
<td>89-164</td>
<td></td>
</tr>
<tr>
<td>DATA CHECKS</td>
<td>0</td>
<td>0</td>
<td>89-166</td>
<td></td>
</tr>
<tr>
<td>FORWARD ABORTS</td>
<td>0</td>
<td>0</td>
<td>89-168</td>
<td></td>
</tr>
<tr>
<td>ABORTS RECEIVED</td>
<td>0</td>
<td>0</td>
<td>89-170</td>
<td></td>
</tr>
<tr>
<td>ADAPTER CHECKS DURING TRANSMISSION</td>
<td>0</td>
<td>0</td>
<td>89-172</td>
<td></td>
</tr>
<tr>
<td>ADAPTER CHECKS WHILE RECEIVING</td>
<td>0</td>
<td>0</td>
<td>89-174</td>
<td></td>
</tr>
<tr>
<td>INVALID RESPONSES RECEIVED</td>
<td>0</td>
<td>0</td>
<td>89-176</td>
<td></td>
</tr>
<tr>
<td>*ENQUIRIES RECEIVED AS AFFIRMATIVE ACK</td>
<td>0</td>
<td>0</td>
<td>89-178</td>
<td></td>
</tr>
<tr>
<td>LOST DATA ERRORS</td>
<td>0</td>
<td>0</td>
<td>89-180</td>
<td></td>
</tr>
<tr>
<td>DISCONNECT TIME-OUTS</td>
<td>0</td>
<td>0</td>
<td>89-182</td>
<td></td>
</tr>
<tr>
<td>RECEIVE TIME-OUTS</td>
<td>0</td>
<td>0</td>
<td>89-184</td>
<td></td>
</tr>
<tr>
<td>*TRANSMISSION TIME-OUTS</td>
<td>0</td>
<td>0</td>
<td>89-186</td>
<td></td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>I/O COUNTER TABLE FOR SDLC LINE 1 (2,3,OR 4)</th>
<th>DATE</th>
<th>LAST</th>
<th>RESET</th>
<th>CURRENT</th>
<th>HISTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-FRAMES TRANSMITTED</td>
<td>00/00/00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I-FRAMES RETRANSMITTED</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I-FRAMES RECEIVED</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL FRAMES TRANSMITTED</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL FRAMES RECEIVED</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 89-200  ERROR HISTORY TABLE FOR SDLC

<table>
<thead>
<tr>
<th>ERROR HISTORY TABLE FOR SDLC LINE 1 (2,3,OR 4)</th>
<th>COMMAND</th>
<th>SENSE INFORMATION</th>
<th>CONTROL STATION</th>
<th>LINE Q</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command Code</td>
<td>SENSE INFORMATION</td>
<td>CONTROL STATION</td>
<td>LINE Q</td>
<td>DATE</td>
<td>TIME</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>08</td>
<td>00</td>
<td>04</td>
<td>11</td>
<td>5C</td>
<td>77/06/30 23:11:57</td>
</tr>
<tr>
<td>85</td>
<td>20</td>
<td>00</td>
<td>08</td>
<td>14</td>
<td>5C</td>
<td>77/06/15 12:05:00</td>
</tr>
<tr>
<td>89-210</td>
<td>89-220</td>
<td>89-230</td>
<td>89-240</td>
<td>89-250</td>
<td>89-260</td>
<td></td>
</tr>
</tbody>
</table>

### 89-210  Command Code

<table>
<thead>
<tr>
<th>Bits</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>Attachment address (8)</td>
</tr>
<tr>
<td>4 5 6 7</td>
<td>Control command</td>
</tr>
<tr>
<td>0 0 0 0</td>
<td>Command modifier</td>
</tr>
<tr>
<td>Hex 80 = disable</td>
<td></td>
</tr>
<tr>
<td>Hex CO = enable</td>
<td></td>
</tr>
<tr>
<td>0 0 1 0</td>
<td>Transmit command (poll/final bit on)</td>
</tr>
<tr>
<td>0 0 1 1</td>
<td>Receive initial command only</td>
</tr>
<tr>
<td>0 1 0 0</td>
<td>Transmit final command</td>
</tr>
<tr>
<td>0 1 0 1</td>
<td>Transmit only command</td>
</tr>
<tr>
<td>0 1 1 0</td>
<td>Transmit initial command only</td>
</tr>
<tr>
<td>0 1 1 1</td>
<td>Receive delayed command</td>
</tr>
<tr>
<td>MLCA only</td>
<td></td>
</tr>
<tr>
<td>1 0 0 0</td>
<td>Start poll receive ready (primary)</td>
</tr>
<tr>
<td>1 0 0 1</td>
<td>Start poll receive not ready (primary)</td>
</tr>
<tr>
<td>1 1 1 1</td>
<td>Stop poll (primary)</td>
</tr>
<tr>
<td>1 1 1 1</td>
<td>Stop auto response (secondary)</td>
</tr>
</tbody>
</table>

### 89-220  Sense Byte 0

<table>
<thead>
<tr>
<th>Bit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Time-out</td>
</tr>
<tr>
<td></td>
<td>a. If primary station, 16-second nonproductive time-out</td>
</tr>
<tr>
<td></td>
<td>b. If secondary station, 32-second inactivity time-out</td>
</tr>
<tr>
<td>1</td>
<td>Frame check (see 89-310)</td>
</tr>
<tr>
<td>2</td>
<td>Adapter check (overrun/underrun) (see 89-350)</td>
</tr>
<tr>
<td>3</td>
<td>Buffer overrun (receive) (see 89-380)</td>
</tr>
<tr>
<td>4</td>
<td>Invalid frame (see 89-320)</td>
</tr>
<tr>
<td>5</td>
<td>Lost data set ready (see 89-330)</td>
</tr>
<tr>
<td>6</td>
<td>Data set not ready (see 89-390)</td>
</tr>
<tr>
<td>7</td>
<td>Primary station idle time-out (see 89-360)</td>
</tr>
</tbody>
</table>
89-230  Sense Byte 1

Sense byte 1 is not used.

89-240  Control Field

<table>
<thead>
<tr>
<th>Control Field Bit Configuration</th>
<th>Command/Response Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Format</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Nr P/F Ns 0</td>
<td>Sequenced Information Frame</td>
</tr>
<tr>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Nr P/F 001</td>
<td>Receive Ready</td>
</tr>
<tr>
<td>Nr P/F 010</td>
<td>Receive Not Ready</td>
</tr>
<tr>
<td>010 P 0011</td>
<td>Disconnect</td>
</tr>
<tr>
<td>010 F 0011</td>
<td>Request Disconnect</td>
</tr>
<tr>
<td>011 F 0011</td>
<td>Unnumbered Acknowledge</td>
</tr>
<tr>
<td>100 P 0011</td>
<td>Set Normal Response Mode</td>
</tr>
<tr>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>111 P/F 0011</td>
<td>Test</td>
</tr>
<tr>
<td>100 F 0111</td>
<td>Frame Reject</td>
</tr>
<tr>
<td>101 P/F 1111</td>
<td>Exchange Identification</td>
</tr>
<tr>
<td>000 F 1111</td>
<td>Disconnected Mode</td>
</tr>
</tbody>
</table>

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
Error Counter Table for SDLC

<table>
<thead>
<tr>
<th>ERROR COUNTER TABLE FOR SDLC LINE 2 (2,3, OR 4)</th>
<th>DATE LAST RESET</th>
<th>00/00/00</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT</td>
<td>HISTORY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRC ERRORS</td>
<td>0</td>
<td>0</td>
<td>89-310</td>
</tr>
<tr>
<td>INVALID FRAMES RECEIVED</td>
<td>0</td>
<td>0</td>
<td>89-320</td>
</tr>
<tr>
<td>LOST DATA SET READY</td>
<td>0</td>
<td>0</td>
<td>89-330</td>
</tr>
<tr>
<td>NONPRODUCTIVE RECEIVE TIME-OUTS</td>
<td>0</td>
<td>0</td>
<td>89-340</td>
</tr>
<tr>
<td>ADAPTER CHECKS</td>
<td>0</td>
<td>0</td>
<td>89-350</td>
</tr>
<tr>
<td>IDLE DETECT TIME-OUTS</td>
<td>0</td>
<td>0</td>
<td>89-360</td>
</tr>
<tr>
<td>FRAME SEQUENCE ERRORS</td>
<td>0</td>
<td>0</td>
<td>89-370</td>
</tr>
</tbody>
</table>

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.
89-400  MLCA CONTROLLER

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

<table>
<thead>
<tr>
<th>BYT</th>
<th>BYTE</th>
<th>PCR</th>
<th>IL</th>
<th>0</th>
<th>1</th>
<th>WR0</th>
<th>WR1</th>
<th>WR2</th>
<th>WR3</th>
<th>WR4</th>
<th>WR5</th>
<th>WR6</th>
<th>WR7</th>
<th>MAR</th>
<th>MAB</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>07</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>01</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>04</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>07</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>10</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>13</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>16</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>19</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>22</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>25</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>28</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02</td>
<td>31</td>
<td>00</td>
<td>00</td>
<td>0000</td>
<td>0000</td>
<td>FFFF</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
</tr>
</tbody>
</table>

PEND OF TABLE

89-460
89-450
89-440
89-430
89-470
89-490
89-400
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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Flag</td>
</tr>
<tr>
<td>1</td>
<td>Positive</td>
</tr>
<tr>
<td>2</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>Zero</td>
</tr>
<tr>
<td>4</td>
<td>Carry</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>Equal</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Hardware Interrupt Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>5</td>
</tr>
<tr>
<td>01</td>
<td>4</td>
</tr>
<tr>
<td>02</td>
<td>Cycle steal (level 1 registers are written in the log)</td>
</tr>
<tr>
<td>03</td>
<td>3</td>
</tr>
<tr>
<td>04</td>
<td>2</td>
</tr>
<tr>
<td>05</td>
<td>1</td>
</tr>
<tr>
<td>07</td>
<td>Main program level</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Storage data register parity check</td>
</tr>
<tr>
<td>1</td>
<td>Micro-operation register parity check</td>
</tr>
<tr>
<td>2</td>
<td>Register parity check—checks parity on the storage gates during move operations and ALU-associated operations.</td>
</tr>
<tr>
<td>3</td>
<td>Register parity check—checks parity on the storage gates during some data move operations and ALU-associated operations.</td>
</tr>
<tr>
<td>4, 5</td>
<td>MLCA controller storage address status as follows:</td>
</tr>
<tr>
<td>6, 7</td>
<td>Not used.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Data bus out parity check</td>
</tr>
<tr>
<td>1</td>
<td>Device address not valid</td>
</tr>
<tr>
<td>2</td>
<td>Data bus in parity check</td>
</tr>
<tr>
<td>3</td>
<td>Input/output time-out check</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
</tr>
<tr>
<td>5</td>
<td>System bus out parity check</td>
</tr>
<tr>
<td>6</td>
<td>Cycle steal operation</td>
</tr>
<tr>
<td>7</td>
<td>Not used</td>
</tr>
</tbody>
</table>

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.
89-470  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 date 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**

<table>
<thead>
<tr>
<th>STATUS BYTE</th>
<th>RETRY COUNT</th>
<th>LINE/ACU</th>
<th>PROTOCOL</th>
<th>PHONE NUMBER</th>
<th>DATE</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>01</td>
<td>13</td>
<td>80</td>
<td>60828</td>
<td>80/05/13</td>
<td>11:19:24</td>
</tr>
<tr>
<td>42</td>
<td>01</td>
<td>13</td>
<td>80</td>
<td>60828</td>
<td>80/05/13</td>
<td>11:17:40</td>
</tr>
<tr>
<td>42</td>
<td>01</td>
<td>13</td>
<td>80</td>
<td>60825</td>
<td>80/05/13</td>
<td>09:52:16</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Status Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cx</td>
<td>The autocall unit has received a command that is not valid. The variable x indicates the 4 low-order bits of the command.</td>
</tr>
<tr>
<td>EB</td>
<td>The autocall unit has received a telephone number with a length of zero.</td>
</tr>
<tr>
<td>EC</td>
<td>Data Terminal Ready (DTR) is off for the communications line.</td>
</tr>
<tr>
<td>xy</td>
<td>The general format for the autocall status byte. The variable x can have the following meanings:</td>
</tr>
<tr>
<td></td>
<td>'1' DLO error</td>
</tr>
<tr>
<td></td>
<td>'2' ACR error</td>
</tr>
<tr>
<td></td>
<td>'3' PND error</td>
</tr>
<tr>
<td></td>
<td>'4' DSC error</td>
</tr>
<tr>
<td></td>
<td>'5' PWI error</td>
</tr>
<tr>
<td></td>
<td>The variable y can have the following meanings:</td>
</tr>
<tr>
<td></td>
<td>'0' Indicated signal was off before the first digit was received.</td>
</tr>
<tr>
<td></td>
<td>'1' Indicated signal was off between digits.</td>
</tr>
<tr>
<td></td>
<td>'2' Indicated signal was off after last digit.</td>
</tr>
<tr>
<td></td>
<td>'C' Indicated signal was on before first digit.</td>
</tr>
<tr>
<td></td>
<td>'D' Indicated signal was on between digits.</td>
</tr>
<tr>
<td></td>
<td>'E' Indicated signal was on after last digit.</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>'80'</td>
<td>Batch BSC</td>
</tr>
<tr>
<td>'81'</td>
<td>SNA33/SDLC Tributary</td>
</tr>
<tr>
<td>'82'</td>
<td>MRJE</td>
</tr>
<tr>
<td>'83'</td>
<td>Primary SDLC</td>
</tr>
<tr>
<td>'84'</td>
<td>SNA44/SDLC Tributary</td>
</tr>
<tr>
<td>'85'</td>
<td>Interactive BSC</td>
</tr>
</tbody>
</table>

89-540  I/O Counter Table Sample

I/O COUNTER TABLE FOR AUTOCALL UNIT PORT 3

<table>
<thead>
<tr>
<th>DATE LAST RESET</th>
<th>PHONE CALL ATTEMPTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>80/05/13</td>
<td>9</td>
</tr>
</tbody>
</table>

******************************************************************************

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

| 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 ******************************************************************************

12  89-530
CONTENTS

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99-010 CSIPL Diagnostics (Wrap Tests)
99-015 CSIPL Switch Options
99-020 CSIPL Wrap Test Error Codes
99-030 System Clock Stop Halt Codes
99-040 Diagnostic Supervisors
99-041 Concurrent Maintenance
99-043 Dedicated Maintenance
99-045 Diagnostic Diskette Information
99-050 Display Station Diagnostic Message Formats
99-055 Diagnostic Utilities
99-060 List of Device IDs
99-062 How to Run Work Station Attachment MDIs from the CE Panel
99-064 How to Run TU Select for the Work Station Attachment from the CE Panel
99-065 How to Run Device TU Select
99-066 I/O Step or Stop on Error Modes for Work Stations and Line Printers
99-067 I/O Controller Display/Dump Under SSP Control
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99-069 How to Run System Test (SYSTST)
99-070 Data Communications Diagnostic Programs
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 Test
99-075 BSCA Online Test
99-076 MLCA Concurrent Wrap Test and Trace Dump Driver Program (COMMTST)
99-077 BSCA Online Test Messages and Control Characters
99-080 How to Run Device Exercisers
99-085 How to Run the Main Storage Processor Exerciser
99-090 Free-lancing with MDIs–System Instruction Step and MDI Special
99-095 Free-lancing the Main Storage Processor Using the MSP Mini-MDI
99-999 TU Test Descriptions for the Work Station Attachment
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 (MDls 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.

MDls 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.

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.
Option

FF00  Bypass tests that need UDT configuration data and wraps (no UDT on B1 diskette).

FFXX  Bypass wrap tests for the device with an ID of XX. (See paragraph 99-060 for a list of device IDs.)

   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.

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.)

FDXX  Loop on CSIPL routine XX (routines 9 through 64). (See paragraph 99-020 for XX values.)

FC02  Loop on control processor loads 1 and 2, and bypass errors.

FC01  Loop on control processor load 1 and bypass errors.

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.)
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.

<table>
<thead>
<tr>
<th>Routine #</th>
<th>WR3L Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>00</td>
<td>Branch and addressing test—tests ability to do an unconditional branch to a selected address.</td>
</tr>
<tr>
<td>01</td>
<td>01</td>
<td>Conditional branching—tests all conditional branches assuming system is at a reset condition.</td>
</tr>
<tr>
<td>02</td>
<td>02</td>
<td>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.</td>
</tr>
<tr>
<td>03</td>
<td>03</td>
<td>Test mask instruction—tests TM instruction using SBN and SBF.</td>
</tr>
<tr>
<td>04</td>
<td>04</td>
<td>Tests high selection of WR1—uses SBN, SBF, TM, and conditional branching instructions to test selecting high–order byte of WR1.</td>
</tr>
<tr>
<td>05</td>
<td>05</td>
<td>Load immediate (LI)—uses TM and conditional branching to test LI.</td>
</tr>
<tr>
<td>06</td>
<td>06</td>
<td>Compare immediate (CI).</td>
</tr>
<tr>
<td>07</td>
<td>07</td>
<td>Branch and link (BAL) and return (RETRN).</td>
</tr>
<tr>
<td>08</td>
<td>08</td>
<td>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).</td>
</tr>
<tr>
<td>09</td>
<td>09</td>
<td>Decrement register by X'01' (DEC) using LA1 instruction.</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>Increment register by X'01' (INC).</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>Decrement register by X'01' (DEC) using LA2 instruction.</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Add registers 2 bytes + 1 byte (AR).</td>
</tr>
<tr>
<td>WR3L Contents</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Add registers 2 bytes + 2 bytes (AR).</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Subtract registers 2 bytes - 2 bytes (SR).</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Load register from direct area of control storage (L).</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Store register to direct area of control storage (ST).</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Load register from control storage (LC).</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Store register from control storage (STC).</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Basic port tests – load and sense port register with all 256 data bytes. Sense port error byte and test for X'00'.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second load is done here. If the load device gets a processor check, WR3(L) contains hexadecimal 90.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Reset display light – byte 0 – bit 3:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MPLF reset carry Reset carry/set equal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MPLF PCRWRNX Load PCR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MPS WRN(X),PCR Sense PCR</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Subtract immediate (SI).</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Logical arithmetic 2 (LA2) increment register (INC).</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Logical OR function (LA1) byte-by-byte.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Logical AND function (LA1) byte-by-byte.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Shift left logical 1 byte (SLL).</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Logical exclusive OR (XR) byte-by-byte.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Logical AND complemented (NCR).</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Logical OR complemented (OCR).</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Add registers – 1 byte (AR).</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Subtract registers – 1 byte (SR).</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Add registers with carry – 1 byte (ACYR).</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Subtract registers with borrow – 1 byte (SCYR).</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Exclusive OR – 2 bytes with 2 bytes (XR).</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>OR – 2 bytes with 2 bytes (OR).</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>AND – 2 bytes with 2 bytes (AND).</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>AND – 2 bytes with complemented 2 bytes (NCR).</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>OR – 2 bytes with complemented 2 bytes (OCR).</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Shift 2 bytes left (SLLD).</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Subtract register (SR) – 1 byte from 2 bytes.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Subtract with borrow (SCYR).</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Add 2 bytes with carry (ACYR).</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Move zone R2 to zone R1 (MZZ); move zone R2 to numeric R1 (MZN).</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Hexadecimal branch using numeric field of register (HBN); hexadecimal branch using zone field of register (HBZ).</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Shift right 1 byte (SRL); shift right 2 bytes (SRLD).</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Load and store test of direct area of the second page of control store.</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
### Description

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Zero and add register (ZAR).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>I/O service request latch (set, reset), go latch (set, reset), sense console status byte for these latches.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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 |

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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 |

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Not valid control storage address check.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>Force ALU gate parity check.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>Force SAR parity check, storage gate parity check, and ALU gate parity check.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>Force ALU gate parity check, force SDR parity check, and storage gate parity check.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Test the I/O storage command.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>Control storage test - part 1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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. |

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>Reset display light - byte 0 - bit 5 sense of PSR, status byte 0 and status byte 2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>Load PSR and status byte 2.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>Load and sense LSR registers with their addresses, X'FF', X'00', and X'01'.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>Sense status byte 3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>Load and sense program mode register (PMR) and control mode register (CMR).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td>Not valid main storage address check.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>Address translation register (ATR) ripple test.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>78</td>
<td>Storage exception test.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contents</th>
<th>Description</th>
</tr>
</thead>
</table>
| 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.
Main Storage Processor Wrap Error Codes

Note: Wrap errors are not valid until the disk is ready.

02000001 Main storage tests run to each 2K block of main storage is checked. (See MAP 0190 for details.)
02000008 No-op (with service request enabled) did not update the IAR correctly.
02000009 Unconditional branch (with service request enabled) did not update the IAR correctly.
0200000A Conditional branch test failed.
0200000B Load PSR and branch on condition failed.
02000010 Compare logical immediate 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 Subtract zoned test failed.
0200001E 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.

Data Communications Wrap Error Codes

First or Second Communications Adapter

80800101 Test line 1 adapter card and internal modem (if installed and in the UDT configuration)
80200101 Test line 2 adapter card and internal modem (if installed and in the UDT configuration)

MLCA

8288XXYY High priority line
828ZXYY Low priority line
828ZXYY Low priority line
828WXYY Low priority line

MLCA Controller

10800YY 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

1255 Magnetic Character Reader Wrap Error Code

52500XX See the IBM System/34 1255 Attachment Feature Theory/Maintenance, SY31-0521.
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.

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

CAC00001 Channel and adapter reset tests
CAC00003A Register tests
CAC00003B PCR tests
CAC00003C PCR tests
CAC00003D PCR tests
CAC000047 Storage addressing test
CAC000048 Storage data test
CAC00004B Storage data test
CAC000053 Controller microinterrupt test
CAC0000A3 Line drivers test

System Console Wrap Error Codes

COC00001 Channel and adapter reset tests
COC0000B Data bus test
COC0000D IAR/SAR increment test
COC0000E Controller busy test
COC0000F System microinterrupt test
COC000A4 Poll system console (address 0,0)
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

DOD00001 Command decode test 1
DOD00002 Command decode test 2
DOD00003 JIO command decode test
DOD00005 Head load latch test
DOD00006 Inner tracks latch test
DOD00007 Head select test
DOD0032 Index counter test
DOD0071 Seek lines test
DOD0091 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
D1D0022 Read bit ring test
D1D0023 Cylinder not match test
D1D0029 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.

EOE00004  Adapter interrupt test
EOE00005  Controller status test
EOE00007  Controller DBO/DBI wrap
EOE00008  Adapter command reject
EOE0000A  Controller time-out test
EOE0002C  Controller storage addressing
EOE0002B  Controller ALU test
EOE00030  Main/auxiliary register select
EOE0004E  Load and store using DAR test
EOE00060  Print data wrap
EOE00062  Printer sense test
EOE00063  Printer error sense test
EOE00065  Printer switch sense test
EOE00067  Data parity check test
EOE00068  Printer contactor test
EOE0006F  Printer diagnostic wrap
EOE00070  Fire tier test
EOE00074  Print data strobe test
EOE00075  Timer interrupt test
EOE00076  Printer control wrap
EOE00079  Carriage interrupt test
EOE0007A  PCR/interrupt test
EOE00096  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.
### 99-030 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

<table>
<thead>
<tr>
<th>Halt Code</th>
<th>Meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>Work station attachment MDI test halt:</td>
</tr>
<tr>
<td></td>
<td>Diagnostic supervisor needs DIAGB4 diskette for the work station attachment tests. Insert DIAGB4 and press the CE Start switch.</td>
</tr>
<tr>
<td>0002</td>
<td>Work station TU select halt:</td>
</tr>
<tr>
<td></td>
<td>The diagnostic supervisor needs the DIAGB4 diskette to be inserted in the diskette drive and the ID of a TU test to be run.</td>
</tr>
<tr>
<td></td>
<td>1. Insert DIAGB4.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>3. Set the Mode Selector switch to Proc Run to loop on the TU test, or</td>
</tr>
<tr>
<td></td>
<td>Set the Mode Selector switch to Sys Insn Step to run the test and stop.</td>
</tr>
<tr>
<td></td>
<td>4. Press the CE Start switch to start the test.</td>
</tr>
<tr>
<td>0003</td>
<td>Work station attachment TU select test result halt:</td>
</tr>
<tr>
<td></td>
<td>The diagnostic supervisor has run a TU test and set up work registers as follows:</td>
</tr>
<tr>
<td></td>
<td>WR3 = TU ID</td>
</tr>
<tr>
<td></td>
<td>WR6 (H) = TU test result byte 1</td>
</tr>
<tr>
<td></td>
<td>WR6 (L) = TU test result byte 2</td>
</tr>
<tr>
<td></td>
<td>WR7 (H) = TU test result byte 3 (if used)</td>
</tr>
<tr>
<td></td>
<td>WR7 (L) = TU test result byte 4 (if used)</td>
</tr>
<tr>
<td></td>
<td>Press the CE Start switch to run the TU test again.</td>
</tr>
<tr>
<td>0005</td>
<td>Current diskette does not have the work station attachment diagnostics on it. Insert DIAGB4 and press CE Start.</td>
</tr>
<tr>
<td>0010</td>
<td>Work station attachment device MDI test halt:</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>WR1 = MDI MAP ID</td>
</tr>
<tr>
<td></td>
<td>WR2 = MDI MAP step number</td>
</tr>
<tr>
<td>0030</td>
<td>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.</td>
</tr>
<tr>
<td>0031</td>
<td>A printer error occurred while work station tests were running. Correct the printer error and press CE Start to try the MDI again.</td>
</tr>
<tr>
<td>0080</td>
<td>Diagnostic supervisor needs DIAGB1 or DIAGB4 diskette to load the work station attachment functional microcode again.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Loaded From</th>
<th>Into</th>
<th>By</th>
<th>Device Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated</td>
<td>Diskette or disk</td>
<td>CSIPL from diskette DIAGB1</td>
<td>All of the system</td>
</tr>
<tr>
<td></td>
<td>Control storage</td>
<td>or CSIPL from disk with F800 in the Data/Address switches</td>
<td></td>
</tr>
<tr>
<td>Concurrent supervisor</td>
<td>Diskette</td>
<td>Enter CONCR option menu</td>
<td>Failing device and controller, 14K MS, diskette drive and display</td>
</tr>
<tr>
<td></td>
<td>Main storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>along with SSP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

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.

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.
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.
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 workstation 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 customize, 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.
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.

Diagnosis 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.)
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.
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.
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.
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.
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=0030; 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'.
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.
### Sample Message

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>EXPECTED ID</th>
<th>ACTUAL ID</th>
<th>DESCRIPTION</th>
<th>ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS HD CYL</td>
<td>FFSSH@CC FFSSH@CC</td>
<td>0E001166</td>
<td>MFG REASSIGNED DEFECT</td>
<td>05381015</td>
</tr>
</tbody>
</table>

#### Field Description

**LOCATION**

- **SS**
  - The position of the record on the track as follows (see 83-981):
    - **Message**
      - **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 0-9). 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**
**Output Messages**

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.

<table>
<thead>
<tr>
<th>Message Type</th>
<th>Description</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTOR ID ERROR</td>
<td>The actual ID did not match the expected ID, or a CRC check occurred while</td>
<td>Run the 62PC Disk initialize utility or the 62PC Disk analyze utility option 2.</td>
</tr>
<tr>
<td></td>
<td>reading the ID.</td>
<td></td>
</tr>
<tr>
<td>NO RECORD FOUND</td>
<td>The record ID did not match any of the ID’s read.</td>
<td>Run the 62PC Disk initialize utility.</td>
</tr>
<tr>
<td>ALTERNATIVE DATA NOT RELIABLE</td>
<td>Bit 0 or 1 in the alternative sector ID is on, indicating that a CRC check occurred while recovering data from the defective sector.</td>
<td>Have the customer run the SSP Build procedure ($BUILD) to verify or correct the data.</td>
</tr>
<tr>
<td>UNREADABLE RECORD FIELD</td>
<td>A CRC check occurred when reading a data field.</td>
<td>Run the 62PC disk initialize utility.</td>
</tr>
<tr>
<td>DISK SERVO SURFACE DEFECT</td>
<td>The servo signals from the disk servo surface do not keep the heads on track.</td>
<td>Run the 62PC disk MDls to determine the cause of this error.</td>
</tr>
<tr>
<td>UNREADABLE ID</td>
<td>The utility could not read a sector ID.</td>
<td>1. Run the 62PC disk MDls.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. If no error is found, run the analyze utility again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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).</td>
</tr>
<tr>
<td>MFG REASSIGNED DEFECT</td>
<td>A defective sector has been assigned to a sector on the alternative cylinder during the making of the disk.</td>
<td>No action required.</td>
</tr>
<tr>
<td>Message</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>USER REASSIGNED</td>
<td>Reassigned</td>
<td>A defective sector has been assigned to a sector on the alternative cylinder by the 62PC initialize utility or the system support program (SSP).</td>
</tr>
<tr>
<td>DEFECT</td>
<td>Defect</td>
<td>Reassigned A defective sector has been assigned to a sector on the alternative cylinder by the 62PC initialize utility or the system support program (SSP).</td>
</tr>
<tr>
<td>DISPLACED DEFECT</td>
<td>Displaced</td>
<td>Displaced 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</td>
</tr>
<tr>
<td>DEFECTIVE ALTERNATIVE SECTOR</td>
<td>Displaced</td>
<td>Displaced A sector on the alternative cylinder is bad and can not be used.</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Message</th>
<th>Required Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERRUPT</td>
<td>Record the error information and run the 62PC disk MDls to find</td>
</tr>
<tr>
<td>TIME-OUT (byte 1,</td>
<td>the error.</td>
</tr>
<tr>
<td>bit 0)</td>
<td></td>
</tr>
<tr>
<td>INVALID DISK</td>
<td>Record the error information and run the 62PC disk MDls to find</td>
</tr>
<tr>
<td>INTERRUPT (byte 1,</td>
<td>the error.</td>
</tr>
<tr>
<td>bit 1)</td>
<td></td>
</tr>
<tr>
<td>MESSAGE MODULE NOT</td>
<td>The DIAGB7PC diskette does not have a required program. Order a</td>
</tr>
<tr>
<td>FOUND (byte 1, bit 2)</td>
<td>new DIAGB7PC diskette.</td>
</tr>
</tbody>
</table>

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).
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>EXPECTED ID</th>
<th>ACTUAL ID</th>
<th>DESCRIPTION</th>
<th>ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>HD</td>
<td>cyl</td>
<td>FFSSH@CC</td>
<td>FFSSH@CC</td>
</tr>
<tr>
<td>20 00 0000</td>
<td>00400000</td>
<td>02400000</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>20 00 0040</td>
<td>00400040</td>
<td>02400040</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>10 00 0076</td>
<td>00200076</td>
<td>0A400076</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>1C 00 007C</td>
<td>0038007C</td>
<td>0A40007C</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>09 00 00A9</td>
<td>001200A9</td>
<td>0A4000A9</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>04 00 00D0</td>
<td>000800D0</td>
<td>0A4000D0</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>0F 00 012A</td>
<td>001E012A</td>
<td>0A40012A</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>17 00 0164</td>
<td>002E0164</td>
<td>0A400164</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>20 00 0166</td>
<td>00400166</td>
<td>02400166</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>1C 01 0009</td>
<td>00280009</td>
<td>0A400009</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>12 01 0013</td>
<td>00140013</td>
<td>0A40013</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>14 01 0022</td>
<td>00180022</td>
<td>0A40022</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>1C 01 002E</td>
<td>0028002E</td>
<td>0A4002E</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
<tr>
<td>1D 01 003E</td>
<td>0028003E</td>
<td>0028003E</td>
<td>*SECTOR ID ERROR</td>
<td></td>
</tr>
<tr>
<td>2D 01 0040</td>
<td>00400040</td>
<td>02400040</td>
<td>DISPLACED DEFECT</td>
<td></td>
</tr>
</tbody>
</table>

Enter Cylinder and Head Values to Option 2

Figure 99-1. Option 1 Output Example

```
0030042E 0032042E 0034042E 0036042E
0038042E 003A042E 003C042E 003E042E
0000042E 0002042E 0004042E 0006042E
0008042E 000A042E 000C042E 000E042E
0010042E 0012042E 0014042E 0016042E
0018042E 001A042E 001C042E 001E042E
0020042E 0022042E 0024042E 0026042E
0040042E 0042042E 0044042E 0046042E
0048042E 004A042E 004C042E 004E042E
0050042E 0052042E 0054042E 0056042E
0058042E 005A042E 005C042E 005E042E
0060042E 0062042E 0064042E 0066042E
0068042E 006A042E 006C042E 006E042E
0070042E 0072042E 0074042E 0076042E
0078042E 007A042E 007C042E 007E042E
0080042E 0082042E 0084042E 0086042E
X ----- ENTER 'R' OR 'C'
MDI AJ1 STEP 14 10 SEC A1J1
```

Figure 99-2. Track of IDs Example

Enter Cylinder and Head Values to Option 2

Number of ID from Start of Track

Sector ID Error Information
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 MDls before either option of the initialize utility to verify that the hardware operates correctly.

Systems with three or four 62PC disk drives have two DIAGAO diskettes. The DIAGAO 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 DIAGAO 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 DIAGAO diskette.

• Writes zeros in the data fields of all usable sectors.

• Reassigns defective sectors that are not defined by DIAGAO 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 DIAGAO Diskette (Organize)

This option is used for disk drives that have not been initialized, or for disk drives for which the DIAGAO diskette has been lost. On systems with three or four 62PC disk drives, verify that you are using the correct DIAGAO 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 DIAGAO 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 DIAGAO 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 DIAGAO diskette for drives C and D, mark the new DIAGAO 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 MDls 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).
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.

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.
  - 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.
  - 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.

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 which can translate the data for you.

1 Datascope is a trademark of the Spectrum Corporation.
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 MDls from the CE panel:

1. **Automatic mode**—Set the Address/Data switches to F100 and set the Mode Selector switch to Proc Run. The MDls 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 MDls 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).

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**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 MDls 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'\text{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 WRO, 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 WRO, 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.
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 WRO.

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.


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 = Sys 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.
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.
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 COXY  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 COXY  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.
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
        CO = work station controller
        EO = 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.

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.
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 DIAG81 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.
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.
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 communications 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.
99-073 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:

\[ \text{XX XX XX XX} \]

\[ ^\d \] 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)

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.
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.
Step 7. The other station should be ready with the same or similar SOLC 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.

<table>
<thead>
<tr>
<th>XX</th>
<th>Value</th>
<th>Content of Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Data entered by operator (requester station sends message from storage that you have entered into storage.)</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>All 256 characters (EBCDIC)</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>A-Z, 0-9 (36 EBCDIC characters)</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>40 X'AA's and 40 X'55's (80 EBCDIC characters)</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>256 X'00's</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>256 X'FF's</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>X'F3' (SDLC TEST command)</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Transmit only all 256 characters</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Random data of specified block size</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>Repeated character (block size)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Transmit only data entered (you enter the data message into storage)</td>
<td></td>
</tr>
</tbody>
</table>

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.

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.
SDLC Online Test Options

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:

<table>
<thead>
<tr>
<th>Error Statistics Table:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FMS RECVD</strong></td>
</tr>
<tr>
<td><strong>VALID FMS RECVD</strong></td>
</tr>
<tr>
<td><strong>BCC ERRORS</strong></td>
</tr>
<tr>
<td><strong>BUFFER OVERRUNS</strong></td>
</tr>
<tr>
<td><strong>ADAPTER CHKS</strong></td>
</tr>
<tr>
<td><strong>INVALID FMS</strong></td>
</tr>
</tbody>
</table>

A list of error messages is contained under Error Messages for Online Test.

---

Note: Options are reset by reloading the online test.
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  SDLC hardware error.
ON RECEIVE  SDLC hardware error.
ADAPTER CHECK  SDLC hardware error.
ON TRANSMIT  Data Set Ready was made not
              active.
ABORTIVE  Data Set Ready not on.
DISCONNECT  Data communications is not in
             the UDT configuration.
CHECK  No response received after 90
        seconds.
DATA SET READY  XX or YY values entered from
               keyboard are not correct.
DROPPED  Expected data messages did not
          compare with data received.

SDLC Control Characters

<table>
<thead>
<tr>
<th>Format</th>
<th>Control Field Bit</th>
<th>Command/Response Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Nr 1 P/F 1 P/F 0</td>
<td>Sequenced Information Frame</td>
</tr>
<tr>
<td>S</td>
<td>Nr 0 P/F 0 0 0 1</td>
<td>Disconnect</td>
</tr>
<tr>
<td></td>
<td>Nr 1 P/F 0 0 0 1</td>
<td>Set Normal Response Mode</td>
</tr>
<tr>
<td></td>
<td>0 0 1 P 0 0 0 1</td>
<td>Exchange Identification</td>
</tr>
<tr>
<td></td>
<td>0 0 0 F 1 1 1 1</td>
<td>Disconnected Mode</td>
</tr>
</tbody>
</table>

Notes:
1. I = Information, S = Supervisor control function, 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 last
   bit from the secondary station.
4. If errors occur on receive operations, the control field byte
   may not be valid.
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.

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.

If Printer Spool Function is active when you press the Print key on the keyboard, the display is written to the Printer Spool File.

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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 a's 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.
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)61(SS)(SS)(SS) 61F(X)F(X)F(X) (no spaces)

For ASCII, enter: 2F3(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.


(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 '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 ACKO 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
F5F6F7F8F9D03

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).
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.

CRC/LRC/VRC CHECK ..................... BCC check.

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 ACKO ...................... No ACKO 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.

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 SEQUENC ........... 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 ACKO .... 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.
MLCA Concurrent Wrap Test and Trace Dump Driver Program (COMMTST)

Function: Permits the running of three programs under option control:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Line wrap test</td>
</tr>
<tr>
<td>2.</td>
<td>Controller wrap test</td>
</tr>
<tr>
<td>3.</td>
<td>Print CE trace</td>
</tr>
<tr>
<td>4.</td>
<td>Print automatic trace</td>
</tr>
<tr>
<td>5.</td>
<td>End test</td>
</tr>
</tbody>
</table>

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 1A. Online test transmission sequence for message type XX = 00 multipoint (See Note 2.)

<table>
<thead>
<tr>
<th>Requester</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOT</td>
<td>EOT</td>
</tr>
<tr>
<td>POLL</td>
<td>POLL</td>
</tr>
<tr>
<td>ENQ</td>
<td>ACK0/1 (See Note 1.)</td>
</tr>
<tr>
<td>ACKO</td>
<td>ACKO/1 (See Note 1.)</td>
</tr>
<tr>
<td>SOH</td>
<td>SOH</td>
</tr>
<tr>
<td>% 0 YY 0</td>
<td>STX</td>
</tr>
<tr>
<td>STX</td>
<td>ETX</td>
</tr>
<tr>
<td>ETX</td>
<td>ACK1</td>
</tr>
<tr>
<td>(DLE)</td>
<td>(DLE)</td>
</tr>
<tr>
<td>STX</td>
<td>ETX</td>
</tr>
<tr>
<td>TEXT</td>
<td>TEXT</td>
</tr>
<tr>
<td>(OLE)</td>
<td>(OLE)</td>
</tr>
<tr>
<td>REPEATED</td>
<td>REPEATED</td>
</tr>
<tr>
<td>TEXT and</td>
<td>TEXT and</td>
</tr>
<tr>
<td>CONTROL</td>
<td>CONTROL</td>
</tr>
<tr>
<td>CHARACTERS</td>
<td>CHARACTERS</td>
</tr>
<tr>
<td>REPEATED</td>
<td>REPEATED</td>
</tr>
<tr>
<td>YY-1 TIMES</td>
<td>YY-1 TIMES</td>
</tr>
<tr>
<td>ACK0/1</td>
<td>ACK0/1</td>
</tr>
<tr>
<td>REPEATED</td>
<td>REPEATED</td>
</tr>
<tr>
<td>YY-1 TIMES</td>
<td>YY-1 TIMES</td>
</tr>
<tr>
<td>EOT</td>
<td>EOT</td>
</tr>
</tbody>
</table>

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 2.** Online test transmission sequence for message type XX = 01 point-to-point

<table>
<thead>
<tr>
<th>Requester</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENQ</td>
<td>ACK0</td>
</tr>
<tr>
<td>SOH</td>
<td></td>
</tr>
<tr>
<td>% 1 YY 0</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td></td>
</tr>
<tr>
<td>TEXT</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>ETX</td>
<td>ACK1</td>
</tr>
<tr>
<td>EOT</td>
<td>ENQ</td>
</tr>
<tr>
<td>ACK0</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td></td>
</tr>
<tr>
<td>TEXT</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>ETX</td>
<td>ACK1</td>
</tr>
<tr>
<td>ACK0/1</td>
<td></td>
</tr>
<tr>
<td>(See Note 1.) TEXT and CONTROL CHARACTERS REPEATED YY-1 TIMES</td>
<td></td>
</tr>
<tr>
<td>ACK0/1</td>
<td></td>
</tr>
<tr>
<td>REPEATED</td>
<td>YY-1 TIMES</td>
</tr>
<tr>
<td>(See Note 1.) EOT</td>
<td></td>
</tr>
</tbody>
</table>

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.)

<table>
<thead>
<tr>
<th>Requester</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOT POLL</td>
<td></td>
</tr>
<tr>
<td>ENQ</td>
<td></td>
</tr>
<tr>
<td>SOH</td>
<td></td>
</tr>
<tr>
<td>% 1 YY N</td>
<td></td>
</tr>
<tr>
<td>ADDR</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td></td>
</tr>
<tr>
<td>TEXT</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>ETX</td>
<td>ACK1</td>
</tr>
<tr>
<td>EOT</td>
<td>EOT</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>ENQ</td>
</tr>
<tr>
<td>ACK0</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td></td>
</tr>
<tr>
<td>TEXT</td>
<td></td>
</tr>
<tr>
<td>(DLE)</td>
<td></td>
</tr>
<tr>
<td>ETX</td>
<td>ACK1</td>
</tr>
<tr>
<td>ACK0/1</td>
<td></td>
</tr>
<tr>
<td>(See Note 1.) TEXT AND CONTROL CHARACTERS REPEATED YY-1 TIMES</td>
<td></td>
</tr>
<tr>
<td>ACK0/1</td>
<td></td>
</tr>
<tr>
<td>REPEATED</td>
<td>YY-1 TIMES</td>
</tr>
<tr>
<td>(See Note 1.) EOT</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Requester</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENQ</td>
<td>ACK0</td>
</tr>
<tr>
<td>SOH</td>
<td></td>
</tr>
<tr>
<td>% XX YY NN</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td>ACK1</td>
</tr>
<tr>
<td>ETX</td>
<td>ENQ</td>
</tr>
<tr>
<td>ACK0</td>
<td>STX</td>
</tr>
<tr>
<td>REPEATED</td>
<td>YY TIMES</td>
</tr>
<tr>
<td>ACK0/1</td>
<td>REPEATED</td>
</tr>
<tr>
<td>YY TIMES</td>
<td>EOT</td>
</tr>
</tbody>
</table>

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.)

<table>
<thead>
<tr>
<th>Requester</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOT</td>
<td>POLL</td>
</tr>
<tr>
<td>SOH</td>
<td>ENQ</td>
</tr>
<tr>
<td>% XX YY N</td>
<td></td>
</tr>
<tr>
<td>ADDR</td>
<td></td>
</tr>
<tr>
<td>STX</td>
<td>ETX</td>
</tr>
<tr>
<td>EOT</td>
<td>ACK1</td>
</tr>
<tr>
<td>EOT</td>
<td>EOT</td>
</tr>
<tr>
<td>ADDRESS</td>
<td>ENQ</td>
</tr>
<tr>
<td>ACK0/1</td>
<td>(DLE)</td>
</tr>
<tr>
<td>YY TIMES</td>
<td>ETX</td>
</tr>
<tr>
<td>REPEATED</td>
<td>(DLE)</td>
</tr>
<tr>
<td>YY TIMES</td>
<td>EOT</td>
</tr>
</tbody>
</table>

Text is specified by XX. (See Table 6.)
Table 6. Message Numbers for BSCA Online Test.

<table>
<thead>
<tr>
<th>Code Type or Feature</th>
<th>Transparency Mode</th>
<th>Applicable Messages</th>
<th>XX Value (message number)</th>
<th>Content of Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requester Routine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multipoint</td>
<td>YES or NO</td>
<td>00, 01, 02, 04, 14, 15, 16, 19</td>
<td>00</td>
<td>Requester sends message from storage (you must put message in storage)</td>
</tr>
<tr>
<td>EBCDIC</td>
<td>YES</td>
<td>00, 01, 02, 04, 14, 15, 16, 19</td>
<td>01</td>
<td>Requester receives message from storage (you must put message in storage)</td>
</tr>
<tr>
<td>EBCDIC</td>
<td>NO</td>
<td>00, 01, 04, 14, 15, 16</td>
<td>02</td>
<td>256 EBCDIC characters (transparent)</td>
</tr>
<tr>
<td>ASCII</td>
<td>NO</td>
<td>00, 01, 05, 06</td>
<td>04</td>
<td>245 EBCDIC characters (all EBCDIC except DLC)</td>
</tr>
<tr>
<td>Responder Routine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multipoint</td>
<td>No applicable messages</td>
<td></td>
<td>06</td>
<td>36 ASCII characters: A-Z, 0-9</td>
</tr>
<tr>
<td>EBCDIC</td>
<td>YES</td>
<td>00, 01, 02, 04, 14, 15, 16, 19, 20, 21 &amp; 22</td>
<td>14</td>
<td>36 EBCDIC characters: A-Z, 0-9</td>
</tr>
<tr>
<td>EBCDIC</td>
<td>NO</td>
<td>00, 01, 04, 14, 15, 16</td>
<td>15</td>
<td>80 EBCDIC characters: 74 X'00' and 6 SYNS</td>
</tr>
<tr>
<td>ASCII</td>
<td>NO</td>
<td>00, 01, 05, 06</td>
<td>16</td>
<td>80 EBCDIC characters: 40 AA and 40 X'55'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>19</td>
<td>290 EBCDIC characters: 280 X'00' and 10 SYNS (transparent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>80 EBCDIC characters: A-Z, 0-9 and 00 through 3F (transparent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>120 EBCDIC characters: A-Z, 0-9, and 00 through 53 (transparent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22</td>
<td>144 EBCDIC characters: A-Z, 0-9, and 00 through 6B (transparent)</td>
</tr>
</tbody>
</table>
Table 7. Communications Control Characters

<table>
<thead>
<tr>
<th>Name of Function</th>
<th>Functional Mnemonic</th>
<th>EBCDIC Code</th>
<th>ASCII Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of heading.</td>
<td>SOH</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>Start of text.</td>
<td>STX</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>End of transmission block.</td>
<td>ETB</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>End of text.</td>
<td>ETX</td>
<td>03</td>
<td>03</td>
</tr>
<tr>
<td>End of transmission.</td>
<td>EOT</td>
<td>37 pad (see note)</td>
<td>04 pad (see note)</td>
</tr>
<tr>
<td>Attn.</td>
<td>ENQ</td>
<td>2D</td>
<td>05</td>
</tr>
<tr>
<td>Negative acknowledge.</td>
<td>NAK</td>
<td>3D pad (see note)</td>
<td>15 pad (see note)</td>
</tr>
<tr>
<td>Synchronous idle.</td>
<td>SYN</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>Data link escape.</td>
<td>DLE</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>End of intermediate transmission block.</td>
<td>ITB</td>
<td>1F</td>
<td>1F</td>
</tr>
<tr>
<td>Even acknowledge.</td>
<td>ACK0</td>
<td>1070</td>
<td>1030</td>
</tr>
<tr>
<td>Odd acknowledge.</td>
<td>ACK1</td>
<td>1061</td>
<td>1031</td>
</tr>
<tr>
<td>Wait before transmit positive acknowledge.</td>
<td>WACK</td>
<td>106B</td>
<td>103B</td>
</tr>
<tr>
<td>Mandatory disconnect.</td>
<td>DISC</td>
<td>1037</td>
<td>1004</td>
</tr>
<tr>
<td>Reverse interrupt.</td>
<td>RVI</td>
<td>107C</td>
<td>103C</td>
</tr>
<tr>
<td>Temporary text delay.</td>
<td>TTD</td>
<td>022D</td>
<td>0205</td>
</tr>
<tr>
<td>Transparent start of text.</td>
<td>XSTX</td>
<td>1002</td>
<td></td>
</tr>
<tr>
<td>Transparent intermediate block.</td>
<td>XITB</td>
<td>101F</td>
<td></td>
</tr>
<tr>
<td>Transparent end of text.</td>
<td>XETX</td>
<td>1003</td>
<td></td>
</tr>
<tr>
<td>Transparent end of transmission block.</td>
<td>XETB</td>
<td>1026</td>
<td></td>
</tr>
<tr>
<td>Transparent synchronous idle.</td>
<td>XSYN</td>
<td>1032</td>
<td></td>
</tr>
<tr>
<td>Transparent block cancel.</td>
<td>XENQ</td>
<td>102D</td>
<td></td>
</tr>
<tr>
<td>Transparent TTD.</td>
<td>XTTD</td>
<td>1002102D</td>
<td></td>
</tr>
<tr>
<td>Data DLE in transparent mode.</td>
<td>XDLE</td>
<td>1010</td>
<td></td>
</tr>
</tbody>
</table>

Note: Pad is 4 low-order bits of 1’s (more bits may optionally be on).
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.

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
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.
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-MDI 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.
<table>
<thead>
<tr>
<th>XX Value</th>
<th>Description</th>
<th>XX Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Issue check reset and sense status byte 3.</td>
<td>26</td>
<td>Load and sense the address translation registers (ATRs) with their addresses.</td>
</tr>
<tr>
<td>02</td>
<td>Sense CPU error byte.</td>
<td>27</td>
<td>Address translation register (ATR) ripple test.</td>
</tr>
<tr>
<td>03</td>
<td>Issue check reset, disable checks, and test MSAR low.</td>
<td>28</td>
<td>Load ACRE with X'AA' and sense the ACRE.</td>
</tr>
<tr>
<td>04</td>
<td>Load BMR with X'00' and sense the BMR.</td>
<td>29</td>
<td>Load and sense main store with X'FF'. Test run in translated mode.</td>
</tr>
<tr>
<td>05</td>
<td>Load BMR with X'55' and sense the BMR.</td>
<td>30</td>
<td>Load and sense main store with X'00'. Test run in translated mode.</td>
</tr>
<tr>
<td>06</td>
<td>Load BMR with X'AA' and sense the BMR.</td>
<td>31</td>
<td>Load and sense main store with X'01'. Test run in translated mode.</td>
</tr>
<tr>
<td>07</td>
<td>Load CMR with X'00' and sense the CMR.</td>
<td>32</td>
<td>Issue an MSP reset and sense the PSR.</td>
</tr>
<tr>
<td>08</td>
<td>Load CMR with X'55' and sense the CMR.</td>
<td>33</td>
<td>Load the MSP PSR with X'3C' and sense.</td>
</tr>
<tr>
<td>09</td>
<td>Load CMR with X'AA' and sense the CMR.</td>
<td>34</td>
<td>Sense the MSP Q register.</td>
</tr>
<tr>
<td>10</td>
<td>Load PMR with X'00' and sense the PMR.</td>
<td>35</td>
<td>Load and sense MSP OP 2 high byte with X'00'.</td>
</tr>
<tr>
<td>11</td>
<td>Load PMR with X'55' and sense the PMR.</td>
<td>36</td>
<td>Load and sense MSP OP 2 high byte with X'FF'.</td>
</tr>
<tr>
<td>12</td>
<td>Load PMR with X'AA' and sense the PMR.</td>
<td>37</td>
<td>Load and sense MSP PSR with X'00'.</td>
</tr>
<tr>
<td>13</td>
<td>Load CCR with X'00' and sense the CCR.</td>
<td>38</td>
<td>Initialize OP 1 high to X'AA', XR1 high to X'55' and sense OP 1 high.</td>
</tr>
<tr>
<td>14</td>
<td>Load CCR with X'55' and sense the CCR.</td>
<td>39</td>
<td>Initialize OP 1 high to X'AA', IAR high to X'55' and sense OP 1 high.</td>
</tr>
<tr>
<td>15</td>
<td>Load CCR with X'AA' and sense the CCR.</td>
<td>40</td>
<td>Initialize OP 1 high to X'AA', OP 2 high to X'55' and sense OP 1 high.</td>
</tr>
<tr>
<td>16</td>
<td>Load ACR(L) with X'00' and sense the ACR(L).</td>
<td>41</td>
<td>Load main store with X'FF' and sense. Test run in translated mode.</td>
</tr>
<tr>
<td>17</td>
<td>Load ACR(L) with X'55' and sense the ACR(L).</td>
<td>42</td>
<td>Load MSP PSR with X'01'. Check for SDR P-check.</td>
</tr>
<tr>
<td>18</td>
<td>Load ACR(L) with X'AA' and sense the ACR(L).</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Load ACR(H) with X'00' and sense the ACR(H).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Load ACR(H) with X'55' and sense the ACR(H).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Load ACR(H) with X'AA' and sense the ACR(H).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Load ACRE with X'00' and sense the ACRE.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Load ACRE with X'55' and sense the ACRE.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Storage Control Card register single addressing test.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XX</td>
<td>Value</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Main store 1 address-1 byte test. This test is run in translated mode. Addressing is from highest to lowest.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Main store 1 address-1 byte test. This test is run in translated mode. Addressing is from lowest to highest.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Main store 1 address-1 byte test. This test is run in real mode. Addressing is from highest to lowest.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Main store 1 address-1 byte test. This test is run in real mode. Addressing is from lowest to highest.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>BMR 16K-byte hardware switch test. This test is run in real mode.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>BMR 16K-byte hardware switch test. This test is run in real mode.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>BMR 16K-byte hardware switch test. This test is run in translated mode.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>BMR 16K-byte hardware switch test. This test is run in translated mode.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Reserved.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Load BMR with X'03' ARR with X'AA'. Sense BMR and test for X'03'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Sense MSP PSR.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Load and sense OP 2 low byte with X'00'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Load and sense OP 2 low byte with X'FF'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Initialize OP 2 low to X'55', OP 2 high to X'AA', and sense OP 1 low.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Load MSP PSR with X'FF' and sense.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Sense all MSP registers and ATRs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Store bad parity into address X'00' of the MSP registers.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XX</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Reset the MSP and sense status byte 2.</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Main storage not valid address check test. This test uses real addressing.</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Main storage not valid address check test. This test uses translated addressing.</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Load main storage address 0000 with X'80' and sense data.</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Reserved.</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>ATR storage exception test.</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Main storage data path flow test.</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>Main storage data path flow test (extended).</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>ATR utilization test.</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Main store 16K block address selection test. Lowest address to highest.</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Main store 16K block address selection test. Highest address to lowest.</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Issue MSP reset and sense status bytes 0 and 1.</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Execute a not valid OP with the MSP and check results in status bytes 0 and 2.</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>Execute a not valid OP with the MSP and check results in status bytes 0 and 2.</td>
<td></td>
</tr>
<tr>
<td>XX Value</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>Execute a not valid OP with the MSP and check results in status bytes 0 and 2 and checks the data in the LCRR.</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Execute a Move Character instruction in the MSP and stop after the OP byte has been executed.</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>Execute a Move Character instruction in the MSP and stop after the 0 byte has been executed.</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Execute a Move Character instruction in the MSP and stop after the first byte of operand 1 has been executed.</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>Execute a Move Character instruction in the MSP and stop after the second byte of operand 1 has been executed.</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>Execute a Move Character instruction in the MSP and stop after the high byte of operand 2 has been executed.</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>Execute a Move Character instruction in the MSP and stop after the low byte of operand 2 has been executed.</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Execute a Move Character instruction in the MSP and stop after the EA cycle has been executed.</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>Execute a Move Character instruction in the MSP and stop when completed. The MVC results are then checked.</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>Execute a Move Character instruction in the MSP and stop after OP time. The instruction is in indexed mode.</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>Execute a Move Character instruction in the MSP and stop after 0 time. The instruction is in indexed mode.</td>
<td></td>
</tr>
<tr>
<td>89</td>
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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.

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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.)
TC001 ADAPTER RESET

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

TC002 DIAGNOSTIC MODE ENABLE/DISABLE

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

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

TC004 U-INTERRUPT REQUEST ENABLE

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 Not Interrupt Serviced
7 Adapter Reset Failed

Result Byte 2
0-7 Not Used

TC005 SET SERVICE REQUEST

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

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
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
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
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

RESULT BYTE 2
0-7 NOT USED

TC00A
JIO FUNCTIONS
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
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
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
TCOOD
X-SAR BIT 2, CONTROLLER LOAD

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

TCO0E
CONTROLLER BUSY

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

TCO0F
CONTROLLER TO CHANNEL 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

TCO10
CONTROLLER OP CHECK LATCH

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

TCO11
CONT DBO/DBI PARITY LATCH

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

TCO12
COMMAND PENDING SENSE TEST

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 SET 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

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 NOT SET
1 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

RESULT BYTE 1
0 CYCLE STEAL XFER CHECK BIT NOT SET
1 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

RESULT BYTE 1
0-7 BITS FAILING TO RESPOND

RESULT BYTE 2
0-7 COMPARE DATA

TC031
CONTROLLER DAR SELECT

RESULT BYTE 1
0 DAR SELECT TEST FAILED
1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

TC032
CONTROLLER DAR DATA (5)

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)

RESULT BYTE 1
0 DAR DATA TRANSFER TEST FAILED
1-7 NOT USED

RESULT BYTE 2
0-7 NOT USED
TC034 CONTROLLER REG/AUX REGS SELECT

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

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)

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)

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

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)

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

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

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 ALU non-zero is on, and ALU zero and ALU carry are 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

Test setting of ALU non-zero indication with control store sense instruction: This test generates a non-zero condition in the ALU. The control store program senses this condition and checks ALU non-zero is on, and ALU carry and ALU non-zero are off.

RESULT BYTE 1
0 ALU non-zero 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

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 non-zero 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

Test setting of ALU carry and non-zero indication with control store sense instruction: This test generates carry and non-zero 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
TC03F CONTROLLER ALU 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 SETTING OF ALU CARRY, ZERO, AND NONZERO INDICATIONS WITH CONTROL STORE SENSE INSTRUCTION: THIS TEST WILL GENERATE CARRY, ZERO, AND NONZERO 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 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 GENERATES 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 ZERO (BZ)  
4 BRANCH ON CARRY (BCY)  
5 BRANCH ON NEGATIVE (BN)  
6 BRANCH ON NOT ZERO (BNZ)  
7 BRANCH UNCONDITIONAL (B)  
0-7 NOT USED

RESULT BYTE 2  
0-7 NOT USED

TC042 CONTROLLER ALU TEST SETTING OF ALU NONZERO 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 NONZERO 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)  
4 BRANCH ON CARRY (BCY)  
5 BRANCH ON NEGATIVE (BN)  
6 BRANCH ON NOT ZERO (BNZ)  
7 BRANCH UNCONDITIONAL (B)  
0-7 NOT USED

RESULT BYTE 2  
0-7 NOT USED

TC043 CONTROLLER ALU 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)  
4 BRANCH ON CARRY (BCY)  
5 BRANCH ON NEGATIVE (BN)  
6 BRANCH ON NOT ZERO (BNZ)  
7 BRANCH UNCONDITIONAL (B)  
0-7 NOT USED

RESULT BYTE 2  
0-7 NOT USED
TC044 CONTROLLER ALU TEST

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)
4 BRANCH ON NEGATIVE (BN)
5 BRANCH ON CARRY (BCY)
6 BRANCH ON NOT ZERO (BNZ)
7 BRANCH UNCONDITIONAL (B)

RESULT BYTE 2
0-7 NOT USED

TC046 CONTROLLER ALU TEST

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)
4 BRANCH ON NEGATIVE (BN)
5 BRANCH ON CARRY (BCY)
6 BRANCH ON ZERO (BZ)
7 BRANCH UNCONDITIONAL (B)

RESULT BYTE 2
0-7 NOT USED

TC047 CONTROLLER MEMORY ADDRESSING

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

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
TC04B MEMORY TEST (000-255)

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

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 Return instruction did not return
7 Branch and link instruction did not branch

RESULT BYTE 2
0-7 Not used

TC053 CONTROLLER BRANCH AND LINK TEST

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

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 BRANCH AND LINK TEST

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 Return instruction did not return from program level 3
5 Branch and link instruction did not branch to program level 3
6 Return 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

TC056 CONTROLLER BRANCH AND LINK TEST

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

TC057 CONTROLLER BRANCH AND LINK TEST

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

TC058 CONTROLLER BRANCH AND LINK TEST

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

TC059 CONTROLLER BRANCH AND LINK TEST

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

TC060 CONTROLLER BRANCH AND LINK TEST

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

TC061 CONTROLLER BRANCH AND LINK TEST

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

TC062 CONTROLLER BRANCH AND LINK TEST

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

TC063 CONTROLLER BRANCH AND LINK TEST

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

TC064 CONTROLLER BRANCH AND LINK TEST

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

TC065 CONTROLLER BRANCH AND LINK TEST

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

TC066 CONTROLLER BRANCH AND LINK TEST

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

TC067 CONTROLLER BRANCH AND LINK TEST

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

TC068 CONTROLLER BRANCH AND LINK TEST

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

TC069 CONTROLLER BRANCH AND LINK TEST

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

TC070 CONTROLLER BRANCH AND LINK TEST

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

TC071 CONTROLLER BRANCH AND LINK TEST

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

TC072 CONTROLLER BRANCH AND LINK TEST

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

TC073 CONTROLLER BRANCH AND LINK TEST

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

TC074 CONTROLLER BRANCH AND LINK TEST

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

TC075 CONTROLLER BRANCH AND LINK TEST

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

TC076 CONTROLLER BRANCH AND LINK TEST

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

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

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 CONTROLLER INTERRUPT AFTER A DISABLED LONG TIME-OUT WAS GIVEN

RESULT BYTE 2
0-7 NOT USED

TC057 CONTROLLER LONG TIME-OUT TEST

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

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

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
TC05A

CONTROLLER, SR, AND SCYR TEST

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 7 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD NOT
1 1 BRANCH ON NEGATIVE (BN) DID NOT BRANCH AND SHOULD
2 2 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
3 3 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
4 4 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
5 5 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD
6 6 BRANCH ON ZERO (BZ) DID NOT BRANCH AND SHOULD
7 7 BRANCH UNCONDITIONAL (B) DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-6 NOT USED
7 7 BRANCH ON ZERO (BZ) DID BRANCH AND SHOULD NOT

TC05B

CONTROLLER SR5, AND SIS TEST

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 7 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD
1 1 BRANCH ON ZERO (BZ) DID NOT BRANCH AND SHOULD
2 2 BRANCH UNCONDITIONAL (B) DID NOT BRANCH AND SHOULD
3 3 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
4 4 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
5 5 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD
6 6 BRANCH ON ZERO (BZ) DID NOT BRANCH AND SHOULD
7 7 BRANCH UNCONDITIONAL (B) DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-5 NOT USED
6 7 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD

TC05C

CONTROLLER AND CR TEST

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. THE PROGRAM PASSES ERROR CODES TO THE PROCESSOR TO INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0-2 NOT USED
3 3 BRANCH ON NOT ZERO (BNZ) DID BRANCH AND SHOULD NOT
4 4 BRANCH ON NEGATIVE (BN) DID BRANCH AND SHOULD NOT
5 5 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD
6 6 BRANCH ON ZERO (BZ) DID NOT BRANCH AND SHOULD
7 7 BRANCH UNCONDITIONAL (B) DID NOT BRANCH AND SHOULD

RESULT BYTE 2
0-7 NOT USED

TC05D

CONTROLLER NR TEST

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. THE PROGRAM PASSES ERROR CODES TO THE PROCESSOR TO INDICATE THE RESULTS OF THE TEST.

RESULT BYTE 1
0 7 BRANCH ON NEGATIVE (BN) DID NOT BRANCH AND SHOULD
1 1 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
2 2 BRANCH UNCONDITIONAL (B) DID NOT BRANCH AND SHOULD
3 3 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
4 4 BRANCH ON NOT ZERO (BNZ) DID NOT BRANCH AND SHOULD
5 5 BRANCH ON CARRY (BCY) DID NOT BRANCH AND SHOULD
6 6 BRANCH ON ZERO (BZ) DID NOT BRANCH AND SHOULD
7 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 6 BRANCH ON ZERO (BZ) DID BRANCH AND SHOULD NOT
7 7 BRANCH ON CARRY (BCY) DID BRANCH AND SHOULD NOT
TC05E CONTROLLER NI TEST

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 ZERO (BZ) DID NOT BRANCH AND SHOULD
6 BRANCH ON ZERO (BZ) BRANCH UNCONDITIONAL (B) 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 NOT BRANCH AND SHOULD
7 BRANCH ON CARRY (BCY) DID BRANCH AND SHOULD NOT

TC05F CONTROLLER AND NRH TEST

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 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
0-3 NOT USED
4 'Y' REG IS ZERO AFTER 'AND' 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
TC060 CONTROLLER
NIH TEST
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)
1 DID NOT BRANCH AND SHOULD
2 BRANCH UNCONDITIONAL (B)
3 BRANCH ON NOT ZERO (BNZ)
4 BRANCH AND SHOULD NOT
5 BRANCH ON CARRY (BCY)
6 BRANCH ON ZERO (BZ)
7 BRANCH UNCONDITIONAL (B)

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)
7 BRANCH ON CARRY (BCY)

TC061 CONTROLLER, CR, AND NRS TEST
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)
4 BRANCH ON NEGATIVE (BN)
5 BRANCH ON CARRY (BCY)
6 BRANCH ON ZERO (BZ)
7 BRANCH UNCONDITIONAL (B)

RESULT BYTE 2
0-7 NOT USED

TC062 CONTROLLER, CR, AND NRS TEST
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)
4 BRANCH ON NEGATIVE (BN)
5 BRANCH ON CARRY (BCY)
6 BRANCH ON ZERO (BZ)
7 BRANCH UNCONDITIONAL (B)

RESULT BYTE 2
0-7 NOT USED
TC063 CONTROLLER, CR. AND NRHS TEST

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

TC064 CONTROLLER, CR. AND NIHS TEST

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

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
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 ZERO (BZ) 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 1
5  'Y' REG NOT 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

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 ZERO (BZ) 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 1
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
The document contains two sections, each testing the zero and non-zero indications of ALU instructions with the 'OIH' and 'XR' instructions.

**TC068 CONTROLLER OIH 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 'OIH' function using 0 and 0
5. 'Y' reg not zero after 'OIH' 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.

**TC069 CONTROLLER XR 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 'XR' function using 0 and 1
5. 'Y' reg is zero after 'XR' 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.
TC06A CONTROLLER XI TEST

TEST SETTING OF ALU ZERO AND NON ZERO INDICATIONS WITH THE 'XI' 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 'XI' FUNCTION USING 1 AND 1
5  'Y' REG IS ZERO AFTER 'XI' 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

TC06B CONTROLLER XRH TEST

TEST SETTING OF ALU ZERO AND NON ZERO INDICATIONS WITH THE 'XRH' 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 'XRH' FUNCTION USING 1 AND 1
5  'Y' REG IS ZERO AFTER 'XRH' 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 '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

RESULT SETTING AND RESETING 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 CONTROLLER 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

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
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 WR514 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
TC070 CONTROLLER CYCLE STEAL TEST

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 WR41L4
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

TC073 CONTROLLER CYCLE STEAL TEST

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 WR51L4
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

TC071 CONTROLLER CYCLE STEAL TEST

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 WR51L4
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

TC074 CONTROLLER CYCLE STEAL TEST

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 WR61L4
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

TC072 CONTROLLER CYCLE STEAL TEST

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 WR41L4
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

TC075 CONTROLLER CYCLE STEAL TEST

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 WR71L4
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
TCOA1
CONTROLLER P-Chk U-INT

This test forces a memory check by attempting to read from nonexistent storage. The test also analyzes the U-interrupt in the channel to verify the ability of the controller to report a memory parity check.

RESULT BYTE 1
0  INTERRUPT NOT FROM WS
1  INTERRUPT NOT FROM CONTROLLER
2  NO INTERRUPT TAKEN
3  'NOT ANY CHECK' JIO FAILED
4  NO 'MEMORY P CHK' REPORTED
5-7 NOT USED

RESULT BYTE 2
0-7 CONTENTS OF SENSE BYTE 2
'CONTROLLER CHECK BYTE'

TCOA2
SERDES SHIFT TEST

This test checks the controller's ability to shift data into and out of the shift registers. It also checks the interrupt and controller stop functions of the diagnostic shift command.

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
4  BAD DATA ON SHIFTED 'AA' CMD
5  BAD DATA ON '55' COMMAND LOAD
6  BAD DATA ON SHIFTED '55' DATA
7  BAD DATA ON SHIFTED '55' DATA

RESULT BYTE 2
0  BAD DATA ON SHIFTED '55' DATA
1-7 NOT USED

TCOA3
DRIVER/RECEIVER ACTIVITY CHECK

The driver/receiver activity registers are caused to increment their count and any that fail to increment are reported in error.

RESULT BYTE 1
0  CABLE ADDRESS 0 FAILED TEST
1  CABLE ADDRESS 1 FAILED TEST
2  CABLE ADDRESS 2 FAILED TEST
3  CABLE ADDRESS 3 FAILED TEST
4-7 NOT USED

RESULT BYTE 2
0-7 NOT USED

TCOA4
W/S CONSOLE POLL

This program polls the work station control console and reports any errors or checks encountered.

RESULT BYTE 1
0  PROPER RESPONSE RECEIVED
1  GO LATCH FAILED TO RESET
2  TRANSMIT FAILED
3  RECEIVE ENABLE FAILED
4  NO RESPONSE
5  NO EOB
6  RECEIVER NOT DISABLED AFTER EOB
7  MULTIFRAME RESPONSE

RESULT BYTE 2
0  SERIAL PARITY CHECK
1  CONTROLLER FAILURE
2-7 NOT USED

RESULT BYTES 3 AND 4
LAST FRAME RETURNED FROM TERMINAL

TCOA5
W/S MDI VALID STOP DISPLAY

This program causes a 'VALID STOP' message to be displayed on the system console CRT at the end of the work station diagnostic pgm run.

RESULTS
THERE ARE NO RESULTS TO REPORT FROM THIS TEST UNIT.

TCOCO
WORK STATION TRANSMIT

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.
CE PANEL SWITCH 1 -> CABLE ADDRESS
CE PANEL SWITCH 2-4 -> DATA

WORK STATION TRANSMIT UTILITY

This is not a functional test. There are no results to report.
Register 6 high nibble has the cable address of the work station being addressed.
Register 6, nibbles 1, 2, and 3 have the data being sent to the work station being tested.

TCOCI
W/S NETWORK ANALYSIS PROGRAM

This program categorizes and reports all polling problems encountered while polling all valid addresses on the work station controller bus.

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