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FLOPPY DISC SUBSYSTEM MAINTENANCE

1. INTRODUCTION

1.1 Subsystem Description

Floppy Disc subsystems are used to store/readback computer data on lightweight flexible discs (diskettes).

Fig. 1 shows a Floppy Disc Subsystem. An AXFD11 controller board interfaces with the computer's GENIE* Bus and with the FDDU Floppy Disc Unit. Floppy Disc Units contain two printed wire assembly (PWA) boards, a power supply, and one or two Disc Drive modules. Disc Drive modules contain a read/write head, a PWA, and a motor to spin the diskette.

1.2 Diskette

Diskettes can hold over 80,000 24-bit words in sectors of 128 8-bit bytes. Tracks 1 - 73 are normally used to record data; track 0 usually holds an "index" to the diskette's contents, and track 74 is a spare data track. The first sector of track 1 is often loaded with a "bootstrap loader" routine. Each track contains 26 sectors.

Address headers are pre-recorded on the diskette and cannot be changed. The diskette spins in a felt lined jacket. A notch in the jacket is normally covered with opaque tape. If the notch is exposed, write operations are prevented (i.e., the diskette is write protected).

*Trademark

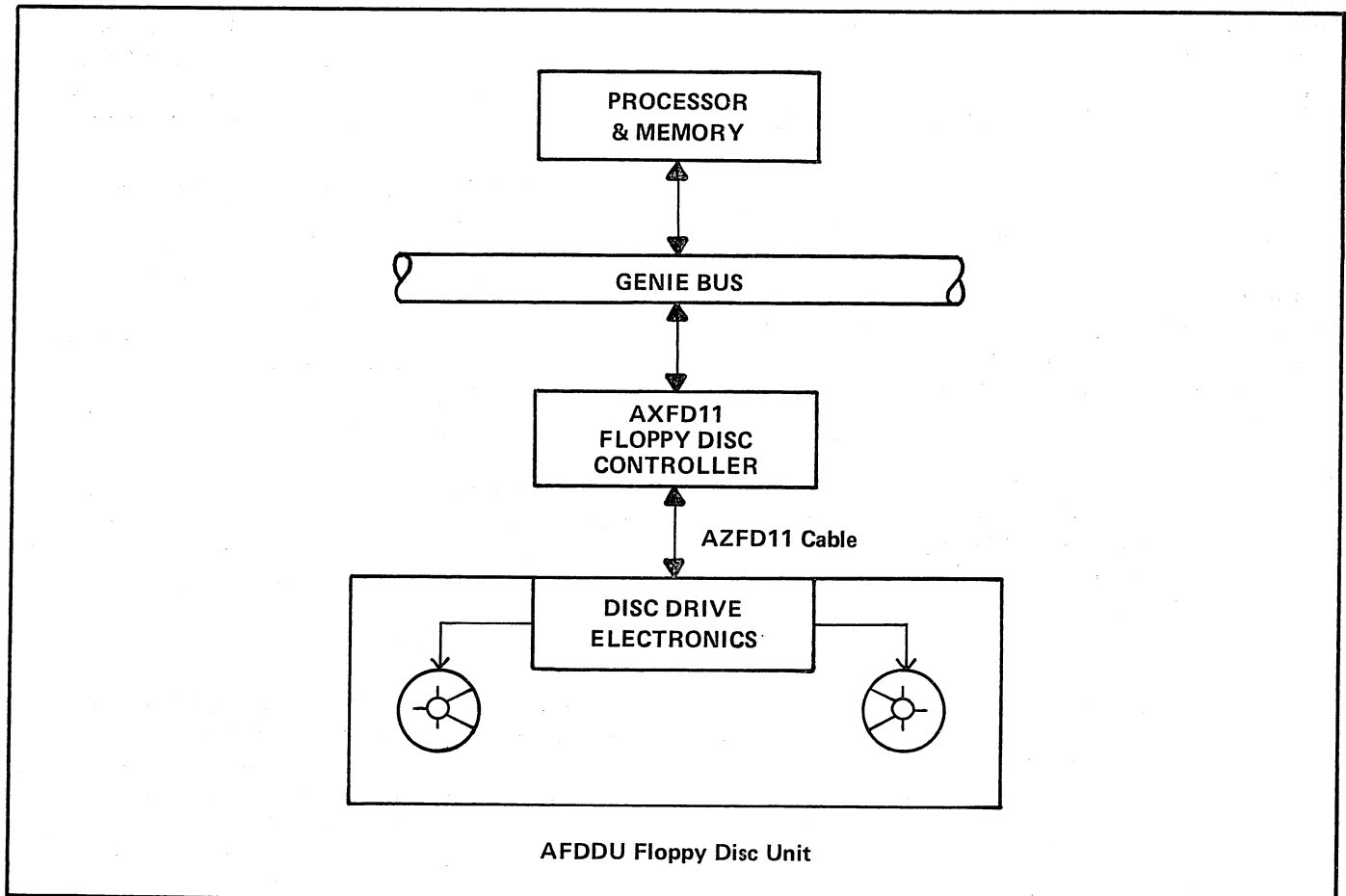


Fig. 1 Block Diagram, Floppy Disc Subsystem

1.3 Disc Unit Indicators and Controls

Fig. 2 shows a dual Floppy Disc Unit. Front panel indicators are used as follows:

On/Off Switch	Press to apply/remove ac power to the Floppy Disc Unit. Lights when power is on.
Ready Lights	When lit, means the diskette is in place and rotating at proper speed.
Busy Lights	When lit, means the Disc Unit and a Drive are in use performing some task, typically transferring data.

1.4 Programming

Machine level programming is described in the 4500 General Description (PTH-019). Briefly, most data transfers to or from the Disc Unit are accomplished by setting up one or more four-word request groups placed consecutively in main memory. The first request group is number 0 and others are numbered up to 89. The transfer is then started by executing the following instructions addressed to the Floppy Disc Controller:

<u>Instructions</u>	<u>Contents of computer's A Register:</u>
Operate, S'=2	Memory address of Request-Group 0.
OUT	Desired Request-Group number.

Control word (CW) four in the request-table contains an operation code (see Fig. 3a) that tells the disc subsystem what to do. Other control words tell where and how much data to transfer. Minimum transfer size is one sector; maximum is 255 sectors.

When the disc subsystem completes an operation, CW1 and CW2 are overwritten by the controller to show the ending status. CW2 contains a termination status which is normally zeros. Error status codes are presented in 11. Troubleshooting.

2. PRECAUTIONS

2.1 General Precautions

Power should be off when removing/installing boards or Disc Unit subassemblies. Avoid touching connector pins. Clips and switches on replacement boards should be set exactly like those on the board being replaced.

2.2 Disc Unit Precautions

Dust and smoke can eventually contaminate the read/write head and diskette surface. Avoid using the diskette in such an environment if possible. Leave at least 1 1/2 inches (38 mm) clearance at the rear of the Disc Unit for unrestricted air exhaust. Make sure power is applied whenever you are loading or unloading a diskette.

2.3 Diskette Precautions

If the diskette isn't in use, keep it in its protective jacket. Don't try to clean the diskette and keep magnets away from it. Handle the diskette by its label and avoid touching its mylar surface. Use a felt tip pen to write on the label; pencils or ball point pens can cause damage. Don't attach paper clips to the diskette.

3. OPTIONS

3.1 Equipment Options

Floppy Disc Units are available in the following models:

AFDD11	115 Vac, 50 Hz, Single Disc Drive
AFDD12	115 Vac, 50 Hz, Dual Disc Drives
AFDD13	115 Vac, 60 Hz, Single Disc Drive
AFDD14	115 Vac, 60 Hz, Dual Disc Drives

Other Floppy Disc Subsystem Model Numbers are:

AXFD11	Floppy Disc Controller Board
AZFD10	Cable, Controller to Disc Unit, 25' Fixed Length
AFDM11	Diskette, Single Surface With Write Protect Notch.

3.2 Clip and Switch Options

Fig. 4 shows the Floppy Disc Controller board clip and switch options. These options are normally assigned by system documentation. Except for replacement boards, clips and switches are pre-set at the factory.

3.2.1 Address Switches

AXFD11 controller boards may be assigned any legitimate GENIE Bus device address. Address switches select the K_0 , K_2 , and two K_3 bits of the GEN 2 device address ($250XK_3K_2K_1K_0$). The most significant K_3 bit is hardwired to a "1" and the K_1 (or S') bits are assumed to be 0's. For a standard address of 4006_8 , address switches 1 and 2 would be set to the "1" side. Since this is an even address, odd parity switch "P" would also be set to a "1".

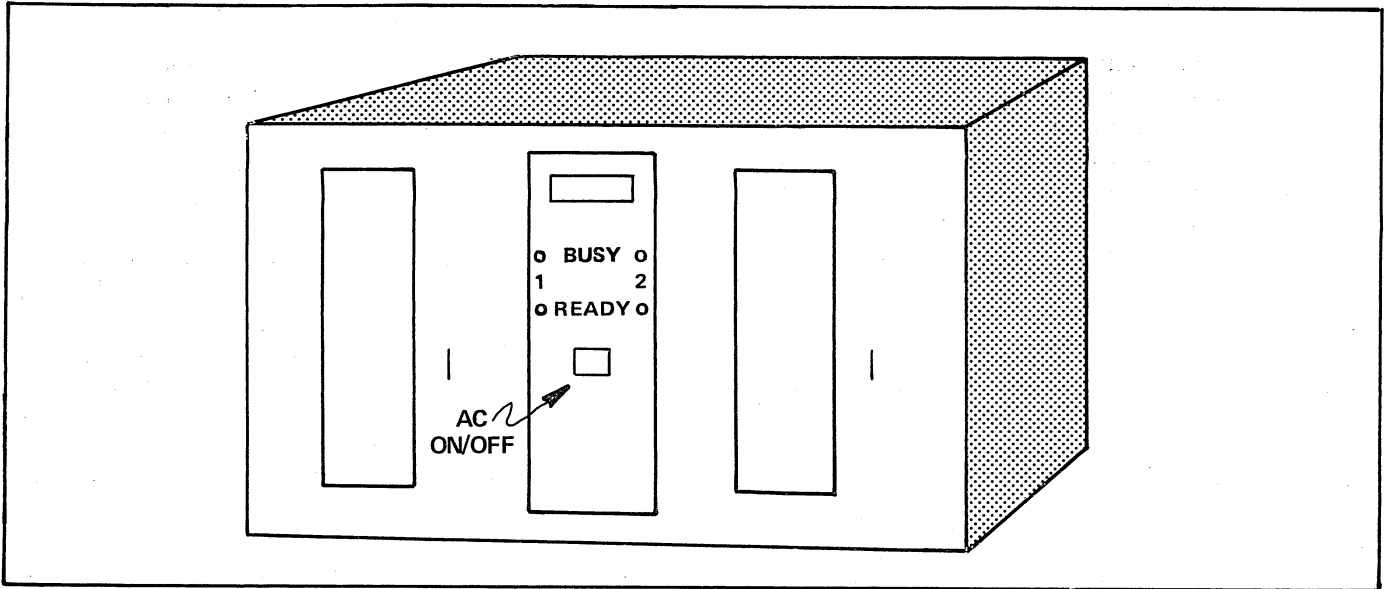


Fig. 2 Floppy Disc Unit

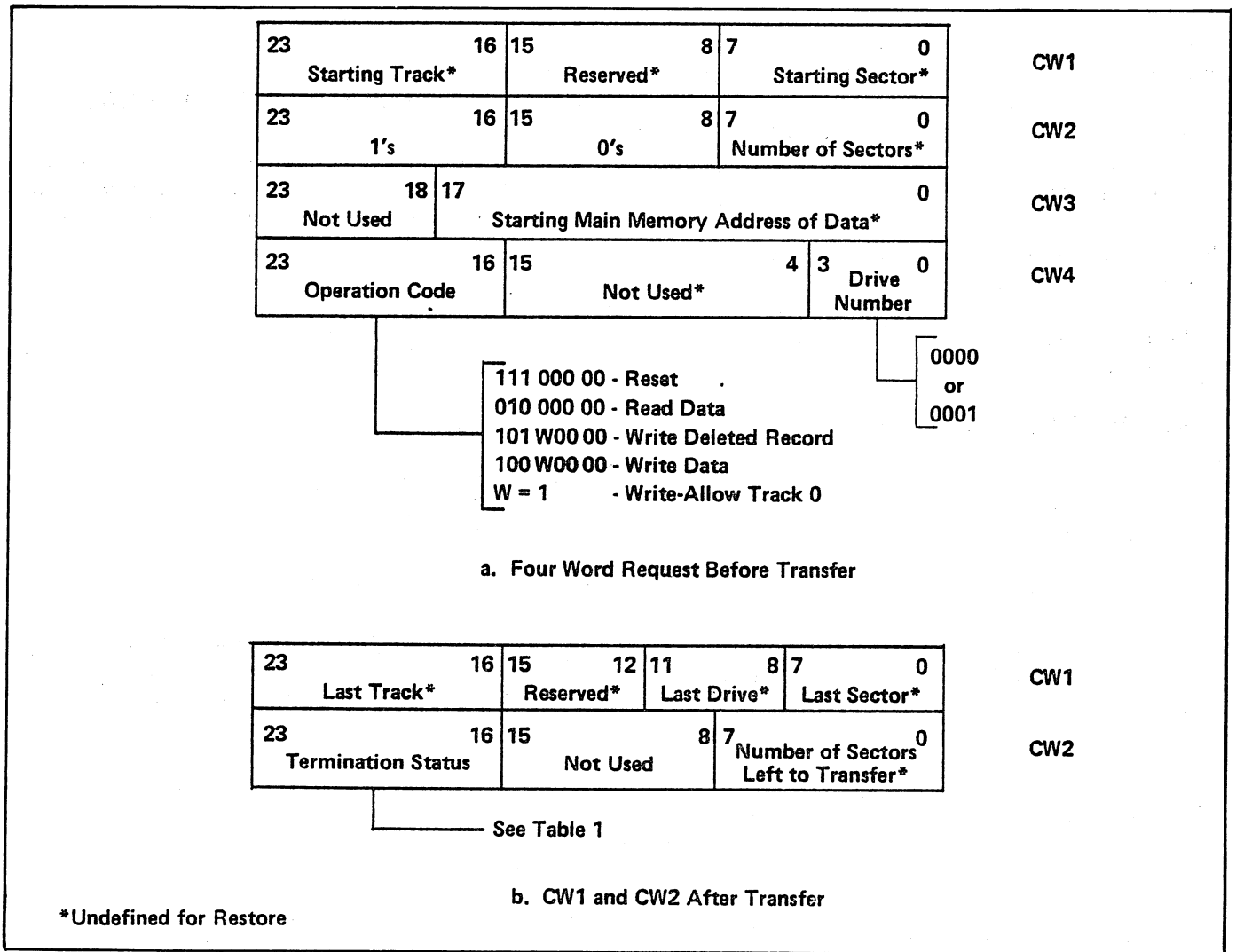


Fig. 3 Control Word Format for Data Transfers

3.2.2 Priority Switches

Only those priority levels shown in Fig. 4 may be set into the priority switches (0 - 5). The priority setting determines which GENIE Bus controller is serviced first if more than one device requests memory or interrupt service at the same time. Each device controller on a bus must be assigned a different priority code. If the priority level is too low, data underrun/overrun errors may result.

3.2.3 Test Clips

Switch "SO" is used with special test proms which plug into sockets Ø1 and Ø2. Clip P5 is moved to the opposite position and clip P4 is removed to enable the test proms. When SO is set to the 1 position, test firmware will repeatedly loop through any group of instructions that causes an error. These test proms are used in the factory. Honeywell Field Service Policy is to replace defective boards.

3.2.4 Interrupt Levels

Clips P1 and P2 select the controllers interrupt level. Both clips must be in the PR1 position to select non-inhibitible interrupts or both clips must be in the PR2 position to select inhibitible interrupts. PR2 is normally selected.

4. REFERENCES

The following publications are either useful or necessary to understand and maintain the Floppy Disc Subsystem:

Floppy Disc Subsystem Theory of Operation
AFDS-T

Floppy Disc Subsystem Test Program
51103008

Floppy Disc Subsystem Exerciser Module
51191072

System Exerciser Executive
51191050

Hardware Maintenance Manual, Flexible Disk Drive
Subsystem
77834756*

Hardware Maintenance Manual, Flexible Disk Drive
77834769

Parts Data (for disc drive)
77834771

* These three Magnetic Peripherals Co. (MPI) manuals are supplied is a single volume numbered 77834756.

5. COMPONENT LOCATIONS

The controller board may be placed in any available GENIE Bus slot. Fig. 4 shows clip and switch locations on the controller board. The Disc Unit connects to a 25 foot cable from the controller board's B-field connector. Fig. 6 shows where to connect the cable at the Disc Unit.

The Disc Unit normally sits on a table. It has identification plates and labels on the rear edge which give the model number, Honeywell part number, line voltage and frequency. Major subassemblies within the Disc Unit also contain identification plates. Fig. 1-1 in the MPI 7783456 Hardware Maintenance Manual shows major parts within the Floppy Disc Unit. Drawings throughout both the MPI Hardware Maintenance Manuals show further parts breakdown.

With dual Disc Drives, there is some inconsistency in the numbering but the lower numbered Drive is on your left as you face the Disc Drive Unit.

6. TEST EQUIPMENT AND MATERIALS

Honeywell Field Service Policy for this equipment is to replace bad boards and major Disc Unit subassemblies with known good units. Therefore the following items should be available (see 12. Parts for numbers):

AXFD11 Controller Board

Disc Unit Micro Proc PWB # 1

Disc Unit Micro Proc PWB # 2

Disc Unit Power Supply

Disc Drive Module

Fuse, 4A, 250 V, slo-blow

6.1 Maintenance Equipment

These items are needed for routine maintenance:

Known good Diskette (preferably two for dual units)

91% Isopropyl alcohol

Lint free cloth

6.2 Special Tools

Those customers who choose to repair or adjust disc subassemblies will find special tools listed in Section 6.2 of the MPI 77834769 Maintenance Manual and in part 7.3.2.1 of the MPI 77834756 Maintenance Manual.

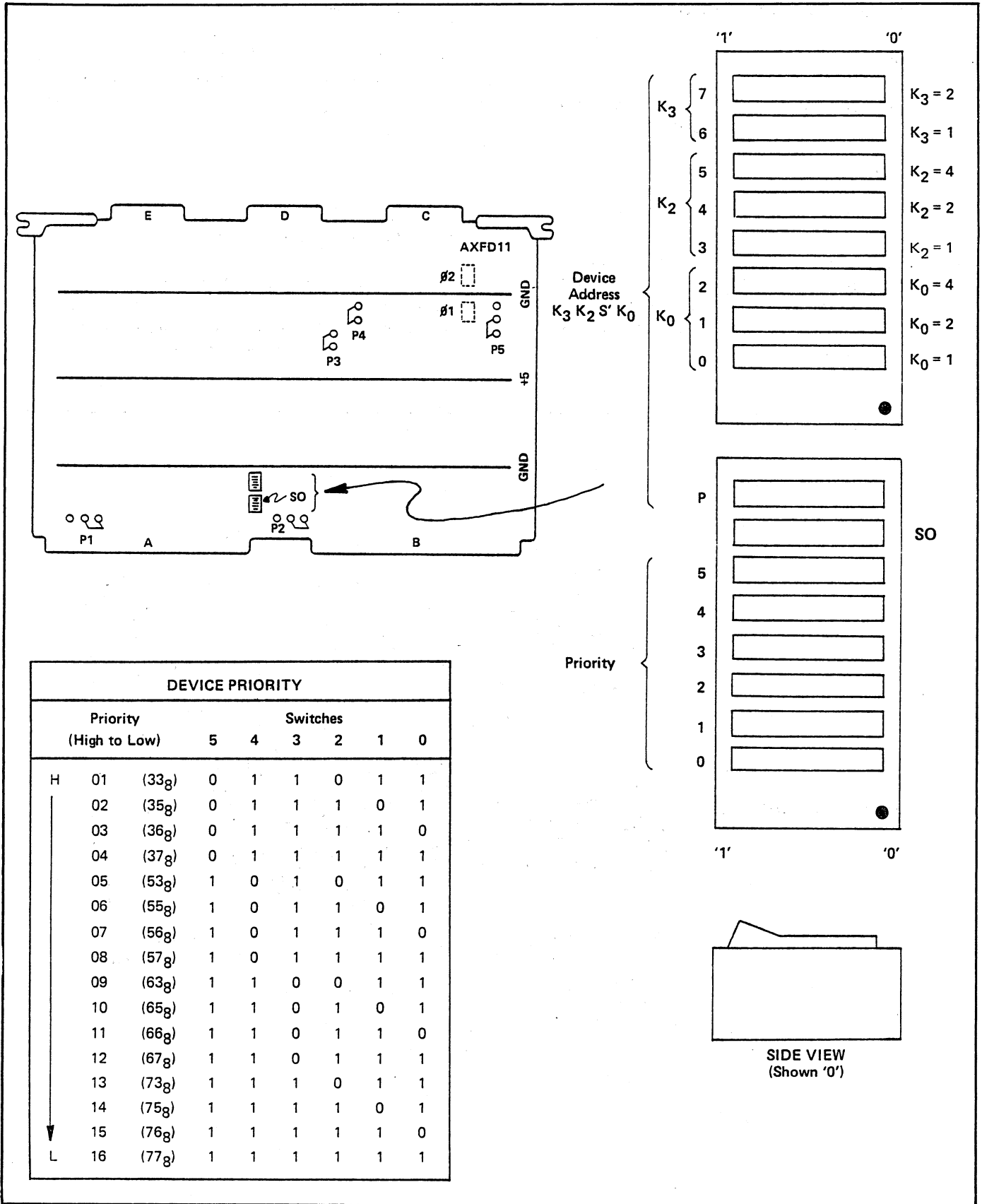


Fig. 4 Controller Clip and Switch Options

7. PREVENTIVE MAINTENANCE

7.1 AXFD11 Controller

There are no adjustments on the AXFD11 controller board and no preventive maintenance is needed.

7.2 Disc Unit

7.2.1 Head Cleaning

Excessive CRC or seek errors may be caused by dirt on the Disc Drive's read/write head. Fig. 5 shows where the head is located. Section 6.4 of the MPI 77834769 Maintenance Manual tells how to clean the head and gives some important precautions.

7.2.2 Head Load Pad

Inspect the head load pad (see Fig. 5 and Section 6.3 of the 77834769 Maintenance Manual). Worn, dirty, torn or loose head pads should be replaced - or replace the Disc Drive.

7.3 Subsystem Test Programs

The exerciser program described in 8. Performance Tests should be run an installation time. The subsystem test should be run yearly or whenever major units are replaced or if a disc subsystem problem is suspected.

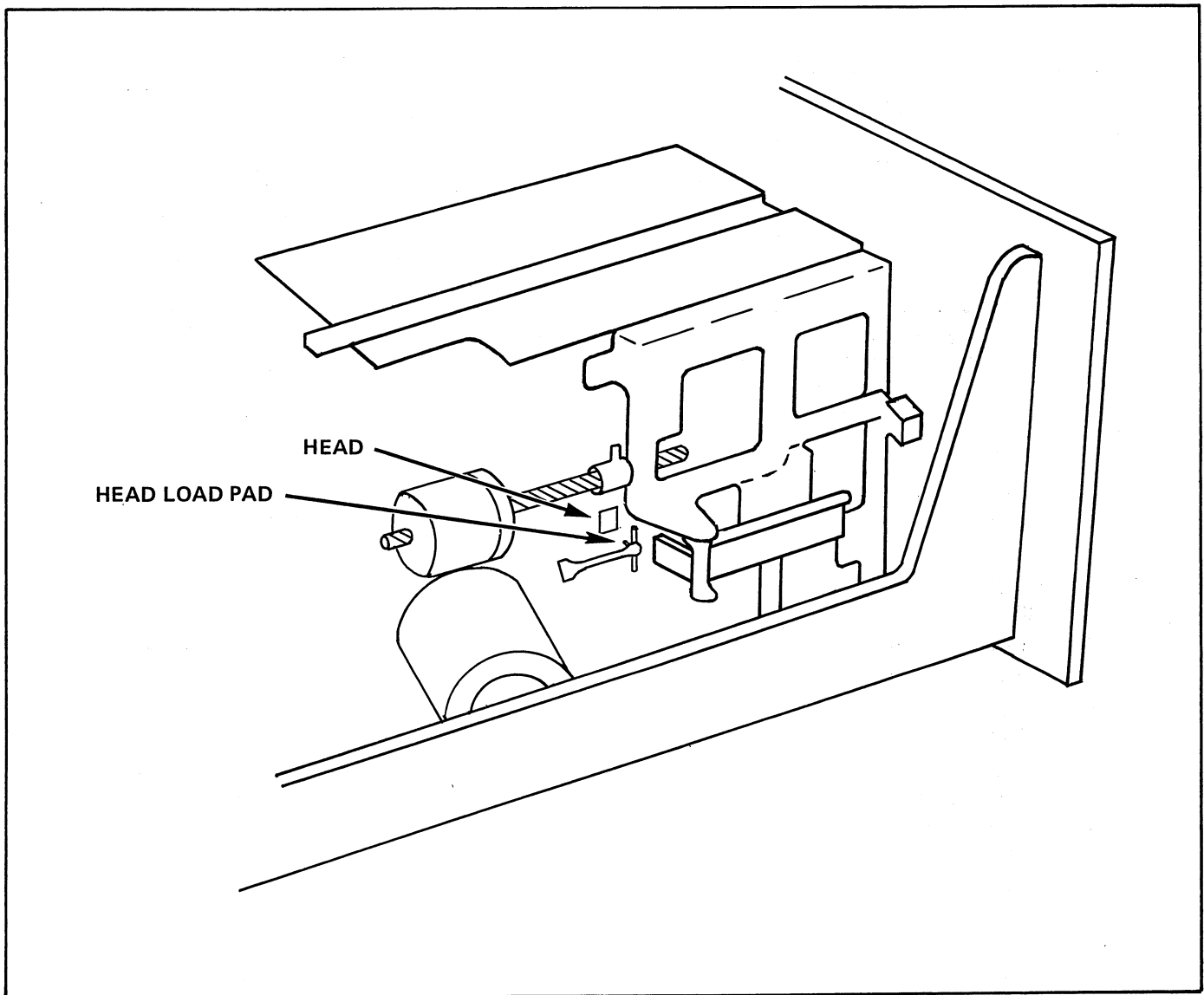


Fig. 5 Read/Write Head Location

8. PERFORMANCE TESTS

8.1 Preparing the Disc Unit

A spare diskette should be used for each Disc Drive used in these tests so that all addresses can be checked without destroying any permanent data. If that isn't practical, destructive tests may be suppressed on the 51103008 program.

Power must be applied to the Disc Unit before inserting or removing a diskette. Make sure the write protect notch is covered by opaque tape and insert the diskette(s) as shown in Fig. 6. The drive's ready light should come on when the diskette gets to 360 rpm.

Notes:

The tests which follow are designed to be run using the inhibitable interrupt. Therefore AXFD11 clips P1 and P2 should be in the PR2 positions (see Fig. 4).

8.2 Floppy Disc Subsystem Test, 51103008

This test is one of the ATPG series. The test program documentation (write-up) tells how to load and use this test. Honeywell publication ATPG-I provides more information about ATPG tests in general.

8.2.1 Test Program Parameters

Load the test program and compare system parameters (disc address, typer address, etc.) to those listed in part 2.1.2 of the test write-up. System parameters will be found in system documentation. Both drives (if a dual unit) or either one may be tested depending on the entry in location 1205g.

8.2.2 Console Switch Options

Interrupts and the stall alarm should be locked out when starting the program. The program types a heading and pauses for console switch options. Set the console switch (CSW) register options by referring to paragraph 2.1.4 of the test write-up.

If the diskette hasn't been used before, set CSW 8. This causes the program to write valid CRC characters before attempting any read operations.

CSW 13 should be set to enable destructive tests unless the diskette contains permanent data.

Normally CSW 18 and 19 are set for the first pass to enable manual intervention tests.

Start testing by permitting interrupts and press the Demand button. This program writes and reads on the diskette using various size transfers and data patterns. The GEN 2 instructions and disc operation codes are checked for proper response. Manual intervention tests tell the operator when to open the door on each drive (i.e., cause it to go "not-ready"). Also, the write protect feature is checked by uncovering the write protect notch. If destructive tests are disabled (CSW 13 = 0) and anytime test 11 (Track 0 Write Protection) is running, don't stop the test, as saved data may not be restored. This program makes up to four read attempts before an error is declared unrecoverable. It takes about twenty-five minutes to run one pass. One complete error free pass is considered enough to check the Floppy Disc Subsystem. If additional passes are run, test headings and manual intervention tests may be suppressed (by console switch option) to increase the transfer rate.

8.3 Floppy Disc Exerciser Test, 51191072

Exerciser modules must be run with an executive program. The procedure consists of loading the executive and using its routine to load one or more exerciser modules. Normally several different exerciser modules are run at the same time to test for system interaction problems. The System Exerciser Executive (51191050) write-up tells how to load and use exerciser type programs. Honeywell publication SEX-I, How To Load And Use System Exerciser Programs, expands on this information and provides numerous examples.

The SETUP command for this exerciser is:

FDS nnnn,IRA,DRIVE0,DRIVE1,STRTRK,ENDTRK

4006,214
is standard

1 = implemented
0 = not implemented

Decimal values from
0 - 74. Applies for
both Drives

This test destroys any previously recorded data between the specified starting and ending track addresses. It exercises the Floppy Disc Subsystem by writing, reading, and comparing data. Alarm typeouts (if any) refer to a numbered alarm dictionary in the exerciser program write-up.

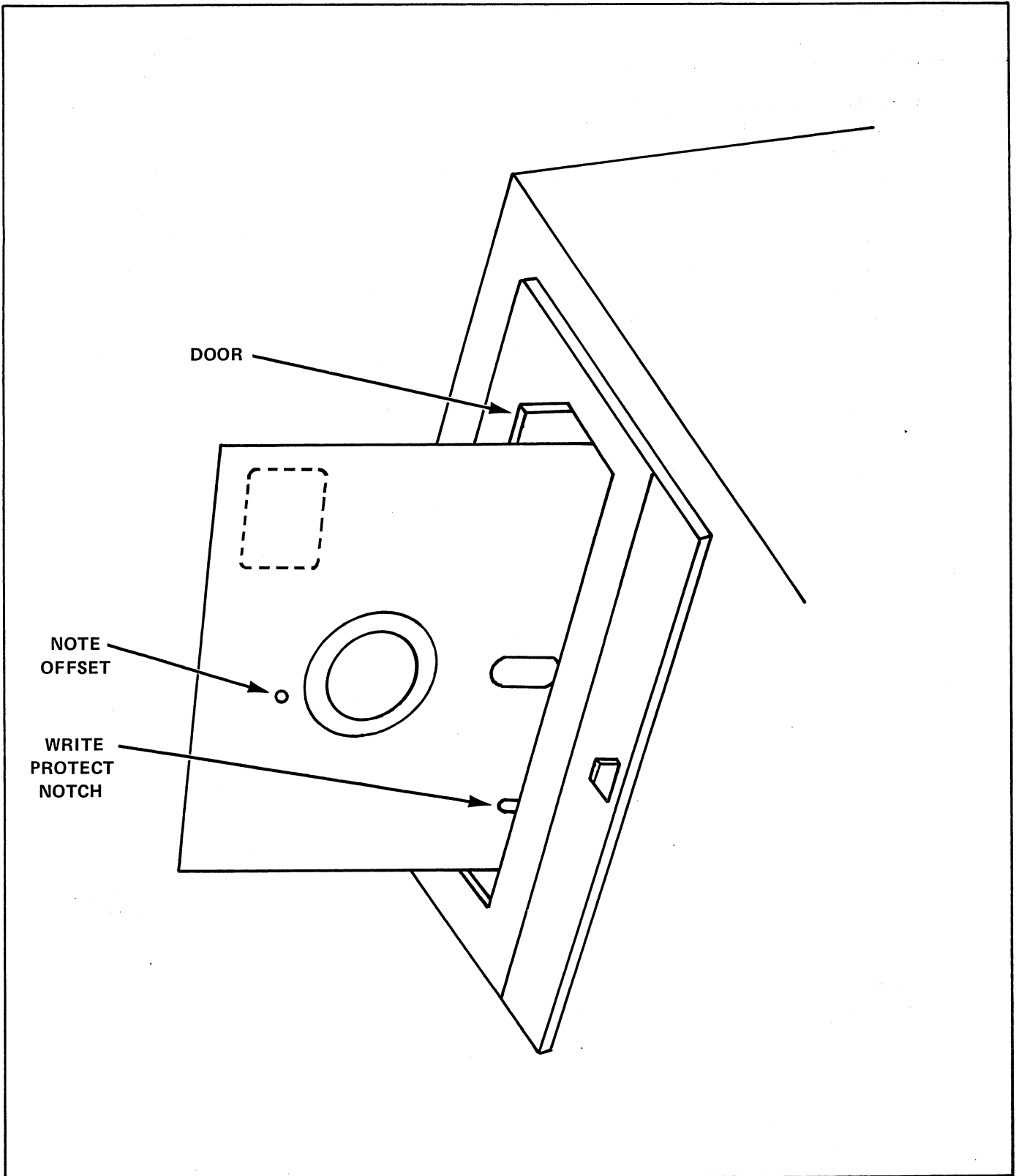


Fig. 6 Inserting the Diskette

9. ASSEMBLY/DISASSEMBLY

9.1 Controller Board

The AXFD11 Floppy Disc Controller is a plug-in board and may be placed in any GENIE Bus slot.

9.2 Controller to Disc Cable

A twenty-five foot (7.6 m) cable connects the controller board and Disc Unit. There are two similar jacks on the Disc Unit, J1 and J2. The controller cable should plug into J1 as shown in Fig. 7.

9.3 Disc Unit Cover

The Disc Unit cover is held by two screws (see Fig. 7) near the bottom of the rear edge. Disconnect cables, remove the two screws and slide the cover off to the rear.

9.4 Microprocessor Boards

As shown by Fig. 8-11 in the MPI 77834756 Maintenance Manual, the Disc Units microprocessor boards are held in place by a top plate. Remove the two top plate screws and unplug the board edge connectors to remove the boards.

9.5 Floppy Disc Drive Modules

Drive modules are held from the bottom by two screws. See Fig. 8-6 in the MPI 77834756 Maintenance Manual.

10. ADJUSTMENTS

10.1 Disc Unit Power Supply

Fig. 7-2 in the MPI 77834756 Maintenance Manual shows voltage adjustments for the Floppy Disc Unit power supply. Voltage test points are shown on Fig. 7-3.

10.2 Disc Drive Adjustments

Honeywell Field Service Policy is to replace Drive Units that are defective or out of adjustment. Customers who maintain their own equipment will find various adjustment procedures described in Section 6 of the MPI 77834769 Hardware Maintenance Manual. Special tools and test equipment are needed for most of those adjustments.

11. TROUBLESHOOTING

Both the controller board and the Disc Unit boards contain pre-programmed microprocessors. Without special test equipment, such as used in the factory, they are hard to troubleshoot. Special tools are also needed to service many areas of the Floppy Disc Unit, especially the Disc Drives. Most of the Disc Unit subassemblies can easily be replaced (see 9. Assembly/Disassembly) and, like replacement boards, are stocked at Honeywell Field Service depots. Honeywell Field Service Policy is to replace bad boards or major Disc Unit subassemblies (see 12. Parts). Return boards or subassemblies to the depot for repair or replacement.

11.1 Troubleshooting Chart

Chart 1 presumes that the computer's memory, GENIE Bus, and processor are working properly. The objective is to repair the subsystem by replacing major units.

11.2 Program Load

Program Load is a simple data transfer routine that provides a lot of information for the troubleshooter. It doesn't require that you set up any request tables and only requires that you execute one instruction at most. It has some limitations: it can only be used on Drive 0, it is a one-sector read-only operation, and the diskette must contain valid information on track 1, sector one to prevent CRC errors.

Advantages to the troubleshooter are these: it should cause the read/write head to move (you'll hear it), sets the Drive "busy" (Busy light will turn on for about two seconds), and reads 128 bytes of data into computer memory locations 0 - 52_g. The upper byte of location 52_g is zeroed.

There are two ways to cause a program load. You may want to zero main memory locations 0 - 52_g first so the contents can be checked later. Drive 0 (see 5. Component Locations) must be ready and the diskette must have some previously recorded data on track 1, sector one. The diskette must contain a bootstrap routine if method two is used.

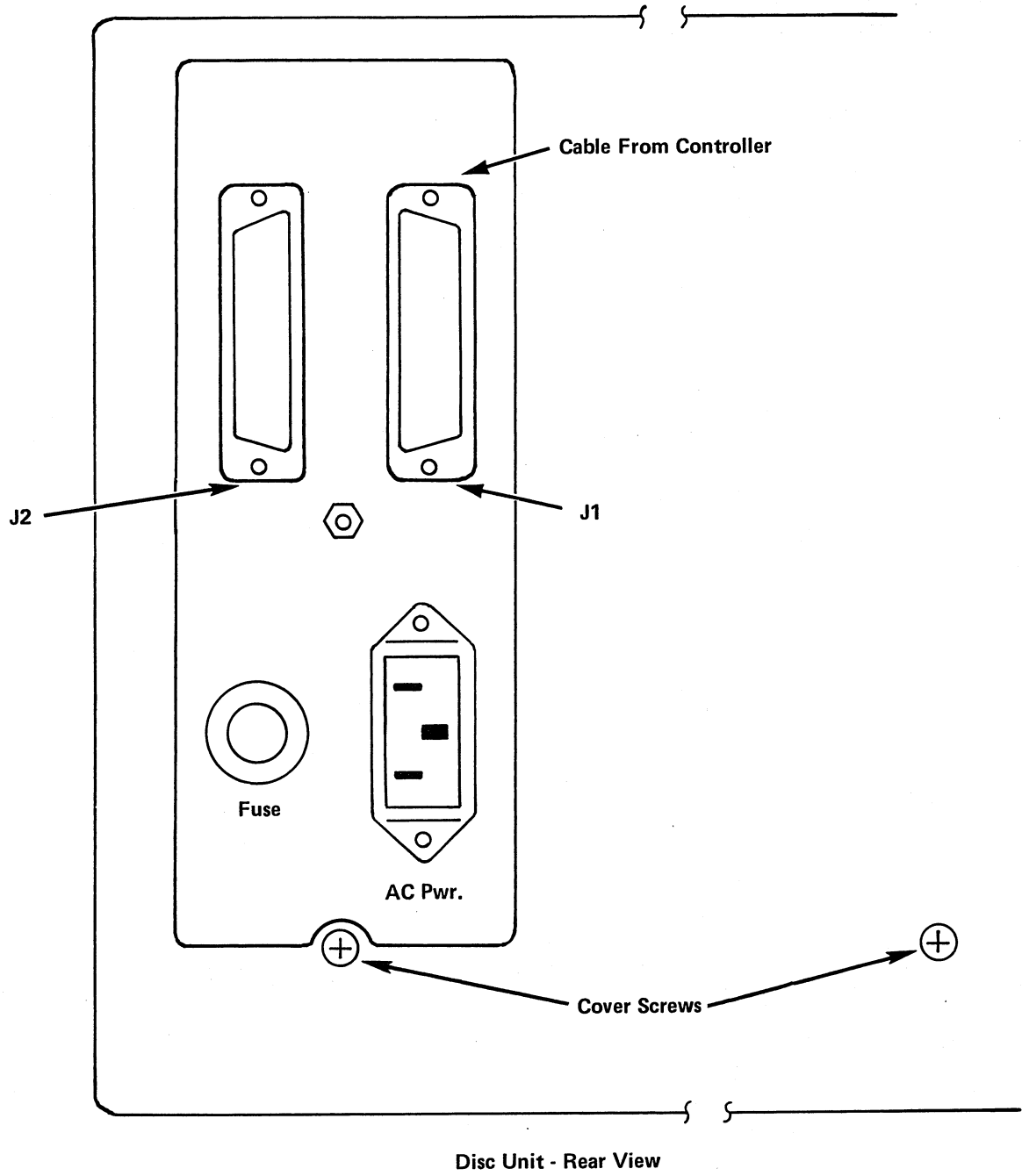


Fig. 7 Disc Unit Connections

Symptoms	Possible Causes	Corrective Action
<p>Visual Indications:</p> <p>Disc Unit On/Off switch won't light when pressed.</p> <p>Ready light doesn't come on when diskette is inserted and door closed.</p> <p>Properly addressed instructions cause alarm at the computer console.</p>	<p>No ac power Fuse blown Lamp burned out</p> <p>Diskette inserted incorrectly Diskette index track bad Motor not turning</p> <p>Indicator bad Disc Unit board bad</p> <p>Bad controller board or address switches set wrong</p>	<p>Check cord and socket. Replace. Replace.</p> <p>See Fig. 6. Replace diskette. Check ac to motor - see Fig. 3-1 in MPI '769 manual. If ac is OK, replace Drive; if not, see Fig. 5-8 in MPI '756 manual. Replace LED. Replace Microprocessor No. 1 board.</p> <p>Replace board, check switches (see Fig. 4).</p>
<p>Transfer Failures:</p> <p>CRC or seek errors.</p> <p>No transfer, one Drive of dual unit.</p> <p>No transfer - dual or single Drive unit.</p> <p>Improper termination status.</p>	<p>Coating on read/write head Diskette damaged</p> <p>Bad Drive module</p> <p>Bad controller board Bad Disc Unit</p> <p>Loose or bad cable to Disc Unit Program error</p> <p>See Table 1</p>	<p>Clean read/write head. Replace diskette</p> <p>Replace Drive. Loose cable inside Disc Unit.</p> <p>Replace AXFD11 board. Check power supply output voltage (see adjustments). Replace one or both microprocessor boards. Replace Drive(s). Replace or repair cable (see Fig. 8). Try program load routine. Run test programs (see 8. Perf. Tests).</p> <p>Use information in Table 1 plus above chart.</p>

Chart 1 Troubleshooting

Method 1

With the computer in "halt" mode, use the computer console to execute an Operate, S' = 0 instruction addressed to the Floppy Disc controller (2502DD0D).

Method 2

With the computer in "halt" mode, press console keys RESET and 5*. Momentarily switch to run mode. Ignore any memory timeout (blue) error. If the diskette contains a bootstrap routine, it must transfer the disc controller's GEN 2 address into memory location three. This location (at least) can be checked for proper data transfer.

If a listing is available, check the data in a few locations. Watch for missing or extra bits. If a program load operation fails completely, the subsystem has major problems, most likely a bad controller board. If a program load operation causes an improper termination status, the subsystem will automatically retry (if it's working well enough to).

* Assumes the controller address is 4006₈.

CW2 Bits 23 -16	Meaning
000 000 00	Normal termination - No error.
000 010 00	Deleted record was read.
100 100 00	Attempted to write on protected track 0, or hardware failure in the Floppy Disc Unit. To write on track 0, a write-allow bit must be set in the operation code.
100 100 10	CRC (Check Character) error on address or data.
101 100 00	Diskette is write protected (edge slot is exposed).
101 100 01	Seek error (unable to find the assigned track).
101 100 10	Illegal command to the Floppy Disc Unit – e.g., impossible track or sector address.
101 100 11	Buffer overload (information is not flowing properly between controller and Floppy Disc Unit).
101 111 00	The selected disc drive is not ready or has not been ready at some time since last operation.
110 100 01	Overrun. The GENIE Bus did not transfer data as fast as the controller required.
111 000 00	Parity error on data from main memory.
111 000 01	GENIE Bus/Disc Controller transaction error.
111 000 10	Addressing error on GENIE Bus transaction.
111 000 11	An OR status of any of the previous three errors.
111 111 11	No transfer (original contents of CW2).

Table 1 Termination Status Codes
(Ref. Fig. 3b)

12. PARTS

Honeywell Field Service Policy is to replace major sub-assemblies. These are:

Controller Board	4DP3AAXFD11
Floppy Disc Cable	4DP3AAZFD10
Diskette	4DP3AAFDM10
Disc Unit Microprocessor Board #1	77834501-7*

Disc Unit Microprocessor Board #2 77834550-4*

Disc Drive 75744056*

Disc Unit Power Supply 83464900*

* Disc Unit subassembly part numbers may change. Therefore, you should obtain subassembly numbers from their identification plates. If necessary, parts breakdown drawings for each sub-assembly are shown in Section 8 of the MPI Hardware Maintenance Manuals.

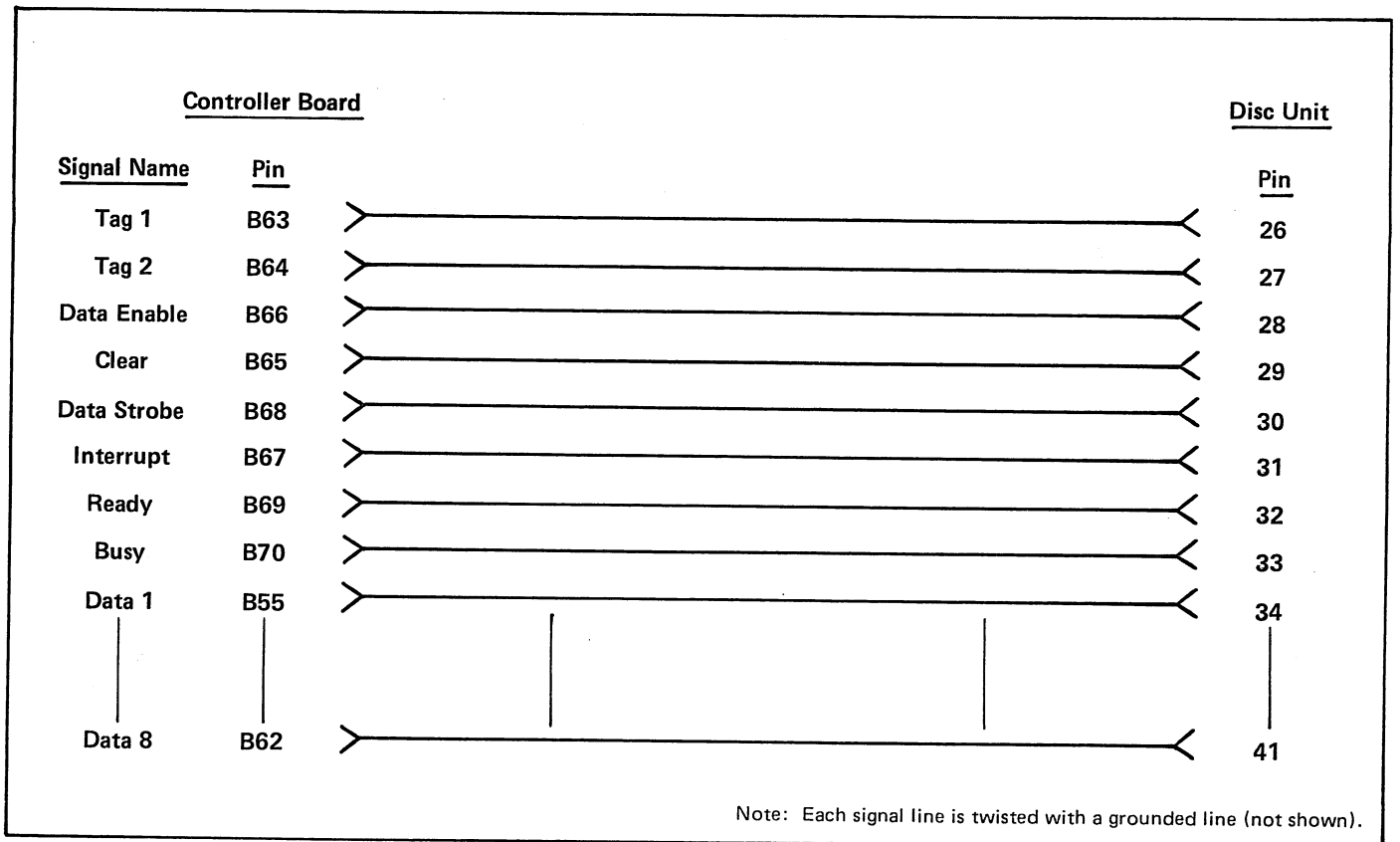


Fig. 8 Cable, Controller to Disc Unit

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