

## INTRODUCTION

In late spring 1986, the Regional Technical Support Managers of EASTOPS identified the need for a Technical Handbook ("Ditty Book") which combined technical information found in various sources into one source which the CSR's can easily use. This handbook is the answer to that need.

The handbook is the result of a collaborative effort by many Customer Service Representatives, Regional Technical Support Analysts, Regional Technical Support Managers and Regional Secretaries in EASTOPS. The handbook contains documentation from Prime Service Manuals, vendor documentation and actual hands-on experience. It is intended to be used in conjunction with the Prime Service Manuals and vendor documents.

Each region in EASTOPS was responsible for working on one or more topics. The information was gathered and assembled using the regions most precious resource, people. The troubleshooting guides are from proven field experience. The drafts were sent to the Washington DC Region where this handbook was edited and produced.

The Technical Handbook will be updated by the EASTOPS technical community as new equipment and procedures are introduced. Please feel free to use the comment form at the end of this manual to express your comments and suggestions for enhancing this manual.

### Acknowledgements

|                      |  |
|----------------------|--|
| Atlanta Region       | Safety Escalation<br>Call Escalation<br>Office / System Security   |
| Philadelphia Region  | 9000 Series Troubleshooting<br>Controller Address Conversion   |
| New England Region   | Kennedy 9100 Tape Drive<br>Telex 6250 Tape Drive   |
| New York City Region | CDC 600MB Disk Drive<br>T&D MPU Overview   |
| New York Metro       | CDC 600MB Disk Drive<br>Status/Fault Codes<br>Control Panel Tests  |
| Washington Region    | Intro to Troubleshooting<br>System Utilities<br>System Information<br>General Disk Information<br>CDS 315MB Disk Drive |

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**OPERATIONAL GUIDELINES**

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| <b>Office / System Security</b> | <b>GUD-SA:03</b> |

**Purpose:**

Escalation Procedure to deal with intermittent and repeat problems. To allow Regional Support to expedite an action plan before the customer situation becomes critical.

**Advantages:**

Regional Management is aware of critical customer situations so they are not surprised by a last minute call from the customer.

Regional Support review of action plan to assure timely fix.

To allow lead time for logistics investigation and planning done before situation becomes critical.

Time to allow time for an optimum action plan rather than being forced by circumstances to choose a less effective one with greater costs.

Bottom line (CUSTOMER SATISFACTION).

**Action Table:**

|  |  |
|--|--|
| System Down<br>(Solid)                   | - Won't Boot or Halts or Hangs!<br>* Region notified before Branch is on-site 4 hours. |
| Critical Peripheral Down<br>(Solid)      | - Disk drive, ICS2, etc.)<br>* Region notified before Branch is on-site 4 hours.       |
| Support Peripheral Down                  | - Tape Drive, Printer, etc.)<br>* Region notified before Branch is on-site 6 hours.    |
| Intermittent System Down Problem         | * Region notified if first attempt doesn't fix problem.                                |
| Intermittent Critical Peripheral Problem | * Region notified if second attempt doesn't fix problem.                               |
| Intermittent Support Peripheral Problem  | * Region notified if second attempt doesn't fix problem.                               |

- NOTE: Unreliable operation of system or peripheral (i.e., the device has had multiple problems in excess of what would normally be expected).
- Region notified when a CSR or a customer perceives a system or device as unreliable.

#### INSTALLATIONS

- Office System installation (includes 2250, 2550, 2655, PW & Producers)
- Region notified after Branch on-site 16 hours.
- Computer Room System Installation (includes all 9xxx) Series)
- Region notified after Branch on-site 32 hours.

- NOTE: (2). After 6 hours of Regional Technical Support on-site will notify the Prime Customer Support Center in Natick

FIELD SAFETY PROBLEMS  
ESCALATION PROCEDURES

\* A safety issue is defined as a situation where equipment has caused or has a potential to cause damage to life, limb or property.

\* If a potential safety issue is encountered in the field, the field personnel should, to the best of their ability, eliminate the hazardous condition. Once this is done, the field personnel should contact the Hardware Support Center via the 800 number, identify the call as a potential safety issue, and provide the following information.

Customer Name:  
Customer Address:  
Customer Phone Number:  
Date and Time:  
System ID:  
Product Type and Description:  
Product Model Number:  
Product Serial Number:  
CSR Name and Phone Number:  
Detailed Problem Description:

\* Once identified as a potential safety issue, Support Center personnel should pass the call through to the appropriate support engineer in Hardware Support.

\* If a customer calls the 800 number with a potential safety issue, Central Dispatch should immediately dispatch a CSR to the site, and pass the call through to a Support Engineer. The Support Engineer must determine if any immediate action is required. The CSR, once on-site, should follow normal safety escalation procedures.

\* The CSR should also at this time notify the responsible branch manager of the potential safety issue, who in turn notifies the Regional Manager, who notifies the OPS Director (Subsidiary Manager), who notifies the V.P. of Customer Service. If the CSR is unable to reach his immediate manager, he must notify the OPS director or Subsidiary Manager.

\* Central Dispatch personnel should notify the appropriate manager in Hardware Planning (HP).

Peripheral Products:

Manager of Peripherals Products, Hardware Planning

System and Communications Products:

Manager of System & Communication Products, Hardware Planning

Video Products:

Manager of Video Products, Hardware Planning

\* Once the safety hazard has been stabilized, the CSR, in conjunction with the Hardware Support engineer, should attempt to rectify the customer situation. However, the equipment in question should be maintained in the condition that it failed in, so that Safety Engineering can evaluate the problem most effectively.

\* The Hardware Planning Manager should immediately do the following:

Contact the local CSR for status of the situation, and make a determination as to what actions the CSR is to take. At this time, it is important that the cause of the safety problem be kept intact, to allow the most effective evaluation. Possible CSR actions include, but are not limited to the following:

- Replace the product, and return effected product to Hardware Planning.
- Replace the FRU, and return effected FRU to Hardware Planning
- Leave the product as is, and wait for home office support personnel to arrive on site.

Hardware Planning should also notify Customer Service Management up to the V.P. of Customer Service of the potential safety issue.

\* Hardware Planning will initiate an investigation team, if necessary, made up of the following groups.

Hardware Planning (chair)  
Safety Engineering  
Engineering  
Risk Management  
Responsible RTSM  
Legal (if necessary)  
Public Relations (if necessary)  
Vendor (if necessary)

\* The Safety Investigation Team is responsible for the following:

Assess scope of the problem and stabilize the situation.

Investigate and inspect the product, and submit an analysis report.

Evaluate risk involved with the product line, and make a determination as to the ship status of the product.

Put together a plan of action and implement. If the plan of action involves Safety FCO's each effected unit must be identified and the installation of the Safety FCO must be tracked.

Hardware Planning will generate minutes of each meeting, and provide them to Customer Service Management, until the problem is resolved. Once the problem is resolved, Hardware Planning should communicate the resolution to all Customer Service Management involved in the safety issue.

Security is a part of everyone's job at PRIME. An awareness of security issues is the first step in security assurance. PRIME expends large amounts of resources on Research and Development to continue to offer state-of-the-art products. The theories, architectures, and operation of our systems are technological assets that are important and private (proprietary) to PRIME. In order to maintain our position as an industry leader and assure our continued corporate growth we must protect these technological assets, just as we would protect our offices and equipment.

- a. **Physical Security.** Keep access to your office limited. Unauthorized access represents a potential threat to personal effects and company property as well as providing an opportunity for access to proprietary (private) documents such as schematics, printouts, and personnel records. Be aware of visitors.
- b. **System Security.** Limit access to your system. As we move more and more information to our in-house system, they become more and more attractive sources of information for unauthorized persons. Change passwords frequently on an irregular schedule. Establish and review ACL's on in-house systems. Control remote access.
- c. **Document Security.** Keep track of documentation assigned to you. Misplaced or lost documentation should be reported as lost to the appropriate manager. Worn or outdated manuals should not be thrown away. Arrangements should be made for shredding or burning any documents marked "PRIME PROPRIETARY" or "PRIME RESTRICTED". Over-shipments of FESM's or FESB's should be returned to Natick for redistribution. Access to technical libraries should be controlled. Before leaving work in the evenings, place all sensitive documentation in secure, i.e., locked storage.
- d. **Personal Security.** Exercise discretion in conversations in public places. Pieces of conversations overheard in restaurants or at public telephones might supply the "missing" pieces of information that could compromise Sales leads, technical information, or personnel issues.

In summary, AWARENESS is the key word. Be alert for unfamiliar persons in our offices. Help protect our proprietary information. Limit access to equipment and data to those persons with a need to know.

**SYSTEM UTILITIES**

**INDEX**

**Make**

**UTIL-SA:01**

**Fix\_Disk**

**UTIL-SA:02**

**Magsav**

**UTIL-SA:03**

**Magrst**

**UTIL-SA:04**

**What is it ?**  
-----

Before a disk can be used, it must conform to Prime's software addressing method. MAKE brings a disk into conformance by "formatting" it. This will allow you to divide the disk space area into two or more subdivisions. This is also referred to as "partitioning" or "creating".

The Primos disk that MAKE creates will contain the following files and directories:

- Disk pack or partition name (packname) as specified by user
- MFD (Master File Directory)
- BOOT (Bootstrap, in Record 0)
- BADSPT (only if badspots are present on disk)
- DOS (which is empty)
- CMDNCO (which is empty)

**Before running MAKE**  
-----

1) You will need to know four major items about the disk before you run the MAKE utility:

- How large is the partition (subdivision of disk) will be. This will be the number of heads you plan to utilize out of the disk.
- The starting head number. This will always be an even value.
- The drive unit number on which the disk is mounted.
- The controller on which the drive unit is connected.

With this information you should be able to construct a physical device number. This is detailed later in the section on "Constructing a Physical Device Number".

2) MAKE can be run in either PRIMOS or PRIMOS II. If you are working under PRIMOS, follow these steps:

- Add the physical device number to the assignable disk table with the DISKS command. This must be done from the system console.  
Format: DISKS physical-device-number
- At your terminal, assign the disk.  
Format: ASSIGN DISK physical-device-number

\*\*\* Reverse this process after the MAKE by below procedure \*\*\*

- At your terminal, unassign the disk.  
Format: UNASSIGN DISK physical-device-number
- Remove the disk from the assignable disk table. This must be done from the system console.  
Format: DISKS NOT physical-device-number

3) If your working under PRIMOS II, write-protect all running disks except the disk to be created by MAKE. This will prevent accidental erasure of data on a disk if the physical device # is mistyped. Take note that you don't use the DISKS and ASSIGN commands in PRIMOS II, so overlap protection is missing.

#### Constructing a Physical Device Number (PDEV)

-----

A physical device number is a value that tells PRIMOS certain identity details about the partition formatted by MAKE (ie: number of heads, controller & drive location, and starting head offset).

The physical device number is specified in octal. You can use a binary breakdown to construct the PDEV (physical device number) that is detailed below, or utilize a PDEV chart that already has calculated out every possible combination(\*).

- \* - Operator's Guide to File System Maintenance: pages A-4,A-5
- System Operator's Guide Volume II: pages A-4,A-5
- Field Engineering Service Manual # 080 : pages L-4, L-5

Your PDEV value is actually a combination of a 16 bit word:

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

#### Breakdown:

-----

Bits: 1,2,3,4 - Head Offset/2  
Bits: 5,6,7,8,16 - Number of surfaces in the the partition  
Bits: 9,10 - Controller address (see table below)  
Bits: 11,12,13 - Device type: Always 6 or binary 110  
Bits: 14,15 - Drive Unit number

| Controller | Bit Pattern | Controller Address |
|------------|-------------|--------------------|
| -----      | -----       | -----              |
| 0          | 00          | '26                |
| 1          | 10          | '27                |
| 2          | 01          | '22                |
| 3          | 11          | '23                |



Options:

The below list is a compilation of the command line options the MAKE utility utilizes as of PRIMOS release 20.1.

- DISK\_TYPE, -DT disk\_type      Specifies what kind of disk.  
Valid types are:  
SMD                    DEFAULT. 80MB or 300MB  
                      removable  
CMD                    cartridge module device  
68MB                   68 megabyte fixed media  
158MB                  158 megabyte fixed media  
160MB                  160 megabyte fixed media  
600MB                  600 megabyte fixed media  
MODEL\_4475            300 megabyte fixed media  
MODEL\_4710            130 megabyte fixed media  
MODEL\_4711            60 megabyte fixed media  
MODEL\_4715            120 megabyte fixed media  
MODEL\_4735            496 megabyte fixed media  
FLOPPY                floppy disk (diskette)
- SPLIT [ \*\_of\_paging\_records ]      Make part of the partition  
for paging. If number of paging records  
is not given, MAKE will print the total  
number available and ask for number of  
paging records.
- PRE\_REV19, -PRE19                  Create a pre-rev 19 partition.
- BADSPOT\_LEVEL, -BADLEV bad\_spot\_checking\_level      Checking level  
can be from 0 to 4 inclusive. If level 0  
is specified, no checking is done. Level  
4 gives the best checking. The default  
is 1 for SMD or CMD, 4 for fixed media  
disks.
- BAUD\_RATE, -BAUD valid\_baud\_rate      Set initial baud rate of  
system console. Valid baud rates are:  
110, 300, 1200, or 9600. The default  
is 300.
- NO\_INIT                              Do not initialize the file system part  
of the disk. Unless this is specified,  
the records are initialized.
- FORMAT, -FMT                        Write hardware formats on the disk.  
Use this only if the disk has never  
been used on a Prime system.

- MAP\_UNCORR, -UNCORR      Map out only records with uncorrectable errors. Default is to map out all records with any error (uncorrectable or correctable). Use of this option is not recommended.
- QUERY\_BADSPOTS, -QBADS    Query user for known badspots on disk.
- NEW\_DISK, -NEWDSK        Suppress the attempt to read the old badspot file.
- COPY\_BADSPOTS\_BY\_NAME, -CPYNAM partition    Copy the badspots from the disk specified by the name 'partition'.
- COPY\_BADSPOTS\_BY\_DEVICE, -CPYDEV copy\_pdev    Copy the badspots from the disk specified by the device 'copy\_pdev'.
- DISK\_REVISION, -DSKREV revision    Specify which revision of disk to make. Valid revisions are 18, 19, or 20.
- NO\_FLAW\_MAP, -NOFLMP,    The new 496 MB (MODEL 4735) contains flaw maps written on a designated area of the disk by the manufacturer. Using this option, MAKE will not attempt to find a flaw map and processing messages of this operation are not displayed.

#### How does MAKE handle badspots?

-----  
 While formatting a disk, MAKE searches for badspots by writing test data into every record on the disk, reading it back, and verifying that it is the same data that was written.

MAKE allows you certain control over the number of test patterns performed with the -BADSPOT\_LEVEL option. There are 5 levels that range from integers 0 thru 4. Level 4 being the most thorough and time consuming, and level 0 meaning no verification at all.

By default, MAKE will provide a level of 1 on SMDs and CMDs, and a level of 4 in badspot checking for FMDs.

MAKE will build a list of badspots gathered from its test result findings. This list is placed in a file called BADSPT (the badspot file) that resides at the MFD level. If no badspots were discovered by MAKE during its tests, MAKE will not write a badspot file.

MAKE also creates a disk record availability table (DSKRAT). This file (same name as partition) contains a list of all records on the disk. For each record, the information in the file indicates whether the record is in use by the system. PRIMOS and PRIMOS II use the DSKRAT when users create, delete, extend, or shorten files or directories.

When MAKE creates the DSKRAT, almost all of the records on the disk are free for use. However, in order to prevent the system from using badspots on the disk, MAKE initializes the DSKRAT so that all bad records are marked as being in use and therefore unavailable. Any time PRIMOS or PRIMOS II needs a new, unused record, it will skip over the badspots.

#### Known Badspots/Flaw Maps

-----

As described above, MAKE assembles a list of badspots found during its verification/testing procedure. However, you may be already aware of badspots on the disk. For instance, if the disk manufacturer provides you with a "flaw map" which lists out probable badspots, you'll need to enter them all into the BADSPT file described above.

You must use the -QUERY\_BADSPOTS option on the command line when entering known badspots. Abbreviation: -QBADS

Example: OK, "MAKE -DISK 1060 -PARTITION TEMP20 -QBADS"

With this query option, make will prompt you for the location of the badspots. There are two different ways for entering badspots; 1) By record number 2) By head, track, and sector.

With the -QUERY\_BADSPOTS, you now have the ability to input badspots from any location on disk, not merely the partition currently being made.

#### Record Number

-----

If the badspot information is by record number, you'll enter an octal value that is the offset from the beginning of the partition. You'll have to respond "YES" to MAKE's prompt of "Enter badspots by record number?".

For more information on determining record values, refer to this manual's section on record/CRA conversions.

### Head, Track, and Sector

Answer a "NO" to MAKE's "Enter badspots by record?" prompt. MAKE will then prompt you for three parameters:

- 1) HEAD - enter the HEAD number from the flaw map
- 2) TRACK - enter the CYL (cylinder) from the flaw map
- 3) SECTOR - obtain the OFFSET value from the flaw map and use the table below to convert this byte offset to a SECTOR value. Then enter your converted SECTOR value.

| Sector | Byte Numbers  |
|--------|---------------|
| 0      | 0000 - 2239   |
| 1      | 2240 - 4479   |
| 2      | 4480 - 6719   |
| 3      | 6720 - 8959   |
| 4      | 8960 - 11199  |
| 5      | 11200 - 13439 |
| 6      | 13440 - 15679 |
| 7      | 15680 - 17919 |
| 8      | 17920 - 20159 |

To terminate the dialog, input a 0 after the TRACK-, HEAD-, and SECTOR- prompts.

### Keeping Redundant Badspot Files/Re-MAKING

MAKE allows you to maintain redundant badspot files for a disk with multiple partitions. MAKE supports redundant badspot files by allowing the badspot file on each partition to contain information about all the badspots on the disk, regardless of the partitions the badspots are in.

After a partition has been created, you can re-MAKE the partition in order to update the BADSPT file. Use the -NO\_INIT option in this case. This option prevents the initialization of file system records(\*) and will save time. It is also recommended that a -BAD\_LEVEL of 0 be used as well, since badspots have already been recorded for the partition you are re-MAKING and time might be an issue.

\* Although the -NO\_INIT option prevents initialization of file system records, it does not prevent initialization of the file system itself. All file system objects on the partition are deleted during a MAKE, except those created by MAKE, even if the -NO\_INIT option is used. Use of the -NO\_INIT option will only reduce the amount of time needed to re-MAKE a partition.

Let's take an example in which we want to MAKE a 675MB disk on drive unit 2 of controller 0. We'd like to breakup the disk into 4 partitions, with 10 heads per partition.

First, make a list of the physical device numbers for each partition. In our example this would be 2464, 52464, 122464, and 172464. Then MAKE the first partition of 2464, entering all badspots from the flaw map.

Next, MAKE the second partition on your list (52464). Use the -COPY\_BADSPOTS\_BY\_DEVICE option on the command line. This option will copy the badspot information from the first partition. Use this option when making your subsequent partitions (122464 and 172464), using the the most recently created badspot file.

MAKE may find additional badspots as subsequent partitions are made. However, previous partitions will lack what future badspot files may contain. With this information, use the below list as a guideline for our example.

```
MAKE -DISK 2464 -PART PACK1 -NEWDSK -FMT -QBADS
      -DT 600MB
MAKE -DISK 52464 -PART PACK2 -NEWDSK -FMT -CPYDEV 2464
      -DT 600MB
MAKE -DISK 122464 -PART PACK3 -NEWDSK -FMT -CPYDEV 52464
      -DT 600MB
MAKE -DISK 172464 -PART PACK4 -NEWDSK -FMT -CPYDEV 122464
      -DT 600MB
MAKE -DISK 2464 -PART PACK1 -NO_INIT -BADLEV 0 -CPYDEV 172464
      -DT 600MB
MAKE -DISK 52464 -PART PACK2 -NO_INIT -BADLEV 0 -CPYDEV 172464
      -DT 600MB
MAKE -DISK 122464 -PART PACK3 -NO_INIT -BADLEV 0 -CPYDEV 172464
      -DT 600MB
```

This example assures us that all the packs are fully updated with all the badspots on the whole drive. With the use of the -NO\_INIT AND -BADLEV 0 options, we are assured that it was performed in the quickest fashion possible.

## Recommendations, Warnings, & Hints

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- Do not attempt to utilize MAKE on the third and fourth controllers in PRIMOS II. MAKE will ignore the fact that you specified a disk on controllers '22 & '23 and will attempt a MAKE of the PDEV's counterpart on the first two controllers.
- Do not use your primary paging partition on controllers '22 and '23. This is the PDEV # specified by PAGDEV in CONFIG.
- It is advisable to MAKE an entire disk before allowing users to access and store data on any portion of the disk. This is recommended because of badspot purposes.
- Never use MAKE on a partition if it contains the only copy of any data that you want to keep. Even if you don't use the -NEWDSK option & utilize the -NO\_INIT option, MAKE will always initialize the file system itself.
- Don't forget to include the -DISK option preceding the PDEV #. If accidentally omitted or entered after the PDEV #, unpredictable behavior occurs. If this happens, perform one of the following procedures depending if your in PRIMOS or PRIMOS II:
  - 1) PRIMOS II: Immediately press the MASTER CLEAR button on the front panel of the CPU (on old style control panel CPU's, turn the rotary knob to STOP/STEP). This is the fastest and most reliable way of stopping a CPU. Then re-boot PRIMOS II and run MAKE again, including the -DISK argument in the correct place.
  - 2) PRIMOS: type a CONTROL P to stop the program. Issue the RELEASE\_LEVEL -ALL command, then invoke MAKE again. Include the -DISK argument in the correct place.
- When you are using the MAKE to create paging surfaces with the -SPLIT option, use the naming convention of PAGING for the option of -PARTITION.
- Don't mix and match different major revisions of MAKE with PRIMOS (18.X, 19.1.X, 19.2.X, 19.3.X, 19.4.X, 20.0.X, etc.). Stay within your major revision. You can run into some problems since PRIME upwardly evolved different data structures between certain revisions. You might also run into library changes and EPF problems as well.

## References

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- System Operator's Guide Volume II DOC7324-XXX
- Operator's Guide to File System Maintenance DOC9300-XXX
- Software Release Document (19.2 & 19.3) MRU4304-01XP

UTIL-SA:02

FIX\_DISK COMMANDS

\*\*\*\*\*  
\* FIX\_DISK \*  
\*\*\*\*\*

I N T R O D U C T I O N

What is it?

FIX\_DISK is a PRIMOS disk repairing utility that enables the integrity of a disk pack to be maintained.

When should it be run?

-When you want to examine and check the integrity of a partition/pack.

- When you want to "repair" a partition. The term "repair" is used when you suspect a problem with the logical integrity of the partition. Use the list below as a guide in pointing out possible problems.

- Pointer mismatches
- Damaged directories (ie: unexpected "End of File" messages)
- Bad DAM file
- Bad truncate of segment directory
- Segment directory error
- The file is too long
- Too many subdirectory levels
- Mismatched disk formats (ie: rev 20 vs rev 19)
- Disk error messages.

\*WARNING\* -> You should attempt repairing disk errors with FIX\_DISK only after you've verified the following items:

- The hardware has been verified as being good
- The disk errors are isolated to one logical partition
- The disk errors are not random. A good way of verifying this is if you continuously receive the same disk error at the same cylinder, head, and record number

When should it not be run?

- Can not be used in PRIMOS II
- If you suspect that the drive itself is faulty (ie: Hardware problems) and FIX\_DISK is run with the -FIX option, it's possible that files and directories could be deleted.

## U S A G E

### How to run FIX\_DISK

The format is rather straight forward. Let's examine the standard FIX\_DISK option list and highlight on some key points.

USAGE: FIX\_DISK -DISK pdev [options]

#### OPTIONS:

|                          |  |
|--------------------------|--|
| -FIX Fix the disk (a)    |  |
| -ufd_COMPRESSION         | Compress unused space in directory records   |
| -LEVEL dec               | Lowest level in which UFD names are displayed. Default is 1.   |
| -MAX_nested_level dec    | The max depth that UFDs are allowed to be nested. This defaults to 99. If exceeded, FIX_DISK should abort with an error message. If you want exceeded levels deleted, use the -AUTO_TRUNCATION option. |
| -Auto_Truncation         | Automatically truncates UFDs that are nested too deep  |
| -List_File               | The file names are printed -No_Quota The partition is not a quota partition  |
| -COMMAND_DEVICE          | The disk being fixed is the command disk. This must be run from the system console (b)   |
| -CONVERT_19              | Convert the disk to a rev 19 style disk  |
| -CONVERT_20              | Convert the disk to a rev 20 style disk  |
| -DUFE                    | Delete all unknown file entries. This is useful for such problems as inconsistent entries within UFD's   |
| -INTERactive             | Interactively fix the DSKRAT   |
| -List_BadSpots           | List badspots and remapping records  |
| -TRuncate                | Truncate the file on error   |
| -ADd_BADSpot oct[, oct,] | Add badspot(s) to disk (Detailed later).   |
| -number_of_retries dec   | Modify the number of retries (Detailed later).   |

(a) If you want FIX\_DISK to make repairs, you must include the -FIX option. You'll probably also want to include the -UFD\_COMPRESSION and -DUFE as well. Example:  
OK, "FIX\_DISK -DISK 42461 -FIX -UFD\_COMPRESSION -DUFE"

(b) If the -COMDEV option is not used, FIX\_DISK assumes that you've already shut down the drive, added it to the assignability table, and assigned it.

How does FIX\_DISK handle badspots?

All badspots encountered are added to the badspot file if it exists. If it does not exist, a new badspot file is created if there is room on the disk. Badspots that are not part of the logical disk (partition) but on the same pack are allowed\* to be added to the BADSPT file. This enables the badspot file in each separate logical partition of one physical pack to contain the same information (\*starting @ 19.3).

PRIMOS reports to the system console and LOGREC\* UFD problem badspots on the pack in the form of disk read and write errors. An example on how one might appear in a typical LOGPRT file is as follows:

```
DISK WT ERROR DVNO- 042461 (4004-SM CTRLR 1, UNIT 0)
CRA- 000000 152263 CYL- 550 HEAD- 8 RECORD- 1
STATUS (ACCUM)- 110000 STATUS (LAST)- 100000 RETRIES- 1
(RECOVERED)
```

NOTE !!! The two general conditions an error could be is either RECOVERED or UNRECOVERED and are treated differently by FIX\_DISK.

#### RECOVERABLE errors

Starting at revision 19.3, FIX\_DISK has been changed to remap records on any errors. A soft error is a recoverable error that can be read within the specified limit of 10 (octal 12) retries. If FIX\_DISK detects a soft error, it will copy that record to a new location and then re-links all of the appropriate file header pointers. The old location is treated as a newly discovered badspot and is placed in the BADSPT map.

#### UNRECOVERABLE errors

An unrecoverable error is a badspot location that can not be read within the limit of 10 (octal 12) retries. Normally, when FIX\_DISK encounters an uncorrectable badspot, it will create a

null record (a record filled with zeros) on a good portion of the disk and append the remaining records of the original file to the null record if the pointers can be recovered.

If you prefer to have FIX\_DISK truncate a file when encountering an uncorrectable badspot (as it did prior to revision 19.3), use the -TRUNCATE option. Abbreviation: -TRU

#### -ADD\_BADSPOT

A new option starting at rev 19.3 is the ability to add a badspot with FIX\_DISK. Prior to this, you had to re-MAKE the partition and add the bad location. The new option, -ADD\_BADSPOT, allows you to specify record numbers to be added to the badspot file. FIX\_DISK will then attempt to map the bad record to a new location. Abbreviation: -ADBADS

You enter record numbers in their octal values. You can obtain the current record address of the badspot from the two halfwords next to the "CRA =" from the disk error.

#### RETRIES

Starting at 19.3, FIX\_DISK was changed to do multiple read attempts on a failing record. This increases the likelihood that the record can be read, but does not guarantee that the record will be read.

There is an option called -NUMBER\_OF\_RETRIES which allows you to specify the number of times FIX\_DISK is to try and read a failing record. The default is two retries. Abbreviation: -NUMTRY

## RECOMMENDATIONS, WARNINGS & HINTS

- If you want FIX\_DISK to make repairs, you must include the -FIX option on the command line. It is always recommended that you first run FIX\_DISK without this option. This will give you an opportunity to view any problems with truncations and/or deletions, as well as more serious issues that could possibly exist. Open a como file, and consult with other individuals or reference manuals to see the implications/problems in attempting a repair when uncovering particular FIX\_DISK error messages. particular FIX\_DISK error messages.
- If your base revision of PRIMOS is 19.3.X, you should try and obtain a copy of FIX\_DISK 19.3.11 or above. This will allow you to utilize all the best aspects of FIX\_DISK for this revision, including -ADD\_BADSPOTS.\*
- If your base revision of PRIMOS is 19.4.X, you should try and obtain a copy of FIX\_DISK 19.4.9 or above. This will give a more complete addressing of soft errors FIX\_DISK might encounter.\*
- \* You'll need to MAGSAV a copy of these revisions CMDNCO\FIX\_DISK onto your "tool box" tape. The above recommendations are based on positive surveys we've received from both CSR's and customers.
- Re-boot the system after you've run a FIX\_DISK on a systems COMDEV.
- Don't mix and match 20.0.X, 19.4.X, and 19.3.X FIX\_DISKS and PRIMOS revisions. Stay within your major revision. You can run into some problems since PRIME upwardly evolved different data structures between revisions. You might also run into library changes and EPF problems as well. You'll probably hear the term FIXRAT as a partition fixing utility. This is a pre-rev 19 version of FIX\_DISK that is completely incompatible at rev 19 and above. Any attempt to run a FIXRAT on rev 19 or above will destroy the logical format of the partition.
- Always verify that the customer has a backup of the partition before getting involved in extensive repair operations of any kind.

## REFERENCES

- System Operator's Guide Volume II DOC7324-XXX
- Operator's Guide to File System Maintenance DOC9300-XXX

MAGSAV writes a file, directory tree, or partition to magnetic tape.  
The command format is:

MAGSAV [options.....]

The options are as follows:

| OPTIONS   | FUNCTION   |
|-----------|--|
| -7TRK     | Specifies 7-track tape format. The default is 9-track.   |
| -P300     | Specifies 1024-byte records. Also suppresses ACLs.   |
| -UPDT     | Specifies an update. The DUMPED switch in the UFD entry will be set for files and directories that are saved from disk onto tape. If you do not specify this option, the DUMPED switch is not set.   |
| -INC      | Specifies an incremental save. Only files and directories with a reset (-O) DUMPED switch are saved. Otherwise, all files and directories are saved.   |
| -SAVE_UFD | Tells MAGSAV always to save directories, whether or not they have been modified. This option is only used with the -INC option. The -SAVE_UFD option causes directory headers to be saved with the individual files. Abbreviation: -SUF            |
| -TTY      | Takes the tape unit number from your terminal. All other information is taken from the current input stream. You use this option with CPL programs and command input files.  |
| -NO_ACL   | Specifies that MAGSAV is not to save any ACLs or ACL references. Tapes saved with the -NO_ACL option can be restored by Rev. 18 MAGRST onto a Rev. 18 system. If this option is not specified, ACL information is saved to tape. Abbreviation: -NA |
| -NO_RBF   | Tells MAGSAV not to save any ROAM (RBF) files if these are present on a disk.  |

- CAM\_TO\_DAM Saves all CAM files to tape as DAM files.  
Abbreviation: -CTD
- REV19 Creates REV 20.0 tapes that are to be read on  
a REV 19 system. Sets the CAM files TO DAM files.

NOTE!! The PRIMOS boot program has been enhanced for REV 20.0. In this enhancement, the MAGSAV label has been enlarged and prevents restoration under a REV 19 system. To counter this, you can use the option (-REV19). With the MAGSAV command to write smaller labels, so that the command can be used for restorations under a REV 19 system. This option also implicitly sets the -CAM\_TO\_DAM option, because contiguous files are not supported under REV 19.

REV 19 tapes created in the way described in the preceding paragraph cannot be used to boot the REV 19 system, because the boot label is artificially truncated.

After MAGSAV is invoked, and you have supplied the tape unit, logical tape number, and tape label information, MAGSAV will then issue the prompt:

Name or Command:

Allowable responses to this prompt are as follows

| RESPONSE       | MEANING   |
|----------------|---|
| (filename)     | Cause MAGSAV to save the specified file or directory residing in the current directory.   |
| *              | Causes MAGSAV to save all the files and directories in the current directory.   |
| MFD            | Causes MAGSAV to save the entire partition. To use this response, you must be attached to the MFD of a partition.   |
| \$I [path] [n] | Causes MAGSAV to produce an index as it saves subsequent files and directories. The index is sent to the file specified by path, or to the user terminal if path is not specified. If path already exists, the information is appended to the end of path. n specifies the number of directory levels to be included in the index - the default for n is 2. |

**\$Q** Terminates the logical tape and returns you to PRIMOS. Does not rewind the tape. If you subsequently invoke MAGSAV for the same tape unit, specify 0 as the logical tape number.

**\$R** Terminates the logical tape, rewinds the tape, and returns you to PRIMOS. If you subsequently invoke MAGSAV for the same tape unit, specify a logical tape number of one more than the logical tape number of the session you just completed.

**\$UPDT ON** Turns on Update mode. After this command is issued, files that are saved will have the dumped switch set. This command is the same as the -UPDT command line option.

**\$UPDT OFF** Turns off Update mode. This overrides any specification of -UPDT on the command line. After this command is issued, files that are saved will not have the DUMPED switch set.

**\$INC ON** Turns on incremental dump mode. If a directory is saved after this command is issued, each file inside it will be saved only if its DUMPED switch is not set. This command is the same as the -INC command line option.

**\$INC OFF** Turns off incremental dump mode. This overrides any specification of -INC on the command line. After this command is issued, all files inside specified directories will be saved, independent of the setting of their DUMPED switches.

**\$A pathname** Changes your current directory to the directory specified by pathname. Similar to the ATTACH command of PRIMOS.

**\$TTY** Allows you to enter a new tape unit number from the terminal during the course of a MAGSAV. Especially helpful if an unexpected End-of-Tape occurs from a command input file or CPL program.

MAGRST allows you to restore information (files, directories, partitions) from a magnetic tape created by MAGSAV onto any Prime-supported disk(s). This information is saved from and readily restored into the PRIMOS file system. MAGRST can read tapes of any record size, with fixed-length or variable-length records (to a maximum of 2048 halfwords), making it compatible with MAGSAV.

The command format is:

MAGRST [options.....]

Type MAGRST after the PRIMOS prompt (OK.). At this point, there are several command line options that you can specify. After you give options (if any) on the command line, MAGRST responds with a series of questions. The MAGRST dialog (questions and appropriate user replies) is discussed following the command line options.

**OPTIONS****FUNCTION**

|        |   |
|--------|---|
| -7TRK  | Specifies seven-track format. The default is nine-track   |
| -TTY   | Takes the tape unit number from your terminal. All other information is taken from the current input stream. You use this option with CPL files and command input files.  |
| -QUERY | MAGRST asks you for a new slave pathname if the master is being restored into an alternate UFD. -QUERY also asks you if existing active copies of the RBF (Recovery Based File) should be deactivated. Use -QUERY to see which RPN filename is used when you attempt to restore an in-use EPF file or to force MAGRST to ask you which EPF file is to be deleted in case all ten RPN files are present. For more information see the Data Management File Administration Guide. |

**Note**

There is no option that restores a tape without restoring the ACL information saved on the tape.

The MAGRST Dialog: After you invoke MAGRST and specify any options on the command line, the MAGRST dialog begins. MAGRST requests information from you in the following order. Appropriate user responses are shown.

| Request                    | Response  |
|----------------------------|---|
| TAPE UNIT:                 | Supply a physical or logical device number (0 through 7). If you do not specify the -7TRK option on the MAGRST command line, the default is nine-track.   |
| ENTER LOGICAL TAPE NUMBER: | Supply a logical tape number from 1 through n (1 for the first logical tape, 2 for the second, and so on) if your tape is divided into several logical units. This number positions your tape to the specified logical tape. If you enter the value 0, MAGRST assumes that your tape is already positioned correctly. |

Note:

A "runaway" tape condition can occur if there is only one logical tape on the currently mounted reel and you supply a number greater than 1 in response to this request. If this happens, MAGRST searches endlessly for the nonexistent logical tape(s) and is not able to read the EOT (end-of-tape) marker. You must unassign your drive to abort the unsuccessful search.

MAGRST does not have to search all logical tapes when it restores sequential ones. After MAGRST returns you to PRIMOS, the tape is not rewind. Instead, it is positioned at the location before the beginning of the next logical tape in sequence. For sequential logical tapes, run MAGRST again and supply 0 as the response to the LOGICAL TAPE NUMBER: request. As a result, the next logical tape is restored without rewinding and reading through the preceding logical tapes.

READY TO  
RESTORE:

Supply one of the following options:

Yes - Restores the entire tape and returns you to PRIMOS. If MAGRST encounters an access problem during a restore operation, then that file is abandoned and MAGRST continues with the next file/UFD (if there is one).

No - Requests a different tape unit and logical tape. (MAGRST does not restore the previously specified tape).

\$I [pathname] [n] - Prints, at your terminal, an index of all files and directories restored. If you specify pathname, the index is written into that file. [n] indicates the number of levels to be included in the index. (The default is two levels.) If a filename already exists which you specify in pathname, the index is appended to that file.

NW [filename] [n] - Prints, at your terminal, a tape index, but files and directories are not restored. If you specify a filename, the index is written into that file. If filename already exists, the index is appended to filename. [n] indicates the number of levels to be included in the index. (The default value is 100.) This option is useful if you wish to determine the tape's contents. NW does not accept pathnames.

\$A [pathname] - Attaches you to the specified directory. Supply a password if needed.

Partial - Restores only certain files and directories. Supply pathnames in response to the TREE NAME: request.

**TREE NAME:**

This request prints only if you give the **PARITIAL** subcommand. In response to **TREE NAME:**, supply the pathname of the file or directory that you wish to restore. In the pathname, do not include the name of the UFD from which the file or directory was saved. You may specify multiple pathnames for a partial restore. In this case, the **TREE NAME:** request is repeated after each restoration until you enter a null line (CR), which signals the end of restoration. For a partial or full restore, files with bad records are omitted. The pathnames of these files are printed, along with an error message.

A maximum of ten treenames per restore is permitted.

After each file or directory is restored, the message **FILE COMPLETE** prints at your terminal. The message **RESTORE COMPLETE** prints when the end of logical tape is reached.

**SYSTEM INFORMATION**

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INFO-SA:01

## CONTROLLER ADDRESS CONVERSIONS

| CONTROLLER NUMBER | ADDRESS (OCTAL) | HEADER / CHIP LOCATION | JUMPERS                             |
|-------------------|-----------------|------------------------|-------------------------------------|
| 2023-901          | '14             | 37 C                   | PIN 5 to PIN 16<br>PIN 13 to PIN 15 |
|                   | '13             | 37 C                   | PIN 4 to PIN 16<br>PIN 13 to PIN 15 |
| 2034-90X          | '10             | 49 B                   | PIN 8 to PIN 16<br>PIN 11 to PIN 15 |
|                   | '11             | 49 B                   | PIN 7 to PIN 16<br>PIN 11 to PIN 15 |
|                   | '36             | 49 B                   | PIN 2 to PIN 16<br>PIN 13 to PIN 15 |
|                   | '37             | 49 B                   | PIN 1 to PIN 16<br>PIN 13 to PIN 15 |
| 2036-90X          | '36             | 37 D                   | PIN 7 to PIN 16<br>PIN 12 to PIN 15 |
|                   | '37             | 37 D                   | PIN 8 to PIN 16<br>PIN 12 to PIN 15 |
|                   | '10             | 37 D                   | PIN 1 to PIN 16<br>PIN 14 to PIN 15 |
|                   | '11             | 37 D                   | PIN 2 to PIN 16<br>PIN 14 to PIN 15 |
|                   | '32             | 37 D                   | PIN 3 to PIN 16<br>PIN 12 to PIN 15 |
|                   | '17             | 37 D                   | PIN 8 to PIN 16<br>PIN 14 to PIN 15 |
|                   | '16             | 37 D                   | PIN 7 to PIN 16<br>PIN 14 to PIN 15 |
|                   | '15             | 37 D                   | PIN 6 to PIN 16<br>PIN 14 to PIN 15 |
|                   | '35             | 37 D                   | PIN 6 to PIN 16<br>PIN 12 to PIN 15 |
|                   | '52             | 37 D                   | PIN 3 to PIN 16<br>PIN 10 to PIN 15 |

| CONTROLLER<br>NUMBER | ADDRESS<br>(OCTAL) | HEADER / CHIP<br>LOCATION | JUMPERS                             |                                     |
|----------------------|--------------------|---------------------------|-------------------------------------|-------------------------------------|
| 2047-90X DISK        | '26                | 35 D                      | PIN 7 to PIN 11<br>PIN 13 to PIN 10 |                                     |
|                      | '27                | 35 D                      | PIN 8 to PIN 11<br>PIN 13 to PIN 10 |                                     |
|                      | TAPE               | '14                       | 35 D                                | PIN 5 to PIN 16<br>PIN 14 to PIN 15 |
|                      |                    | '13                       | 35 D                                | PIN 4 to PIN 16<br>PIN 14 to PIN 15 |
| 2081-90X             | '14                | 37 B                      | WIRE TO PIN 5                       |                                     |
|                      | '13                | 37 B                      | WIRE TO PIN 4                       |                                     |
| 2270-901             | '14                | 39 C                      | PIN 5 to PIN 16<br>PIN 13 to PIN 15 |                                     |
|                      | '13                | 39 C                      | PIN 4 to PIN 16<br>PIN 13 to PIN 15 |                                     |
| 2294-90X             | '03                | 49 C                      | PIN 1 to PIN 2<br>PIN 12 to PIN 16  |                                     |
|                      | '05                | 49 C                      | PIN 1 to PIN 3<br>PIN 12 to PIN 16  |                                     |
| 2301-90X             | '14                | 37 B                      | PIN 1 to PIN 3<br>PIN 11 to PIN 16  |                                     |
|                      | '13                | 37 B                      | PIN 1 to PIN 3<br>PIN 12 to PIN 16  |                                     |
| 2382-001 DISK        | '26                | 25 E                      | PIN 6 to PIN 15                     |                                     |
|                      | '27                | 25 E                      | PIN 6 to PIN 16                     |                                     |
|                      | '22                | 25 E                      | PIN 6 to PIN 11                     |                                     |
|                      | '23                | 25 E                      | PIN 6 to PIN 12                     |                                     |
|                      | TAPE               | '14                       | 25 C                                | PIN 7 to PIN 13                     |
|                      |                    | '13                       | 25 C                                | PIN 7 to PIN 12                     |

| CONTROLLER NUMBER | ADDRESS (OCTAL)  | HEADER / CHIP LOCATION | JUMPERS                    |
|-------------------|--|------------------------|----------------------------|
| 2382-002 TAPE     | '14  | 25 C                   | PIN 7 to PIN 13            |
|                   | '13  | 25 C                   | PIN 7 to PIN 12            |
| 3156-90X          | '03  | 37 B                   | WIRE TO PIN 4              |
|                   | '05  | 37 B                   | WIRE TO PIN 6              |
| 4004-9XX          | CUT ETCH AT IC 39B BETWEEN THE FEED THROUGH PAD AND PIN 7. |                        |                            |
|                   | '26  | 39 B                   | WIRE FEED THROUGH TO PIN 7 |
|                   | '27  | 39 B                   | WIRE FEED THROUGH TO PIN 9 |
|                   | '22  | 39 B                   | WIRE FEED THROUGH TO PIN 3 |
|                   | '23  | 39 B                   | WIRE FEED THROUGH TO PIN 4 |
| 4005-90X          | LIFT LEG AT I.C. 35D PIN 5                                 |                        |                            |
|                   | '26  | N/A                    | 35D-PIN5 to 37C-PIN7       |
|                   | '27  | N/A                    | 35D-PIN5 to 37C-PIN9       |
|                   | '22  | N/A                    | 35D-PIN5 to 37C-PIN3       |
|                   | '23  | N/A                    | 35D-PIN5 to 37C-PIN4       |
| 4020-90X          | '14  | 37 B                   | WIRE TO PIN 5              |
|                   | '13  | 37 B                   | WIRE TO PIN 4              |

| CONTROLLER NUMBER                | ADDRESS (OCTAL) | HEADER / CHIP LOCATION | JUMPERS                                      |
|----------------------------------|-----------------|------------------------|--|
| 5154-90X                         | '54             | N/A<br>N/A             | 37B-PIN6 to 31D-PIN5<br>39B-PIN5 to 31D-PIN9 |
|                                  | '53             | N/A<br>N/A             | 37B-PIN6 to 31D-PIN5<br>39B-PIN4 to 31D-PIN9 |
|                                  | '52             | N/A<br>N/A             | 37B-PIN6 to 31D-PIN5<br>39B-PIN3 to 31D-PIN9 |
|                                  | '35             | N/A<br>N/A             | 37B-PIN4 to 31D-PIN5<br>39B-PIN6 to 31D-PIN9 |
|                                  | '15             | N/A<br>N/A             | 37B-PIN2 to 31D-PIN5<br>39B-PIN6 to 31D-PIN9 |
|                                  | '16             | N/A<br>N/A             | 37B-PIN2 to 31D-PIN5<br>39B-PIN7 to 31D-PIN9 |
|                                  | '17             | N/A<br>N/A             | 37B-PIN2 to 31D-PIN5<br>39B-PIN9 to 31D-PIN9 |
|                                  | '32             | N/A<br>N/A             | 37B-PIN4 to 31D-PIN5<br>39B-PIN3 to 31D-PIN9 |
| 5602-9XX                         | '50             | 49 B                   | PIN 8 to PIN 16<br>PIN 11 to PIN 15          |
|                                  | '51             | 49B                    | PIN 7 to PIN 16<br>PIN 11 to PIN 15          |
| 5622-9XX                         | '50             | 49 B                   | PIN 8 to PIN 16<br>PIN 11 to PIN 15          |
| TLA10019-001<br>(6580 DISK CNTL) | '26             | 43 C                   | PIN 3 to PIN 10                              |
|                                  | '27             | 43 C                   | PIN 3 to PIN 9                               |
|                                  | '22             | 43 C                   | PIN 3 to PIN 14                              |
|                                  | '23             | 43 C                   | PIN 3 to PIN 13                              |
|                                  | '24             | 43 C                   | PIN 3 to PIN 12                              |
|                                  | '25             | 43 C                   | PIN 3 to PIN 11                              |
|                                  | '45             | 43 C                   | PIN 5 to PIN 11                              |
| '46                              | 43 C            | PIN 5 to PIN 10        |  |

| CONTROLLER<br>NUMBER   | ADDRESS<br>(OCTAL) | HEADER / CHIP<br>LOCATION | JUMPERS             |
|------------------------|--------------------|---------------------------|---------------------|
| TLA10021-001<br>(ICS3) | '10                | 03 D                      | SWITCH 1,2,3,5,6 ON |
|                        | '11                | 03 D                      | SWITCH 2,3,5,6 ON   |
|                        | '36                | 03 D                      | SWITCH 1,6 ON       |
|                        | '37                | 03 D                      | SWITCH 6 ON         |
| TLA10021-002<br>(ICS3) | '10                | 03 D                      | SWITCH 1,2,3,5,6 ON |
|                        | '11                | 03 D                      | SWITCH 2,3,5,6 ON   |
|                        | '36                | 03 D                      | SWITCH 1,6 ON       |
|                        | '37                | 03 D                      | SWITCH 6 ON         |

INFO-SA:02

ICS1 ADDRESSING WITH ICS2'S

Chart below shows the address for the ICS1 controller. The addresses for the ICS2 are; '10 for the first controller, '11 for the second controller, '36 for the third controller, and '37 for the fourth controller.

| ICS1 NUMBER | NO ICS2 | ONE ICS2 | TWO ICS2 | THREE ICS2 | FOUR ICS2 |
|-------------|---------|----------|----------|------------|-----------|
| FIRST       | '36     | '36      | '36      | '37        | '32       |
| SECOND      | '37     | '37      | '37      | '32        | '17       |
| THIRD       | '10     | '11      | '32      | '17        | '16       |
| FOURTH      | '11     | '32      | '17      | '16        | '15       |
| FIFTH       | '32     | '17      | '16      | '15        | '35       |
| SIXTH       | '17     | '16      | '15      | '35        | '52       |
| SEVENTH     | '16     | '15      | '35      | '52        | N/A       |
| EIGHTH      | '15     | '35      | '52      | N/A        | N/A       |

ICS1 ADDRESSING WITH ICS3'S

The chart below shows the address configuration for ICS3's in a system with ICS1's.

| ICS3 NUMBER | NO ICS1 | ONE ICS1 | TWO ICS1 |
|-------------|---------|----------|----------|
| FIRST       | '10     | '10      | '10      |
| SECOND      | '11     | '11      | '11      |
| THIRD       | '36     | '37      | N/A      |
| FOURTH      | '37     | N/A      | N/A      |

Attached is a copy of the new CPBOOT functional specification. The specification describes how the CPBOOT program interfaces with systems that contain a diagnostic processor. Sense switch settings for the CPBoot routine can be found in appendixes A and B. If the system is running pre Rev 20 software the following error message will appear if switch 000002 is not set (Appendix B).

[CPBOOT Rev. 4.0 Copyright (c) Prime Computer, Inc. 1985]

[Failure Report]

Testing: MTBOOT Revision Compatability.  
Actual: INCOMPATIBLE  
Expected: COMPATIBLE

For pre-REV-20 tapes use:  
BOOT <SS-value>2

Examples:  
BOOT 15 2  
BOOT 405 2  
BOOT 505 2  
BOOT 1205 2

NOTE: Controller '000014, Unit 000000 must be used.

DPM400: CPU halted at 012002: 005025  
28 Aug 85 14:24:34 Wednesday

The CPBOOT routine has been incorporated into the 2655 and 9655 systems at the time of FCS. Other systems must have the following FCO's installed in order to run the new CPBOOT.

| System Type | FCO Number | Part Number | Revision |
|-------------|------------|-------------|----------|
| 9955        | 384        | DSK7084-909 | F        |
| 9950        | 382        | DSK7084-901 | T        |
| 9750        | 383        | DSK7084-907 | G        |
| 9650        | 387        | DSK7084-902 | K        |
| 2550        | 386        | DSK7084-905 | E        |
| 9655        | N/A        | DSK7084-915 | A        |
| 2655        | N/A        | DSK7084-913 | A        |

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## 1 Overview

The purpose of this specification is to describe the new CPBOOT program and its uses on the Prime products that incorporate a diagnostic processor. All references to the term "CPBoot" imply this new boot strap program.

The task of raising a central processor from a dormant state to an active state is the primary role of the CPBOOT program. CPBOOT provides the essential mechanism of transferring stored information from the source media to the target memory, thus providing the central processor with the necessary instructions to perform a useful task. The useful task, in most cases, is to perform the next boot strap routine.

Because CPBOOT is the only mechanism used for leaving the dormant state, it has the potential of being the weak line in the chain of events. In a worst case, the field engineer will attempt to use CPBOOT to load a diagnostic test to further diagnose a hardware failure. However, if the boot mechanism itself fails, the field engineer will not be able to load diagnostics. Therefore, the boot mechanism, CPBOOT, will provide diagnostic capability and will report boot failures in a friendly manner.

## 3 CPBOOT

CPBOOT is a boot strap program. It provides the linkage in a chain of boot strap routines. Upon power up, the diagnostic processor provides the first boot strap required to load CPBOOT. Next, CPBOOT provides the boot strap required to load another boot strap program from the selected I/O device. In addition to providing the boot strap mechanism, CPBOOT also provides CPU and I/O diagnostic coverage. This specification is limited to defining the diagnostic coverage and the boot procedure. For a detailed description of the diagnostic coverage, and the boot procedure, refer to the sections on "Hardware Verification" and "Boot Procedure". CPBOOT is written in PMA (Prime Macro Assembler) and uses the "hard core instruction subset" defined in PE-T-1055.

## 4 Hardware Interface

### 4.1 Required for execution of CPBOOT

Depending on the system, CPBOOT will reside on the diagnostic processor floppy disk or the diagnostic processor EPROM card. For execution of CPBoot to begin, the diagnostic processor bootstrap mechanism must be capable of transferring CPBOOT from storage media (floppy disk or EPROM) to main memory. After the transfer is complete, CPBOOT will reside in the first 32 kilowords of main memory. Execution will begin at location

'1000. Therefore, the hardware required for CPBOOT includes a functional main memory, and the media on which CPBOOT resides. In addition, CPBOOT requires a central processor capable of program execution in 64V-mode, supporting at least the hard core instructions as defined in PE-T-1055. The hard core instructions are used to report the test results of a hardware failure. The diagnostic processor must be capable of communication with the system console. A functional I/O device is needed for the system console. The diagnostic processor makes no assumptions about system console characteristics; the system console may be either hardcopy or CRT. Also, baud rate requirements have been made transparent by the diagnostic processor. The system console device address is assumed to be "04.

#### 4.2 Required for Successful Completion of CPBOOT

The selected boot device must be available for use; the supporting controller must be present in the system; and interconnecting cables must be attached. Also, the boot device must have the appropriate media mounted, and the boot device must be set on-line and ready. In the special case of the PAL boot, and I/O bus tester, a host system, and the interconnecting cable are required.

#### 4.3 Required for Display of Failure Report

Because no testing can be performed on the diagnostic processor, via PMA, CPBOOT assumes coherence between the diagnostic processor and the system console.

#### 4.4 Compatibility

For compatibility, CPBOOT continues to provide the same method for booting from storage module disk, magnetic tape, and Prime Automatic Load (PAL), as the early versions of this program. CPBOOT continues to use a minimum of controller hardware required to perform the boot sequence. Thereby, any generic type, 4004/4005 disk controller, magnetic tape controller, I/O Bus Tester, or diagnostic processor, will be supported by CPBOOT. See Appendix A.

Disk controllers must have the device addresses '26, '27, '22, and '23. The magnetic tape controllers must have the device addresses '14 and '13.

CPBOOT will not support Option A, Option B', floppy disk, fixed head disk, paper tape, or 7-track magnetic tape, as these devices are not supported by PRIMOS.

## 5 Software Interface

CPBOOT will determine the destination for each type of media transfer.

The boot program loaded from moving head disk will be transferred to main memory starting at location '000760. Because the disk record size used by PRIMOS is 1040 words, a total of 1040 words (one record) will be transferred via DMA. The first 16 words transferred consist of the "disk record header", thus the starting address of the transfer is location '000760. Upon completion of the transfer, execution of the boot program (from disk) starts at location '1000.

The boot program loaded from magnetic tape will be transferred to main memory starting at location '000200. The first record from magnetic tape will be transferred via DMA. Upon completion of the transfer, execution of the boot program (from tape) starts at location '1000.

The boot program loaded from the "I/O Bus Tester" will be transferred to main memory starting at location "017000. A total of 512 words will be transferred via PIO. Upon completion of the transfer, execution of the boot program (from the I/O Bus Tester) starts at location "017000.

All device specific code (I/O drivers) is self contained within CPBOOT. Prior to execution of the new boot program overlay, registers are not initialized with "RVEC" data and execution is continued in V-mode.

## 6 Design Constraints

CPBOOT will occupy no more than 32 kilowords of storage.

In the event of a failure, CPBOOT will provide the user with an error message indicating what was being tested, the expected results, and the actual results. CPBOOT will provide, as an option, the ability to enable an informative message display. For more detail about the informative message display, see the section on "Display Formats".

CPBOOT will not identify FRU (Field Replaceable Unit) components. CPBOOT does not provide "scope loop" capability.

CPBOOT will provide the user with diagnostic coverage for V-mode addressing, and will provide, as an option, the ability to bypass diagnostic testing. See Appendix B.

## 7 Assumptions

The Memory Test assumes the memory size to be at least twice the cache size. MTBOOT produced by MAGSAV and used for magnetic tape boot is assumed to be built by PRIMOS REV 20.

## 8 Differences

The visual appearance of CPBOOT to the user remains the same as the earlier version of this program, with two exceptions. Upon a hardware failure, an error message will be displayed at the system console, rather than an unfriendly halt with no error message. Also, the user has the option of displaying informative messages while CPBOOT executes.

CPBOOT provides additional testing, prior to the boot procedure, to verify the integrity of the hardware. During the boot procedure, additional testing continues to provide a constant check of hardware conditions.

CPBOOT assumes a new sense switch definition to include two additional disk controllers. See Appendix A for "Storage Module '22" and "Storage Module '23". The sense switch (11) used here for previously a "don't care".

## 9 User Interface

CPBOOT is automatically invoked upon power up. CPBOOT may also be invoked upon power up. CPBOOT may also be invoked manually, via the diagnostic processor command, "BOOT". This command supports the boot device arguments. See Appendix A.

To lessen the impact on the user, the silent appearance of CPBOOT will remain the same as the earlier version, with the two exceptions. In the first exception, any subsequent hardware failures during the boot process will be reported at the system console. The intention here, is to assist the user in diagnosing the problem. In the second exception, the user may enable the CPBOOT option to display informative messages. The informative messages are intended to display the progress of CPBOOT as execution proceeds. The option is enabled via "data switch" setting. The diagnostic processor command line is: BOOT [arg1] [arg2], where [arg1] is the "sense switch" value, and [arg2] is the "data switch" value.

When the central processor is unable to perform a rudimentary task, such as successful execution of the hard core instructions required for communication to the system console, then there is no alternative but to proceed with an unfriendly halt. Also, multiple checks, traps, and faults will be terminated with a halt to avoid the potential hazard of looping indefinitely within the handler routine, after attempting to display the Failure Report.

A warning message will appear at the system console when CPBOOT detects a microverify failure on any of the I/O controllers. This warning may not be fatal, provided the controller is not needed to complete the boot sequence.

The only change visible to the user, therefore, is the reporting of a hardware failure rather than halting on a hardware failure, and the optional display of informative messages.

All messages are in English.

## 10 Display Formats

### 10.1 Informative Messages

By default, the informative messages are disabled (suppressed). The user may request the informative messages to be displayed via a data switch setting. See appendix B. Informative messages will display a short description of each test case as CPBOOT executes. The user may also request a forced display of error messages. This forced display of error messages will display the intermediate results of each test case regardless of the results.

With the informative display turned on, the user is prompted with the first message: "Beginning Control Panel Boot". Subsequent test case messages, such as, "Testing: Register File", "Testing: Memory", or "Testing: Disk Controller '26, Disk Unit 0, channel order SELECT", will be displayed. Upon successful completion of the boot routine, the user is prompted with the final message: "Control Panel Boot Completed". (See the following sample display)

Beginning Control Panel Boot. [Rev 1.0]  
Testing: Register File.  
Testing: Register File Address.  
Testing: Address Trap Mechanism.  
Testing: 64V Base Register Relative Indirect.  
Testing: 64V Base Register Relative Indirect Preindexed.  
Testing: 64V Procedure Relative Indirect Postindexed.  
Testing: 64V Two Word Indirect.  
Testing: 64V Two Word Indexed by Y.  
Testing: 64V Two Word Indirect Preindexed by X.  
Testing: 64V Two Word Indirect Postindexed by X.  
Testing: Base Registers.  
Testing: 64V Two Word Direct using XB.  
Testing: Memory  
Testing: I/O controller sanity.  
Boot Procedure.  
Testing: Existence of controller: '000026  
Testing: Controller "000026, Unit 000000, SELECT  
Testing: OTA ready.  
Testing: Controller '000026, Unit 000000, STATUS  
Testing: OTA ready.  
Testing: Controller '000026, Unit 000000, SEEK  
Testing: OTA ready.  
Testing: Controller '000026, Unit 000000, STATUS  
Testing: OTA ready.  
Testing: Controller '000026, Unit 000000, READ  
Testing: OTA ready.  
Testing: Controller '000026, Unit 000000, STATUS  
Testing: OTA ready  
Testing: BOOT Record Header.  
Testing: BOOT Revision Compatibility  
Control Panel Boot Completed.

[ Failure Report ]  
Testing: Existence of controller: '0000xx  
Actual: ABSENT  
Expected: PRESENT

[ Failure Report ]  
Testing: Microverify. controller '0000xx  
Actual: FAIL  
Expected: PASS

[ Failure Report ]  
Testing: OTA ready.  
Actual: TIME OUT  
Expected: READY

[ Failure Report ]  
Testing: Controller '0000xx, Unit 00000x, STATUS  
Actual: 100000  
Expected: 100000

[ Failure Report ]  
Testing BOOT Record Header  
[address '000760 - '000763]  
Actual: 000000 000000 000000 000000  
Expected: 000000 000000 000000 000001

[ Failure Report ]  
Testing: BOOT Revision Compatibility  
Actual: INCOMPATIBLE  
Expected: COMPATIBLE

[ Failure Report ]  
Testing: MTBOOT Revision Compatibility  
Actual: INCOMPATIBLE  
Expected: COMPATIBLE

[ Failure Report ]  
Testing: INA ready  
Actual: NOT READY  
Expected: READY

[ Failure Report ]  
Testing: Memory  
Address: 000000  
Actual: 000000  
Expected: 000000

Machine Check Flag  
Actual: SET  
Expected: RESET

DSWSTAT: 000000/000000  
DSWPARITY: 000000/000000  
DSWRMA: 000000/000000

[ Failure Report ]  
Testing: INA ready  
Actual: TIMEOUT  
Expected: READY

[ Failure Report ]  
Testing: Sense switch setting.  
Must be at least '100000.

[ Failure Report ]  
Testing: Register File.  
Address: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: Register File Address.  
Address: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: Address Trap Mechanism.  
Address: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Base Register Relative Indirect.  
Initial A-register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Base Register Relative Indirect Preindexed.  
X-register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Procedure Relative Indirect Postindexed.  
X-register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Two Word Indirect.  
Indirect Pointer: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Two Word Indexed by Y.  
Y-register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Two Word Indirect Preindexed by X.  
X-register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: 64V Two Word Indirect Postindexed by X.  
X-Register: 000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
Testing: Base Registers.  
Base Register: 000000  
Actual: 000000/000000  
Expected: 000000/000000

[ Failure Report ]  
Testing: 64V Two Word direct using XB.  
XB Register: 000000/000000  
Actual: 000000  
Expected: 000000

[ Failure Report ]  
MACHINE CHECK  
Program Counter: 000000  
  
DSWSTAT: 000000/000000  
DSWPARITY: 000000/000000  
DSWRMA: 000000/000000

[ Failure Report ]  
MEMORY PARITY  
Program Counter: 000000  
  
DSWSTAT: 000000/000000  
DSWPARITY: 000000/000000  
DSWRMA: 000000/000000

[ WARNING ] Controller '0000xx has failed microverify.

## 10.2 Error Messages

The Failure Report messages detail what is being tested, the results expected, and the results actually obtained. The Customer Service Representative is the primary target of the Failure Report. However, manufacturing should also benefit from

the Failure Report. (See the following sample Failure Reports)  
Upon reporting the error message, CPBOOT will halt. At this  
time, CPBOOT can be continued via the "RUN" command. However,  
the results are unpredictable since the hardware is failing. In  
cases when the RUN command is not permitted after the Failure  
Report, the user will be prompted with the message, "SYSCLR  
required.", and the boot sequence must be restarted.

## 11 Performance

CPBOOT requires approximately 11 seconds to complete execution.  
Note that 10 of these seconds are spent waiting for completion of  
I/O controller initialization.

## 12 CPBOOT Algorithm

This is the basic program flow of CPBOOT. Note the diagnostic  
testing is performed prior to the boot procedure, and is  
continued in the boot procedure.

```
Begin CPBOOT
/*Perform hardware verification*/
Test the hard core instruction subset.
If unsuccessful then HALT.

Test the CPBOOT checksum.
If unsuccessful then HALT.

Clean memory parity.
Enable machine check mode.
Setup the system console.
/*Failure report handler is now enabled. */
If NOT bypass diagnostics
Then
/*If the following diagnostics are unsuccessful*/
/*then a failure report will be displayed. */
/*followed by a HALT. */

Test the register file.
Test v-mode addressing.
Test memory.

Perform sanity test on all controllers.
End
/*Perform the boot procedure*/
End CPBOOT
```

## 13 Hardware Verification

The hard core instructions are tested to ensure that at least the kernel code and the error message handler of CPBOOT will execute successfully. The checksum test will detect a main memory failure caused by bad ram or a program load failure caused by a faulty diagnostic processor boot strap mechanism. The register file plays an integral part in the various memory references, and therefore, the register file is tested for data and address integrity. Also, the address trap mechanism is tested. Because the disk boot strap program, "BOOT", requires V-mode addressing from the onset, CPBOOT will provide V-mode addressing tests, which include V-mode memory reference, V-mode PIO, and a subset of branch instructions. The memory is checked to verify its basic function of storing and retrieving data. The emphasis, here, is placed on data integrity. A "sanity" test is performed on the new I/O controllers that provide CPBOOT with information regarding the pass/fail condition of the on-board microverify. CPBOOT will inform the user of I/O controller hardware failures that a system crash, due to a bold attempt by PRIMOS to use broken hardware, will be less surprising.

### 13.1 Hard Core Instructions

The minimum of instructions required for communication to the system console will be tested. These hard core instructions are described in PE-T-1055. If one of these hard core instructions fails, there is no alternative but to halt. This and multiple checks, traps, and faults are the only unfriendly part of CPBOOT.

### 13.2 Checksum

A checksum of CPBOOT will be done to verify a successful bootstrap transfer by the diagnostic processor. Bad memory cells, within the program area of CPBOOT, will also be detected here. Any subsequent failure will cause a halt.

### 13.3 System console

Upon successful completion of the hardcore instruction testing, and checksum test, the PIO instruction, "INA" will be attempted to establish the existence of I/O device 4. further, the diagnostic processor is initialized for half-duplex. From this point, error messages can now be displayed to the user.

### 13.4 Register File Test

This test consists of a write to, then read from, each register file location of the current register set. The data patterns consist of floating ones and floating zeroes. Also, a register file unique address test will be done. Finally, the address trap mechanism will be checked, to ensure that the register file is being used rather than memory.

### 13.5 V-Mode Addressing Test

This test will verify 64V Procedure Relative direct, indirect, indexed, and indirect postindexed addressing modes. The 64V Base Register Relative mode will include direct and indirect address testing. Also, 64V Two Word Memory Reference direct, indirect indexed by X, indexed by Y, preindexed by X, and postindexed by X will be tested. The "EIO" instruction (execute I/O) will be tested using the branch instructions, "BCNE" and "BCEQ", to check the condition codes.

### 13.6 Memory Test

The first 64 kilowords of memory will be tested, using a data pattern of alternating ones and zeroes. Because this is a non-destructive test, the initial data at each test location will be saved prior to testing, then restored after testing.

After using a temporary location to save the initial data from the test location, the first test data pattern is written to the test location. To ensure a read from memory, rather than from cache, the same cache locations is invalidated (flushed), then the read is performed on the test memory location. Next, the resultant data from the memory read operation is compared to the test data pattern. The initial data, in the temporary location, is then restored to the test location. Because machine check mode is not enabled here, no memory parity traps can occur. However, the "machine check flag" is checked, as an indication of a memory parity error. This process is repeated using the complement data pattern. The test address range is from '000000 to '177777.

On the assumption that the memory size is at least twice the size of cache, the cache invalidation routine used in the memory test will support any cache size.

### 13.7 Sanity Test

Each controller (addressed '01 to '76) will be polled and checked for a ready responses. If the controller responds ready and the controller has the new 32-bit "ID" longword, then the "LED" bits, from the resultant "ID" word, are checked for the condition: "divide is functioning correctly". If the "ID" word indicates something other than this condition, a warning message is displayed at the system console, indicating that the controller has failed microverify. At this point, the error is not considered critical, and CPBOOT continues.

### 14 Boot Procedure

First, the boot device, indicated by sense switches [14-16] (APPENDIX A), will be checked. If the selected boot device is not supported, the user will be informed at the system console. CPBOOT then halts execution, such that the user may select a boot

device that is supported by CPBOOT. The user must reenter the "BOOT" command and any arguments.

If the selected boot device is supported, the supporting controller for the selected boot device, will be polled. If the poll fails the ready condition, then the user will be informed that the controller is absent from the system. Next if the controller has the new 32-bit "ID" longword, then the "LED" bits, from the resultant "ID" word, are checked for the condition: "device is functioning correctly". If the "ID" word indicates something other than this condition, a warning message is displayed at the system console, indicating that the controller has failed microverify. At this point, the error is considered critical, and CPBOOT halts. If the "ID" word is okay, then singular controller functions will be attempted, as part of the boot procedure, and as part of the hardware verification. Completion of each function is expected. In order to avoid the potential infinite loop, PIO ready conditions are expected to respond within a given period of time. The time delay is CPU model sensitive. A data switch completion of the controller function, a status check will be taken from the controller. Unsuccessful completion of a controller function or a status error as a result of the attempted controller function will be reported to the user. Upon successful completion of the boot procedure, execution continues with the boot program overlay, obtained from the boot device media. From this point, the CPBOOT function is completed.

No attempt is made to turn on or turn off burst mode on the controller. No retry is attempted after a read failure. However, a retry can be accomplished by rebooting.

15 Appendix A

| Sense Switches |     |     |     |     |     | Definition                                 |        |         |
|----------------|-----|-----|-----|-----|-----|--|--------|---------|
| 0              | 000 | 000 | 001 | 111 | 111 |  |        |         |
| 1              | 234 | 567 | 890 | 123 | 456 |  |        |         |
| .              | ... | ... | ... | ... | 000 | Start at address in sense switches [01-10] |        |         |
| .              | ... | ... | ... | ... | 001 | Not supported                              |        |         |
| .              | ... | ... | ... | ... | 010 | Not supported                              |        |         |
| .              | ... | ... | ... | ... | 011 | Not supported                              |        |         |
| .              | ... | ... | 001 | 001 | 100 | Storage Module '26                         | Unit 0 |         |
| .              | ... | ... | 001 | 001 | 100 | Storage Module '26                         | Unit 1 |         |
| .              | ... | ... | 101 | 001 | 100 | Storage Module '26                         | Unit 2 |         |
| .              | ... | ... | 111 | 001 | 100 | Storage Module '26                         | Unit 3 |         |
| .              | ... | ... | 001 | 011 | 100 | Storage Module '27                         | Unit 0 |         |
| .              | ... | ... | 011 | 011 | 100 | Storage Module '27                         | Unit 1 |         |
| .              | ... | ... | 101 | 011 | 100 | Storage Module '27                         | Unit 2 |         |
| .              | ... | ... | 111 | 011 | 100 | Storage Module '27                         | Unit 3 |         |
| .              | ... | ... | 001 | 101 | 100 | Storage Module '22                         | Unit 0 |         |
| .              | ... | ... | 011 | 101 | 100 | Storage Module '22                         | Unit 1 |         |
| .              | ... | ... | 101 | 101 | 100 | Storage Module '22                         | Unit 2 |         |
| .              | ... | ... | 111 | 101 | 100 | Storage Module '22                         | Unit 3 |         |
| .              | ... | ... | 001 | 111 | 100 | Storage Module '23                         | Unit 0 |         |
| .              | ... | ... | 011 | 111 | 100 | Storage Module '23                         | Unit 1 |         |
| .              | ... | ... | 101 | 111 | 100 | Storage Module '23                         | Unit 2 |         |
| .              | ... | ... | 111 | 111 | 100 | Storage Module '23                         | Unit 3 |         |
| .              | ... | ... | 00. | .0. | 101 | Magnetic Tape '14                          | Unit 0 | 9 track |
| .              | ... | ... | 01. | .0. | 101 | Magnetic Tape '14                          | Unit 1 | 9 track |
| .              | ... | ... | 10. | .0. | 101 | Magnetic Tape '14                          | Unit 2 | 9 track |
| .              | ... | ... | 11. | .0. | 101 | Magnetic Tape '14                          | Unit 3 | 9 track |
| .              | ... | ... | 00. | .1. | 101 | Magnetic Tape '14                          | Unit 0 | 9 track |
| .              | ... | ... | 01. | .1. | 101 | Magnetic Tape '13                          | Unit 1 | 9 track |
| .              | ... | ... | 10. | .1. | 101 | Magnetic Tape '13                          | Unit 2 | 9 track |
| .              | ... | ... | 11. | .1. | 101 | Magnetic Tape '13                          | Unit 3 | 9 track |
| .              | ... | ... | ... | ... | 111 | Pal Boot (in-house only)                   |        |         |
| .              | ... | ... | ..1 | ... | ... | Do not enter machine check mode            |        |         |

Each "." is a "don't care".

## 16 Appendix B

| Data Switches                     | Definition                           |
|-----------------------------------|--------------------------------------|
| 0 000 000 001 111 111             |                                      |
| 1 234 567 890 123 456             |                                      |
| . . . . . . . . . . . . . . . 1   | Pal Boot (in-house only)             |
| . . . . . . . . . . . . . . . 1   | Pre REV20 Mag Tape Boot              |
| . . . . 1. . . . . . . . . . . .  | Display informative messages         |
| . . . . 1. . . . . . . . . . . .  | Force error display                  |
| . . . 1 . . . . . . . . . . . . . | Bypass diagnostics                   |
| . . 1. . . . . . . . . . . . . .  | Inhibit PIO time outs                |
| . 1. . . . . . . . . . . . . . .  | Force halt after Force error display |

Each "." is a "don't care".

## 17 Packaging

The source code and associated documentation of CPBOOT is located in the UFD 'CPBOOT'. The runfile, 'CPBOOT.SAVE', is built using the CPL program 'CPBOOT.CPL'.

INFO-SA:04

REVISION COMPATIBILITY MATRIX

Since microcode on processors utilizing a diagnostic processor (VCP-III) is not resident in the CPU, an "ID" PROM is used to store revisions of the CPU boards. When the system is "booted", the diagnostic processor compares the board revisions stored in the PROM to the revisions required by the microcode on the diskette. If they are compatible, the diagnostic processor will load the CPU RAM with the microcode. If there is an incompatibility, the RAM will not be loaded and an error message will be displayed on the console.

Since the diagnostic processor does not actually check board revisions but just checks the PROM, it is imperative that if a spare board is installed which requires a different revision ID PROM or microcode, that these be changed also.

The following matrices show the current revision dependencies for PRIME's existing ECL and VLSI product range through the end of Q2, 1986.

2350 MATRIX

|                |   |     |  |  |
|----------------|---|-----|--|--|
| I.D. PROM (GQ) |   |     |  |  |
| PRM10041-001   | B | B   |  |  |
| U-CODE         |   |     |  |  |
| PRD10001-001   | C | C   |  |  |
| U-DIAG         |   |     |  |  |
| PRD10003-003   | A | A   |  |  |
| 2352-001 (A)   | F | F-G |  |  |
| 6282-901 (B)   | M | M-N |  |  |

**2450 MATRIX**

|                |   |     |  |  |
|----------------|---|-----|--|--|
| I.D. PROM (GQ) |   |     |  |  |
| PRM10041-001   | B | B   |  |  |
| U-CODE         |   |     |  |  |
| PRD10001-002   | C | C   |  |  |
| U-DIAG         |   |     |  |  |
| PRD10001-004   | A | A   |  |  |
| 2378-001 (A)   | C | C-E |  |  |
| 2379-001 (B)   | C | C-E |  |  |

**2550 MATRIX**

|                |     |     |     |     |
|----------------|-----|-----|-----|-----|
| I.D. PROM (CM) |     |     |     |     |
| PRM8407-001    | B-D | B-D | B-D | B-D |
| U-CODE         |     |     |     |     |
| DSK7084-905    | B-C | B-C | B-E | B-E |
| U-DIAG         |     |     |     |     |
| DSK7084-906    | C   | C   | C   | C   |
| 2352-001 (A)   | D   | D-F | D-F | D-G |
| 6282-901 (B)   | H-M | H-M | H-M | H-N |

2655 MATRIX

|                |   |   |     |  |
|----------------|---|---|-----|--|
| I.D. PROM (FZ) |   |   |     |  |
| PRM10037-001   | A | B | B   |  |
| U-CODE         |   |   |     |  |
| DSK7084-913    | C | D | D   |  |
| U-DIAG         |   |   |     |  |
| DSK7084-912    | B | C | C   |  |
| 2378-001 (A)   | B | C | C-E |  |
| 2379-001 (B)   | C | C | C-E |  |

9655 MATRIX

|                |   |   |     |  |
|----------------|---|---|-----|--|
| I.D. PROM (GN) |   |   |     |  |
| PRM10038-001   | A | B | B   |  |
| U-CODE         |   |   |     |  |
| DSK7084-915    | C | D | D   |  |
| U-DIAG         |   |   |     |  |
| DSK7084-914    | B | C | C   |  |
| 2378-001 (A)   | B | C | C-E |  |
| 2379-001 (B)   | C | C | C-E |  |

9650 MATRIX

|                |     |     |     |     |  |
|----------------|-----|-----|-----|-----|--|
| I.D. PROM (VA) |     |     |     |     |  |
| PRM3144-983    | D-F | D-F | D-F | D-F |  |
| U-CODE         |     |     |     |     |  |
| DSK7084-902    | G-H | G-H | G-K | G-K |  |
| U-DIAG         |     |     |     |     |  |
| DSK7084-904    | E   | E   | E   | E   |  |
| 6281-901 (A)   | M   | M-P | M-P | M-P |  |
| 6282-901 (B)   | H-M | H-M | H-M | H-N |  |

9750 MATRIX

|                |     |     |     |     |  |
|----------------|-----|-----|-----|-----|--|
| I.D. PROM (CX) |     |     |     |     |  |
| PRM8700-001    | A   | B   | C   | C   |  |
| U-CODE         |     |     |     |     |  |
| DSK7084-907    | A-B | C-E | F-G | F-H |  |
| U-DIAG         |     |     |     |     |  |
| DSK7084-908    | A-B | C   | D   | D   |  |
| 2296-901(CS)   | A-G | A-G | A-H | A-J |  |
| 2365-001(E2)   | A   | A   | A   | A-B |  |
| 2298-901(E1)   | A-G | A-G | A-G | A-H |  |
| 2299-901(S)    | E-J | E-J | E-J | E-K |  |
| 2300-901(I)    | A-C | E   | E   | E-F |  |
| 2366-001(MC)   | A-B | A-B | C-E | C-F |  |

DSWPARTY High Side 9000 Series Systems

- 01 PCCPER The Control Store detects an RCC parity error. Refer to bits 3 through 8 for the set state of the RCC parity error.
- 02 IOPER The Control Store detects an I/O parity error. Refer to bits 3 through 8 for the set state of the I/O parity error.
- 03 RCCPEADR1 \* Encoding of RCC parity error bits 1-8.  
IOPE LEFT \*\* Error in left byte, either BPA or BPD.
- 04 RCCPEADRS \* Encoding of RCC parity error bits 1-8  
IOPE RIGHT \*\* Error in right byte, either BPA or BPD
- 05 RCCPEADR3 \* Encoding of RCC parity error bits 1-8  
BPD PE \*\* CPU detected parity error on BPD  
(internal)
- 06 RCCPE1-8 \* Logical OR of RCC parity error bits 1-8  
BPA PE \*\* CPU detects parity error on BPA  
(internal)
- 07 RCCPE09 \* RCC parity error bit 9  
EXTBPD PE \*\* Controller detects parity error on BPA
- 08 0 \* Zero  
EXTBPAPE \*\* Controller detects parity error on BPA
- 09 Not Used
- 10 BBH Left Byte E1 detects a parity error on BBH,  
Parity Error left byte.
- 11 BBH Right Byte Parity error detected on BBH, right byte  
Parity Error
- 12 BBL Left Byte Parity error detected on BBL, left byte  
Parity Error
- 13 BBL Right Byte Parity error detected on BBL, right byte  
Parity Error
- 14 BAH PE Parity error detected on BAH
- 15 BAL PE Parity error detected on BAL
- 16 BAE PE Parity error detected on BAE
- Note \* Bit 1 - 1 \*\* Bit 2 - 1

|    |                         |  |
|----|-------------------------|--|
| 13 | F or S Unit Error       | The F or S unit detects a parity error encoded in bits 14-16 |
| 14 | F or S Unit Error Bit 1 | S Unit   |
| 15 | F or S Unit Error Bit 2 | Bits   |
| 16 | F or S Unit Error Bit 3 | 14 15 16 Error Location                                      |
|    |                         | 0 0 0 PID or STLB control bits                               |
|    |                         | 0 0 1 LBPA out of STLB in error                              |
|    |                         | 0 1 0 Cache index, right 16 bits                             |
|    |                         | 0 1 1 Cache index, left 16 bits                              |
|    |                         | 1 0 0 Cache data, high side                                  |
|    |                         | 1 0 1 Cache data, low side                                   |
|    |                         | 1 1 0 LBVA out of STLB in error                              |
|    |                         | 1 1 1 Branch cache parity error                              |

F Unit (9955 only)

|  |  |
|--|--|
|  | Bits   |
|  | 14 15 16 Error Location                            |
|  | 0 0 0 No error                                     |
|  | 0 0 1 LPID out of STLB in error (Process ID)       |
|  | 0 1 0 LBPA out of STLB in error (Physical Address) |
|  | 0 1 1 LBVA out of STLB in error (Virtual Address)  |
|  | 1 0 0 ARR out of STLB in error (Access and Ring)   |
|  | 1 0 1 Cache index                                  |
|  | 1 1 0 Cache data high side                         |
|  | 1 1 1 Cache data low side                          |

Note \* Bit 1 - 1    \*\* Bit 2 - 1    \*\*\* Bit 3 - 1



SYS-SA:06

DSWSTAT High Side P750 and P850

- 01 CI Check immediate. If set, the error in question caused an immediate software check.
- NOTE Note that ECCC's and errors, while the I/O bus is in use, will allow the current instruction or DMX cycle to complete before causing the actual check. This bit will be reset in these cases.
- 02 MC A Machine Check condition exists (parity error)
- 03 MP A Memory Parity (ECCC or ECCU) has occurred  
--from DSWPARITY--
- 04 MM A Missing Memory Module condition has occurred.  
--from DSWPARITY--
- 05 thru 07 J Board parity error code  
--from DSWPARITY--
- 08 RCMPE --from DSWPARITY--
- 09 ECCU An ECCU has occurred --from DSWPARITY--
- 10 ECCC An has occurred --from DSWPARITY--
- 11 BUP Inv If reset, the RP back-up count below is valid
- 12 thru 13 The program counter back-up count. If BUP Inv is reset, this field added to the RP value is DSWPB will give the address of the failing instruction
- 15 FDMX If set, the error occurred during FDMX --from DSWPARITY--
- 16 IO Bus If set, the error occurred while the I/O bus was in use: PIO, DMX trap or Interrupt

DSWSTAT Low Side P750 and P850

- 01 thru 05 If and ECCC has occurred, this field indicates the bit in error
- 06 OP Overall Parity associated with ECC code
- 07 Unused
- 08 MOD \* Gives the low order bit of the ECCC address in DSWRMA. Unlike earlier machines, the P750/P850 exactly identifies the failing address and hence copies the LSB of DSWRMA into here.
- 09 RMA Inv If reset, the address in DSWRMA is the address of the memory related error (MMOD, ECCU, ECCC, etc.)
- 10 thru 16 Identifies Micro-Verify failing test number ('177 implies no failure)

DSWPARITY High Side P750 and P850

| BIT      | DESCRIPTION   |
|----------|---|
| 01       | RPARERR1+ CS Board Burst Mode or Wide-Word Write error                        |
| 02       | RPARERR2+ CS Board Burst Mode or Wide-Word Write error                        |
| 03       | RBDMX+ CS Board selects between Burst Mode (-0) or Wide-Word Write error (-1) |
| 04       | RW+ CS Board selects between Burst Mode input (0) or output (1)               |
| 05,06,07 | J Board define J Board detected errors  |
| 0:       | FPDPE+ Peripheral detected BPD error on output                                |
| 1:       | FBRFHPE+ Error on Prefetch Unit Base Register File High Side                  |
| 2:       | FMDPE+ Memory detected data error during HSM write (BMA or BMD)               |
| 3:       | FIPBAPE+ Error detected by Prefetch Unit on EAF address from Prefetch Buffers |
| 4:       | FPAPE+ Peripheral detected BPA error  |
| 5:       | FBRFLPE+ Error on Prefetch Unit Base Register File Low Side                   |
| 6:       | FMAPE+ Memory detected error on BMA address during read or write              |
| 7:       | FIPBIPE+ Error detected by Prefetch Unit on instruction from Prefetch Buffers |
| 08       | RCMPE- Error detected by a board other than the J Board if low                |
| 09       | FMDECCU+ J Board ECCU detected during an explicit memory read                 |
| 10       | GDBDPE J Board error (if reset): bits 05,06,07 are valid otherwise            |
| 11       | BPAIPE+ A Board CPU detected BPA error (DMX or interrupt)                     |
| 12       | FRDXPE+ A Board RDX parity error  |
| 13       | FRFPE+ A Board Register File Parity error                                     |
| 14       | FREAPE+ a Board REA parity error  |
| 15       | FDMX+ J Board error occurred during a DMX cycle                               |
| 16       | APPER+ AP Board on P850 only, an AP Board detected parity error               |

DSWPARITY Low Side P750 and P850

- 01 GCBDPE- C Board error detected by C Board, if low
- 02 FBMDEVPE+ C Board BMD parity error detected during Cache Miss read: even word (BMD)
- 03 FBMDODPE+ C Board BMD parity error detected during Cache Miss read: odd word (BMA if E6's installed)
- 04 LMMOD+ C Board Missing Memory Module detected during a Cache Miss
- 05 LBMAPE+ C Board memory detected BMA parity error during a Cache Miss
- 06 LFERNEXT+ C Board used to reconstruct erring address for a C Board error
- 07 LFLRMA15+ C Board used to reconstruct erring address for a C Board error
- 08 FMISFL16+ C Board used to reconstruct erring address for a C Board error
- 09 LBMDECCU+ C Board ECCU condition detected during a Cache Miss HSM read
- 10 LBMCECCC+ C Board ECCC condition detected during a Cache Miss HSM read
- 11 LRCIAPE+ C Board parity error detected on Index during a read from Cache
- 12 LRCDODPE+ C Board parity error detected on odd side of Data during a read from Cache
- 13 LRCDEVPE+ C Board parity error detected on even side of Data during a read from Cache
- 14 LFSERVDBD C Board at time of C Board error, who was accessing Cache: 0- Prefetch Unit, 1- Execution Unit
- 15 Unused
- 16 Unused

SYS-SA:07

## P750/P850 MICRO-VERIFY TESTS

| TEST NUMBER |         | FUNCTION   | BOARD TESTED |
|-------------|---------|--|--------------|
| PASS 1      | PASS 2  |  |              |
| 0           | 100     | TEST OF INCREA AND JUMP REAL16   | A            |
| 1           | 101     | TEST OF 16 LOCATIONS IN CU STACK   | J,C          |
| 2-5         | 102-105 | A BOARD ALU TESTS: LOGICAL FUNCTIONS OF ALU, 16 AND 32 BIT INCREMENTS, CARRYS IN AND OUT, CONDITION CODES, LINK AND CBIT SETTINGS. | A            |
| 6           | 106     | MACHINE CHECK FOLLOWING ADDER TESTS  | A            |
| 7           | 107     | MACHINE CHECK RESETABLE  | A            |
| 10          | 110     | RD - 0   | A            |
| 11          | 111     | RMA - 0  | C,A          |
| 12          | 112     | REA - 1  | A            |
| 13          | 113     | RP - 0   | J,A          |
| 14          | 114     | RD - -1  | A            |
| 15          | 115     | RMA - -1   | C,A          |
| 16          | 116     | REA - -1   | A            |
| 17          | 117     | RP - -1  | J,A          |
| 20          | 120     | MACHINE CHECK FOLLOWING REGISTER TESTS   | J            |
| 21-23       | 121-123 | DECREA, AND INCREA, DECREA BY 2  | A,C          |
| 24-25       | 124-125 | INCRP AND RP BACKUP 1 AFTER INCRP  | J,A          |
| 26-27       | 126-127 | INCRP, BY2 AND RPBACKUP 2 AFTER INCRP BY2  | J,A          |
| 30-31       | 130-131 | REAH TESTS   | A            |
| 32          | 132     | REGISTER FILE PARITY   | A,J          |
| 33          | 133     | REA PARITYS  | A,J          |
| 34          | 134     | RPA PARITY   | A,J          |
| 35          | 135     | BMA PARITY   | C,A,J        |
| 36          | 136     | RDX PARITY   | A,J          |
| 37          | 137     | BMD PARITY   | A,J          |
| 40          | 140     | CACHE PARITY   | C,A,J        |
| 41          | 141     | PREFETCH TEST OF GENERIC   | J,C,A        |
| 42          | 142     | PREFETCH BUFFER ADDRESS PARITY TEST  | J,C,A        |
| 43          | 143     | PREFETCH TEST OF SHORT MR  | J,C,A        |
| 44          | 144     | PREFETCH TEST OF SHORT INDIRECT  | J,C,A        |
| 45          | 145     | PREFETCH TEST OF LONG, TWO WORD INDIRECT   | J,C,A        |
| 46          | 146     | CACHE TESTS  | C,A          |
| 47-50       | 147-150 | BPA DATA TEST 52525, BPA DATA TEST 125252  | A            |
| 51          | 151     | BPD DATA TEST 52525  | A            |
| 52          | 152     | BPD DATA TEST 125252 AND MACHINE CHECK   | A            |
| 53          | 153     | BMD DATA TEST 52525  | A            |
| 54          | 154     | BMD DATA TEST 125252 AND MACHINE CHECK   | A            |
| 55          | 155     | LOAD ALL 128 LOCATIONS OF RF   | A            |
| 56          | 156     | 32 BIT CACHE READ EVEN AND ODD BOUNDARY  | C,A          |
| 57-60       | 157-160 | BD SHIFT/ROTATE TESTS  | A            |
| 61-62       | 161-162 | STLB TESTS   | C,A          |
| 63-63       | 163-164 | XIS LOAD UNLOAD TESTS  | X,A,C        |
| 65          | 165     | LOADING RS EMITTING CONSTANTS TO RFE   | X,A          |
| 66          | 166     | ZEROING  | X,A          |
| 67          | 167     | RF ADDRESSING  | X,A,C        |
| 70-71       | 170-171 | XALU TESTS   | X            |
| 72-73       | 172-173 | NORMALIZE AND ADJUST TESTS   | X            |
| 74          | 174     | MULTIPLY   | X,A          |
| 75          | 175     | DIVIDE   | X,A          |
| 76          | 176     | NORMALIZE BACKSHIFT CASE   | X            |
| 77          | 177     | DECIMAL ARITHMETIC   | X            |

1. Make sure all power cords are plugged in and no thermal circuit breakers are tripped.
2. Check the ECL power supply voltages (-2.0V and -5.2V) from the binding posts on the CPU backplane.
3. Check the memory array 1051 power supply. To check the complement of the power fail signal produced by the two power fail circuits in the 1051 power supplies set your meter to OHMs and measure the resistance between pin B24 to ground and then from pin B46 to ground. The will indicate a failure if they are open (near infinite resistance) and no failure if they show about 0 OHMs (a logic ground should be used as the reference point). BE CAREFUL SINCE THESE ARE BEING CHECKED WITH POWER ON AND ADJACENT PINS HAVE ACTIVE SIGNALS ON THEM.
4. Check pin 24 at the fault monitor card connector. It should read close to +5V if the voltage from the memory array power supply is actually being received by the CPU.
5. Check each of the two I/O 1051 power supplies. Use the same procedure as in step #3.
6. Next determine if the VCP-III is causing the power fail problem. Check the voltages at pins 7 and 9 at the fault monitor connector and record what you read (most likely pin 7 will be low, 0V, and pin 9 will be high, +5V). Bring the system down and take the cable off that goes from the VCP-III to the MC board. Next take the cable out of the "CONTROL IN" connector in the PDU. By taking these two cables out of their respective connectors you are disabling any signals from passing into the system from the VCP-III. Now power the system back up, do not pay any attention to the system console at this point, and go back and check the voltages at pins 7 and 9. If they are now both high (+5V) then the VCP-III was causing the powerfail problem. If they are both in the same state they were previously in, then the problem is still in the system.
7. Go to pins CA3-34 and CA4-06 on the Memory Control board slot on the CPU backplane. Measure the voltages coming off each of those pins, if both of those pins is close to -2.0V (-1.75V) then the Control Store board is causing the power fail problem. If, however, either one of those pins is close to 0V (-.8V) then either the Memory Control board, the clock card or the fault monitor card is causing the power fail and you must continue with the next step.

8. Check TP2 and TP9 through TP15 on the clock card and measure the voltage. If you read a -1.6V then the clock card is bad. If you read a -1.2V then the clock card is good and you will go on to the next step. Any other voltage indicates a bad fault monitor card.
9. Set your meter to OHMs and measure on your fault monitor card connector from pin 8 to ground and then from pin 10 to ground, if either is open (measures near infinite resistance) then your fault monitor card is bad and your Memory Control board is good. If, however, they both show about 0 OHMs then your Memory Control board is bad. (NOTE: Keep in mind however, that there is a slight chance that an open reading on pins 8 and 10 are caused by one of the ECL power supplies).

GENERAL DISK INFORMATION

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| Disk Testing Using DTS                                      | DSK-SA:04 |
| Disk Testing Using DISCT2                                   | DSK-SA:05 |
| Priam Disk Troubleshooting                                  | DSK-SA:06 |

## PRIME DISK STATUS WORD INTERPRETATION AND TROUBLESHOOTING

| BIT | OCTAL EQUIV | MEANING   |
|-----|-------------|---|
| 1   | 100000      | Always set when an error is present. tied to a pullup in controller.  |
| 2   | 040000      | DMA overrun--set when cpu unable to keep up with the disk data transfer rate. This can happen if controller boards are in the wrong order.  |
| 3   | 020000      | Write . Set when the write protect protect button is depressed and:<br>CDC drives--during a voltage fault<br>or during an up to speed fault.<br>CDS drives--only when button depressed.<br>Priam drives--not transmitted to controller.   |
| 4   | 010000      | Data CRC error-- the CRC word, that was calculated while the data portion of a record was read, does not match the CRC word that was recorded when the data was written.  |
| 5   | 004000      | Internal controller parity error.   |
| 6   | 002000      | Header error-- one of the following:<br>1)header field CRC error-- the CRC word, that was calculated while the header portion of a record was read, does not match the CRC word that was recorded when the header was written.<br>2)a match between the desired header was the header fields on the disk could not be made in 128 attempts. |
| 7   | 001000      | Not used. Grounded in controller.   |
| 8   | 000400      | Not used. Grounded in controller.   |

|    |        |  |
|----|--------|--|
| 9  | 000200 | Not used. Grounded in controller.  |
| 10 | 000100 | Not used. Grounded in controller.  |
| 11 | 000040 | Selected drive is busy servicing the controller on the other port. This is for dual ported devices only.   |
| 12 | 000020 | Not used. Grounded in controller.  |
| 13 | 000010 | Set when the selected disk drive is not on cylinder.   |
| 14 | 000004 | Seek error-- one of the following:<br>1)seek did not complete within the time allowed.<br>2)on cylinder was lost without a seek command ( heads drifted off cylinder).<br>3)illegal cylinder address was received by the disk drive. |
| 15 | 000002 | Select error-- one of the following:<br>1)more than one device responded to a unit select command.<br>2)a device that exceeds the unit number that is legal with the device prom on the controller responded to a unit select.       |
|    | 000001 | No ready signal from disk drive.   |

.....  
The following status words are generated ad hoc by software and  
you should not attempt to break them down bit by bit.  
.....

177777-- Bad record identifier-- The record address read from the disk did not compare with the requested record address. This differs from bit 6 in that this check is done in software and bit 6 is set by a compare in hardware. Also, this compare is using file system record addresses while the bit 6 error is using physical disk record addresses. Getting this error means the PHYSICAL disk record was read successfully, but the LOGICAL disk record from the data portion of the PHYSICAL disk record was read incorrectly. This could be due to corrupted data or a R/W problem. If this error occurs by itself the data ALMOST surely is corrupted.

177776-- No ready signal from drive or seek timeout. In combination with other servo status errors this indicates a servo problem. In combination with interface status errors this indicates an interface problem. See the troubleshooting guide below.

177774-- Controller not responding (bad controller)

177773-- Disk hung or controller halted. This is usually a disk servo and  
177772 problem.

000001-- This is the same as 177776 ( drive not ready ). The software just stripped bit 1 from the hardware generated status word.

.....  
.....  
TROUBLESHOOTING GUIDE FOR VARIOUS STATUS ERRORS  
.....  
.....

110000 only

OR

110000 and 112000 and 102000

READ/WRITE

110000 indicates the drive got a CRC error while reading data.

112000 indicates the same, plus the controller couldn't match the desired header with the headers on the disk. If these are the only two types of errors, you have a read or write problem.

- 1) If all errors are on one head then the problem is most likely the read/write board or hda.
- 2) If errors are on the same spot (track, head and record) the likely culprit is a badspot. If there are multiple spots that come up repeatedly compare the spots with the badspots listed on the flawmap. If the flawmap entries were not put in the badspot file please do so. Use `fix_disk` with the `-add_badspot` option. Alternatively you may run `make` and use `mapflaws` but then the customer must restore data. Make sure you are not the person who installs disk drives without entering the flawmap properly! Otherwise someone will be cussing at you like you are now cussing the person who did not enter your customer's flawmaps.
- 3) If the spots are in the same place and are not badspots there is a possibility of a head crash. Inspect the heads and disk.
- 4) If you arrived here the problem is intermittent data errors.  
These may be caused by:
  - worn out static eliminator
  - r/w electronics
  - bad hda
  - bad or dirty media
  - bad or dirty heads
  - power supply ( check voltage levels and ripple )

## SERVO

102000 only

or

100004

or

102000 and 100004

Any combination of the above with bits 13 or 16 set:

100005,100014,100015,etc.

These errors indicate a servo problem. The drive is having trouble getting to where it wants to be and staying there. Look for the following:

- 1.servo adjustment(s)
- 2.servo cards
- 3.hda
- 4.spindle worn ( perform track following check if applicable)
- 5.power supply ( check voltage levels and ripple )
- 6.bad media
- 7.actuator
- 8.velocity transducer

Many times bit 13 and/or 16 will also be set. Bit 16 indicates that the drive is not ready. This is usually because of a drive fault which will happen if the drive is not on cylinder and the controller attempts to read or write. Bit 13 indicates the drive was not on cylinder.

Note: Sometimes bits that indicate an interface problem are also set. This is caused by drive faults and/or loss of clocks. Examples of such status errors that may accompany valid servo status errors are 120047 and 120057. When faced with mixed status codes such as these it is very helpful to isolate the drive in question on a unique controller and cables before performing any tests.

## INTERFACE

177776  
and  
12xxxx (x=0 or 1) and drive is not write protected or faulted.  
or  
xxxx4x  
or  
xxxxx7  
or any combination of the above  
120047,120057,122047,etc.

These errors indicate an interface problem. Suspect the following:

- 1.cables
- 2.controller
- 3.i/o board(s)
- 4.device prom
- 5.terminator
- 6.control electronics boards
- 7.power supply ( check voltage levels and ripple )

Many of these errors also accompany servo problems. USUALLY if there are no accompanying servo status errors you can be reasonably sure that the problem is an interface problem. If servo status errors accompany the interface status errors try to isolate the drive on a unique controller and cables before testing with Primos utilities or diagnostics. Using the CDC disk tester will also eliminate most of the interface.

104000

Bad controller

DSK-SA:02

OCTAL RECORD NUMBER CONVERSION TO  
CYLINDER, HEAD, AND RECORD NUMBER

The following are the steps that need to be taken to convert current record address (CRA) to cylinder, head and record format. These step must be taken when the system is in PRIMOS II and you encounter disk errors (ie. during a MAKE in PRIMOS II)

1. Needed input data:

- a. Number of head in paritition in decimal ( # HEADS)  
(decode from PDEV #)
- b. Number of records per track (9)
- c. CRA of the error. Two conversions must be done to this data
  1. Convert 2 word octal number to a continuous 32 bit octal number
  2. Convert octal CRA to a decimal number

2. Conversion process:

- a.  $CYLINDER = CRA / (\# HEADS * 9)$  round result to smallest whole number
  - b.  $CRA - (CYLINDER * \#HEADS * 9) =$  record displacement from head 0 record 0 on cyl  
(call this RECDISP)
  - c.  $HEAD = ( RECDISP / 9 )$  round result to smallest whole number
  - d.  $RECORD = ( RECDISP - (HEAD * 9 ) )$
3. Examples (the logrec information is included to make it easy to prove all these calculations actually work ! )

14:06:12 MON 23 JUN 1986

-----  
DISK RD ERROR DVNO- 004467 (4004-SM CTRLR 1, UNIT 3)  
CRA- 000000 007542 CYL- 23 HEAD- 0 RECORD- 5  
STATUS (ACCUM)-110000 STATUS (LAST)- 100000 RETRIES- 2

Partition - 4467 (#HEADS = 19)  
CRA - 000000 007542 = 7542 = 3938 (decimal)  
CYLINDER - 3938 / ( 19 \* 9 ) = 23 (rounded down)  
RECDISP - 3938 - ( 23 \* 19 \* 9 ) = 5  
HEAD - ( 5 / 9 ) = 0 (rounded down)  
RECORD - ( 5 - ( 0 \* 9 ) ) = 5  
CYLINDER = 23 HEAD = 0 RECORD = 5

DISK WT ERROR DVNO- 003660 (4004-SM CTRLR 2, UNIT 0)  
 CRA- 000001 044263 CYL- 667 HEAD- 11 RECORD- 6  
 STATUS (ACCUM)- 102000 STATUS (LAST)- 100000 RETRIES- 1

Partition - 3660 ( #HEADS - 14 )  
 CRA - 000001 044263 - 244263 - 84147 (decimal)  
 CYLINDER - 84147 / ( 14 \* 9 ) = 667 (rounded down)  
 RECDISP - ( 84147 - ( 667 \* 14 \* 9 ) ) = 105  
 HEAD - ( 105 / 9 ) = 11 (rounded down)  
 RECORD - ( 105 - ( 11 \* 9 ) ) = 6

CYLINDER - 667 HEAD - 11 RECORD - 6

Working backwards is easier:

The formula is CRA (decimal) is

$CRA = ( CYLINDER * \#HEADS * 9 ) + (( HEAD * 9 ) + RECORD )$

$( 667 * 14 * 9 ) + (( 11 * 9 ) + 6 ) = 84147$

84147 (decimal) = 244263 (octal) which is equivalent to  
 000001 044263

#### Current Record Address (CRA) conversion

CRA - AAAAAB YZZZZZ

Both the high half and the low half of the CRA consist of a 16 bit octal representation of a binary number. Since there are three binary bits in each octal number one binary bit is left over of the most significant bit of each half ( 16 bits divided by 3 bits/octal digit = 5 octal digits and one bit left over). These left over bits are represented as y in the low half and leftmost A in the high half. Let's use an example:

CRA - 000001 123456

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|--------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |        |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 000001 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0  | 1  | 0  | 1  | 1  | 1  | 0  | 123456 |

Notice that the most significant digit on both numbers consists of only one binary digit. To perform a calculation using the CRA a true octal number must be created out of the two 16 bit numbers provided by the printout. Let's look at another example using 7 bit numbers:

CRA - 002 123

|   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |       |
|---|---|---|---|---|---|---|-------|---|---|---|---|---|---|---|-------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |       | 1 | 2 | 3 | 4 | 5 | 6 | 7 |       |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | (002) | 1 | 0 | 1 | 0 | 0 | 1 | 1 | (123) |

To combine these two number we must attach the high half to the low half and shift bits accordingly (2 places) to create 3 bit octal numbers.

|   |   |   |   |   |   |   |       |   |   |    |    |    |    |    |            |
|---|---|---|---|---|---|---|-------|---|---|----|----|----|----|----|------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |       | 1 | 2 | 3  | 4  | 5  | 6  | 7  | (was this) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |       | 8 | 9 | 10 | 11 | 12 | 13 | 14 | (now this) |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | (002) | 1 | 0 | 1  | 0  | 0  | 1  | 1  | (123)      |

Which, when properly arranged into threes will give us:

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |         |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|---------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |         |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1  | 1  |    |    |    | (00523) |

So a 7 bit CRA of 002 123 is actually 00523. The 16 bit numbers work identically but they don't fit on paper so you'll have to work out how the first example above was done earlier when converting to head, cylinder, and record number.  
( 000001 044263 = 244263 )

Remember to attach the lower 2 bits of the high half at the most significant bit of the low half to form the first number. Then shift the remainder of the high half if there are any more bits set in it.

#### Numbr of Cylinders for Some Prime Disk Drives

| * of CYL | DRIVE TYPE                             |
|----------|--|
| 823      | CDC 80's, 300's, and CMD's : CDS 315MB |
| 842      | CDC 600MB FMD                          |
| 711      | CDC 496MB FMD                          |
| 1121     | PRIAM 68MB and 158MB WINCHESTER        |

Octal to decimal conversion: (multiply position values by associated powers of 8 and add results)

145 (octal)

|   |   |       |   |   |   |      |   |    |
|---|---|-------|---|---|---|------|---|----|
| 5 | * | (8e0) | = | 5 | * | (1)  | = | 5  |
| 4 | * | (8e1) | = | 4 | * | (8)  | = | 32 |
| 1 | * | (8e2) | = | 1 | * | (64) | = | 64 |

64 + 32 + 5 = 101 (decimal)

Decimal to octal conversion: (keep dividing by 8 and result is remainder in reverse order)

224 (decimal)

|         |   |    |           |   |   |
|---------|---|----|-----------|---|---|
| 224 / 8 | = | 28 | remainder | = | 0 |
| 28 / 8  | = | 3  | remainder | = | 4 |
| 3 / 8   | = | 0  | remainder | = | 3 |

224 (decimal) = 340 (octal)

Another way to convert octal to decimal and back is to use the CPL function calls available in PRIMOS as below:

OK. TYPE [TO\_OCTAL 224]

340

OK. TYPE [OCTAL 145]

101

OK.

The presence of customer data on Winchester type disks precludes the possibility of running extensive disk diagnostics except under special circumstances. In order to exercise the disks properly it is necessary to intelligently use Primos utilities and file structure mechanisms.

One area of a disk drive which must be tested is the read/write logic. This is rather simple and can consist of nothing more complicated than copying files. This should be done on all partitions to verify the integrity of the head select logic and read/write heads.

The second area of a disk that needs to be tested is the servo circuits. The best way to do this is to copy across partitions on a single drive. If the partitions differ in fullness and size the disk will be forced to position often between cylinders when going from one partition to another. If this doesn't happen (due to similarities between the partitions) increasing the data size, using multiple copies, and/or varying the data source will increase the drive's need to position to the point that you will almost always get effective testing done.

Due to the less than optimum nature of this testing, it will take longer to insure adequate confidence in the disk than would a properly used disk diagnostic. Several hours could be necessary for highly intermittent problems. Because of system performance impact, overnight runs are highly desirable. These cautions apply to intermittent problems only. A properly configured test should have no problems in pulling out any blatant hardware malfunctions in one or two hours. Phantoms can be set up that repeatedly copy then delete data between temporary UFD's that are set up and filled with data for the express purpose of testing the drive.

The paging surface can be exercised by loading the system with many users or running specifically designed programs written in such a way as to cause page faults.

Whatever way is used to exercise the disk, the Usage utility should be used to ensure that adequate disk I/O is being performed. Also, a simple touch of the hand will tell you if the servo system is being properly exercised.

EXAMPLE TEST SETUP

DRIVE HAS PARTITIONS 1060, 21460, 32460, 100461

1. Create UFD's TESTDATA1 and TESTDATA2 on each and every partition.
2. Fill UFD's TESTDATA1 and TESTDATA2 on partition 1060 with any convenient data. The more data the better but be sure you have room on all the partitions for the data in both test UFD's.
3. Start phantoms that copy data in a circular fashion, never stopping. Use COMO files in case anything goes wrong.
4. Monitor the test using Usage, Logrec and by feeling the positioning of the heads.

1. a mfd 0  
create testdata1  
create testdata2  
a mfd 1  
create testdata1  
create testdata2  
a mfd 2  
create testdata1  
create testdata2  
a mfd 3  
create testdata1  
create testdata2
2. a mfd 0  
avail  
(check space available on each mfd)  
.  
.  
.

a mfd 0  
ld -size  
(Look for largest directory that will fit easily in all partitions. Keep in mind it may be there twice since we are using 2 test directories.)

copy PRIRUN testdata1 ( PRIRUN is about 1200 records )  
copy PRIRUN testdata2

3. Phantom #1: (this is a file called test1.comi created with any editor)

```
como test1.como -ntty
copy <mfd0>testdata1@@ <mfd1>testdata1,-- -delete -nq
copy <mfd1>testdata1@@ <mfd2>testdata1,-- -delete -nq
copy <mfd2>testdata1@@ <mfd3>testdata1,-- -delete -nq
copy <mfd3>testdata1@@ <mfd0>testdata1,-- -delete -nq
como -end
delete test1.como
co test1.comi
```

- Phantom #2: (this is a file called test2.comi)

```
como test2.como -ntty
copy <mfd0>testdata2@@ <mfd3>testdata2,-- -delete -nq
copy <mfd3>testdata2@@ <mfd2>testdata2,-- -delete -nq
copy <mfd2>testdata2@@ <mfd1>testdata2,-- -delete -nq
copy <mfd1>testdata2@@ <mfd0>testdata2,-- -delete -nq
como -end
delete tes2.como
co test2.comi
```

- 4.a. If many users are on system the test phantoms will get intermittent attention from the cpu. Monitor operation over several minutes before deciding that there isn't enough disk activity.
- b. Ensure all test phantoms are running before leaving for an overnight run. Check to see if the como files exist. Also check the "downline ufd's" with 'LD TESTDATA@@ -SIZE' to see if files are being transferred.
- c. Heavily loaded systems will require more time to test the disk because of competition with other users. Plan accordingly.
- d. For optimum disk I/O, the NLBUF parameter in the config file should be set to octal 10. This only applies to systems running revision 19.4 or later. Be sure to return it to its original value as it will adversely affect system performance if set improperly.
- e. You will need to check the NPUSR parameter in the config file to be sure you have enough phantom user capability for the test phantoms and all of the customers phantom processes ( printers, communications lines, Primenet, FTS, etc.).
- f. This example will suffice for many configurations. However, more phantoms may be added to better test specific devices or partitions. Each phantom will require its own unique directory on each partition to be tested.

DSK-SA:04

DISK TESTING USING DTS

TEST NAME: IO.DISK REVISION: 7.1 FUNCTION:  
Testing of the following controllers and associated drives

Controller  
4004, 4005, LCDTC, 10019, 2382

TESTING: Testing can be performed for one to eight controllers with from 0-8 drives on each controller. All PIO, channel commands, and drive functions are tested.

The following drives are supported by controller type:

4004/4005: CMD CDC 16MB, 32MB, 64MB, 96MB  
SMD CDC 80MB AND 300MB  
600 CDC 600MB FMD  
160 CDC 160MB FMD  
4475 CENTURY 315MB FMD

LCDTC: 068MB PRIAM  
158MB PRIAM

10019: All disk listed for 4005  
4735 496MB CDC

2382 : 4711 060MB MICROPOLIS  
4715 120MB MICROPOLIS

For any of the above controllers, the user can enter SPEC for the disk type and thereby control the number of tracks, thereby control the number of tracks, heads, and sectors/track used in testing.

LOCAL SENSE SWITCHES:

BUFF (Buffer Disk Media Errors)  
CKRD (Check Read Buffer Against Write Buffer)  
CORR (Perform Error Correction on Read Errors)  
DATA (Display Data Patterns Used, Read, and  
Corrected)  
HEAD (Sort Errors in Buffer Display by Head)  
INC (Manufacturing Incoming Inspection)

Configuration)

- INIT (Initialize Controller after Interrupt Errors)
- OCT (Display Track/Head/Record Numbers in Octal)
- OVLP (Overlap seek operations among drives)
  
- SUMM (Display Summary Statistics Only)
- TIME (Time PIO and Interrupt Operations)
  
- BUFF - if SET, media error messages are buffered and not displayed until the end of execution. BY default, BUFF is set.
  
- CKRD - if SET, the read buffer is compared against the write buffer during media testing. By default, ring media testing. By default, CKRD is set.
  
- CORR - if SET, error correction is performed on disk read errors. By default, CORR is set.
  
- DATA - if SET, display the data patterns written, read, and corrected when displaying the error summary. By default DATA is set.
  
- INC - if SET, the diagnostic assumes an incoming inspection configuration is present. One controller is assumed present at address '26. The user is asked to identify the drives which are configured. One BADSPOT pattern is used in testing with a record size of 1040 words using the entire media.
  
- INIT - if SET, the diagnostic initializes the controller when the controller fails to post interrupts. By default, INIT is set.
  
- HEAD - if SET, errors are sorted in the buffered error display by head number. If RESET, errors sorted by track number. By default, HEAD is RESET.
  
- OCT - if SET buffered error messages use octal notation in displaying track, head, and record numbers. When RESET, these displays are in decimal. By default, OCT is RESET.

OVLP - if SET and multiple drives are tested, seek operations are overlapped in the random access test to speed execution. By default,

OVLP is RESET.

SUMM - if SET, only a summary of buffered errors is output. When RESET, each buffered error and a summary is displayed. This sense switch is ignored if the BUFF sense switch is RESET. By default, SUMM is RESET.

TIME - if SET, the diagnostic times the execution of PIO and interrupt operations. If they do not respond READY within a specified time period, an error message is generated. If RESET, the program loops forever waiting for the operations to complete. By default, TIME is SET.

OPERATION: If the monitor sense switch OPER (Allow Operator Intervention) is RESET, the diagnostic is aborted by the diagnostic monitor.

Otherwise, the diagnostic asks the user the type of configuration which is present. The user is asked the controller address(es), models, and if drives are present. The diagnostic prompts the user for the drive type and capacity based upon the controller model. If desired, the user can also enter special testing options controlling the data patterns, record lengths, pattern counts, etc. Entering CARRIAGE RETURN always results in a displayed default value being used.

To change an drive option which is already entered, continue to answer queries until the diagnostic asks if any more drives are to be configured. At that point, re-enter the number of the drive whose testing options are to be changed, and enter the new option value when prompted.

To change a controller option which has been entered, continue to answer queries until the diagnostic asks if any more controllers are to be configured. At that point, re-enter the controller whose testing options are to be changed, and enter the new option value when prompted.

Answering 'Q' to any query aborts the diagnostic. whenever the configuration is changed, the error buffer is cleared. Executing the last test case always results in a display of the error buffer.

**RUNTIME:** The runtime varies with disk size. While the diagnostic is executing lengthy media tests, one can enter 'CR' to return to diagnostic monitor control. Entering the STATUS command will result in a display of how far execution has proceeded (i.e., track number). Entering CONTINUE will then continue execution.

**ASSUMPTIONS:** Correct CPU and DMX operation.

**RESTRICTIONS:** THIS DIAGNOSTIC ONLY EXECUTES IN STAND-ALONE MODE (SAM).

**CAUTIONS:** THE DIAGNOSTIC ASK THE OPERATOR IF THE DISK CAN BE WRITTEN. IF THE OPERATOR RESPONDS YES, THE DIAGNOSTIC WILL DESTROY THE DATA CONTAINED ON THE DISK. TO PROTECT A DISK, THE USER SHOULD WRITE PROTECT THE DISK AND INFORM THE DIAGNOSTIC NOT TO PERFORM WRITE TESTS.

Below is an example of IO.DISK run on a 300MB.SMD without writing on the disk pack. If you are not familiar with running IO.DISK use the 'US' command after loading the diagnostic to read the user guide.

\*\*\*\*\*IO.DISK\*\*\*\*\*

SAM>RESET CKRD ( To eliminate buffer miscompares when reading a disk which was not written by IO.DISK,reset the CKRD sense switch.)

SAM>RUN  
0030 Executing IO.DISK Rev 7.1  
CONTROLLER ADDRESS ['22-'27,'45,'46 (CR-'26)]?  
CONTROLLER MODEL [4004,4005,2382.LCDTC,10019,OR CR(READ ID)]?  
INITIALIZING CONTROLLER. PLEASE WAIT  
DRIVE# [0-3],CR (NONE)? 0  
OK TO WRITE ON DRIVE (Y(CR) OR N)? N  
ENTER TYPE [600,160,CMD,4475.SPEC,OR SMD(CR)]:  
ENTER SIZE [80 OR 300(CR)]: 300  
SPECIAL OPTIONS [Y OR N(CR)]? N  
ADDITIONAL DISKS [Y OR N(CR)]  
ADDITIONAL CONTROLLERS [Y OR N(CR)]? N

TESTING 4005 CNTRL AT '26

| UNIT | TYPE | SIZE | HEADS | TRACKS | PATTERN | PASSES | RECORDS | LEN  | BRST |
|------|------|------|-------|--------|---------|--------|---------|------|------|
| 0    | SMD  | 300  | 0-18  | 0-822  | BADSPOT | 1      | 9       | 1040 | YES  |

Case 00001: INITIALIZE CONTROLLER  
Case 00002: INA '11 AND INA '12 IDS  
Case 00003: INA '17 (INPUT OAR)  
Case 00004: HALT CHANNEL ORDER  
Case 00005: HALT CHANNEL ORDER ADDRESS  
Case 00006: INPUT OAR CHANNEL ORDER  
0041 Case 00007 of IO.DISK suppressed.Not supported on this cntl  
Case 00008: LOAD AND STORE ADDRESSES  
Case 00009: LOAD AND STORE FIFO  
Case 00010: ILLEGAL CHANNEL ORDER  
Case 00011: STANDARD INTERRUPTS  
Case 00012: INTERRUPT MASK  
Case 00013: VECTORED INTERRUPTS  
Case 00014: VECTORED INTERRUPT ADDRESSES  
Case 00015: STALL CHANNEL ORDER

Case 00016: TRANSFER CHANNEL ORDER  
Case 00017: CHAINED TRANSFER CHANNEL PGM.  
Case 00018: INA '17 WHEN CHANNEL BUSY  
Case 00019: INPUT STATUS  
Case 00020: INTERRUPT PENDING  
0041 Case 00021 of IO.DISK suppressed. Not supported on this cntl  
Case 00022: SELECT CHANNEL ORDER  
Case 00023: DE-SELECT CHANNEL ORDER  
0041 Case 00024 of IO.DISK suppressed. Not supported on this cntl  
0041 Case 00025 of IO.DISK suppressed. Not supported on this cntl  
Case 00026: FAULT CLEAR CHANNEL ORDER  
Case 00027: SLOW SEEK CHANNEL ORDER  
Case 00028: SEEK CHANNEL ORDER  
Case 00029: TRANSFER WITH MASK BITS  
Case 00030: CONDITIONAL ORDER EXECUTION  
Case 00031: OUT-OF-RANGE TRACK ADDRESS  
0041 Case 00032 of IO.DISK suppressed. Requires Write Access  
0041 Case 00033 of IO.DISK suppressed. Requires Write Access  
Case 00034: READ CHANNEL ORDER  
0041 Case 00035 of IO.DISK suppressed. Requires Write Access  
0041 Case 00036 of IO.DISK suppressed. Not supported on this cntl  
0041 Case 00037 of IO.DISK suppressed. Requires Write Access  
0041 Case 00038 of IO.DISK suppressed. Requires Write Access  
0041 Case 00039 of IO.DISK suppressed. Requires Write Access  
0041 Case 00040 of IO.DISK suppressed. Requires Write Access  
0041 Case 00041 of IO.DISK suppressed. Requires Write Access  
0041 Case 00042 of IO.DISK suppressed. Requires Write Access  
Case 00043: READ 8 DMA CHANNELS  
0041 Case 00044 of IO.DISK suppressed. Requires Write Access  
0041 Case 00045 of IO.DISK suppressed. Requires Write Access  
0041 Case 00046 of IO.DISK suppressed. Requires Write Access  
Case 00047: SEEK TO COMPLETE DISK  
0041 Case 00048 of IO.DISK suppressed. Requires Write Access  
0041 Case 00049 of IO.DISK suppressed. Requires Write Access  
Case 00050: READ RECORD ADDR. UNIQUENESS  
0041 Case 00051 of IO.DISK suppressed. Requires Write Access  
Case 00052: READ COMPLETE DISK  
Case 00053: YOZZLE POSITIONER  
Case 00054: RANDOM ACCESS TEST  
Case 00055: OVERLAP SEEK.READ.WRITE  
Case 00056: DUMP MEDIA ERROR BUFFER  
NO ERRORS BUFFERED FOR DISK 0,CNTL '26

Case 00057: READ DURING SEEK  
0041 Case 00058 of IO.DISK suppressed. Not supported on this cntl  
Case 00059: READ OFF CYLINDER  
ACCESSING 00822 00000 00000  
DRIVE 0 IS WRITE PROTECTED: STATUS 120001  
DO YOU WISH TO ONLY READ DISK [Y(CR) OR N]? Y  
Case 00060: SHORT DATA READ  
0041 Case 00061 of IO.DISK suppressed. Not supported on this cntl  
Case 00062: SLOW SEEK GOES TO TRACK 0  
0041 Case 00063 of IO.DISK suppressed. Not supported on this cntl.  
0041 Case 00064 of IO.DISK suppressed. Requires Write Access  
  
Case 00065: CLEAR MEDIA ERROR BUFFER  
Case 00066: DISK OFF-LINE  
IS DRIVE 0 ON CONTROLLER '26 OFFLINE [Y OR N(CR)]? N  
0041 Case 00067 of IO.DISK suppressed. Requires Write Access  
0041 Case 00068 of IO.DISK suppressed. Not supported on this cntl  
0041 Case 00069 of IO.DISK suppressed. Not supported on this cntl  
Case 00070: SEEK HEAD MAINTENANCE  
POSSIBLE OPERATIONS:  
1) RTZ TO TRACK 0 - SEEK TO TRACK N  
2) SEEK TO TRACK n - SEEK TO TRACK n  
3) SEEK TO TRACK n, READ  
4) SEEK TO TRACK n  
ENTER DESIRED OPTION [1-4, SKIP(CR)]:  
0041 Case 00071 of IO.DISK suppressed. Requires Write Access  
Case 00072: DISPLAY VENDOR FLAWMAP  
0041 Case 00072 of IO.DISK suppressed. No PRIME standard flawmaps  
0041 Case 00073 of IO.DISK suppressed. Requires Write Access  
Case 00074: DECODE DISK STATUS WORD  
ENTER OCTAL STATUS WORD:

SAM.

FOLLOWING IS A LIST OF SUBCASES PERFORMED UNDER IO.DISK.  
SUBCASES CAN BE EXECUTED ONE AT A TIME OR ALL AT ONCE UNDER SAM.

Case 00001: INITIALIZE CONTROLLER  
Case 00002: INA '11 AND INA '12 IDS  
Case 00003: INA '17 (INPUT OAR)  
Case 00004: HALT CHANNEL ORDER  
Case 00005: HALT CHANNEL ORDER ADDRESSES  
Case 00006: INPUT OAR CHANNEL ORDER  
Case 00007: INPUT CONTROLLER REVISION  
Case 00008: LOAD AND STORE ADDRESSES  
Case 00009: LOAD AND STORE FIFO  
Case 00010: ILLEGAL CHANNEL ORDER  
Case 00011: STANDARD INTERRUPTS  
Case 00012: INTERRUPT MASK  
Case 00013: VECTORED INTERRUPTS  
Case 00014: VECTORED INTERRUPT ADDRESSES  
Case 00015: STALL CHANNEL ORDER  
Case 00016: TRANSFER CHANNEL ORDER  
Case 00017: CHAINED TRANSFER CHANNEL PGM.  
Case 00018: INA '17 WHEN CHANNEL BUSY  
Case 00019: INPUT STATUS  
Case 00020: INTERRUPT PENDING  
Case 00021: INTERRUPT-HALT ORDER  
Case 00022: SELECT CHANNEL ORDER  
Case 00023: DE-SELECT CHANNEL ORDER  
Case 00024: ILLEGAL SELECT  
Case 00025: SELECT HEAD  
Case 00026: FAULT CLEAR CHANNEL ORDER  
Case 00027: SLOW SEEK CHANNEL ORDER  
Case 00028: SEEK CHANNEL ORDER  
Case 00029: TRANSFER WITH MASK BITS  
Case 00030: CONDITIONAL ORDER EXECUTION  
Case 00031: OUT-OF-RANGE TRACK ADDRESS  
Case 00032: FORMAT CHANNEL ORDER  
Case 00033: WRITE CHANNEL ORDER  
Case 00034: READ CHANNEL ORDER  
Case 00035: READ CRC CHANNEL ORDER  
Case 00036: WRITE VERIFY CHANNEL ORDER  
Case 00037: OUT-OF-RANGE HEAD ADDRESS  
Case 00038: READ VARYING DMA RANGE  
Case 00039: SHORT READ OF RECORD  
Case 00040: BUFFER ALIGNMENT  
Case 00041: ALL DMA CHANNELS  
Case 00042: WRITE 8 DMA CHANNELS  
Case 00043: READ 8 DMA CHANNELS  
Case 00044: CHECK WORD GENERATION  
Case 00045: SCATTER TRANSFER  
Case 00046: PARTIAL WRITE OF RECORD  
Case 00047: SEEK TO COMPLETE DISK

Case 00048: FORMAT COMPLETE DISK  
Case 00049: WRITE RECORD ADDR. UNIQUENESS  
Case 00050: READ RECORD ADDR. UNIQUENESS  
Case 00051: WRITE COMPLETE DISK  
Case 00052: READ COMPLETE DISK  
Case 00053: YOZZLE POSITIONER  
Case 00054: RANDOM ACCESS TEST  
Case 00055: OVERLAP SEEK, READ, WRITE  
Case 00056: DUMP MEDIA ERROR BUFFER  
Case 00057: READ DURING SEEK  
Case 00058: SEEK/READ DURING SEEK  
Case 00059: READ OFF CYLINDER  
Case 00060: SHORT READ DATA  
Case 00061: READ NEXT HEADER  
Case 00062: SLOW SEEK GOES TO TRACK 0  
Case 00063: CACHING OF READ RECORDS  
Case 00064: WRITE CACHE INTERLOCK  
Case 00065: CLEAR MEDIA ERROR BUFFER  
Case 00066: DISK OFF-LINE  
Case 00067: FILE PROTECT  
Case 00068: DUAL PORT RELEASE  
Case 00069: DUAL PORT PRIORITY SELECT  
Case 00070: SEEK HEAD MAINTENANCE  
Case 00071: BUILD USER CHANNEL PROGRAM  
Case 00072: DISPLAY VENDOR FLAWMAP  
Case 00073: MANUALLY UPDATE VENDOR FLAWMAP  
Case 00074: DECODE DISK STATUS WORD  
Case 00075: DISPLAY TESTING CONFIGURATION

2) .RESUME PAM -ENTER .R PAM. THE PRIMOS DIAGNOSTIC MONITOR WILL IMMEDIATELY EXECUTE. ONCE THE DIAGNOSTIC MONITOR (PAM OR SAM) IS EXECUTING, ONE CAN USE ANY OF THE MONITOR COMMANDS.

1) .ATTACH TO .DIAG.UFD -ENTER .A DIAG.

.....TO USE DTS UNDER PRIMOS (REV.19 OR LATER).....

5 . WILL BOOT WITH MACHINE-CHECKS ENABLED.  
THE USER BEING ASKED TO ENTER A TREENAME. ON REVISION 20 TAPES, .BOOT  
DISABLE MACHINE-CHECKS. ON PRE-REV. 20 TAPES, .BOOT 5 . WILL RESULT IN  
REVISIONS OF PRIMOS. FOR PRIMOS REV. 20 OR LATER, IT WILL INITIALLY  
2) .BOOT SAM.SAVE -ENTER .BOOT 1005. THIS WILL BOOT SAM ON ALL

DIAG UFD.  
1) .POWER UP THE MACHINE AND TAPE UNIT ZERO. THIS TAPE UNIT SHOULD BE  
ATTACHED TO THE CONTROLLER AT ADDRESS .14. ASSERT .MASTER CLEAR. ON  
THE CPU. SAM.SAVE SHOULD BE THE FIRST FILE ON THE TAPE, FOLLOWED BY THE

.....TO BOOT DTS FROM TAPE.....

MACHINE-CHECKS DISABLED.  
.DIAG.SAM.SAVE. ONE CAN ALSO USE .BOOT 1114 TO BOOT WITH  
2) .BOOT THE NEW SYSTEM BOOT WITH THE SENSE SWITCHES SET TO FORCE BOOT  
TO ASK FOR A FILE NAME (BOOT 1014). WHEN PROMPTED, ENTER

1) .POWER UP THE MACHINE AND DESIRED DISK, LOADING THE SELECTED DISK.  
ASSERT .MASTER CLEAR, ON THE CPU.

.....TO BOOT DTS FROM DISK (PRIMOS REV.20 OR LATER).....

4) .RESUME HBOOT -ENTER .R HBOOT. HBOOT WILL PROMPT FOR THE PHYSICAL  
DISK DEVICE. ENTER THE SAME NUMBER AS IS USED FOR PRIMOS II.

3) .ATTACH TO THE .DIAG. UFD -ENTER .A DIAG.

2) .BOOT PRIMOS II -ENTER .BOOT 1014. FOR EXAMPLE.

1) .POWER UP THE MACHINE AND THE DESIRED DISK, LOADING THE SELECTED  
DISK. ASSERT .MASTER CLEAR, ON THE CPU.

.....TO BOOT DTS FROM DISK (PRIMOS PRE-REV.20).....

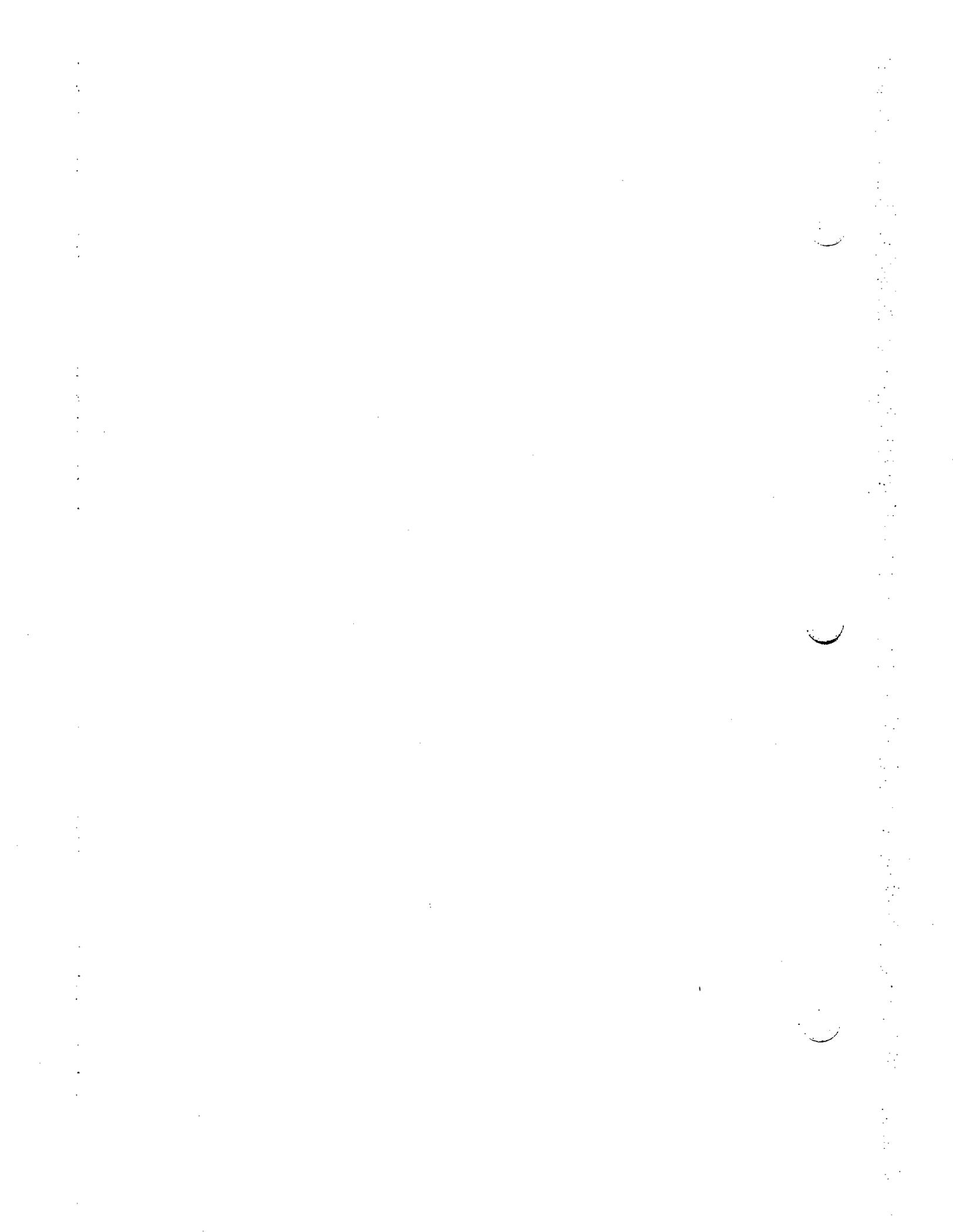
DTS RESIDES ON TAPE OR DISK IN THE .DIAG. UFD. WHEN DISK IS  
USED, THE .DIAG. UFD RESIDES IN THE MFD OF THE SYSTEM DISK, I.E., THE  
PATHNAME IS .MFD,DIAG. WHEN TAPE IS USED, THE DTS TAPE CONTAINS  
SAM.SAVE AND DIAG AS THE FIRST TWO ITEMS ON THE TAPE.

.....USING DTS.....

\*\*\*\*\*USER QUICK REFERENCE\*\*\*\*\*

| FUNCTION                  | COMMAND      | CONTEXT               |
|---------------------------|--------------|-----------------------|
| BOOT SAM FROM DISK        | BOOT 10114   | CP, MASTER DISK       |
| BOOT SAM FROM TAPE        | BOOT 1005    | CP, DTS TAPE MEDIA    |
| RESUME HBOOT              | R HBOOT      | PRIMOS II, 'DIAG' UFD |
| RESUME PAM                | R PAM        | PRIMOS, 'DIAG' UFD    |
| TERMINATE PAM             | QUIT         | PAM                   |
| GET HELP (COMMAND LIST)   | HELP         | SAM OR PAM            |
| GET HELP FOR A COMMAND    | HELP cmd     | SAM OR PAM            |
| GET LIST OF DIAGNOSTICS   | LISTD        | SAM OR PAM            |
| GET LIST OF CASES IN TEST | LISTC        | SAM OR PAM            |
| GET HELP ON A DIAGNOSTIC  | USER name    | SAM OR PAM            |
| LOAD AND RUN DIAGNOSTICS  | LOAD; RUN    | SAM OR PAM            |
| LOAD A DIAGNOSTIC         | LOAD name    | SAM OR PAM            |
| EXECUTE A DIAGNOSTIC      | EX           | SAM OR PAM            |
| OBTAIN CONFIGURATION      | CONF         | SAM OR PAM            |
| OBTAIN CURRENT STATUS     | STAT         | SAM OR PAM            |
| TALK TO MONITOR           | CARRIAGE RTN | SAM OR PAM            |

\*ABOVE IS A LIST OF FUNCTIONS COMMONLY PERFORMED. FOR MORE INFORMATION ON THE ABOVE COMMANDS REFER TO DIAGNOSTIC TESTING SYSTEM SERVICE MANUAL 400.



## NOTES:

1. The test number is available in the data lights bits 1-5.
2. If the test is halted in test 30 the test must be reloaded.
3. If the test hangs starting test 30 try reloading the test.
4. Test 22 will always fail in special mode. This is normal and should be ignored.
5. For acceptance testing the terminal should be a hard copy device to preserve the complete run on paper.
6. The quick verify option is a quick check of all heads and the read and write circuits. It is NOT a good servo system test. A good quick verify of the servo system can be done by running the test in special mode on one head and all tracks. This produces full length seeks as opposed to the 20 cylinder seeks done by the standard quick verify option.
7. Test Times:
  - 80 MB FULL PASS - 45 MINUTES
  - 300 MB FULL PASS - 100 MINUTES
  - 300 MB QV OPTION - 4 MINUTES
  - 300MB QV SERVO OPTION (SPECIAL MODE) - 35 MINUTES
8. Always use 1040 word records except on CMD drives.
9. Always use BADSPOT data pattern.

## THIS PROGRAM IS DIVIDED INTO 27 INDEPENDENT TESTS AS FOLLOWS

|    |       |  |
|----|-------|--|
| 1  | THLT  | TEST HALT CHANNEL ORDER                                |
| 2  | TIOAR | TEST INPUT OAR CHANNEL ORDER                           |
| 3  | TOAR  | TEST COMPLETE RANGE OF OAR                             |
| 4  | TSTL  | TEST STALL CHANNEL ORDER                               |
| 5  | TINT  | TEST INTERRUPT (STANDARD MODE) CHANNEL ORDER           |
| 6  | TLS   | TEST LOAD AND STORE CHANNEL ORDERS (SIMPLE)            |
| 7  | TLSC  | TEST LOAD AND STORE CHANNEL ORDERS (COMPLETE RAM TEST) |
| 10 | TTRN  | TEST TRANSFER CHANNEL ORDER                            |
| 11 | TCAI  | TEST VECTORED MODE INTERRUPT AND CAI                   |
| 12 | TINTV | TEST INTERRUPT (VECTORED MODE) CHANNEL ORDER           |
| 13 | TSEL  | TEST SELECT CHANNEL ORDER                              |

14 TSEK TEST SEEK CHANNEL ORDER  
 15 TSEK10 TEST CONDITIONAL SEEK MASK  
 16 TISA TEST OUT-OF-RANGE TA AND INVALID SA  
 17 TFRM FORMAT A SINGLE CYLINDER  
 20 TWR1\* TEST WRITE CHANNEL ORDER  
 21 TRD1\* TEST READ CHANNEL ORDER (DISK WRITTEN BY  
 TEST TWR1)  
 22 TSTHA TEST FAULT CLEAR  
 23 TCHN TEST CHAINING  
 24 TCRC TEST CHECK WORD GENERATION  
 25 TSRD TEST SHORT-READ OF RECORD  
 26 TSW TEST PARTIAL RECORD WRITE  
 27 FORM FORMAT COMPLETE DISK  
 30 TWCD WRITE COMPLETE DISK  
 31 TFDR READ COMPLETE FORMATTED DISK (DISK  
 WRITTEN BY TEST TWCD)  
 32 TYOZ YOZZLE POSITIONER TEST. (DISK WRITTEN BY TEST  
 TWCD)  
 33 TRM RANDOM ACCESS TEST (DISK WRITTEN BY TEST TWCD)

TESTS MARKED WITH AN \* ARE RUN SEVERAL TIMES IN BURST  
 MODE  
 TESTS TO VERIFY THAT BOTH STANDARD AND BURST MODE ARE  
 FUNCTIONING.

PROGRAM STARTS AT '1000

SET SENSE SWITCHES AS FOLLOWS

SS3 UP BUFFER ERRORS AND ONLY OUTPUT AT END OF PASS OR  
 IF DEVICE IS ELIMINATED.

SS6 UP RUN CONTROLLER IN DIAGNOSTIC MODE. ALL TESTS  
 THAT DO NOT NEED A DEVICE ARE PERFORMED

SS7 UP OUTPUT MESSAGES ON GE TERMINET (AT 300 BAUD)  
 (OVERRIDES AUTOMATIC BAUD RATE SETTER.)  
 DN OUTPUT MESSAGES ON TELETYPE (110 baud)

SS9 UP RUN COMPATIBILITY TEST. JUMP TO TEST TFDR AND  
 READ COMPLETE FORMATTED DISC OR CARTRIDGE AS  
 LONG AS THIS SENSE SWITCH IS SET.

SS12 UP PROGRAM WILL USE BAUD RATE TERMINAL IS SET AT.  
 TYPE CARRIAGE RETURN UNTIL PROGRAM HEADER PRINTS.

SS16 UP ENABLES 'QUICK PASS' OPTION. LIMITS TRACKS  
 FROM 0 TO 20, USES ALL HEADS, RUNS 256 RANDOM  
 SEEKS IN RANDOM ACCESS TEST. USED TO QUICKLY  
 VERIFY DEVICE IS CAPABLE OF RUNNING.

ERROR MESSAGES

1) TYPE 1-----

FOR EVERY ERROR DETECTED BY THE PROGRAM, A 5 CHARACTER MESSAGE IS OUTPUT. THESE ARE DEFINED AS FOLLOWS

ERRH1 HALT ORDER HUNG  
ERRID INA ID FAILED  
ERRO1 I/P OAR ORDER HUNG  
ERRO2 WRONG VALUE OF OAR  
ERRS1 STALL ORDER HUNG OR TOO LONG  
ERRS3 STALL ORDER- TOO SHORT  
ERRI1 INTERRUPT ORDER- NO INTERRUPT  
ERRI2 SKS INTERRUPT FAILING  
ERRI4 INTERRUPT ROUTINE- INTERRUPT NOT RELEASED  
ERRH3 COMPLETE OAR TEST- HALT ORDER HUNG  
ERRH4 COMPLETE OAR TEST- OAR WRONG VALUE  
ERRL1 LOAD ORDER- HUNG  
ERRL3 STORE ORDER- HUNG  
ERRL5 LOAD/STORE, DATA ERROR  
ERRT1 TRANSFER TEST, HUNG  
ERRT3 TRANSFER TEST, DATA ERROR  
ERRV1 VECTORED INTERRUPT TEST - FAILING  
ERRV2 VECTORED INTERRUPT TEST - CAI FAILING  
ERITA OUT-OF-RANGE TRACK ADDRESS PROBLEM  
ERRD2 READ ORDER- DATA COMPARE PROBLEM  
ERRD6 WRITE/READ ORDER- DATA COMPARE PROBLEM  
ERCRD CRC TEST- DATA PROBLEM  
ERCRM CRC TEST-OAR OR MASK PROBLEM  
ERCRC CRC TEST- INCORRECT CHECK WORD  
ERSRD SHORT READ - DATA ERROR  
ERFRD TOTAL READ- DATA COMPARE PROBLEM  
ERRYD YOZZLE TEST READ DATA ERROR  
ERRRD RANDOM TEST- READ DATA  
ERRE1 SEEK TEST- CONDITIONAL EXECUTION PROBLEM  
ERRE2 SEEK TEST- CONDITIONAL EXECUTION PROBLEM

ERROR MESSAGES

2) TYPE 2---

THE TEST NUMBER IS OUTPUT FOLLOWED BY --ERS--  
FOR A STATUS ERROR OR --ERR-- FOR A RANGE ERROR.  
THE STATUS IS THEN PRINTED FOR AN ERS ERROR. THE  
CYLINDER NUMBER IS PRINTED WHEN RELEVANT TO THE  
TEST BEING PERFORMED.

E.G. TEST27 ERS 110000  
TEST17 ERR CYLINDER 000156

OPERATION OF THE TEST:

ONE PASS OF THE TEST IS EQUIVALENT TO THE PERFORMING OF ALL 27 SEPARATE TESTS ONCE. THE PASS NUMBER IS THEN OUTPUT. ONE PASS TAKES ABOUT AN HOUR WITH THE BULK OF THE TIME PERFORMING THE RANDOM ACCESS TEST (TRM). THE PASS COUNTER IS DECREMENTED AND DEPENDING UPON THE RESULT, THE SAME DEVICE IS RUN AGAIN, OR THE NEXT DEVICE IN THE CHAIN (IF ANY) IS RUN.

DUAL PORT OPERATION:

START MASTER DEVICE (EITHER ONE) WITH SS11 AND SS14 RAISED. WAIT 20 SECONDS AND START SLAVE DEVICE WITH SS14 RAISED

TO OPERATE THE TEST, SET SENSE SWITCHES AS DESIRED AND START PROGRAM. IF SENSE SWITCH 12 IS RAISED, NO OUTPUT WILL IMMEDIATELY APPEAR ON THE TERMINAL. TYPE CARRIAGE RETURN SLOWLY UNTIL THE PROGRAM HEADER PRINTS OUT. IF SSW 12 IS NOT RAISED, SSW 7 DETERMINES THE BAUD RATE. AFTER THE HEADER PRINTS OUT, THE PROGRAM WILL ASK FOR DEVICE INFORMATION. THE QUESTIONS WILL BE SIMILIAR TO THE FOLLOWING.

DEVICE NUMBER

DEVICE TYPE (SMD,CMD,MMD,FMD,SPEC)

CAPACITY (OPTIONS HERE DEPEND ON DEVICE TYPE SELECTED)

RECORD SIZE (448,1040,ALT)

DATA PATTERNS (COMPAT.,BADSPOT)

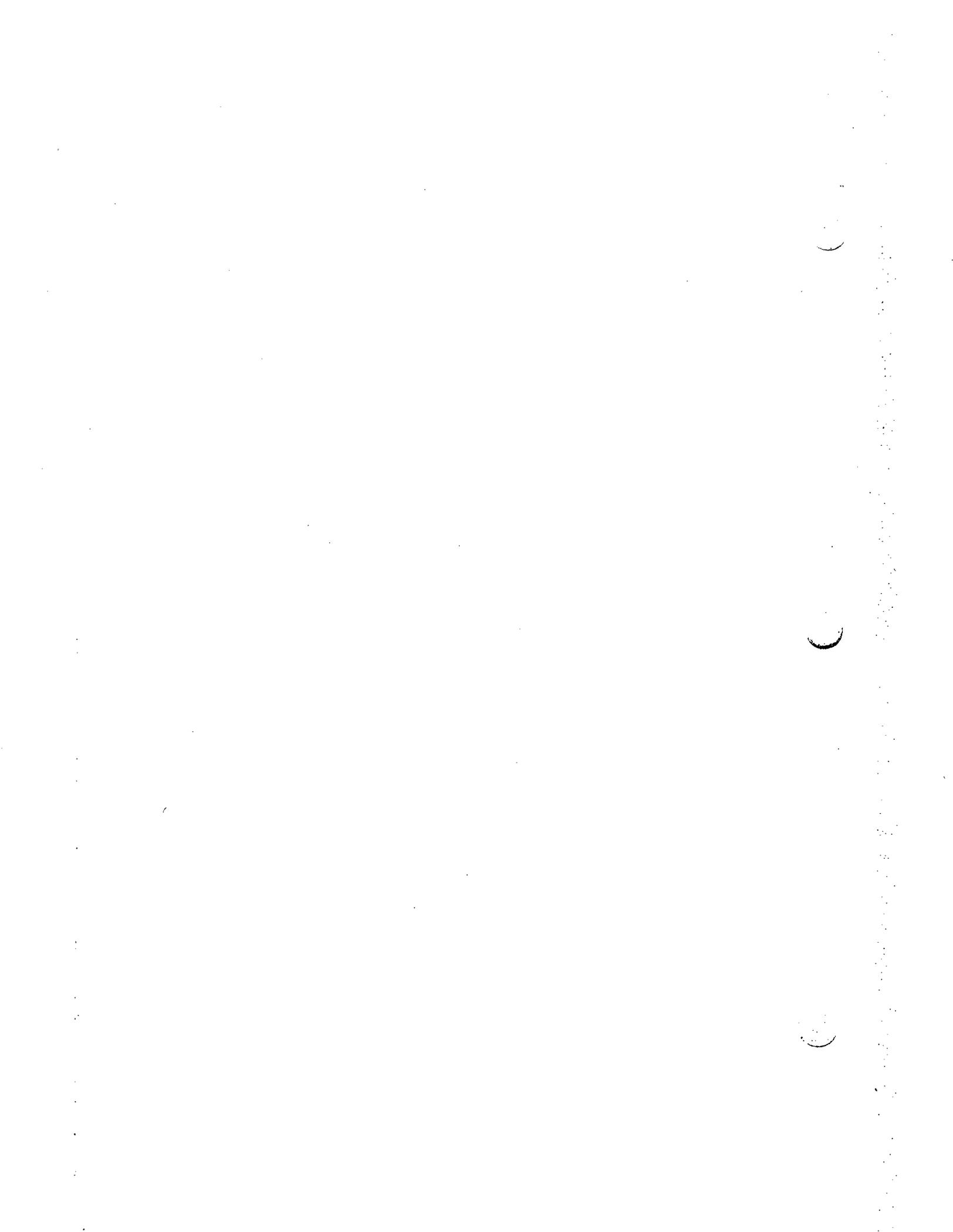
NUMBER OF PASSES PER CYCLE

AFTER THESE QUESTIONS ARE ANSWERED, THE PROGRAM WILL AGAIN ASK FOR DEVICE NUMBER. IF MORE DRIVES ARE TO BE RUN, THESE QUESTIONS SHOULD BE ANSWERED. IF NO MORE DEVICES ARE BEING RUN, TYPING A CARRIAGE RETURN AFTER 'DEVICE NUMBER' WILL CAUSE THE PROGRAM TO START RUNNING. DEVICE NUMBER CAN BE ANY NUMBER FROM 0 TO 3 AND SHOULD MATCH THE NUMBER ON THE SELECT PLUG OF THE DEVICE TO BE RUN. DEVICE TYPE DEFINES EITHER SMD OR CMD HEAD INFORMATION TO THE PROGRAM. SPECIAL MODE WILL BE DESCRIBED LATER. CAPACITY WILL GIVE OPTIONS OF (40,80,150,300 MB) IF SMD WAS TYPED FOR DEVICE TYPE AND (CART,32,64,96 MB) IF CMD WAS THE DEVICE TYPE. 'CART' IN THE OPTION FIELD INDICATES TO THE PROGRAM TO USE ONLY THE CARTRIDGE FOR TESTING IN THE CMD. RECORD SIZE WILL SELECT WHAT SIZE RECORDS ARE TO BE RUN. ALT WILL CAUSE THE RECORD SIZE TO ALTERNATE ON EACH PASS OF THE TEST, STARTING WITH 448 WORD RECORDS. DATA PATTERNS DETERMINES WHAT TYPE OF DATA TO WRITE ON THE DISK. 'COMPAT.' WILL USE THE STANDARD DATA PATTERN,

'BADSPOT' WILL USE WORSE CASE DATA PATTERNS TO DETERMINE THE QUALITY OF THE DISK MEDIA. (CAUTION: THE USE OF BADSPOT PATTERNS WHEN RUNNING COMPATIBILITY PACKS WILL CAUSE SEVERE READ ERRORS). NUMBER OF PASSES DETERMINES HOW MANY TIMES THE PRESENT DEVICE WILL RUN BEFORE GOING ON TO THE NEXT DEVICE.

SPECIAL MODE:

TO ENTER SPECIAL MODE, TYPE SPEC IN RESPONSE TO 'DEVICE TYPE'. THE PROGRAM WILL TYPE OUT 'SPECIAL MODE'. IT WILL THEN REQUEST 'HEAD STRUCTURE (OCTAL)'. IF DECIMAL INPUT IS WANTED, TYPE RETURN AND A ':' WILL BE TYPED. THEN ENTER THE DECIMAL NUMBER. IF OCTAL INPUT IS WANTED, TYPE RETURN AGAIN AND ENTER THE OCTAL NUMBER. THE FORMAT FOR INPUTTING INFORMATION IS AS FOLLOWS: FOR HEADS WHICH HAVE NO BREAKS FROM LOWEST TO HIGHEST HEAD, ENTER (LOWEST HEAD NUMBER)-(HIGHEST HEAD NUMBER). THIS IS THE CASE FOR SMD'S. AN 80 MB HEAD STRUCTURE WOULD BE ENTERED AS 0-4, A 300 MB AS 0-18 (DECIMAL).(OCTAL WOULD BE 0-22) IF THE HEADS HAVE A BREAK IN THEIR COUNTING, A / IS USED TO INDICATE THE BREAK. THEREFORE, IN THE CASE OF A 96 MB CMD, WHICH HAS HEADS NUMBERED 0,16,17,18,19,20,(DEC) THE HEAD STRUCTURE WOULD BE 0/16-20, AND A 32 MB HAS HEADS 0,16, AND THE HEAD STRUCTURE WOULD BE 0/16. THE ENTIRE HEAD STRUCTURE NEED NOT BE ENTERED. TO RUN ONE HEAD, ENTER JUST THE HEAD WANTED. TO RUN A CERTAIN SUBSET, ENTER THE HEADS TO BE RUN. IE: TO RUN THE FIXED DISKS OF A 96 MB CMD, ENTER 16-20.(DECIMAL). (OCTAL WOULD BE 20-24). THE SAME RULES HOLD FOR THE TRACK STRUCTURE. THE STANDARD TRACK STRUCTURE FOR BOTH CMD'S AND SMD'S IS 0-822. ANY SUBSET OF THIS CAN BE RUN. TO RUN THE HIGHER HALF OF THE TRACKS, 410-822 COULD BE ENTERED. ALSO, ONE TRACK CAN BE RUN BY ENTERING THE TRACK NUMBER DESIRED.



## GENERAL CHECKOUT

1. MAKE SURE THE HEAD AND SPINDLE ARE UNLOCKED.
2. CHECK DISK POWER SUPPLY VOLTAGES.

## CONNECTOR J3 (MAIN PCB)

PIN 1 - GND  
PIN 2 - +24V  
PIN 3 - -5V  
PIN 4 - -12V  
PIN 5 - +5V

NOTE: THESE ARE ALL RUNNING VOLTAGES WITH A +/- 5% TOLERANCE.

3. CHECK POWER SUPPLY FUSE.
4. CHECK MOTOR CONTROL PCB FUSE.
5. CHECK DEVICE ADDRESS, SECTORING AND WRITE PROTECT SWITCHES.
6. CHECK CONTROLLER, CABLE AND TERMINATOR CONNECTIONS.

## \*\*\*SYPTOM A\*\*\*

## ROTATION DOES NOT START

1. CHECK SPINDLE LOCK.
2. CHECK POWER SUPPLY VOLTAGES.
3. CHECK CONNECTOR J4, PIN 4. THIS SHOULD BE AT 0V, IF NOT, REPLACE THE MAIN LOGIC PCB.
4. CHECK MOTOR CONTROL PCB FUSE.
5. CHECK CONNECTOR J1, PIN 5. THIS SHOULD BE AT +4V, IF NOT, REPLACE THE MOTOR CONTROL PCB.
6. CHECK SPINDLE MOTOR. \*\*BE VERY CAREFUL WHEN PERFORMING THIS CHECK. ROTATE THE SPINDLE IN A CLOCKWISE DIRECTION ONLY AS VIEWED FROM THE BOTTOM OF THE DISK.

MANUALLY ROTATE SPINDLE IN A CLOCKWISE DIRECTION (AS VIEWED FROM THE BOTTOM OF THE DISK). IF BINDING, REPLACE THE DISK UNIT. IF THE MOTOR APPEARS TO BIND, REPLACE THE DISK.

7. CHECK PHOTOCELL ASSEMBLY OUTPUT. CLEAN IF DIRTY. REPLACE IF DEFECTIVE.

\*\*\*\*SYSPOTOM B\*\*\*\*

SPINDLE ROTATES BUT STOPS AFTER APPROXIMATELY 1 MINUTE

1. CHECK HEAD LOCK.
2. CHECK MOTOR CONTROL PCB (AS PER SYSPOTOM A, STEPS 4 AND 5).
3. CHECK PHOTOCCELL ASSEMBLY OUTPUT. REPLACE IF DEFECTIVE.
4. CHECK SPINDLE MOTOR (AS PER SYSPOTOM A, STEP 6).
5. REPLACE MAIN LOGIC PCB AND TEST.

\*\*\*SYMPTOM C\*\*\*

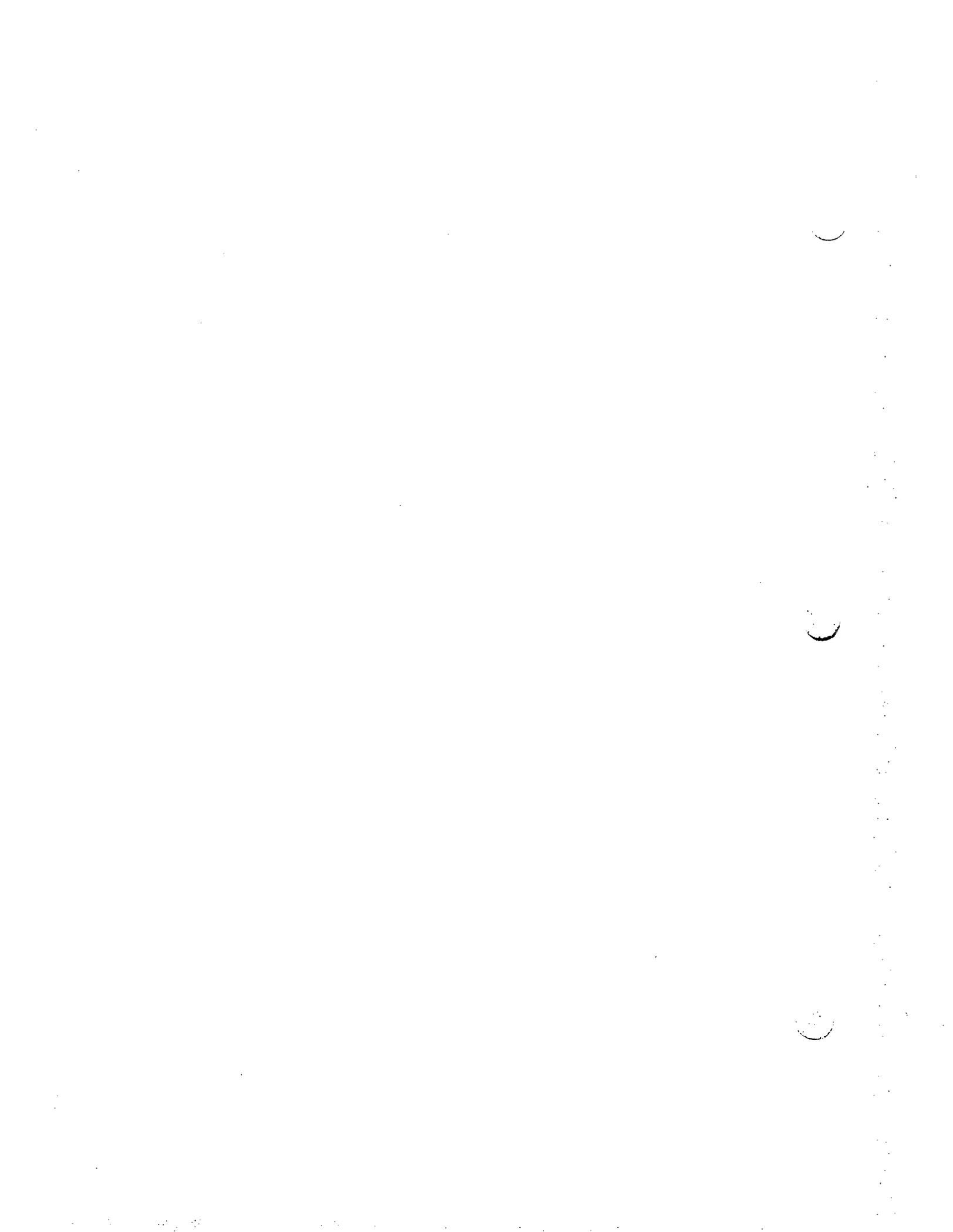
SPINDLE ROTATES, DISK EITHER DOES NOT COME READY OR COMES READY AND DROPS.

1. CHECK POWER SUPPLY VOLTAGES, MAY BE INTERMITTENT VOLTAGE DROPS.
2. DEFECTIVE MAIN LOGIC PCB. REPLACE AND TEST
3. DEFECTIVE MOTOR CONTROL PCB (CHECK AS PER SYMPTOM A, STEPS 4 & 5 )
4. DEFECTIVE HEAD/DISK ASSEMBLY. REPLACE DISK AND TEST.

CDC 600MB FIXED MODULE DRIVE

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FMD-SA:01      600MB T & D Microprocessor Functions

This Test and Diagnostic Microprocessor is responsible for the following:

- I.     Drive Power Up/Down
- II.    Analysis of Power Supply Performance
- III.   Offsetting + and - 5 Volt Supplies
- IV.    Performing Field Test Unit Functions
- V.     Communicating with Servo Microprocessor
- VI.    Communicating with T&D Control Panel
- VII.   Performing Self-Test
- VIII. Performing Drive Tests (Access and Read/Write)
- IX.    Performing Logic Card Tests

## I. Drive Power Up/Down

AC power applied to the drive with the main circuit breaker ON will activate a +5 V, MSU +24Y power supply. This unregulated 24Y is used for pulling relays and the brake coil. The regulated +5 V is the power for the T&D Microprocessor and some of its associated circuits.

In the Power Up/Down mode of operation, the T&D processor monitors the following signals:

1. Air Switch
2. Circuit Breaker Interlock
3. Local/Remote Switch
4. Start Switch
5. Pick In
6. Hold In
7. ON Cylinder
8. Up to Speed
9. Brake Current
10. PLO Locked ON
11. Power Supply Status

The outputs controlled by the processor during Power Up/Down are:

1. Brake Power
2. Pick Out
3. Drive Motor Run
4. Drive Motor Start
5. DC Power ON
6. Power ON Master Clear
7. Servo PLO Fast Start
8. 15-Second Time Out
9. DC Master Clear
10. 1 KHZ Clock
11. RTZ Seek
12. Ready
13. Fault

Upon recognizing the proper conditions of the Local/Remote switch, Pick/Hold Lines, Air switch, Start switch and the interlock line the processor will turn on the DC power supplies. If any conditions are missing or in error an appropriate code will be displayed on the T&D Control Panel. After a sufficient time has elapsed to allow the DC supplied to stabilize the processor will perform a power supply diagnostic test. Depending on the results of this test the processor will either post an Error Code on the T&D control panel and light the fault lite or will issue a Power ON master clear to the servo Microprocessor and resume looking for the proper conditions which will cause the drive to continue powering up. Assuming no improper conditions or errors are present, the processor will turn off the brake and energize the drive motor. At this point a 15 second time-out is started and all input statuses are monitored to look for conditions which would warrant a power down. An up-to-speed signal must be detected before the 15-seconds has elapsed or a fault code will be posted and the drive will be powered down. The receipt of the Up to Speed signal will cause Pick Out to be sent to the I/O if the Local/Remote switch is in the Remote position. Up to Speed will also cause a servo PLO fast start to be issued. If after an adequate number of retries no servo PLO Locked On signal is detected a Fault code will be posted. The servo PLO locking ON causes an RTZ command to be sent to the servo microprocessor. After a sufficient time the ON cylinder status is checked. If no ON cylinder is detected a fault code will be posted. An ON cylinder condition with no other improper status present will result in the ready signal being set. This completes the power-up and the T&D processor goes into a loop waiting to be interrupted to perform a power-down or some diagnostic function.

## II. Analysis of Power Supply Performance

The DC power supply contains a microprocessor interface card which allows the T&D Microprocessor to monitor the voltages within the supply via an A/D converter. The A/D converter provided on the Interface card is only the "Front End" of an A/D converter with the digital conversion being provided by the T&D microprocessors Software and Memory. The voltages monitored are:

1. +10 V
2. -10 V
3. -5 V
4. -5 V
5. +24 V
6. -24 V
7. -36 V on capacitor
8. -36 V on circuit breaker

The voltages measured are compared to upper and lower limit values stored in memory. If a measured voltage falls outside of its desired range an Error Bit is set within a series of Error Status bytes. At the completion of the Power Supply Diagnostic the T&D microprocessor analyzes the Error status bytes and posts the necessary fault code or successful completion code then returns to its monitor loop to wait for another interrupt.

Since the linear motor power amplifier is also contained within the DC supply an output is provided from the Interface card to clamp off the power amp during portions of the Power Up/Down sequence to prevent undesired carriage motion.

### III. Offset of Power Supply Voltages

The DC power supply T&D interface card contains circuitry which may be activated by the T&D microprocessor and will cause the plus and minus 5 V supplies to be offset +5%. The power supply voltage offset feature is used in Diagnostic mode to aid in determining marginal circuit operation.

### IV. FTU Functions

With the local/remote switch in the local position and an FTU Function command entered on the T&D control panel the T&D processor will disable the drives transmitters and ignore any signal present on the receivers. With the I/O disabled the processor will then perform the selected FTU function until commanded to STOP from the T&D control panel or an End of Test signal is detected.

FTU functions provided by the T&D microprocessor are:

1. Direct Seek to any Cylinder
2. Continuous Seeks between any two cylinders.
3. Sequential forward seeks of any increment
4. sequential reverse seeks of any increment
5. sequential fwd/rev seeks of any increment
6. Random seeks
7. X N seeks
8. Average Access Time measurements over 10,000 seeks
9. Average access time measurements over X N seek
10. Manual Tags
11. RTZ (Single or continuous)
12. Limited Read/Write

The T&D processor will write and read via a 3/4 cell delay either an all high frequency pattern or an all low frequency pattern on part of a CE cylinder.

## V. Communications with Servo Microprocessor

During the course of its operation the servo microprocessor performs self-test and operational status checks on itself and the servo operation. The results of these checks are stored in memory (servo microprocessor memory). Any servo fault conditions which occur are passed on to the T&D microprocessor in the form of a single "servo error" signal. It is necessary for the T&D microprocessor to transfer the status/error bytes from the servo memory into the T&D memory. Once in the T&D memory the T&D processor analyzes the status/error words and determines whether to set a machine "seek error" and/or "fault" or to simply remember that some marginal servo problem may be developing.

For example, a failure to come ON cylinder after a seek or the detection of a guardband during a seek would be a seek error fault conditions which should be passed on to the I/O where as, the detection of slightly excessive overshoot when coming ON cylinder is a servo error condition which is logged and posted on the T&D control panel display to aid in pointing out a marginal condition developing.

Servo status which is transferred to the T&D Microprocessor may include:

1. Results of Servo Memory Self-Test
2. Results of Servo I/O Self-Test
3. Drift Off Cylinder Check
4. Marginal Access Time
5. No Track Crossings Sensed
6. Seek Error - End of Travel
  - Failed to Lock ON Cylinder
  - Failed to Complete Seek within 500 ms
  - Failed to complete RTZ
  - RTZ took too long
  - Maximum address fault
7. Present Cylinder - Upper Address
8. Present Cylinder - Lower Address
9. Results of Velocity Adjustment Test
10. Track following performance
11. Overshoot check.

The T&D Processor is capable of communicating to the Servo Processor to cause it to run Diagnostic checks on itself or simply to ask for status information to be passed on to the T&D Control panel display. The communications is achieved via four lines from the T&D Processor to the Servo Processor, four lines from the Servo Processor to the T&D Processor and two handshake lines between the two Processors.

#### VI. COMMUNICATIONS WITH T&D CONTROL PANEL

The T&D Control Panel consists of four 7-segment Hexidecimal displays, two hexidecimal output rotary switches, three Toggle switches and one LED indicator. The LED gives an indication that power is being supplied to the T&D Microprocessor circuits. The Toggle switches are for loading data from the Rotary Switches into Memory (LOAD), for clearing the Memory which has the Displays Data stored in it (CLEAR) and for initiating (INIT).

Data is transferred from the Processor to the T&D Control Panel in one 8-Bit byte. Four-Bits contain the data to be loaded into one 7-Segment Display's Register-Decoder-Drive. Three-Bits contain information to select which of the four displays the data is to be loaded into and the remaining bit is used to blank all four displays to conserve power when the Control Panel is not in use.

The Rotary and Toggle switches are wired in a matrix of four rows and three columns. Three bits of a 7-Bit Byte Select which column of switches is to be read Column 1 (Rotary Sw1), Column 2 (Rotary Sw 2), or Column 3 (All Toggle Switches). The remaining four bits transmit the selected columns switch data back to Microprocessor.

During the Monitor Loop Column 3 is enabled so the Microprocessor can only be interrupted by one of the Toggle switches. After being interrupted, the processor determines which switch caused the interrupt and takes the appropriate action.

#### VII. SELF TEST

One of the routines which may be called up from the T&D Control Panel and which is also called up as part of the Power ON Sequence is a Self Test Routine. Self Test Analyzes the condition of the Read Only Memory (ROM), Read Write Memory (RAM) and I/O circuits (Timers, Peripheral Interface Adapters, A/Ds, etc.).

The ROMs are written at the factory with a checksum stored in the lowest addressable location. During Self Test the Processor reads all ROM Data words including the checksum and adds them together. A non-zero sum indicates an error has developed somewhere within the ROM and an Error Message is posted on the T&D Control Panel.

The RAMs are tested by writing and reading a variety of patterns into each location. Failure to read back from a RAM the same pattern that was written into it causes an Error Code to appear on the TWD Control Panel.

The PIAs, Timers and remaining Processor I/O circuits are tested as extensively as possible, without causing damage to the drive, by writing and reading from the Data Registers and Control Registers and by monitoring Output Pins.

The TWD Processor can command the Servo Processor to execute a similar Self-Test Routine.

#### VIII. DRIVE TESTS

A series of Drive Tests can be executed via the TWD Control Panel provided the Local Remote switch is in the Local position. Initiating a Diagnostic Test Results in the transmitters being disabled and the received data from the I/O being ignored.

A variety of manually selected options are available which include linking all tests together (completion of one test automatically initiates the next test), stopping on the First Error, continuing the test but logging the errors, looping on a test and ignoring errors and looping on a test and counting errors.

In general, this section describes the tests the Processor performs by simulating instructions as though they were coming from the I/O.

If the Linkable Diagnostic Test is initiated with the Drive powered down the TWD Processor will perform a Self Test on itself, power the drive up, command the Servo Processor to initiate a Self Test and then enter into the Drive Diagnostic Tests. If the drive is already powered up when the Linkable Diagnostic routine is initiated, the Self Tests and Power Up sequencing are bypassed and the Processor will immediately start executing the Drive Diagnostics.

The Drive Diagnostics performed are:

1. Interface Test

The Processor simulates I/O signals, Bus and Tag commands, and looks for the proper response at a variety of points within the Logic.

2. Fault Test

The Processor sets up the conditions required to generate faults and then monitors the Logic to verify that the correct Fault has been detected.

3. The Head Registers are manipulated while monitoring the Chip Select and Y-Select outputs to verify the proper decoding has taken place.

#### 4. Servo Tests

An A/D Converter provides the Processor with information used to determine the quality of Track Following, amount of Overshoot and response to Offset commands. The actuators are commanded to move and the motion verified by monitoring the Position signal. The sequency of events for a Seek is monitored and some of the events are timed looking for marginal conditions.

#### 5. Read/Write Tests

A portion of a CE Cylinder has been reserved for R/W testing by the T&D Processor. Read/write testing is permitted only on the CE Cylinder and only on one track.

The processor is capable of writing either an all High Frequency pattern or an all Low Frequency pattern. The Read Recovery is achieved by using a 3/4 cell delay. This simplified R/W technique allows the Processor to verify that a Data Transfer is possible by using a minimum of hardware.

The processor monitors the sequencing of the signals during the R/W, verifies the timing and makes sure that the Data on the disk can be changed.

#### IX. LOGIC CARD TESTS

In the case of Diagnostic Drive Tests failing without providing sufficient information to completely resolve the problem. The Processor will enter into a Card Test Mode. In this mode inputs to cards will be switched to Microprocesor control and the Processor will sequency the inputs while monitoring the outputs to further try to isolate the Fault. This mode of operation is useful in trying to isolate a failure that has occurred on a card that normally runs at a speed that is too high for the Processor to monitor.

FMD-SA:02 STATUS, TEST, AND FAULT CODES

| Parameter         | Parameter Number | Parameter Digits           |                            |                 |             | Number System |
|-------------------|------------------|----------------------------|----------------------------|-----------------|-------------|---------------|
|                   |                  | 15-12                      | 11-8                       | 7-4             | 3-0         |               |
| Test Option       | 80               | Not Used                   | See Fig 1                  |                 |             | Binary        |
| Seek Increment    | 81               | 15-12                      | 11-8                       | 7-4             | 3-0         | Hex           |
| See Note (1)      |                  |                            |                            |                 |             |               |
| Manual Tag/Bus    | 82               | Tag<br>-321<br>Note<br>(2) | Bus<br>--98<br>Note<br>(3) | Bus<br>7654     | Bus<br>3210 | Hex           |
| Record Register   | 83               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Record Register   | 84               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Head Register     | 85               | 0                          | 0                          | 10 s            | 1 s         | Dec           |
| Head Counter      | 86               | 0                          | 0                          | 10 s            | 1 s         | Dec           |
| Destination 1     | 87               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Destination 2     | 88               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Maximum Sector    | 89               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Maximum Record    | 8A               | 0                          | 100s                       | 10 s            | 1 s         | Dec           |
| Data Field Length | 8B               | 15-12                      | 11-8                       | 7-4             | 3-0         | Hex           |
| Data Pattern      | 8C               | 0                          | 0                          | See Note<br>(4) |             | Hex           |
| Status Bypass     | 8D               | See Fig.2                  |                            | 0               | 0           | Binary        |
| Special Function  | 8E               | 15-12                      | 11-8                       | 7-4             | 3-0         | Hex           |
| Address           |                  |                            |                            |                 |             |               |
| Display/Alter     | 8F               | 15-12                      | 11-8                       | 7-4             | 3-0         | Hex           |

NOTES:

1. If high-order bit (15) is set, sequential reverse will be a shift bit seek, that it cylinders 512 to 256 to 128 to 64 to 32 to 16 to 8 to 4 to 2 to 1.
2. If bit 15 is a "1" the Tag Gate in error is bypassed.
3. If bit 11 is "1" the tag is held until the next initiate.
4. An all-zeros parameter is low frequency. All other parameters are high frequency.

|               | 7 | 6          | 5       | 4      | 3        | 2      | 1      | 0   |
|---------------|---|------------|---------|--------|----------|--------|--------|-----|
| Manual Record |   | Sequential | Random  | Random | Error    | Log    |        |     |
| Heads         |   | Heads      | Records | Heads  | Override | Errors | Single | EDT |

Figure 1. Test Option Bits (80)

|      |      |     |        |        |        |       |       |
|------|------|-----|--------|--------|--------|-------|-------|
| 15   | 14   | 13  | 12     | 11     | 10     | 9     | 8     |
| Time | Seek | On  | On     | PLO    | Select | Seek  | Fault |
| Out  | End  | Cyl | Sector | Locked |        | Error |       |
|      |      |     |        | On     |        |       |       |

Figure 2. Status Bypass (8D)

STATUS DISPLAY

| Display Number         | Display Number | Display Digits |       |            |       | System |
|------------------------|----------------|----------------|-------|------------|-------|--------|
|                        |                | 12-15          | 8-11  | 4-7        | 0-3   |        |
| Cylinder               | 90             | 0              | 100s  | 10s        | 1s    | Dec    |
| Total Seeks upper      | 91             | 31-28          | 27-24 | 23-20      | 19-16 | Hex    |
| Total Seeks Lower      | 92             | 15-12          | 11-8  | 7-4        | 3-0   | Hex    |
| Average Seek Time      | 93             | 100m           | 10ms  | 1ms        | 0.1ms | Dec    |
| Read Error Counter     | 94             | 0              | 0     | 7-4        | 3-0   | Hex    |
| Machine Status         | 95             | 0              | 0     | See Fig. 3 |       | Hex    |
| Not Used               | 96             | thru           | 98    |            |       |        |
| Clear Parameters       | 99             | 15-12          | 11-8  | 7-4        | 3-0   | Hex    |
| Pass Counter           | 9A             | 15-12          | 11-8  | 7-4        | 3-0   | Hex    |
| Servo Code Word        | 9B             | See Fig. 4     |       | See Fig. 5 |       | Hex    |
| Seek Error Status Word | 9C             | See Fig. 6     |       | See Fig. 7 |       | Hex    |
| LED Fault Status       | 9D             | 0              | 0     | See Fig. 8 |       | Hex    |
| Not Used               | 9E/9F          |                |       |            |       |        |

|      |      |     |      |        |        |       |       |
|------|------|-----|------|--------|--------|-------|-------|
| 7    | 6    | 5   | 4    | 3      | 2      | 1     | 0     |
| Not  | Seek | On  | Not  | PLO    | Select | Seek  |       |
| Used | End  | Cyl | Used | Locked |        | Error | Fault |
|      |      |     |      | on     |        |       |       |

Figure 3. Machine Status Lower Byte (95)

|       |      |           |          |        |     |          |        |
|-------|------|-----------|----------|--------|-----|----------|--------|
| 15    | 14   | 13        | 12       | 11     | 10  | 9        | 8      |
| Seek  | Not  |           | Servo    | Servo  |     | Servo    | Normal |
| Error | Used | Direction | Hardware | Status | RTZ | Hardware | Seek   |

Figure 4. Servo Code Upper Byte (9B)

|          |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|
| 7        | 6     | 5     | 4     | 3     | 2     | 1     | 0     |
| SERVO    | MPU   | TIMER | RAM   | ROM   | PIA 2 | PIA 1 | PIA 0 |
| HARDWARE | ERROR |

Figure 5. Servo Code Lower Byte (9B)

|            |                   |                  |                   |              |                 |                 |          |
|------------|-------------------|------------------|-------------------|--------------|-----------------|-----------------|----------|
| 15         | 14                | 13               | 12                | 11           | 10              | 9               | 8        |
| Seek Error | No Track Crossing | Guardband During | Track 0 Settle-in | Track 0 Seek | No guard Bank 2 | No guard Band 1 | Not used |

Figure 6. Seek Error Upper Byte (9C)

|            |                |                       |                 |                             |            |            |     |
|------------|----------------|-----------------------|-----------------|-----------------------------|------------|------------|-----|
| 7          | 6              | 5                     | 4               | 3                           | 2          | 1          | 0   |
| Seek Error | Access Timeout | Destination too Large | Servo Off-track | Overshoot Off-Track Timeout | Over-shoot | Over-shoot | RTZ |

Figure 7. Seek Error 0 Bits (9C)

|          |               |             |                   |                       |                      |            |          |
|----------|---------------|-------------|-------------------|-----------------------|----------------------|------------|----------|
| 7        | 6             | 5           | 4                 | 3                     | 2                    | 1          | 0        |
| Not Used | Voltage Fault | Write Fault | Head Select Fault | (Read + Write) On Cyl | (Read o Write) Fault | Seek Error | Not Used |

CONTROL STATUS

| Status Code | Status Description  | CE Action   |
|-------------|---|---|
| XXF0        | Test is running (XX equals test number).  | Actuate INITIATE switch to temporarily stop test.   |
| XXF1        | Test is temporarily stopped (XX equals test number).  | Actuate INITIATE switch tgo restart test.   |
| XXF2        | Test has stopped due to EOT bit being set and end of test was reached, or end of a test was reached.  | Select another test or exit diagnostic/FTU mode.  |
| XXF3        | Test has stopped due to an error (XX equals test number). The error code is stored in the error logging area (DO-EF). The error logging area must be read to determine the exact reason for the stop. | 1. Ensure drive is in FTU mode<br>2. Examine contents of error logging area DO-EF and look up error codes in FTU error code dictionary. |

CE FUNCTIONS

| Number | CE Function                           |
|--------|---------------------------------------|
| F0     | Clear all error logs/parameters       |
| F1     | Clear Fault LEDs on BO4/CO4           |
| F2     | Clear Fault Codes and Fault Counts    |
| F3     | Clear Fault Counts; Clear Error Codes |
| F4     | Clear Seek Counters and Timers        |
| F5     | Clear Read Error Counter              |
| F6     |                                       |
| thru   | Not Used                              |
| FF     |                                       |

FTU TESTS

| Number | Test Name                  | Number | Test Name        |
|--------|----------------------------|--------|------------------|
| A0     | Manual Tags                | A8     | RTZ              |
| A1     | Direct Seek                | A9     | special Function |
| A2     | Direct Continuous          | AA     | Write            |
| A3     | Sequential Forward         | AB     | Read             |
| A4     | Sequential Reverse         | AC     | Write/Read       |
| A5     | Sequential Forward/Reverse | AD     | Not Used         |
| A6     | Random                     | AF     | Not Used         |
| A7     | X---N                      |        |                  |

## DIAGNOSTICS TESTS

| Number           | Test Name                                    |
|------------------|--|
| 00               | Linked Series - Bypass Errors                |
| 01               | Linked Series - Stop on Error                |
| 02               | Linked Series - One Pass Only                |
| 03               | Linked Series - DC Power on,<br>Pack stopped |
| 04               | Linked Series - Drive Ready                  |
| 05               | Linked Series - Test 03 and 04<br>One pass   |
| 06<br>thru<br>0F | Not used                                     |
| 10               | Servo RAM test                               |
| 11               | Servo ROM test                               |
| 12               | Servo PIA Test                               |
| 13               | Servo Timer Test                             |
| 14               | Velocity DAC Test                            |
| 15               | Comparator DAC Test                          |
| 16               | Servo Hardware Test                          |
| 17               | Reset Velocity DAC Test                      |
| 18               | Servo Status Test                            |
| 19               | Track Following Test                         |
| 1A               | Inner Guardband Test                         |
| 1B               | Guardband 2 Test                             |
| 1C               | Drag Test                                    |
| 1D               | Servo MPU Test                               |
| 1E               | Clear Seek Error Word Test                   |
| 1F               | Enable Servo Communication                   |
| 20               | Disable Servo Communication                  |
| 21               | Velocity Gain Test                           |
| 22               | AGC Test                                     |
| 23               | Overshoot Test                               |
| 24               | Positive and Negative Position Test          |
| 25               | Servo Head Test                              |
| 26               | Odd or Even over 2 Test                      |
| 27               | Reset Comparator DAC Test                    |
| 28               | Average Access Time Test                     |
| 29               | Index Test                                   |
| 2A<br>thru<br>2E | Not used                                     |
| 2F               | 3 Minute Delay                               |
| 30               | RTZ Test                                     |
| 31               | Shift Bit Seek Test                          |
| 32               | Index Bit Test                               |
| 33               | Squelch and Read Gate Test                   |
| 34               | Static AGC Test                              |
| 35               | Fault/Control Test                           |
| 36               | Head Select Test                             |
| 37               | Movable Head Chip Select Test                |

|      |                                 |
|------|---------------------------------|
| 38   | Fixed Head Chip Select Test     |
| 39   | Write Zoning Test               |
| 3A   | Seek Time Tet                   |
| 3B   | Write/Read Tet                  |
| 3C   |                                 |
| thru | Not Used                        |
| 53   |                                 |
| 54   | EPROM 1 Part Number, High Order |
| 55   | EPROM 1 Part Number, Low Order  |
| 56   | EPROM 2 Part Number, High Order |
| 57   | EPROM 2 Part Number, Low Order  |
| 58   | EPROM 3 Part Number, High Order |
| 59   | EPROM 4 Part Number, Low Order  |
| 5A   | EPROM 4 Part Number, High Order |
| 5B   | EPROM 4 Part Number, Low Order  |
| 5C   | EPROM 5 Part Number, High Order |
| 5D   | EPROM 5 Part Number, Low Order  |
| 5E   | Reserved                        |
| 5F   | Reserved                        |
| 60   | Enter FTU Mode                  |
| 61   | Exit FTU Mode                   |
| 62   | Enter Diagnostic Mode           |
| 63   | Exit Diagnostic Mode            |
| 64   |                                 |
| thru | Not used                        |
| 6D   |                                 |
| 6E   | Set Voltage Margin Flag         |
| 6F   | Clear Voltage Margin Flag       |

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Tests 70 thru 7F are Voltage Monitors

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|    |                                   |
|----|-----------------------------------|
| 70 | + Position                        |
| 71 | - Position                        |
| 72 | Power Amp DAC                     |
| 73 | Comparator DAC                    |
| 74 | -8.3 V Servo Pre-Amp              |
| 75 | + Odd or Even Over 2              |
| 76 | -36 V Servo -7.2 +0V A2A2J2-7     |
| 77 | -15 V MPU                         |
| 78 | +15 V MPU                         |
| 79 | -24 V MPU                         |
| 7A | +24 V MPU                         |
| 7B | +5 V MPU +0.05V A3CO3-43A         |
| 7C | +5 V Logic +0.05 V A3A01-44A      |
| 7D | -5 V Logic -5.1 +0.05 V A3A01-02A |
| 7E | +24 V Logic +2.4V A3A01-45A       |
| 7F | -24 V Logic +2.4V A3A01-01A       |

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MISCELLANEOUS

| Error Code | Error Description   | Action Code |
|------------|---|-------------|
| Blank      | T&D* MPU not active   | 10          |
| Unknown    | Any number combination along with the operator FAULT light on indicates a T&D MPU error.                    | 10          |
| Unknown    | Any number combination along with the MPU LED (on BO3/CO3) on indicates the T&D MPU was unable to power up. | 10          |

\*Test & Diagnostic

FTU FUNCTION ERROR CODES

| Error Code | Error Description                                    | Action Code      |
|------------|--|------------------|
| AFA0       | Not Used   |                  |
| AFA1       | Seek End did not drop                                | 9.6,5,4,11,10,12 |
| AFA2       | Seek End not found                                   | 9.6,5,4,11,10,12 |
| AFA3       | On Cylinder not found                                | 9.6,5,4,11,10,12 |
| AFA4       | Incorrect Machine Status before a seek.              | 36,37            |
| AFA5       | Incorrect Machine Status before a seek               | 36,37            |
| AFA6       | On sector not found                                  | 9.4,3,1,7,11,12  |
| AFA7       | Incorrect Machine Status before a head select        | 36,37            |
| AFA8       | Incorrect Machine Status after a head select         | 36,37            |
| AFA9       | Sector Mark Time-out                                 | 9.4,3,1,7,11,12  |
| AFAA       | Incorrect Machine Status after a write               | 36,37            |
| AFAb       | Incorrect Machine Status after a read                | 36,37            |
| AFAC       | Read Error. Data is assumed to be written correctly. | 40,41,42, 43,59  |
| AFAc       | Not Used   |                  |
| AFAE       | Time-out while counting sectors.                     | 11,10,8,9        |
| AFAF       | Too Many sectors for FTU tests to be run.            | 44               |

STATUS CODES

| <u>Status Code</u> | <u>Status Description</u>   | <u>CE Action</u>   |
|--------------------|---|--|
| EEO0               | Waiting for START switch to be pressed  | Press START switch to power up drive   |
| EEO1               | Failed to reach Up to speed on first try  | None-Microprogram will retry.  |
| EEO2               | Interrupt occurred but unable to determine cause  | None-Microprogram will return to monitor. If constant display, replace card B03/C03 and -VWV card (in T&D control panel). Check -VWV and -VWV cabling. |
| EEO3               | No Hold.  | Indicates Drive was powered down from controller or there is a faulty interface cable.   |
| EEO4               | Not Used.   |  |
| EEO5               | Illegal manual tag entered or a write was attempted on a non-CE cylinder. Writing is allowed on CE cylinder 842 only. | Check validity of parameters entered and try again.  |
| EEO6               | Not Used.   |  |
| EEO7               | An illegal test was selected.   | Verify the test number and initiate the test again.  |
| EEO8               | Waiting for Up to Speed.  | None.  |
| EEO9               | Waiting for Ready.  | None.  |
| EEOA               | PLO took two tries to lock on-now waiting for Ready.  | None.  |
| EEOb               | PLO took three tries to lock on-now waiting for Ready.  | None.  |

STATUS CODES

| <u>Status Code</u> | <u>Status Description</u>  | <u>CE Action</u>   |
|--------------------|--|--|
| EE0c               | Drive completed first seek during power up and became Ready. No diagnostic functions have been performed and no diagnostic/machine errors have occurred. | None.  |
| EE0d               | Waiting for Pick and Hold  | Determine position of LOCAL/REMOTE switch on card B03/C03.<br><br>Remote-Pick and Hold came from the controller or preceding drive. Status will change when Pick and Hold are received; if no, replace card B03/C03 and check I/O cables.<br><br>Local-This status should not occur. Replace card B03/C03. |
| EE0F               | Tried to put drive in FTU mode (60) or diagnostic mode (62)  | Ensure LOCAL/REMOTE switch on card at B03/C03 is set to LOCAL.   |
| EE10 thru EEFC     | Not Used.  |  |
| EEFd               | Data from a parameter entry (8X) has been stored in memory.  | Operate CLEAR switch to end panel activity.  |
| EEFE               | Not Used.  |  |
| EEFF               | The diagnostic control panel is initialized and ready. This occurs when AC power is turned on or after a clear from the diagnostic control panel.        | None.  |

TEST & DIAGNOSTIC ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>   | <u>Action Code</u> | <u>Note</u> |
|-------------------|--|--------------------|-------------|
| F10F              | Servo RAM error. Data read did not compare with data written.  | 5                  |             |
| F11F              | Servo ROM error. Prewritten data plus check sum did not equal zero.  | 5                  |             |
| F12F              | Servo PIA error. Data loaded did not compare with data read.   | 5                  |             |
| F13F              | Servo timer error.   | 5                  |             |
| F14F              | Velocity trajectory DAC. Analog output did not compare to predetermined value.   | 5.9                |             |
| F15F              | Comparator DAC Error. Analog output did not compare to predetermined value.  | 6.9                |             |
| F16F              | Servo hardware test error<br>Failure occurred while reporting results of tests 10,11,12, and 13.                       | 5                  |             |
| F17F              | Reset Velocity DAC error.<br>Velocity DAC was not set to zero.   | 5                  |             |
| F18F              | Servo status test error<br>Failure occurred while transmitting servo status from the servo MPU to the TGD MPU.         | 5,10               |             |
| F19F              | Track following error. The track following position signal exceeded predetermined positive and negative signal levels. | 5                  |             |
| F1AF              | Inner guardband error.<br>Inner guardband not detected.  | 11.5               |             |
| F1bF              | Guardband 2 error. Guard band 2 not detected.  | 11.5               |             |
| F1cF              | Drag Error. Outer guardbands were not detected before timer timed out.   | 11.5               |             |

TEST & DIAGNOSTIC ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>   | <u>Action Code</u> | <u>Note</u> |
|-------------------|--|--------------------|-------------|
| F1dF              | Servo MPU error.   | 5                  |             |
| F1EF              | Clear seek word error.<br>Seek word was not set to zero.                                     | 5                  |             |
| F1FF              | Enable servo communication error.<br>Failure occurred while enabling<br>servo communication. | 5,10               |             |
| F20F              | Disable servo communication.<br>Failure occurred while disabling<br>servo communication.     | 5,10               |             |
| F211              | Servo seek velocity too slow.  | 6                  | 1           |
| F217              | Seek error during full length<br>seek.   | 35                 |             |
| F21F              | Servo seek velocity too fast.  | 6                  | 1           |
| F220              | AGC output not logical "0"<br>during a ready condition.                                      | 4                  |             |
| F230              | Excessive overshoot oc-<br>curred during a seek.   | 4,6                |             |
| F231              | Overshoot error.   | 4,35               |             |
| F232              | No fine servo.   | 4,6                |             |
| F240              | Positive and negative position<br>signals are not within 40<br>millivolts of each other.     | 4,6                |             |
| F250              | Servo head output not logical<br>"0" during a ready condition.                               | 4                  |             |
| F260              | Odd or even over 2 output<br>amplitude was not + 2.0 V<br>+ 0.5V.                            | 4,9                |             |
| F27F              | Reset comparator DAC error<br>Comparator DAC was not re-<br>set to zero.                     | 6                  |             |
| F290              | Index pulses were not received<br>at the proper intervals.                                   | 11,1,9             |             |

TEST & DIAGNOSTIC ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>  | <u>Action Code</u> | <u>Note</u> |
|-------------------|---|--------------------|-------------|
| F302              | No RTZ was executed when an RTZ was issued.                                     | 5,6,3,4,10         |             |
| F303              | Seek error during an RTZ  | 35                 |             |
| F306              | Cylinder register not equal to 00 after an RTZ.                                 | 5,10,9             |             |
| F313              | Seek error after a zero track seek was issued.                                  | 35                 |             |
| F315              | Seek error on a forward shifted bit seek  | 35                 |             |
| F316              | Cylinder register contains wrong cylinder                                       | 5,9,10,12          |             |
| F317              | Seek error after a zero track seek was issued.                                  | 5                  |             |
| F318              | Carriage movement during a zero track seek.                                     | 5                  |             |
| F319              | No carriage movement after a forward seek was issued.                           | 9,5                |             |
| F31A              | After a forward seek was issued carriage movement was in the reverse direction. | 9,5                |             |
| F31F              | Seek error during shift bit seek.   | 35,6,5,4           |             |
| F320              | Index pulse generation was incorrect.   | 12,1,9             |             |
| F330              | Squelch and read gate generation was incorrect.                                 | 12,1,11,9          |             |
| F340              | AGC output not a logical "1" during a not ready condition.                      | 4                  |             |
| F350              | One or more fault latches could not be set or reset.                            | 11,6,9,12,8        |             |
| F360              | One or more movable heads could not be selected.                                | 12,10              |             |

TEST & DIAGNOSTIC ERROR CODES

| Error Code | Error Description  | Action Code                      | Note |
|------------|--|----------------------------------|------|
| F370       | One or more head arm groups (2 arms each) could not be selected.   | 12,9                             |      |
| F380       | One or more fixed heads could not be selected.                     | 12,5                             |      |
| F390       | Write zone decoding was incorrect.                                 | 12,6                             |      |
| F3A3       | Seek error during an RTZ   | 35,6,5                           | 1    |
| F3A4       | Servo seek velocity too slow.                                      | 4,6                              | 1    |
| F3A5       | Servo seek velocity too fast                                       | 4,6                              | 1    |
| F3A7       | Seek error after a zero track seek was issued.                     | 35                               |      |
| F3A8       | Carriage movement during a zero track seek.                        | 5                                |      |
| F3Ab       | Seek error   | 35                               |      |
| F3AF       | Seek error while timing seeks.                                     | 35,6,5,4                         |      |
| F3bb       | Low frequency write fault during a sequential record write.        | 15,1,11,2<br>22,21,41            |      |
| F3bC       | Low frequency read error or fault during a sequential record read. | 15,2,19,13<br>6,11,1,22<br>21,41 |      |
| F3bd       | High frequency write fault during a one record write.              | 1,4,10,<br>22,21,41              |      |
| F3bE       | High frequency read error during one record read.                  | 13,15,10,22<br>21,41             |      |

NOTE: 1. Perform velocity seek adjustment.

ACTION CODES

| Fault Code | Description of Action  | Location  | Note |
|------------|--|-----------|------|
| 1          | Replace KAX Write PLO  | A3A01     | 1    |
| 2          | Replace JSX SWrite Comp  | A3A02     | 1    |
| 3          | Replace DKX Servo PLO  | A3A03     | 1    |
| 4          | Replace JYX Servo Decode   | A3A04     | 2    |
| 5          | Replace LGX MPU Servo  | A3A05     | 2    |
| 6          | Replace LHX Analog Servo   | A3A06     | 2    |
| 7          | Replace FBX DC Steering  | A3A07     |      |
| 8          | Replace FAX CH1 I/O  | A3A08     |      |
| 9          | Replace LFX T&D I/O  | A3B02-C02 |      |
| 10         | Replace KTX T & D  | A3B03-C03 | 1    |
| 11         | Replace LEX Flt/Cont   | A3B04-C04 |      |
| 12         | Replace JTX AM Detect  | A3B05-C05 |      |
| 13         | Replace KCX Rd Decode  | A3B06-C06 | 1    |
| 14         | Replace FAX CH2 I/O  | A3B08     |      |
| 15         | Replace JVX Read PLO   | A3C08     |      |
| 16         | Replace YUV Pwr Amp  | A3A2      |      |
| 17         | Replace GDV +5 V Reg   | A2A1      |      |
| 18         | Replace VMV Diag I/O   | A2A7      |      |
| 19         | Replace VLV Reg  | A1A2      |      |
| 20         | Replace VXV Motor Cont   | A1A1      |      |
| 21         | Replace YMV Head Select  |           |      |
| 22         | Replace YYV R/W Chassis  |           |      |
| 23         | Replace VWV Diagnostic Panel   |           |      |
| 24         | Check voice coil, Replace HDA  |           | 2    |
| 25         | Check Thermal breaker,<br>Replace motor assembly   |           |      |
| 26         | Check or replace drive belt  |           |      |
| 27         | Check or replace DC power supply   |           | 3    |
| 28         | Check circuit breakers   |           |      |
| 29         | Check or replace AC power supply   |           | 3    |
| 30         | Check or replace brake   |           |      |
| 31         | Check or replace pressure switch   |           |      |
| 32         | Check or replace blower assembly   |           |      |
| 33         | Check or replace MPU power supply  |           | 4    |
| 34         | Check or replace absolute filter<br>and prefilter  |           |      |
| 35         | Check error log (DO-EF)  |           | 5    |
| 36         | Display machine status (95)  |           |      |
| 37         | Replace cards for bit(s) in error:<br>Bit 4 or 7 on: 10<br>Bit 5 or 6 off: 10,6,12,5<br>Bit 3 off: 10,11,4,1,3<br>Bit 2 on: 10,11,8 or 14<br>Bit 1 on: 10,5<br>Bit 0 on: 10,12,11,21 |           |      |
| 38         | Replace cards for bit(s) in error:<br>Bit 4 or 7 on: 10<br>Bit 5 or 6 off: 10,6,12,5<br>Bit 3 off: 10,11,4,1,3<br>Bit 2 on: 10,11,9 or 14<br>Bit 1 on: 10,5<br>Bit 0 on: 9,4,3,1     |           |      |

### ACTION CODES

| Fault Code | Description of Action   | Location | Note |
|------------|---|----------|------|
| 39         | Check FTU read circuit adjustments  |          |      |
| 40         | Test for flaw free tracks on map  |          |      |
| 41         | Use FTU for further testing of failing heads  |          |      |
| 42         | Use scope to check for media flaws  |          |      |
| 43         | Check customers error log for errors on same head(s)  |          |      |
| 44         | Change drive sector to equal or less than 128   |          |      |
| 45         | Press START switch  |          |      |
| 46         | None - MPU will retry   |          |      |
| 47         | None - microprogram will return to monitor.<br>If constant display, replace 10 and 18.  |          |      |
| 48         | Indicates drive was powered down from controller or there is a faulty I/O cable   |          |      |
| 49         | Check validity of parameters and try again  |          |      |
| 50         | Verify the test number and initiate the test again  |          |      |
| 51         | Determine position of LOCAL/REMOTE switch on card 10. Pick and Hold come from controller or preceding drive when operating in Remote mode. Status will change when Pick and Hold are received. If operating in in Local mode, this status should not occur, replace 10. |          |      |
| 52         | Check seek error status word 9C   |          |      |
| 53         | Remove carriage restraint   |          |      |
| 54         | Check output of power amp at flex leads.  |          |      |

**NOTES:**

1. Perform velocity gain adjustment.
2. Check FTU read circuit and velocity gain adjustments.
3. Check wiring, measure ripple and voltage.
4. Adjust supply, check ripple and voltage. Check wiring.
5. Error indicates appropriate corrective action.

SERVO DIAGNOSTIC ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>                         | <u>Action Code</u> |
|-------------------|--|--------------------|
| dFA0              | Indicates last seek performed was a rezero seek. |                    |
| dFA1              | Overshoot check                                  | 5,6,16             |
| dFA2              | Overshoot time-out                               | 5,6,16             |
| dFA3              | Overshoot off track timeout                      | 5,6,16             |
| dFA4              | Servo off track error.                           | 5,6,16             |
| dFA5              | Not used.  | 5,6,16             |
| dFA6              | Access time-out.                                 | 5,6,16             |
| dFA7              | Seek error.                                      | 5,6,16             |
| dFA8              | Not used.  |                    |
| dFA9              | No guardband 1.                                  | 5,6                |
| dFAA              | No guardband 2.                                  | 5,6                |
| dFAb              | Servo received a zero track seek.                | 14,58,5,8          |
| dFAC              | Settle-in time-out                               | 5,6                |
| dFAd              | Guardband detected during a seek.                | 4,5,11             |
| dFAE              | No track crossing pulses.                        | 4,5,6,16           |
| dFAF              | Seek error                                       | 5,6,16             |
| dFb0              | Servo PIA 0 error.                               | 5                  |
| dFb1              | Servo PIA 1 error.                               | 5                  |
| dFb2              | Servo PIA 2 error.                               | 5                  |
| dFb3              | Servo ROM error.                                 | 5                  |
| dFb4              | Servo RAM error.                                 | 5                  |
| dFb5              | Servo timer error.                               | 5                  |
| dFb6              | Servo MPU error.                                 | 5                  |
| dFb7              | Servo hardware error.                            | 5                  |
| dFb8              |  |                    |
| thru              |  |                    |
| EdFF              | Not used.  |                    |

POWER UP/DOWN ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>  | <u>Action Code</u>   |
|-------------------|---|----------------------|
| FF00              | Motor not up to speed   | 11,10,25<br>26,4,1   |
| FF01              | Brake malfunction   | 10,30                |
| FF02              | Lost Ready.   | 11,5,6               |
| FF03              | PLO not locked on after<br>three tries.                                       | 3,4                  |
| FF04              | Error in self-testing PIA 1.  | 10,9,18,<br>23,28,29 |
| FF05              | Error in self-testing PIA 2.  | 10,9,18,<br>23,28,29 |
| FF06              | Error in self-testing<br>PIA 5.   | 10,9,18,<br>23,28,29 |
| FF07              | Error in self-testing PIA 9.  | 9,10,18,<br>23,28,29 |
| FF08              | Error in self-testing PIA 10.   | 9,10,18,<br>23,28,29 |
| FF09              | Error in self-testing PIA 11.   | 9,10,18,<br>23,28,29 |
| FF0A              | Error in self-testing PIA 12.   | 9,10,18,<br>23,28,29 |
| FF0b              | Error in self-testing timer 1.  | 9,10,18,<br>23,28,29 |
| FF0C              | Error in self-testing timer 2.  | 9,10,18,<br>23,28,29 |
| FF0d              | Error in self-testing EPROM 1.  | 9,10,18,<br>23,28,29 |
| FF0E              | Error in self-testing EPROM 2.  | 9,10,18,<br>23,28,29 |
| FF0F              | Error in self-testing EPROM 3.  | 9,10,18,<br>23,28,29 |
| FF10              | Error in self-testing EPROM4.   | 9,10,18,<br>23,28,29 |
| FF11              | Error in self-testing RAM 1.  | 9,10,18,<br>23,28,29 |
| FF12              | Error in self-testing RAM 2.  | 9,10,18,<br>23,28,29 |
| FF13              | No air pressure.  | 10,31,32,<br>34      |
| FF14              | -24 V MPU dropped below -18 V.  | 9,10,27              |
| FF15              | Not used.   |                      |
| FF16              | Failed to reach Up to Speed<br>on second try. Pick out<br>sent to next drive. | 26,25,11,<br>4,3,1   |

POWER UP/DOWN ERROR CODES

| <u>Error Code</u> | <u>Error Description</u>  | <u>Action Code</u> |
|-------------------|---|--------------------|
| FF17              | Cannot turn on DC power.  | 28,10,27,29        |
|                   | Circuit breaker(s) are not on   | 28,10,27,29        |
| FF18              | DC power was turned on but a circuit breaker has tripped.                 | 10,28,29           |
| FF19              | Lost air pressure   | 10,31,32,34        |
| FF1A              | PLO lost lock   | 3,4                |
| FF1b              | Lost speed while trying to lock on PLO.                                   | 1,3,4,11,25,26     |
| FF1C              | First seek took too long.   | 1,4,5,6            |
| FF1d              | Index Mark or Sector Mark missing at I/O.                                 | 11                 |
| FF1e              | RAM 1 not installed   | 10                 |
| FF1F              | RAM 2 not installed   | 10                 |
| FF20              | PLO lost lock   | 3,4,10,11          |
| FF21              | PLO lost lock and could not recover in three attempts.                    | 3,4,10,11          |
| FF22              | Recovered from lost PLO lock  | 3,4,10,11          |
| FF23              | No A/D data ready within 50 milliseconds.                                 | 9,10               |
| FF24              | DC master clear pulse not functioning.                                    | 10                 |
| FF25              | Power on master clear pulse not functioning.                              | 10                 |
| FF26              | -36V dropped below -36V   | 9,10,27            |
| FF27 thru<br>FF3F | not used.   |                    |
| FF40              | Ground reference upper limit exceeded for voltage monitor D2 on VMV card. | 10,18,27,29        |
| FF41              | Ground reference upper limit exceeded for voltage monitor D4 on VMV card. | 10                 |
| FF42              | Upper limit exceeded for +10V   | 10,18,27           |
| FF43              | Upper limit exceeded for -36V. line side                                  | 9,10,18,27         |

POWER UP/DOWN ERROR CODES

| <u>Error Code</u>    | <u>Error Description</u>  | <u>Action Code</u> |
|----------------------|---|--------------------|
| FF44                 | Upper Limit exceeded for -10V.  | 9,10,18,27         |
| FF45                 | Upper limit exceeded for -36V, load side.                                   | 9,10,18,27         |
| FF46                 | Upper limit exceeded for +5V.   | 9,10,17            |
| FF47                 | Always zeroed by firmware.  | 10,18              |
| FF48                 | Unable to determine bit that indicated error.                               | 10,18              |
| FF49                 | Not used.   |                    |
| FF4A                 | Upper limit exceeded for +5V MPU.   | 9,10,29,33         |
| FF4b<br>thru<br>FF4F | Not used.   |                    |
| FF50                 | Upper limit exceeded for -5V  | 9,10,17,<br>18,27  |
| FF51                 | Always zeroed by firmware.  | 10,18              |
| FF52                 | Upper limit exceeded for +24 V.   | 9,10,18,27         |
| FF53                 | Always zeroed by firmware   | 10,18              |
| FF54                 | Upper limit exceeded for -24V.  | 9,10,<br>18,27     |
| FF55                 | Always zeroed by firmware.  | 10,18              |
| FF56                 | Referenced voltage upper limit exceeded for voltage monitor D4 on VMV card. | 10,18,29           |
| FF57                 | Reference voltage upper limit exceeded for voltage monitor D4 on VMV card.  | 10,18,29           |
| FF58                 | Unable to determine bit that indicated error.                               | 10,18              |
| FF59<br>thru<br>FF5F | Not used.   |                    |
| FF60                 | Always zeroed by firmware.  | 10,18              |
| FF61                 | Always zeroed by firmware.  | 10,18              |
| FF62                 | Upper limit exceeded for +10V   | 9,10,18,27         |
| FF63                 | Lower limit exceeded for -36V, line side.                                   | 9,10,18,27         |
| FF64                 | Lower limit exceeded for -10V   | 9,10,18,27         |
| FF65                 | Lower limit exceeded for -36V, load side.                                   | 9,10,18,27         |
| FF66                 | Lower limit exceeded for +5V.   | 9,10,17,           |
| FF67                 | Always zeroed by firmware.  | 16,18              |
| FF68                 | unable to determine bit that indicated error.                               | 10,18              |
| FF69                 | Not used.   |                    |
| FF6A                 | Lower limit exceeded for +5 V MPU.  | 9,10,29,33         |

POWER UP/DOWN ERROR CODES

| <u>Error Code</u>            | <u>Error Description</u>   | <u>Action Code</u>               |
|------------------------------|--|----------------------------------|
| FF6b<br>thru<br>FF6F<br>FF6A | Not Used.<br><br>Lower limit exceeded for<br>+5 V MPU.                           | <br><br>9,10,29,33               |
| FF6b<br>thru<br>FF6F<br>FF70 | Not used.<br><br>Lower limit exceeded for<br>-5V                                 | <br><br>9,10,16,<br>18,27        |
| FF71                         | Always zeroed by firmware.   | 10,18                            |
| FF72                         | Lower limit exceeded for +24V  | 9,10,18,27                       |
| FF73                         | Always zeroed by firmware.   | 10,18                            |
| FF74                         | Lower limit exceeded for -24V.   | 9,10,18,27                       |
| FF75                         | Always zeroed by firmware.   | 10,18                            |
| FF76                         | Reference voltage lower limit<br>exceeded for voltage monitor<br>D2 on VMV card. | 10,18,27                         |
| FF77                         | Reference voltage lower<br>limit exceeded for voltage<br>monitor D4 on VMV card. | 10,18,27                         |
| FF78                         | Unable to determine bit<br>that indicated error.                                 | 10,18                            |
| FF79<br>thru<br>FF8F<br>FF90 | Not used.<br><br>Seek error  | <br><br>4,5,10,11<br>16,24,53,54 |
| FF91                         | No servo communication.  | 5,9,10                           |
| FF92                         | Servo hardware fault   | 5,35                             |
| FF93<br>thru<br>FFFE<br>FFFF | Not Used.<br><br>T&D MPU not active.   |                                  |

Tests for the 600MB FMD are divided into diagnostic and FTU tests. Diagnostic test are non-destructive and will only allow you to examine registers or do servo checks/adjustments. FTU tests will allow you to read/write on the CE cylinder (842).

The tests are selected on the control panel by turning the rotary knobs to the appropriate positions and toggling the load switch. The left rotary knob is for the first digit and the right rotary knob is for the second digit of the test number (see 600-SA:XX for a detailed summary of test numbers). The initiate switch is used for starting and stopping tests. The clear switch clears out parameter information.

The tests below are examples of different tests and what areas they test. To run the tests turn the knobs to the appropriate test number and activate the switches in the order listed. Test description explains the action taken.

.....

| Test Number | Activate Switch     | Test Description      |
|-------------|---------------------|-----------------------|
| 60          | clear/load/initiate | Enter FTU mode        |
| 61          | clear/load/initiate | Exit FTU mode         |
| 62          | clear/load/initiate | Enter diagnostic mode |
| 63          | clear/load/initiate | Exit diagnostic mode  |

.....

Voltage Monitors

|    |                     |                       |
|----|---------------------|-----------------------|
| 62 | clear/load/initiate | Enter diagnostic mode |
| 76 | clear/load/initiate | -36 V servo -7.2/+0.0 |
| 77 | clear/load/initiate | -15 V MPU             |
| 78 | clear/load/initiate | +15 V MPU             |
| 79 | clear/load/initiate | -24 V MPU             |
| 7A | clear/load/initiate | +24 V MPU             |
| 7B | clear/load/initiate | +5 V MPU              |
| 7C | clear/load/initiate | +5 V Logic            |
| 7D | clear/load/initiate | -5 V Logic            |
| 7E | clear/load/initiate | +24 V Logic           |
| 7F | clear/load/initiate | -24 V Logic           |
| 63 | clear/load/initiate | Exit diagnostic mode  |

.....

SERVO TESTS

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| Test Number | Activate Switch     | Test Description               |
|-------------|---------------------|--------------------------------|
| 62          | clear/load/initiate | Enter diagnostic mode          |
| 21          | clear/load/initiate | Velocity gain                  |
|             | initiate            | Stop test                      |
| 23          | clear/load/initiate | Overshoot                      |
|             | initiate            | Stop test                      |
| 28          | clear/load/initiate | Average access time            |
|             | initiate            | Used to do velocity adjustment |
|             | initiate            | Stop test                      |
| 63          | clear/load/initiate | Exit diagnostic mode           |

.....

|    |                     |                            |
|----|---------------------|----------------------------|
| 60 | clear/load/initiate | Enter FTU mode             |
| A3 | clear/load/initiate | Sequential forward         |
|    | initiate            | Stop test                  |
| A4 | clear/load/initiate | Sequential reverse         |
|    | initiate            | Stop test                  |
| A5 | clear/load/initiate | Sequential forward/reverse |
|    | initiate            | Stop test                  |
| A6 | clear/load/initiate | Random seeks               |
|    | initiate            | Stop test                  |
| A7 | clear/load/initiate | X -to- N seeks             |
|    | initiate            | Stop test                  |
| A8 | clear/load/initiate | RTZ seek                   |
|    | initiate            | Stop test                  |
| 61 | clear/load/initiate | Exit FTU mode              |

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WRITE/READ TESTS

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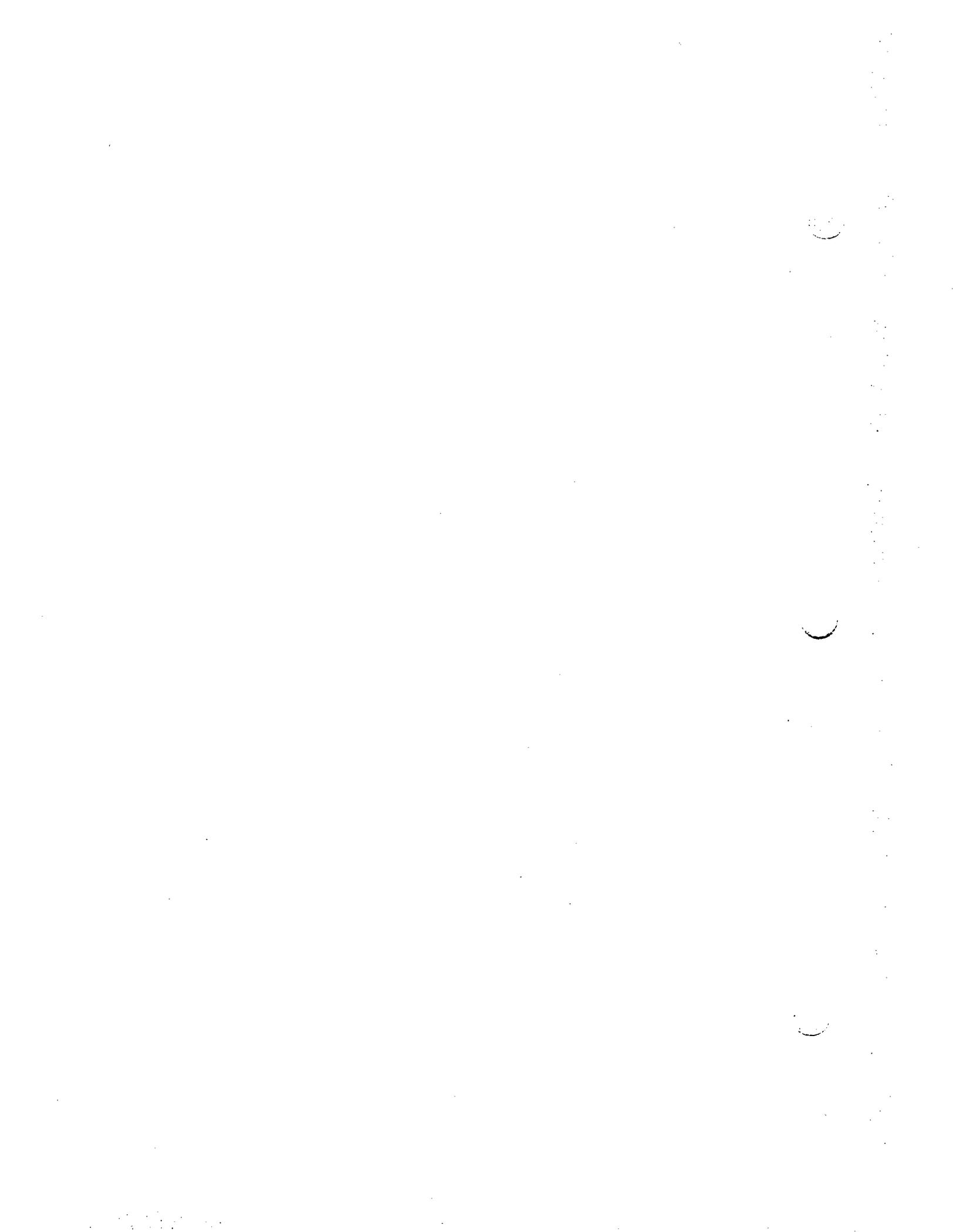
| Test Number | Activate Switch     | Test Description   |
|-------------|---------------------|--|
| 60          | clear/load/initiate | Enter FTU mode   |
| 8C          | clear/load/initiate | Selects data pattern                                       |
| 00          | load                | Loads high order (no option)                               |
| 00          | load/initiate       | Load low order (no option)                                 |
| AA          | clear/load/initiate | Write, all heads (sequential),<br>on the CE cylinder (842) |
|             | initiate            | Stop test  |
| AB          | clear/load/initiate | Read, all heads (sequential),<br>on the CE cylinder (842)  |
|             | initiate            | Test AA must be ran first<br>Stop test                     |
| 61          | clear/load/initiate | Exit FTU mode  |

.....

|    |                     |   |
|----|---------------------|---|
| 60 | clear/load/initiate | Enter FTU mode                                    |
| 8C | clear/load/initiate | Selects data pattern                              |
| 00 | load                | Loads high order (no option)                      |
| 00 | load/initiate       | Loads low order (no option)                       |
| 80 | clear/load/initiate | Selects test options                              |
| 00 | load                | Loads high order (no options)                     |
| 30 | load/initiate       | Loads low order (random heads,<br>random records) |
| AC | clear/load/initiate | Write/read on CE cylinder (842)                   |
|    | initiate            | Stop test   |

.....

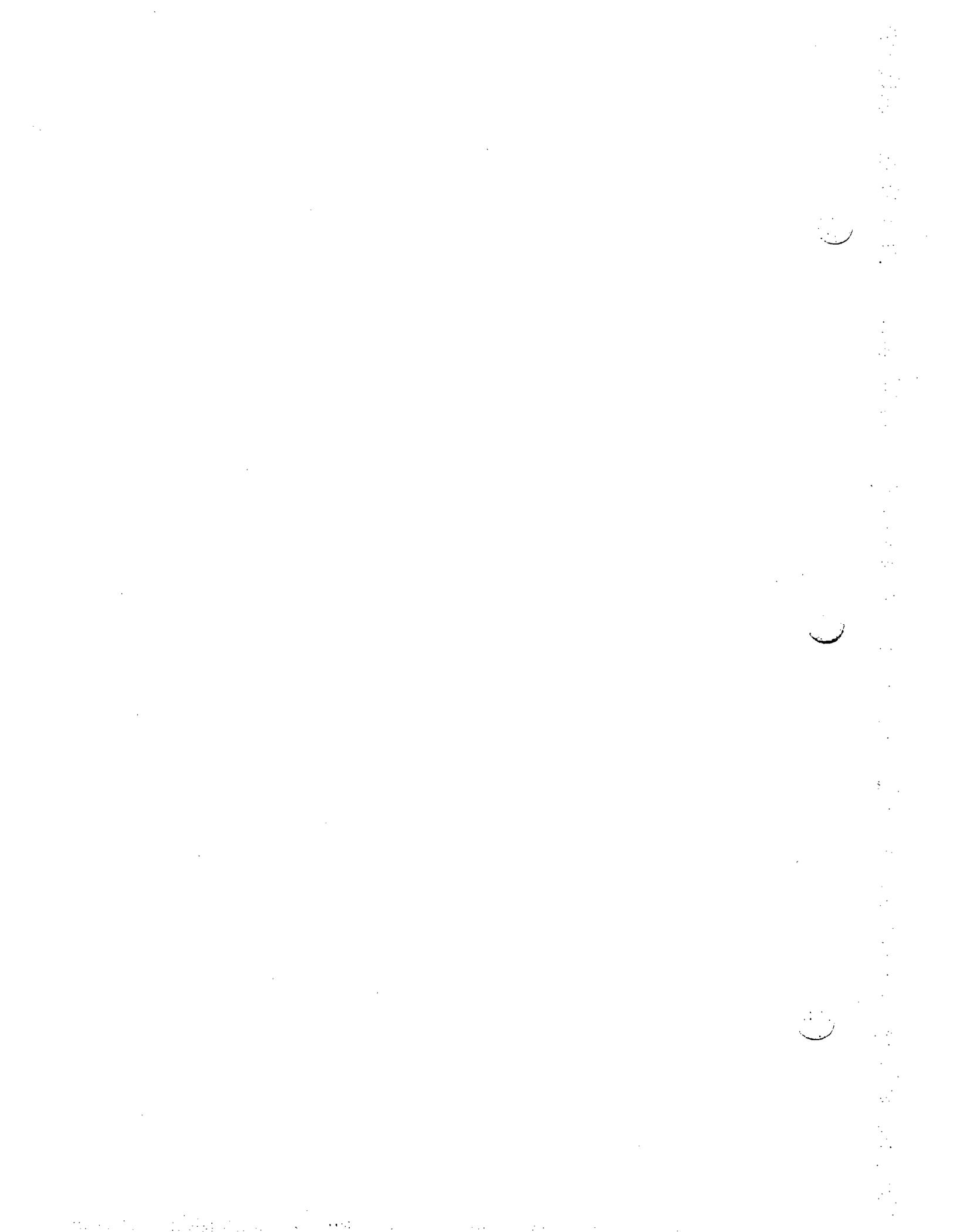
For additional test and option setting see the Parameters handout included in this section.



CDS 315MB FIXED MODULE DRIVE

INDEX

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|--------------------------|-----------|
| I/O Board Status Lights  | CDS-SA:01 |
| Preventative Maintenance | CDS-SA:02 |
| Adjustments              | CDS-SA:03 |



## DS1 Overtemperature (Linear Motor/ Voice Coil)

If the internal temperature of the linear motor which positions the R/W heads rises above a preset value (approximately 180 degrees F).

1. Check for proper air flow from fans.
2. Check for spacer between HDA and circuit boards. There should also be a metal air deflector installed to increase the air flow over the HDA.
3. Replace servo PCB and/or interface PCB. The temperature sensor is located on the HDA but all associated logic for DS1 to come on is located on these two boards.
4. Replace HDA.

## DS2 DC Voltage Unsafe (Power Fail)

Any of the DC voltages are too low for proper operation. The voltages checked are +12, -12, +5, +24, and -24.

1. Check the 5 voltage LED's on the servo board. These LED's only check to see if some voltage is present. If one or more of the LED's are off check for missing voltage and isolate power supply.
2. Check all DC voltages for low output. If low output isolate power supply from logic boards and recheck voltages. (this will check to insure logic boards are not holding down the voltage) If voltage is still low reconnect logic boards and adjust power supply as applicable.
3. If all DC voltages are OK then replace the servo PCB and/or interface PCB.

## DS3 Power Amplifier Unsafe

If the power amplifiers that drive the linear motor fail while the disk drive is in use.

1. Replace the servo PCB. All the servo drive circuits are located on the servo PCB.
2. Replace the interface PCB. Detection circuits are located on the interface PCB.
3. Replace HDA.

DS4 Read/Write Fault

A fault condition occurred on the Read/Write PCB. This condition is also called a Read/Write fault which indicates that no head or more than one head was selected.

1. Replace Read/Write PCB. The Read/Write PCB enables the heads on the HDA.
2. Replace Interface PCB. The interface PCB decodes the head tag from the controller and passes the information along to the Read/Write PCB.
3. Replace the HDA.

DS5 An attempt was made to read while the disk drive did not indicate "ON CYLINDER" status condition.

1. Replace Interface PCB. The interface PCB decodes commands from the controller and returns status bits to the controller
2. Replace Servo PCB. The servo PCB passes on cylinder status to the interface PCB.

DS6 An attempt was made to write on the disk drive while the the heads were not properly positioned over the data tracks. (Upper Threshold on)

1. Replace Servo PCB. The servo PCB controls all positioning in the disk drive.
2. Replace Interface PCB. The interface PCB receives status information fro the servo PCB.
3. Replace HDA.

DS6 &  
DS7 An attempt was made to write while the disk drive was in a read only mode. (Write Protected)

1. Check to see if the drive is write protected.
2. Replace front panel PCB.
3. Replace Interface PCB.

DS6 &  
DS8     An attempt was made to write while the disk drive was in an offset condition (functionality not supported by Prime) or while the disk drive did not indicate "ON CYLINDER".

1. Replace the Servo PCB.
2. Replace the Interface PCB.

DS9     Seek error which is defined as one of the following:

1. Attempt to seek to an illegal cylinder address (cannot exceed cylinder 822 for Prime)
2. Positioning system took too much time to complete the seek. (Seek Incomplete)
3. Attempt to seek when a seek operation is inhibited by firmware. (Power up/down sequence or loss of speed)

1. Check velocity adjustment.
2. Replace Servo PCB.
3. Replace Interface PCB.
4. Replace HDA.

DS11    Unit Selected

DS14    1. Is a fault LED when on in conjunction with DS1 thru DS8.  
2. If a head greater than "18" is selected during a read or write operation, then only DS14 will illuminate.

At the point where an HDA will be replaced either the ATS IO.DISK or DISCT2 should be run on the old HDA to insure failure can be reproduced. After the HDA has been changed the diagnostics should be run to guarantee the drive has been fixed.

FAULT (MAINTENANCE) INDICATORS

| LED INDICATORS |   |   |   |   |   |   |   |   |    | FAULT CONDITION                          |
|----------------|---|---|---|---|---|---|---|---|----|--|
| 1              | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 14 |  |
| 1              | X | X | X | X | X | X | X | X | 1  | LINEAR MOTOR<br>OVERTEMP                 |
| X              | 1 | X | X | X | X | X | X | X | 1  | DC VOLTAGE OUT<br>OF SPECS               |
| X              | X | 1 | X | X | X | X | X | X | 1  | POWER AMP FAIL                           |
| X              | X | X | 1 | X | X | X | X | X | 1  | FAULT ON R/W<br>PCB                      |
| X              | X | X | X | 1 | X | X | X | X | 1  | READ NOT ON<br>CYLINDER                  |
| X              | X | X | X | X | 1 | 1 | X | X | 1  | WRITE IN READ<br>ONLY MODE               |
| X              | X | X | X | X | 1 | X | 1 | X | 1  | WRITE IN OFFSET<br>OR NOT ON<br>CYLINDER |
| X              | X | X | X | X | 1 | 0 | 0 | X | 1  | WRITE DURING<br>UPPER THRESHOLD          |
| X              | X | X | X | X | X | X | X | 1 | 0  | ERROR DURING<br>SEEK OPERATION           |
| 0              | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1  | HEAD 18<br>SELECTED                      |

1 - ON            0 - OFF            X - DON'T CARE

The specific PM task are outlined below. Be sure to have drive powered down before performing PM.

1: Pre-filter

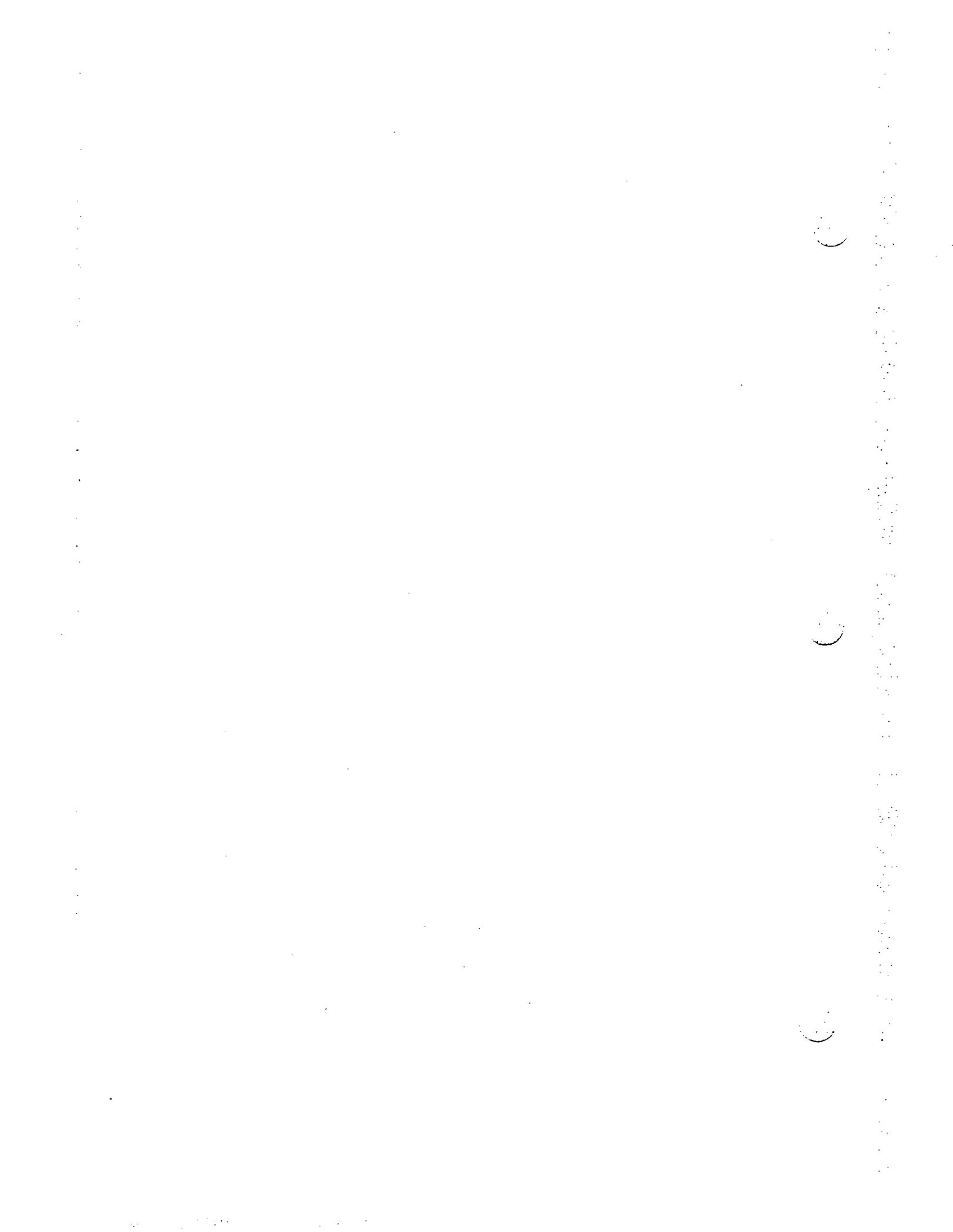
The pre-filter should be removed and cleaned (vacuumed).

2: Spindle spring

The spindle spring (static eliminator) should be removed and cleaned. Replace if worn or noisy.

3: Drive motor belt

Inspect the drive motor belt for wear or cracks, replace if necessary.



CDS-SA:03

SERVO VELOCITY ADJUSTMENT PROCEDURE

The servo velocity adjustment should be made after a servo PCB or a Head Disk Assembly (HDA) has been replaced. The adjustment should be checked if the device is experiencing intermittent Seek and or Read/Write problems.

The servo velocity adjustment can be made using IO.DISK or the PRIME disk tester. The procedure for both follows.

A. Preliminary setup using the PRIME disk tester. Set up the disk drive and tester as follows

- 1: Turn off the power switch at the rear of the drive.
- 2: Fully extend the drive on its slides and remove the drive cover.
- 3: Connect cables to the disk tester.
- 4: Connect cables to disk unit port 'A'.
- 5: Place the I/O and control PCB in the maintenance position (cut tie wraps as necessary).
- 6: Place a 20 pin DIP clip on IC A15 of the I/O and control PCB.
- 7: Place a 20 pin DIP clip on IC D16 of the I/O and control PCB.
- 8: Turn on power to the disk tester and cycle up the disk drive.
- 9: Set up the disk tester to do continuous seeks between cylinder zero and 822.

WARNING: BE SURE TO WRITE PROTECT DISK

B: Preliminary setup using IO.DISK of DTS under SAM.

1: The following is a step by step procedure for setting up IO.DISK to do the velocity adjustment.

SAM> LOAD IO.DISK  
0000 Loading IO.DISK.SEG

SAM> SET MANU (Allow manual intervention must be set to  
execute case 70)

SAM> E 70  
0030 Executing IO.DISK Rev 7.1  
CONTROLLER ADDRESS ['22-'27,'45,'46 (CR-'26)]?  
CONTROLLER MODEL [4004,4005,2382.LCDTC,10019,OR CR(READ ID)]?  
INITIALIZING CONTROLLER. PLEASE WAIT  
DRIVE# [0-3],CR (NONE)? 0  
OK TO WRITE ON DRIVE {Y(CR) OR N}? N  
ENTER TYPE [600,160,CMD,4475,SPEC.OR SMD(CR)]: 4475  
SPECIAL OPTIONS {Y OR N(CR)}? N  
ADDITIONAL DISKS {Y OR N(CR)}? N  
ADDITIONAL CONTROLLERS {Y OR N(CR)}? N

TESTING 4005 CNTRL AT '26

| UNIT | TYPE | SIZE | HEADS | TRACKS | PATTERN | PASSES | RECORDS | LEN  | BRST |
|------|------|------|-------|--------|---------|--------|---------|------|------|
| 0    | 4475 | 315  | 0-18  | 0-822  | BADSPOT | 1      | 9       | 1040 | YES  |

Case 00070: SEEK HEAD MAINTENANCE

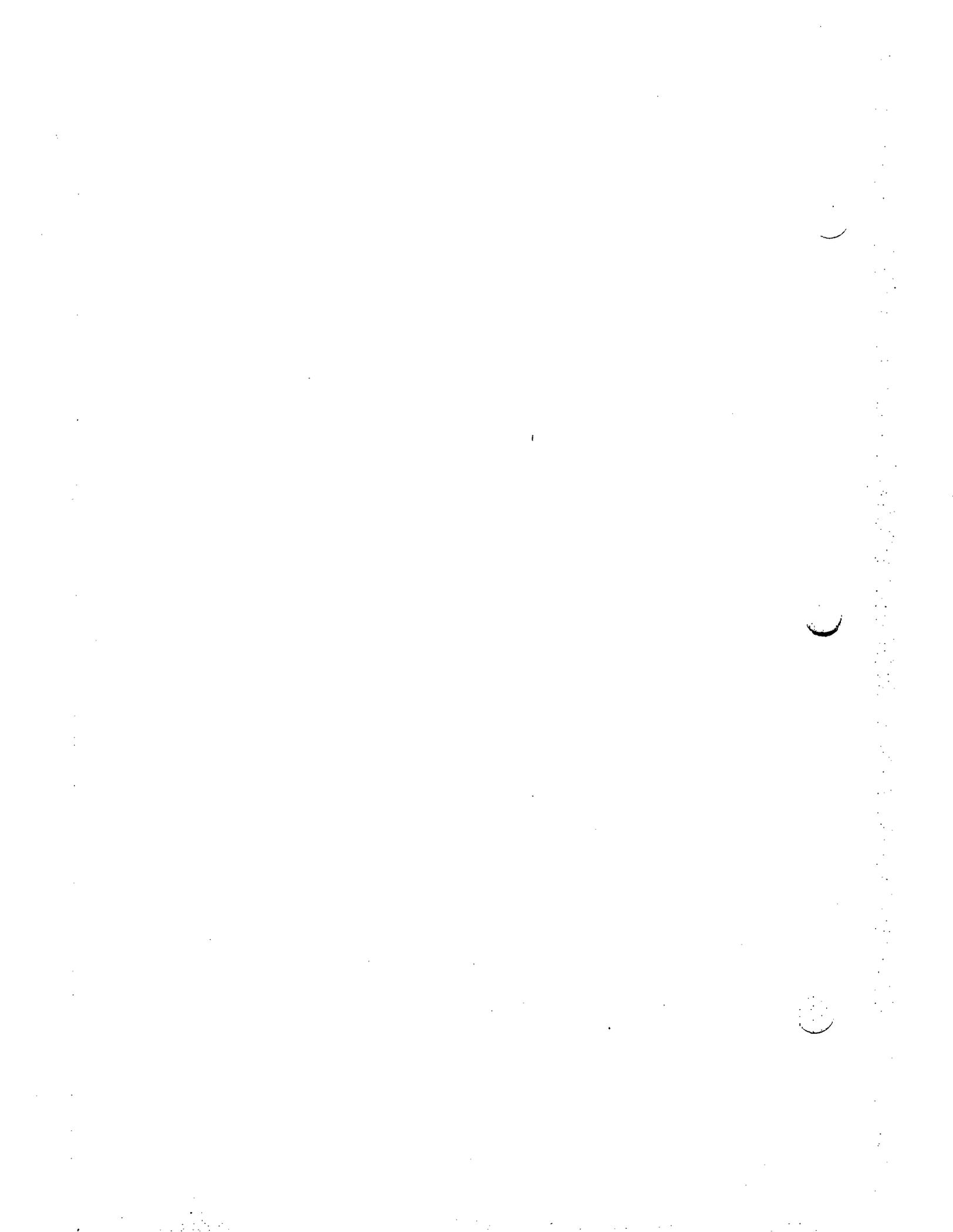
POSSIBLE OPERATIONS:

- 1) RTZ TO TRACK 0 - SEEK TO TRACK N
- 2) SEEK TO TRACK n - SEEK TO TRACK n
- 3) SEEK TO TRACK n, READ
- 4) SEEK TO TRACK n

ENTER DESIRED OPTION [1-4,SKIP(CR)]: 2  
ENTER LOWER TRACK NUMBER [0(CR)-00822]: 0  
ENTER UPPER TRACK NUMBER [00000-00822(CR)]: 822  
DO YOU WANT THE OPERATION REPEATED {Y OR N(CR)}? Y  
ENTER CARRIAGE RETURN TO STOP; THEN 'CONT' TO CONTINUE

C. Check and adjustment of the servo velocity. The disk drive should take a maximum of 50 +/- 1 milliseconds to move the read/write heads in a full stroke seek (cylinder zero to cylinder 822). This time should be checked and adjusted as follows:

- 1: Set channel one on your oscilloscope for 2v/div and channel two for 5v/div.
- 2: Put the scope in chopped mode and set time/div to 10 milliseconds. Synchronize on channel one.
- 3: Clip the channel one scope probe on pin 3 of IC A15 (FWD signal).
- 4: Clip the channel two scope probe on pin 9 of IC D16 (ONCYLINDER signal).
- 5: Start the disk drive doing seeks with the tester or IO.DISK case 70 (O-822).
- 6: Synchronize on channel one (FWD signal). The ONCYLINDER signal on channel two should remain inactive (zero volts) for 50 +/- 1 milliseconds.
- 7: If ONCYLINDER does not remain inactive for 50 +/- milliseconds, adjust R305 on the servo PCB.



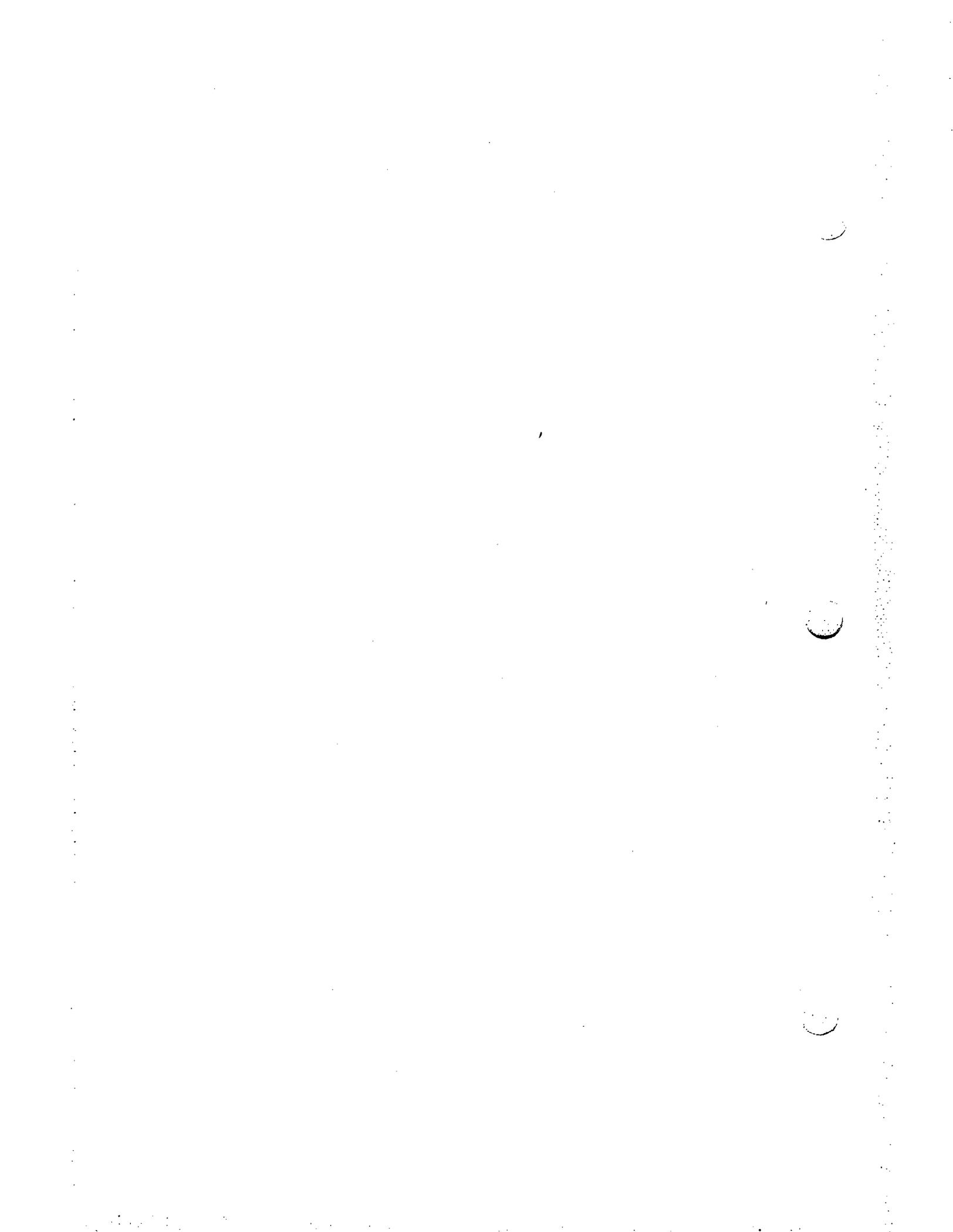
## KENNEDY 9100 TAPE DRIVE

### INDEX

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### Using Service Aids

Check notes and warnings at the beginning of each service aid.  
Follow sequentially thru the appropriate service aid.  
Branch to the specified service aid and action when instructed to  
do so.



The controller maintains a status word that is relevant to the operation just completed and the transport last selected. This status word may be transferred to the A register by issuing the appropriate OTA 02 followed by and INA 00.

The bits of the status word are defined as follows:

- BIT 1 Set for a vertical parity error which occurred during a read operation.
- BIT 2 Set when a tape runaway condition is detected. If during a read operation no data is detected within a certain time period, the tape runaway status will be set. For a write operation, a tape runaway status will occur if the read-after-write head fails to detect the data just written within the specified time period.
- BIT 3 This bit is set when a CRC error is detected during a 9 track read (or read and correct) order.
- BIT 4 Set when an LRC error has been detected during a read order. For 9 track operation, it is probably that BIT 3 will also be set.
- BIT 5 Bit set for one of the two reasons: (a) a false gap was detected during the record just read. (b) DMX end of range occurred while reading a record before the physical end of the record.
- BIT 6 Uncorrectable error. Set following a 9 track read record order when the controller has determined that it will be unable to correct an error using a read and correct order.
- BIT 7 Set when a read-after-write error is detected during a write record or write file mark order.
- BIT 8 Set when the selected transport is READY to receive an order. This means it is on-line and not rewinding.
- BIT 10 Set when the selected transport is on-line. This means it has power on, tape loaded, etc., and requires no further operator attention to be used.

- BIT 11 Set when the selected transport has detected the end-of-the-tape reflective tab when moving tape in the forward direction. This sticker is placed such that 25 feet of usable tape remain on the file reel. It is the program's responsibility to ensure that the tape is not pulled off the file reel.
- BIT 12 Set when the selected transport is REWINDING.
- BIT 13 Set when the selected transport is at LOAD POINT. This means the reflective tab at the beginning of tape is under the detector.
- BIT 14 Set when the selected transport is FILE PROTECTED. This means the file reel has had its write enable ring removed.
- BIT 15 Set when the controller has detected a DMX overrun condition
- BIT 16 Set when an interrupt was caused by the completion of a transport rewind operation.

#### SUMMARY OF STATUS BITS

- BIT 1 Vertical parity error
- BIT 2 Runaway
- BIT 3 CRC Error
- BIT 4 LRC error
- BIT 5 False gap/insufficient DMX range
- BIT 6 Uncorrectable error
- BIT 7 RAW error
- BIT 8 File mark detected
- BIT 9 Selected transport READY
- BIT 10 Selected transport ON-LINE
- BIT 11 Selected transport EOT
- BIT 12 Selected transport REWINDING
- BIT 13 Selected transport LOAD POINT
- BIT 14 Selected transport FILE PROTECTED
- BIT 15 DMX overrun
- BIT 16 Rewind interrupt

KEN-SA:02

MTA SWITCH SETTINGS FOR KENNEDY TAPE DRIVES

2081 and Pertec Formatter / 4020 / 2295

| Drive Type  | S1 | S2 | S3  | S4 | S5 | S6 | S7 | CNTL/FMT    | Drive    | PWB | Slot |
|-------------|----|----|-----|----|----|----|----|-------------|----------|-----|------|
| 9TRK 75 IPS | ON | ON | OFF | ON | ON | ON | ON | 2081/PERTEC | 4365-006 |     | 7    |
| 9TRK 45 IPS | ON | ON | ON  | ON | ON | ON |    | 4020/2295   | 7365-003 |     | 7    |
| 7TRK 45 IPS | ON | ON | ON  | ON | ON |    |    | 4020/2295   | 6771-003 |     | 7    |

2081 and Kennedy Formatter / 2269 and 2270

| Drive Type  | S1 | S2 | S3 | S4 | S5 | S6 | S7 |  | Drive    | PWB | Slot |
|-------------|----|----|----|----|----|----|----|--|----------|-----|------|
| 9TRK 75 IPS |    |    | ON |    |    |    |    |  | 4365-006 |     | 7    |
| 9TRK 45 IPS |    |    | ON | ON | ON |    |    |  | 4365-003 |     | 7    |
| 9TRK 45 IPS |    | ON |    | ON | ON |    |    |  | 6771-003 |     | 7    |

DENSITY SELECTION

DENSITY SELECT SWITCH

| LOW | HIGH |            |         |         |  | DRIVE    | PWB | SLOT |
|-----|------|------------|---------|---------|--|----------|-----|------|
| 800 | 1600 |            |         |         |  | 4365-006 |     | 7    |
| 800 | ---- |            |         |         |  | 7365-003 |     | 7    |
| 556 | 800  | Slot 7 PWB | S1 - ON | S3 - ON |  | 6771-003 |     | 7    |
| 200 | 556  | Slot 7 PWB | S2 - ON | S4 - ON |  | 6771-003 |     | 7    |



KEN-SA:03

KENNEDY POWER PROBLEMS

NOTE Make sure replacement fuse is correct amperage and voltage rating.

STEP 1 Check all voltages at the following test points.  
+10 +- 0.5 TP-A Sensor AMP Slot 12.  
-10 +- 0.5 TP-B Sensor AMP Slot 12.  
+5 +- 0.25 TP-C Sensor AMP Slot 12.  
+-24V on the large capacitor on the right hand side of the drive. (Cycled UP).

Problem 1

Problem :Plus 5.0V missing.  
Action 01 :Check fuses F1 and F2.  
Result 02 :F2 blown. (if not blown go to action 09).  
Action 03 :replace it and try again.  
Result 04 :F2 blows again.  
Action 05 :turn off all power and check the resistance from GND to TP-C, TP-B, TP-A on the sensor AMP (about 1500 OHMS)  
Result 06 :Low resistance  
Action 07 :Remove all logic PWBS one at a time to determine which one is loading down the plus 5.0 or 10.0 volts  
Result 08 :Resistance is OK  
Action 09 :Check all diodes on the rectifier board in the power supply. If shorted or open replace rectifier PWB.  
Result :Diodes OK  
Action 11 :Unplug heat sink assembly and check for 8.0 volts pin 6 J40.  
Result 12 :OK  
Action 13 :Replace 5.0 volt regulator on heat sink assembly  
Result 14 :Still not fixed, low power transformer is defective

Problem 2

Problem : No +-24 volts F3 blows  
Action : remove all power from the drive and check the large diodes on the right hand side of the drive  
Action : Check the 24 volt capacitors (large caps right hand side of the drive).  
Result : the above check OK.  
Action : Replace solid state relay K6 (Located in the power supply.)  
Result : No 24 volts  
Action : Check relay K4

Problem 3

Problem : Plus 5.0 volts but no plus 10.0 volts  
Action : Check 18.0 volts on C3 in power supply, if  
missing replace rectifier board 5584 (in power  
supply).  
Result : 18.0 Volts on C3.  
Action : Replace regulator board 4352 on heat sink.

Problem 4

Problem : Fuse F4 blows.  
Cause : Blower or motor binding  
: Blower motor start cap defective  
: Fuse F4 wrong size

KEN-SA:04

KENNEDY SERVO PROBLEMS

Warning :Do not replace preamp or heat sink assembly without  
checking the other for shorted or open transistors!!!  
NOTE :Transistors must be removed from heat sink to check  
them.  
Warning :Do not use cold spray on the servo preamp!!!  
Tolerance change may blow preamp or heat sink assembly.

KEN-SA:04

TAPE WON'T LOAD

Problem :Tape won't load  
Action :use a tape loop and cycle up the drive.  
:place a reflective object in front of the load sensor  
to stop the capstan  
Result :Capstan won't stop, go to KEN-SA:06  
Action :Move the tape up and down in each column.  
Result :Each reel motor should reverse directions as the tape  
is moved in the associated column.  
Result :Both reel motors respond  
Action :go to KEN-SA:05  
Result :Both reel motors fail to respond  
Action :check +-24V on large caps. If missing go to KEN-SA:03  
Action :check servo enable not, pin 19 and sensor disable pin  
13 low on the sequence control pwb.  
Action :check servo enable relay K1  
Result :either reel motor fails to respond.  
action :Remove servo preamp and check transistors Q8,Q09,Q19,  
Q20 for opens or shorts. If any transistors are open  
or shorted do not replace the servo preamp before  
checking the associated transistors on the heat sink  
assembly (Q7 thru Q14).  
Result :All transistors check OK.  
Action :Check all fuse resistors on the servo preamp.  
Result :Any fuse resistors on the servo preamp.  
Action :Replace the defective fuse resistors and check Q7 thru  
Q14 on the heat sink assembly.  
Result :All transistors and fuse resistors check ok.  
Action :Remove both reel motor connectors from the heat sink  
assembly. Connect the red and black wires from the  
the supply motor to the opposite colored wires on the  
take up reel motor. Rotate either reel motor CW/  
Result :The other reel motor should rotate CCW.  
Result :The other reel motor does not move.  
Action :Replace the defective reel motor.  
Result :Both reel motors rotate.  
Action :Replace the associated loop chamber.

KEN-SA:05

KENNEDY SERVO PROBLEMS  
LOAD PROBLEM, TAPE LOOP OK

Problem :Tape won't load and reel motors respond correctly to the  
tape loop.  
Action :Remove both wires from the vacuum switch and short them  
together.  
Action :Try loading tape again.  
Result :Tape loads OK.  
Action :Check tape column vacuum 10-15 inches of water.  
Result :Vacuum less than 9 inches of water.  
Action :Adjust vacuum to 12-14 inches of water and try again.  
Result :OK, problem is fixed, return to be adjusted.  
Action :Vacuum was OK didn't need to be adjusted.  
Result :Replace vacuum switch and try loading tape again.  
Result :Tape loads OK. Problem is fixed return drive to  
customer.  
Result :Tape doesn't Load.  
Action :Go to KEN-SA:07 Action 1.

KENNEDY SERVO PROBLEMS  
CAPSTAN MOTOR WON'T STOP

KEN-SA:06

- NOTE :Perform the following steps before proceeding.
- Step 1 :Thread a tape loop thru the tape path and cycle up the drive.
- Step 2 :Place a reflective object in front of the load point sensor. Make sure the load point indicator on the control panel is illuminated.
- Step 3 :Check load point sensor adjustment and adjust if necessary.
- Step 4 :Check the following voltages.  
+10 Volts  $\pm$ .5V at TP-A Sensor AMP slot 12  
-10 Volts  $\pm$ .5V at TP-B Sensor AMP slot 12  
+5 Volts  $\pm$ .25 at TP-C Sensor AMP slot 12  
+24 Volts on the large caps right hand side of the drive.
- Step 5 :Check TP-D on servo pre-amp and adjust to zero volts, if unable to adjust go to KEN-SA:07 Action 10.
- Result :All of the above steps check OK and the problem still exists.
- Action 01:Connect a scope probe to the plus lead of the capstan motor.
- Result 02:If you get a plus or minus reading, the servo pre-amp or heat sink assembly is defective.
- Action 03:Check Q29,Q30 and fuse resistors F5,F6 on the servo pre-amp.  
:Check Q5 and Q6 on the heat sink.
- NOTE!!! :Q5 and Q6 must be removed from the heat sink to be checked.
- Warning :Do not replace the heat sink or pre-amp before checking the other for open or shorted transistors.
- Action 04:Repair or replace the defective pre-amp or heat sink.

KEN-SA:07

KENNEDY SERVO PROBLEMS  
CAPSTAN MOTOR DOESN'T RESPOND

Note : Perform Steps 2 thru 5 of KEN-SA:06.  
Problem : Capstan won't respond  
Action 1 : Connect scope probe to TP-D on servo pre-amp.  
Action 2 : Enter test mode on the test panel and command the drive  
FWD and REV.  
Result 3 : Signal on the scope swings plus for FWD and negative  
for REV.  
YES: Continue to action 4  
NO: Go to action 10  
Action 4 : connect scope probe to the plus lead of the capstan  
motor.  
Result 5 : Plus lead of the capstan motor swings plus for FWD and  
NEG for REV.  
Action 6 : replace the capstan motor.  
Result 7 : Plus lead of the capstan motor doesn't swing plus or  
minus.  
Action 8 : Go to KEN-SA:06, action 03  
Result 9 : TP-D on servo pre-amp doesn't swing plus or minus.  
Action 10: Check TP-A on ramp generator. Command the drive to  
move tape FWD and REV, signal on TP-A should swing neg  
and pos.  
Result 11: TP-A OK.  
Action 12: Replace servo pre-amp  
Result 13: TP-A not OK replace ramp generator.  
Result 14: Still not fixed check pin 15 on sequence control PWB  
should be low. If pin 15 is high replace sequence  
control PWB.

KEN-SA:08

REWIND PROBLEMS

Problem 01 :tape pulls out or bottoms in either column in fast forward or rewind.  
note :load tape or use a tape loop for the following checks.  
note :action 2 thru 5 checks require capstan motion.  
Action 01 :load tape into the columns (tape loop preferred)  
check :C2-B should be -24 volts.  
check :C1-B should be +24 volts.  
result :OK, go to action 2  
Result :not OK, go to KEN-SA:04.  
Action 02 :command fast forward or rewind.  
check :C2-B should be -30 volts.  
check :C1-B should be +30 volts.  
result :OK, go to KEN.SA:01  
result :not OK, continue with action 03.  
action 03 :command fast forward or rewind.  
check :C2-A should be -6 volts.  
Check :C1-A should be +6 volts.  
result :+6 volts or -6 volts missing go to action 05.  
result :+6 and -6 volts missing, go to action 04.  
result :both voltages OK, recheck action 02.  
action 04 :command fast forward or rewind.  
check :J4-13.  
result :J4-13 +5 volts go to action 05.  
result :J4-13 +16 volts replace the servo preamp pwb 6666.  
Action 05 :swap relay K8 with K1 (relay K8 could be defective).  
:command fast forward or rewind.  
Check :C2-B should be -30 volts.  
check :C1-B should be +30 volts.  
result :+30 volts OK, replace relay K8 (now K10).  
result :problem unchanged go to action 06.  
action 06 :remove all power from the drive.  
:remove the lower back panel from the power supply.  
:position the back panel so it won't short to anything.  
:restore power to the drive, do not load tape.  
check :C1 for +8 volts.  
check :C4 for -8 volts.  
result :voltage missing replace the rectifier pwb 5584.  
result :voltages OK, go to action 07.  
Action 07 :  
check :+-8 volts getting to the relay cool down pwb 5897.  
result :voltages OK, replace the relay cool down pwb 5897.  
result :+ or - voltage missing, check the wires from C1,C4 to the relay cool down pwb 5897.  
Action 08 :call support.

KEN-SA:09

KENNEDY READ/WRITE PROBLEMS

Visual Checks.

- 01 :Check erase bar touches the full width of the tape.
- 02 :Check the tape cleaner for wear and proper adjustment.
- 03 :Check tape guides for wear.
- 04 :Check broken tape reflector does not touch the tape.
- NOTE :The following steps must be performed correctly, if you are unsure of any of them refer to KEN-SA:14

- Step 00 :Check loop chamber vacuum 10-15 inches of water
- Step 01 :Clean Read/Write head.
- Step 02 :Install a known good tape.
- Step 03 :Check ripple on +-24V 400MV.
- Step 04 :Check read gains while writing in test mode.  
Read pre-amp 5728-8.0 volts peak to peak  
Read pre-amp 2935-9.0 volts peak to peak
- Step 05 :check write skew
- Step 06 :Install skew tape and check skew forward and reverse
- Step 07 :Check capstan speed using a skew tape.  
75 IPG - 100 Micro sec for 3 sine waves  
45 IPS-55 micro sec for one sine wave
- Step 08 :check stop start times  
75 IPS-5.0 milli sec  
45 IPS-8.0 milli sec
- Step 09 :Determine if it is a read or write problem.
- Step 10 :Determine if it fails 800/1600 or both densities.
- Step 11 :Check capstan zero adjustment
- Step 12 :connect a scope probe on the plus lead of the capstan motor.  
move tape forward/reverse check ripple should not exceed 800 milli volts.
- Step 13 :Check read pre-amp grounding screws (must be in)

### Problem 1

ASSUMPTION You have determined it is a write problem, not a read problem.

Problem :Excessive write errors and unable to write, not a read problem.

Action :Perform steps 01 thru 12.

Action :install known good tape and do a MAGSAV.

Result :None or few errors, try the other density same result problem is fixed.

Result :Excessive write errors

Action :Replace the following associated PWBS to isolate the problem.

- |   |  |    |   |
|---|--|----|---|
| 1 | :5 CH write amp  | 2. | 4 CH write AMP  |
| 3 | :Dual P channel clipping   | 4. | Dual density control  |
| 5 | :QUAD read amp slot 4  | 6. | QUAD read amp slot 5  |
| 7 | :Check TP-D for a high on the sensor amp. (write head drive and erase head drive). | 8. | Heatsink assembly, more predominant if MAGSAV -VAR option is used |

Result :Problem still exists.

Action :recheck steps 3,6,11,12 if OK suspect defective cable, controller or formatter.

### Problem 2

Problem :Excessive read errors or unable to read

Action :Perform Steps 1 thru 12 of Kennedy read/write problems.

Action :Do a MAGSAV at 800,1600 BPI. If either or both densities fail continue to next Action

Action :Replace the following PWBS one at a time to isolate the problem

- 1 :QUAD read amp slot 4.
- 2 :QUAD read amp slot 5.
- 3 :Dual density control slot 7.
- 4 :Dual P channel clipping slot 6
- 5 :Read Pre-amp (must be adjusted)
- 6 :Sensor amp slot 12 (must be adjusted).
- 7 :Push button control slot 10.

Result :Problem still exists

Action :recheck steps 4,6,11,12. if OK suspect defective cable controller or formatter.

### Problem 3

**Problem** :Tape fails to stop at E.O.T. during a write.  
**Note** :for the following actions, the E.O.T. patch must be moved on and off the E.O.T. sensor. This can be accomplished with a tape loop by placing a E.O.T. and B.O.T. patch on the tape loop about six inches apart.

**Quick Test** :If tape motion stops at E.O.T. in test mode. and pin-20 slot 09 switches at E.O.T. the problem is not in the drive.

**Step 01 Action** :Check load point sensor adjustment (see KEN-SA:06)  
:Enter test mode, push forward run  
:connect a scope probe to pin-e on the interface control PWB.

**Result** :Pin-E goes high and forward tape motion stops.  
**Action** :Replace interface control PWB.  
**Result** :Pin-E goes high and forward motion continues.  
**Action** :Replace interface control PWB.  
**Result** :Replace push button control PWB.  
**Action** :Pin-E doesn't go high.  
**Result** :Connect a scope probe to Pin-Z on the interface control PWB.

**Action** :Pin-Z goes high.  
**Action** :replace the interface control PWB.  
**Result** :Pin-Z doesn't go high.  
**Action** :connect a scope probe to pin-z on the sensor AMP PWB.  
**Result** :Pin-Z swings from a negative to a plus voltage when E.O.T. is detected.

**Action** :Replace the sensor amp PWB.  
**Result** :Pin-Z on the sensor amp doesn't swing from a negative to a positive voltage when E.O.T. it detected.  
**Action** :Replace the load point sensor assembly.

KEN-SA:10

KENNEDY LOGIC BOARDS

| BOARD NUMBER | DESCRIPTION                  | DRIVE VERSION |        |
|--------------|------------------------------|---------------|--------|
|              |                              | 45 IPS        | 75 IPS |
| 4368         | Five channel write AMP       | 001           |        |
| 4366         | Four channel write AMP       | 003           | 006    |
| 5368         | Five channel write AMP       | 201           | 002    |
| 5366         | Four channel write AMP       | 003           | 002    |
| 3860         | Data terminator              | 001           | 001    |
| 6385         | Quad read AMP                | 003           | 006    |
| 6367         | Dual P channel/clipping      | 003           | 006    |
| 4365         | Dual density control         | 003           | 006    |
| 7365         | Dual density control         | 003           | Note 1 |
| 3841         | Control terminator           | 003           | Note 2 |
| 3842         | Interface control (use 4842) | 001           | 001    |
| 4842         | Interface control            |               | 001    |
| 3843         | Pushbutton Control           | 023           | 023    |
| 5733         | Ramp generator               | 001           | 001    |
| 5719         | Sensor amp/driver            | 003           | 001    |
| 5728         | Read preamp                  | 001           | 001    |
| 6667         | Sequence control             | 002           | 002    |
| 6666         | Servo preamp                 | 102           | 101    |

NOTES

NOTE 1: 4365 Dual density control, will not work with a 4020 controller.

NOTE 2: 7365 Dual Density control PWB will work with all controllers.

KEN-SA:11

INTEGRATED FORMATTER SELECT PROBLEM  
DRIVE OFFLINE OR NOT READY STATUS

Action 01 :Assign the tape drive if Primos IV.  
:Mount and load a tape, when the load point indicator  
:is illuminated depress the online switch.  
Result :online indicator illuminated.  
Yes :go to action 02.  
No :is pin-P slot 10 low.  
Yes :online indicator should be illuminated (defective  
bulb).  
No :Replace the pushbutton control PWB and try again.  
Result :Pin-P slot 10 still high.  
Yes :check the online switch  
No :Go to action 02.  
Action 02 :Do a MAGSAV, when asked for unit number enter 0.  
Result :Select indicator illuminated.  
Yes :go to action 03.  
No :Unas MTO and as MT1 do a magsav, when asked for unit  
number enter 1.  
Result :select indicator illuminated.  
Yes :system cold start is necessary drive can be used as  
unit 1.  
No :go to action 04.  
Action 03 :is the drive still sending offline or not ready  
status.  
No :Problem is fixed.  
Yes :check pins-19,14 slot 09 both should be low.  
Result :Pins-19,14 slot 09 low.  
Yes :cable or formater problem go to action 05.  
No :if the tape is not rewinding replace the following  
PWBS.  
:interface control slot 09.  
:Pushbutton control slot 10.  
:sequence control.  
Action 04 :check pin-11 slot 09 low.  
Yes :the drive is receiving select check the following  
pins slot 12.  
:pin 12 low defective interface control slot 12.  
:pin-12 high, pin-V low defective bulb.  
:pin-12 high, pin-V high defective sensor amp.  
No :Pin-11 slot 09 is high, defective formater or cable  
go to action 05.  
Action 05 :Swap the control cable with the data cable on the  
drive and formater and try again.  
Result :drive status offline or not ready.  
Yes :replace the formater  
No :cable defective replace what is now the data cable.

KEN-SA:12

KENNEDY FORMATTER SELECT PROBLEM  
DRIVE OFFLINE OR NOT READY STATUS

Indication :Drive offline or not ready status.  
Action 01 :mount and load a tape, when the load point indicator  
is illuminated depress the online switch.  
Result :online indicator illuminated.  
Yes :go to action 02.  
No :is pin-P slot 10 low.  
Yes :online indicator should be on (Defective Bulb)  
No :replace the pushbutton control pwb.  
Result :Pin-P slot 10 still high.  
Yes :check the online switch.  
No :go to action 02.  
Action 02 :is the select indicator illuminated.  
Yes :go to action 03.  
No :go to action 04.  
Action 03 :is the drive still sending offline or not ready  
status.  
No :problem is fixed.  
yes :check pins-19,14 slot 09 both should be low.  
Result :pins-19,14 slot 09 low.  
yes :cable or formatter problem, go to action 07.  
No :if the tape is not rewinding replace the following  
PWBS.  
:interface control slot 09.  
:pushbutton control slot 10.  
:sequence control.  
Action 04 :check pin-11 slot 09 low (not ground).  
Result :pin-11 slot 09 low.  
Yes :the drive is receiving select check the following  
pins slot 12.  
:pin-12 low defective interface control pwb.  
:pin-12 high pin-V low defective bulb.  
:Pin-12 High Pin-V high defective sensor amp.  
No :pin-11 slot 90 is high (defective formatter pwb or  
cable) go to action 07.  
No :pin-11 slot 09 is ground (formatter missing +5 volts  
go to action 05.  
Action 05 :remove CBL3126-001 from formatter J101, check plus  
5.0 volts from J101-B50 to J101-A50 (Top and bottom  
pins right side of J101).  
Result :plus 5.0 volts OK.  
yes :go to action 07.  
No :go to action 06.  
Action 06 :Make sure formatter is plugged into a live outlet.  
:check fuse in the formatter.  
:Check voltage select card installed correctly.  
:is plus 5.0 volts being held down by a logic pwb  
(remove pwbs one at a time).  
:verify your meter is working correctly.

Result :above checks OK.  
yes :power supply is defective repair or replace it.  
no :take appropriate action.  
Action 07 :swap the control cable with the data cable on the  
drive and formatter and try again.  
Result :Drive status offline or not ready.  
yes :formatter logic board defective  
no :cable defective, replace what is now the data cable.

KEN-SA:13

PERTEC FORMATTER SELECT PROBLEM  
DRIVE OFFLINE OR NOT READY STATUS

INDICATION :drive offline or not ready status.  
Action 01 :mount and load a tape, when the load point indicator  
is illuminated depress the online switch.  
Result :online indicator illuminated.  
yes :go to action 02.  
No :is pin-p slot 10 low.  
Yes :online indicator should be on (defective bulb)  
no :replace the pushbutton control pwb.  
Result :pin-P slot 10 still high.  
yes :check the online switch.  
no :go to action 02.  
Actin 02 :is the select indicator illuminated.  
yes :go to actin 03.  
no :go to action 04.  
Action 03 :is the drive still sending offline or not ready  
status.  
no :problem is fixed.  
yes :check pins-19,14 slot 09 both should be low.  
Result :pins-19,14 slot 9 low.  
yes :cable or formatter problem, go to action 07.  
no :if the tape is not rewinding replace the following  
pwbs.  
:interface control slot 09.  
:pushbutton control slot 10.  
:sequence control.  
Action 04 :check pin-11 slot 09 (not ground)  
Result :pin-11 slot 09 low.  
Yes :the drive is receiving select check the following  
pins slot 12.  
:pin-12 low defective interface control slot 12.  
:pin-12 high, pin-V low defective bulb.  
:pin-12 high, pin:V high defective sensor amp.  
no :pin-11 slot 09 is high (defective formatter pwb or  
cable) to to action 07.  
no :Pin-11 slot 09 is ground (formatter missing +5 volts  
go to action 05).  
Action 05 :pertec formatter.  
:remove the top cover from the formatter and check  
plus 5.0 volts.  
result :plus 5.0 volts OK.  
yes :go to action 07.  
no :go to action 06.  
Action 06 :make sure formatter is plugged into a live outlet.  
:check fuse in the formatter.  
:check power on switch.  
:is plus 5.0 volts being held down by a logic pwb  
(remove pwbs one at a time).  
:verify your meter is working correctly.  
Result :above checks OK.  
yes :power supply is defective repair or replace it.  
no :take appropriate action.

Action 07 :formatter not sending select or receiving online and ready.  
from Action 04  
From Actin 05  
:check J102-B42 low (select to drive 0).  
yes :the cable is defective  
no :remove the P.E. Logic boards, try again.  
Result :ok  
yes :Defective P.E. Logic board.  
no :install the P.E. boards and remove the NRZI board  
try again.  
Result :OK  
yes :defective NRZI board.  
from Action 03.  
yes :check J102-B27 (ready) and J101-A27 (online low.  
(To C.U.)  
no :defective cable (per102201)  
Result :j101-B27 and J101-A27 low  
yes :cbl1401 or controller defective, try selecting  
device 1 or 2.  
no :defective formatter logic board, go to beginning of  
action 07.

## 01: Check all Power Supply Voltages

- A. 5719 Sensor AMP TPA +10V
- B. 5719 Sensor AMP TPB -10V
- C. 5719 Sensor AMP TPC +5V
- D. C1 Positive Terminal +24V (+26V NOM)
- E. C2 Negative Terminal -24V (-24V NOM)

## 02: Capstan zero adjustment

- A. Connect digital meter to TP-D (servo preamp) and GND.
- B. Adjust R-139 for a reading of zero volts.
- C. Command the drive to do reads or writes for ten minutes re-check capstan zero adjustment, if it has changed more than 0.5 volts replace the servo preamp.

## 03: Load Point Sensor.

- A. Place a blank tape over the load point sensor.
- B. Connect Digital meter leads between TP-E and TP-F (sensor AMP slot 12).
- C. Adjust R-16 for a reading of zero volts.

## 04: Capstan speed

- A. Mount a skew tape on the drive
- B. Push load, enter test mode and press forward.
- C. Connect a scope probe to any test point on the read preamp and sync internal.
- D. Adjust R-14 (Bottom pot slot 11) to achieve result as indicated in step E.
- E. 75 IPS-100 micro sec for three complete sine waves.  
45 IPS-55 micro sec for one complete sine waves.

## 05: Start stop time

- A. Mount a scratch tape and command the drive to write file marks.
- B. Sync POS internal TP-A Slot 11.
- C. Adjust R-3 (middle pot) slot 11 to achieve rise time as indicated.  
75 IPS-5.0 milli sec.  
45 IPS-8.0 milli sec.
- D. Sync neg internal for stop time.
- E. Adjust R-4 (Top Pot) to achieve fall time as indicated in C.

## 06: Read Gains.

- A. Load a reel of scratch tape with write enable ring installed.
- B. Select test mode, write test, fwd run.
- C. Observe the wave forms at each test point on the read preamp.
- D. Adjust the associated pot on the read preamp to the indicated level.  
75 and 45 IPS 5728 read preamp-8.0 volts peak to peak.  
45 IPS 3935 read preamp-9.0 volts peak to peak.

07:Read Skew.

- A. Load a skew tape.
- B. Press test mode, fwd run.
- C. Connect scope probe ch 1 to ch 4 test point on the read preamp.
- D. Connect scope probe ch 2 to ch 5 test point on the read preamp.
- E. Sync internal on ch 1.
- F. Adjust skew adjusting screw on the head mounting plate until the two signals overlay each other.
- G. Connect ch 2 to each test point, if any channel is 180 degrees out re-adjust the head mounting plate.
- H. Check the skew in reverse, if it is out suspect tape tracking problem or a worn read/write head.

08:Write Skew.

- A. Load a scratch tape write enable ring installed.
- B. Press test mode, write, fwd run.
- C. Sync internal on P channel test point.
- D. Connect ch 2 to each test point and adjust the corresponding switch on the write amps for the correct skew.

09:Head Face Shield

- A. Loosen stop screw with tape removed.
- B. Insert three thicknesses of tape (0.006 inch) between shield surface and top surface of head. Do not use metal feeler guage.
- C. Press shield against tape firmly and tighten stop screw.
- D. Remove tape pieces by lifting shield.

9755 MATRIX

|                |   |  |  |  |
|----------------|---|--|--|--|
| I.D. PROM (TW) |   |  |  |  |
| PRM10108-001   | A |  |  |  |
| U-CODE         |   |  |  |  |
| DSK7084-920    | A |  |  |  |
| U-DIAG         |   |  |  |  |
| DSK7084-921    | A |  |  |  |
| 2296-901(CS)   | J |  |  |  |
| 2297-901(E2)   | G |  |  |  |
| 2298-901(E1)   | H |  |  |  |
| 2299-901(S)    | K |  |  |  |
| 2300-901(I)    | F |  |  |  |
| 2049-901(MC)   | L |  |  |  |

9950 MATRIX

|                |     |     |     |     |
|----------------|-----|-----|-----|-----|
| I.D. PROM (KW) |     |     |     |     |
| PRM3144-982    | D   | E   | F   | F   |
| U-CODE         |     |     |     |     |
| DSK7084-901    | F-M | N-R | S-T | S-U |
| U-DIAG         |     |     |     |     |
| DSK7084-903    | D-H | J   | K   | K   |
| 2296-901(CS)   | A-G | A-G | A-H | A-J |
| 2297-901(E2)   | F   | F   | F   | F-G |
| 2298-901(E1)   | A-G | A-G | A-G | A-H |
| 2299-901(S)    | E-J | E-J | E-J | E-K |
| 2300-901(I)    | A-C | E   | E   | E-F |
| 2049-901(MC)   | A-G | A-G | H-K | H-L |

9955 MATRIX

|                |     |     |     |     |
|----------------|-----|-----|-----|-----|
| I.D. PROM (CW) |     |     |     |     |
| PRM8698-001    | C   | C   | D   | D   |
| U-CODE         |     |     |     |     |
| DSK7084-909    | B   | B-D | E-F | E-G |
| U-DIAG         |     |     |     |     |
| DSK7084-910    | B   | B-C | D   | D   |
| 2296-901(CS)   | E-G | E-G | E-G | E-J |
| 2353-001(F)    | A-B | A-B | A-B | A-B |
| 2298-901(E1)   | G   | G   | G   | G-H |
| 2300-901(I)    | E   | E   | E   | E-F |
| 2380-001(M)    | A-C | A-C | A-C | A-D |
| 2049-901(MC)   | A-G | A-G | A-G | H-L |

9955II MATRIX

|                |   |  |  |  |
|----------------|---|--|--|--|
| I.D. PROM (TX) |   |  |  |  |
| PRM10109-001   | A |  |  |  |
| U-CODE         |   |  |  |  |
| DSK7084-918    | C |  |  |  |
| U-DIAG         |   |  |  |  |
| DSK7084-919    | C |  |  |  |
| TLA10063-001   | C |  |  |  |
| TLA10064-001   | C |  |  |  |
| TLA10065-001   | E |  |  |  |
| TLA10066-001   | D |  |  |  |
| TLA10067-001   | D |  |  |  |
| TLA10062-001   | C |  |  |  |

INFO-SA:05 REGISTER INFORMATION FOR SYSTEM HALTS

CUSTOMER: \_\_\_\_\_ DATE: \_\_\_\_\_ SYSTEM ID: \_\_\_\_\_ TIME: \_\_\_\_\_

!!!! NOTE !!!!! DO NOT "SYSCLR" OR MASTER CLEAR THE SYSTEM UNTIL  
THE FOLLOWING REGISTERS HAVE BEEN DUMPED

RECORD THE HALT ADDRESS [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

TO DUMP THE REGISTERS THE OPERATOR SHOULD TYPE THE COMMANDS LISTED IN  
PARENTHESES (CR MEANS CARRIAGE RETURN ).

( D DSWSTAT (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D DSWPARITY (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D DSWPB (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D DSWRMA (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D A (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D B (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D X (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D Y (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D PSWPB (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

( D PSWKEYS (CR) ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

IF THE MACHINE IS AN 850 PROCESSOR ADDITIONAL REGISTERS NEED TO BE  
DUMPED (SEE NEXT PAGE FOR INSTRUCTIONS). THESE REGISTER ARE TO BE  
DUMPED BEFORE CONTINUING WITH THE FOLLOWING COMMANDS.

( SYSCLR ) THE CONSOLE SHOULD RESPOND WITH \*\*\* CPU VERIFIED \*\*\*  
IF NO MESSAGE APPEARS OR \$\$\$ CPU DID NOT VERIFY \$\$\$  
DO NOT CONTINUE WITH THE FOLLOWING COMMANDS. TYPE STOP  
AND RECORD INFORMATION

MOUNT A SCRATCH TAPE ON TAPE DRIVE AND PUT DRIVE ON-LINE. MAKE SURE  
TAPE HAS A WRITE RING INSTALLED.

( RUN 775 ) UNIT 0 TAPE SHOULD BEGIN TO MOVE. WAIT FOR SYSTEM TO  
( RUN 776 ) UNIT 1 HALT. LABEL TAPE AND CONTINUE

(SYSCLR ) THE CONSOLE SHOULD RESPOND WITH \*\*\* CPU VERIFIED \*\*\*

AT THIS POINT A WARM START SHOULD BE ATTEMPTED TO RECOVER FROM THE  
HALT. IF THE SYSTEM IS USING MIDASPLUS OR DBMS DO NOT WARM START  
A COLD START MUST BE PERFORMED TO INSURE ACCURACY OF THE DATA BASES.

( RUN 1001 ) OR ( WARM ) WARM ONLY WORKS ON THE NEWER CPU'S (I.E.  
P2550, P2650, P9750, P9950, AND P9955)

IF THE SYSTEM HALTS RIGHTS AWAY OR HANGS STOP THE SYSTEM AND  
ATTEMPT A COLD START

ADDITIONAL REGISTERS FOR P850 PROCESSOR

( A 4/176106 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

HALT ADDRESS

( A 14/2516 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

DSWPARITY

( A 14/2556 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

DSWRMA

( A 14/2570 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

DSWSTAT

( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]

DSWPB

( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

L REGISTER

( A 14/2704 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

X REGISTER

( A 14/2717 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

( A 14/2750 <CR> ) [ \_\_\_\_\_ / \_\_\_\_\_ ; \_\_\_\_\_ ]  
( / <CR> )

SYSTEM HALT RECOVERY USING A CONTROL PANEL

IMPORTANT: FOLLOW THESE PROCEDURES EXACTLY IN THE ORDER GIVEN. DO NOT LEAVE OUT ANY STEPS. SHOULD YOU ENCOUNTER ANY PROBLEMS CALL YOUR CSR OR THE CUSTOMER SERVICE SUPPORT CENTER FOR ASSISTANCE.

A. TO GET HALT ADDRESS:

1. PLACE KEY IN ENABLE POSITION.
2. TURN ROTARY SWITCH TO STOP.
3. PLACE ADDRESS/DATA SWITCH IN ADDRESS POSITION.
4. COPY DOWN THE ADDRESS FROM THE LIGHTS. \_\_\_\_\_

B. TO GET SEGMENT: (FROM HIGH SIDE OF REGISTER 14-PROCEDURE BASE)

1. SET SWITCHES 1 THROUGH 16 DOWN.
2. TURN ROTARY SWITCH TO FETCH Y.
3. PUSH DATA CLEAR SWITCH.
4. ENTER '14 IN LIGHTS BY PRESSING THE FOLLOWING SWITCHES DOWN:  
14,13
5. PLACE SENSE SWITCHES 1 AND 4 UP.
6. PLACE ADDRESS/DATA SWITCH IN DATA POSITION.
7. PUSH DATA CLEAR SWITCH.
8. PUSH START.
9. COPY SEGMENT NUMBER FROM LIGHTS. \_\_\_\_\_

C. TO GET HIGH SIDE OF DSWSTAT:

1. PLACE ADDRESS/DATA SWITCH IN ADDRESS POSITION.
2. PUSH DATA CLEAR SWITCH.
3. ENTER '35 IN LIGHTS BY PRESSING THE FOLLOWING SWITCHES DOWN:  
16,14,13,12
4. PLACE ADDRESS/DATA SWITCH IN DATA POSITION.
5. PUSH DATA CLEAR SWITCH.
6. PUSH START.
7. COPY DSWSTAT HIGH SIDE FROM LIGHTS. \_\_\_\_\_

D. TO GET LOW SIDE OF DSWSTAT:

1. PUT SWITCH 4 DOWN.
2. PRESS DATA CLEAR.
3. PUSH START.
4. COPY DSWSTAT LOW SIDE FROM LIGHTS. \_\_\_\_\_

E. MASTER CLEAR SYSTEM:

1. PUT SWITCH 1 DOWN.
2. PLACE ROTARY SWITCH IN STOP POSITION.
3. PRESS MASTER CLEAR.

SYSTEM HALT RECOVERY USING A CONTROL PANEL

F. GET A TAPE DUMP:

1. MOUNT A SCRATCH TAPE WITH A WRITE RING INSTALLED ON YOUR TAPE DRIVE. DRIVE SHOULD BE ONLINE AND AT LOAD-POINT.
2. PLACE ROTARY SWITCH IN STORE Y POSITION.
3. PLACE ADDRESS/DATA SWITCH IN ADDRESS POSITION.
4. PRESS DATA CLEAR SWITCH.
5. PUT '7 IN LIGHTS BY PRESSING DOWN THE FOLLOWING SWITCHES:  
16,15,14
6. PLACE ADDRESS/DATA SWITCH IN DATA POSITION.
7. PRESS DATA CLEAR SWITCH.
8. PUT '775 OR '776 IN LIGHTS ACCORDING TO YOUR TAPE DRIVE UNIT BY PRESSING THE FOLLOWING SWITCHES:  
FOR TAPE DRIVE 0: 16,14,13,12,11,10,9,8  
FOR TAPE DRIVE 1: 15,14,13,12,11,10,9,8
9. PRESS START SWITCH. YOU HAVE JUST LOADED THE PROGRAM COUNTER WITH THE ADDRESS OF THE TAPE DUMP ROUTINE.
10. PLACE ROTARY SWITCH IN THE RUN POSITION.
11. PRESS START. TAPE WILL BE WRITTEN AND MACHINE WILL HALT WHEN DUMP IS COMPLETE.

G. WARM START IF POSSIBLE:

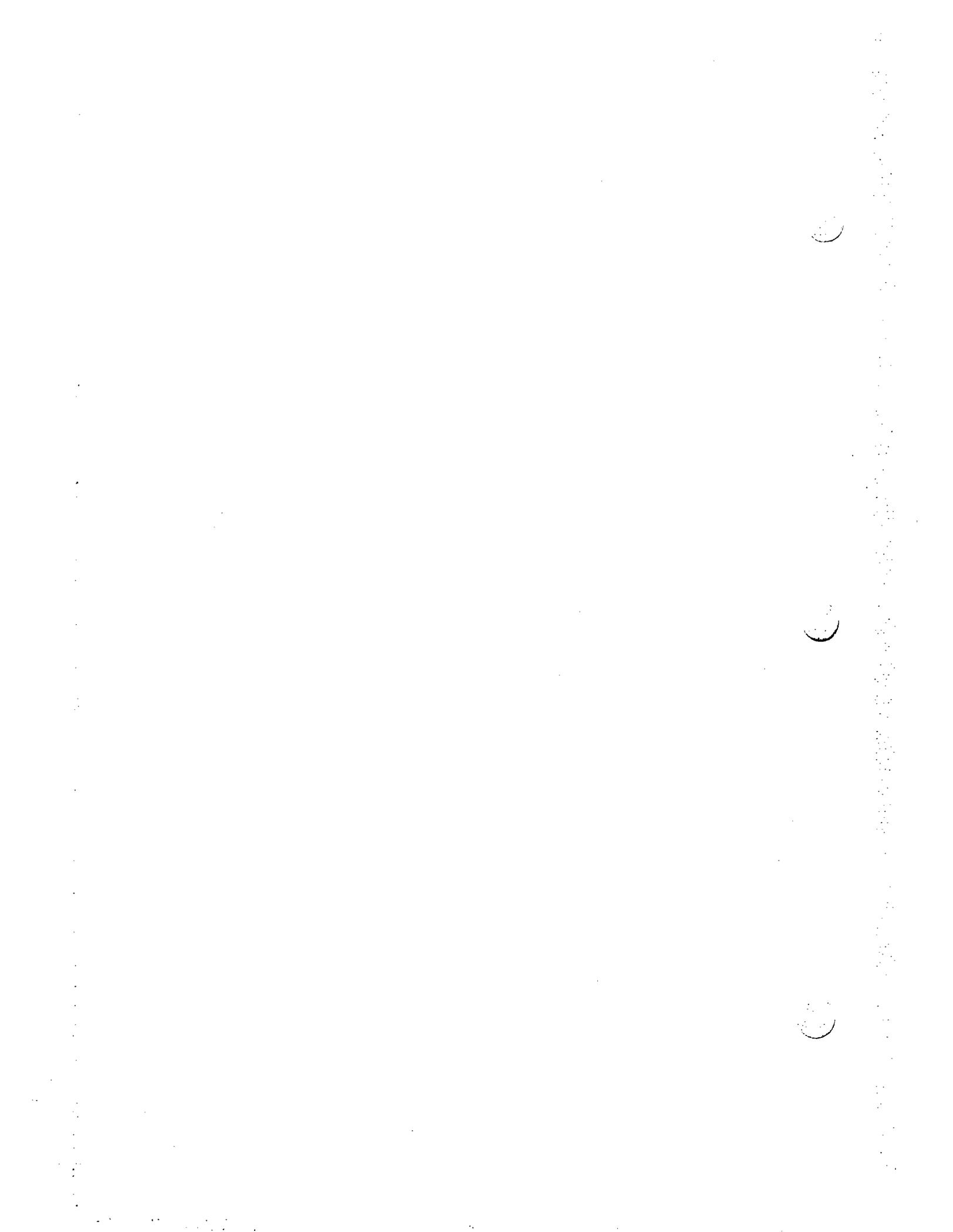
1. PLACE ROTARY SWITCH IN STOP POSITION.
2. PRESS MASTER CLEAR SWITCH.
3. PLACE ADDRESS/DATA SWITCH IN ADDRESS POSITION.
4. PLACE ROTARY SWITCH IN RUN POSITION.
5. PRESS START.
6. PRESS START A SECOND TIME.

(IF THE SYSTEM HALTS IMMEDIATELY OR HANGS STOP THE SYSTEM AND ATTEMPT A COLD START).

## SYSTEM TROUBLESHOOTING

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Troubleshooting is a way of thinking and not a specific act. In order to be able to solve specific problems, the way of thinking must be well ordered. It is especially important that the thought process be kept well ordered when using automatic test methods. Because of the speed and quantity of data presented by automatic testing, it is often easy to overlook details that help to define a problem. A problem is some deviation from a standard, that is, a definable change in an accepted level of performance. In order to solve the problem, the following steps must be accomplished:

1. Collect all available data.
2. Define the extent or nature of deviation
3. Propose theory of cause, according to above data.
4. Test theory.

#### COLLECTION OF AVAILABLE DATA

The collection of data must be the first step in the correction process. Since a problem rarely, if ever, identifies itself completely, it is necessary to collect all available information. This must be done with an open mind. Therefore, before going to step 2, assemble and record (WRITE DOWN) all data. Facts not recorded have a habit of adjusting themselves to fit the theory of the moment.

The type of data reasonable to collect depends on how well the original problem is defined. The following is a list of various types of information that are helpful:

1. Operator's description of problem. Remember, however, that an operator's description is very limited. Ask specific and detailed questions. Find out everything possible about when the first symptoms occurred, exactly how those symptoms were displayed (which lights, indicators, console messages). Find out if anything significant occurred immediately before the problem was noted. Both the terms "significant" and "immediately before" are very relative. Be specific when asking questions.
2. Memory dumps, register information, and system diagnostic information should be gathered. Any hard copy information that can be obtained could be very helpful.

3. Indicator lights on all machines connected to the processor. The presence or absence of all indications, both normal and abnormal, is worthwhile information.

4. When trying to trace an intermittent problem, it is always helpful to record such information as what was being done on the system when the error occurred.

#### DEFINING DEVIATION

In order to know what the problem is, it must be precisely stated and must be stated in two ways: the problem is.../the problem is not... If a problem exists, it can be determined that the problem exists to some limited extent. Write a complete definition of the problem, including both the extent and the limit. Writing down all the information does not waste time. On the contrary, that kind of definition to a problem saves time. It forces the additional information gathering that can pin a problem to a specific cause. Once enough information has been gathered to state the problem in specific terms, proposing a theory of cause should be at least half done.

#### PROPOSE THEORY OF CAUSE

It is not just guesswork that proposes a theory of cause. It is a matter of considering all the available facts, and then asking what would explain all the facts in the definition of the problem.

#### TEST THEORY

To test the theory of cause, change the one thing that has been identified as the cause of the problem. If the entire problem (not just some of the more obvious symptoms) goes away, it can be safely assumed that was the cause. If, however, only part of the problem is corrected, determine if the problem has a multiple cause or another unexplained symptom. If a corrective action does not correct a problem or if it cannot be completely explained as a reasonable part of the problem, the corrective action should not be left in the machine. A change of that sort only adds another unknown to the problem and changes the data that was established to begin with. Take care not to confuse the issue with changes that are merely guesses.

## INTERMITTENT PROBLEMS

Some actions should be taken to correct an intermittent problem whenever possible, even if the failure cannot be duplicated. The purpose of the following is to assist in trying to duplicate the failure, and if that cannot be done, to provide some guidance as to possible corrective actions that can be taken.

1. If system type errors are being generated, loop microdiagnostic routines/tests in an attempt to produce microdiagnostic errors. Looping routines/tests increases the testing frequency on specific areas of logic. If the microdiagnostics detects errors, follow the actions listed or reported by the test.
2. If the microdiagnostics do not produce errors, use the most frequent system errors to replace, swap, or check suspected items to correct the error.
3. Maintain a list of what has been done. This information may be valuable if additional action is required. A check of the customer's operation has to be made to determine if the problem has been corrected. If mass card replacement was used, every attempt should be made to determine which one caused the error by putting removed cards back in one or two at a time.
4. Other forms of stress testing, such as marginal voltages, raising and lowering temperature, and vibration may be tried. A non-metallic static free device raked across the boards while in a test loop sometimes helps find a bad card connection or a vibration sensitive card. Moving cables and connections under the same conditions also occasionally locates a problem.
5. It is essential to have all the information possible regarding failures. Use full dumps and analyze them completely. Understand how much of the system is working correctly as well as what is failing.
6. Use a voltmeter to check voltage levels and an oscilloscope to check voltage ripple on the power supplies. Marginal voltages and ripple can produce intermittent failures.
7. Check the time when errors occur. It is possible some external noise source is present only at certain times.
8. Question the customer about other possible environmental problems such as room temperature, static discharges possibly from low humidity, new electrical circuit installed that would effect the computer, or other unusual occurrences.

## PROBLEM NOT FOUND

The unit is failing now and the maintenance actions have not corrected the problem. The following is designed to help you to further isolate and correct the problem.

Return to the original problem and replace, swap, and check items listed. Test the machine in the original manner to determine if the trouble is corrected.

### !!!!!! N O T E !!!!!

WHEN REPLACING OR SWAPPING COMPONENTS, KEEP A LIST OF WHAT HAS BEEN DONE. THIS IS VERY VALUABLE IF THE ERROR IS BEING PROPAGATED DUE TO COMPONENTS BEING DAMAGED OR DOA.

At this point, understanding the failure becomes essential. A methodical approach must be developed and followed. Analyze all failure information; microdiagnostic failures, error messages, status codes, halt registers, or anything else pertaining to the failure. Know what is failing and what is not. If the failure can be duplicated with the same failure information, you should be close to understanding the problem.

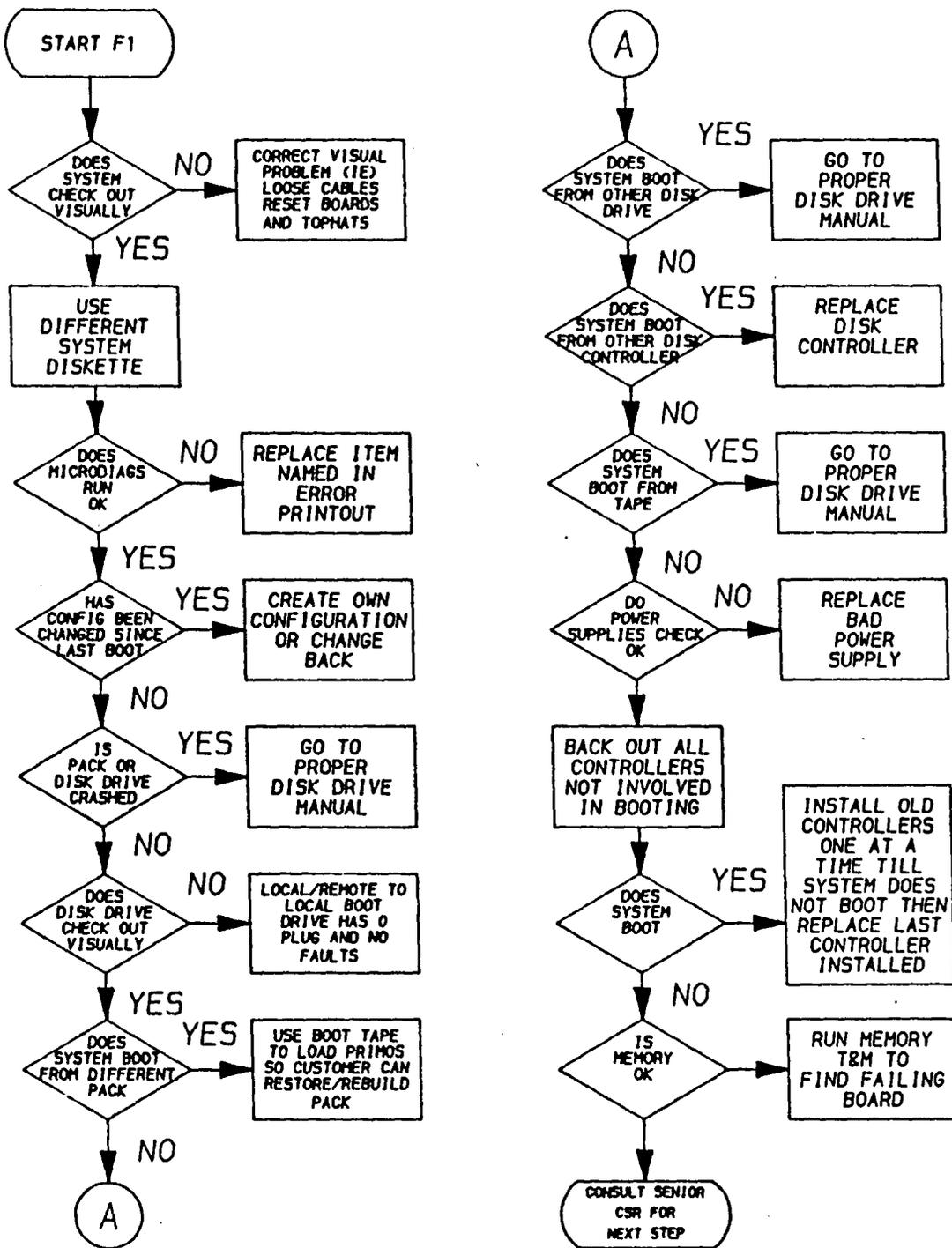
If the failures are random or the failure still has not been found, monitor the voltages with a voltmeter to be sure they are within specification. Check the power supplies for noise or high frequency ripple with an oscilloscope. Check grounding, cables, and connectors for bad crimps, shorts, or poor connections. Check other environmental conditions that may cause machine problems such as temperature, static, primary power, external noise, etc.

SYS-SA:02      MICRODIAGNOSTICS FOR 9000 SERIES MACHINES

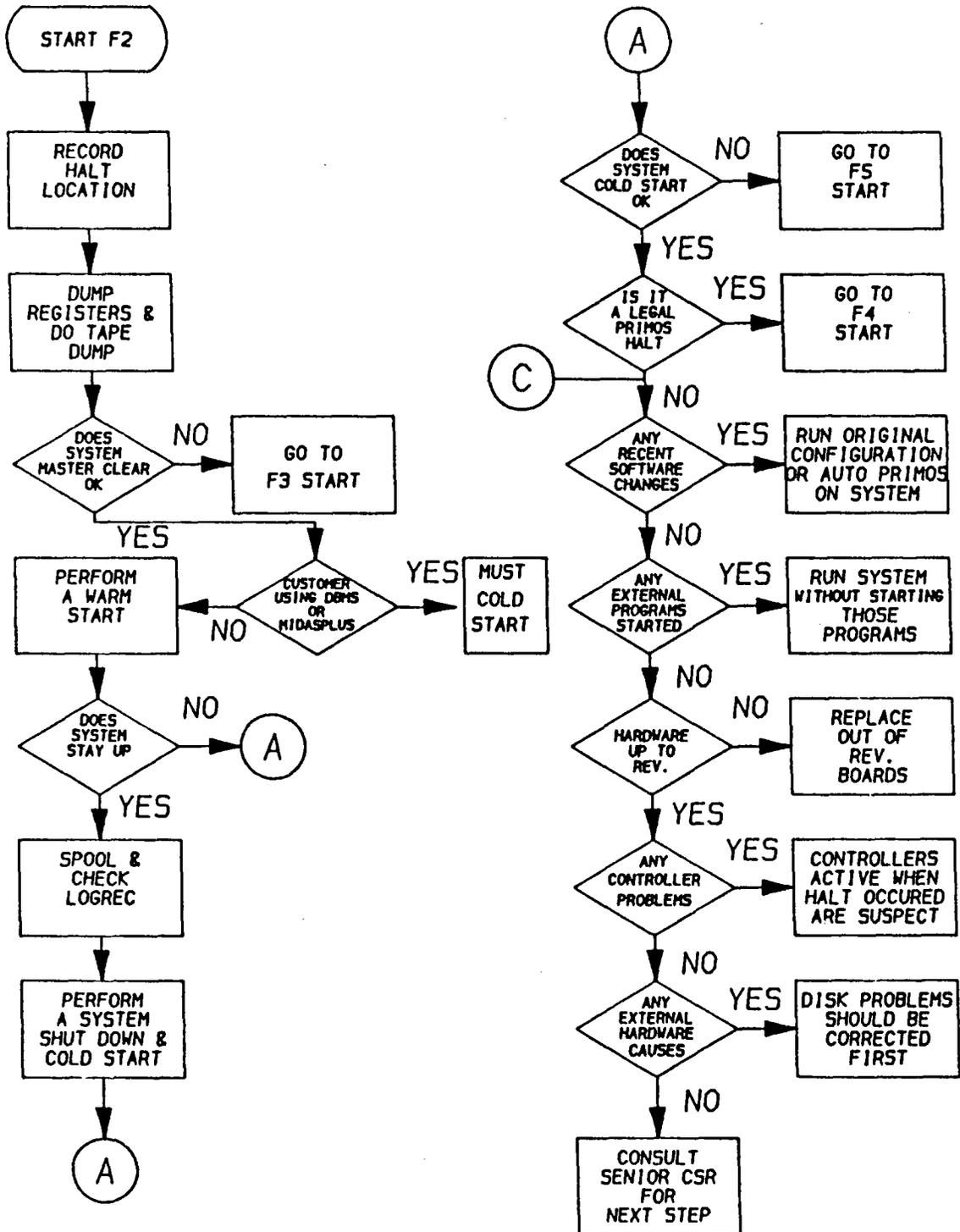
The microdiagnostics and system verify are composed of the following eight overlays:

- UDIAG 1    - TESTS E1, E2, AND CS PCBS:
  - BASIC CONTROL STORE CYCLING
  - ALU FUCTIONS
  - REGISTER FILES
  - TXNX MICROCODE EXTENSIONS
  
- UDIAG 2    - TESTS E1 AND E2 PCBS:
  - HARDWARE MULTIPLIER
  - JUMP NET
  - FLOATING POINT HARDWARE
  
- UDIAG 3    - TEST I AND S PCBS:
  - ADDRESS REGISTERS
  - CACHE
  - STLB TESTING
  - INSTRUCTION FETCH MECHANISMS
  
- UDIAG 4    - TEST 1 PCB (THE INSTRUCTION PROCESSING HARDWARE)I
  
- UDIAG 5    - TEST MC AND MEMORY ARRAY PCBS:
  - MC PCB OPERATION
  - MAIN MEMORY INTEGRITY
  - DECIMAL AND CHARACTER INSTRUCTIONS ON THE E UNIT
  
- UDIAG 6    -TEST THE S UNIT (CACHE)
  
- SYSVERIFY1 - CONTAINS SECTIONS OF UDIAG 1 AND 2.
  
- SYSVERIFY2 - CONTAINS SECTIONS OF UDIAG 3 , 4 , AND 5.

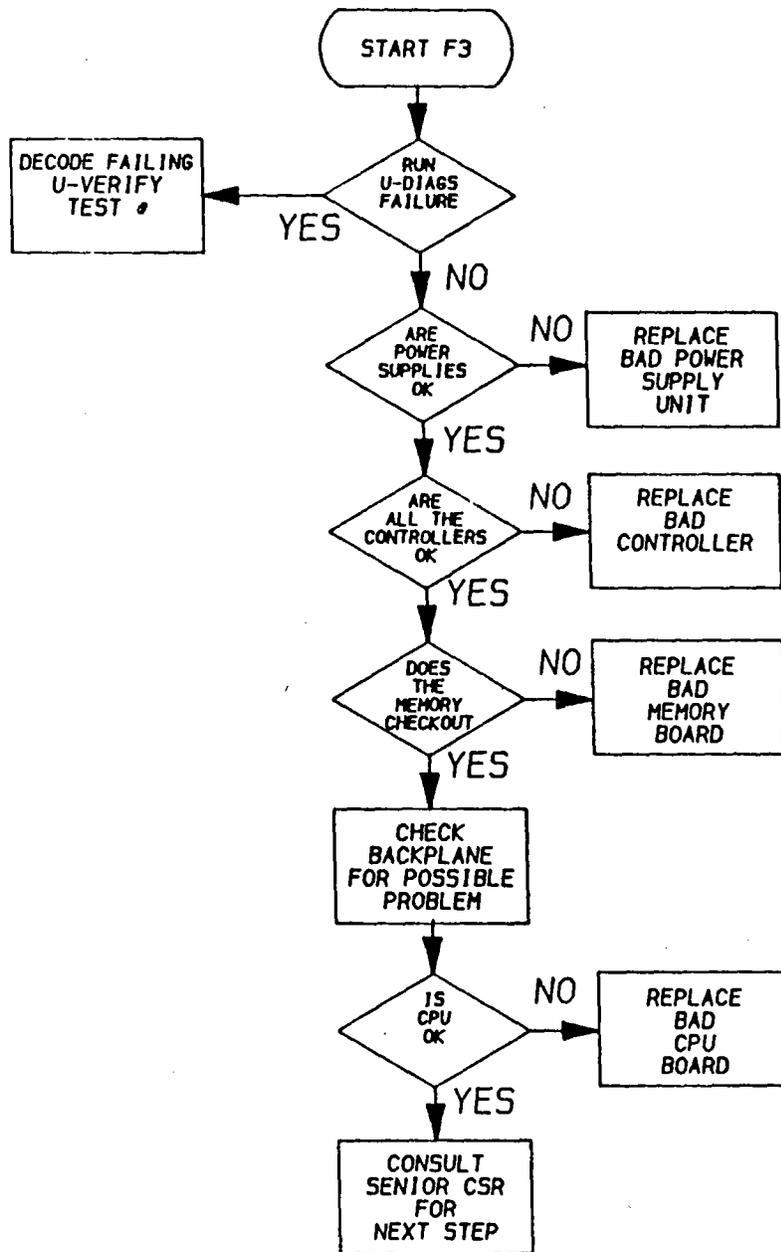
# SYSTEM WILL NOT BOOT



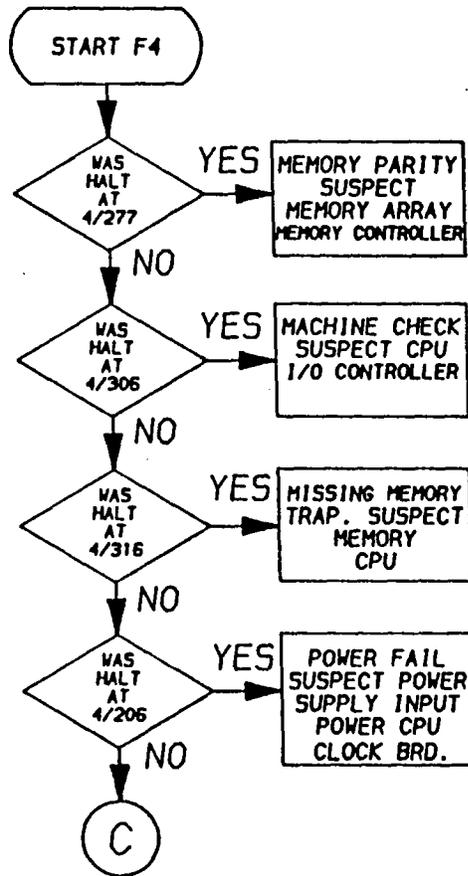
# SYSTEM HALTS



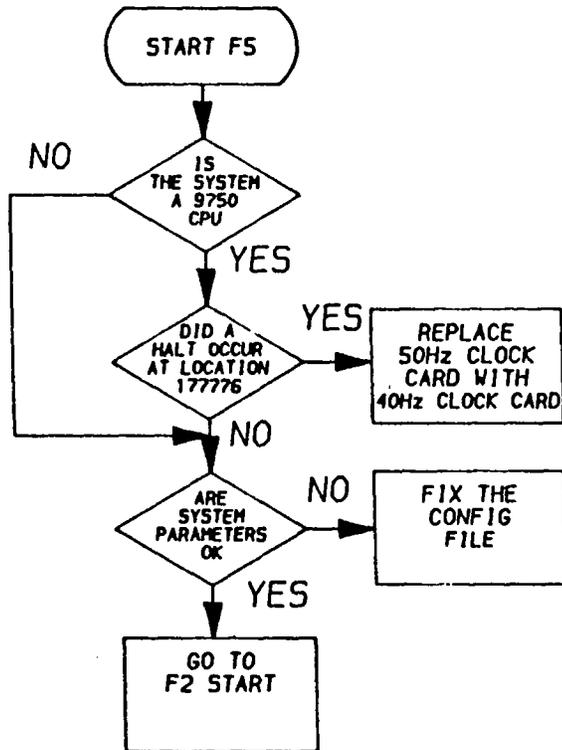
# SYSTEM WILL NOT MASTER CLEAR



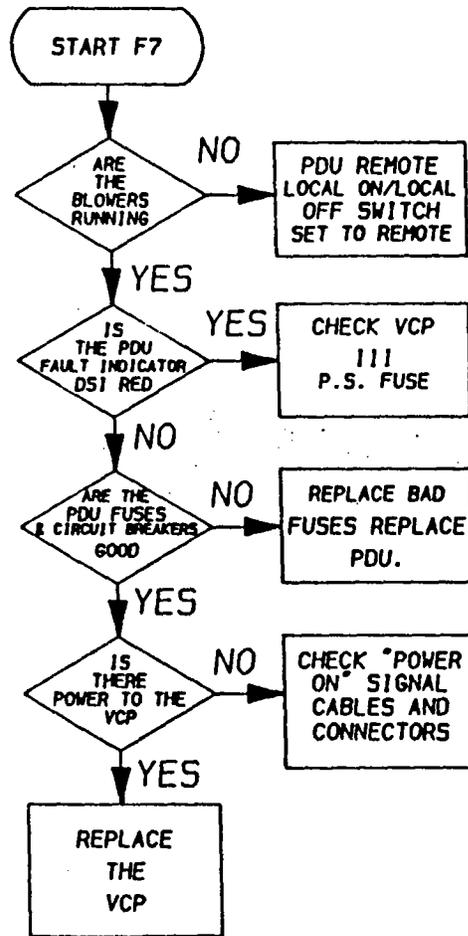
# COMMON VALID SYSTEM HALTS



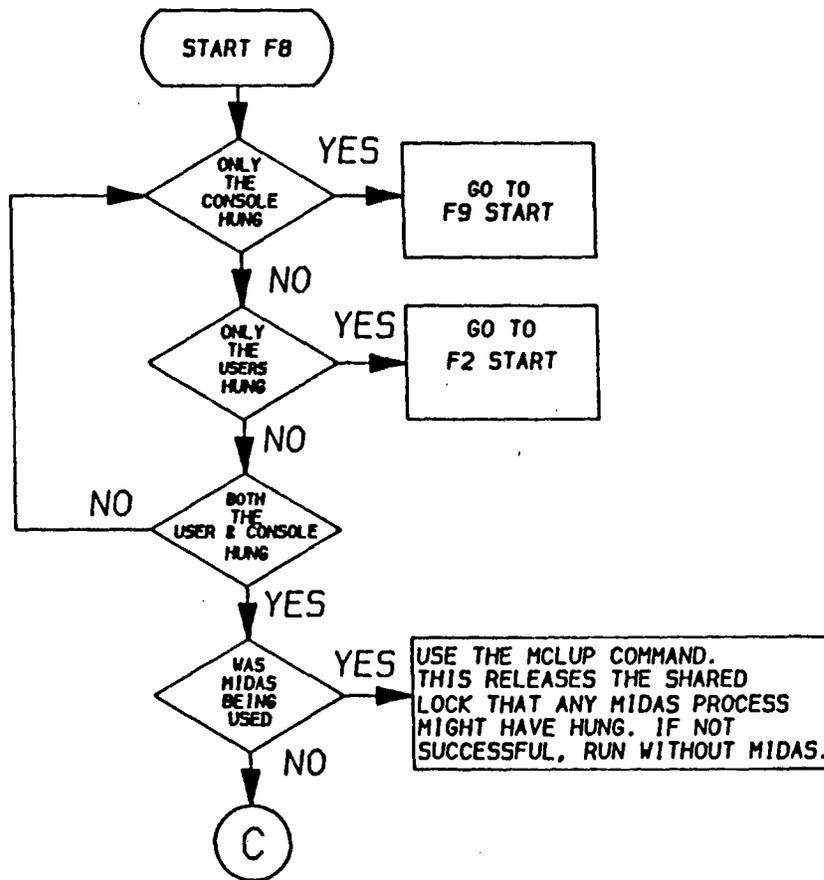
# SYSTEM HALTS DURING COLD START



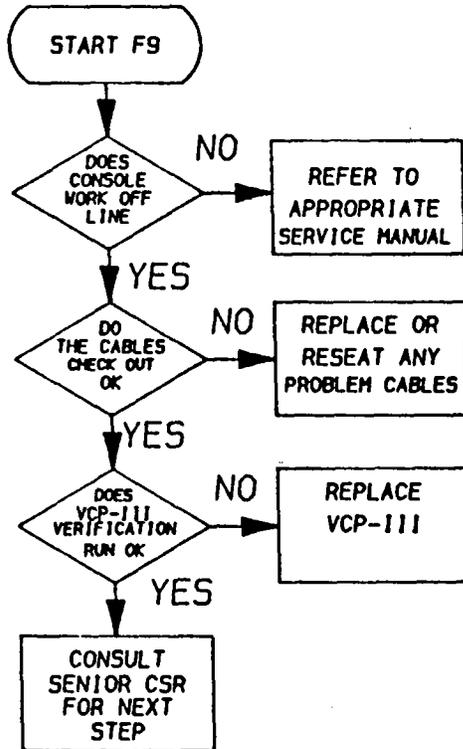
# NO INDICATOR LIGHTS LIT



# SYSTEM HANGS



# SYSTEM CONSOLE DOES NOT RESPOND



SYS-SA:04

DSWSTAT High Side P2250, P2350, P2450, P2550, P2655,  
P9650, and P9655

BIT DESCRIPTION

- 01 Check Immediate The check was taken as soon as the trap was taken in the microcode.
- 02 Machine Check The cause of the check was a machine check.
- 03 Memory Parity The cause of the check was a memory parity error on incoming data from memory.
- 04 Missing Memory The cause of the check was a missing memory module trap.

05-07 Machine Check Code:

- 111 - A Board Parity
- 110 - BMA Parity
- 101 - STLB Parity
- 100 - BPA Parity
- 011 - Cache Data
- 010 - BMD Parity
- 001 - BPD Parity
- 000 - No Error

- 08 Not RCM Not register control memory.
- 09 ECCU Together with bit 3, means that the memory parity error was an ECC uncorrectable.
- 10 ECCC Together with bit 3, means that the memory parity error was an ECC correctable.
- 11 BUP INV RP backup count invalid
- 12-14 RP BAK RP backup count (subtract from DSWPB)
- 15 DMX A direct memory transfer was in progress at the time of the error.
- 16 IO An input/output operation was in progress at the time of the error.

DSWSTAT Low Side P2250, P2350, P2450, P2550, P2655,  
P9650, and P9655

01 SYNDROME 4 ECC Syndrome Bits. If caused by a memory  
parity error, the syndrome bits describe  
02 SYNDROME 3 the error. Refer to the ECC Memory Error  
03 SYNDROME 2 Handling Guide in the appropriate Service  
04 SYNDROME 1 Manual.  
05 SYNDROME 0  
06 OP Overall Parity.  
07 Not used.  
08 MOD NUMBER Low order address bit of module in error.  
09 RMA VAL DSWRMA is valid.  
10-16 Not used.

Machine Check Codes from DSWSTAT High Side Bits 5-7.

| BITS<br>5 6 7 | Failure        | Possible Cause in order of likelihood |
|---------------|----------------|---------------------------------------|
| 0 0 0         | None           |                                       |
| 0 0 1         | BPD            | 1- CPU, 2- Controller                 |
| 0 1 0         | BMD            | 1- CPU, 2- Memory                     |
| 0 1 1         | Cache Data     | 1- CPU                                |
| 1 0 0         | BPA Parity     | 1- CPU, 2- Controller                 |
| 1 0 1         | STLB           | 1- CPU, 2- Controller                 |
| 1 1 0         | BMA Parity     | 1- CPU, 2- Memory                     |
| 1 1 1         | A-Board Parity | 1- CPU                                |

RCM (bit 08 DSWSTAT H) RESET - indicates the CPU has a  
microcode parity error. MCC is  
invalid.  
SET - no RCM parity. MCC is valid.

DSWPARTY High Side P2550, P2350, P2450, P2655,  
P9650, and P9655

|    |             |                                      |
|----|-------------|--------------------------------------|
| 01 | GADRB       | Wide Word mode.                      |
| 02 | GADRI       | Interleaved mode.                    |
| 03 | STLB PE     | STLB parity error                    |
| 04 | CI PE       | Cache Index parity error.            |
| 05 | CD PE EVEN  | Cache Data even parity error.        |
| 06 | CD PE ODD   | Cache Data odd parity error.         |
| 07 | BMD PE      | BMD parity error ( B-board ).        |
| 08 | BPD PE      | BPD parity error ( B-board ).        |
| 09 | RFHL PE     | RFH left byte parity error.          |
| 10 | RFHR PE     | RFH right byte parity error.         |
| 11 | RFL PE      | RFL left byte parity error.          |
| 12 | RFLR PE     | RFL right byte parity error.         |
| 13 | RFH LATE PE | RFH late parity error.               |
| 14 | RFL LATE PE | RFL late parity error.               |
| 15 | BMD/BPD PE  | BMD or BPD parity error ( A-board ). |
| 16 | BMA/BPA PE  | BMA or BPA parity error ( A-board ). |

SYS-SA:05

DSWSTAT High Side 9000 Series Systems

- 01 Check Immediate The check was taken immediately
- 02 Machine Check A machine check occurred
- 03 Memory Parity A memory parity error caused the check
- 04 Missing Memory Module A missing memory module caused the check
- 05 E1 Unit The E1 board reports a parity error
- 06 F or S Unit The F or S unit reports a parity error
- 07 I Unit The I unit reports a parity error
- 08 MC Unit The MC unit reports an error
- 09 ECCU If bit 3 = 1, the memory parity error is an ECCU
- 10 ECCC If bit 3 = 1, the memory parity error is an ECCC
- 11 CS Unit The CS unit reports a parity error
- 12 RCM Parity The CS unit detects an RCM parity error
- 13 RPBU 2 The RP backup count at the time of the error indicates the number of words in the current instructions
- 14 RPBU 1 Same as RPBU 2
- 15 DMX A direct memory transfer is in progress at the time of the error
- 16 I/O OP An Input/Output operation is in progress at the time of the error

DSWSTAT Low Side 9000 Series Systems

- 01 ECC Syndrome Bits. If a memory parity error occurs, the syndrome bits describe the error
- 02 Refer to ECC Memory Error Handling in the 9000 Series Service Manual (CSM 230)
- 03
- 04
- 05
- 06
- 07
- 08 Memory Module Number If memory error, identify the interleaved memory module that contained the error, bit 15 at time of error
- 09 RMA INVLD If 1, DSWRMA content is invalid
  
- 10 Recoverable Machine Check For the 9955 only, a recoverable machine check has occurred  
Currently unused on the 9950 and 9750
- 11 Not Used
- 12 Not Used
- 13 Not Used
- 14 Not Used
- 15 Not Used
- 16 Not Used

TEST NAME: IO.TAPE REVISION: 2.4  
FUNCTION: Testing of the following controllers and tape units:

## Controller/ID

|                      |          |
|----------------------|----------|
| Tape Drive 2081/'114 | Kennedy  |
| 2269/'214            | Kennedy  |
| 2301/'013            | Streamer |

TESTING: Testing can be performed for a controller or up to eight tape drives. All PIO, controller registers, and drive functions are exercised. No controller testing is performed in a PRIMOS environment.

LOCAL SENSE SWITCHES: INIT, SOFT, CKRD

INIT - if SET, controller is initialized whenever errors are detected. By default, INIT is RESET.

SOFT - if SET, error recovery results from soft media errors are displayed. By default, SOFT is RESET.

CKRD - if SET, the data read is compared against that written. Otherwise, the buffers are not compared. By default, CKRD is SET.

OPERATION: If the monitor sense switch OPER (Allow Operator Intervention) is RESET, the diagnostic is skipped.

When the monitor sense switch OPER is SET, the diagnostic asks the user if default testing is desired. If so, the diagnostic finds and tests all available tape drives and controllers. By not selecting default testing, the user can specify the tape units, model controllers, densities, tracks, data patterns, record lengths, number of retries, and pass length. The user is prompted for each option; entering CARRIAGE RETURN always results in a default value being used.

To change an option which has already been entered, continue to answer queries until the diagnostic asks if any more drives are to be configured. At that point, re-enter the number of the drive whose testing options are to be changed, and enter the new option value when prompted.

Answering 'Q' to any query aborts the diagnostic.

**RUNTIME:** The runtime varies with the record size, controller model, and pass length. For a default record size, model 2269 controller, and stand-alone environment, the pass length runtimes are listed below.

**Model 2081 and 2269:**

Short Pass - 02 min. 00 sec.  
Medium Pass - 07 min. 00 sec.  
Long Pass - 19 min. 00 sec.

**Model 2301:**

Short Pass - 06 min. 10 sec.  
Medium Pass - 22 min. 00 sec.  
Long Pass - 66 min. 30 sec.

**ASSUMPTIONS:** Correct CPU, DMA, DMC operation. Executes under SAM or PAM.

**RESTRICTIONS:** If the ATS diagnostic tape is loaded and IO.TAPE is executed against that drive, the ATS diagnostics will be overwritten. Under PRIMOS, one must ASSIGN drives to be tested before invoking the diagnostic monitor PAM.

THE FOLLOWING IS AN EXAMPLE OF HOW TO RUN IO.TAPE FROM PAM.

OK, R PAM

PAM Rev. 10.1 Copyright (c) Prime Computer, Inc. 1985  
Enter 'LOAD;RUN' for Default Execution

PAM: LOAD IO.TAPE  
0014 Building directory  
0000 Loading IO.TAPE.SEG

PAM: RUN  
0030 Executing IO.TAPE Rev 2.4  
TAPES MUST BE ASSIGNED UNDER PRIMOS  
USE 'ASSIGN MTx' PRIOR TO INVOKING PAM

DEFAULT CONFIGURATION [Y(CR) OR N]?  
DO YOU WISH TO OVERWRITE TAPE 4 [Y(CR) OR N]?

| DRIVE# | MODEL | DENSITY | TRK | PATTERN | REC. SIZE | RECOVER |
|--------|-------|---------|-----|---------|-----------|---------|
| 4      | 2269  | 1600    | 9   | 052525  | 00512     | YES     |

Case 00023: SELECT, REWIND STATUS  
Case 00024: REWINDING STATUS  
Case 00025: COMMAND REJECT STATUS  
Case 00026: WRITE FILEMARK STATUS  
Case 00027: SPACING FILE FILEMARK STATUS  
Case 00028: SPACING RECORD FILEMARK STATUS  
Case 00029: READ RECORD FILEMARK STATUS  
Case 00030: ERASE GAP OPERATION  
Case 00031: WRITE A RECORD  
Case 00032: READ A RECORD  
Case 00033: WRITE, ERASE, READ OPERATIONS  
Case 00035: INSUFFICIENT DMX RANGE  
Case 00038: MODE CHANGE AND BUFFER ALIGNMENT  
Case 00040: WRITE/READ 7 TRACK BCD  
Case 00041: WRITE RECORDS  
Case 00042: READ RECORDS  
Case 00043: FILEMARK SPACING OVER RECORDS  
Case 00044: TAPE TRANSPORT EXERCISER  
Case 00045: WRITE/READ BYTE RECORDS  
Case 00046: WRITE WORD/READ 1 BYTE RECORDS  
Case 00047: WRITE 1 BYTE/READ WORD RECORDS  
0041 Case 00048 of IO.TAPE suppressed. NEED MANUAL INTERVENTION  
0041 Case 00049 of IO.TAPE suppressed. NEED MANUAL INTERVENTION  
0041 Case 00050 of IO.TAPE suppressed. NEED MANUAL INTERVENTION

PAM: Q

#### USING DTS

DTS RESIDES ON TAPE OR DISK IN THE 'DIAG' UFD. WHEN DISK IS USED, THE 'DIAG' UFD RESIDES IN THE MFD OF THE SYSTEM DISK, I.E., THE PATHNAME IS 'MFD·DIAG'. WHEN TAPE IS USED, THE DTS TAPE CONTAINS SAM.SAVE AND DIAG AS THE FIRST TWO ITEMS ON THE TAPE.

#### TO BOOT DTS FROM DISK (PRIMOS PRE-REV.20)

- 1). POWER UP THE MACHINE AND THE DESIRED DISK, LOADING THE SELECTED DISK. ASSERT 'MASTER CLEAR' ON THE CPU.
- 2). BOOT PRIMOS II -ENTER 'BOOT 10114' FOR EXAMPLE.
- 3). ATTACH TO THE 'DIAG' UFD -ENTER 'A DIAG'.
- 4). RESUME HBOOT -ENTER 'R HBOOT'. HBOOT WILL PROMPT FOR THE PHYSICAL DISK DEVICE. ENTER THE SAME NUMBER AS IS USED FOR PRIMOS II.

#### TO BOOT DTS FROM DISK (PRIMOS REV.20 OR LATER)

- 1). POWER UP THE MACHINE AND DESIRED DISK. LOADING THE SELECTED DISK. ASSERT 'MASTER CLEAR' ON THE CPU.
- 2). BOOT THE NEW SYSTEM BOOT WITH THE SENSE SWITCHES SET TO FORCE BOOT TO ASK FOR A FILE NAME (BOOT 10114). WHEN PROMPTED, ENTER 'DIAG·SAM.SAVE'. ONE CAN ALSO USE BOOT 11114 TO BOOT WITH MACHINE-CHECKS DISABLED.

#### TO BOOT DTS FROM TAPE

- 1). POWER UP THE MACHINE AND TAPE UNIT ZERO. THIS TAPE UNIT SHOULD BE ATTACHED TO THE CONTROLLER AT ADDRESS '14'. ASSERT 'MASTER CLEAR' ON THE CPU. SAM.SAVE SHOULD BE THE FIRST FILE ON THE TAPE, FOLLOWED BY THE DIAG UFD.
- 2). BOOT SAM.SAVE -ENTER 'BOOT 1005'. THIS WILL BOOT SAM ON ALL REVISIONS OF PRIMOS. FOR PRIMOS REV. 20 OR LATER, IT WILL INITIALLY DISABLE MACHINE-CHECKS. ON PRE-REV. 20 TAPES, 'BOOT 5' WILL RESULT IN THE USER BEING ASKED TO ENTER A TREENAME. ON REVISION 20 TAPES, 'BOOT 5' WILL BOOT WITH MACHINE-CHECKS ENABLED.

#### TO USE DTS UNDER PRIMOS (REV.19 OR LATER)

- 1). ATTACH TO 'DIAG' UFD -ENTER 'A DIAG'.
- 2). RESUME PAM -ENTER 'R PAM'. THE PRIMOS DIAGNOSTIC MONITOR WILL IMMEDIATELY EXECUTE. ONCE THE DIAGNOSTIC MONITOR (SAM OR PAM) IS EXECUTING, ONE CAN USE ANY OF THE MONITOR COMMANDS.

## USER QUICK REFERENCE

| FUNCTION                  | COMMAND      | CONTEXT               |
|---------------------------|--------------|-----------------------|
| BOOT SAM FROM DISK        | BOOT 10114   | CP, MASTER DISK       |
| BOOT SAM FROM TAPE        | BOOT 1005    | CP, DTS TAPE MEDIA    |
| RESUME HBOOT              | R HBOOT      | PRIMOS II, 'DIAG' UPD |
| RESUME PAM                | R PAM        | PRIMOS, 'DIAG' UPD    |
| TERMINATE PAM             | QUIT         | PAM                   |
| GET HELP (COMMAND LIST)   | HELP         | SAM OR PAM            |
| GET HELP FOR A COMMAND    | HELP cmd     | SAM OR PAM            |
| GET LIST OF DIAGNOSTICS   | LISTD        | SAM OR PAM            |
| GET LIST OF CASES IN TEST | LISTC        | SAM OR PAM            |
| GET HELP ON A DIAGNOSTIC  | USER name    | SAM OR PAM            |
| LOAD AND RUN DIAGNOSTICS  | LOAD;RUN     | SAM OR PAM            |
| LOAD A DIAGNOSTIC         | LOAD name    | SAM OR PAM            |
| EXECUTE A DIAGNOSTIC      | EX           | SAM OR PAM            |
| OBTAIN CONFIGURATION      | CONF         | SAM OR PAM            |
| OBTAIN CURRENT STATUS     | STAT         | SAM OR PAM            |
| TALK TO MONITOR           | CARRIAGE RTN | SAM OR PAM            |

\*ABOVE IS A LIST OF FUNCTIONS COMMONLY PERFORMED. FOR MORE INFORMATION ON THE ABOVE COMMANDS REFER TO DIAGNOSTIC TESTING SYSTEM SERVICE MANUAL 400.

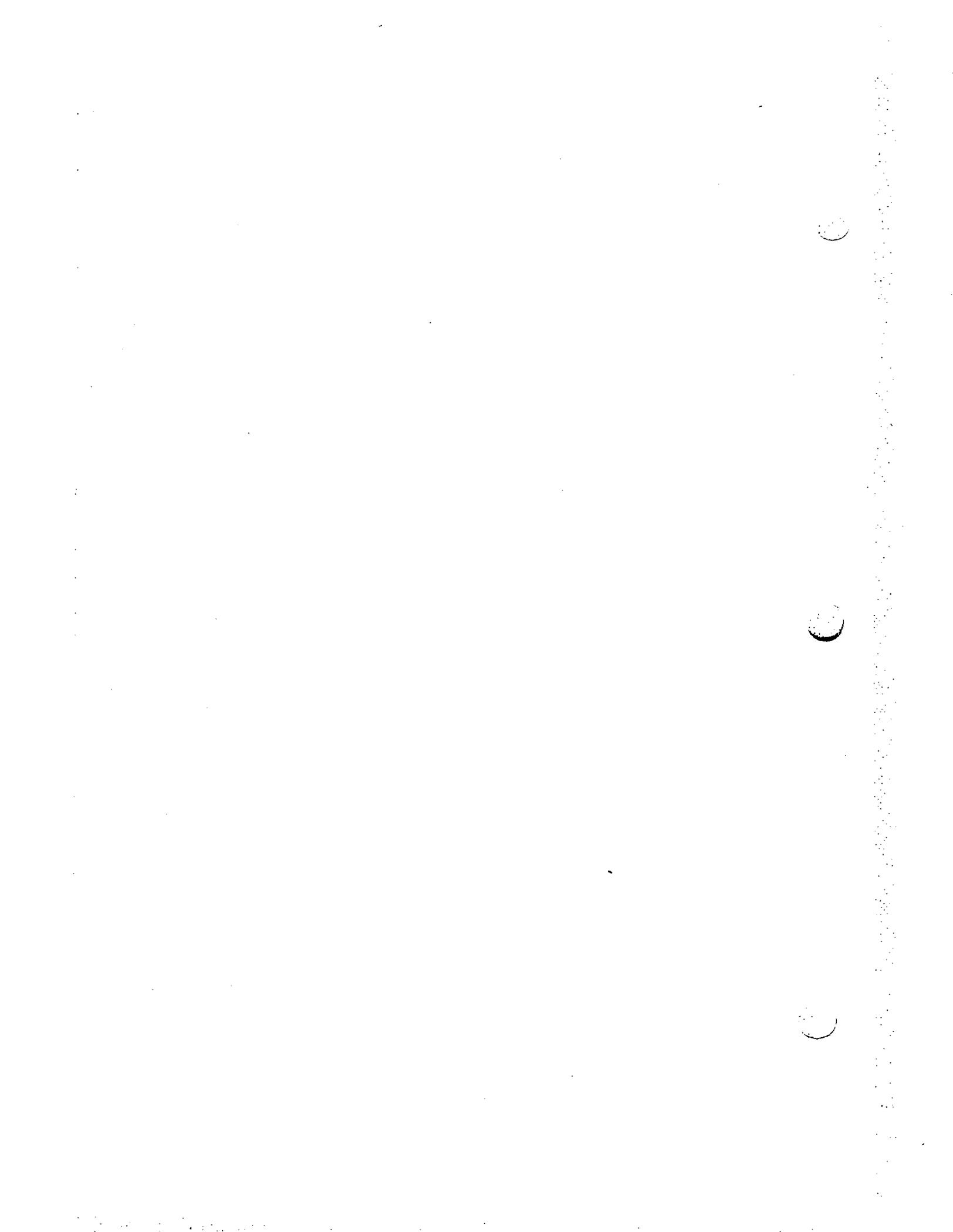


TELEX 6250 TAPE DRIVE

INDEX

|                             |           |
|-----------------------------|-----------|
| Status Word Decodes         | TLX-SA:01 |
| Tape Load Problems          | TLX-SA:02 |
| Read/Write Problems         | TLX-SA:03 |
| Formatter PWB Functions     | TLX-SA:04 |
| Formatter Self Tests        | TLX-SA:05 |
| Test for Formatter to Drive | TLX-SA:06 |
| Status Display Board        | TLX-SA:07 |
| Head Cable Connections      | TLX-SA:08 |
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| Fuse Definition             | TLX-SA:10 |
| Adjustments                 | TLX-SA:11 |
| Diagnostics                 | TLX-SA:12 |

Check notes and warnings at the beginning of each service aid.  
Follow sequentially thru the appropriate service aid. Branch to  
the specified aid and action when instructed to do so.



The controller maintains a status word that is relevant to the operation just completed and the transport last selected. This status word may be transferred to the A register by issuing the appropriate OTA 02 followed by and INA 00.

The bits of the status word are defined as follows:

STATUS WORD I

- BIT 1 Indicates one or more of the following conditions during a read.
- Tape not compatible with:
- PE/GCR/NRZI
  - Multi-track errors
  - Data Format errors
  - Transport Malfunctions
  - Formatter Malfunctions
- BIT 2 Always Zero
- BIT 3 Always Zero
- BIT 4 Always Zero
- BIT 5 Bit set for one of the two reasons: (a) a false gap was detected during the record just read. (b) DMX end of range occurred while reading a record before the physical end of record.
- BIT 6 Uncorrectable error. Set following a 9 track read record order when the controller has determined that it will be unable to correct an error using a read and correct order.
- BIT 7 Set when a read-after-write error is detected during a write record or write file mark order. Examine status words II, III, and IV for further definition.
- BIT 8 Set when a file mark is detected during any read or spacing operation
- BIT 9 Set when the selected transport is READY to receive an order. This means it is on-line and not rewinding.

- BIT 10 Set when the selected transport is on-line. This means it has power on, tape loaded, etc., and requires no further operator attention to be used.
- BIT 11 Set when the selected transport has detected the End-Of-Tape reflective tab, when moving tape in the forward direction. This sticker is placed such that 25 feet of usable tape remain on the file reel. It is the program's responsibility to insure that the tape is not pulled off the file reel.
- BIT 12 Set when the selected transport is REWINDING.
- BIT 13 Set when the selected transport is a LOAD POINT. This means the reflective tab is at the beginning of tape and is under the detector.
- BIT 14 Set when the selected transport is FILE PROTECTED. This means the file reel has had its write enable ring removed.
- BIT 15 Set when the controller has detected a DMX overrun condition.
- BIT 16 Not Used

STATUS WORD II

BIT 1     Density  
          00 - NRZI  
and       10 - PE  
          11 - GCR

BIT 2

BIT 3     Always Zero

BIT 4     Set when ID burst at beginning of tape is read

BIT 5     Set when a command is rejected by the formatter.  
          (ie. write command while tape is file protected)

BIT 6     Parity error in formatter microprocessor ROM.

BIT 7     Set when the formatter has corrected a single track  
          error in PE during a read, has corrected a two  
          track error in GCR during a read, or when a multi-  
          track error has occurred during a write operation.

BIT 8     Bus parity error detected between the formatter  
          and controller.

BIT 9     Data parity error has been detected by the  
          controller.

BIT 10    Set when the previous mode of operation was in  
          the reverse direction.

BIT 11    Formatter in read mode.

BIT 12    Formatter in write mode.

BIT 13    Illegal formatter command.

BIT 14    Data overrun in the formatter.

BIT 15    Erase mode.

BIT 16    Not used.

STATUS WORD III

- BIT 1 \* Not compatible. (ie. 800 bpi tape trying to be read on a 1600/6250 bpi drive)
- BIT 2 \* I/O bus vertical redundancy check. (parity error between controller and formatter during data transfer)
- BIT 3 \* Multi-track error. The number of tracks in error exceeds the error correction capability. 1 or more dead tracks during a write / 2 or more dead tracks during a read for 1600 bpi. 2 or more dead tracks during a write / 3 or more dead tracks during a read for 6250 bpi.
- BIT 4 \* SAGC check. The read circuits have been unable to set the read gain to the proper level while reading the ARA burst.
- BIT 5 \* File mark error.
- BIT 6 \* Noise. Data was detected during an erase operation or data detected during erase portion of a write file mark.
- BIT 7 \* Formatter equipment failure. Formatter has failed or is malfunctioning due to microprogram parity errors occurring out of sequence.
- BIT 8 \* Tape drive equipment failure. Tape drive has failed or is malfunctioning due to IBG overflow or hardware failure. ID burst check, tape mark check, or velocity check during a write operation will also set this bit.
- BIT 9 \* LRC. Longitudinal redundancy check error has been detected during an 800 bpi operation.
- BIT 10 \* Envelope check. One or more tracks have fallen below a reference amplitude level.
- BIT 11 \*\* Preamble error. Too few bytes or a missing ones marker in the preamble during a 1600 or 6250 operation.
- BIT 12 \*\* Postamble error. Too many bytes or a missing ones marker in the postamble during a 1600 or 6250 operation.
- BIT 13 \* Partial record. An IBG is detected before the end of the data block.

- BIT 14 \* Lost beginning of block. Beginning of block is lost at begin block time during 1600 or 6250 operation.
- BIT 15 \* Skew. Excessive skew is detected on 6250/1600 write or read operation.
- BIT 16 \* CRC. A cyclic redundancy check error was detected during 6250 or 800 operations or in 1600 write operations.
- NOTE \* Indicates one or more errors if Status Word I bits 1 or 7 are set.
- \*\* Valid only in write mode.

STATUS WORD IV

- BIT 1 \* ID burst check. The 6250 or 1600 ID burst is not written correctly, or in 6250 mode the ARA burst or its ID cannot be read.
  - BIT 2 \* Velocity check. Speed variation during a write operation is beyond tolerance.
  - BIT 3 \* Tach fail. Tach pulses have not been received from the tape drive within a preset time.
  - BIT 4 \* Erase/write current failure. Current not present when it should be, or is present during a read.
  - BIT 5 \* Loopout. The tape loop has passed the loopout sensor in the vacuum column.
  - BIT 6 \* No data read/word count zero. No data was detected during a read operation or no data transferred during a write operation.
  - BIT 7 \* IBG overflow. An excessive IBG count was detected.
  - BIT 8 \* Dead track P.
  - BIT 9 \* Dead track O.
  - BIT 10 \* Dead track 1
  - BIT 11 \* Dead track 2
  - BIT 12 \* Dead track 3
  - BIT 13 \* Dead track 4
  - BIT 14 \* Dead track 5
  - BIT 15 \* Dead track 6
  - BIT 16 \* Dead track 7.
- \* Indicates one or more errors when Status Word I has bits 1 or 7 set.

Verify the tape load failure and check for the following occurrences:

1. Vacuum motor turns on.
2. File reel motor rotates counter clockwise.
3. Both reel motors rotate clockwise, tape threads onto the fixed reel.
4. Tape dumps into the columns correctly.
5. Tape moves forward to load point.
6. The ready indicator lights.

After verifying the drive has a tape load problem, remove power from the logic boards (power off switch on operator panel). Remove the control board from slot 5. Install the manual switch board (part # \*TLX91X71827) into slot 5, and restore power to the logic boards.

\*\*\* NOTES \*\*\*

- \*Steps 1 through 3-b can be performed without a tape mounted to check the functionality of the reel motors, vacuum motor, and diverter valve.
- \*In steps 1 through 6, switch 1 is considered to be at the top of the manual switch board with all other switches following in numeric order.
- \*Actions for this Service Aid are on the next page.

1. Turn VACUUM on (set switch 3 UP).
  - A. The vacuum motor should start.
  - B. If this test fails, go to action 1.
2. Turn BKWRP ON (set switch 2 DOWN).
  - A. The file reel should turn counterclockwise.
  - B. If this test fails, go to action 2.
3. Turn THRD ON (set switch 2 UP), and diverter valve on (set switch 4 UP).
  - A. Both reels should turn clockwise.
  - B. The diverter valve should energize (move to left).
  - C. The tape should thread through and wrap onto the fixed reel.
  - D. If this test fails, go to action 3.
4. Turn THRD OFF (set switch 2 to middle position).  
Turn DUMP ON (set switch 1 UP).  
DIVERTER VALVE OFF, 4 to middle position).
  - A. The tape should dump into the columns.
  - B. Turn DUMP OFF (set switch to middle position).
  - C. If this test fails, to action 4.
5. All switches except switch 1 (VACUUM) should be in the middle position and the tape should be loaded in the columns.

\*\*\* ACTIONS \*\*\*

1. Vacuum/pressure motor fails to start.
  - A. Defective AC power control board \*TLX91072261-01.
  - B. Defective motor.
  - C. If vacuum motor started only after manual switch board was installed, the control logic board or operator control panel is defective.
  
2. File reel does not rotate.
  - A. Check all voltages (see page 14 for test points).
  - B. Check the fuse on slot 2 logic board.
  - C. Defective logic board in slot 2. Swap with logic board in slot 1 to verify it is bad.
  - D. Defective reel preamp in slot 4.
  
3. File reel counterclockwise rotation has been verified.
  - A. File reel clockwise rotation failure.
    - a. Check voltages (see page 14 for test points).
    - b. Replace reel preamp in slot 4.
    - c. Replace file reel power amp in slot 2.
  - B. Machine reel motor failure.
    - a. Replace reel preamp in slot 4.
    - b. Replace fixed reel power amp in slot 1.
  - C. Diverter valve failure.
    - a. Defective diverter valve solenoid.
    - b. Defective solenoid drive board.  
(part # \*TLX91C71812-01).
    - c. Missing or low +12 or -12 volts.
  - D. Tape thread failure.
    - a. Head flux shield sticking.
    - b. Missing pressure.
      - 1) Broken belt.
      - 2) Hose off.
      - 3) Diverter valve sticking.
      - 4) Foreign matter in diverter valve.
      - 5) Dirty filter.
    - c. Use guage to check the pressure.
  - E. Tape fails to wrap onto fixed reel.
    - a. No vacuum to fixed reel.
      - 1) Broken belt.
      - 2) Hose off.
      - 3) Diverter valve sticking.
      - 4) Foreign matter in diverter valve.
    - b. Use vacuum guage to check for vacuum.
  
4. Tape fails to dump into the columns.
  - A. Reel motors not properly adjusted.
  - B. Check B.O.T. adjustment.
  - C. Defective loop chamber sensor.

## Verify the following:

1. The problem is a read problem only.
2. The problem is a write problem only.
3. The problem is a read and write problem.
4. The problem occurs in 1600BPI only.
5. The problem occurs in 6250BPI only.
6. The problem occurs in 1600 and 6250BPI.

## Probable causes:

1. Dirt
2. Media
3. Tape Drive Subsystem
4. Cables
5. Formatter
6. Controller
7. Memory
8. Software

## \*\*\* NOTES \*\*\*

Be sure to verify drive failure BEFORE preceding with any ACTION

## \*\*\* ACTIONS \*\*\*

1. Dirt
  - A. Visually inspect the following
    - a. Tape path
    - b. Capstan  
(look for dirt or cracks on the capstan wheel).
    - c. Tape cleaner  
(look for dirt and check if it is adjusted correctly).
    - d. Read/Write head  
(look for dirt and/or wear, especially near the tape deck).
  - B. CAREFULLY but THOROUGHLY clean all the above items.
2. Media
  - A. Check the tapes for quality (Prime standards).
  - B. Try to use another tape.  
(sometimes tapes will work on some drives, but not others. Try several tapes before determining the drive or tape is defective).

## \*\*\* WARNING \*\*\*

Unassign all tape drives on the formatter before removing power to the formatter. Install the status PWB in slot 11 of the formatter before proceeding to action 2-C.

- C. Use the status PWB to determine what the errors are.  
(See TLX-SA:07 for explanation of indicators.)

- D. Using the Telex tester, determine if the errors are just at the beginning of the tape. (Indicates media defective).
  - E. Find out if the tape has ever been used at 800BPI. (This will cause problems at 6250BPI).
3. Tape Drive Subsystem
- A. If at all possible, connect the tape drive to another formatter or run the formatter self tests to determine if the problem is in the formatter or tape drive. (For explanations of formatter self tests see TLX-SA:05).
  - B. Check the read gains (1.0 volt peak to peak at 1600BPI)
    - b. Select P.E. density (on the operator panel)
    - b. On board in slot 8, set switches 1 and 2 ON (3200 fci).
    - c. Set the switches on the PWB board in slot 5 for forward tape motion.
    - d. Look for any tracks with high or low amplitude and check if they match the dead tracks on the status PWB.

\*\*\*NOTE\*\*\*

Physical tracks and status bits are different (see TLS-SA:08).

- e. Adjust the read gains to 1.0 volt peak to peak.
- C. Check the read gains (.6 volts peak to peak at 6250BPI)
  - a. Select GCR density (on the operator panel)
  - b. On board in slot 8, set switches 1 and 4 ON.
  - c. Set the switches on the PWB board in slot 5 for forward tape motion.
  - d. Check the read gains on all tracks. Minimum .6 volts peak to peak.

\*\*\* NOTE \*\*\*

NO OUTPUT OR LOW READ GAINS AT THIS POINT INDICATE THE FOLLOWING:

- 1. Defective read/write head
- 2. Defective PE/GCR read electronics (slot 10)
- 3. Defective AGC and amp sense (slot 9)
- 4. Defective write electronics (slot 8)

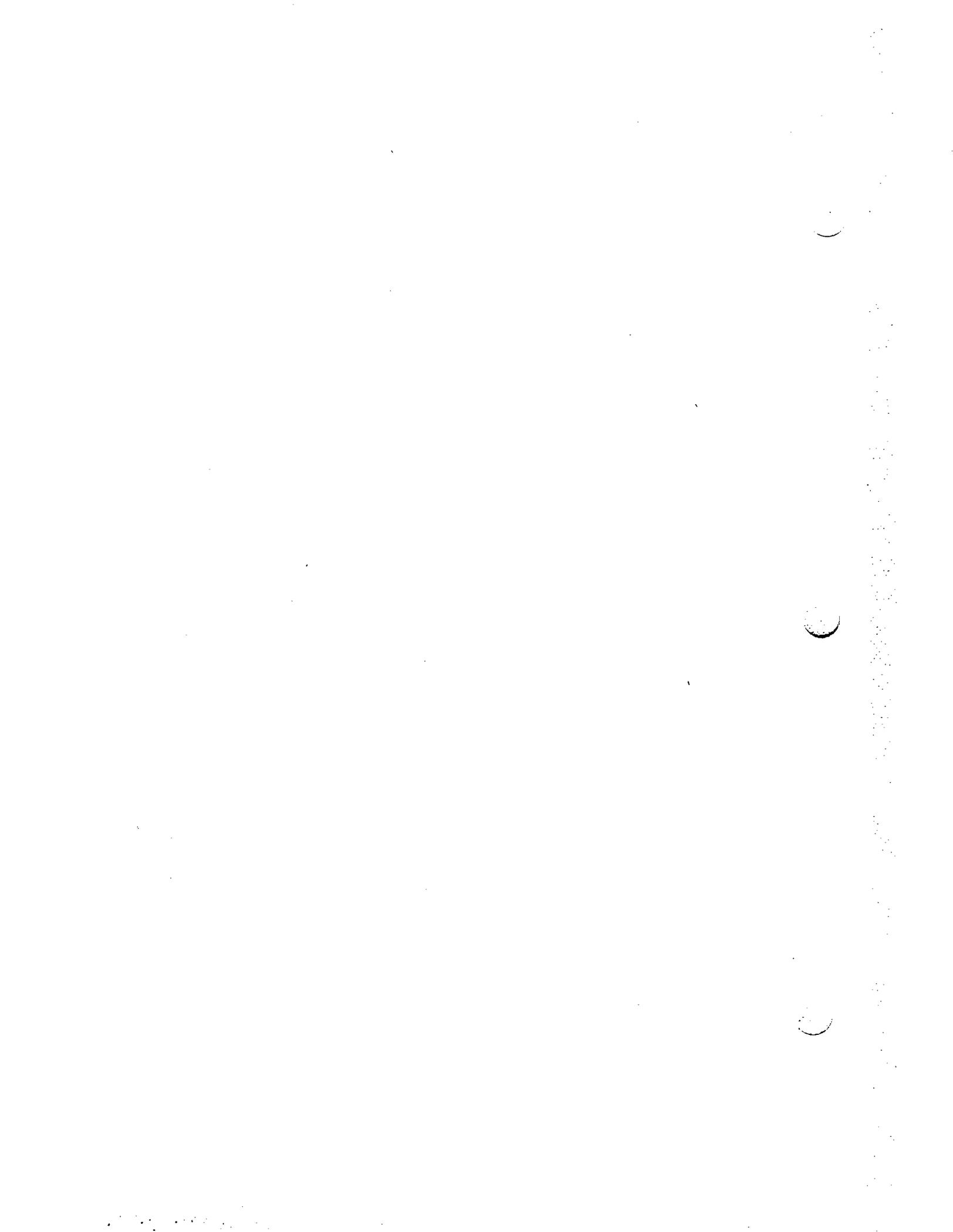
If any of the above parts are replaced, perform actions 3.E, 3.F, 3.G, and 3.H after installation.

- D. Check and adjust capstan speed using a skew tape.
- E. Adjust write current. (Both Densities)
- F. Adjust write compensation. (Both Densities)
- G. Adjust flux shield.
- H. Check write head skew using a skew tape and adaptor cable \*TLX91022640-01.
- I. Check tape tracking on the capstan.
- J. Replace I/O PWB.
- K. Replace capstan motor. (Tape Tracking, capstan speed and skew adjustments must be checked).

4. CABLES.
  - A. Replace formatter to drive cable.
  - B. Replace formatter to controller cables or use telex tester to eliminate controller cables.
  - C. The cables from the controller can be connected directly to the I/O board slot 17 in the formatter to eliminate internal cable problems in the formatter.
  
5. Formatter \*\*See PWB function list on page 6\*\*
  - A. Run formatter self tests (see TLX-SA:05).
    - a. If the tests run look elsewhere for the problem, but it does not guarantee the integrity of the formatter.
  - B. Use the telex tester to run diagnostics tests.
  - C. Use the status PWB (slot 11). Unassign all drives on the formatter before removing power to install the status PWB.
  
6. Controller
  - A. Use the telex tester to eliminate the controller.
  - B. Replace the controller.
  
7. Memory

NOTE!! Indication of defective memory. The drive will fail in PRIMOS IV but will work in PRIMOS II.

  - A. Check logrec for memory errors
  - B. Rotate memories in the back plane.
  - C. Run memory test.
  
8. Software
  - A. Consult your software analyst for any known problems.
  - B. Try different software.



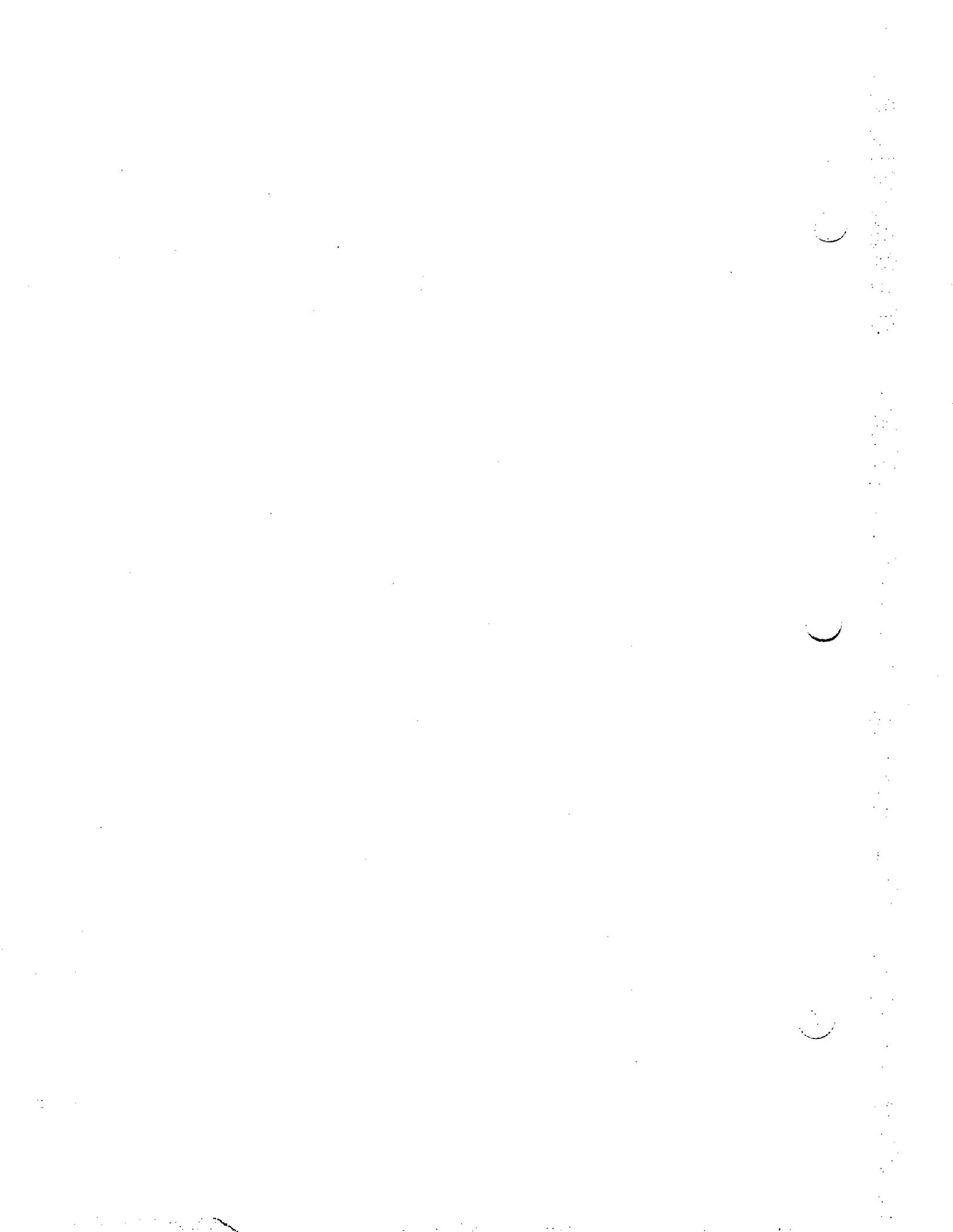
TLX-SA:04

FORMATTER PWB FUNCTIONS

1. Determine if the formatter failure is GCR, PE, read or write.
2. Use this list as an aid to determine which logic PWB is failing.

Formatter PWB Function List

| SLOT | GCR | P.E. | READ | WRITE | Functional Description       |
|------|-----|------|------|-------|------------------------------|
| J-01 | GCR |      | Read |       | Read Buffer                  |
| J-02 | GCR |      | Read |       | Error Correction             |
| J-03 | GCR | P.E. | Read |       | Pointer system               |
| J-04 | GCR | P.E. | Read |       | Pointer system               |
| J-05 | GCR | P.E. | Read |       | Jitter Filter                |
| J-06 |     | P.E. | Read |       | Error Correction             |
| J-07 | GCR | P.E. | Read |       | Skew Buffer                  |
| J-08 | GCR | P.E. | Read |       | PLO Clock                    |
| J-09 | GCR | P.E. | Read |       | PLO Clock                    |
| J-10 | GCR | P.E. | Read |       | PLO Clock                    |
| J-11 |     |      |      |       | C.E. Status Display          |
| J-12 | GCR | P.E. | Read | Write | Clocks/Controls all function |
| J-13 | GCR | P.E. | Read | Write | Clocks/Controls all function |
| J-14 | GCR | P.E. |      | Write | Encoder. Write Triggers      |
| J-15 | GCR |      |      | Write | Character Sequencer          |
| J-16 | GCR | P.E. | Read | Write | Interface to 2023            |
| J-17 |     |      |      |       | CE Tester Adaptor slot       |
| J-20 | GCR | P.E. | Read | Write | Interface to tape drive      |



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TELEX FORMATTER SELF TESTS

Run the tests in the following sequence and watch logic board and CE tester indicators for error indications.

| TEST #      |  | Defective Logic Board        |
|-------------|--|------------------------------|
| 01-Test 17: | Repeat Mode.   |                              |
| 02-Test 02: | Verifies working storage   | J12, J13.                    |
| 03-Test 03: | Verifies I/O Data Stack  | J12, J13, J16                |
| 04-Test 04: | SETS P.E. Mode for other tests   | J12, J13                     |
| 05-Test 10: | Loop writes to read and check for errors   |                              |
|             | J16 LED on   | J16                          |
|             | J14 LED on   | J14                          |
|             | J 6 LED on   | J6, 7,4,3,8,9,10             |
| 06-Test 11: | Loop write to read one dead track  |                              |
|             | J 6 LED on   | J5,J6,J4,J3,J8,<br>J9,J10    |
| 07-Test 12: | Loop write to read two dead tracks   | (Should fail)                |
| 08-Test 06: | Set GCR Mode   |                              |
| 09-Test 10: | Loop write to read and check for errors  |                              |
|             | J15 LED on   | J15,J14                      |
|             | J 2 LED on   | J2,J3,J4,J5,J7,<br>J8,J9,J10 |
|             | J14 LED on   | J14,J15                      |
| 10-Test 11: | Loop write to read one dead track (J2 LED on)  | J2,J4,J3,J7                  |
| 11-Test 12: | Loop write to read two dead tracks   | J2,J3,J4,J8,J9<br>J10,J7     |
| 12-Test 13: | Loop write to read three dead tracks   | (Should Fail)                |
| 13-Test 07: | Loop write to read bus out-bus in  | J20,J21,J13                  |
| 14-Test 04: | Set P.E. Mode  |                              |
| 15-Test 07: | Loop write to read bus out-bus in  | J20,J21,J13                  |
| 16-Test 00: | Returns Microprocessor to normal operation to prevent formatter from being inaccessible. |                              |

Eight LED's form a display located on the MPU II board. This display aids in performing the diagnostics. Five switches, also located on the MPU II board, are used to select the desired diagnostic test. The LED display is used during several of the diagnostic routines. Unless otherwise stated, the LED display is defined as follows:

- o CR1 - A microprocessor detectable error condition exists
- o CR2 - Not defined
- o CR3 - GCR mode selected
- o CR4 - NRZ1 mode selected
- o CR5-8 -Sel Test op code

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HAND LOOP TO TEST FORMATTER TO DRIVE

Routine to check formatter to drive I/O. Drive must be unit 0 on controller '14, ready and online. Run in PRIMOS II.

| LOC  | DATA   |
|------|--------|
| 1001 | 031714 |
| 1002 | 005102 |
| 1003 | 170014 |
| 1004 | 003002 |
| 1005 | 131620 |
| 1006 | 003005 |
| 1007 | 130014 |
| 1010 | 003007 |
| 1011 | 171720 |
| 1012 | 003000 |
| 1102 | 003010 |

Sense switches

|     |               |
|-----|---------------|
| 6+7 | Status word 4 |
| 6   | Status word 3 |
| 1   | Status word 1 |

1-9 RDY Indicates the selected tape drive has tape loaded, is online and is not rewinding.

1-10 ONL Indicates the selected tape drive has been placed online by the operator.

1-12 RWG Indicates the selected tape drive is in the process of rewinding to B.O.T., the ready indicator will be out.  
RNR Rewinding and not ready.

1-13 BOT Indicates the selected drive has tape stopped at B.O.T.  
IDB Indicates the drive has read an ID burst 1600 or 6250 BPI, based on the ID burst information the formatter selects the density of operation of the tape sub-system.

2-12 GCR On indicates 6250 BPI off indicates 1600 BPI.  
NRZ Indicates 800 BPI not used by Prime.  
FPT Indicates no write ring installed in the file reel thus inhibiting a write or erase operation.  
ERM Indicates the selected tape drive is performing or has completed an erase operation.  
WRM Indicates the selected drive is performing or has completed a write or write tape mark operation in the forward direction.  
RDM Indicates the drive is performing or has completed read forward space forward, or space reverse operation and not writing or erasing tape.  
RES  
BSY Formatter busy.

1-8 FMK Indicates the selected drive has read a file mark.  
EOT Set when the leading edge of the E.O.T. marker is sensed during a forward operation and reset when the trailing edge of the marker is sensed during a backward operation.  
REV Indicates the selected drive is moving tape in the reverse direction.  
ADO Indicates tape unit 4  
AD1 Indicates tape unit 2  
AD2 Indicates tape unit 1  
Abnormal status  
REJ Indicates command given to the formatter can not be executed and will be aborted by dropping formatter busy. Examples follow.  
\*TU Sense Byte 0, bit 7 'cmd rej' is set.  
\*An invalid command is issued to the formatter.  
\*Any reverse motion is issued at load point (except unload).  
\*Any write operation is issued to a file protected TU.  
\*Any write operation is issued to a read only system.  
\*Any command except clear, LWR1, NOP, or diagnose is issued to a not ready or offline TU.  
\*A tie command is issued to a TU not in NRZI mode.  
\*Any tape motion command except rewind or rewind and unload with an IBG overflow condition indicated.  
\*ALWR1 or LWR2 command is issued in NRZI mode.

\*The TU is not capable of writing in the commanded density.

- COR Indicates the formatter has corrected a single track error in 1600 operation or a dual or single track error in 6250 operation.
- PAR Indicates a parity error condition exists in the micro-processor read only memory.
- OVR Indicates the I/O adapter did not respond to the data request in sufficient time to allow proper transfer of data.
- ERR Indicates one or more errors in error bytes 0,1 & 2 have been detected. Preamble and postamble errors are reported only in a write mode.
- DPE Data parity error. VRC,LRC,CRC.

STATUS DISPLAY BOARD  
SELECTED BY ERROR STATUS CONTROL LINES ESCO,ESC1

Error Byte 0

Bit

- 0 NC : Not compatible:indicates density of tape to LL read is not compatible with tape unit density capabilities,or the tape unit is not capable of writing in the commanded density.
- 1 IOP : vertical redundancy check:indicates a parity error on data bytes transferred to or from the C.U. during a read or write.
- 2 MTE : Multi-track error:indicates the number of tracks in error exceeds the error correction capability.1 or more tracks in 1600 BPI write, 2 or more tracks in 6250 BPI write.
- 3 AGC : SAGC check:Indicates that the read circuits have been unable to set the read gains to the proper level while reading the ARA burst.
- 4 FMK : File Mark Error:indicates the file mark was not detected properly.
- 5 NOI : Noise:indicates data is detected during an erase operation or data is detected during the erase portion of a write tape mark.
- 6 FEQ : Equipment fail formatter:indicates the formatter has failed or is malfunctioning.Set if microprogram parity error occurs or if various parity errors in the data path occur out of sequence.
- 7 TEQ : Equipment fail tape drive:indicates the drive has failed or is malfunctioning. This is set by IBG overflow or tape unit fail. ID burst check, tape mark check, or velocity check in a write operation.

ERROR BYTE 1

Bit

- 0 LRC : LRC error:800 BPI Operation.
- 1 ENV : Envelope Check: indicates that one or more tracks have below a pre-set level. During a 1600 BPI write, also sets error status (ERR).
- 2 PRE : Preamble error:indicates there is a preamble error in 1600 or 6250 BPI operation. The error is too few bytes or a missing ones marker (reported only in a write mode).
- 3 PST : Post amble error: Indicates there is a postamble error in 1600 or 6250 BPI operation. The error is too few bytes or a missing ones marker (reported in a write mode).
- 4 PR : Partial Records:an IBG is detected that BOB is lost during begin block time in 1600 or 6250 BPI operation.
- 5 BOB : Lost beginning of block:indicates that BOB is lost during begin block time in 1600 or 6250 BPI operation.
- 6 SKW : SKEW:indicates excessive SKEW is detected on 6250/1600 write or read operation.
- 7 CRC : Cyclical redundancy check:a CRC error was detected in 6250 or 800 BPI operation or in 1600 BPI write operation.

**Error Byte 2**

**BIT**

- 0 ID : ID burst check:the 6250 or 1600 ID burst is not written correctly or in 6250 mode the ARA burst or its ID can't be read.
- 1 VEL : Velocity check:the speed variation during write is beyond tolerance.
- 2 TCH : TACH fail:TACH pulses have not been received from the drive within a pre-set time.
- 3 EWC : Erase/write failure:indicates one of these currents is not present when it should be or is present during a read.
- 4 LPO : Loopout:indicates the tape loop has crossed the loopout sensor in one of the vacuum columns.
- 5 WCZ : No data read/word count zero:indicates that no data was detected in read or no data transferred during a write.
- 6 IBG : IBG overflow:indicates that an excessive IBG count was detected
- 7 DTP : Head 4:dead track/track in error status Bit P.

**Error Byte 3**

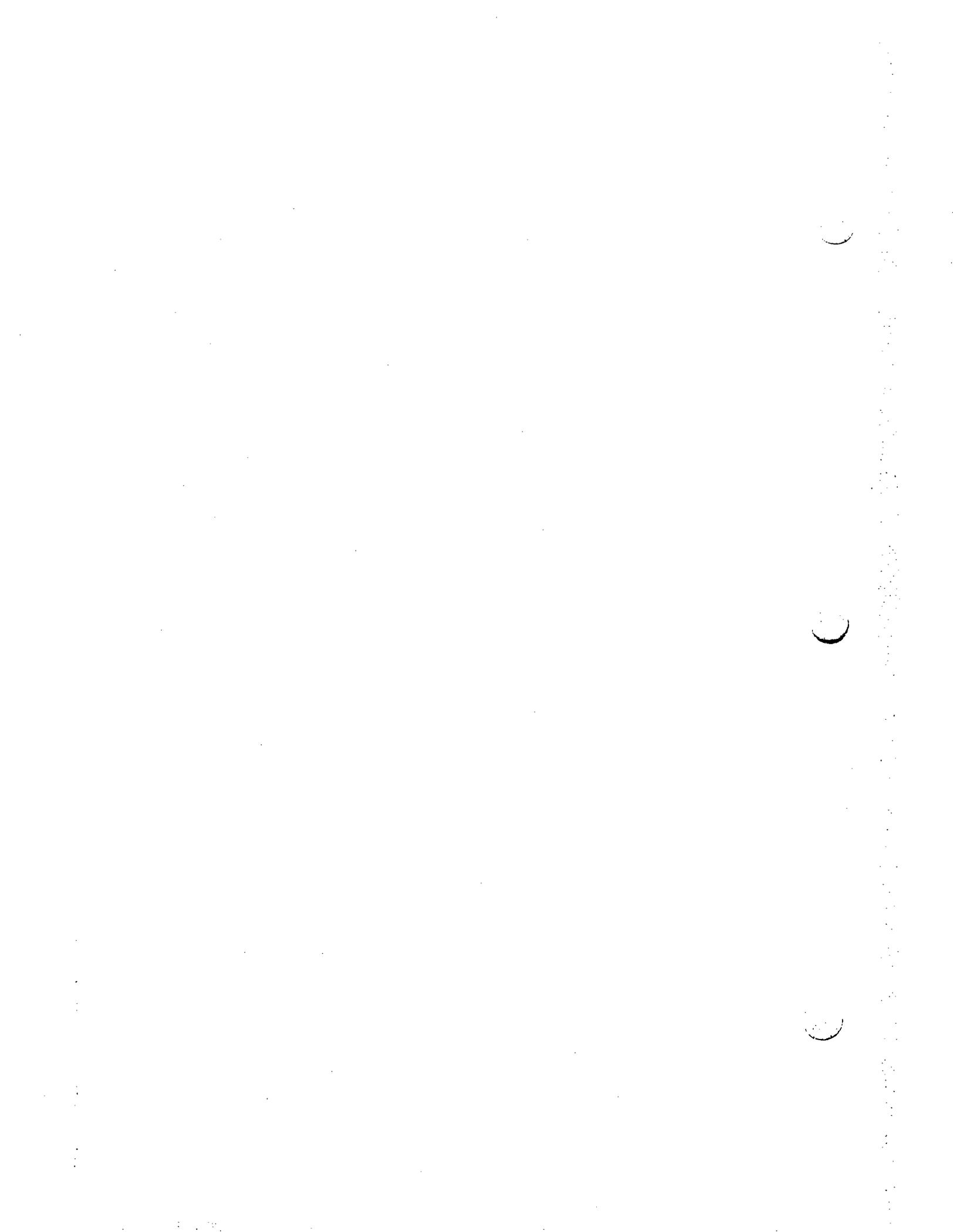
**BIT**

**HEAD**

- 0 7 :dead track/track in error status bit 0.
- 1 6 :dead track/track in error status bit 1.
- 2 5 :dead track/track in error status bit 2.
- 3 3 :dead track/track in error status bit 3.
- 4 9 :dead track/track in error status bit 4. (near deck)
- 5 1 :dead track/track in error status bit 5. (outside)
- 6 8 :dead track/track in error status bit 6.
- 7 2 :dead track/track in error status bit 7.

**Read PLO Layout**

|     | Section A      | Section B      | Section C      |
|-----|----------------|----------------|----------------|
| J10 | Bit 0 (PHYS 7) | Bit 1 (PHYS 6) | Bit 2 (PHYS 5) |
| J09 | Bit 3 (PHYS 3) | Bit 4 (PHYS 9) | Bit 5 (PHYS 1) |
| J08 | Bit 6 (PHYS 8) | Bit 7 (PHYS 2) | Bit P (PHYS 4) |



TLX-SA:08

R/W HEAD CONNECTIONS

TLX 91C2264-01 (Write head SKEW cable)

FEMALE (Front View)

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34  
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17

MALE (Front View)

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17  
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

| FEMALE | MALE (to write head) | Track Bit |
|--------|----------------------|-----------|
| 30     | 01                   | GND       |
| 13     | 18 (outside channel) | 01 05     |
| 12     | 19                   |           |
| 32     | 03                   | GND       |
| 14     | 20                   | 02 07     |
| 15     | 21                   |           |
| 34     | 05                   | GND       |
| 16     | 22                   | 03 03     |
| 17     | 21                   |           |
| 19     | 07                   | GND       |
| 18     | 24                   | 04 P      |
| 01     | 25                   |           |
| 20     | 09                   | GND       |
| 03     | 26 (middle channel)  | 05 02     |
| 02     | 27                   |           |
| 22     | 11                   | GND       |
| 04     | 28                   | 06 11     |
| 05     | 29                   |           |
| 24     | 13                   | GND       |
| 07     | 30                   | 07 00     |
| 06     | 31                   |           |
| 26     | 15                   | GND       |
| 08     | 32                   | 08 06     |
| 09     | 31                   |           |
| 28     | 16 (inside channel)  | GND       |
| 10     | 17 Next to deck      | 09 04     |
| 11     | 34                   |           |

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TELEX DRIVE LOAD LIST AND VOLTAGE TEST POINTS

| TEST POINTS<br>Location | J14-6<br>OCP+5   | TP8<br>+5 | Slot 6     |            |   | C-1<br>+45 | C-2<br>-45           | Back plane<br>Description |
|-------------------------|------------------|-----------|------------|------------|---|------------|----------------------|---------------------------|
|                         |                  |           | TP4<br>+12 | TP7<br>-12 |   |            |                      |                           |
| J-01                    |                  |           | X          | X          |   | Fuse Fuse  | Reel power AMP Fixed |                           |
| J-02                    |                  |           | X          | X          |   | Fuse Fuse  | Reel power AMP File  |                           |
| J-03                    | Can load         | +12       |            |            |   | X X        | Capstan power AMP    |                           |
| J-04                    |                  | X         | X          | X          |   |            | Reel preamp          |                           |
| J-05                    |                  | X         |            |            |   |            | Control Logic        |                           |
| J-06                    | Change speed dip |           |            |            |   |            |                      |                           |
|                         |                  | X         | X          | X          |   |            | Capstan Preamp       |                           |
| J-07                    |                  | X         |            |            |   |            | Interface            |                           |
| J-08                    | 1 Fuse/track     |           |            |            |   |            |                      |                           |
|                         |                  | X         | X          | X          |   |            | Write                |                           |
| J-09                    |                  | X         | X          | X          |   |            | AGC AMP Sense        |                           |
| J-10                    |                  | X         | X          | X          |   |            | PE/GCR read          |                           |
|                         | X                |           | X          |            |   |            | Operator Ctrl Panel  |                           |
|                         |                  |           | X          | X          | X | X          | Dump Circuit         |                           |
|                         |                  | X         |            |            |   |            | VAC Column LED       |                           |
|                         |                  | X         |            |            |   |            | VAC Column Sensor    |                           |
|                         |                  | X         |            |            |   |            | EOT/BOT Sensor       |                           |
|                         |                  | X         | X          | X          |   |            | Reel Tach Sensor     |                           |
|                         |                  | X         |            |            |   |            | Pack Sensor          |                           |
|                         |                  | X         | X          | X          |   |            | Cartridge Opener     |                           |
|                         |                  |           | X          | X          |   |            | Solenoid Drive       |                           |
|                         |                  | X         |            |            |   |            | Write Enable         |                           |

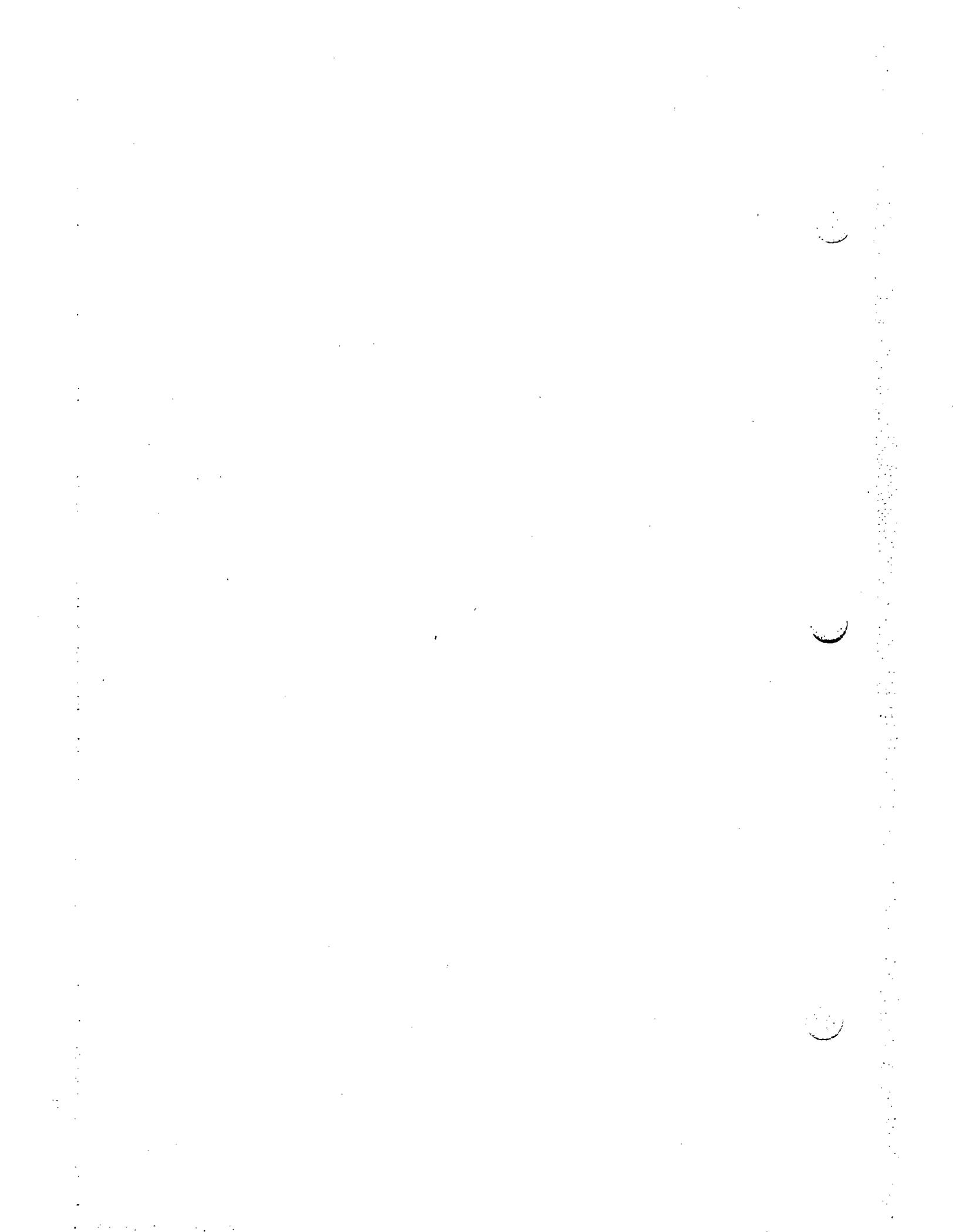
TLX-SA:10

FUSE DEFINITION

| FUSE | SIZE   | LOCATION                  | CONTROLS                   |
|------|--------|---------------------------|----------------------------|
| F1   | .2 AMP | AC Power Cntl PWB 72261   | OCF 5, P.S. Cntl, VAC.MTR. |
| F4   | 5 AMP  | Behind Power Supply Cover | +5 +12 -12                 |
| F1   | 3 AMP  | Behind Power Supply Cover | +12                        |
| F2   | 3 AMP  | Behind Power Supply Cover | -12                        |
| F3   | 5 AMP  | Behind Power Supply Cover | +5                         |
| CB2  | 20 AMP | On Power Supply Cover     | +45                        |
| CB3  | 20 AMP | On Power Supply Cover     | -45                        |

If any voltage is low, remove the logic boards supplied by that voltage one at a time to determine if a logic board is loading down that voltage.

See voltage load list on page TLX-SA:09.



## SECTION 5 MAINTENANCE

TLX-SA:11

### 5.1 PREVENTIVE MAINTENANCE

Although the 6200 Series tape drives have been designed for maximum utility and trouble-free operation, routine preventive maintenance should be performed to keep the units operating at their optimum level.

#### 5.1.1 DAILY MAINTENANCE

For every eight hours of use the tape path and capstan should be inspected and cleaned. Tape damage or read/write problems may be avoided with a consistent cleaning routine.

While cleaning, inspect the tape path for loose hardware, for burrs or other obstructions, and for indications of wear.

Use the following materials to clean the drive:

TELEX Tape Transport Cleaner A98X01723-01  
Lint-free cloth pledgets, Texwipe TX 325 or equivalent  
Cotton swabs

### CAUTION

Transport cleaner is flammable and toxic. Follow the precautions on the container label. *Do not put tape transport cleaner in a container without a label.*

1. Unload the tape and remove the file reel.
2. Open the vacuum column cover.
3. Moisten a lint-free cloth with Telex cleaner and wipe clean the following tape path components:
  - Vacuum column cover
  - Vacuum columns and threading path
  - Air bearings
  - Roller tape guides
  - Ceramic tape guides
  - BOT-EOT sensor housing and mirror
  - Flux shield
4. Clean the magnetic head and tape cleaner with a cotton swab moistened in transport cleaner.
5. When cleaning the vacuum columns and the adjacent area, do not saturate the reflective tape on the rails with cleaner.
6. Stubborn oxide buildup may be removed with a cotton swab and cleaner.

7. Inspect the tape rollers for free rotation and the spring-loaded ceramic guides for free movement.
8. (Maintenance personnel only). Clean the capstan by rotating it with a cloth-covered finger and gently wiping its surface with a lint-free cloth moistened with cleaner.

### CAUTION

The Supr-Lite capstan is extremely thin and light. Use care in cleaning. Clean with Telex cleaner only. Do not use alcohol or other substitutes. Avoid touching the capstan with bare fingers. Moisture or skin oil can contaminate the capstan surface.

9. Close the vacuum column cover.
10. Clean the reel hubs, file protect ring and surrounding deck plate with a damp cloth.
11. Clean the transparent reel door and the control panel and indicators with a damp cloth. Avoid using solvents that may attack the finish. If necessary use a detergent to remove oily deposits.
12. Make sure all tape transport cleaner has evaporated before loading a tape.

#### 5.1.2 FILE REEL LATCH PAD CLEANING

Once each week, or more often if the environment is unusually dirty, clean the rubber latch pads on the file reel hub. Use a cotton swab sparingly moistened with tape transport cleaner. Avoid letting the cleaner get inside the hub.

#### 5.1.3 QUARTERLY MAINTENANCE

Once every three months of operation check the following parameters and adjust if necessary.

1. Capstan speed (Refer to Paragraph 5.3.6).
2. Head azimuth (Paragraph 5.4.1).
3. Read-write level and skew (Paragraph 5.3.7, 5.3.8 or 5.3.9 as applicable).

#### 5.1.4 SEMI-ANNUAL MAINTENANCE

Once every six months of operation perform the following:

1. Replace the air filter on the pressure blower.
2. Check the condition and tension of the blower drive belts and adjust if necessary.
3. Check magnetic read-write and erase head for significant wear. Examine the heads visually and check the signal with an oscilloscope.
4. Check the tape cleaner blades for troughing. If wear is visible, replace the entire tape cleaner assembly and align it according to Paragraph 5.4.3.
5. Check the BOT-EOT assembly adjustment. (Refer to Paragraph 5.3.3.)

## CAUTION

Do not use a metal tool to clear clogged holes. A small burr can result in severe tape damage.

6. Check the air bearings for clogged holes. Remove the bearing disks and clean the holes with a solvent. When replacing the upper and lower air bearings, make sure they are flush against the column rails. Rotate the center air bearing fully counter-clockwise before tightening, then perform the tape cleaner adjustment, Para. 5.4.3.

## 5.2 SERVICE TOOLS AND TESTER

The 6200 series tape drives have been designed for easy serviceability. All electronics except large power supply components are on plug-in printed circuit boards. The tape deck swings open, allowing access to most components from the front. Rear access is needed only for the power connector and the blower belts and pulleys.

A kit of special service tools under part number 16A20242-03 includes the following items.

|   |             |
|---|-------------|
| Tool, Lens Cap Remover  | 68X00533-01 |
| Tool, Alignment, Cleaner  | 78C20557-01 |
| Tool, Alignment, Reel Tachometer                                  | 68B20010-01 |
| Cable Assembly, Extender, Write Head                              | 91C22434-01 |
| Cable Assembly, Extender, Read Head                               | 91C22434-02 |
| Cable Assembly, Tri-Density,<br>Read Board to Read Board Extender | 91C22639-01 |
| Cable Assembly,<br>Write Head to Read Board Adapter               | 91C22640-01 |
| Cover, Plastic, Vacuum Chamber *                                  | 91D22367-02 |
| Switch Board  | 91D71827-01 |
| Extender Board  | 91D71823-01 |
| Tensiometer, Belt   | 68X00216-01 |
| Retention Assy., Extender Board                                   | 91B22677-01 |
| Gauge, 30 inches Vacuum, 80 inches Pressure                       | 91C22259-02 |
| Installation Tool, Pneumatic Latch                                | 91D22648-01 |
| Installation Tool, Mechanical Reel Collets                        | 68C20020-01 |
| Torque Wrench   | 68X00236-01 |
| Extension, 1/4 hex to square                                      | 68X00531-01 |
| Bit, 1/4 hex to #1 Phillips                                       | 68X00535-01 |
| Hex Bit Socket & Bit, 9/64  | 68X00103-01 |
| Skew Tape   | 88X00122-01 |
| Decal, PCB Pin Locator  | 96B20258-02 |
| Shim, Utility, 0.004 in.  | 89B20753-04 |
| Shim, Utility, 0.010 in   | 89B20753-10 |

The test functions built into the tape drive provide local generation of commands and data. All normal check out and maintenance tests may be performed with an oscilloscope as the only additional instrument. The tape motion command circuit is located on the Control Logic board, the write data generator is on the Write Electronics board. Instructions for use are given as required in the following procedures. Return the FWD/REV toggle switch on the Control Logic board, slot 5, to the FWD position after any tester controls use.

## 5.3 ELECTRONIC ADJUSTMENTS

The following procedures are a detailed guide to each adjustment. They are to be used only as necessary, usually after parts replacement. Each procedure is as independent as possible, and the electronic adjustments are given in sequence. Because of their interrelationships, some mechanical misalignments can produce electronic malfunctions. Of particular importance to the read/write functions are the alignment of the head and capstan and the position of the flux shield and tape cleaner. Before making read/write adjustments, always verify these four mechanical functions.

CARD CAGE LEDS

| No | Rel | Design. | Indicates                                       |
|----|-----|---------|---|
| 1  | CR2 |         | -4.5V on  |
| 2  | CR3 |         | -4.5V on  |
| 3  | CR5 |         | Loop-out  |
| 4  | CR4 |         | 90T sense                                       |
| 5  | CR6 |         | File protect and write power on* or no col. vac |
| 6  | CR4 |         | +12V on   |
| 7  | CR5 |         | -12V on   |
| 8  | CR6 |         | +5V on  |
| 9  | CR1 |         | Tester on                                       |
| 10 | CR7 |         | Erase on  |
| 11 | CR6 |         | Write power on                                  |

\*Fault. Tape motion disabled.

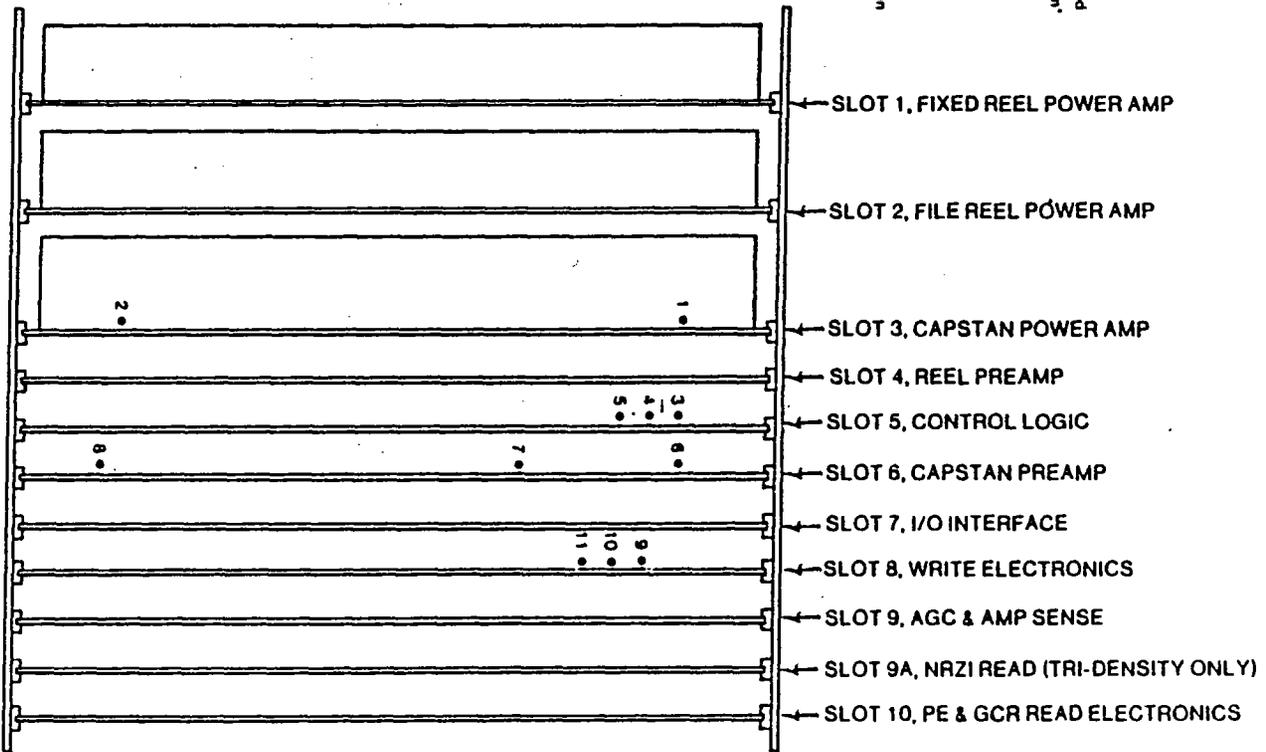


Figure 5-1. Card Cage PCB Locations

### 5.3.1 POWER SUPPLY ADJUSTMENT

1. Power on and check the voltage at the test points on the Capstan Preamp, slot 6, with reference to logic ground, TP10:

|      |                  |
|------|------------------|
| TP 8 | +5V + or - 0.1V  |
| TP 4 | +12V + or - 0.2V |
| TP 7 | -12V + or - 0.2V |

If any of the voltages are out of tolerance, remove the back of the power supply and trim to the precise voltage. The adjustment pots are identified in Figure 5-2. If the +5 volt supply requires adjustment, do that first, then adjust *both* 12-volt supplies. Do not alter the LIMIT adjustment. Adjustment of power supply voltage may necessitate adjustment of other electronic circuits.

2. On the backplane, check J14-6 for +4.8 to 5.2 volts to the Operator Control Panel.
3. Power off, plug the Switch board, with all switches off, into slot 5 (Control Logic) and power on.
4. Switch VAC on (third switch from top). The blowers should run and the servo voltages should come up.

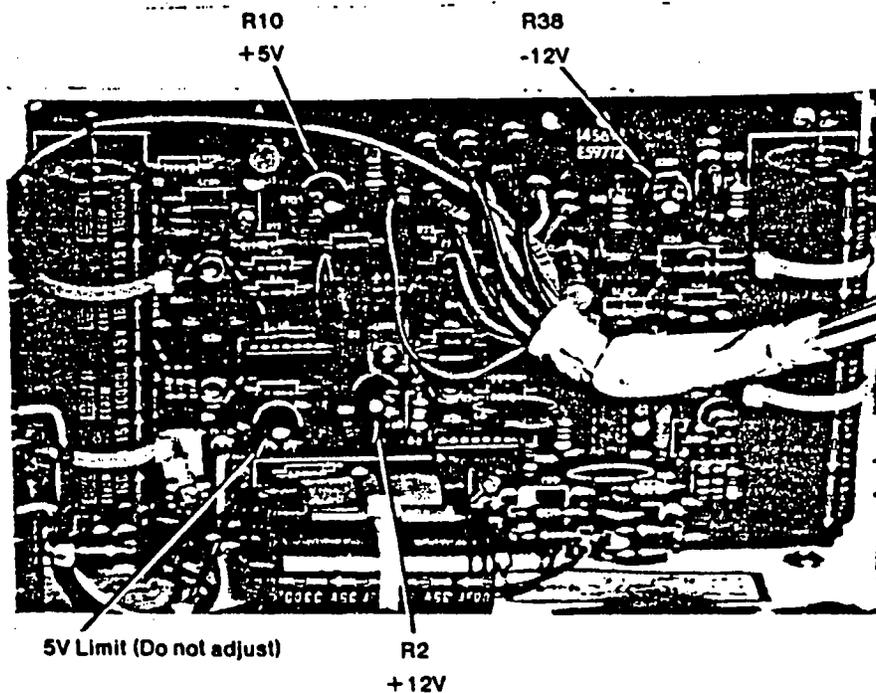


Figure 5-2. Power Supply Voltage Adjustments

5. Check the voltage across the backplane terminals of filter capacitors C1 and C2:

C1: +45V (+ or -5V)  
C2: -45V (+ or -5V)

Greater than 50 volts indicates improper line voltage or a faulty dump circuit. Investigate and repair before proceeding.

6. Power off, remove the Switch board, and plug in the Control Logic board.

#### 5.3.2 PACK SENSE ADJUSTMENT (Low Tape)

1. Scope TP 1 on the Pack Sense board behind the fixed (maching) reel.
2. Turn the fixed reel until the reflective marker on the flange is positioned over the sensor and check for +3 volts minimum, then rotate the reel so the marker is on top and confirm that the voltage drops to less than 1 volt. The most common cause of deterioration of this adjustment is a dirty, wrinkled, or loose reflective marker.
3. If necessary, adjust R4.

#### 5.3.3 BOT-EOT ADJUSTMENT

1. Install new EOT and BOT markers on a tape at least 1 foot apart.
2. Scope TP2 on the control logic board in slot 5.
3. Position the BOT marker over the sensor and adjust R38 for a minimum of 2 volts at TP2.
4. Position the EOT marker over the sensor and adjust R32 for a minimum of 2 volts at TP1.
5. Position the tape so that there is no marker at the sensor. Confirm that there is no more than 0.25 volt present at TP1 and TP2.
6. With no tape present, confirm there is at least 1.25 volts present at both TP1 and TP2. If not, align the sensor for maximum output (refer to paragraph 5.4.4), and repeat steps 3 and 4.

#### 5.3.4 REEL SERVO ADJUSTMENT

This procedure applies to Reel Preamp K91D71805-01 or higher prefix. This adjustment should be performed for any of the following reasons:

When a reel motor has been changed,  
When tape bottoms occur only upon increasing drive temperature due to usage,  
When the reel oscillates during thread mode or while tape is stopped with columns loaded.

This adjustment should be performed before doing the basic reel motor speed adjustments.

#### NOTE

This adjustment must be performed while the drive is cool to warm. If it has been under heavy usage, allow it to cool for approximately one hour.

1. With machine power off, place Reel Preamp board, slot 4, on extender board.

2. On TB1, reverse the reel motor field leads by reversing the blue and yellow wire for each motor. This reduces the torque during adjustment.
3. Open column door and install the transparent column cover.
4. Using the minireel pushbutton, manually thread a 2400-foot tape past BOT marker.
5. Hit RESET, then LOAD to load columns.

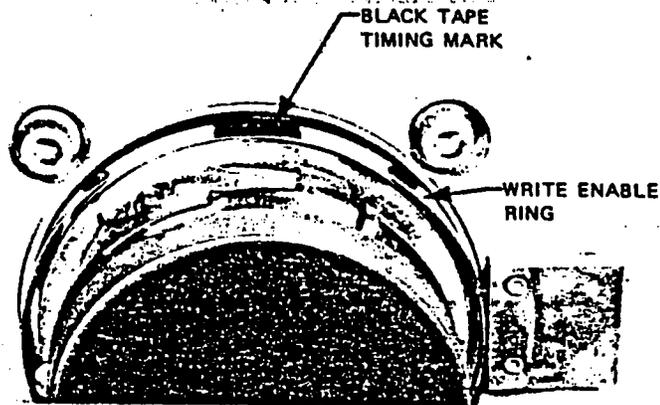
**NOTE**

If reels go into oscillation, turn R239, file reel (top pot) or R240, fixed reel (bottom pot) CCW. Pots are located next to backplane connector.

6. Set scope to 1v/cm, DC coupled, and adjust vertical positioning so ground reference of trace is centered.
7. Connect scope to TP4. Turn file reel by hand to place tape loop between column sensors 5 and 6. Hold the reel in place with masking tape, and adjust R239 (top pot) for zero volts. Next, place the tape loop between sensors 3 and 4. The trace should be zero volts. If not, adjust R239 until trace is not more than 0.5 volt with loop in either position.
8. Adjust the fixed reel, using the same procedure as in Step 7 with scope on TP10 and using R240 (lower pot).
9. After completing adjustments, turn power off (do not attempt a rewind or unload operation with field leads reversed) and return reel motor leads to normal position. Rewind and unload the tape, then adjust reel preamp.

**5.3.5 REEL PREAMP ADJUSTMENT**

1. Apply a half-inch piece of black electrical tape to the reflective write enable ring on the file reel hub. This will interrupt the WE1 signal once per revolution of the file reel.
2. Mount a tape reel having a write ring installed. If there is tape on the reel, affix the end of the tape so it will not unwind during these adjustments.



*Figure 5-3. File Reel Hub with Timing Mark*

- ★
3. Make sure all switches of the Switch Board are off and substitute the Switch Board for the Control Logic in slot 5. Power off while changing boards.
  4. Switch VAC on (Switch Board, third switch from the top).
  5. Scope TP1 on the Write Enable Board. Set scope to triggered sweep, speed to 0.2 sec/cm (2 seconds per sweep).
  6. Switch to BKWRP (second switch, down). The file reel should rotate counterclockwise slowly. Adjust scope triggering and vertical amplitude to measure the rotational rate.
  7. Adjust R83 FLE BKWRP on Reel Preamp (slot 4, fifth pot) for a rotational period of 1.50 seconds. Measure period and not pulse width!
  8. Switch to THRD (second switch, up). Both reels should rotate clockwise.
  9. Adjust R31 FLE THRD (slot 4, top pot) for a period of 2.00 seconds.
  10. On Switch Board, switch THRD off. Switch to WRAP (top switch, down). Both reels should rotate counterclockwise. Select scope sweep of 0.1 sec/cm (1 second per sweep).
  11. Adjust R33 FILE WRAP (slot 4, third pot) for a rotational period of 0.60 second.
  12. On Switch Board, switch to DUMP (top switch up). The file reel should now be rotating clockwise, the fixed reel counterclockwise.
  13. Adjust R35 FLE DUMP (slot 4, second pot) for 0.75 second.
  14. Move scope probe to LOW PACK on Switch Board (second test point from top). Select scope sweep of 50 ms/cm (0.5 second per sweep).
  15. Adjust R71 FIX DUMP (slot 4, bottom pot) for 0.35 second period.
  16. On the Switch Board, switch to WRAP (top switch down).
  17. Adjust R69 FIX WRAP (slot 4, second from bottom) for 0.45 second.
  18. On the Switch Board, switch WRAP off. Switch to THRD (second switch, up). Reel turns CW.
  19. Adjust R67 FIX THRD (third from bottom) for 0.45 second.
  20. On the Switch Board, switch THRD and VAC off. Power off. Replace Control Logic board. Remove black tape from write enable ring. Plug in blower cable.
  21. Power on, mount a tape, and press LOAD REWIND switch. The machine should thread the tape, dump it into the columns, run forward seeking the BOT marker, and stop at the marker with the LOAD POINT indicator on.
  22. Reel Bias: Manually rotate each reel to both limits and release. If the reel jitters, adjust bias until it remains where released, as follows: With a full reel of tape at LOAD POINT, manually position the file reel so the tape loop is approximately halfway between limits (sensors 4 and 5).

Adjust FILE BIAS R45 (slot 4, fourth pot) counterclockwise until the top reel begins to creep clockwise, moving the tape loop down into the vacuum column. Then adjust the pot slowly clockwise until no creep occurs from any position between sensors 4 and 5. Do not overadjust the pot clockwise.

23. With a full reel of tape at LOAD POINT, manually position the fixed reel so the tape loop is approximately halfway between limits. Adjust FIX BIAS R81 (slot 4, sixth pot) clockwise until the bottom reel creeps clockwise, moving the tape loop out of the vacuum column. Then adjust the pot slowly counterclockwise until no creep occurs from any position between sensors 4 and 5. Do not overadjust the pot counterclockwise.
24. Position the tape at LOAD POINT. Rotate the fixed and file reels so tape is positioned between sensors 4 and 5. Release the reels and observe no creep of the tape loops. Repeat at EOT. If creep occurs, repeat steps 22 and 23.

**NOTE**

Occasionally, during normal operation, the reel motors may stop in a position near sensor 4 or 5 that will cause jitter to occur. This is normal and does not impair operation.

**5.3.6 CAPSTAN PREAMP ADJUSTMENT**

**NOTE**

This complete procedure is required only if the capstan preamp has been replaced. For a speed check only, go to step 5.

With no tape on the drive, install Switch Board in place of Control Logic in slot 5 and Capstan Preamp on extender in slot 6. Unplug Reel Preamp from slot 4. (Floats IN LIM signal to enable capstan.)

1. Operational Amplifier Balance
  - a. Power on and scope TP5 on Capstan Preamp.
  - b. With no tape loaded and capstan stopped, adjust R77 OP AMP BAL for 0 volts.
  - c. Power off, remove extender and replace Capstan Preamp.
2. Preliminary Speed Adjustment
  - a. Power on and scope TP1 on Capstan Preamp (third TP from bottom).
  - b. Manually run capstan forward using Switch Board (slot 5) VAC ON (third switch from top) and FWD switches (fifth switch from top).
  - c. Adjust R4 SPEED ADJ to the applicable voltage:

| <u>SPEED</u> | <u>VOLTAGE</u> |
|--------------|----------------|
| 125ips       | 1.7V           |
| 75ips        | 1.0V           |
| 50ips        | 0.7V           |
3. V-F Converter Balance Adjustment
  - a. Scope TP9 TACH PLS on the Capstan Preamp (third test point from top).
  - b. With no capstan motion adjust R69 BALANCE (top pot) clockwise until pulses appear, then counterclockwise until they disappear, then three additional turns counterclockwise.

#### 4. Preliminary V-F Converter Frequency Adjustment

Run capstan forward and adjust R74 FREQ ADJUST, slot 6, for the following approximate periods:

| <u>Tape Speed</u> | <u>Period</u> |
|-------------------|---------------|
| 125 ips           | 37.7 us       |
| 75 ips            | 63 us         |
| 50 ips            | 94 us         |

#### 5. Final Speed Adjustment

- Power off and plug in Reel Preamp, slot 4.
- Remove Switch Board, replace Control Logic, slot 5.
- Load the same 800 bpi master skew tape used for previous speed adjustments.
- Scope the read signal at TP5 on the Read board, slot 10.
- Run tape forward using built-in tester, slot 5.
- Adjust R4 SPEED ADJ (slot 6) to the applicable period:

| <u>Tape Speed</u> | <u>Period</u> | <u>Scope Sweep</u> | <u>Tolerance</u> |
|-------------------|---------------|--------------------|------------------|
| 125 ips           | 20.0 us       | 2 us/cm            | +0.4 us          |
| 75 ips            | 33.3 us       | 5 us/cm            | +0.7 us          |
| 50 ips            | 50.0 us       | 5 us/cm            | +1.0 us          |

When verifying tape speed, always use the same skew tape.

#### 6. Final V-F Converter Frequency Adjustment

- Scope TP9 TACH PLS, on the Capstan Preamp. (slot 6)
- Run tape forward.
- Adjust R74 FREQ ADJ to the applicable period:

| <u>Tape Speed</u> | <u>Period</u> |
|-------------------|---------------|
| 125 ips           | 37.7 us       |
| 75 ips            | 63.0 us       |
| 50 ips            | 94.2 us       |

- Unload the skew tape.

#### 7. Rewind Speed Adjustment (applies to Capstan Preamp U91D71822-01 or higher prefix).

- Adjust R83 on the Capstan Preamp fully counterclockwise.
- Load a scratch tape and run the capstan forward until the tape stops at EOT.
- Measure the period of the tach pulses at TP9 on the Capstan Preamp while rewinding.
- Adjust R83 for a period of 9.9 us (9.4us if reel power amp M91C71807-01 or higher prefix).
- Unload the scratch tape.

#### 5.3.7 NRZI READ AND SKEW ADJUSTMENT

Verify that head azimuth and capstan alignment are correct before proceeding. Refer to Paragraph 5.4.1 and 5.4.5.

- Select NRZI (800 bpi) density.
- Write a tape at 800 fci (tester switch 1 to the right, slot 8).

- While writing, scope each track on the NRZI Read board, slot 9A, and adjust its level to 6.0 volts zero-to-peak, as shown in Figure 5-4.

| NRZI Read Bd | Adjust |        |
|--------------|--------|--------|
| TP1          | R5     | Bottom |
| TP2          | R30    |        |
| TP3          | R55    |        |
| TP4          | R80    |        |
| TP5          | R105   | To     |
| TP6          | R130   |        |
| TP7          | R155   |        |
| TP8          | R180   |        |
| TP9          | R205   | Top    |

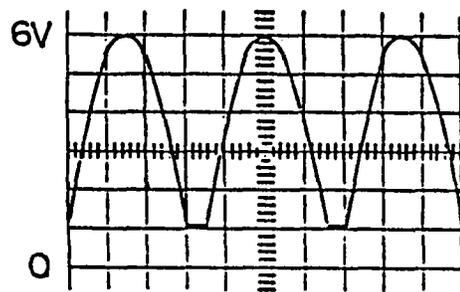


Figure 5-4. NRZI Read Output

- Power off, install the NRZI Read board, slot 9A, on an extender board and use the extender cable to connect it to the Read board, slot 10. Disconnect the write head cable from the Write board, slot 8. Power on.
- Load an 800 bpi master skew tape.
- Verify NRZI density.
- Sync the scope channel 1 on TP15 (physical track 5) of the NRZI Read Board.
- While reading the skew tape forward, adjust the forward skew pot for track 5 (R122) for the positive pulse width given below. This pulse width is 30% of the data rate.

| Tape Speed | Pulse Width | Tolerance     |
|------------|-------------|---------------|
| 125 ips    | 3.0 us      | $\pm 0.05$ us |
| 75 ips     | 5.0 us      | $\pm 0.05$ us |
| 50 ips     | 7.5 us      | $\pm 0.05$ us |

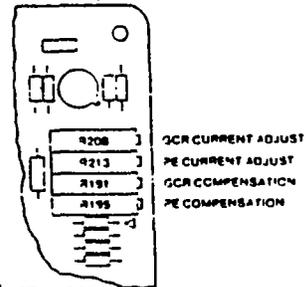
9. Scope TP11 on channel 2.
10. Adjust the forward skew pot for track 1 (R22) to align the negative going trailing edge of the pulse with that of track 5.
11. Move channel 2 probe to the remaining test points (TP12-TP19) and adjust the corresponding forward skew pot for alignment with track 5 on channel 1.
12. Read reverse. Still scoping TP15 with scope channel 1, adjust the reverse skew pot for track 5 (R121) for the positive pulse width given below.

| Tape Speed | Pulse Width | Tolerance |
|------------|-------------|-----------|
| 125 ips    | 3.0 us      | +0.05 us  |
| 75 ips     | 5.0 us      | +0.05 us  |
| 50 ips     | 7.5 us      | +0.05 us  |

13. Scope TP11 using scope channel 2.
14. Adjust the reverse skew pot for track 1 (R21) to align the negative going trailing edge of the pulse with that of track 5.
15. Move scope channel 2 probe to the remaining test points (TP12-TP19) and adjust the corresponding reverse skew pot to align each trace with the track 5 (TP15) trace on channel 1.
16. Unload the skew tape.
17. Power off, and return the read and write boards to normal configuration. The crossfeed should now be checked and the flux shield adjusted if necessary. Refer to Paragraph 5.4.2.

#### 5.3.8 PE WRITE/READ ADJUSTMENTS

1. Load an IBM Multi-Systems Tape (Telex Part No. A88X00166-01) with a write enable ring on the drive.
2. Select PE density.
3. Scope TP5 on the PE Read board, slot 10 (vertical sensitivity 0.2V/cm).
4. Write at 3200 fci (tester switches 1 and 3 to the right, Write board, slot 8).
5. On the Write board, slot 8, turn the PE current pot (second pot from top) counterclockwise until read output decreases.
6. Turn PE current pot clockwise until the read output just peaks.
7. Adjust read level of track 5, (TP5, Slot 10), to 1.0 volt peak-to-peak.



8. Write at 1600 fci (switches 1 and 2 to the right) and turn the PE current pot (second from top, slot 8) clockwise until the read output dip is 0.2 volt, as shown by the arrow in Figure 5-5.
9. Set up the following conditions for compensation adjustment: write at 1600 fci, then read reverse, and cycle (Control Logic tester switches on FWD/REV and GO. Set the cycle time for about a half second in each direction).

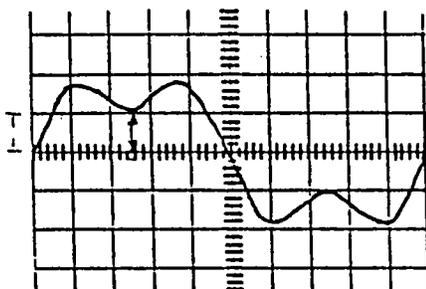


Figure 5-5. PE Read Output 1600 fci

10. Adjust the PE compensation potentiometer (fourth pot from top, slot 8) until the rocking is about equal on the top and bottom as shown in Figure 5-5.
11. Switch to 3200 fci (switches 1 and 3 to the right) and repeat steps 7-10 as required to reach a stable condition.
12. While writing at 3200 fci adjust PE read level to 1.0 volt peak-to-peak on all tracks (slot 10, TP1-9).

| PE Read Bd | Adjust |        |
|------------|--------|--------|
| TP1        | R6     | Bottom |
| TP2        | R31    |        |
| TP3        | R56    |        |
| TP4        | R81    |        |
| TP5        | R106   | To     |
| TP6        | R131   |        |
| TP7        | R156   |        |
| TP8        | R181   |        |
| TP9        | R206   | Top    |

13. Write at 1600 fci and check the waveform at TP1-TP9 (Figure 5-5). Only minor differences should exist from track to track.
14. After performing either the PE or GCR write/read adjustment, check the crossfeed. Refer to Paragraph 5.4.2

### 5.3.9 GCR WRITE ADJUSTMENTS

1. Load an IBM Multi-Systems Tape with a write-enable ring installed.
2. Select GCR density and write at 9042 fci (tester switches 1 and 5 to the right). Scope TP5 on Readboard, slot 10.
3. On the Write board, slot 8, turn GCR current pot (top pot) counterclockwise until read output decreases due to low write current.
4. Turn GCR current pot clockwise until the read output peaks.
5. While writing at 9042 fci, adjust the vertical sensitivity of the scope so that the read output spans exactly 6 major divisions. Refer to Figure 5-6.
6. Write at 3014 fci (tester switches 1 and 4 to the right) and adjust the GCR current pot until both top and bottom dips are 4 minor divisions as shown by the arrow in Figure 5-6.
7. Write at 3014 fci while the drive runs alternately forward and reverse for about one half second each direction. Set Control Logic tester switches on FWD/REV and GO.
8. Adjust the GCR compensation pot (third pot from top) until the rocking is about equal on the top and bottom.
9. Repeat steps 5 and 6 for each track to verify that all dip between 4 and 7.5 minor divisions from 0.
10. Repeat steps 7 and 8 on all tracks to verify that a good compromise exists among tracks.

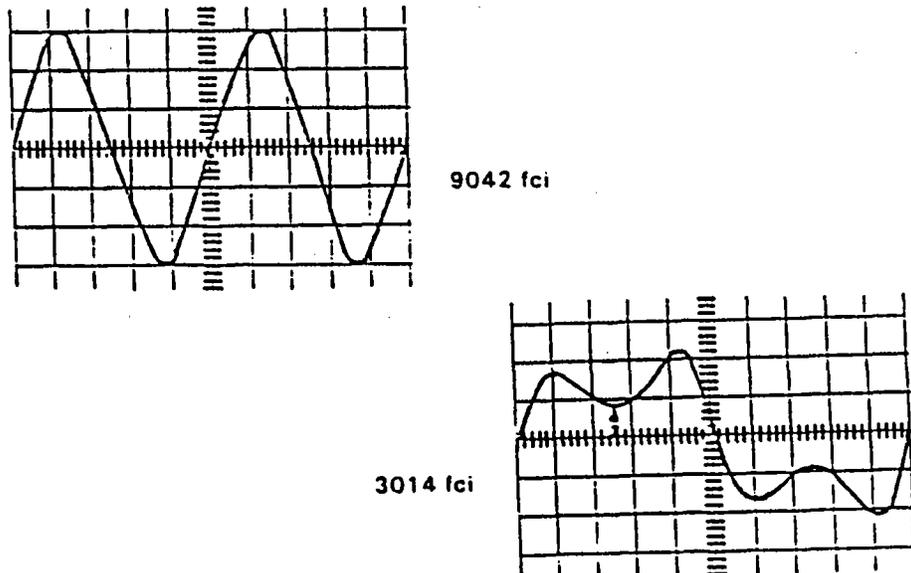


Figure 5-6. GCR Read Output 9042 fci, 3014 fci

## 5.4 MECHANICAL ALIGNMENTS

### 5.4.1 WRITE HEAD AZIMUTH ALIGNMENT

If the magnetic head assembly has been replaced, perform both coarse and fine azimuth adjustments as follows. Otherwise, only fine tune by omitting Steps 5 through 8. The azimuth adjust screw has No. 6 threads on one end and No. 8 threads on the other end. Do not attempt to screw it all the way through any threads. Refer to Figure 5-7.

1. Verify that the flux shield and tape cleaner alignment are correct before proceeding. Refer to Paragraphs 5.4.2 and 5.4.3.
2. Load a skew tape.
3. Plug the write head into the Read board with the adapter cable.
4. On the Read board, slot 10, scope TP1 and TP9. Sync on TP1.
5. Using a 0.050-inch Allen, back off the azimuth bushing setscrew.
6. While reading the tape forward, flex the head base plate in or out until track 1 and track 9 signals are coincident.
7. Tighten the set screw with minimum disturbance of this adjustment.
8. Check the coincidence of several other tracks to insure that the azimuth is not skewed one byte or more.
9. Fine tune the azimuth by adjusting the azimuth screw with a 5/64-inch Allen while reading the skew tape forward, until TP1 and TP9 signals are coincident.
10. Read reverse and verify the same track relationship.

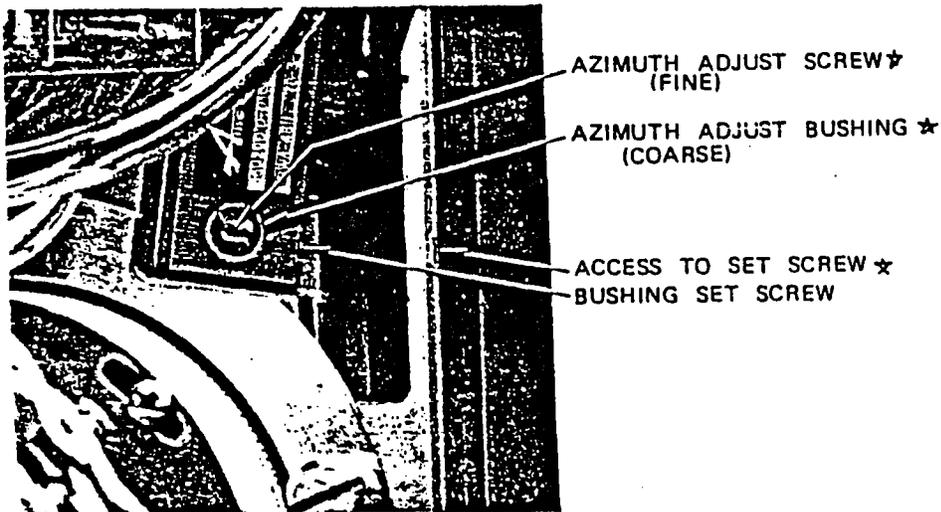


Figure 5-7. Read Head Azimuth Alignment

11. If the difference between forward and reverse is greater than 1.2 usec for 125 ips, 2 usec for 75 ips, or 3 usec for 50 ips, adjust capstan alignment. Refer to Paragraph 5.4.5.
12. If the capstan required alignment, recheck coincidence of several tracks to make sure the head alignment is still valid. If not, repeat the fine-tune procedure.
13. Unload the skew tape.
14. Remove the adapter cable and reconnect the write head cable.

#### 5.4.2 FLUX SHIELD ALIGNMENT, FERRITE ELEMENT (Write to Read Crossfeed)

1. Load an IBM Multi-Systems Tape.
2. Select PE density and write on the tape at 3200 fci (tester switches 1 and 3 on, slot 8).
3. Stop the tape by switching S1 on the Control Logic board, slot 5, to STOP (center position). The write circuit will remain on (write current LED, slot 8, on).
4. Scope TP1 of Read board, slot 10. On a scope with variable bandwidth use narrow (low) setting. Measure only the data rate crossfeed (write circuit to read circuit). The peak-to-peak signal level should be less than 80mv. Move probe to TP2-TP9 of the Read board. If any track exceeds this limit adjust the flux shield as follows.

### CAUTION

Do not position the flux shield closer to the head than 0.008 inch.

5. Refer to Figure 5-8 for parts location. Hold a non-metallic 0.008 inch shim between the head assembly and the flux shield by pushing the flux shield body toward the head.

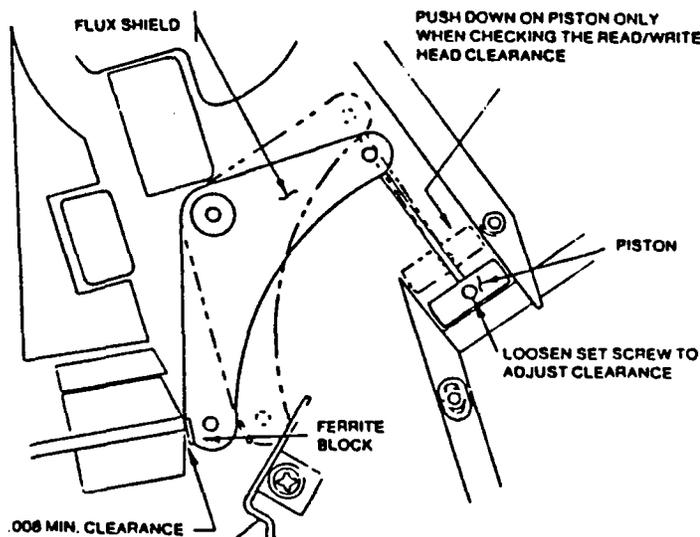


Figure 5-8. Ferrite Flux Shield Alignment

Loosen the set screw in the piston. Move the piston until it rests squarely against the piston stop, and tighten the set screw. Use care not to score the piston shaft. Do not overtighten the set screw, just snug is enough. Also guard against bending the shaft; the piston must slide easily.

#### 5.4.2A CROSSFEED SHIELD ADJUSTMENTS, FERRITE/COPPER ELEMENT

Because of the interrelationships between the crossfeed signal and the head azimuth and compensation, all of the other adjustments must be approximately correct in order to determine that the shield is set properly and the crossfeed is within limits. Likewise, once the crossfeed is minimized it may be advisable to recheck write/read and azimuth.

The full adjustment procedure will be required only if a head or crossfeed shield has been replaced. If only a check of crossfeed levels is needed, perform steps (7), (8), and (9) of paragraph 2.

##### 1. Shield to Head Spacing:

#### CAUTION

The read-write head can be made unusable by scratches if both the head and shim are not absolutely clean, or the shim is forced to slide while it is tight.

- (1) Place a 0.010 plastic shim over the face of the read-write head and secure the ends with masking tape. The shim will both protect the head from damage and establish the initial gap setting.
- (2) Loosen the two mounting screws for the crossfeed shield, press the body of the shield toward the head as far as possible and retighten the screws. Do not overtighten them.
- (3) Using a 1/16th-inch Allen wrench, adjust the stop screw so the shield almost touches the shim when it is held in the actuated position. Remove the masking tape and recheck the clearance. The shim should be a loose feeler gauge fit.

##### 2. Crossfeed Shield Vertical Adjustment, GCR

- (1) Set the crossfeed shield to the activated position and secure it by taping down the piston with masking tape. Close the vacuum column door.
- (2) Set up 9042 fci density by setting tester switches 1 and 5 to ON. Using a jumper (clip) lead, short test point WRT on the write board, J9, to ground. This forces write current on.
- (3) Using a short probe-ground clip, ground the scope to the read board, slot 11, at a point above TP9 (the outside lead of the top diode). Route the probe lead away from the write cables and float the scope from the AC outlet.

#### WARNING

Make sure the ground clip is secure on the board before floating the scope from the AC ground. Otherwise a ground fault in the scope could produce electrical shock.

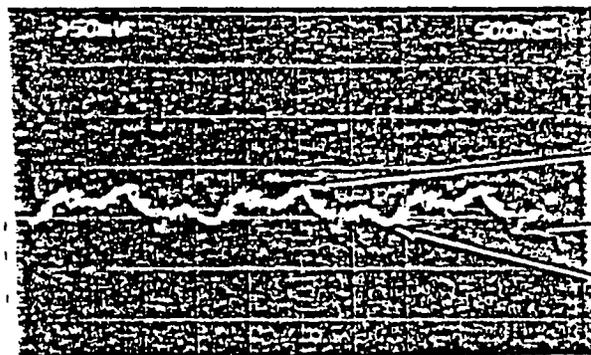
- (4) Scope the crossfeed on TP9 on the read board and adjust the scope vertical for maximum trace height. Use minimum bandwidth. Note the trace height, valley to peak, then scope TP1 and compare. Leave the scope on the track with the greater crossfeed.
- (5) Open the column door and remove the tape from the actuating piston. Loosen the shield mounting screws just enough to permit some vertical movement. While holding the shield in the actuated position and the shield body toward the head, slowly move the shield up and down until the crossfeed is minimized. Tighten the mounting screws while watching the scope to be sure the shield has not moved.
- (6) Remove the jumper from test point WRT and load an IBM Multi-Systems tape.
- (7) While writing forward at 9042 fci with built-in tester, scope TP1 on the read board and adjust the scope so the trace is 8 major divisions peak-to-valley. (Figure 5-9).



GCR SIGNAL  
8 major divisions,  
peak-to-valley

Figure 5-9. GCR Signal, Crossfeed Shield Adjustment

- (8) Stop tape motion (tester switch centered). Check the crossfeed level with the trace valley set to a convenient zero reference (Figure 5-9A). The maximum allowable crossfeed is 3 minor divisions, valley to peak.



GCR CROSSTALK  
Peak -- 3 minor divisions  
Noise -- ignore  
Valley on zero reference

Figure 5-9A. Crossfeed Signal

- (9) Repeat steps (7) and (8) for the remaining tracks, starting with TP9, then TP2 through 8.
- (10) If the crossfeed exceeds the allowable level, readjust the shield-to-head clearance. The minimum allowable is 0.008-in. (two 0.004-in. shims). Some vertical repositioning also may be needed.
- (11) Adjust the actuating piston flush with the top of its chamber, with the shield in its retracted position.

3. Crossfeed Shield Failure to Actuate:

NOTE

A gross increase in crossfeed levels when a tape is loaded indicates that the shield has not moved to the activated position.

- (1) Check the piston rod for straightness and the piston for binding. A bent rod may be straightened. Remove any foreign material from the sides of the piston and its chamber.
- (2) Because the clearances between crossfeed shield, deck plate and vacuum column cover are very small, binding may be due to a combination of manufacturing tolerances in the shield and deck plate rails, rather than an actual defect. Before rejecting a shield, try it on another drive.

5.4.3 TAPE CLEANER ALIGNMENT

The Tape Cleaner Alignment Gauge establishes the precise alignment required in the relationship of tape cleaner, read-write-erase head, and the tape guide center air bearing. It should be used to align these three components after any one of them is replaced or disturbed. *If the machine has a ferrite/copper crossfeed shield, only the gauge with a plastic insert can be used. This gauge has a notch to clear the shield.*

1. Loosen the tape cleaner assembly mounting screws.

CAUTION

Make sure the alignment gauge is clean, particularly the head contact area, and avoid rubbing the gauge on the head surface. Even minute scratches on the head surface will make it unusable.

2. Insert the gauge as shown in Figure 5-10.

NOTE

If the tape cleaner is the old style, with the blades mounted near the ends of the body, make this adjustment with two 0.004-in. plastic shims inserted between the cleaner blades and the gauge.

3. With the right hand hold the step in contact with the air bearing at the top, and the plastic insert on the body in contact with the head to the left. This will require pressing the gauge left at the bottom and right at the top (a clockwise pressure).

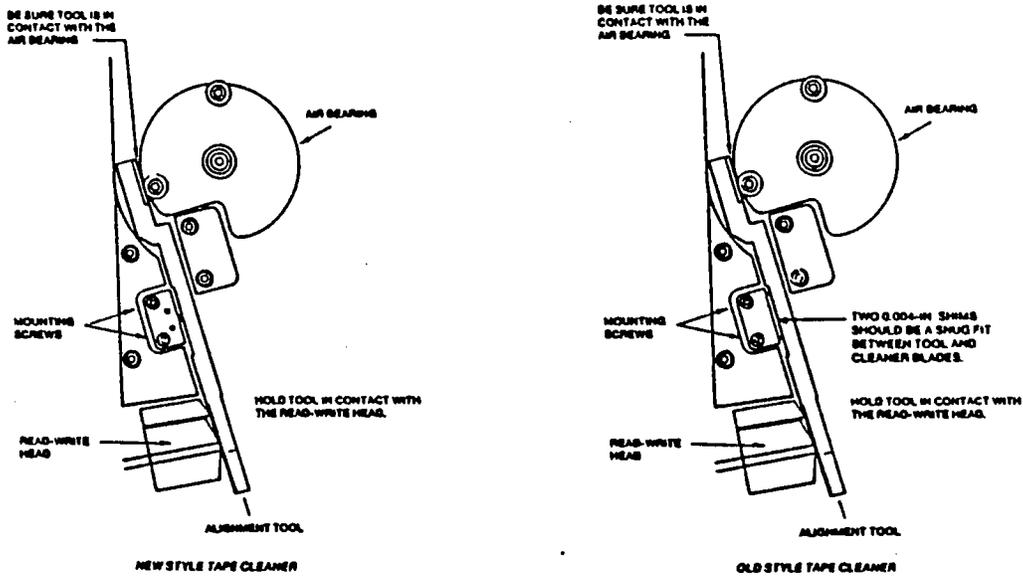


Figure 5-10. Tape Cleaner Adjustment

4. With the left hand move the tape cleaner assembly to the right against the gauge.
5. Without moving the gauge, hold the gauge and tape cleaner with the right hand. Tighten both screws on the tape cleaner before releasing. Remember the clockwise pressure on the gauge.
6. Withdraw the gauge.

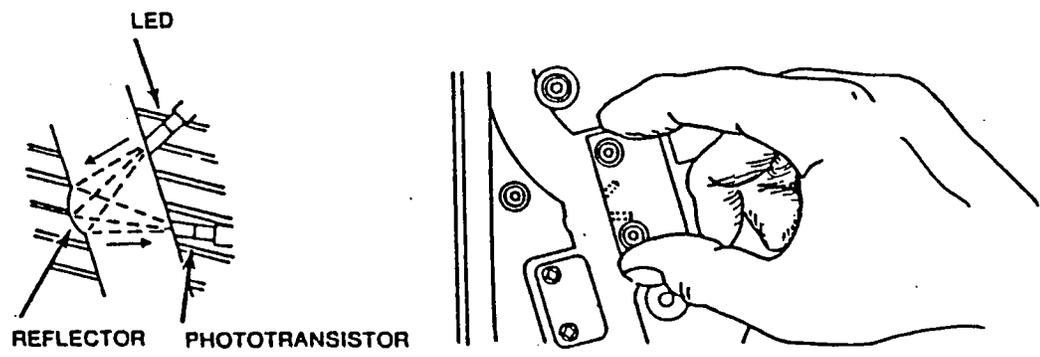


Figure 5-11. BOT-EOT Alignment

#### 5.4.4 BOT-EOT SENSOR ALIGNMENT

When either the BOT-EOT sensor or the file pocket loading block is replaced, the sensor must be aligned so that both phototransistors are centered in the beam from the tape-not-present reflector, Figure 5-11, before attempting to adjust the sensor output. Use the following procedure:

1. Before tightening any mounting screws, connect a scope to TP 1 and TP 2 on the Control Logic board, slot 5 and power up the drive.
2. With no tape present, move the sensor about until the scope indicates maximum output.
3. Tighten the mounting screws carefully, watching the scope to make sure the sensor alignment is maintained.
4. Perform the BOT-EOT adjustment in paragraph 5.3.3.

#### 5.4.5 CAPSTAN ALIGNMENT

1. Remove the loading block directly below the head (use a 3/32 inch Allen). Move the fixed pocket rail away from capstan.
2. Install the plastic column cover.
3. Load a scratch tape.
4. On the Control Logic board, slot 5, set the tester controls to GO and FWD and press the tester pushbutton. This moves tape forward.
5. Select FWD/REV and adjust the rate controls for about a half second go time between direction changes.
6. Using a flashlight, observe the capstan, tape, and lower tape guide through the opening provided by the removal of the loading block. Visualize the tape running on the capstan wheel as a flat belt runs on a flat pulley. The objective is to align the motor precisely so that the tape runs centered on the capstan wheel. These are minute changes within confines of the vacuum column; good lighting is essential.
7. Adjust the capstan alignment screws as necessary to correct the following:
  - Change in horizontal position of the tape on the capstan wheel with the direction of tape motion. Observe the hairline spacing between the tape edge and the vacuum column plate.
  - Buckling of the tape on either ceramic edge guide on the lower tape guide assembly, and buckling of the tape edge against the vacuum column plate, or vacuum column cover next to the capstan wheel.
  - Off-center of the tape on the pulling surface of the capstan wheel.
  - Spacing between the tape edge and the outer ceramic tape guide on the guide block assembly. The tape should run flush with the outer guide without buckling.

Use a 5/64 Allen to make this adjustment. Adjust the lower screw to remove the side to side motion of the tape as the tape changes to forward or reverse direction. Adjust the upper screw to position the tape in the vacuum column. Adjust the left screw to

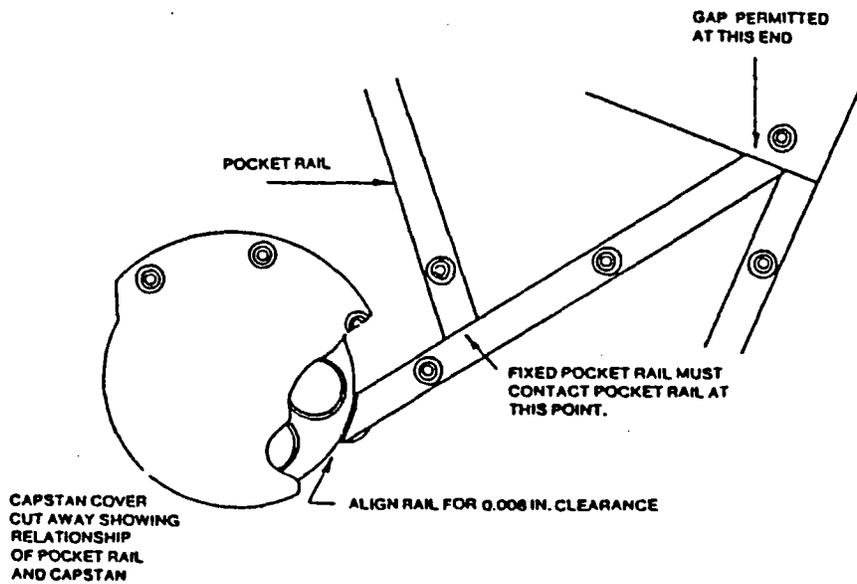
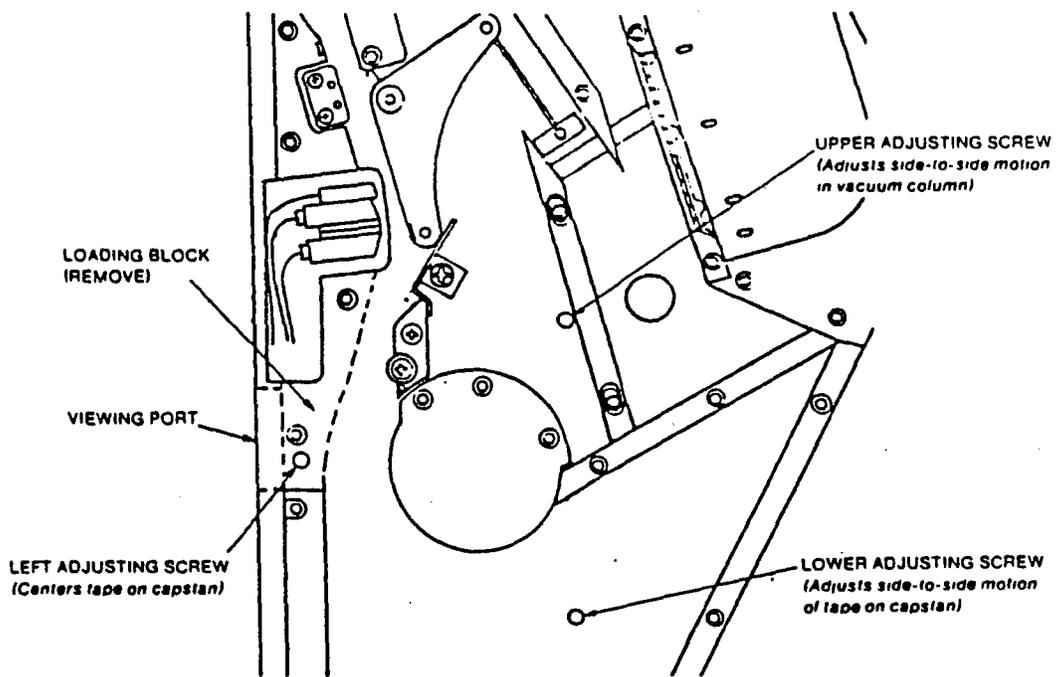


Figure 5-12. Capstan Alignment

center the tape on the capstan.

8. Loosen the outer ceramic tape guide and pull it clear of the edge.
9. Depress the rear, spring loaded ceramic guide, to clear the tape edge. Wedge the guide with a toothpick.
10. With both ceramic guides out of contact with the tape edge, fine tune the capstan alignment so that the tape maintains precisely the same path as with the guides in place and so that all of the conditions in step 7 are met. Restore both guides to normal.
11. Unload the tape, remove the plastic column cover. Adjust the fixed pocket rail clearance as follows:
  - a. Hold the rail to prevent its touching the capstan, loosen the mounting screws and press the rail as far as possible to the right. Tighten the screws just enough to hold the rail in position.
  - b. Slip a 0.010 in. plastic shim between the capstan and the end of the rail and up under the capstan cover. Wrap the shim around the capstan.
  - c. Loosen the rail mounting screws sufficiently to permit moving the rail, then move it to the left until it contacts the shim. Use sufficient upward pressure to make good contact with the pocket plenum rail.
  - d. Tighten the rail mounting screws and remove the shim.
  - e. Insert two 0.004 in. shims between the capstan and the rail. They should be a loose feeler gauge fit.
12. Install the plastic cover and check the capstan alignment after adjusting the rail. Minor adjustment may be necessary.
13. Remove the plastic cover and close the column cover.
14. Reload the tape and observe the tracking again.
15. Reinstall the loading block.
16. Check read head azimuth adjustment. Refer to Paragraph 5.4.1.

#### 5.4.6 REEL TACHOMETER ALIGNMENT

The Reel Tachometer Alignment Gauge establishes the proper position of the reel tachometer roller assembly with respect to the vacuum column plate. The gauge is a 0.002 inch step in a steel bar.

1. Hold the gauge against the plate as shown in Figure 5-13 so that the cut in the gauge overlaps the step on the roller. Do not measure to the roller flange.
2. Move the gauge away from and then toward the roller. The roller step should not be felt.
3. Turn the gauge on edge, part number out, and reinsert it. The step then should be felt when the gauge is withdrawn.
4. Use any combination of shims to achieve dimensions. Color-coded shims are available in 0.001, 0.002, 0.004 and 0.075 inch thickness. (See parts list, page 6-16 for part numbers of shims.)

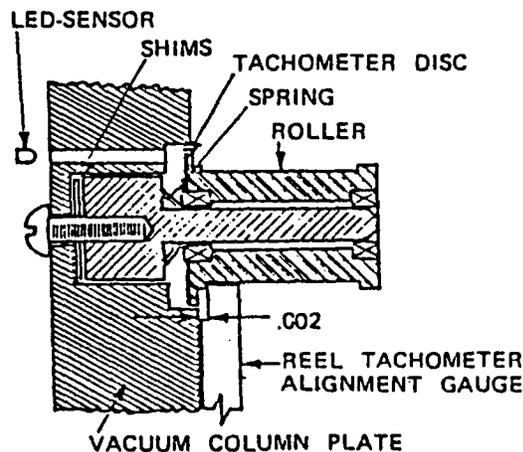


Figure 5-13. Reel Tachometer Alignment

#### 5.4.7 REEL TACHOMETER SENSOR ALIGNMENT (PWB D91C71806 and later)

The following procedure should be used whenever a new sensor is installed. It may be used also if a poor tachometer signal is causing problems such as loopouts and tape bottoming.

1. Connect the scope to TP 1 on the sensor board and set it up for DC coupling, 1V/div and the slowest sweep available (usually, about 5 sec/div).
2. Open the column door and turn the tachometer roller by hand. Verify that a signal appears on the scope, then set the range for maximum signal display, keeping all the trace within the grid. Note that the signal swing is negative.
3. Power off, replace the Control Logic board in slot 5 with the Switch Board, then power on and mount a scratch tape.
4. Turn on the VACUUM switch, the DIVERTER VALVE switch, then the THREAD switch. As the drive threads, the tachometer roller will turn and the signal will appear on the scope. The drive will continue to run forward slowly.

5. Adjust the scope sweep and sweep variable control so that more than 10 cycles of signal are visible and the "once-around" amplitude variation is stable.
6. Adjust the potentiometer R9 to set the shortest pulse in the display to  $6.0 \pm 1$  -0 volts peak-to-peak. See Figure 5-14. Slight clipping of the longest pulses is acceptable and may be ignored.

**NOTE:**

If the signal voltage is either above or below the adjustment range of R9, loosen the sensor mounting screws slightly and carefully attempt to rotate the sensor to improve the output level. If an adequate improvement can be made, tighten the screws and repeat the adjustment. If the signal remains low or one or more pulses is significantly weak, replace the tachometer roller.

7. Check the zero offset of the signal. If it is greater than 0.5 volt, replace the tachometer roller or the sensor.
8. Restore the drive to normal, load a scratch tape and spool forward 500 to 1000 feet. Enter rewind and verify normal operation.

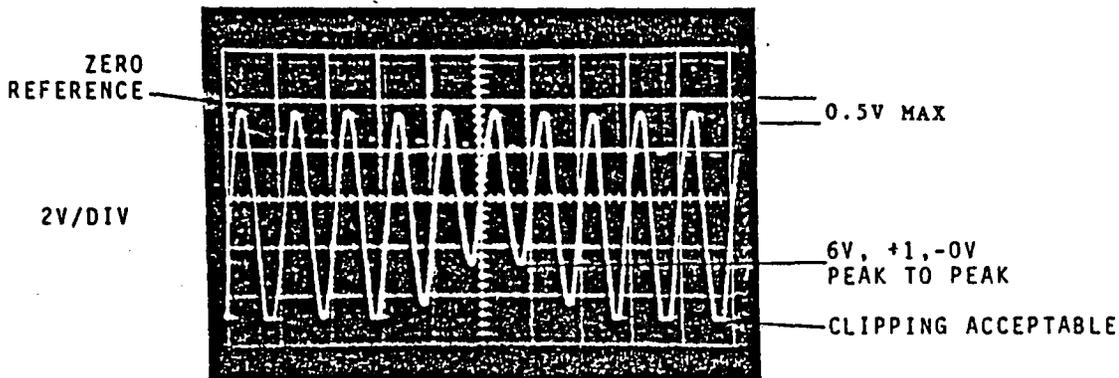


Figure 5-14. Reel Tachometer Sensor Output

## 5.5 PNEUMATIC SYSTEM ADJUSTMENTS

### 5.5.1 BELT REPLACEMENT AND/OR TENSION ADJUSTMENT

1. Turn machine power off.
2. Remove the pneumatic supply safety shield.
3. FOR BELT REPLACEMENT: Loosen the blower mounting screws and slide blower towards the motor; remove old belt and install new belt. (To replace vacuum belt it will be necessary to remove pressure belt.)

**CAUTION:** Do not install belt by rolling it onto rigidly-spaced pulleys. Always loosen the blower mounting screws and fit belt over pulleys without twisting it. A properly installed belt will have the belt "V" seated in the pulley "V".

4. FOR BELT ADJUSTMENT: Loosen blower mounting screws and move blower along mounting slots away from the motor to increase belt tension. Tighten blower mounting screws just enough to hold belt in tension for measurement.
5. Place tensiometer on belt as shown in Figure 5-10
6. Pull button around the top circumference of the tensiometer (View 2)
7. When the right tab of the tensiometer just touches the top of the belt (View 3A), read the belt tension in pounds on the scale at the left edge of the spring (view 3B). Tension for a new belt should read 20-22 pounds. Tension for a belt that has been installed for more than 24 hours should be no less than 15 pounds. Adjust tension as necessary and tighten screws firmly.
8. Repeat steps 4 through 7 to set the correct tension on the second belt.
9. Replace the safety shield.

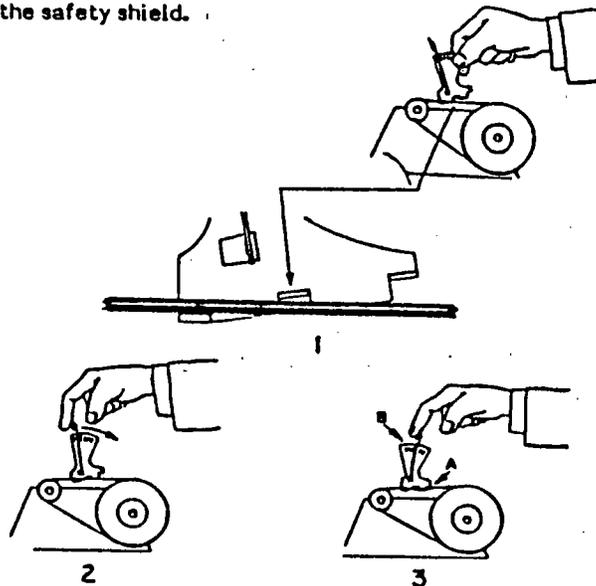


Figure 5-15. Belt Tensiometer

6. Repeat for the other belt.

7. Replace the cover.

### 5.5.2 PNEUMATIC ADJUSTMENTS

The pneumatic system is adjusted at the factory to thread and load several brands and types of tape. Under normal circumstances, these adjustments should not change; threading difficulties usually are due to other problems such as low system pressures, leaks, clogged orifices, static charges due to low humidity, or a tape end not rounded off.

Listed below are the critical system pressures and points of measurement. If any pressure is out of limits, look for leaks or obstructions and correct them, before attempting an adjustment. The pressures given are for a machine at operating temperature (after approximately 20 minutes running). Refer to Figures 5-15 and 5-16 and system diagram 92D20603.

| <i>Pressure and Test Point</i>                            | <i>Control</i>      | <i>Pressure Range Inches of Water</i> |
|---|---------------------|---------------------------------------|
| System Pressure at Diverter Valve Inlet (Pneu-latch port) | No adjustment       | 49 minimum                            |
| System Vacuum at Tape Cleaner Port                        | Vacuum blower bleed | 25 to 28                              |
| Peel Jet  | V9                  | 15 to 17*<br>12 to 18                 |
| File Reel Loading Block                                   | V12                 | 24 to 27*<br>20 to 28                 |
| File Reel Autoload Shoe                                   | V10                 | 10 to 12*<br>7.5 to 8.5               |
| Center Air Bearing Jet                                    | Affected by V12     | 24 to 27*<br>19 to 27                 |
| Lower Left Loading Block                                  | V2                  | 11 to 13*<br>4 to 5                   |
| Cartridge Air (cartridge mounted and open)                | No adjustment       | 16 to 30*<br>19 to 25                 |
| Pneu-latch Plenum   | No adjustment       | 49 minimum                            |

\*After installation of OKS 49 (6253), 19 (6256), 10 (6257)

#### NOTE

System pressures will be on the low side of tolerance at altitudes near 3500 feet. Above 3500 feet, a different blower drive pulley and belts (high altitude kit) are required.

If system pressures are low, check the pressure inlet filter, the condition and tension of the blower drive belts and the hoses and fittings for leaks. Make sure the blower motor is rotating clockwise, viewed from the driving end. The blowers will function in either

(continued on Page 5-28)

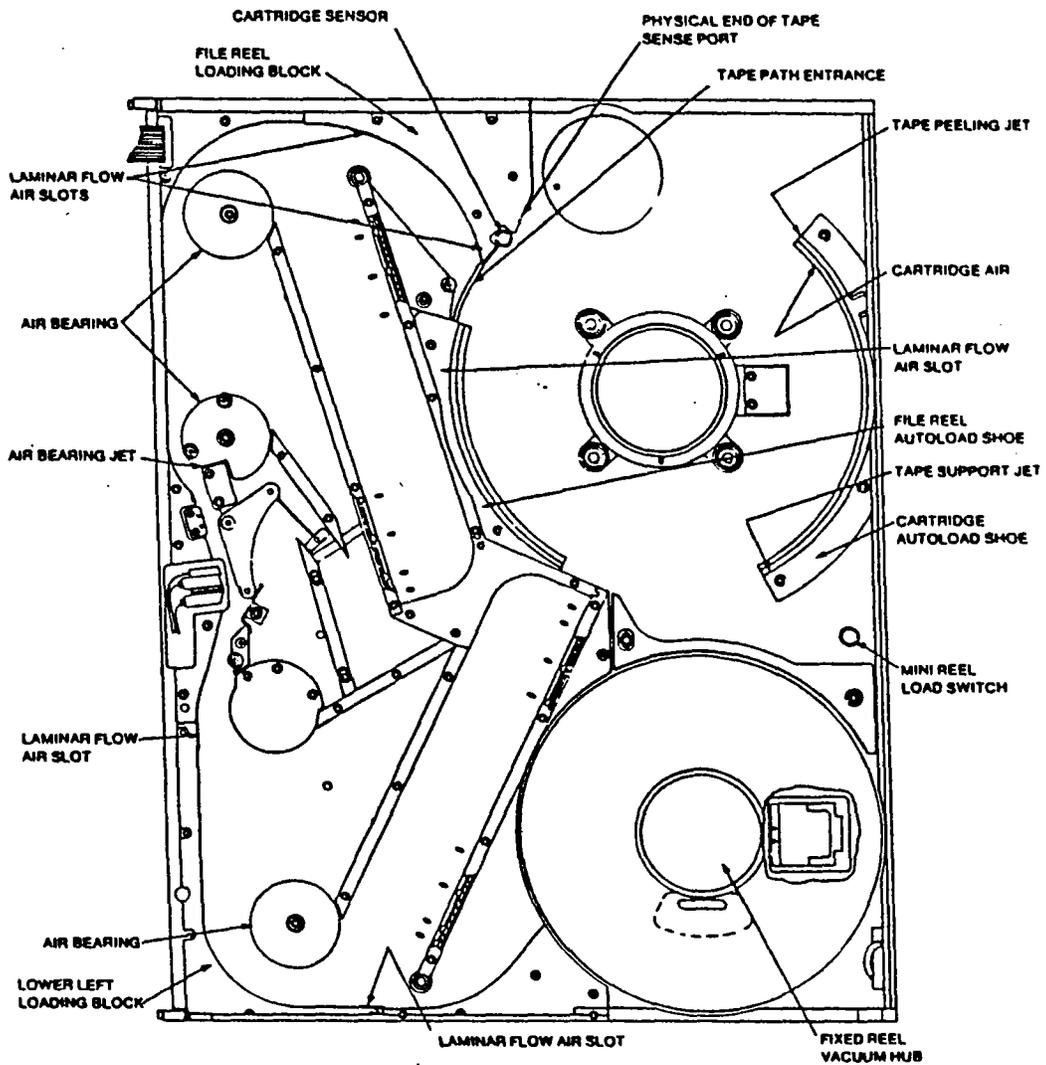


Figure 5-16. Pneumatic Components (Sheet 1 of 2)

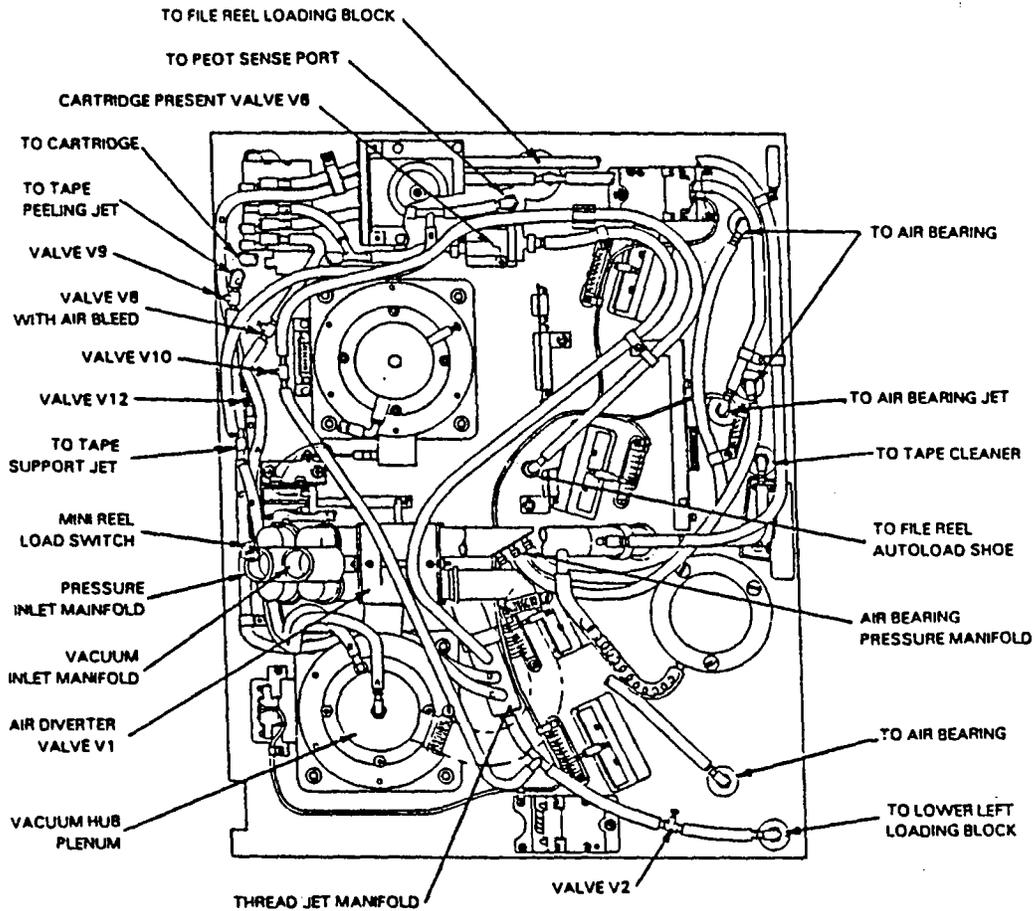


Figure 5-16. Pneumatic Components (Sheet 2 of 2)

Changed 15 Oct 1982  
6253-470B

direction, but incorrect rotation will reduce output about 30%. Pressure at an individual point that is below tolerance indicates a leak, while pressure above tolerance indicates an obstruction, probably foreign matter in an orifice.

The system vacuum can be adjusted by moving a vane on the vacuum blower case to cover or uncover bleed holes in the case.

Once any out-of-tolerance pressure has been corrected, install the transparent vacuum column cover and load a tape, preferably a BASF low-pack (9 1/4-inch diameter), observing the tape behavior as it threads. The tape should lift off the reel, momentarily touch the PEOT sense port, then move smoothly through the tape path entrance, down the left side to the lower left loading block and onto the vacuum hub of the fixed reel. If necessary, use the control valves to fine-tune the autothread sequence, as follows:

1. If the tape buckles at the tape path entrance, slightly increase the peel jet air (V9). If it dives into the entrance, missing the PEOT sense port, reduce the peel jet air. Make the adjustments in no more than 1/8-turn increments. (As long as the autoloader shoe pressure is within tolerance, adjusting V10 will have little effect on loading).
2. To minimize flutter and bowing in the upper tape path, reduce air flow from the file reel loading block (V12).
3. Adjust the air flow from the lower left loading block (V2) to minimize tape bulge. When the flow is correct, the tape will be suspended nearly in a straight line across the bottom and only the end of the tape will be lifted onto the file reel hub. Excessive pressure, will cause the tape to fold onto the vacuum hub.

If a fixed reel motor or hub has been replaced, connect the gauge to the hub vacuum switch, S1, hose and check the hub vacuum by alternately wrapping and unwrapping a few layers of tape on the file reel. The vacuum should be at least 20 inches with tape wrapped on the hub and 10 inches or less with no tape on the hub. If necessary, adjust valve V8 so these pressures are balanced around the switch actuation pressure of 15 inches.

## 5.6 REMOVAL and REPLACEMENT PROCEDURES

### 5.6.1 CAPSTAN REMOVAL AND REPLACEMENT

1. Remove the tachometer leads from the rear of capstan assembly.
2. Remove the fixed pocket rail located to the right of the capstan. (Figure 5-12). Use 3/32 inch Allen.

#### CAUTION

Use extreme care - do not touch or bump the capstan wheel. Do not adjust or remove the three capstan alignment screws accessible from the front of the tape unit.

3. Remove the vacuum hose, then the three mounting screws and springs. Viewed from rear of tape drive, remove the mounting screws in the following sequence: (1) Lower left (2) Upper left (3) Upper right.

#### CAUTION

Hold the capstan motor in one hand, making sure it does not slip as capstan wheel damage could result.

4. Once the motor is removed disconnect the two capstan power leads.

To install the capstan, proceed as follows:

5. Replace capstan power leads, observing polarity: white lead to positive terminal, black lead to negative terminal.
6. Replace capstan and secure to back of front deck with the three mounting screws and springs. Make sure that the shoulders on the mounting screws pass through the mounting bracket. Tighten finger-tight.
7. Using a common screwdriver, firmly tighten each screw against the tape deck.
8. Replace tachometer leads, observing polarity: white lead to positive terminal, black lead to negative terminal. Replace vacuum hose.
9. Replace fixed pocket rail, making sure it does not contact the capstan wheel.
10. Perform capstan mechanical alignment. Refer to Paragraph 5.4.5.

#### 5.8.2 READ-WRITE HEAD REMOVAL AND REPLACEMENT

1. Unplug read-write head cables from their circuit board connectors.
2. Loosen the azimuth adjust bushing set screw. Use .050 inch Allen.
3. Remove the two Phillips mounting screws.
4. Remove head assembly. Refer to Figure 5-17. The azimuth adjust screw, bushing, and spring washer remain on the deck plate. If the screw or bushing are moved, adjust them as follows. Otherwise, go to step 9.

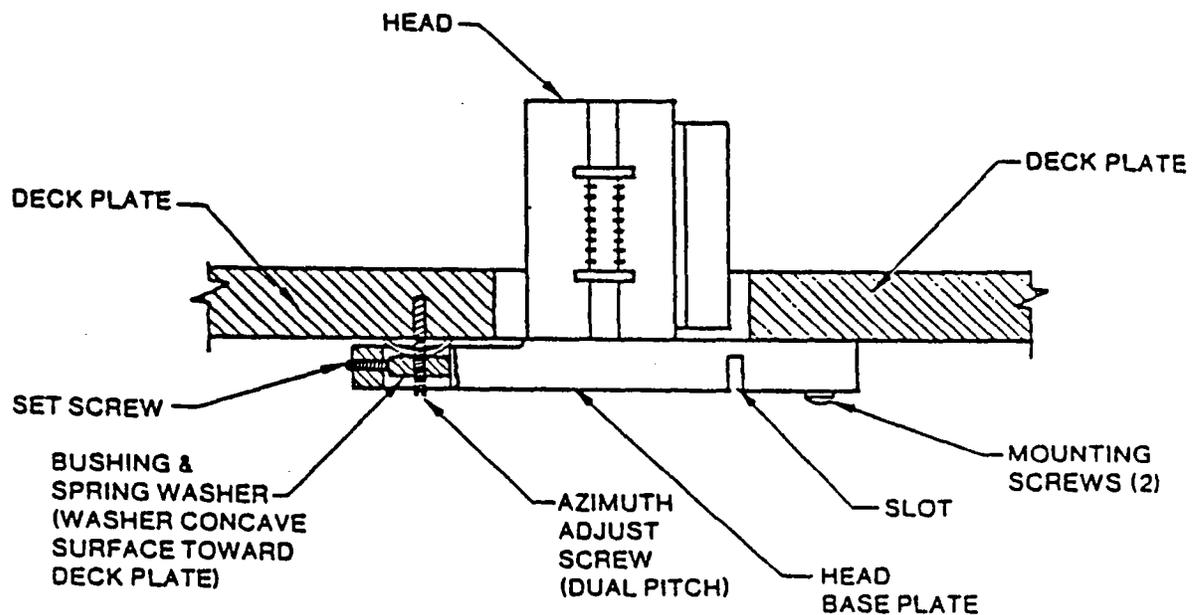


Figure 5-17. Read-Write Head

5. Screw the differential screw into the deck plate until the threads just disappear (Use 5/64 inch Allen).
6. Slip the spring washer over the screw, *concave side toward the deck plate*.
7. Hold the differential screw to keep it from turning in the deck plate, and screw the bushing on until it is snug against the spring washer.
8. Turn the bushing an additional 1/2 turn clockwise to compress the washer slightly.
9. Replace head assembly.
10. Replace the two Phillips mounting screws.
11. Plug in read-write cables to their respective connectors.
12. Perform the tape cleaner alignment, Paragraph 5.4.3 and then the read head azimuth alignment, Paragraph 5.4.1. Before aligning the tape cleaner, be sure the center air bearing is positioned correctly.

### 5.6.3 PNEUMATIC LATCH REMOVAL AND REPLACEMENT

1. Remove the three retaining screws from the hub cover and remove the cover.
2. Remove the six retaining screws and the center nut from the cam cover and remove the cover.
3. Back out the three collet plate screws sufficiently to expose their heads, then tap each screw head lightly to loosen the collet plate.
4. Pull the hub off the motor shaft. If the hub has seized on the shaft, remove the plenum on the back of the motor and while holding the exposed shaft with pliers, twist the hub to free it.

### CAUTION

Make sure the motor shaft and the bore of the hub collet are clean and oil-free. If necessary, clean the motor shaft with crocus cloth or Scotchbrite, then wipe it with a cloth moistened with tape path cleaner.

5. Before installing the latch assembly, make certain the return spring assembly and its friction retainer ring are completely seated in the hub.

### NOTE

If a replacement hub is being installed, make sure it has the improved collet plate, with a radius in the large end of the bore. Do not, however, use new style collet plate on a hub that was previously installed with the old plate.

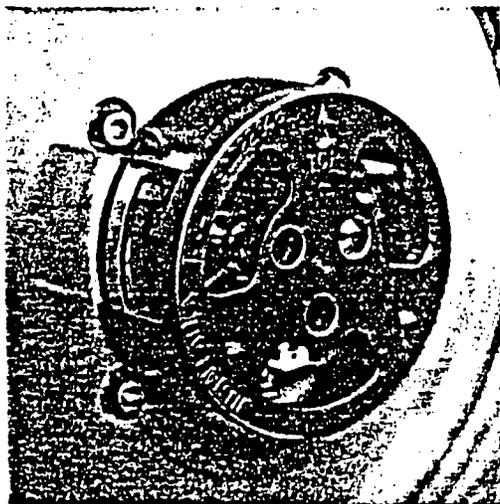


Figure 5-18. Pneu-Latch Installation

6. Remove the six retaining screws from the cam cover, then remove the center nut and the cover, if installed.
7. Attach the pneumatic latch installation tool, A91D22648-01, to the hub using the three captive screws in the tool.

#### CAUTION

Tighten the screws just enough to secure the tool to the hub. Overtightening can damage the threaded inserts in the hub.

8. Rotate the tool so that it will not interfere with the write enable photosensor and push it toward the deck plate until the four feet on the tool contact the surface of the deck plate (not overlay) where it is exposed at the four reel motor mounting bolts. Refer to Figure 5-18.
9. Torque the three collet screws sequentially in 2 inch-pound increments, beginning at the 2 inch-pound setting, until each screw is torqued to 25 inch-pounds.
10. Remove the installation tool.
11. Orient any one of the flats on the hex nut in the center of the hub perpendicular to the white line on the hub. This insures that the hex nut can accept the mating hex socket in the cam cover.
12. Replace the cam cover, tightening the six attaching screws to 2 inch-pounds torque.
13. Replace the outer cover. Do not overtighten the attaching screws.

#### 5.6.4 FIXED REEL HUB REMOVAL AND REPLACEMENT

1. Unscrew the hub cover.
2. Remove three socket head screws from the hub and remove the hub and flanges.
3. Back out the exposed socket head screws in the collet about 1/4 inch.
4. Tap these screws toward the motor to separate the collet and collet plate.
5. Pull these remaining parts off the motor shaft.
6. To install the hub, loosely assemble the collet and collet plate with three one-inch screws.
7. Put the assembled collet and plate in the recess in the FIXED REEL side of the collet alignment tool and attach it with one of the hub attaching screws, pulled down finger tight.
8. Press the tool and collet on the motor shaft until the feet on the tool contact the exposed deck plate near the motor mounting screws. Refer to Figure 5-19.
9. Hold the collet and alignment tool in this position and tighten the three collet screws sequentially in 2 inch-pound increments until each screw is torqued to 25 inch-pounds.
10. Remove the alignment tool and reassemble the reel hub, flanges, and cover.

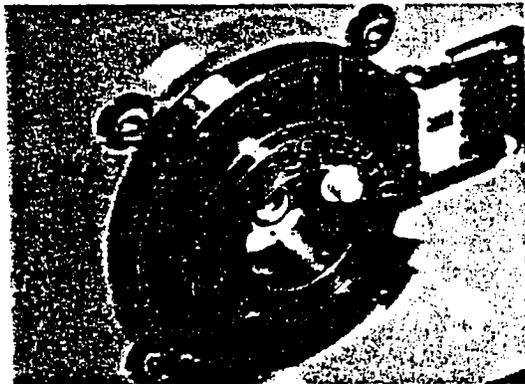


Figure 5-19. Fixed Reel Collet Installation

#### 5.6.5 CARTRIDGE OPENER ASSEMBLY REPLACEMENT AND ADJUSTMENT

This procedure applies to cartridge opener assemblies with slotted mounting holes that permit it to be rotated so the actuating pin position in the slot on the cartridge can be adjusted.

##### Removal:

1. Manually rotate the cartridge opener disk to position the setscrews for access, loosen the setscrews and pull the disk off the shaft.
2. Disconnect the cable at the backplane.

3. Remove the three mounting screws that attach the opener to the deck plate standoffs and remove the opener.

#### Installation:

1. Position the cartridge opener assembly on the deck plate standoffs and install the three mounting screws. Rotate the switch actuator pin to the 12 o'clock position.
2. Install the opener disk on the shaft. The flat on the shaft will be horizontal and the cartridge actuator pin at approximately the 2 o'clock position.
3. Tighten the opener disk setscrew that is in line with the switch actuator, wiggling the disk as you do so to make sure the screw is seated on the flat of the shaft.
4. If necessary, rotate the opener disk for access to the remaining setscrew and tighten it. Connect the cable to the backplane connector.

#### Adjustment:

1. Rotate the opener disk fully counterclockwise and mount a reel with a cartridge.
2. Loosen the cartridge opener mounting screws and rotate the cartridge opener baseplate to center the actuator pin in its mating slot in the cartridge. Tighten the mounting screws.
3. Power up and load several tapes in cartridges to verify the adjustment. If the cartridges do not open or close completely, loosen the opener mounting screws and readjust the actuating pin position as necessary.

#### **5.6.8 REEL MOTOR REPLACEMENT**

Because the reel motors weigh nearly 25 pounds each, it is important that all preliminary steps have been completed before the mounting screws are removed. This allows both hands to be free to remove the motor from the tape drive and set it down. Whenever possible, two people should perform the removal and replacement of the mounting screws, one in front installing and tightening the screws and the other in the back, holding the motor.

#### Removal:

1. Mark all the wire positions on the terminal block cover, then disconnect all of the wires to the terminal block.
2. Cut the tie wraps holding the capstan wires to the card cage. Remove the PWBA's from the card cage and remove the card cage from the unit. Remove the pneumatic plenum and the cooling air hose from the back of the motor. The hoses need not be disconnected from the plenum.

#### NOTE

If a file reel motor is being changed, remove the write enable sensor to provide additional clearance between the motor base and the pins on the backplane.

3. Remove the pneumatic reel latch and hub (Paragraph 5.6.3 and 5.6.4).

### CAUTION

Be prepared to support the full weight of the motor while the last mounting screw is being removed. Be sure the motor is cool enough to handle.

4. Using a 1/4-inch hex bit or Allen wrench, remove the four screws that attach the motor mounting spacer to the deck plate.
5. Pull the motor and adapter straight back to clear the deck-mounted components, then remove it.
6. Place the motor and spacer on a convenient horizontal surface and remove the spacer.

#### Installation:

1. Install the spacer on the motor mounting flange.

### CAUTION

Be sure there are no wires or hoses caught between the spacer and the deck plate.

2. Carefully position the motor on the deck plate with the cooling air duct correctly oriented.
3. Install one mounting screw tight enough to hold the weight of the motor while permitting it to be rotated to align the remaining screws.
4. Install the three remaining screws. Tighten all four completely.
5. Replace the reel hub (Paragraph 5.6.3 or 5.6.4).
6. Install the pneumatic plenum and cooling air hose. Replace the write-enable sensor if it was removed. Insert the PWBA's and install the card cage.
7. Connect the motor leads at the terminal block and tie wrap the leads.
8. Perform the reel preamp and reel servo adjustments in Paragraphs 5.3.4 and 5.3.5. If a fixed reel motor was replaced, check the hub vacuum switch setting (Paragraph 5.5.2).

#### 5.6.7 DIVERTER VALVE SOLENOID REPLACEMENT

##### Removal

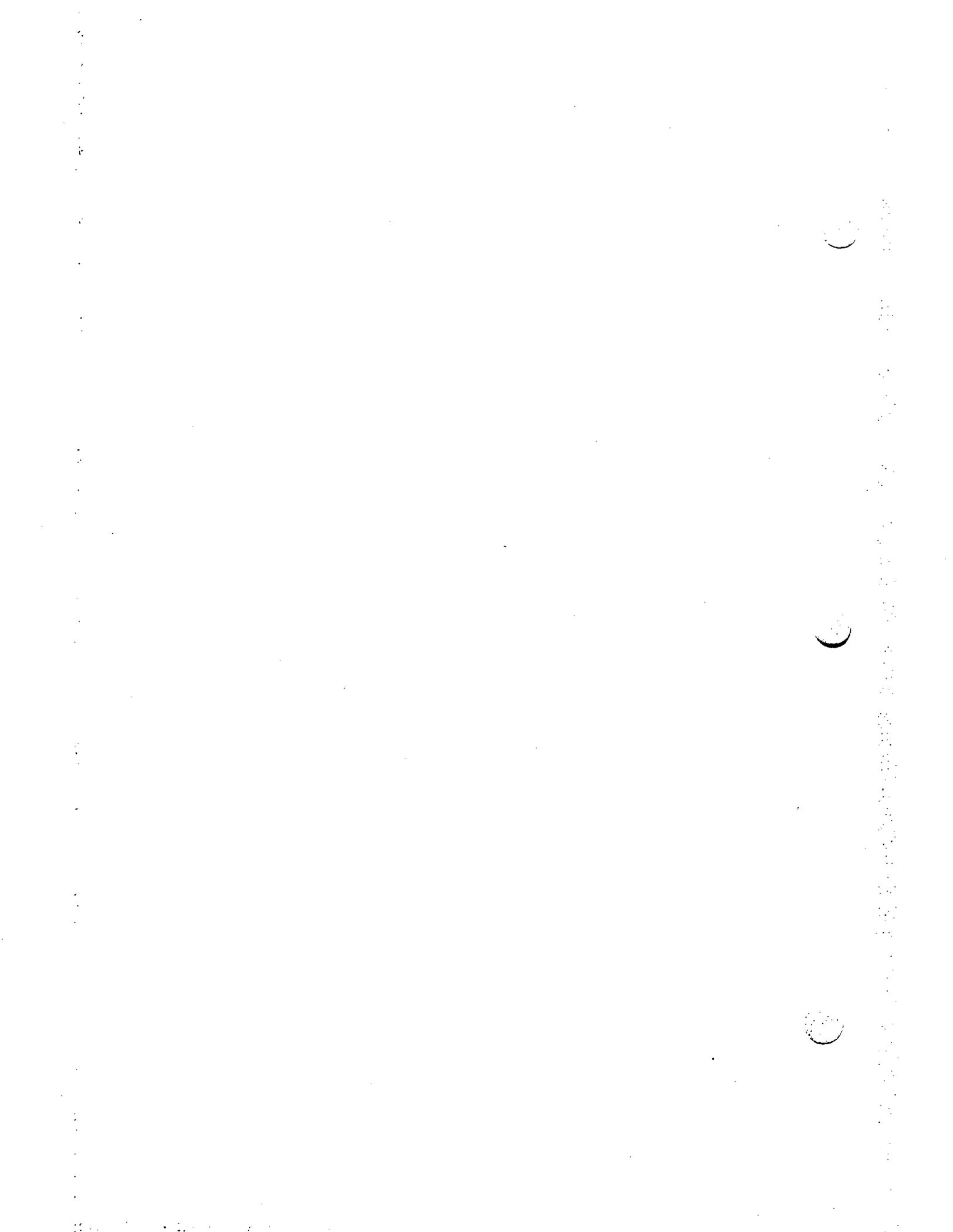
1. Disconnect the power leads at the solenoid and remove the attaching screws from the solenoid body.
2. Disconnect the link from the diverter valve actuating pins one at a time. Do not remove the actuating pins or the return spring.
3. Press out the spring pin connecting the link to the solenoid armature.

**Installation:**

1. Assemble the solenoid and link.
2. Connect the link to the valve actuator pins by passing them one at a time through the hole in the link.
3. Mount the solenoid body on its bracket, leaving the screws loose enough to move the solenoid back and forth. Connect the power leads.

**Adjustment:**

1. Manually compress the solenoid armature until it bottoms and hold it.
2. Slide the solenoid away from the diverter valve until the valve is completely actuated and the actuator pins are slightly bowed.
3. While holding the solenoid armature bottomed on the actuator pins slightly bowed, tighten the mounting screws.



TEST NAME: IO.TAPE.GCR

REVISION: 2.5

FUNCTION: Testing of the following controllers and tape units:

Controller/ID            Tape Drive 2023/'314            TELEX

TESTING:            Testing can be performed for a controller or up to eight tape drives. All PIO, controller registers, and drive functions are exercised. No controller testing is performed in a PRIMOS environment.

LOCAL SENSE SWITCHES: INIT, SOFT, CKRD

INIT - If SET, controller is initialized whenever errors are detected. By default, INIT is RESET.

SOFT - If SET, error recovery results from soft media errors are displayed. By default, SOFT is RESET.

CKRD - If SET, the data read is compared against that written. Otherwise, the buffers are not compared. By default, CKRD is SET.

OPERATION:        If the monitor sense switch OPER (Allow Operator Intervention) is RESET, the diagnostic is skipped.

When the monitor sense switch OPER is SET, the diagnostic asks the user if default testing is desired. If so, the diagnostic finds and tests all available tape drives and controllers. By not selecting default testing, the user can specify the tape units, model controllers, densities, tracks, data patterns, record lengths, number of retries, and pass length. The user is prompted for each option; entering CARRIAGE RETURN always results in a default value being used.

To change an option which has already been entered, continue to answer queries until the diagnostic asks if any more drives are to be configured. At that point, re-enter the number of the drive whose testing options are to be changed, and enter the new option value when prompted.

Answering 'Q' to any query aborts the diagnostic.

**RUNTIME:** The runtime varies with the record size, controller model, and pass length. For a default record size, model 2047 controller, and stand-alone environment, the pass length runtimes are listed below.

Short Pass - 03 min.  
Medium Pass - 08 min.  
Long Pass - 21 min.

**ASSUMPTIONS:** Correct CPU, DMA, DMC operation. Executes under SAM or PAM.

**RESTRICTIONS:** If the ATS diagnostic tape is loaded and IO.TAPE.GCR is executed against that drive, the ATS diagnostics will be overwritten. Under PRIMOS, one must ASSIGN drives to be tested before invoking the diagnostic monitor PAM.

THE FOLLOWING IS A EXAMPLE OF HOW TO RUN IO.TAPE.GCR FROM PAM .

OK. R PAM

PAM Rev. 10.1 Copyright (c) Prime Computer, Inc. 1985  
Enter 'LOAD;RUN' for Default Execution

PAM> LOAD IO.TAPE.GCR  
0014 Building directory  
0000 Loading IO.TAPE.GCR.SEG

PAM> RUN  
0030 Executing IO.TAPE.GCR Rev 2.5  
TAPES MUST BE ASSIGNED UNDER PRIMOS  
USE 'ASSIGN MTx' PRIOR TO INVOKING PAM

DEFAULT CONFIGURATION [Y(CR) OR N]?  
DO YOU WISH TO OVERWRITE TAPE 0 [Y(CR) OR N]?

| DRIVE# | MODEL | DENSITY | TRK | PATTERN | REC. SIZE | RECOVER |
|--------|-------|---------|-----|---------|-----------|---------|
| 0      | 2023  | 1600    | 9   | 052525  | 00512     | YES     |

Case 00012: SELECT, REWIND STATUS  
Case 00013: REWINDING STATUS  
Case 00014: COMMAND REJECT STATUS  
Case 00015: WRITE FILEMARK STATUS  
Case 00016: SPACING FILE FILEMARK STATUS  
Case 00017: SPACING RECORD FILEMARK STATUS  
Case 00018: READ RECORD FILEMARK STATUS  
Case 00019: ERASE GAP OPERATION  
Case 00020: WRITE A RECORD  
Case 00021: READ A RECORD  
Case 00022: WRITE, ERASE, READ OPERATIONS  
Case 00023: INSUFFICIENT DMX RANGE  
Case 00026: MODE CHANGE AND BUFFER ALIGNMENT  
Case 00028: WRITE RECORDS  
Case 00029: READ RECORDS  
Case 00030: READ REVERSE RECORDS  
Case 00031: FILEMARK SPACING OVER RECORDS  
Case 00032: TAPE TRANSPORT EXERCISER  
Case 00033: SET/RESET ALTERNATE CHANNEL MODE  
Case 00034: ERASE VARIABLE GAP  
Case 00035: DIAGNOSTIC MODE SET COMMAND  
Case 00036: REJECT, NOP, AND CLEAR COMMANDS  
Case 00037: SENSE, TAPE-UNIT-SENSE COMMANDS  
Case 00038: TRACK IN ERROR  
Case 00039: DEAD TRACK  
Case 00040: REPEAT USER OPERATION  
Case 00041: FILE PROTECT  
Case 00042: REWIND-UNLOAD

PAM> quit

.....USING DTS.....

DTS RESIDES ON TAPE OR DISK IN THE 'DIAG' UFD. WHEN DISK IS USED, THE 'DIAG' UFD RESIDES IN THE MFD OF THE SYSTEM DISK, I.E., THE PATHNAME IS MFD:DIAG. WHEN TAPE IS USED, THE DTS TAPE CONTAINS SAM.SAVE AND DIAG AS THE FIRST TWO ITEMS ON THE TAPE.

.....TO BOOT DTS FROM DISK (PRIMOS PRE-REV.20).....

1). POWER UP THE MACHINE AND THE DESIRED DISK, LOADING THE SELECTED DISK. ASSERT, MASTER CLEAR, ON THE CPU.

2). BOOT PRIMOS II -ENTER, BOOT 10114, FOR EXAMPLE.

3). ATTACH TO THE 'DIAG' UFD -ENTER, 'A DIAG'.

4). RESUME HBOOT -ENTER, 'R HBOOT'. HBOOT WILL PROMPT FOR THE PHYSICAL DISK DEVICE. ENTER THE SAME NUMBER AS IS USED FOR PRIMOS II.

.....TO BOOT DTS FROM DISK (PRIMOS REV.20 OR LATER).....

1). POWER UP THE MACHINE AND DESIRED DISK, LOADING THE SELECTED DISK. ASSERT, MASTER CLEAR, ON THE CPU.

2). BOOT THE NEW SYSTEM BOOT WITH THE SENSE SWITCHES SET TO FORCE BOOT TO ASK FOR A FILE NAME (BOOT 10114). WHEN PROMPTED, ENTER 'DIAG,SAM.SAVE'. ONE CAN ALSO USE BOOT 11114 TO BOOT WITH MACHINE-CHECKS DISABLED.

.....TO BOOT DTS FROM TAPE.....

1). POWER UP THE MACHINE AND TAPE UNIT ZERO. THIS TAPE UNIT SHOULD BE ATTACHED TO THE CONTROLLER AT ADDRESS '14'. ASSERT, MASTER CLEAR, ON THE CPU. SAM.SAVE SHOULD BE THE FIRST FILE ON THE TAPE, FOLLOWED BY THE 'DIAG UFD.

2). BOOT SAM.SAVE -ENTER, BOOT 1006. THIS WILL BOOT SAM ON ALL REVISIONS OF PRIMOS. FOR PRIMOS REV. 20 OR LATER, IT WILL INITIALLY DISABLE MACHINE-CHECKS. ON PRE-REV. 20 TAPES, BOOT 5, WILL RESULT IN THE USER BEING ASKED TO ENTER A TREENAME. ON REVISION 20 TAPES, BOOT 5, WILL BOOT WITH MACHINE-CHECKS ENABLED.

.....TO USE DTS UNDER PRIMOS (REV.19 OR LATER).....

1). ATTACH TO 'DIAG' UFD -ENTER, 'A DIAG'.

2). RESUME PAM -ENTER, 'R PAM'. THE PRIMOS DIAGNOSTIC MONITOR WILL IMMEDIATELY EXECUTE. ONCE THE DIAGNOSTIC MONITOR (SAM OR PAM) IS EXECUTING, ONE CAN USE ANY OF THE MONITOR COMMANDS.

\*\*\*\*\*USER QUICK REFERENCE\*\*\*\*\*

| FUNCTION                  | COMMAND      | CONTEXT               |
|---------------------------|--------------|-----------------------|
| BOOT SAM FROM DISK        | BOOT 10114   | CP, MASTER DISK       |
| BOOT SAM FROM TAPE        | BOOT 1005    | CP, DTS TAPE MEDIA    |
| RESUME HBOOT              | R HBOOT      | PRIMOS II, 'DIAG' UFD |
| RESUME PAM                | R PAM        | PRIMOS, 'DIAG' UFD    |
| TERMINATE PAM             | QUIT         | PAM                   |
| GET HELP (COMMAND LIST)   | HELP         | SAM OR PAM            |
| GET HELP FOR A COMMAND    | HELP cmd     | SAM OR PAM            |
| GET LIST OF DIAGNOSTICS   | LISTD        | SAM OR PAM            |
| GET LIST OF CASES IN TEST | LISTC        | SAM OR PAM            |
| GET HELP ON A DIAGNOSTIC  | USER name    | SAM OR PAM            |
| LOAD AND RUN DIAGNOSTICS  | LOAD;RUN     | SAM OR PAM            |
| LOAD A DIAGNOSTIC         | LOAD name    | SAM OR PAM            |
| EXECUTE A DIAGNOSTIC      | EX           | SAM OR PAM            |
| OBTAIN CONFIGURATION      | CONF         | SAM OR PAM            |
| OBTAIN CURRENT STATUS     | STAT         | SAM OR PAM            |
| TALK TO MONITOR           | CARRIAGE RTN | SAM OR PAM            |

\*ABOVE IS A LIST OF FUNCTIONS COMMONLY PERFORMED. FOR MORE INFORMATION ON THE ABOVE COMMANDS REFER TO DIAGNOSTIC TESTING SYSTEM SERVICE MANUAL 400.

