HP 1000 A/L-Series Computer Interface Diagnostic

Reference Manual

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Printing History

The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, Update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past Updates, however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all Updates.

To determine what software manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

First Edition	**Mar 1982**	
Update 1	Jan 1983	Incorporation of 12005B test procedures.
Update 2	Jun 1983	Incorporation of A700 Writable Control Store Card and A900 Control Store Interface Card test procedures.
Reprint	**Jun 1983**	**Updates 1 and 2 have been incorporated.**
Update 3	Jun 1984	Add 15M byte disc drive.

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Section 1
Introduction

1.1 General Information

This manual provides a description, special operating instructions, error messages, and program listing for each of the following interface and storage card diagnostic programs:

- HP 12005A/B Asynchronous Serial Interface (ASIC)
- HP 12006A Parallel Interface (PIC)
- HP 12008A PROM Storage Module (PROM)
- HP 12009A HP-IB Interface (HP-IB)

1.2 Test Limitations

Each diagnostic program provides a detailed check of card hardware functions, excluding the I/O processor chip and its support logic. The I/O processor chip, although located on each of the above cards, is functionally part of the computer I/O circuitry and is tested by the Kernel I/O Master diagnostic program (refer to HP 1000 A/L-Series Computer Kernel Diagnostic Reference Manual, part no. 24612-90003).

1.3 Required Media, Equipment, and Documentation

The following media, equipment, and documentation items are required in order to load and run the HP 1000 A/L-Series Computer Interface Diagnostic programs described in this manual:

- HP 1000 A/L-Series Diagnostic Operating and Troubleshooting Manual, part no. 24612-90001
- One of the following Diagnostic Control System (DCS) file media, and respective drive unit:

- o Mini-cartridge Tape, part no. 24612-13301 thru 13305
- o Cartridge Tape (CS/80), part no. 24612-13311
- o 3 1/2" Flexible Disc, part no. 24612-13404 and 13405
- o 5 1/4" Flexible Disc, part no. 24612-13402 and 13403
- o 8" Flexible Disc, part no. 24612-13401

1.4 Additional Information

For additional information concerning the HP 1000 A/L-Series diagnostic programming and operation, refer to the following manuals:

- HP 1000 A/L-Series Computer Kernel Diagnostic Reference Manual, part no. 24612-90003
- HP 1000 A/L-Series DDL Programming Reference Manual, part no. 24612-90002

1.5 General Operation

The interface diagnostics in this manual operate under control of the Diagnostic Design Language (DDL) interpreter module, a part of the Diagnostic Control System (DCS). Operating procedures for loading and executing the DCS, the Kernel diagnostic programs, and the interface diagnostic programs, are provided in the HP 1000 A/L-Series Diagnostic Operating and Troubleshooting Manual, part no. 24612-90001.

Error codes and additional operating information specific to a particular interface card diagnostic are provided in this manual.

For user diagnostic design and programming procedures, refer to the HP 1000 A/L-Series, DDL Programming and Reference Manual, part no. 24612-90002.

The diagnostic operating procedures in this manual assume a VCP terminal is connected and enabled. To execute diagnostics without a terminal, refer to the diagnostic operating and troubleshooting manual.

Section 2
HP 12005A/B Asynchronous Serial Interface (ASIC)

2.1 General

Load and execute the Diagnostic Control System (DCS) and the asynchronous serial interface diagnostic program (ASIC), using the diagnostic operating mode desired (see the diagnostic operation and troubleshooting manual). When the ASIC diagnostic is ready to run, refer to the additional operating procedures in this section.

During execution of the ASIC diagnostic, refer to Appendix 2A for a list of execution error messages and codes, Appendix 2B for test hood jumper connections, and Appendix 2C for a listing of the ASIC diagnostic program.

2.2 Additional Equipment Required

In order to complete the individual tests within the diagnostic for card drivers and receivers, the following test hood is required during actual execution of the ASIC diagnostic:

- o HP 12005A/B Test Hood, part no. 24397-60005.
- o HP 12005B Fiber Optic Loopback Cable, part no. 5061-7933.

2.3 Diagnostic Operation

1. Type "RUN<cr>" following the ">" DDL prompt to start the diagnostic program.

   Note: Typing "RUN !<cr>" will cause the diagnostic to execute on the highest priority HP 12005A/B Interface card in a noninteractive mode. If any failures are detected, the diagnostic terminates and prints the error message. If the diagnostic completes normally, it will automatically execute on the next highest priority HP 12005A/B card. When all HP 12005A/B cards have been tested, the diagnostic terminates and returns with the ">" DDL prompt.

2. The message:
"12005A/B ASYNCHRONOUS SERIAL INTERFACE DIAGNOSTIC"
"12005A INPUT SELECT CODE:"
will be displayed on the console. If a 12005A interface is tested, enter octal select code of card (e.g., 22<cr>, or enter -1 to skip the request for the 12005A and continue to the 12005B. the message "12005B INPUT SELECT CODE:" will then be displayed on the console. Enter octal select code of 12005B interface card to be tested.

3. The message
"HOOD INSTALLED?"
will be displayed. Type in whether or not the diagnostic test hood is attached to the card. For example "YES<cr>" or "NO<cr>".

4. Set the U21 switches on the HP 12005A/B Interfaces that are to be tested as follows (U21 is the switch pack facing the side of the computer card cage):

HP 12005A Switch U21	#1	2	3	4	5	6	7	8
Setting		1	1	1	1	1	1	0

HP 12005B Switch U21	#1	2	3	4	5	6	7	8
Setting		1	1	1	1	1	0	1

1 = open = up; 0 = closed = down

5. Attach the HP 12005A/B test hood. The test hood must be attached to operate the diagnostic when following the procedures in this section.

For the 12005B, also connect the fiber optic loopback cable.

NOTE

The older test connector,
Rev. A, will not function
with the 12005B.

6. If the HP 12005A/B test hood is attached, and YES was entered following "HOOD INSTALLED", the message
"BAUD RATE TEST"
"BAUD RATE UNDER TEST = "
will be displayed. The baud rate under test message is repeated for every baud rate tested.

7. The external clock test is part of the baud rate test which uses a crystal built into the test hood. The message:
"EXTERNAL CLOCK SOURCE TEST"
will be displayed. If the baud rate test completes successfully the message:
"BAUD RATE TEST COMPLETE"
will be displayed.

8. If the 12005B is under test with the fiber optic loopback cable installed, the message
   "OPTICAL LINK TEST"
   will be displayed.

9. If the HP 12005A/B test hood is not attached, the message:
   "HOOD TESTS NOT EXECUTED"
   will be displayed.

10. If the HP 12005A/B Interface diagnostic completes successfully the message:
    "12005A PASS COMPLETE"
    "INPUT SELECT CODE:"
    will be displayed on the terminal.

11. To run the diagnostic again, reenter the select code for another complete pass, or press <cr> to put diagnostic in the loop mode.

12. To discontinue program execution, type zero, "0<cr>", following the "INPUT SELECT CODE:" message. The diagnostic program will be terminated, and the DDL prompt ">" will be displayed. Any valid DDL command or statement can now be entered.

13. Remember to return the HP 12005A/B Interface card switches to their original configurations.

2.4 Terminal to Interface Communication Test

Optional - If the HP 12005A/B diagnostic completes sucessfully the communication path from the terminal to the HP 12005A/B Interface can be tested with this short test.

1. Turn off the power to the computer and the terminal.

2. Set the U21 switches on the HP 12005A/B Interface that is to be tested for normal operation of the terminal.

3. Disconnect the test hood (if used) and connect a terminal to the HP 12005A/B Interface card that is to be tested.

4. Load the diagnostic using procedures listed in the diagnostic operation and troubleshooting manual.

5. The DDL prompt ">" should be displayed. Type "RU A<cr>".

6. The message:
   "1500 PRGM A TERMINAL-12005A/B INTERFACE COMMUNICATION TEST"
   "INPUT SELECT CODE:"
   will be displayed. Type in the select code of the HP 12005A Interface to be tested.

7. The following message should be displayed on the terminal connected to the HP 12005A/B Interface that is to be tested:
   "TERMINAL TO 12005A/B INTERFACE COMMUNICATION TEST"
   "TYPE TWENTY CHARACTERS ON THE KEYBOARD NOW"
   Type twenty (20) characters on the terminal keyboard.

8. After the last character has been typed, the message:
   "ASIC TERMINAL TEST COMPLETE"
   "nn CHARACTERS RECEIVED"
   "PASS COMPLETE"
   "INPUT SELECT CODE"
   is displayed on the terminal that is the VCP. This indicates the terminal input and output have sucessfully completed.

   Less than twenty characters can be typed if the transmission is terminated by the RETURN key or the BACK SPACE key. The message:
   "no. CHARACTERS RECEIVED"
   will be displayed on the terminal not under test, where "no." is the number of characters received.

9. If the twenty characters are not received within about two minutes the message:
   "TEST FAILURE"
   is displayed on the terminal that is the VCP indicating the communication transfer never completed.

2.5 Special Character Recognition Test

Optional - If the diagnostic completes sucessfully this test can display the special characters that the HP 12005A/B Interface card can recognize.

1. Load the diagnostic using the procedures listed in the diagnostic operation and troubleshooting manual.

2. The DDL prompt ">" should be displayed. Type "RU B<cr>".

3. The message:
   "1700 PRGM B SPECIAL CHR. TEST"
   "INPUT SELECT CODE:"
   will be displayed. Type in the select code of the HP 12005A/B Interface to be tested.

4. The following message should be displayed:

   "SPECIAL CHARACTER RECOGNITION"
   "ASCII CHR.(OCT.) T1   T2   T3"
   will be displayed. The following displayed messages will show what special characters are recognized by the card in its three special character type modes. With a standard card, type one characters are EOT (4 octal or 204 octal), BACKSPACE (10 or 210), CARRIAGE RETURN (15 or 215), DC2 (22 or 222), and RUBOUT (177 or 377). The type two special character is the RECORD SEPARATOR (36 or 236), and the type three special character is the CARRIAGE RETURN (15 or 215). Note the special characters are recognized once with the most significant bit clear and once with the most significant bit set (difference is 200 octal).

   For the standard card the following will be displayed:

```
SPECIAL CHARACTER RECOGNITION
ASCII CHAR.(OCT)  T1   T2   T3

            004   X
            010   X
            015   X          X
            022   X
            036         X
            177   X
            204   X
            210   X
            215   X          X
            222   X
            236         X
            377   X
PASS COMPLETE
INPUT SELECT CODE:
```

2.6 Execution Times

The execution time with the test hood is about 90 seconds.

The execution time without the test hood is about 30 seconds.

2.7 Program Description

The diagnostic is separated into different tests as described below. These tests are described in the same order as they are executed in the diagnostic program.

Control Register Check

The first test run by the diagnostic is an integrity test of the control register (register number 31). This is done by writing into the control register, reading back, and comparing.

The control register check also insures that the card can be reset properly. The OTA @32 and CLCC 0 instructions are executed and then the card is checked to see if the control register is cleared out properly.

Break Check

The break feature is checked to insure that a prolonged space condition will cause a break to occur. The card reset is tested again to insure that the break is cleared by a reset. This test is run under a diagnose mode to keep the input to the break function separated from the receive line of the card.

Transmission Test

The transmission test puts the card into a diagnose mode which allows checking of the inbound and outbound data registers and the UART. The diagnose mode connects the output of the UART transmitter to the input of the UART receiver. This allows a character to be stored in the data register, transmitted and received at the same time, and then read back from the data register. All possible seven-bit and eight-bit patterns are transmitted to test for UART pattern sensitivity and to test the data registers. Note that this test only checks the lower eight bits of the data registers because these are the only registers used during programmed I/O. This test also checks the status register to insure that the data valid and data ready bits are set properly. As each character is received, the diagnostic checks a bit in the status register to see if the character just received is a special character. This is done for all three types of special characters by changing the control register contents.

The eight-bit and special character recognition check part of this test checks all eight-bit patterns through the UART with the card in the wraparound mode. Each pattern is checked to insure that it is a "standard" (factory programmed) special character.

The seven-bit transmission test part of this test puts the card into the seven-bit mode and checks the card operation with eight-bit patterns. Bit number seven is set to zero regardless of data for this test.

DMA Check

The DMA check verifies that DMA can successfully transmit and receive and checks the self-configuration feature. This is done in a similar manner to the transmission check but the transmission is initiated by DMA. Self-configuration is initiated which transmits the data and causes the data that is received to be stored from the data register into memory. In this way, the upper half of the data registers is checked to insure proper operation. The DMA flags and logic are also tested. After the first DMA transfer has completed, a second transfer is done with the special character recognition feature enabled. If a special character is recognized the DMA transfer should stop and indicate completion even though the word count is not zero. The special character chosen for the test is the last special character that was determined in the previous test. If no special characters were found this part is skipped.

Break-Overrun Check

The break-overrun check verifies the overrun function of the UART by doing a series of STC @30 instructions. A STC @30 instruction causes successive transmissions and receptions from the UART. The data is never read out of the receiving section of the UART so an overrun error should occur. The interrupt logic is checked to insure that an interrupt occurs and that the status register is updated correctly. This test also insures that a pending BREAK from the interface holds off all other interrupts from the interface.

Hood Tests

The hood tests loop certain output signals back into selected input channels in order to check the input and output drivers as well as the input functions which cannot be checked using the diagnose mode. This allows the checking of the baud rate generator and the modem status line detection logic. This test is only executed if the test hood is installed.

Hood Transmission Test

The hood transmission test checks the 20ma drivers and receivers to insure they operate properly. A worst-case pattern is transmitted by the drivers and looped back to the receivers. The received data is then compared to the transmitted data. The test also checks the transmit flag. This test is only executed if the test hood is installed.

Baud Rate Test

The baud rate test operates by doing a reset to the baud rate generator via the test hood. The baud rate generator is programmed with a specific baud rate by using the modem control lines and a 50 byte DMA transfer is initiated. The diagnostic uses the time base generator to time the transfer. The transfer completion time count is compared to a predetermined value. If the count exceeds the value the UART or baud rate generator is assumed to be operating improperly. For the external clock test a one MHz. crystal in the test hood is used. A worst case pattern is transmitted/received thru the UART and verified. All sixteen baud rates are checked on the baud rate generator. This test is only executed if the test hood is installed.

Parity Error Test

The parity error test works like the transmission test, except the UART transmits a "@176". The SSD line, which is logically connected to the received data line, is brought low during the transmission. This causes a parity error to be detected by the UART that should cause a parity error interrupt and should set the parity error bit in the status word. This test is only executed if the test hood is installed.

Parity Sense Check

UART functions are tested by resetting the parity bit select. The parity and stop bit test insures that a transmission can occur with the UART set in this mode. This test is only executed if the test hood is installed.

Line Driver/Receiver Test

The line driver/receiver test checks all drivers and receivers on the modem status and control lines. The modem line interrupt capability is checked to insure that a modem line status change along with the status register will cause interrupts correctly. This test is only executed if the test hood is installed.

The modem check part of this test performs three self-configured DMA quads, two output followed by one input. The input quad has special character recognition enabled, so DMA can be terminated by a carriage return or backspace ASCII character. After these quads complete, the DMA character is added to twenty to obtain the number of characters received, which is printed on the screen.

Optical Link Test

The optical link test checks the fiber optic transmitter and receiver, with the transmitter looped back to the receiver with a fiber optic cable. The diagnostic enables the optical circuits through the test hood, and transmits and receives data at the external baud rate to ensure proper transmitter/receiver operation.

Terminal to 12005A/B Interface Communication Test

Refer to paragraph 2.4 for a description of this test.

Special Character Recognition Test

Refer to paragraph 2.5 for a description of this test.

Appendix 2A
Error Messages

A.1 Error Messages

The diagnostic displays the error messages on the VCP if it is connected to the computer. If any of the following messages occur the HP 12005A/B Interface card should be replaced. For replacement parts ordering information refer to the HP 12005A/B Asynchronous Serial Interface Card Reference Manual 12005-90001.

Following are the error messages. Each error message is followed by a description of what caused the error. The error messages are general and do not always point to the exact piece of hardware that has failed. For example a bad baud rate generator can cause a "ERROR - CONTROL REGISTER CHECK" error message. Keep this in mind if component level repair is being performed on the HP 12005A/B Interface card.

ERROR - BAUD RATE GENERATOR TEST

Baud rate generator is not functioning properly.

ERROR - BREAK FEATURE CHECK

Card cannot detect a break, a break cannot be cleared by a reset, or the baud rate generator is not working.

ERROR - BREAK/OVERRUN CHECK

Overrun error was not detected by the UART, the overrun did not cause an interrupt, or the overrun bit in the status word was not set.

ERROR - CARD RESET

Card reset failed OTA @32 or CLCC 0 instructions.

ERROR - CONTROL REGISTER CHECK

Control Register failed to hold data properly. Also displayed if the select code entered is not correct.

ERROR - DMA CHECK FAILURE

DMA transfer did not sucessfully complete by interrupting, flag did not set on DMA completion, data received did not match the data transmitted, register 30 upper byte failure, or DMA was not terminated by a special character recognition.

ERROR - HOOD TRANSMISSION TEST

Failure in either the 20ma current loop driver, 20ma receiver, or HP 12005A test hood.

ERROR - MODEM CHECK

Modem receiver lines are not working, output drivers are not working properly, modem lines are not being read properly into the status register, or the moden lines are not causing interrupts properly.

ERROR - PARITY ERROR

Card did not detect a parity error, or failed to cause an interrupt when it occured.

ERROR - PARITY OR STOP-BIT CHECK

UART does not operate correctly when its stop sense or parity sense is changed.

ERROR - TRANSMISSION
DATA OUT =XXXXXX STATUS=XXXXXX DATA IN=XXXXXX

UART did not send the data out properly, did not receive data properly or did not set flags properly. The information indicates what was being transmitted out of the data register at the time of the failure, the data that came into the data register during the transfer, and the status of the card in the status register.

ERROR - OPTICAL LOOP CHECK

The data transmitted over the fiber optic loop cable was not returned correctly.

WARNING - NON-STANDARD ROM INSTALLED

An information message displayed to indicate that the special character ROM installed in the HP 12005A/B card does not match the "standard" (factory programmed) ROM.

TEST FAILURE

Failure in the communication path between the HP 12005A Interface card and the terminal during the terminal to interface communication test (paragraph 2.3). Check the cable between the terminal and the HP 12005A Interface card.

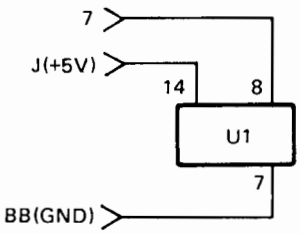
Appendix 2B
Test Hood

The 24397-60003 Rev. A test hood will only test the HP 12005A interface card, whereas the 24397-60003 Rev. B test hood will test both the 12005A and the 12005B interface cards. The Rev. B card incorporates a number of additional components and circuit changes in order to accomplish this universal application. For clarification the connector jumper connections and schematics for both the Rev. A and Rev. B versions of the 24397-60003 test hood are provided below.

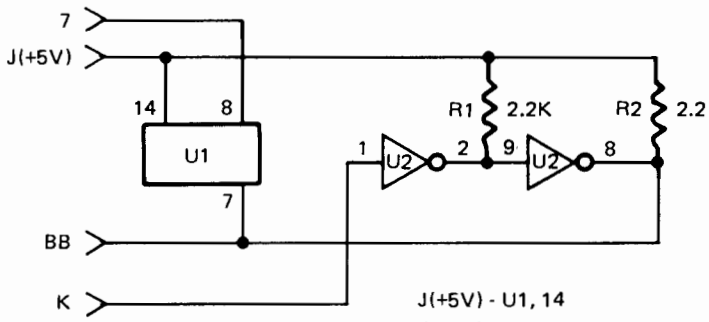
I. CONNECTOR JUMPERS:

REV. A	REV. B
B-2	B-2
F-3	F-3
5-8	5-8
K-11	K-11
U-23	U-23
T-D	T-D
X-E	X-E
9-15	9-15
10-17	10-17
6-22	6-22
H-21	H-21
C-20	C-20
L-19	L-19
W-Z	W-Z
M-V	M-V
AA-18-S-BB-Y	AA-18-S-24-Y

II. SCHEMATICS



8200-164



Appendix 2C
Program Listing

NOTE

The HP 12005A product program listing
applies also to the HP 12005B product.

The following is a listing of the source program of the Asynchronous Serial Interface Diagnostic (date code 2001). Diagnostic programs with date codes greater than 2001 may vary slightly from this copy. To list the diagnostic statement file that is in memory on the virtual control panel screen, use the DDL "LIST" command following the ">" DDL prompt character (refer to the DDL Operating and Programming manual).

The comments that are supplied with the listing below should be used as a guide to the program action of each statement. The comments are not included on the diagnostic media supplied by Hewlett-Packard.

```
     PROGRAM                    !!       COMMENTS
     STATEMENTS                 !!
================================!!=================================
                                !!
   1 FMT  ("12005A ASYNCHRONOUS SERIAL INTERFACE DIAGNOSTIC")
   2 REM  (C) HEWLETT-PACKARD CO. ALL RIGHTS RESERVED
   3 REM  SERVICE #24397-16005 REV. 2001
   4 PRNT 1                !! PRINT HEADER
   5 LET  Z=0              !! ESTABLISH Z AS ZERO
   6 GTSC 0 Z              !! GET THE SELECT CODE
   7 GOSB 1440             !! CHECK IT OUT
   8 GOTO 6                !! BAD SELECT CODE
   9 GOSB 745              !! CHECK FOR HOOD
                           !!
  10 REM  CONTROL REGISTER CHECK
                           !!
  11 BUF                   !! CLEAR AND ESTABLISH
  12 BUF  P(8) E(2) S(5) T(15) U(15) V(15) L(30)
                           !! BUFFERS
  13 LET  P(1)=@125052,@52525,0,@177577
                           !! CONTROL REGISTER CHECK PATTERNS
  14 LET  A=1              !! A = INDEX OF PATTERNS IN BUFFER
  16 GOSB 680              !! RESET CARD AND SET GLOBAL REG..
  18 OTA  @31 P(A)         !! OUTPUT PATTERN
  20 LIA  @31 C            !! READ IT BACK
                           !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
  22 SKIF P(A)=C          !! ARE THEY THE SAME?
  23 GOSB 750             !! NO - ERROR
  24 LET  A=A+1           !! INCREMENT INDEX
  26 SKIF A>4             !! ALL PATTERNS DONE?
  27 GOTO 18              !! NO - DO NEXT ONE
  28 CLCC 0               !! CLEAR CARD SHOULD CLEAR 31
  30 CLF  @2              !! ENABLE THE GLOBAL REGISTER
  32 LIA  @31 C           !! READ 31
  34 SKIF C=0             !! IS IT ZERO?
  35 GOSB 755             !! NO - ERROR
  36 OTA  @31 @177577     !! SET 31 TO A PATTERN
  38 OTA  @32 0           !! CARD RESET SHOULD CLEAR UPPER BYTE
  40 LIA  @31 C           !! READ 31
  42 SKIF 0=C.@177400     !! IS UPPER BYTE ZERO?
  43 GOSB 755             !! NO - ERROR
                          !!
  45 REM  BREAK CHECK     !!
                          !!
  46 LET  Y=@170          !! SET UP BAUD RATE IF HOOD ON
  48 GOSB 620             !! DO IT
  50 OTA  @32 1           !! ESTABLISH DIAGNOSE MODE ON CARD
  52 LET  H=0             !! SET H=0
  54 INT  Z 630           !! ESTABLISH INTERRUPT SUBROUTINE
  56 OTA  @31 @3170       !! CAUSE SSD = 0 (BIT 2)
  58 STCC @30             !! SET CONTROL TO ENABLE INTERRUPT
  60 LIA  @32 B           !! READ STATUS
  62 SKIF 0=B.@6          !! DR AND RD = 0?
  63 GOSB 760             !! NO - ERROR
  64 DLY  1000            !! WAIT FOR BREAK COUNT
  66 STF  0               !! ENABLE INTERRUPTS
  68 OTA  @31 @3174       !! SSD=1 CAUSES BREAK
  70 DLY  50              !! INTERRUPT OCCURS HERE (SEE 630)
  72 LIA  @32 C           !! GET SECOND STATUS
  74 SKIF @40100=B.@40100*H
                          !! INTERRUPT OCCUR AND STATUS CORRECT?
  75 GOSB 760             !! NO - ERROR
  76 SKIF 0=C.@40000      !! IS SECOND STATUS CORRECT(NO BREAK)?
  77 GOSB 760             !! NO - ERROR
  78 DLY  1000            !! WAIT FOR ANOTHER BREAK
  80 LIA  @32 C           !! READ STATUS
  82 SKIF 0=C.@40000      !! ANOTHER BREAK SHOULDN'T OCCUR
  83 GOSB 760             !! IT DID - ERROR
  84 LET  B=0             !! CLEAR B
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 85 OTA  @32 0            !! AND CARD
                          !!
 90 REM  EIGHT-BIT AND SPECIAL CHARACTER RECOGNITION CHECK
                          !!
 94 LET  P(1)=@43574,@103574,@143574
                          !! SPECIAL CHARACTER PATTERNS
 98 LET  R=1              !! ESTABLISH CONSTANTS
100 LET  A=0              !! FOR TEST
102 LET  I=0              !!
104 LET  F=1              !!
108 OTA  @32 1            !! ESTABLISH DIAGNOSE MODE
110 OTA  @31 P(F)         !! SEND FIRST CONTROL WORD
112 OTAC @30 A            !! OUTPUT DATA PATTERN
114 STCC @30              !! START THE TRANSFER (THRU UART)
116 WFI  Z 1000           !! WAIT FOR COMPLETION INTERRUPT
117 GOSB 800              !! DIDN'T OCCUR - ERROR
118 LIA  @32 B            !! GET STATUS
120 SFS  @30              !! IS 30 SET?
121 GOSB 800              !! NO - ERROR
122 LIA  @30 C            !! READ DATA PATTERN (FROM UART)
124 SKIF A=C.@377         !! ARE THEY THE SAME?
126 GOSB 800              !! NO - ERROR
128 SKIF @100100=B.@174100
                          !! IS STATUS CORRECT?
129 GOSB 800              !! NO - ERROR
130 GOSB 690              !! CHECK FOR TYPE ONE SPEC. CHR.
132 LET  F=F+1            !! INCREMENT INDEX
134 GOSB 710              !! CHECK FOR TYPE TWO SPECIAL CHR.
136 LET  F=F+1            !! INCREMENT INDEX
138 GOSB 730              !! CHECK FOR TYPE THREE SPEC. CHR.
140 LET  A=A+1            !! INCREMENT DATA PATTERN
142 SKIF A=@400           !! ALL DONE?
143 GOTO 104              !! NO - DO IT AGAIN
144 SKIF 14=I*R           !! CORRECT NUMBER OF SPEC. CHR.?
145 PRNT 1220             !! NO - PRINT WARNING
148 OTA  @32 1            !! CLEAR CARD - ESTABLISH DIAG. MODE
                          !!
150 REM  SEVEN BIT TRANSMISSION CHECK
                          !!
152 OTA  @31 @3174        !! DO SEVEN BIT TRANSMISSION
154 LET  D=0              !! ESTABLISH CONSTANTS
156 LET  C=0              !!
158 LET  A=D              !!
                          !!
```

```
                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
 160 OTAC @30 A           !! OUTPUT DATA PATTERN
 162 LET  A=A.@177        !! MASK OFF UPPER BIT OF LOWER BYTE
 164 STCC @30             !! START TRANSFER THRU UART
 166 WFI  Z 1000          !! WAIT FOR COMPLETION INT.
 167 GOSB 800             !! DIDN'T OCCUR SO ERROR
 168 LIA  @32 B           !! GET STATUS
 170 SKIF @100101=B.@174101
                          !! IS STATUS CORRECT?
 171 GOSB 800             !! NO - ERROR
 172 LIAC @30 C           !! READ DATA PATTERN FROM UART
 174 SKIF A=C.@377        !! IS IT CORRECT?
 176 GOSB 800             !! NO - ERROR
 178 LET  D=D+1           !! INCREMENT DATA PATTERNS
 180 SKIF D=@201          !! LAST PATTERN?
 181 GOTO 158             !! NO - DO IT AGAIN
                          !!
 185 REM  DMA CHECK       !!
                          !!
 186 OTA  @32 1           !! ESTABLISH DIAGNOSE MODE
 188 OTA  @31 @4          !! MAKE SURE SSD=1
 190 LET  E(1)=@125125, 0
                          !! PATTERN FOR TEST
 192 LET  P(1)=@165400,@3574,E(!),-2
                          !! OUTPUT DMA QUAD
 194 LET  P(5)=@61600,@3574,E(!)+1,-2
                          !! INPUT DMA QUAD
 196 OTAC @20 P(!)        !! OUTPUT STARTING DMA ADDR.
 198 STCC @20             !! START THE TRANSFER
 200 WFI  Z 2000          !! WAIT FOR COMPLETION INTERRUPT
 201 GOSB 770             !! DIDN'T INTERRUPT - ERROR
 202 SFS  @23             !! IS 23 SET?
 203 GOSB 770             !! NO - ERROR
 204 SFS  @20             !! IS 20 SET?
 205 GOSB 770             !! NO - ERROR
 206 SFS  @21             !! IS 21 SET?
 207 GOSB 770             !! NO - ERROR
 208 SKIF E(1)=E(2)       !! ARE DATA PATTERNS EQUAL?
 209 GOSB 770             !! NO - ERROR
 210 CLCC @23             !! TURN OFF DMA
 212 LET  E(1)=E(1)*-1-1!! COMPLEMENT PATTERN
 213 SKIF E(1)>0          !! ALL DONE?
 214 GOTO 196             !! NO - DO IT AGAIN
 218 LET  E(1)=@6400,0    !! E(1)=CARR. RET.
                          !!
```

```
                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 219 LET  P(1)=@71600,@43574,E(!)+1,-2
                          !! TYPE ONE SPECIAL CHR. QUAD
 220 SKIF R=1             !! CORRECT PROM?
 221 GOTO 236             !! NO - DON'T DO TEST
 222 OTAC @20 P(!)        !! OUTPUT STARTING ADDRESS
 223 OTAC @30 E(1)        !! AND DATA PATTERN
 224 STCC @20             !! START THE TRANSFER
 226 WFI  Z 2000          !! WAIT FOR COMPLETION INT.
 227 GOSB 770             !! DIDN'T INT. - ERROR
 228 SKIF P(4)=-1         !! RESIDUE WRITTEN BACK =-1?
 230 GOSB 770             !! NO - ERROR
 232 SKIF E(1)=E(2).@177400
                          !! IS DATA CORRECT?
 234 GOSB 770             !! NO - ERROR
 236 CLCC @23             !! TURN OFF DMA
                          !!
 240 REM  BREAK-OVERRUN CHECK
                          !!
 242 OTA  @32 1           !! CLEAR CARD - ESTABLISH DIAG. MODE
 244 OTA  @31 @11170      !! CARD CONTROL WORD
 246 OTAC @30 @25252      !! DATA PATTERN
 248 STCC @30             !! START TRANSFER THRU UART
 250 DLY  1000            !! WAIT AWHILE
 252 LIA  @32 C           !! GET STATUS
 254 LET  C=C.@2          !! IS DATA WAITING?
 256 SKIF C=@2            !! CHECK IT
 258 GOSB 780             !! NO - ERROR
 260 STC  @30             !! DO TWO MORE TRANSFERS
 261 STC  @30             !! TO FORCE OVERRUN ERROR
 262 WFI  Z 2000          !! INTERRUPT SHOULDN'T OCCUR
 263 GOTO 265             !! BREAK IS PENDING. IF IT DOES,
 264 GOSB 780             !! IT'S AN ERROR
 265 LIA  @32 C           !! GET STATUS
 266 SKIF @4000=C.@4000   !! OVERRUN PENDING?
 267 GOSB 780             !! NO - ERROR
 268 OTA  @31 @11174      !! FORCE BREAK
 269 WFI  Z 2000          !! CHECK FOR INTERRUPT
 270 GOSB 780             !! DIDN'T OCCUR - ERROR
 271 LIA  @32 C           !! CHECK STATUS AND CLEAR BREAK
 272 SKIF @44000=C.@44000
                          !! IS STATUS CORRECT?
 273 GOSB 780             !! NO - ERROR
 274 STCC @30             !! DO ANOTHER STC TO FORCE OVERRUN
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 275 WFI  Z 2000          !! CHECK FOR INTERRUPT
 276 GOSB 780             !! DIDN'T OCCUR - ERROR
 278 GOSB 740             !! KEEP GOING TO HOOD TESTS
 279 GOTO 550             !! NO
                          !!
 280 REM  HOOD TESTS      !!
                          !!
 281 GOSB 680             !! CLEAR AND RESET CARD
 282 OTA  @31 @1574       !! CARD CONTROL WORD
 283 OTA  @30 @125252     !! TEST PATTERN IN LOWER BYTE
 284 STCC @30             !! START TRANSFER THROUGH HOOD
 285 LIA  @32 B           !! GET STATUS
 286 SKIF 0=B.@2          !! IS STATUS CORRECT?
 287 GOSB 810             !! NO - ERROR
 288 WFI  Z 1000          !! WAIT FOR TRANSMISSION COMPLETION
 289 GOSB 810             !! DIDN'T COMPLETE - ERROR
 290 SFS  @30             !! IS 30 SET?
 291 GOSB 810             !! NO - ERROR
 292 LIA  @30 C           !! GET DATA
 294 SKIF @52=C.@177      !! IS IT CORRECT?
 295 GOSB 810             !! NO - ERROR
                          !!
 296 REM  BAUD RATE TEST!!
                          !!
 298 PRNT 1320            !! PRINT HEADING
 300 LET  T(1)=1003,669,458,375,336
                          !! T BUFFER IS UPPER LIMIT
 301 LET  T(6)=169,86,58,44,30
 302 LET  T(11)=25,17,13,10,8
 303 LET  V(1)=50,75,110,134,150
                          !! V BUFFER IS BAUD RATE UNDER TEST
 304 LET  V(6)=300,600,900,1200,1800
 305 LET  V(11)=2400,3600,4800,7200,9600
 306 LET  U(1)=999,665,454,371,332
                          !! U BUFFER IS LOWER LIMIT
 307 LET  U(6)=165,82,54,40,26
 308 LET  U(11)=21,13,9,6,4
 310 LET  B=1              !! INITIALIZE B
 312 LET  J=@5014          !! CONTROL REG. IN J
 314 OTA  @32 0            !! CLEAR CARD
 316 LET  Y=J              !! ESTABLISH PROPER BAUD RATE
 317 GOSB 620              !! GO DO IT
 318 PRNT 1330 V(B)        !! PRINT BAUD RATE UNDER TEST
                          !!
```

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                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 320 INT  Z 0             !! CLEAR INTERRUPTS
 322 LET  A=0             !! INITIALIZE TIMER IN A
 324 CLF  @30             !! CLEAR 30
 326 LET  P(1)=@60400,L(!),-50
                          !! DMA TRIPLET
 330 IBP  L(1) L(30)  PA 1300
                          !! WITH A PATTERN
 332 LET  H=0             !! CLEAR H
 334 INT  6 640           !! ESTABLISH TBG INTERRUPT ROUTINE
 336 CLCC @21             !! MAKE SURE DMA IS
 338 CLCC @23             !! OFF
 340 STF  0               !! TURN ON INTERRUPTS
 341 STCC 6               !! AND TIME BASE GENERATOR
 342 OTAC @20 P(!)        !! OUTPUT FIRST QUAD
 343 SKIF H=1             !! H=1 ON FIRST TBG TICK
 344 GOTO 343             !! WAIT FOR FIRST TICK
 345 STCC @20             !! START DMA
 346 STF  0               !! MAKE SURE INTERRUPTS ARE ON
 347 REM  ALLOW TIME FOR TBG INT.
 348 SFS  @20             !! TRANSFER COMPLETED OR TIMEOUT??
 349 GOTO 346             !! NO - KEEP WAITING
 350 CLF  0               !! TRANSFER DONE - TURN OFF
 351 CLC  6               !! INTERRUPTS AND TBG
 352 SKIF A<T(B)          !! IS A BELOW UPPER LIMIT?
 353 GOSB 840             !! NO - ERROR
 354 SKIF A>U(B)          !! IS A ABOVE LOWER LIMIT?
 355 GOSB 840             !! NO - ERROR
 356 LET  J=J+@10         !! INCREMENT CONTROL REG. TO NEXT
 358 LET  B=B+1           !! BAUD RATE AS WELL AS INDEX
 360 CLCC @23             !! TURN OFF DMA
 362 SKIF B=16            !! LAST PATTERN?
 363 GOTO 314             !! NO - DO IT AGAIN
 364 CLF  0               !! MAKE SURE INTERRUPTS ARE OFF
 366 INT  Z 0             !! CLEAR TRAP CELLS
 368 INT  6 0             !!
 370 LET  H=0             !! INITIALIZE H
 372 LET  Y=@7004         !! SET EXTERNAL CLOCK
 374 GOSB 620             !!
 376 OTA @32 1            !! ESTABLISH DIAGNOSE MODE
 375 OTA @31 @3004        !! SET CONTROL REGISTER
 376 OTA @30 @125         !! SET DATA PATTERN
 378 STCC @30             !! START TRANSFER
 380 WFI Z 100            !! WAIT FOR COMPLETION INTERRUPT
 381 GOSB 840             !! NO COMPLETION INTERRUPT
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
=================================================================
                          !!
 382 LIAC @30 C           !! CLEAR FLAG AND GET DATA
 383 SKIF @125=C.@377     !! IS DATA CORRECT?
 384 GOSB 840             !! NO - EXTERNAL CLOCK IN ERROR
 385 OTA  @31 @3000       !! CAUSE A BREAK
 386 OTA  @31 @3004       !! THIS DOES IT
 387 SFS  @30             !! DID 30 SET?
 388 GOSB 840             !! NO - ERROR
 389 PRNT 1350            !! PRINT COMPLETION MESSAGE
                          !!
 390 REM  PARITY ERROR TEST
                          !!
 392 LIAC @30 C           !! READ DATA
 394 OTA  @32 0           !! CLEAR CARD
 396 INT  Z 630           !! ESTABLISH INTERRUPT ROUTINE
 398 LET  H=0             !! CLEAR H
 400 OTAC @30 @176        !! OUTPUT ALL ONE'S PATTERN
 402 OTA  @31 @23014      !! ENABLE PARITY INTERRUPTS
 404 STF  0               !! ENABLE SYSTEM INTERRUPTS
 406 STCC @30             !! START THE TRANSFER
 408 OTA  @31 @22010      !! CAUSE PARITY ERROR
 410 DLY  15              !! WAIT A WHILE
 412 OTA  @31 @22014      !! RESTORE DATA PATH
 414 DLY  2500            !! WAIT STILL LONGER
 416 SKIF H=1             !! WAS THERE AN INTERRUPT?
 417 GOSB 845             !! NO - ERROR
 418 SKIF @20000=B.@160000
                          !! WAS IT A PARITY ERROR INTERRUPT?
 419 GOSB 845             !! NO - ERROR
                          !!
 420 REM  PARITY SENSE CHECK
                          !!
 422 OTA  @32 1           !! ESTABLISH DIAGNOSE MODE
 424 LET  Y=@17175        !! ESTABLISH CONTROL REGISTER
 425 GOSB 620             !! DO IT
 426 OTAC @30 @125        !! DATA PATTERN TO SEND
 428 STCC @30             !! DO IT
 430 WFI  Z 2000          !! WAIT FOR COMPLETION INTERRUPT
 431 GOSB 860             !! NONE OCCURRED - ERROR
 432 LIAC @30 C           !! GET DATA
 434 SKIF @125=C.@377     !! IS IT CORRECT?
 435 GOSB 860             !! NO - ERROR
 438 OTA  @32 0           !! CLEAR CARD
                          !!
```

```
                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 440 REM  MODEM CHECK     !!
                          !!
 442 LET  V(1)=@367,@357,@347,@277
                          !! CONTROL REG. VALUES FOR TEST
 443 LET  V(5)=@1214,@1224,@1244,@1304
 445 INT  Z 0             !! CLEAR INTERRUPTS
 446 LET  Y=@5014         !! SET FOR 50 BAUD
 447 GOSB 620             !! DO IT
 448 OTA  @31 @17         !! SET ALL MODEM LINES HIGH
 450 LIA  @32 B           !! GET STATUS
 452 SKIF @3070=B.@3070   !! ARE THEY HIGH ALSO?
 453 GOSB 850             !! NO - ERROR
 454 OTA  @31 @1014       !! SEND ALL LINES LOW VIA CONTROL
 456 OTAC @30 0           !! AND SENDING A ZERO OVER UART
 458 STCC @30             !! START TRANSFER
 460 DLY  10              !! WAIT FOR FIRST ZERO
 462 LIA  @32 B           !! READ STATUS
 464 SKIF 0=B.@3070       !! ARE LINES LOW?
 465 GOSB 850             !! NO - ERROR
 466 WFI  Z 1500          !! WAIT FOR COMPLETION INTERRUPT
 467 GOSB 850             !! DIDN'T OCCUR SO ERROR
 468 LET  C=1             !! SET INDEX
 470 OTA  @32 0           !! CLEAR CARD
 472 CLF  @30             !! AND FLAG
 474 OTA  @31 @177        !! SET CONTROL REGISTER INT. PATTERN
 476 SFC  @30             !! MAKE SURE INT. DOESN'T SET FLAG YET
 477 GOSB 850             !! IT DID - ERROR
 478 OTA  @31 @377        !! TURN ON MODEM INTERRUPTS
 480 DLY  1               !! WAIT A WHILE
 482 SFC  @30             !! MAKE SURE FLAG IS STILL CLEAR
 484 GOSB 850             !! IT ISN'T SO ERROR
 486 OTA  @31 V(C)        !! OUTPUT INTERRUPTING PATTERN
 488 SFS  @30             !! FLAG SET?
 489 GOSB 850             !! NO - ERROR
 490 LIA  @32 B           !! GET STATUS
 492 OTA  @31 @177        !! CLEAR INT.
 494 SKIF 0=B.@100        !! IS MIEN CLEAR?
 495 GOSB 850             !! NO - ERROR
 496 LET  C=C+1           !! INCREMENT INDEX
 498 SKIF C>4             !! ALL DONE WITH ONE PATTERNS?
 499 GOTO 470             !! NO - DO IT AGAIN
 500 OTA  @32 0           !! CLEAR CARD
 502 CLF  @30             !! AND FLAG
                          !!
```

```
                                !!
     PROGRAM                    !!       COMMENTS
     STATEMENTS                 !!
================================!!================================================
                                !!
 504 OTAC @30 0                 !! SEND A ZERO OVER UART
 506 OTA  @31 @1004             !! TRANSMIT ONLY
 508 SFC  @30                   !! MAKE SURE FLAG IS CLEAR
 509 GOSB 850                   !! NO - ERROR
 510 OTA  @31 @1204             !! ENABLE INTERRUPTS
 512 OTA  @31 V(C)              !! SEND INTERRUPTING PATTERN
 514 STC  @30                   !! DO IT
 516 DLY  100                   !! WAIT A WHILE
 518 SFS  @30                   !! IS THE FLAG SET?
 519 GOSB 850                   !! NO - ERROR
 520 LIA  @32 B                 !! GET STATUS
 522 OTA  @31 @1004             !! CLEAR INTERRUPTING CONDITION
 524 LET  B=B.@100              !! IS MIEN CLEAR?
 526 SKIF B=0                   !!
 528 GOSB 850                   !! NO - ERROR
 530 LET  C=C+1                 !! INCREMENT INDEX
 532 SKIF C>8                   !! ALL DONE?
 533 GOTO 500                   !! NO - AGAIN
                                !!
 550 REM  DIAGNOSTIC COMPLETE
                                !!
 552 OTA  @2 0                  !! CLEAN-UP ROUTINE
 554 STF  @2                    !! DISABLE GR
 556 CLCC 0                     !! CLEAR
 558 GOTO 1999                  !! ALL DONE!
 600 OTA  @31 P(F)              !! SPEC. CHR. DETECT:
                                !! OUTPUT CONTROL WORD
 601 LIA  @32 G                 !! GET STATUS
 604 SKIF 0=G.@200              !! 0=SPEC. CHR. DETECTED
 605 RTN                        !! NO - RETURN N+1
 607 RTN  1                     !! YES - RETURN N+2
 620 OTA  @31 Y                 !! RESET CARD ROUTINE ;RESET CARD
 621 DLY  40                    !! WAIT AWHILE
 622 LET  Y=Y-@4000             !! REMOVE RESET BIT ("ECHO")
 623 OTA  @31 Y                 !! DO IT
 624 RTN                        !! ALL DONE
 630 CLF  0                     !! INT. SUBROUTINE, TURN OFF INTERRUPTS
 632 SFS  @30                   !! IS 30 SET
 633 GOSB 760                   !! NO - ERROR
 635 LET  H=1                   !! SET H INDICATING INTERRUPT OCCURRED
 636 LIA  @32 B                 !! READ STATUS
 637 RTN                        !! ALL DONE
 640 CLF  0                     !! TBG SUBROUTINE, TURN OFF INTERRUPTS
                                !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 641 LET  H=1             !! SET H INDICATING FIRST TICK
 642 LET  A=A+1           !! INCREMENT TIMER
 644 SKIF A<2000          !! HAS TIMER ROLLED OVER?
 645 GOSB 840             !! YES - ERROR
 646 RTN                  !! NO - RETURN
 680 CLCC 0               !! DO A CRS
 682 OTAC @2 Z            !! AND ENABLE THE GR TO THIS CARD
 684 RTN                  !! ALL DONE
 690 LET  S(1)=@4,@10,@15,@22,@177
                          !! TYPE ONE SPEC. CHR.
 692 GOSB 600             !! IS IT A SPEC. CHR.?
 693 RTN                  !! NO - RETURN
 694 LET  S=1             !! SET INDEX
 696 SKIF S(S) C.@177     !! IS IT ONE OF THESE CHR.?
 697 GOTO 705             !! YES
 698 LET  S=S+1           !! INCREMENT INDEX
 700 SKIF S=6             !! ALL PATTERNS CHECKED?
 701 GOTO 696             !! NO - DO AGAIN
 702 LET  R=0             !! NON-STANDARD ROM - SET R=0
 704 RTN                  !! ALL DONE
 705 LET  I=I+1           !! INCREMENT SPEC. CHR. COUNT
 706 RTN                  !! RETURN
 710 GOSB 600             !! TYPE 2, IS IT A SPEC. CHR.?
 711 RTN                  !! NO - RETURN
 712 SKIF @36 C.@177      !! IS IT THE PROPER ONE?
 713 GOTO 716             !! YES -
 714 LET  R=0             !! NO - NON-STANDARD ROM
 715 RTN                  !! RETURN
 716 LET  I=I+1           !! INCREMENT COUNT
 717 RTN                  !! RETURN
 730 GOSB 600             !! TYPE 3, IS IT A SPEC. CHR.
 731 RTN                  !! NO - RTN
 732 SKIF @15 C.@177      !! IS IT CORRECT SPEC. CHR.?
 733 GOTO 736             !! YES
 734 LET  R=0             !! NO - INDICATE
 735 RTN                  !! ALL DONE
 736 LET  I=I+1           !! INCREMENT COUNT
 737 RTN                  !! ALL DONE
 740 SKIF M=0             !! DO HOOD TESTS? ;CHECK FLAG
 741 RTN  1               !! YES, DO HOOD TEST
 742 PRNT 1230            !! NO -INDICATE
 743 RTN                  !! ALL DONE
 745 LET  M=1             !! HOOD FLAG SET ROUTINE: SET FLAG
                          !!
```

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                          !!
     PROGRAM              !!        COMMENTS
     STATEMENTS           !!
=============================================================================
                          !!
 746 HOOD                 !! IS THERE A HOOD?
 747 LET  M=0              !!
 748 RTN                  !! BACK TO PROGRAM
 750 PRNT 1000            !! ERROR MESSAGE ROUTINES -
                          !! THESE LINES ARE CALLED
 752 GOTO 804             !! BY THE APPROPRIATE SUBROUTINE
                          !! IN THE PROGRAM. THEY
 755 PRNT 1010            !! PRINT THE APPROPRIATE
                          !! ERROR MESSAGE AND THEN GOTO
 756 GOTO 804             !! LINE 804 FOR PROGRAM CLEAN UP
 760 PRNT 1050            !!
 762 GOTO 804             !!
 770 PRNT 1100            !!
 772 GOTO 804             !!
 780 PRNT 1250            !!
 782 GOTO 804             !!
 800 PRNT 1150            !!
 802 PRNT 1151 A B C      !!
 804 OTA  @2 0            !! CLEAN-UP ROUTINE ZEROS
                          !! OUT ALL DIAGNOSE MODES
 806 STF  @2              !! AND TURNS OFF THE GLOBAL REG.
 808 STOP                 !! STOPS HERE
 810 PRNT 1260            !!
 811 GOTO 804             !!
 820 PRNT 1270            !!
 821 GOTO 804             !!
 830 PRNT 1280            !!
 831 GOTO 804             !!
 840 PRNT 1310            !!
 842 GOTO 804             !!
 845 PRNT 1360            !!
 846 GOTO 804             !!
 850 PRNT 1370            !!
 851 GOTO 804             !!
 860 PRNT 1400            !!
 861 GOTO 804             !!
1000 FMT  ("ERROR - CONTROL REGISTER CHECK"/)
1010 FMT  ("ERROR - CARD RESET"/)
1050 FMT  ("ERROR - BREAK FEATURE CHECK"/)
1100 FMT  ("ERROR - DMA CHECK FAILURE"/)
1150 FMT  ("ERROR - TRANSMISSION"/)
1151 FMT  ("DATA OUT="K6"  STATUS="K6"  DATA IN="K6/)
1200 FMT  ("SPECIAL CHARACTER RECOGNITION"/)
                          !!
```

```
                          !!
     PROGRAM              !!        COMMENTS
     STATEMENTS           !!
================================================================
                          !!
1205 FMT  ("ASCII CHR.(OCT)   T1   T2   T3"//)
1210 FMT  (11X,K3,4X,A2,5X,A2,4X,A2/)
1220 FMT  ("WARNING - NON-STANDARD ROM INSTALLED"/)
1230 FMT  ("HOOD TESTS NOT EXECUTED"/)
1250 FMT  ("ERROR - BREAK-OVERRUN TEST"/)
1260 FMT  ("ERROR - HOOD TRANSMISSION TEST"/)
1300 ASC  THIS IS A BAUD RATE TEST PATTERN!!!!!!!!!!
1310 FMT  ("ERROR - BAUD RATE GENERATOR TEST"/)
1320 FMT  ("BAUD RATE TEST"//)
1330 FMT  ("BAUD RATE UNDER TEST = "I4/)
1340 FMT  ("EXTERNAL CLOCK SOURCE TEST"//)
1350 FMT  ("BAUD RATE TEST COMPLETE"/)
1360 FMT  ("ERROR - PARITY ERROR"/)
1370 FMT  ("ERROR - MODEM CHECK"/)
1400 FMT  ("ERROR - PARITY OR STOP-BIT CHECK"/)
1410 FMT  ("CARD IS VCP. TEST NOT EXECUTED"/)
1440 SKIF Z=@20           !! POSSIBLE FRONT PANEL?
1442 RTN  1               !! NO - EXECUTE TEST
1450 GOSB 680             !! VCP CHECK - CLEAR AND ESTABLISH CARD
1451 OTA  @2 @2           !! ESTABLISH DIAGNOSE MODE 2
1452 LIA  @2 B            !! READ GR
1453 OTA  @2 0            !! DISABLE DIAGNOSE MODE 2
1455 SKIF @10000=B.@10000
                          !! IS CARD VCP?
1456 RTN  1               !! NO -
1457 PRNT 1410            !! YES - PRINT MESSAGE
1458 RTN                  !! DON'T DO TEST
                          !!
1500 PRGM A TERMINAL-12005A INTERFACE COMMUNICATION TEST
                          !!
1502 LET  Z=0             !! INITIALIZE Z
1505 GTSC 0 Z             !! GET SELECT CODE
1510 BUF                  !! CLEAR AND ESTABLISH
1520 BUF  A(40) B(40) C(40) D(40) Q(40)
                          !! BUFFERS
1530 IBP  A(1) A(24)  PA 1500
                          !! THESE ROUTINES BUILD THE BUFFERS
1532 IBP  A(25) A(38)  CL
                          !! TO TRANSMIT
1534 LET  A(40)=0         !!
1540 LET  A(39)=@6412     !!
1545 IBP  B(1) B(21)  PA 1550
1547 IBP  B(22) B(40)  CL
                          !!
```

```
                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
=================================================================
                          !!
1550 REM  TYPE TWENTY CHARACTERS ON THE KEYBOARD NOW
                          !!
1555 LET  B(39)=@6412     !!
1560 IBP  D(2) D(14)   PA 1565
1561 LET  D(1)=@6412      !!
1562 IBP  D(15) D(39)  CL
                          !!
1565 REM  TIC-TERMINAL TEST COMPLETE
                          !!
1570 LET  D(40)=@6412     !!
1580 LET  Q(1)=@161400,@1000,A(!),-80
                          !! DMA QUADS
1585 LET  Q(5)=@161400,@1000,B(!),-80
1590 LET  Q(9)=@71200,@46000,C(!),-20
1598 LET  Q(13)=@61400,@1000,D(!),-80
1600 GOSB 680             !! ESTABLISH CARD
1601 INT  Z 1650          !! SET UP COMPLETION ROUTINE
1602 OTAC @20 Q(!)        !! GIVE DMA STARTING ADDRESS
1603 LET  H=0             !! CLEAR INTERRUPT FLAG
1604 STF  0               !! ENABLE SYSTEM INTERRUPTS
1605 STCC @20             !! START THE TRANSFER
1608 DLY  32767           !! WAIT LOOP TAKES APPR. 0.5 MIN
1610 SKIF H=0             !!
1611 GOTO 1505            !!
1616 CLF  0               !! NO INTERRUPT SO TURN IT OFF
1617 CLCC @23             !! AND DMA
1618 PRNT 1699            !! SAY THE TEST FAILED
1620 STOP                 !! AND STOP
1650 CLF  0               !! INTERRUPT OCCURRED - IS FLAG SET?
1651 SFS  @20             !! CHECK IT
1652 GOTO 1618            !! NO - ERROR
1653 CLCC @21             !!
1654 STCC @20             !! TURN ON DMA FOR FINAL QUAD
1655 WFI  Z 2000          !! WAIT FOR COMPLETION INTERRUPT
1656 STOP                 !! STOP IF IT DOESN'T OCCUR
1657 CLCC @23             !! SHUT DOWN DMA
1658 LET  C=20+Q(12)      !! COMPLEMENT
1659 PRNT 1698 C          !! SAY ALL DONE
1660 LET  H=1             !! SET FLAG
1662 RTN                  !! BACK WE GO
1698 FMT  (I2" CHARACTERS RECEIVED"/)
1699 FMT  (/"TEST FAILURE"/)
1700 PRMG B SPECIAL CHR. TEST
1701 LET  Z=0             !!
                          !!
```

```
                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
=================================================================
                          !!
1702 GTSC 0 Z             !! GET SELECT CODE
1703 GOSB 1440            !! CHECK IF ITS VALID
1704 GOTO 1701            !! NOT VALID ASK FOR AGAIN
1705 PRNT 1200            !! PRINT HEADERS
1706 PRNT 1205            !!
1707 GOSB 680             !! CLEAR SYSTEM
1708 BUF                  !! CLEAR AND ESTABLISH
1710 BUF  P(3) F(3)       !! BUFFERS
1712 LET  P(1)=@43574,@103574,@143574
1714 OTA  @32 1           !! ENABLE DIAGNOSE MODE
1716 OTA  @31 @3574       !! CONTROL FOR CARD
1718 LET  A=0             !! INITIALIZE CONSTANTS
1722 LET  R=0             !!
1723 LET  F=1             !!
1724 LET  F(1)=0,0,0      !!
1725 OTAC @30 A           !! OUTPUT PATTERN
1726 STCC @30             !! START TRANSFER
1728 WFI  Z 2000          !! WAIT FOR INTERRUPT
1729 STOP                 !! STOP IF IT DOESN'T OCCUR
1730 GOSB 600             !! CHECK FOR SPECIAL CHARACTER
1731 GOTO 1734            !! NO
1732 LET  F(F)=$X         !! YES PUT "X" IN F BUFFER
1733 LET  R=1             !! SET FLAG
1734 LET  F=F+1           !! INCREMENT INDEX
1735 SKIF F=4             !! ALL DONE?
1736 GOTO 1730            !!   NO - TRY NEXT ONE
1738 SKIF R=0             !! DON'T PRINT IF NO SPEC. CHR.
1739 PRNT 1210 A F(1) F(2) F(3)
1740 LET  A=A+1           !! INCREMENT PATTERN
1742 SKIF A=@400          !! ALL DONE?
1743 GOTO 1722            !! NO - DO AGAIN
1744 GOTO 1701            !! YES - STOP
1999 GOTO 6               !! LAST LINE
```

Section 3
HP 12006B Parallel Interface Diagnostic (PIC)

3.1 General

Load and execute the Diagnostic Control System (DCS) and parallel interface diagnosic (PIC), using the diagnostic operating mode desired (see the diagnostic operating and troubleshooting manual). When the PIC diagnostic is ready to run, refer to the additional operating procedures in this section.

During execution of the PIC diagnostic, refer to Appendix 3A for a list of execution error messages and codes, Appendix 3B for test hood jumper connections, and Appendix 3C for a listing of the PIC diagnostic program.

3.2 Additional Equipment Required

- o HP 12006A Test Hood, part no. 24397-60004.

3.3 Diagnostic Operation

1. Type "RUN<cr>" following the ">" DDL prompt to start the diagnostic program.

   Note: Typing "RUN !<cr>" will cause the diagnostic to execute on the highest priority HP 12006B Interface card in a noninteractive mode. The test hood must be installed for this operation. If any failures are detected, the diagnostic terminates and prints the error message. If the diagnostic completes normally, it will automatically execute on the next highest priority HP 12006B card. When all HP 12006B cards have been tested, the diagnostic terminates and returns with the ">" DDL prompt.

2. The message
   "12006A PARALLEL INTERFACE DIAGNOSTIC"
   "INPUT SELECT CODE:"
   will be displayed. Type in the select code in octal notation of the HP 12006B Interface to be tested. For example "24<cr>".

3. The message:
   "HOOD INSTALLED?"
   will be displayed. Type in whether or not the diagnostic test hood is attached to the card. For example "YES<cr>" or "NO<cr>".

4. The message:
   "DEVICE COMMAND SENSE SWITCH--ACTIVE HIGH"
   will be displayed. This information displays the U1S2 switch setting and must be in the active high (up) setting for the correct operation of the diagnostic.

5. If the HP 12006B Interface diagnostic completes successfully, the message:
   "PASS COMPLETE"
   "INPUT SELECT CODE:"
   will be displayed on the terminal.

6. To run the diagnostic again, enter the select code to run through one pass, or enter <cr> to loop diagnostic.

7. To discontinue program execution, type zero, "0<cr>", following the "INPUT SELECT CODE:" message. The diagnostic program will be terminated, and the ">" DDL prompt will be displayed. Any valid DDL command or statement can now be entered.

8. Remember to return the interface card switches to their original configurations.

3.4 Execution Times

The execution time with the test hood is about 10 seconds.

The execution time without the test hood is about 5 seconds.

3.5 Program Description

The diagnostic is separated into different tests as described below. These tests are described in the same order as they are executed in the diagnostic program.

When reviewing the diagnostic program listing, the various test is useful at times to refer to the HP 12006B Parallel Interface Reference Manual, part number 12006-90001, for a description of the logic circuitry which performs the test identified by the REM statement.

Status Test

The first test run by the diagnostic is a check of the status bits in the status register and the control register. This test also checks one other bit in the upper and lower bytes of these registers, and confirms that the state of the interface is the same as that signified by the status and control registers. If there is not a test hood attached, this is the only test executed.

This test can be executed with a peripheral device connected to the HP 12006B Interface card because no device handshake signals are asserted.

I/O Driver Test

The I/O drivers are checked to insure the proper operation of all the forty signal lines. The logic sense is inverted and the forty lines are checked again. These signal lines include the status lines from the peripheral.

Register Test

The input register and output register are checked to insure they send and receive data correctly in the latched, transparent, and the byte mode of operation.

The status register is checked to insure that each bit correctly reports the status of the line it is connected to, and its operation is verified in the latched and transparent mode of operation.

The individual bits in the control register are checked for their proper operation in this test.

Device Interface Logic Tests

The device interface logic, including the DMA termination, byte/word mode, flag and control signals, interrupt termination, and device interface assetion level lines, is checked to insure that the interface signals are properly asserted. Upon assertion, the signals are checked to verify their proper effect on the interface card logic. The control and status registers are used to verify the logic during this test.

Appendix 3A
Error Messages

A.1 Error Messages

The diagnostic displays the error messages on the VCP if it is connected to the computer. If any of the following messages occur, the HP 12006B Interface card should be replaced. For replacement parts ordering information refer to the HP 12006B Parallel Interface Card Reference Manual 12006-90001.

Each of the error messages in this Appendix is followed by a description of what caused the error. The error messages are general and do not always point to the exact piece of hardware that has failed. For example a "ERROR - STATUS REG. FAILED" error message does not always mean the status register has failed. Keep this in mind if component level repair is being performed on the HP 12006B Interface card.

ERROR - BYTE MODE DMA : PACK OR DMAON STATUS

Either a status or data error during a byte mode DMA transfer.

ERROR - CARD RESET FAILED

Either the status or command register did not reset after an OTA @32 statement.

ERROR - DATA REG. DID NOT LATCH

The data register (register no. 30) did not latch the data loaded into it.

ERROR - DATA REG. FAILED

A failure in the data path between the internal and external data buses. Probably a failure in either the input or output line drivers.

ERROR - DATA REG. NOT IN TRANSPARENT MODE

Failure when the data register was programmed in the transparent mode (pass data without a clock).

ERROR - DCL LINE FAILED

Device command was not cleared by the device flag.

ERROR - DEVICE COMMAND FLIP FLOP FAILED

The device command flip-flop did not change state after a STC @30 or CLC @30 statement.

ERROR - DFS LINE FAILED

A device flag did not generate a service request to the I/O processor chip.

ERROR - DMA DID NOT START

DMA transfer did not start.

ERROR - DMAON FLIP FLOP FAILED

Incorrect status reported during DMA operation.

ERROR - IN BYTE MODE DMA TRANSFER

Failure during a byte mode DMA transfer.

ERROR - IN COMMON BITS OF REG. 31 AND 32

Failure in the status register (reg. 32) bits which are looped from the control register (reg. 31).

ERROR - IN DEVICE FLAG SIGNAL

The device flag did not change state after a STC @30 statement (issue device command).

ERROR - INTERNAL PATH FAILURE

Failure in the status register bits which are looped from the control register but do not go to the drivers.

ERROR - IRQEN CAUSES ERRONEOUS INTERRUPT

IRQEN caused an interrupt when the IRQ bit was not set.

ERROR - IRQEN DOES NOT CAUSE INTERRUPT

IRQEN did not cause an interrupt when the IRQ bit was set.

ERROR - LBYEN DID NOT TERMINATE DMA

The LBYEN signal to the I/O processor chip did not terminate the DMA transfer.

ERROR - PACK FLIP FLOP FAILED

The DMA state did not correspond to the bit in the status register which indicates the state of byte mode DMA.

ERROR - PREMATURE TERMINATION OF DMA BY LBYEN

The LBYEN signal to the I/O processor chip caused premature termination of a DMA transfer.

ERROR - SNS DID NOT INVERT DATA BITS

The data bits were not inverted by the SNS signal.

ERROR - SNS DID NOT INVERT STATUS BITS

The status bits were not inverted by the SNS signal.

ERROR - STATUS REG. DID NOT LATCH

Incoming status bits were not latched while the interface was in the latch mode.

ERROR - STATUS REG. FAILED

A failure in the data path between the internal and external data buses. Probably a failure in either the input or output line drivers.

ERROR - STATUS REG. NOT IN TRANSPARENT MODE

Failure when the status register was programmed in the transparent mode (pass status without a clock).

ERROR - SRQ FLIP FLOP FAILED

Device flag signal was generated but did not generate an SRQ signal.

Appendix 3B
Test Hood

The test hood allows complete testing of the drivers and receivers of the HP 12006B Interface. Following is a listing of the jumper connections in the test hood.

JUMPERS:

3A-1
B-2
C-3
D-4
E-5
F-6
H-7
J-8
K-9
L-10
M-11
N-12
P-13
R-14
S-15
T-16
U-17
V-18
W-19
X-20
AA-23

NOTE: Y-21, Z-22, and BB-24 connections are not jumpered.

Appendix 3C
Program Listing

The following is a listing of the source program of the Parallel Interface Diagnostic (date code 2001). Diagnostic programs with date codes greater than 2001 may vary slightly from this copy. To list the diagnostic statement file that is in memory on the virtual control panel screen, use the DDL "LIST" command following the ">" DDL prompt character (refer to the DDL Operating and Programming manual).

The comments that are supplied with the listing below should be used as a guide to the program action of each statement. The comments are not included on the diagnostic media supplied by Hewlett-Packard.


```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!================================================
                                !!
  1 FMT  ("12006B PARALLEL INTERFACE DIAGNOSTIC"/)
  2 REM  (C) COPYRIGHT HEWLETT-PACKARD CO. ALL RIGHTS RESERVED
  3 REM  SERVICE  24397-16006 REV. 2001
  4 PRNT 1                      !! DIAG NAME
  5 BUF  C(30) T(10) M(55) P(10) S(2048) Q(50)
  6 LET  H=0                    !! "FLAG" FOR HOOD
  7 LET  Z=0                    !! CLEAR SELECT CODE VARIABLE
  9 CLCC @0                     !! SYSTEM RESET
 12 GTSC @1000 Z                !! GET SELECT CODE
 15 HOOD                        !! IS HOOD INSTALLED?
 18 GOTO 24                     !! NO
 21 LET  H=1                    !! YES, SET "FLAG"
 24 OTAC @2 Z                   !! SETUP GLOBAL REGISTER
 30 LIA  @32 T(1)               !! SAVE CONTROL BITS
 31 LET  M=T(1).@7400           !!
 32 LET  M=M/256                !! SHIFT RIGHT
 33 LET  E=T(1).@20             !! "E"IS DCSS "FLAG"
 36 PRNT 1801                   !! PROMPT DCSS STATUS
 39 SKIF E=0                    !!
 42 GOTO 1802                   !!
 45 GOTO 1805                   !!
                                !!
```

```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!=============================================
                                !!
  50 REM  ON LINE SECTION       !! THIS PART RUNS WITHOUT A HOOD
                                !!
  57 LET  C=@100212             !!
  60 OTA  @31 @100212           !! CONTROL WORD FOR CARD
  63 GOSB 1580                  !! CHECK COMMON BITS IN 31&32
  66 LET  C=@5                  !!
  69 OTA  @31 C                 !! CONTROL WORD FOR CARD
  72 GOSB 1580                  !! CHECK COMMON BITS IN 31&32
                                !!
  75 REM  TEST BITS 6,12,13 OF 32
                                !! STATUS OF
  81 LIA  @32 T(3)              !!
  84 SKIF @20000=T(3).@20000    !! DMAON FLIP FLOP
  87 GOSB 1826                  !! ERROR
  90 LET  T(4)=T(3).@10000      !! PACK FLIP FLOP
  93 SKIF T(4)=0                !!
  96 GOSB 1898                  !! ERROR
  99 LET  T(4)=T(3).@100        !! DEVCOM FLIP FLOP
 102 SKIF T(4)=0                !!
 105 GOSB 1832                  !! ERROR
 106 OTA  @31 M                 !! RESTORE CONTROL REGISTER
 108 SKIF H=1                   !! IS THERE A HOOD?
 111 GOTO 12                    !! NO, RESTART
                                !!
 114 REM  MAIN PROGRAM OFF-LINE SECTION
                                !!
 117 REM  CARD RESET TEST       !! YES,CONTINUE
                                !!
 120 OTA  @30 @177777           !! DIRTY UP DATA REGISTER
 123 OTA  @31 @100217           !! DIRTY UP CONTROL REGISTER
 126 LIA  @32 T(4)              !! GET STATUS (SHOULD BE DIRTY TOO)
 129 OTA  @32 0                 !! CARD RESET
 132 LIA  @30 T(1)              !! SAVE THE DATA REGISTER
 138 LIA  @32 T(3)              !! SAVE THE STATUS REGISTER
 141 SKIF T(1)=0                !! IS THE DATA REGISTER CLEAN
 144 GOSB 1841                  !! NO, ERROR
 150 LET  T(5)=T(3).@107617     !! IS THE CONTROL REGISTER "CLEAN"
 153 SKIF T(5)=0                !!
 156 GOSB 1841                  !! NO, ERROR
 158 LET  T(4)=T(4).@70160      !! YES, AS FAR AS WE CAN TELL
 159 SKIF T(4) 0                !! IS THE STATUS REGISTER INTACT
 162 GOSB 1844                  !! NO, ERROR
                                !!
```

```
                                !!
    PROGRAM                     !!        COMMENTS
    STATEMENTS                  !!
================================!!=================================================
                                !!
 165 REM SNS TEST               !!
                                !!
 168 CLF @30                    !! CLEAR THE FLAG
 171 LET  R=0                   !!
 174 LET T(4)=@25               !!
 177 LET T(5)=@52525            !! CONTROL WORD
 180 OTA  @31 @20               !! OUTPUT IT HERE
 183 OTA  @30 T(5)              !! READ BACK HERE
 186 LIA  @30 T(6)              !! LOAD THE INPUT DATA REGISTER
 189 SKIF T(5)=T(6)             !! IS IT THE SAME
 192 GOSB 1847                  !! NO, ERROR
 195 OTA  @31 T(4)              !! CONTROL WORD (REG.31)
 198 LIA  @32 T(8)              !! STATUS WORD (REG. 32)
 201 LET  T(9)=T(8).@17         !! CHECK STATUS BITS
 204 LET  T(3)=T(4).@17         !!
 207 SKIF T(3)=T(9)             !!
 210 GOSB 1850                  !! ERROR
 213 SKIF R=0                   !!
 216 GOTO 231                   !!
 219 LET  R=1                   !!
 222 LET  T(5)=@125252          !! CHANGE TEST PATTERN
 225 LET  T(4)=@32              !! CHANGE CONTROL WORD
 228 GOTO 180                   !! SO DO SNS TEST OVER
                                !!
 231 REM  I/O DRIVER TEST       !!
                                !!
 234 OTA  @32 0                 !! RESET CARD
 237 LET  C=@102012             !! IN THE SUBROUTINES TO FOLLOW:RM
 240 LET  P=@52525              !! C IS CONTROL PARM; P IS
                                !! PATTERN PARM
 243 GOSB 1400                  !! THIS SUBR. CHECKS THE DATA
                                !! REGISTER
 246 GOSB 1500                  !! THIS SUBR. CHECKS UPPER BYTE OF
                                !! REG. 32
 249 GOSB 1580                  !! THIS SUBR. CHECKS LOWER BYTE OF
                                !! REG. 32
 252 LET C=@102005              !!
 255 LET P=@125252              !!
 258 GOSB 1400                  !!
 261 GOSB 1500                  !!
 264 GOSB 1580                  !!
 267 LET C=@102032              !!
 270 LET P=@52525               !!
                                 !!
```

```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!=============================================
                                !!
 273 GOSB 1400                  !!
 276 GOSB 1500                  !!
 279 GOSB 1580                  !!
 282 LET  C=@102025             !!
 285 LET  P=@125252             !!
 288 GOSB 1400                  !!
 291 GOSB 1500                  !!
 294 GOSB 1580                  !!
                                !!
 297 REM  DRM TEST              !! THIS SUBR. TESTS LATCHED AND
                                !! TRANSPARENT MODES
 300 OTA  @32 0                 !! RESET CARD (XPARENT MODE)
 303 OTA  @30 @52525            !! OUTPUT DATA PATTERN
 306 LIA  @30 T(5)              !! SAVE DATA REGISTER
 309 SKIF T(5)=@52525           !! IS DATA CORRECT?
 312 GOSB 1835                  !! NO, ERROR
 315 OTA  @31 @4040             !! NOW PUT IN LATCHED MODE
 318 OTAC @30 @52525            !! OUTPUT PATTERN
 321 STC  @30                   !! CAUSE DEVFLG ASSERTION
 324 LIA  @30 T(5)              !! SAVE DATA REGISTER
 327 OTAC @30 @125252           !! TRY TO CHANGE IT
 330 LIA  @30 T(6)              !! SAVE IT AGAIN
 333 SKIF T(6)=T(5)             !! ARE THEY THE SAME?
 336 GOSB 1814                  !! NO, ERROR
                                !!
 339 REM  SRM TEST              !! YES, NEXT TEST (STATUS REG.)
                                !!
 342 OTA  @32 0                 !! RESET CARD AGAIN
 345 OTA  @31 @104212           !! OUTPUT TEST PATTERN
 348 LIA  @32 T(5)              !! SAVE STATUS REGISTER
 351 LET  T(6)=T(5).@107617     !!
 354 SKIF T(6)=@105212          !! IS STATUS CORRECT?
 357 GOSB 1838                  !! NO, ERROR
 360 OTA  @31 @4100             !! NOW PUT IN LATCHED MODE
 363 STC  @30                   !! CAUSE DEVFLG ASSERTION
 366 LIA  @32 T(5)              !! SAVE STATUS REGISTER
 369 OTA  @31 @4177             !! TRY TO CHANGE IT
 372 LIA  @32 T(6)              !! SAVE STATUS AGAIN
 375 SKIF T(6)=T(5)             !! ARE THEY THE SAME?
 378 GOSB 1817                  !! NO, ERROR
                                !!
```

```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!=================================================
                                !!
 379 REM  IRQEN TEST            !! YES, CONTINUE
                                !!
 381 IBP  S(1) S(2048)  IN      !! INITIALIZE BUFFERS
 384 IBP  M(1) M(50)  CL        !!
 387 CLF  @30                   !! CLEAR FLAG
 390 OTA  @31 @400              !! SET IRQEN, STO=0
 393 SFS  @30                   !! DID FLAG SET
 402 GOTO 411                   !! NO, OK CONTINUE
 405 GOSB 1820                  !! YES, ERROR
 411 OTA  @31 @401              !! SET IRQEN, NOW STO=1
 414 SFS  @30                   !! IS FLAG SET NOW?
 417 GOSB 1823                  !! YES, ERROR
                                !!
 420 REM  DFF TEST              !! NO, CONTINUE
                                !!
 423 OTA  @32 0                 !! RESET CARD
 426 OTA  @31 @4000             !! SET DCL OF 31 (BIT 11)
 429 CLCC @30                   !! RESET DEVCOM FF
 432 LIA  @32 T(2)              !! IS DFF SET?
 435 LET  T(3)=T(2).@100        !!
 438 SKIF T(3)=0                !!
 441 GOSB 1832                  !! YES, ERROR
 444 STC  @30                   !! NO, CONTINUE SET DEVCOM FF
 447 LIA  @32 T(2)              !! SAVE STATUS
 450 LET  T(3)=T(2).@100        !! GET DEVCOM STATUS
 453 SKIF T(3) 0                !! DID DEVCOM FF SET?
 456 GOSB 1832                  !! NO, ERROR
                                !!
 459 REM  PLV TEST              !! YES, CONTINUE
                                !!
 462 OTA  @32 0                 !! RESET PIC
 465 OTA  @31 @12000            !! SET FOR PULSED DEVICE COMMAND
 468 CLCC @30                   !! RESET DEVICE COMMAND FF
 471 LIA  @32 T(1)              !! SAVE STATUS
 474 LET  T(2)=T(1).@40         !! GET FLAG LINE STATUS
 477 STC  @30                   !! SET DEVCOM FF
 480 LIA  @32 T(3)              !! SAVE STATUS
 483 LET  T(4)=T(3).@40         !! FLAG LINE STATUS
 486 SKIF T(4)=T(2)             !! DO FLAG LINES MATCH
 489 GOSB 1832                  !! NO, ERROR
 492 OTA  @31 @4000             !! YES, SET DCL (BIT 11)
 495 LIA  @32 T(1)              !! SAVE STATUS
 498 LET  T(2)=T(1).@40         !! GET DEV FLG STATUS
                                !!
```

```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!================================================
                                !!
  *  .ADD HEAD6::DR
     ERROR:  FMP ERR -32
 501 STCC @30                   !! SET DEV COM FF,CLEAR FLAG
 504 LIA  @32 T(3)              !! SAVE STATUS
 507 LET  T(4)=T(3).@40         !! GET DEV FLG LINE STATUS
 510 SKIF T(4) T(2)             !! COMPARE STATUS BITS
 513 GOSB 1877                  !! ERROR, THEY ARE EQUAL
                                !!
 516 REM  SRQ LINE AND FLAG LINE TEST
                                !!
 519 OTA  @32 0                 !! RESET PIC
 522 CLCC @30                   !! INITIALIZE
 525 LIA  @32 T(1)              !! SAVE STATUS
 528 LET  T(2)=T(1).@40         !! GET DEV FLG STATUS
 531 SKIF E=0                   !! IS DEV COM SENSE SWITCH...
 534 GOTO 552                   !! ACTIVE HIGH
 537 SKIF T(2)=0                !! IS DEV FLG LOW?
 540 GOSB 1877                  !! NO, ERROR
 546 OTA  @31 0                 !! YES OUTPUT CONTROL WORD TO REG 31
 549 GOTO 561                   !! CONTINUE
 552 SKIF T(2) 0                !! IS DEV FLG LOW?
 555 GOSB 1832                  !! YES, ERROR
 558 OTA  @31 @10000            !! NO, OUTPUT CONTROL WORD
 561 STC  @30                   !! SET DEV COM FF
 564 SFS  @30                   !! IS FLAG SET
 567 GOSB 1901                  !! NO,ERROR
                                !!
 570 REM  DFS AND DCL TEST      !! YES, CONTINUE
                                !!
 573 SKIF E=0                   !! SET UP
 576 GOTO 585                   !! DEPENDING ON THE
 579 LET  P(1)=@10000,@14000    !! STATE OF THE
 582 GOTO 588                   !! DEVICE COMMAND
 585 LET  P(1)=@0,@4000         !! SENSE SWITCH
 588 OTA  @32 0                 !! INITIALIZE CARD
 591 CLCC @30                   !!
 594 OTA  @31 P(1)              !! OUTPUT CONTROL WORD TO CLOCK
                                !! DEV COM FF
 597 STCC @30                   !! SET DEV COM FF
 600 LIA  @32 T(1)              !! SAVE STATUS
 603 LET  T(2)=T(1).@100        !! SAVE DEV COM FF STATE
 606 OTA  @31 P(2)              !! CONTROL WORD TO CLOCK DEV COM FF
 609 LIA  @32 T(3)              !! SAVE STATUS
 612 LET  T(4)=T(3).@100        !! SAVE DEV COM FF STATE
 615 SKIF T(4) T(2)             !! DID DEV COM TOGGLE?
                                !!
```

```
                                !!
    PROGRAM                     !!       COMMENTS
    STATEMENTS                  !!
================================!!=================================================
                                !!
 618 GOSB 1907                  !! NO, ERROR
 621 SFS  @30                   !! YES, DID TOGGLE--IS FLAG SET?
 623 GOSB 1904                  !! NO, ERROR
                                !!
 625 REM  LBYEN TEST            !! YES, COMNTINUE
                                !!
 626 REM  SET UP DMA            !!
                                !!
 628 OTA  @32 0                 !! RESET CARD
 630 OTA  @21 @40200            !! DMA CONTROL WORD 1
 632 OTA  @22 S(!)              !! DMA CONTROL WORD 2
 634 OTAC @23 @176030           !! DMA CONTROL WORD 3
 636 GOSB 1628                  !! SET UP HANDSHAKES FOR DMA
 638 STC  @21                   !! ENABLE DMA
 640 WFI  Z 1000                !! WAIT FOR INTERRUPT
 642 GOSB 1890                  !! ERROR, NO INTERRUPT OCCURRED
 644 OTA  @32 0                 !! RESET
 645 OTAC @21 @200              !!
 647 OTA  @22 S(!)              !!
 649 OTAC @23 @177775           !!
 651 LET  V=V+1000              !! SET LAST BYTE ENABLE
 653 STCC @21                   !! ENABLE DMA
 655 STCC @30                   !! START XFER
 657 OTA  @31 V                 !!
 659 STCC @30                   !! WAIT FOR INTERRUPT
 661 STCC @30                   !!
 663 CLCC @21                   !! CLEAN UP DMA FLAG
 665 LIA  @23 D                 !! LOOK AT DMA WORD COUNT
 669 SKIF D=0                   !! IS IT 0?
 672 GOSB 1892                  !! NO, CONTINUE
 673 OTA  @32 0                 !!
 675 OTAC @21 @200              !! YES, NOW SET UP DMA AGAIN  CW 1
 678 OTA  @22 S(!)              !! CONTROL WORD 2
 681 OTAC @23 @177775           !! CONTROL WORD 3
 684 LET  V=V+@2                !! SET CN 1
 685 CLF  @30                   !! INSURE FLAG IS CLEAR
 687 STC  @21                   !! ENABLE DMA
 690 STCC @30                   !! START XFER
 692 OTA  @31 V                 !! TRY TO INTERRUPT XFER
 694 STCC @30                   !! FINISH XFER
 696 STCC @30                   !!
 698 CLCC @21                   !! CLEAN UP DMA FLAGS
 702 LIA  @23 D                 !! NOW LOOK AT WORD COUNT
                                !!
```

```
                                !!
     PROGRAM                    !!        COMMENTS
     STATEMENTS                 !!
================================!!=============================================
                                !!
 704 SKIF D#0                   !! IS IT
 706 GOSB 1895                  !! YES ERROR
                                !!
 717 REM  BYTE PACKING AND PACK FF TEST
                                !! NO, INTERRUPT WAS SUCCESSFUL
 720 LIA  @32 Y                 !! SAVE STATUS
 723 LET  T(1)=Y.@10000         !! GET PACK FF STATUS
 726 SKIF T(1)=0                !! IS IT CORRECT?
 729 GOSB 1898                  !! NO, ERROR
 732 REM  50 WORD (100 BYTE) TRANSFER
                                !! YES, CONTINUE
 735 IBP  M(1) M(50)  CL        !! INPUT BUFFER FOR DMA
 738 IBP  Q(1) Q(50)  PA 739    !! OUTPUT BUFFER FOR DMA
 739 ASC  THIS IS RANDOM DATA TO CHECK BYTE PACKING
 741 CLCC 0                     !! BECAUSE DMAON FF TOGGLES
 744 OTAC @2 Z                  !! RESET GLOBAL REGISTER
 747 GOSB 1647                  !! THIS SUBR. DOES MANUAL DMA
                                !!
 749 REM  THE FIRST WORD TRANSFERRED IS JUNK
                                !!
 750 CPBF M(2) Q(1) 49 0        !! COMPARE OUTPUT BUFFER TO
                                !! INPUT BUFFER
 753 GOSB 1910                  !! ERROR, THEY ARE NOT THE SAME
 760 GOTO 12                    !! END OF DIAGNOSTIC PROMPT
                                !!
1400 REM  SUBROUTINE 1          !!
                                !!
1401 REM  CHECKS DATA REGISTERS
                                !!
1402 REM  PASS PARMS C (CONTROL WORD), P (PATTERN)
                                !!
1409 OTA  @32 0                 !! RESET CARD
1412 OTA  @31 C                 !! OUTPUT CONTROL WORD
1415 OTAC @30 P                 !! OUTPUT DATA
1418 LIA  @30 R                 !! READ IN DATA
1421 SKIF P=R                   !! ARE THEY EQUAL?
1424 GOSB 1808                  !! NO, ERROR
1427 LET  P=P*@2                !! YES, CHANGE PATTERN AND
                                !! TRY AGAIN
1430 SKIF P 0                   !! FINISHED WITH DIFFERENT
                                !! PATTERNS?
1433 RTN                        !! YES
1436 GOTO 1415                  !! NO, CONTINUE TEST
                                !!
                                !!
```

```
                                !!
     PROGRAM                    !!       COMMENTS
     STATEMENTS                 !!
================================!!=================================================
                                !!
1500 REM  SUBROUTINE 2          !!
1501 REM  COMPARES 0-3 & 7 OF 31 & 32
                                !!
1505 LIA  @32 S                 !! SAVE STATUS
1508 LET  S(1)=S.@217           !! GET BITS 0-3 AND 7 OF 32
1511 LET  T(1)=C.@217           !! GET BITS 0-3 AND 7 OF 31
1514 SKIF T(1)=S(1)             !! ARE THEY EQUAL?
1517 GOSB 1811                  !! NO, ERROR
1520 RTN                        !!
1580 REM  SUBROUTINE 3          !!
                                !!
1581 REM  COMPARES 0-3,7,15 OF 31 TO 7,8-11,15 OF 32
                                !!
1586 LET  T(2)=C.@100200        !! GET BITS 15 AND 7 OF 31
1589 LIA  @32 S                 !! SAVE STATUS
1592 LET  S(2)=S.@107600        !! GET BITS 15 AND 8-11 OF 32
1595 LET  T(3)=C.@17            !! GET BITS 0-3 OF 31
1598 LET  T(3)=T(3)*256         !! SHIFT TO UPPER BYTE
1604 LET  T(5)=T(3)+T(2)        !! MERGE
1607 SKIF S(2)=T(5)             !! ARE THEY THE SAME?
1610 GOSB 1853                  !! NO, ERROR
1613 RTN                        !!
                                !!
1628 REM  SETUP 31 FOR F.S. DMA
                                !!
1630 SKIF E 0                   !! IS DEV COM SELECT SWITCH.....
1632 GOTO 1636                  !! ACTIVE LOW
1634 GOTO 1642                  !! ACTIVE HIGH
1636 LET  V=@14000              !! CONTOL WORD FOR F.S.DMA
1638 OTA  @31 V                 !! OUTPUT TO REGISTER 31
1640 RTN                        !!
1642 LET  V=@2000               !! CONTROL WORD FOR F.S. DMA
1644 OTA  @31 V                 !! OUTPUT TO REGISTER 31
1646 RTN                        !!
                                !!
1647 REM  THIS SUB RUNS BYTE MODE MDMA
                                !!
1648 SKIF E=0                   !! IS DEV COM SENSE SWITCH..
1650 GOTO 1658                  !! ACTIVE HIGH
1652 LET  J=@10140              !! ACTIVE LOW, 1ST HALF OF
                                !! CLOCK CYCLE
1654 LET  K=@140                !! ACTIVE LOW, 2ND HALF OF
                                !! CLOCK CYCLE
                                !!
```

```
                                !!
     PROGRAM                    !!        COMMENTS
     STATEMENTS                 !!
================================!!=================================================
                                !!
1656 GOTO 1662                  !! CONTINUE
1658 LET J=@14140               !! ACTIVE HIGH, 1ST HALF OF
                                !! CLOCK CYCLE
1660 LET K=@4140                !! ACTIVE HIGH, 2ND HALF OF
                                !! CLOCK CYCLE
1662 LET  X=1                   !! COUNTER
1664 OTA  @21 @20000            !! DMA CONTROL WORD 1
1666 OTA  @22 Q(!)              !! DMA CONTROL WORD 2
1668 OTAC @23 @177634           !! DMA CONTROL WORD 3
1670 STC  @21                   !! ENABLE DMA
1672 OTA  @31 J                 !! OUTPUT 1ST HALF OF CLOCK CYCLE
1683 STC  @30                   !! ASSERT DEVICE COMMAND
1685 LIA  @30 M(X)              !! LOAD DATA INTO THE BUFFER
1686 OTA  @31 K                 !! OUTPUT 2ND HALF OF CLOCK CYCLE
1688 LIA  @32 T(3)              !! GET STATUS
1690 SKIF X 1                   !! SKIP FIRST STATUS WORD
1691 GOTO 1696                  !!
1692 LET  T(4)=T(3).@30000      !! SAVE PACK AND DMAON STATUS
1693 SKIF T(4)=@10000           !! IS PACK=1 AND DMAON=0
1694 GOSB 1913                  !! NO, ERROR
1696 LET  X=X+1                 !! INCREMENT COUNTER
1697 SKIF X<51                  !! LAST WORD DONE YET?
1698 RTN                        !! YES, RETURN
1699 GOTO 1672                  !! NO, CONTINUE
1801 FMT  ("DEVICE COMMAND SENSE SWITCH--ACTIVE ")
1802 PRNT 1803                  !!
1803 FMT  ("HIGH"/)             !!
1804 GOTO 50                    !!
1805 PRNT 1806                  !!
1806 FMT  ("LOW"/)              !!
1807 GOTO 50                    !!
1808 PRNT 1809                  !!
1809 FMT  ("ERROR - DATA REGISTER FAILED"/)
1810 STOP                       !!
1811 PRNT 1812                  !!
1812 FMT  ("ERROR - IN COMMON BITS OF REG. 31 AND 32"/)
1813 STOP                       !!
1814 PRNT 1815                  !!
1815 FMT  ("ERROR - DATA REG. DID NOT LATCH"/)
1816 STOP                       !!
1817 PRNT 1818                  !!
                                !!
```

```
                                !!
     PROGRAM                    !!        COMMENTS
     STATEMENTS                 !!
================================!!=============================================
                                !!
1818 FMT  ("ERROR - STATUS REG. DID NOT LATCH"/)
1819 STOP                       !!
1820 PRNT 1821                  !!
1821 FMT  ("ERROR - IRQEN CAUSES ERRONEOUS INTERRUPT"/)
1822 STOP                       !!
1823 PRNT 1824                  !!
1824 FMT  ("ERROR - IRQEN DOES NOT CAUSE INTERRUPT"/)
1825 STOP                       !!
1826 PRNT 1827                  !!
1827 FMT  ("ERROR - DMAON FLIP FLOP FAILED"/)
1828 STOP                       !!
1832 PRNT 1833                  !!
1833 FMT  ("ERROR - DEVICE COMMAND FLIP FLOP FAILED"/)
1834 STOP                       !!
1835 PRNT 1836                  !!
1836 FMT  ("ERROR - DATA REG. NOT IN TRANSPARENT MODE"/)
1837 STOP                       !!
1838 PRNT 1839                  !!
1839 FMT  ("ERROR - STATUS REG. NOT IN TRANSPARENT MODE"/)
1840 STOP                       !!
1841 PRNT 1842                  !!
1842 FMT  ("ERROR - CARD RESET FAILED"/)
1843 STOP                       !!
1844 PRNT 1845                  !!
1845 FMT  ("ERROR - STATUS REG. FAILED"/)
1846 STOP                       !!
1847 PRNT 1848                  !!
1848 FMT  ("ERROR - SNS DID NOT INVERT DATA BITS"/)
1849 STOP                       !!
1850 PRNT 1851                  !!
1851 FMT  ("ERROR - SNS DID NOT INVERT STATUS BITS"/)
1852 STOP                       !!
1853 PRNT 1812                  !!
1854 PRNT 1855                  !!
1855 FMT  ("ERROR - INTERNAL PATH FAILURE"/)
1856 STOP                       !!
1877 PRNT 1878                  !!
1878 FMT  ("ERROR - IN DEVICE FLAG SIGNAL"/)
1879 STOP                       !!
1889 PRNT 1890                  !!
1890 FMT  ("ERROR - DMA DID NOT START"/)
1891 STOP                       !!
1892 PRNT 1893                  !!
                                !!
```

```
                                !!
     PROGRAM                    !!       COMMENTS
     STATEMENTS                 !!
================================!!================================================
                                !!
1893 FMT  ("ERROR - PREMATURE TERMINATION OF DMA BY LBYEN"/)
1894 STOP                       !!
1895 PRNT 1896                  !!
1896 FMT  ("ERROR - LBYEN DID NOT TERMINATE DMA"/)
1897 STOP                       !!
1898 PRNT 1899                  !!
1899 FMT  ("ERROR - PACK FLIP FLOP FAILED"/)
1900 STOP                       !!
1901 PRNT 1902                  !!
1902 FMT  ("ERROR - SRQ FLIP FLOP FAILED"/)
1903 STOP                       !!
1904 PRNT 1905                  !!
1905 FMT  ("ERROR - DFS LINE FAILED"/)!!
1906 STOP                       !!
1907 PRNT 1908                  !!
1908 FMT  ("ERROR - DCL LINE FAILED"/)!!
1909 STOP                       !!
1910 PRNT 1911                  !!
1911 FMT  ("ERROR - IN BYTE MODE DMA TRANSFER"/)
1912 STOP                       !!
1913 PRNT 1914                  !!
1914 FMT  ("ERROR - BYTE MODE DMA : PACK OR DMAON STATUS "/)
1915 STOP                       !!
```

Section 4
HP 12008A PROM Storage Module Diagnostic

4.1 General

Load and execute the Diagnostic Control System (DCS) and PROM diagnostic program (PROM), using the diagnostic operating mode desired (see diagnostic operating and troubleshooting manual). When the PROM diagnostic is ready to run, refer to the additional operating procedures in this section.

During execution of the PROM diagnostic, refer to Appendix 4A for a list of execution error messages and codes and Appendix 4B for a listing of the PROM diagnostic program.

4.2 Diagnostic Operation

1. Type "RUN<cr>" following the ">" DDL prompt to start the diagnostic program.

   NOTE: Typing "RUN !" will cause the diagnostic to execute on the highest priority HP 12008A PROM Storage Module in a noninteractive mode. If any failures are detected, the diagnostic terminates and prints the error message. If the diagnostic completes normally, it will automatically execute on the next highest priority HP 12008A card. When all HP 12008A cards have been tested, the diagnostic terminates and returns with the ">" DDL prompt.

2. The message
   "12008A PROM CARD DIAGNOSTIC"
   "INPUT SELECT CODE:"
   will be displayed. Type in the select code in octal notation of the HP 12008A PROM Module to be tested. For example "22<cr>".

3. If the HP 12008A PROM Storage Module diagnostic completes successfully, the message:
   "PASS COMPLETE"
   "INPUT SELECT CODE:"
   will be displayed on the terminal.

4. To run the diagnostic again, enter select code to run through one pass, or <cr> only to loop diagnostic.

5. To discontinue program execution, type zero, "0<cr>", following the "INPUT SELECT CODE:" message. The diagnostic program will be terminated, and the ">" DDL prompt will be displayed. Any valid DDL command or statement can now be entered.

4.3 PROM Data Access Program

Optional - If the HP 12008A diagnostic completes successfully, the operator can access the PROM data for inspection as follows. At least two PROMs must be installed in the HP 12008A card for this test.

1. Load the diagnostic.

2. The DDL prompt ">" should be displayed. Type "RU A<cr>".

3. The message:
   "650 PRGM A PROM ACCESS PROGRAM"
   "INPUT SELECT CODE"
   will be displayed. Type in the select code in octal notation of the HP 12008A card to be tested.

4. The message:
   "INPUT STARTING (,ENDING) ADDRESS, IN OCTAL"
   will be displayed. Type the starting address (in octal), a comma, and the ending address (in octal) of the sequential PROM locations to be inspected. For example: "300, 303<cr>".

   If the typed PROM address is not octal, is not positive, or is not within the PROM memory boundaries, the message:
   "YOU HAVE PASSED THE LIMITS OF PROM DATA"
   "INPUT STARTING (,ENDING) ADDRESS, IN OCTAL"
   will be displayed.

5. The PROM memory data will be displayed for the addresses requested in step 4.

   For example (sample data):
   "INPUT STARTING (,ENDING) ADDRESS, IN OCTAL" 300, 303

ADDRESS	DATA
(300)	002074
(301)	102077
(302)	030202
(303)	113406

6. The message:
   "WOULD YOU LIKE TO CONTINUE??"
   will be displayed. If a "YES<cr>" is typed, the PROM access program execution starts again at step 5, above. If a "NO<cr>" is typed, the PROM access program execution will end and the ">" DDL prompt will be displayed.

4.4 Execution Times

The execution time is about 90 seconds.

4.5 Program Description

The diagnostic is separated into different tests as described below. These tests are described in the same order as they are executed in the diagnostic program.

Device Command Check

The device command circuitry (STC @30 with the global register enabled) is checked for the following actions: all device commands generate an SRQ (or set the flag) and after loading the address register, the first device command does not increment the address register and all succeeding device commands increment the address register.

Address to Data Loop Check

This check tests the address and data registers and insures that there are not any stuck bits on the data bus. For this test, the card diagnose mode is used to connect the address bus to the data bus.

DMA Test

The DMA test checks both the standard and self-configured DMA logic by performing 2000 word block transfers with the diagnose mode enabled. When the transfer is complete, the input buffer is compared to the received buffer to insure the transfer is correct.

PROM Access Program

Refer to paragraph 4.3 for a description of this test.

Appendix 4A
Error Messages

A.1 Error Messages

The diagnostic displays the error messages on the VCP if it is connected to the computer. If any of the following messages occur, the HP 12008A card should be replaced. For replacement parts ordering information refer to the HP 12008A PROM Storage Module Reference Manual 12008-90001.

Each of the error messages in this Appendix is followed by a description of what caused the error. The error messages are general and do not always point to the exact piece of hardware that has failed. Keep this in mind if component level repair is being performed on the HP 12008A PROM Storage Module.

ERROR - ADDRESS READ BACK

The program has output a word to the address register (OTA @31), read it back (LIA @31), and the compare did not match.

ERROR - ADDRESS TO DATA LOOP BACK

Indicates an error in the address to data loop back check.

ERROR - DATA DOES NOT EQUAL ADDRESS
ADDRESS IS XXXXXX DATA IS XXXXXX

Incorrect data received during the DMA transfer.

ERROR - FIRST DEVICE COMMAND INC. ADDRESS REG.

After loading the address register, the first device command incremented the address register.

ERROR - FLAG NOT SET BY DEVICE COMMAND

Indicates that the STCC @30 instruction did not set the flag (or generate SRQ).

ERROR - FLAG NOT SET BY IRQ

PROM card flag was not set when IRQ line was asserted.

ERROR - 'IRQ' DID NOT INTERRUPT DMA

The 'IRQ' signal was set during a DMA read and should have interrupted.

ERROR - NON SELF-CONFIGURED DMA DID NOT START

DMA transfer did not respond to the STCC @20 or STCC @21 instruction.

ERROR - PARITY ERROR IN DMA TRANSFER

A parity error occurred during a read of the self-configuration data in memory.

ERROR - SELF-CONFIGURED DMA DID NOT START

DMA transfer did not respond to the STCC @20 or STCC @21 instruction.

Appendix 4B
Program Listing

The following is a listing of the source program of the PROM Storage Module Diagnostic (date code 2001). Diagnostic programs with date codes greater than 2001 may vary slightly from this copy. To list the diagnostic statement file that is in memory on the virtual control panel screen, use the DDL "LIST" command following the ">" DDL prompt character (refer to the DDL Operating and Programming manual).

The comments that are supplied with the listing below should be used as a guide to the program action of each statement. The comments are not included on the diagnostic media supplied by Hewlett-Packard.

```
                                    !!
     PROGRAM                        !!        COMMENTS
     STATEMENTS                     !!
=========================================================================
                                    !!
   1 FMT  ("12008A PROM INTERFACE DIAGNOSTIC"/)
   2 REM  (C) COPYRIGHT HEWLETT-PACKARD CO. 1980. ALL RIGHTS RESERVED
   3 REM  SERVICE  24397-16008 REV. 2001
   4 PRNT 1                         !! DIAG NAME
   5 BUF  P(10) D(2048)             !! BUFFER DEFINITIONS
   6 LET  P=0                       !! FIRST TIME THROUGH
   7 GTSC @3000 P                   !! GET SELECT CODE OF PROM CARD
   8 CLCC @0                        !! RESET
  10 OTAC @2 P                      !!
  20 IOCA                           !!
  22 LET  F=0                       !!
  30 IOA  CLA                       !! BUILD I/O ROUTINE TO CHECK
  32 IOA  OTA 31                    !! CONTROL REGISTER AND STCC
  34 IOA  STC 30,C                  !! INSTRUCTION
  38 IOA  SFS 30                    !!
  40 IOA  JSB RTN                   !! IF ANY ERROR - RETURN WITH
  42 IOA  LIB 31                    !! F NOT EQUAL TO @10000
  43 IOA  CLF 30                    !!
  44 IOA  CPA 1                     !!
  46 IOA  INA,RSS                   !!
                                    !!
```

```
                                    !!
     PROGRAM                        !!       COMMENTS
     STATEMENTS                     !!
=========================================================================
                                    !!
  52 IOA  JSB RTN                   !!
  54 IOA  STA F                     !!
  56 IOA  SSA,RSS                   !!
  58 IOA  JMP 2                     !!
  62 IOA  JSB RTN                   !!
  70 IORA                           !! EXECUTE TEST
  72 SKIF F#@100000                 !! CHECK RESULTS
  74 GOTO 100                       !!
  76 SFS  @30                       !!
  78 GOSB 900                       !! FLAG NOT SET BY STCC
  82 SKIF F=0                       !!
  84 GOSB 905                       !! ADDRESS READ BACK ERROR
  86 GOSB 910                       !! FIRST STCC AFTER LOAD INCREMENTED ADDR.
 100 OTA  @31 @100000               !! CHECK DATA BUS FOR STUCK BITS
 102 LIA @30 D                      !! BY USING VARIOUS DATA PATTERNS
 104 SKIF D=@100000                 !!
 106 GOSB 915                       !!
 108 OTA  @31 @177777               !!
 110 LIA  @30 D                     !!
 112 SKIF D=@177777                 !!
 114 GOSB 915                       !!
 116 OTA  @31 @125252               !!
 118 LIA  @30 D                     !!
 120 SKIF D=@125252                 !!
 122 GOSB 915                       !!
 124 OTA  @31 @152525               !!
 126 LIA  @30 D                     !!
 128 SKIF D=@152525                 !!
 130 GOSB 915                       !!
 150 OTA @31 0                      !!
 152 CLF @30                        !!
 154 OTA  @31 @100000               !!
 156 SFS  @30                       !!
 158 GOSB 920                       !!
                                    !!
```

```
                                    !!
    PROGRAM                         !!       COMMENTS
    STATEMENTS                      !!
=============================================================
                                    !!
 300 REM  START DMA TEST            !!
 302 LET  P(1)=@41600,0,D(!),-2048
 303 IBP  D(1) D(2048)  CL          !! ZERO OUT BUFFER
 305 LET  F=0                       !! F IS FLAG FOR NORMAL\
                                    !! SELF CONFIG. DMA
 310 LET  U=1                       !! U IS DMA BUFFER COUNTER
 320 LET  N=1                       !! N IS BUFFER INDEX
 321 CLCC @0                        !! RESET CARD
 323 SKIF F=0                       !! NORMAL DMA?
 324 GOTO 330                       !! NO, GO DO SELF CONFIGURED
 326 GOSB 540                       !! YES, GO DO NORMAL DMA TRANSFER
 328 GOTO 370                       !! RTN FROM SUB 540, CONTINUE
 330 GOSB 558                       !! SELF CONGFIGURED DMA
 332 GOTO 370                       !! RETURN FROM SUB 558, CONTINUE
 370 SFC  @22                       !! WAS THERE A DMA PARITY ERROR?
 380 GOSB 940                       !! YES, GOTO ERROR MESSAGE
 381 STF  0                         !! TURN ON INTERRUPT SYSTEM
 390 LET  M=P(2)                    !! SET UP
 400 LET  Q=-2048                   !! TO CHECK
 410 LET  R=D(!)                    !! DATA
 420 IOCB                           !! CLEAR IO ROUTINE
 422 IOB  LDA R,I                   !!
 424 IOB  CPA M                     !! MAKE
 426 IOB  RSS                       !! SURE
 428 IOB  JSB RTN                   !! ALL
 430 IOB  ISZ M                     !! DMA'ED
 432 IOB  ISZ R                     !! DATA
 434 IOB  ISZ Q                     !! IS
 436 IOB  JMP *-7                   !! CORRECT
 438 IOB  JSB RTN                   !!
 440 IORB                           !! RUN I O ROUTINE
 450 SKIF Q=0                       !! ANY ERRORS?
 460 GOSB 947                       !! YES
 470 LET  P(2)=U*2048               !! NO, CONTINUE
 480 SKIF U=<15                     !! HAS FULL 32K BEEN CHECKED
 490 GOTO 532                       !! YES, CONTINUE
 500 LET  U=U+1                     !! NO, GO DO NEXT BLOCK
 530 GOTO 320                       !!
                                    !!
```

```
                                  !!
    PROGRAM                       !!       COMMENTS
    STATEMENTS                    !!
================================================================
                                  !!
 532 SKIF F=0                     !! HAVE YOU DONE SELF
                                  !! CONFIGURED YET?
 534 GOTO 600                     !! YES, END OF DIAGNOSTIC
 536 LET  F=1                     !! NO, I'M GOING TO DO IT NOW
 537 LET  P(2)=0                  !! RESET STARTING ADDR.
                                  !! (DMA CONTROL WORD)
 538 LET  U=1                     !! INITIALIZE BUFFER COUNTER AGAIN
 539 GOTO 320                     !! START DMA TEST
                                  !!
 540 REM  NON SELF CONFIGURED DMA (326)
                                  !!
 542 OTAC @2 P                    !! SET UP GLOBAL REGISTER
 546 LET  P(2)=P(2)+@100000       !! PUT IN DIAGNOSE MODE 7
 547 OTA  @31 P(2)                !! OUTPUT CONTROL WORD
 548 OTA  @21 P(1)                !! DMA CW 1
 549 OTA  @22 P(3)                !! DMA CW 2
 550 OTA  @23 P(4)                !! DMA CW3
 551 STCC @21                     !! ENABLE DMA
 552 LET  C=0                     !!
 553 SFC  @21                     !!
 554 RTN                          !!
 556 LET  C=C+1                   !!
 557 SKIF C>2000                  !!
 558 GOTO 553                     !!
 559 GOSB 999                     !!
 560 REM  SELF CONFIGURED DMA (330)
 561 OTAC @2 P                    !! SET UP GLOBAL REGISTER
 562 LET  P(2)=P(2)+@10000        !! PUT IN DIAGNOSE MODE
 566 OTA  @20 P(!)                !! ADDRESS OF FIRST DMA CONTROL WORD
 568 STCC @20                     !! ENABLE SELF CONFIGURED DMA
 570 LET  C=0                     !! SET UP TIMEOUT
 572 SFC  @20                     !! DID DMA START?
 576 RTN                          !! YES, RETURN TO CALLER
 578 LET  C=C+1                   !!
 580 SKIF C>2000                  !! NO, CHECK COUNT
 582 GOTO 572                     !!
 584 GOSB 1002                    !! COUNT COMPLETE
                                  !!
```

```
                                    !!
    PROGRAM                         !!       COMMENTS
    STATEMENTS                      !!
=========================================================================
                                    !!
 600 REM  IRQ TEST                  !! CHECK THAT DMA CAN BE INTERRUPTED
 602 IOCA                           !! BY SETTING BIT 15 IN ADDRESS REG.
 605 CLCC 0                         !! SET UP ROUTINE FIRST
 606 OTAC 2 P                       !!
 608 OTAC @20 P(!)                  !!
 610 IOA  CLA                       !!
 611 IOA  CLF 30                    !!
 612 IOA STC 20,C                   !!
 614 IOA INA,SZA,RSS                !!
 616 IOA JMP *+9                    !!
 618 IOA SFS 30                     !!
 620 IOA JMP *+3                    !!
 621 IOA CLC 0,C                    !!
 622 IOA STA T                      !!
 623 IOA CLF 2                      !!
 626 IOA LIA 23                     !!
 628 IOA STA C                      !!
 630 IOA JSB RTN                    !!
 632 IOA STA T                      !!
 634 IOA JSB RTN                    !!
 636 IORA                           !! EXECUTE TEST ROUTINE
 638 SKIF T#0                       !! DID IT INTERRUPT?
 640 GOSB 1002                      !! NO - DMA DID NOT START
 642 SKIF C#0                       !! YES - DID DMA COMPLETE?
 644 GOSB 1020                      !! NO -
 646 GOTO 7                         !! OK - TRY FOR NEXT CARD
                                    !!
 650 PRGM A PROM ACCESS PROGRAM     !!
                                    !!
 652 LET  P=0
 654 GTSC @3000 P
 656 OTAC 2 P
 658 PRNT 930                       !! OUTPUT STARTING PROMPT
 660 INN  @A $B @E                  !! GET INPUT FROM TERMINAL
 670 LET  S=A                       !! TEMP. STORAGE
 680 SKIF A=>0                      !! IS INPUT WITHIN LOWER RANGE
 682 GOTO 936                       !! NO, ERROR
 684 SKIF A=<32767                  !! YES, IS INPUT WITHIN
                                    !! UPPER RANGE?
                                    !!
```

```
                                  !!
    PROGRAM                       !!       COMMENTS
    STATEMENTS                    !!
=================================================================
                                  !!
 690 GOTO 936                     !! NO, ERROR
 700 SKIF B @15                   !! IS THERE A SECOND INPUT
 710 LET  E=S                     !! NO, CONTINUE
 712 SKIF E=>0                    !! YES, IS IT WITHIN THE
                                  !! LOWER RANGE?
 714 GOTO 936                     !! NO, ERROR
 716 SKIF E=<32767                !! IS IT WITHIN THE UPPER RANGE
 718 GOTO 936                     !! NO ERROR
 720 SKIF A=<E                    !! YES, IS IT< OR = TO THE
                                  !! FIRST NUMBER
 722 GOTO 650                     !! YES, START OVER
 725 PRNT 932                     !! NO, START FORMATTING OUTPUT
 730 OTA  @31 A                   !! LOAD PROM ADDRESS
 740 STC  @30                     !!
 750 LIA  @30 0                   !! GET DATA
 760 PRNT 944 S 0                 !! OUTPUT DATA
 770 SKIF S#E                     !! FINISHED?
 780 GOTO 810                     !! YES,GOTO CONTINUE PROMPT
 790 LET  S=S+1                   !! NO, INCREMENT COUNTER AND
 800 GOTO 740                     !! GET NEXT DATUM
 810 PRNT 934                     !! IS USER FINISHED LOOKING
                                  !! AT DATA
 820 YES? 658                     !! NO, START OVER AGAIN
 830 GOTO 1999                    !! YES, END OF PROGRAM
 900 FMT  ("ERROR - FLAG NOT SET BY DEVICE COMMAND"/)
 901 PRNT 900                     !!
 902 STOP                         !!
 905 FMT  ("ERROR - ADDRESS READ BACK"/)
 906 PRNT 905                     !!
 907 STOP                         !!
 910 FMT  ("ERROR - FIRST DEVICE COMMAND INC. ADDRESS REG."/)
 911 PRNT 910                     !!
 912 STOP                         !!
 915 FMT  ("ERROR - ADDRESS TO DATA LOOP BACK"/)
 916 PRNT 915                     !!
 917 STOP                         !!
 920 FMT  ("ERROR - FLAG NOT SET BY IRQ"/)
 921 PRNT 920                     !!
 922 STOP                         !!
 930 FMT  ("INPUT STARTING (,ENDING) ADDRESS, IN OCTAL   ")
 932 FMT  ("ADDRESS"22X"DATA"/)  !!
 934 FMT  ("WOULD YOU LIKE TO CONTINUE?? ")
 936 PRNT 938                     !!
                                  !!
```

```
                                    !!
     PROGRAM                        !!       COMMENTS
     STATEMENTS                     !!
=========================================================================
                                    !!
 938 FMT  (/"YOU HAVE PASSED THE LIMITS OF PROM DATA."/)
 939 GOTO 650                       !!
 940 PRNT 941                       !!
 941 FMT  ("ERROR - PARITY ERROR IN DMA TRANSFER."/)
 942 STOP                           !!
 944 FMT  ("("K6")",20X,K6/)        !!
 947 PRNT 948                       !!
 948 FMT  ("ERROR - DATA DOES NOT EQUAL ADDRESS."/)
 949 LET  M=M+1                     !!
 950 LET  K=R-D(!)+1                !!
 951 PRNT 952 M D(K)                !!
 952 FMT  ("ADDRESS IS  "K6,10X,"DATA IS  "K6/)
 953 STOP                           !!
 999 PRNT 1000                      !!
1000 FMT  ("ERROR - NON SELF-CONFIGURED DMA DID NOT START."/)
1001 STOP                           !!
1002 PRNT 1010                      !!
1010 FMT  ("ERROR - SELF-CONFIGURED DMA DID NOT START."/)
1011 STOP                           !!
1020 PRNT 1022                      !!
1022 FMT  ("ERROR - 'IRQ' DID NOT INTERRUPT DMA"/)
1024 STOP                           !!
1999 REM  END                       !!
```

Section 5
HP 12009A HP-IB Interface Diagnostic

5.1 General

Load and execute the Diagnostic Control System (DCS) and HP-IB interface diagnostic program (HP-IB), using the diagnostic operating mode desired (see the diagnostic operating and troubleshooting manual). When the HP-IB diagnostic is ready to run, refer to the additional operating procedures in this section.

During execution of the HP-IB diagnostic, refer Appendix 5A for a list of execution error messages and codes and Appendix 5B for a listing of the HP-IB diagnostic program.

5.2 Diagnostic Operation

1. Type "RUN<cr>" following the ">" DDL prompt to start the diagnostic program.

   NOTE: Typing "RUN !<cr>" will cause the diagnostic to execute on the highest priority HP 12009A HP-IB card in a noninteractive mode. If any failures are detected, the diagnostic terminates and prints the error message. If the diagnostic completes normally, it will automatically execute on the next highest priority HP 12009A HP-IB card. When all HP 12009A HP-IB cards have been tested, the diagnostic terminates and returns with the ">" DDL prompt.

   If the card-to-card test is to be executed, the diagnostic must be started with the "RUN !<cr>" command.

2. The message
   "12009A HP-IB INTERFACE DIAGNOSTIC"
   "INPUT SELECT CODE:"
   will be displayed. Type in the select code in octal notation of the HP 12009A HP-IB Interface to be tested. For example "27<cr>".

3. If an HP-IB device responds to the HP-IB identify command with a two-byte identification code, the message:
"ADDR. addr. IDENTIFIES WITH number OCTAL" will be displayed, where "addr." is the HP-IB bus address and "number" is the octal identification number.

4. If the diagnostic program identifies a disc drive, the message:
"DISC CONTROLLER LOOPBACK TEST ON HP-IB ADDR. address"
is displayed, where "address" is the address of the HP-IB disc. This indicates that the disc drive loopback test is being executed.

   Verify that the displayed HP-IB address of each disc identified is equal to the address of the attached disc. For proper operation of this test, the correct HP-IB load resistors must be installed.

   If the diagnostic program does not identify a disc drive, the message:
"NO HP-IB DISCS FOUND"
will be displayed. If there is a disc attached, this could signify a failure when the PHI chip went on-line and tried to communicate with the disc, a failure with the HP 12009A HP-IB Interface card HP-IB drivers, or a failure with the disc HP-IB interface.

   If the interface is not configured as 'controller-in-charge' (switch U1S1), the message:
"CARD NOT SYSTEM CONTROLLER"
"ON-LINE TEST NOT EXECUTED"
will be displayed. This indicates that the on-line test and disc drive loopback test is not executed.

5. If the HP 12009A Interface diagnostic completes successfully, the message:
"PASS COMPLETE"
"INPUT SELECT CODE:"
will be displayed on the terminal.

6. If there are two or more HP 12009A HP-IB cards, the optional card-to-card test can be executed. This test checks the input and output drivers of each card. To execute this test:

   a. Connect together via HP-IB cables all HP 12009A HP-IB cards which are to execute this test. No HP-IB device with address equal to zero should be connected to the HP 12009A HP-IB cards which are to run the card-to-card test. This cable configuration is for diagnostic test purposes only, do not use for standard operation.

b. Set the U16 switch on each of the cards which are to execute the test as follows:

HP 12009A Switch U16	#1	2	3	4	5	6	7	8
Setting	1	0	0	0	0	0	0	1

1 = open = up, 0 = closed = down

c. Set the U16 switch on each of the HP 12009A HP-IB cards which are NOT to execute the test to all down (closed).

d. On all HP 12009A HP-IB cards which are to execute the test, set the data settling time switch, U1S2, to the high speed setting (open = up).

If the card-to-card test is not to be executed, set the U16 switch on each of the HP 12009A HP-IB cards to all down (closed).

During the diagnostic execution, the card-to-card test will automatically execute on all HP 12009A HP-IB cards which have been selected to run the test.

If the card-to-card test is to be executed, the message:
"CARD-CARD TEST: SELECT CODES scl AND sc2"
will be displayed, where "scl" ad "sc2" are the select codes of the HP 12009A HP-IB cards tested.

7. To run the diagnostic again, refer to the diagnostic operating and troubleshooting manual.

8. To discontinue program execution, type zero, "0<cr>", following the "INPUT SELECT CODE:" message. The diagnostic program will be terminated, and the ">" DDL prompt will be displayed. Any valid DDL command or statement can now be entered.

9. Remember to return the processor card and interface card switches to their original configuration.

5.3 PHI Chip Access Program

Optional - If the HP 12009A diagnostic completes successfully, the operator can access the PHI (processor to HP-IB interface) chip registers. This can be used to communicate to HP-IB instruments.

1. Load the diagnostic program.

2. The DDL prompt ">" should be displayed. Type "RU A<cr>".

3. The message:
"SELECT CODE?"
will be displayed. Type in the select code of the HP 12009A Interface to be tested.

4. The message:
"R/W/S TO REGISTER?"
will be displayed. To read a register, type "Rn<cr>. To write a register, type "Wn<cr>". The "n" parameter is the register number (for example: "W4<cr>"). A list of the register numbers and their function is in table 5-1.

To stop the program type "S<cr>". The message:
"PASS COMPLETE"
"INPUT SELECT CODE"
will be displayed. Type zero, "0<cr>, to discontinue program execution.

READ

If a read was requested, the message:
"REGISTER n = number OCTAL"
is displayed, where "n" is the register number requested, and "number" is the octal representation of the contents of the ten-bit register.

The "R/W/S TO REGISTER?" will be displayed again. All three options are available.

NOTE: If the register number zero is requested, the message:
"AGAIN?"
will be displayed. If "YES<cr>" is typed, the register will be read again. This allows continued reads of the inbound FIFO register, register number zero. If "NO<cr>" is typed, the "R/W/S REGISTER?" question will be displayed again. All three options are available.

WRITE

If a write was requested, the message:
"DATA? -1 TO END ENTRY :"
will be displayed. Type the data, in octal representation, on the terminal (for example: "0372<cr>"). The data will be written into the register and displayed on the the console in the same format as the "READ" request.

NOTE: If the register number zero is requested, the message:
"DATA? -1 TO END ENTRY :"
will be displayed after the register contents have been changed. This process will be continued until "-1<cr>" is typed, then the message: "R/W/S TO REGISTER?" will be displayed.

Table 5-1. Register Numbers and Their Function

HP-IB REGISTER NO.	FUNCTION
0	HP-IB FIFO's
1	PHI CHIP STATUS
2	PHI CHIP INTERRUPT SENSE
3	PHI CHIP INTERRUPT MASK
4	PARALLEL POLL MASK
5	PARALLEL POLL SENSE
6	HP-IB CONTROL
7	HP-IB ADDRESS

5.4 Execution Times

The execution time is about 45 seconds.

5.5 Program Description

The diagnostic is separated into different tests as described below. These tests are described in the same order as they are executed in the diagnostic program.

Reg 31 Check

The control register (register no. 31) is tested by writing worst case patterns into the control register, reading back, and comparing.

Card Bus & DMA Check

The ten-bit data bus to the PHI chip is checked by writing and reading back an incrementing pattern. All possible patterns are checked. A two-byte self-configured DMA input and output transfer is done to insure that the DMA logic is working correctly. The DMA test is done twice to check all possible data patterns.

The card bus and DMA check tests the data registers in the same manner as the control register was tested (Reg. 31 Check). The data registers are also checked for DMA input and DMA output operation. This test insures that the card can be reset properly by executing the OTA @32 and CLCC 0 instructions and verifing that the control register is cleared out properly.

PHI Chip/HP-IB Card Check

The PHI (processor to HP-IB interface) chip is a CMOS/SOS chip designed to handle all HP-IB handshaking for the host processor. It consists of eight registers, including the two FIFO buffers (one outbound and one inbound) which do the actual communication with the HP-IB. The control registers set interrupt conditions in the PHI and set control conditions on the bus transfers and status registers that indicate the current status of the bus and the PHI chip. Although the PHI is designed to communicate on-line with the HP-IB, it can also be set off-line. This turns the PHI into an HP-IB talker and listener without going out to the external bus. In this way, the PHI chip can be checked for proper operation without having it on-line and communicating with other HP-IB devices. The PHI logic that is tested in this manner includes the interrupt mask, FIFOs, status, and control registers. This test also checks how the PHI chip interrupts affect the interrupt flag, interrupt trap, and the DMA operation. Secondary Address HP-IB commands, Get commands, and Parallel Poll commands are executed in order to insure the flag and proper status bits are set properly. The byte packing mode is also checked.

On-Line Check

The PHI chip is put on-line to test the parallel poll timer, as well as SRQ interrupts. This test is conducted only if the switch that selects system system controller (switch U1S1) is set to the closed (down) position. This selects the interface card as the controller-in-charge.

Interactive Test

This test is executed only when an HP-IB disc is attached. The physical drivers that connect the PHI to the external bus and the PHI chip/HP-IB interaction with the HP-IB discs is tested. The test starts by doing an Identify command to HP-IB addresses 0 through 7. If a disc with write loopback capability is identified, the diagnostic will write and read patterns to and from the disc. This test will check the operation of the disc handshake logic as well as the HP-IB interface on the disc. This test does not write data on the disc. It only interacts with the disc controller. This test will only work with self-identify protocol discs (such as the HP 7902A, HP 7906H, or HP 7910HR).

Card-Card Test

As each card is tested by the diagnostic, it is also checked to see if it is configured for a card-to-card test. If two or more cards are configured for this test, the test will be executed.

For example, assume there are four HP 12009A HP-IB cards in the computer with select codes 24, 27, 31, and 37 (highest to lowest priority) and all but the select code 31 card are configured for the card-to-card test. The diagnostic would:

1. Run regular diagnostic on select code 24.
2. Run regular diagnostic on select code 27.
3. Run card-card test on select codes 24 and 27.
4. Run regular diagnostic on select code 31.
5. Run regular diagnostic on select code 37.
6. Run card-card test on select codes 27 and 37.

The card-card test checks the I/O drivers by configuring one card as the HP-IB controller and the other as a standard HP-IB device. An output transfer, parallel poll test, SRQ and serial poll test, and an input test are executed. The same test is executed again with the other HP 12009A HP-IB card as the HP-IB controller.

PHI Register Access Program

The PHI register access program writes to the selected PHI chip registers with the OTA @30 @0#0data" statement followed by the STCC @31 statement, where "#" is the three bit register select and "data" is the ten bits of data. The PHI chip registers are read with the OTA @31 @1#0000" statement followed by the STCC @30 statement and the LIA @30 statement to read the data, where "#" is the three bit register select.

Appendix 5A
Error Messages

A.1 Error Messages

The diagnostic displays the error messages on the VCP if it is connected to the computer. If any of the following messages occur the HP 12009A Interface card should be replaced. For replacement parts ordering information refer to the HP 12009A HP-IB Interface Card Reference Manual 12009-90001.

Each of the error messages in this Appendix is followed by a description of what caused the error. The error messages are general and do not always point to the exact piece of hardware that has failed. For example a "CONTROL REGISTER CHECK" error message does not always mean the control register has failed. Keep this in mind if component level repair is being performed on the HP 12009A Interface card.

ERROR - CARD BUS CHECK

Failure in the internal HP-IB interface card bus, or a failure in one of the data registers that interfaces with the PHI chip and the backplane.

ERROR - CARD-CARD TEST FAILURE

Failure when two HP 12009A HP-IB cards tried to communicate with each other. Could be a problem in line drivers and receivers.

ERROR - CARD RESET

Card reset failed after an OTA @32 or CLCC 0 statement.

ERROR - CONTROL REGISTER CHECK

Control register failed to hold data properly. Also displayed if the select code entered is not correct.

ERROR - DMA CHECK

A direct memory access write/read to the data registers on the interface card (not PHI chip) has failed.

ERROR - HP-IB INTERACTIVE TEST FAILURE

A failure with the HP-IB drivers, with the PHI chip interaction with the actual HP-IB, or with the HP-IB disc interface that is being used to loop data back to the PHI chip over the HP-IB. This test will also indicate if there is a failure on data transmission, since several types of data patterns are used. It probably indicates a failure in communicating with the last disc under test (e.g. the last HP-IB address displayed by the diagnostic).

ERROR - ON-LINE TEST FAILURE

Failure when the PHI chip was placed on-line and was detected when the PHI chip generated an SRQ, a DMA transfer did not complete while waiting for a Parallel Poll, or the PHI chip did not change state when an IFC was generated.

ERROR - PHI CHIP/HP-IB CARD FAILURE

The card did not interact correctly with the PHI chip. This could be an incorrect DMA completion, an expected interrupt that didn't occur, or an error in the status register.

Appendix 5B
Program Listing

The following is a listing of the source program of the HP-IB Interface Diagnostic (date code 2001). Diagnostic programs with date codes greater than 2001 may vary slightly from this copy. To list the diagnostic statement file that is in memory on the virtual control panel screen, use the DDL "LIST" command following the ">" DDL prompt character (refer to the DDL Operating and Programming manual).

The comments that are supplied with the listing below should be used as a guide to the program action of each statement. The comments are not included on the diagnostic media supplied by Hewlett-Packard.

```
                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
   1 FMT  ("12009A HP-IB INTERFACE DIAGNOSTIC"/)
   2 REM  (C) HEWLETT-PACKARD CO. ALL RIGHTS RESERVED
   3 REM  SERVICE #24397-16009 REV. 2001
   4 PRNT 1               !! PRINT HEADER
   5 GOSB 880             !! INITIALIZE SELECT CODE REGS.
   6 GTSC @4000 Z         !! GET SELECT CODE TO TEST
   7 CLCC 0               !! CLEAR CARD
   8 OTAC @2 Z            !! ESTABLISH GLOBAL REGISTER
   9 BUF                  !! CLEAR AND
  10 BUF  P(64) Q(4) R(64)
                          !! ESTABLISH BUFFERS
                          !!
  11 REM  REG 31 CHECK    !!
                          !!
  12 LET  P(1)=@125252,@52524,0,@177776
                          !! PATTERNS TO CHECK CONTROL REG.
  14 LET  A=1             !! INDEX TO BUFFER
  16 OTA  @31 P(A)        !! OUTPUT THE PATTERN
  18 LIA  @31 C           !! GET IT BACK
  20 SKIF P(A)=C          !! IS IT THE SAME?
  22 GOSB 700             !! NO - ERROR
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
  23 REM  CARD BUS & DMA CHECK
                          !!
  24 LET  A=A+1           !! INCREMENT INDEX
  26 SKIF A=5             !! ARE ALL DONE?
  27 GOTO 16              !! NO - DO ANOTHER ONE
  30 OTA  @31 @177777     !! YES - TRY A CARD CLEAR
  32 LIA  @31 C           !! GET CONTROL REGISTER
  34 SKIF C=0             !! SHOULD BE ZERO
  35 GOSB 705             !! NO - ERROR
  36 OTA  @31 @177776     !! ESTABLISH ALL ONE'S AGAIN
  38 GOSB 801             !! CLEAR AND RESET CARD
  41 LIA  @31 C           !! GET CONTROL REGISTER AGAIN
  42 SKIF C=0             !! SHOULD BE ZERO
  43 GOSB 705             !! NO - ERROR
  45 LET  D=0             !! CONTROL REG. CHECK DONE
                          !! NOW DO BUS CHECK
  46 GOSB 805             !! OUTPUT D TO 30
  47 STCC @30             !! STC PUTS DATA IN INBOUND REG.
  48 LIA  @30 C           !! GET IT BACK
  49 SKIF D=C.@377        !! ARE THEY THE SAME?
  50 GOSB 710             !! NO - ERROR
  51 LET  D=D+1           !! INCREMENT PATTERN
  52 SKIF D>@1777         !! ALL PATTERNS DONE?
  53 GOTO 46              !! NO - DO IT AGAIN
  54 LET  D=@60003        !! ALL PATTERNS CHECKED. DO DMA
  55 GOSB 805             !! SEND TO PHI CONTROL
  56 LET  Q(1)=@165000,@2000,P(!),-2
                          !! TWO DMA QUADS
  57 LET  Q(1)=@61200,@2000,P(!)+1,-2
  58 GOSB 820             !! SET UP AND START DMA
  60 GOSB 825             !! CHECK FOR CORRECT COMPLETION
  61 GOSB 740             !! INCORRECT COMPLETION - ERROR
  62 SKIF P(1)=P(2)       !! WAS DATA TRANSFERRED CORRECTLY?
  63 GOSB 740             !! NO - ERROR
  64 GOSB 810             !! YES - TURN OFF DMA
  65 OTA  @31 1           !! CLEAR CARD
  66 LET  P(1)=P(1)*-1-1!! COMPLEMENT DATA
  67 SKIF P(1)<0          !! ALL DONE?
  68 GOTO 56              !! NO - DO IT AGAIN
                          !!
  70 REM  PHI CHIP/HP-IB CARD CHECK
                          !!
  72 GOSB 801             !! CLEAR CARD
  74 LET  P(1)=@40125,@50252,@10201,@30177,@70140
                          !! SET UP PHI REGISTERS
                          !!
```

```
                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 76 LET  P(6)=@20100      !!
 78 LET  Q(1)=@41000,0,P(!),-6
                          !! USE DMA TO ESTABLISH THEM
 80 GOSB 820              !! SET UP AND START DMA
 82 GOSB 825              !! CORRECT COMPLETION?
 83 GOSB 720              !! NO - ERROR
 91 LET  C=0              !! INITIALIZE C
 92 OTA  @31 @120000      !! READ REG.  2 (PHI 0)
 94 GOSB 815              !! READ IT INTO D
 98 LET  D=D.@120004      !! MASK OUT IRRELEVANT BITS
100 SKIF D=@120004        !! IS PHI FULL?
102 GOTO 120              !! NO - START TESTS
104 OTA  @30 @100000      !! YES - READ PHI
106 STCC @30              !! ONCE
108 LIA  @30 A            !!
110 LET  C=C+1            !! INCREMENT C
112 SKIF C>8              !! READ MORE THAN 8 TIMES?
114 GOTO 92               !! NO - DO IT AGAIN
116 GOSB 720              !! YES - ERROR
120 OTA  @31 0            !! INITIALIZE CARD
122 LET  P(1)=@70040,@10220,@20211
                          !! SET UP THESE REGISTERS
124 LET  Q(4)=-3          !! WORD COUNT FOR DMA
126 GOSB 810              !! CLEAR DMA
130 GOSB 820              !! AND START IT--
133 GOSB 825              !! DID IT COMPLETE CORRECTLY?
134 GOSB 720              !! NO - ERROR
137 OTA  @31 @120000      !! READ INTERRUPT REGISTER (PHI 2)
138 GOSB 815              !! READ IT
140 GOSB 810              !! SHUT OFF DMA
141 LET  D=D.@120377      !! MASK OUT IRRELEVANT BITS
142 SKIF D=@120012        !! PHI IDLE? PHI EMPTY?
144 GOSB 720              !! NO - ERROR
146 LET  P(1)=@10100,@60042,@31114,@21777,@537
                          !! DATA TRANSMISSION
147 LET  P(6)=@477,@536,@476,8,2
                          !! OF PATTERNS THROUGH PHI
148 LET  P(11)=@125,@252,@377,0,@1010
                          !! PHI TALKS AND LISTENS ALWAYS
149 LET  Q(4)=-15         !! DMA WORD COUNT
151 OTA  @31 1            !! CLEAR CARD
152 GOSB 820              !! START DMA
156 GOSB 825              !! CHECK FOR COMPLETION]
157 GOSB 720              !! DIDN'T COMPLETE - ERROR
160 DLY  1000             !! WAIT A WHILE
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 162 OTA  @31 @120000     !! READ PHI 0
 164 GOSB 815             !! READ IT
 166 SKIF @14=D.@14        !! BYTE AVAILABLE? ROOM IN PHI?
 167 GOSB 720             !! NO - ERROR
 168 LIA  @32 B           !! GET STATUS
 170 SKIF @4400=B.@177400
                          !! PHI INT.? DMA REQ.?
 171 GOSB 725             !! NO - ERROR
 178 LET  D=@60040        !! TURN PHI AROUND
 179 GOSB 805             !! FOR INPUT
 180 IBP  R(1) R(15) CL   !! CLEAR R BUFFER
 182 LET  Q(1)=@51200,@101604,R(!),-15
                          !! DMA QUAD
 184 GOSB 810             !! CLEAR DMA
 186 GOSB 820             !! START IT
 190 GOSB 825             !! CHECK FOR PROPER COMPLETION
 191 GOSB 725             !! NO - ERROR
 196 SKIF Q(4)=-4         !! IS WORD COUNT CORRECT?
                          !! (DMA READ 12 WORDS ONLY)
 197 GOTO 725             !! NO - ERROR
 200 CPBF P(5) R(1) 11 @177600
                          !! DID DATA COME BACK CORRECTLY?
 201 GOSB 720             !! NO - ERROR
 202 SKIF @200=R(1).R(2).R(9).@200
                          !! WAS BIT 8 SET IN CORRECT WORDS?
 203 GOSB 720             !! NO - ERROR
 204 SKIF @101410=R(11)   !! WAS LAST WORD CORRECT?
 205 GOSB 720             !! NO - ERROR
 206 LIA  @32 B           !! GET STATUS
 207 SKIF @24000=B.@177400
                          !! DMA FROZEN? DMA REQ?
 208 GOSB 725             !! NO - ERROR
 210 GOSB 815             !! DO ONE MORE READ
 212 LIA  @32 B           !! THEN STATUS CHECK
 214 SKIF @4000=B.@177400
                          !! DMA REQ. ONLY?
 215 GOSB 725             !! NO - ERROR
 216 OTA  @31 1           !! CLEAR CARD
 217 GOSB 810             !! AND DMA
 218 LET  D=@60042        !! SET PHI FOR INPUT
 219 GOSB 805             !! DO IT
 220 LET  P(15)=8,9,10,11,12
                          !! MORE DATA PATTERNS FOR PHI
 221 LET  P(20)=13,14,15!!
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
=================================================================
                          !!
 222 LET  P(3)=@31100     !! SET INTERRUPT MASK
 223 OTA  @31 @104        !! AND CONTROL WORD
 224 LET  Q(1)=@51000,@104,P(!),-22
                          !! DMA QUAD
 225 CLF  @30             !! CLEAR 30
 226 GOSB 820             !! AND START DMA
 230 WFI  Z 3000          !! WAIT FOR AN INTERRUPT
 231 GOSB 725             !! NONE OCCURRED - SO ERROR
 232 SFC  @20             !! DMA SHOULDN'T HAVE COMPLETED
 233 GOSB 725             !! IT DID SO ERROR
 234 SFS  @30             !! FLAG 30 SHOULD HAVE SET.
 235 GOSB 725             !! NO - ERROR
 236 LIA  @32 B           !! GET STATUS
 237 SKIF @6400=B.@177400
                          !! PHI INT.? DMA FROZEN? DMA REQ.?
 238 GOSB 725             !! NO - ERROR
 239 CLCC @23             !! SHUT OFF DMA
 240 LIA  @23 B           !! READ WORD COUNT
 242 SKIF B=-22           !! SHOULD BE -22
 243 GOSB 725             !! IT ISN'T
 244 OTA  @31 @120000     !! READ PHI 0
 245 GOSB 815             !! READ IT
 246 SKIF D=@121110       !! INT. PEND? PROC. ABORT.? FIFO ROOM?
 247 GOTO 725             !! NO - ERROR
 248 OTA  @31 1           !! CLEAR CARD
 251 LET  D=@21777        !! AND PHI INT.
 252 GOSB 805             !! DO IT
 254 LET  D=@60040        !! SET PHI FOR OUTPUT
 256 GOSB 805             !! DO IT
 258 CLF  @30             !! CLEAR 30
 260 LET  Q(2)=4          !! CONTROL WORD
 261 GOSB 820             !! START DMA
 264 WFI  Z 3000          !! WAIT FOR INTERRUPT
 265 GOSB 725             !! NONE OCCURRED
 266 SFC  @20             !! DMA SHOULDN'T HAVE COMPLETED
 267 GOTO 725             !! IT DID.  ERROR
 268 LIA  @23 B           !! LOOK AT WORD COUNT
 269 SKIF B=-1            !! SHOULD BE -1
 270 GOSB 725             !! IT ISN'T - ERROR
 272 SFS  @30             !! WAS 30 SET?
 273 GOSB 725             !! NO - ERROR
 274 GOSB 810             !! CLEAR DMA
 275 OTA  @31 @120000     !! READ PHI INT.
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 276 GOSB 815             !! NO PHI INT. SHOULD BE PENDING
 277 SKIF D=@120000       !! SHOULD BE ZERO
 278 GOSB 720             !! IT ISN'T SO ERROR
 279 GOSB 810             !! CLEAR DMA
 280 LET  D=@60040        !! PHI OUTPUT
 281 GOSB 805             !! DO IT
 282 IBP  R(1) R(32) CL   !! INITIALIZE BUFFER
 283 LET  Q(1)=@51200,@100604,R(!),-30
 284 CLF  @30             !! CLEAR 30
 285 GOSB 820             !! START DMA
 287 DLY  1000            !! WAIT A WHILE
 288 GOSB 810             !! TURN OFF DMA
 289 LIA  @23 B           !! GET WORD COUNT
 290 SKIF B=-14           !! SHOULD BE -14
 291 GOSB 725             !! NO - ERROR
 292 OTA  @31 @120000     !! LOOK AT PHI INT.
 293 GOSB 815             !! GO DO IT
 294 SKIF D=@121100       !! PHI INT.? PROC. ABORT?
 295 GOSB 720             !! NO - ERROR
 296 OTA  @31 0           !! CLEAR CONTROL
 297 LET  D=@60040        !! TURN PHI AROUND
 298 GOSB 805             !! GO TO IT
 299 CLF  @30             !! TURN OFF 30
 300 LET  Q(2)=@105614,R(!),-8
                          !! DO A FORCED FLUSH
 301 IBP  R(1) R(8)  CL   !! CLEAR INPUT BUFFER
 302 GOSB 850             !! GO CHECK START DMA ON INT.
 303 GOSB 725             !! DMA DIDN'T START SO ERROR
 304 GOSB 825             !! CHECK FOR PROPER DMA COMPLETION
 305 GOSB 725             !! DIDN'T COMPLETE - ERROR
 310 IBP  R(20) R(28)  CL
                          !! CLEAR TEST BUFFER
 311 CPBF R(1) R(20) 8 @100000
                          !! COMPARE INPUT AND TEST BUFFERS (ALL 0)
 312 GOSB 720             !! NO - ERROR IN PHI
 313 GOSB 810             !! TURN OFF DMA
 315 OTA  @31 4           !! ENABLE INT. FROM CARD
 320 LET  D=@31200        !! INT. FROM STATUS CHANGE
 322 GOSB 805             !! DO IT.
 324 LET  D=@21777        !! CLEAR PENDING INT.
 325 GOSB 805             !! DO IT.
 326 CLF  @30             !! SHUT OFF 30
 328 SFC  @30             !! AND MAKE SURE IT'S OFF
                          !!
```

```
                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 329 GOSB 725             !! IT ISN'T - ERROR
 330 LET  D=@60062        !! DO AN IFC
 332 GOSB 805             !! DO IT.
 334 SFS  @30             !! DID 30 SET?
 335 GOSB 725             !! NO - ERROR
 336 OTA  @31 @120000     !! READ PHI INT.
 337 GOSB 815             !! DO IT
 338 SKIF D=@121200       !! STAT CHANGE? PHI INT?
 339 GOSB 720             !! NO - ERROR
 340 LET  P(9)=@574       !! SET UP P(9) WITH SECONDARY
 341 LET  Q(1)=@51000,0,P(!),-9
                          !! DMA QUAD
 342 GOSB 810             !! SET UP
 343 GOSB 820             !! START
 345 GOSB 825             !! CHECK FOR PROPER COMPLETION
 346 GOSB 720             !! DIDN'T - ERROR
 349 GOSB 810             !! TURN OFF DMA
 350 IBP  R(1) R(8)  CL   !! INITIALIZE INPUT BUFFER
 351 CLF  @30             !! TURN OFF 30
 352 LET  Q(1)=@51200,@100604,R(!),-8
                          !! DMA INPUT QUAD
 353 OTA  @31 0           !! CLEAR CONTROL
 354 LET  D=@60040        !! TURN PHI AROUND
 355 GOSB 805             !! DO IT
 356 GOSB 820             !! START DMA
 357 CLF  @30             !! CLEAR 30
 358 GOSB 825             !! WAIT FOR PROPER COMPLETION
 359 GOSB 725             !! DIDN'T - ERROR
 362 SFS  @30             !! DID FLAG SET?
 363 GOSB 725             !! NO - ERROR
 364 SKIF Q(4)=-7         !! ONE WORD ONLY?
 365 GOSB 725             !! NO - ERROR
 366 LIA  @32 B           !! GET STATUS
 367 SKIF @10000=B.@177400
                          !! MSA RECEIVED?
 368 GOSB 725             !! NO - ERROR
 370 OTA  @32 0           !! CLEAR STATUS
 371 LIA  @32 B           !! GET STATUS AGAIN
 372 SKIF 0=B.@177400     !! MSA GONE?
 373 GOSB 725             !! NO - ERROR
 374 LET  P(9)=@410       !! TRY A "GET"
 375 LET  Q(1)=@51000,4,P(!),-9
                          !! OUTPUT DMA QUAD
                          !!
```

```
                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
376 CLF  @30              !! TURN OFF 30
377 OTA  @31 @100000      !! READ ONE WORD FROM FIFO
378 GOSB 815              !! DO IT. (CLEARS MSA OUT)
379 GOSB 810              !! CLEAR DMA
380 GOSB 820              !! START IT
381 GOSB 825              !! CHECK FOR COMPLETION
382 GOSB 725              !! DIDN'T - ERROR
384 SFS  @30              !! DID 30 SET?
385 GOSB 725              !! NO - ERROR
386 LIA  @32 B            !! GET STATUS
387 SKIF @40400=B.@177400
                          !! "GET" RECEIVED?
388 GOSB 725              !! NO - ERROR
389 LIA  @32 B            !! SECOND READ OF STATUS
                          !! SHOULD CLEAR "GET"
390 SKIF @400=B.@177400!! IS IT GONE?
391 GOSB 725              !! NO - ERROR
392 OTA  @31 0            !! CLEAR CONTROL
393 LET  D=@60052         !! RESPOND TO PARALLEL POLL
394 GOSB 805              !! DO IT
395 LET  D=@70140         !! TALK AND LISTEN ALWAYS
396 GOSB 805              !! DO IT
397 LET  G=@121040        !! G = PHI INT. & PARALLEL POLL INT.
398 LET  P(9)=@40377,@50000,@405,@550
                          !! SET MASK AND SENSE
399 LET  P(2)=@60052,@31040
                          !! RESPOND TO PP & INT. MASK
400 LET  Q(1)=@51000,@4,P(!),-12
                          !! INITIAL DMA TRANSFER
402 CLF  @30              !! CLEAR 30
403 GOSB 820              !! START TRANSFER
404 GOSB 825              !! CHECK FOR PROPER COMPLETION
405 GOSB 725              !! DIDN'T - ERROR
410 SFS  @30              !! FLAG 30 SET?
411 GOSB 725              !! NO - ERROR
412 LET  E=@550           !! STEP THROUGH EACH PARALLEL POLL LINE
413 LET  F=1              !! F = POLL LINE RESPONSE
414 OTA  @31 @120000      !! READ PHI INT.
415 GOSB 815              !! DO IT
416 SKIF D=G              !! SHOULD EQUAL G
417 GOSB 720              !! IT DOESN'T SO ERROR
418 OTA  @31 0            !! OUTPUT TO FIFO
419 LET  D=E              !! FIRST PP CONFIGURE
                          !!
```

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                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
 420 GOSB 805             !! DO IT
 421 OTA  @31 @100000     !! READ FIFO FOR PP RESONSE
 422 GOSB 815             !! DO IT
 423 SKIF D=@100000+F     !! SHOULD EQUAL F
 424 GOSB 720             !! IT DOESN'T SO ERROR
 425 LET  E=E+1           !! INCREMENT CONFIGURE COMMAND
 426 LET  F=F*2           !! MOVE F TO NEXT DIO POSITION
 427 SKIF E=@560          !! LAST ONE?
 428 GOTO 414             !! NO - DO AGAIN
 429 SKIF F 0             !! IF F = 0 ALL DONE
 430 GOTO 440             !! YES DO NEXT TEST
 432 LET  F=0             !! NO - SET F =0
 433 OTA  @31 0           !! CLEAR CARD
 434 LET  D=@40000        !! MASK ALL PP RESPONSES
 435 GOSB 805             !! DO IT.
 436 LET  G=@120000       !! PROPER PHI. INT STATUS
 437 LET  E=@550          !! RESET CONFIGURE COMMAND
 438 GOTO 414             !! DO PP TEST AGAIN TO CHECK MASK
 440 LET  D=@60042        !! SET PHI FOR OUTPUT
 441 GOSB 805             !! DO IT
 442 LET  P(1)=@57477,@57076,@76160
                          !! SET UP OUTPUT BUFFER
 443 LET  Q(1)=@71000,@2400,P(!),-6
                          !! AND DMA QUAD FOR BYTE MODE
 444 CLF  @30             !! TURN OFF 30
 445 GOSB 810             !! AND DMA
 446 GOSB 820             !! START DMA
 447 GOSB 825             !! CHECK FOR COMPLETION
 448 GOSB 725             !! DIDN'T - ERROR
 450 LET  Q(2)=@3002,P(!),-8
                          !! DMA QUAD
 451 LET  P(1)=@125252,@177777,@52525,0
 452 GOSB 810             !! CLEAR DMA
 453 GOSB 820             !! START DMA
 454 GOSB 825             !! CHECK FOR PROPER COMPLETION
 455 GOTO 457             !! DMA SHOUDN'T COMPLETE. IF IT DOES,
 456 GOSB 725             !! DMA NOT WAITING FOR PARALLEL POLL
 457 GOSB 810             !! CLEAR DMA
 458 LIA  @23 C           !! GET WORD COUNT
 459 SKIF C=0             !! SHOULD BE ZERO
 460 GOSB 725             !! IT ISN'T - ERROR
 462 OTA  @31 1           !! CLEAR CARD
 464 LET  R(1)=@21000     !! TURN PHI AROUND IN BYTE MODE
                          !!
```

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                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
 465 LET  Q(2)=@62000,R(!),-1
                          !! THIS IS SAME AS OTA @30 @60042
 466 GOSB 810             !! CLEAR DMA
 467 GOSB 820             !! START TRANSFER
 468 GOSB 825             !! CHECK FOR COMPLETION
 469 GOSB 725             !! DIDN'T - ERROR
 472 IBP  R(1) R(10) CL !! CLEAR INPUT BUFFER
 474 LET  Q(1)=@71200,@103000,R(!),-12
                          !! SET TO READ PHI
 476 GOSB 810             !! TURN OFF DMA
 477 GOSB 820             !! START DMA
 478 GOSB 825             !! CHECK FOR PROPER COMPLETION
 479 GOSB 725             !! DIDN'T OCCUR - ERROR
 482 SKIF Q(4)=-2         !! IS WORD COUNT CORRECT?
 483 GOSB 725             !! NO - ERROR
 484 CPBF P(1) R(2) 4 0 !! IS THE READ-BACK DATA CORRECT?
 485 GOSB 725             !! NO
 486 OTA  @31 1           !! CLEAR THE CARD
 487 LET  D=@60042        !! TURN PHI AROUND FOR OUTPUT
 488 GOSB 805             !! DO IT
 490 LET  P(1)=@57477     !! OUTPUT THESE BYTES
 492 LET  Q(1)=@71000,@2402,P(!),-2
                          !! DMA OUTPUT QUAD
                          !!
 493 REM  ON-LINE CHECK !!
                          !!
 494 LET  D=@70200        !! PUT THE PHI ON-LINE
 496 GOSB 805             !! DO IT
 498 OTA  @31 @110000     !! READ PHI STATUS
 499 GOSB 815             !! DO IT
 500 SKIF @10=D.@10       !! IS PHI SYSTEM CONTROLLER?
 501 GOTO 795             !! NO - DON'T DO FOLLOWING TESTS
 502 SKIF D=@110310       !! SYS CNTRL? HP-IB CNTRL?
 503 GOTO 730             !! NO - PHI ERROR
 504 OTA  @31 0           !! CLEAR CONTROL WORD
 506 LET  D=@31200        !! OUTPUT INTERRUPT MASK
 507 GOSB 805             !! DO IT.
 508 LET  D=@21777        !! CLEAR PHI INTERRUPTS
 509 GOSB 805             !! DO IT
 510 SFC  @30             !! CHECK THAT 30 IS CLEAR
 511 GOTO 725             !! IT ISN'T - ERROR
 512 LET  D=@60062        !! DO IFC
 513 GOSB 805             !! DO IT
                          !!
```

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                          !!
     PROGRAM              !!        COMMENTS
     STATEMENTS           !!
=================================================================
                          !!
 514 DLY  100             !! WAIT A WHILE
 516 LET  D=@60042        !! REMOVE IFC
 517 GOSB 805             !! DO IT
 518 SFC  @30             !! FLAG SHOULD STILL BE CLEAR
 519 GOSB 730             !! IT ISN'T. INT NOT MASKED
 520 OTA  @31 4           !! ENABLE INT.
 521 SFS  @30             !! FLAG SHOULD SET
 522 GOSB 730             !! IT DIDN'T - ERROR
 523 OTA  @31 @120000     !! SET UP TO READ INT. MASK
 524 GOSB 815             !! DO IT
 525 SKIF D=@121200       !! PHI INT? STAT CHNG?
 526 GOSB 730             !! NO - PHI ERROR
 527 OTA  @31 @110000     !! SET UP TO READ STATUS
 528 GOSB 815             !! DO IT
 530 SKIF D=@110230       !! HP-IB CNTRL? SYS. CNTRL?
 531 GOSB 730             !! NO - ERROR
 532 OTA  @31 0           !! CLEAR CONTROL WORD
 533 LET  D=@70000        !! TAKE PHI OFF-LINE
 534 GOSB 805             !! DO IT
 535 LET  D=@70200        !! PUT IT ON-LINE AGAIN
 536 GOSB 805             !! DO IT
 537 LET  D=@60046        !! PULL SRQ
 538 GOSB 805             !! DO IT
 539 SFC  @30             !! MAKE SURE 30 IS CLEAR
 540 GOSB 730             !! IT ISN'T. INT NOT MASKED OFF
 541 OTA  @31 @24         !! ENABLE INT. AND SRQ DETECTION
 542 SFS  @30             !! FLAG SHOULD BE SET
 543 GOSB 730             !! IT ISN'T - ERROR
 544 LIA  @32 B           !! GET CARD STATUS
 545 SKIF @1400=B.@177400
                          !! SRQ PENDING?
 546 GOSB 730             !! NO - ERROR
 547 LET  D=@60042        !! REMOVE SRQ
 548 GOSB 805             !! DO IT
 549 LIA  @32 B           !! GET STATUS
 550 SKIF @400=B.@177400  !! IS SRQ GONE?
 551 GOSB 730             !! NO - ERROR
 552 CLF  @30             !! CLEAR 30
 553 LET  D=@30777        !! UNMASK ALL PHI INT.
 554 GOSB 805             !! DO IT
 555 LET  D=@60062        !! DO ANOTHER IFC
 556 GOSB 805             !! DO IT
 557 LET  D=@60042        !! REMOVE IFC
                          !!
```

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                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 558 GOSB 805             !! DO IT
 559 CLF  @30             !! CLEAR 30
 560 SFC  @30             !! AND MAKE SURE ITS CLEAR
 561 GOSB 725             !! STILL SET - ERROR
 562 GOSB 810             !! CLEAR DMA
 563 GOSB 820             !! START DMA QUAD (SEE LINES 490-500)
 564 GOSB 825             !! CHECK FOR PROPER COMPLETION
 565 GOSB 730             !! DO IT
 568 LIA  @32 B           !! GET STATUS
 569 SKIF @100400=B.@177400
                          !! DID CARD PARALLEL POLL 7 US?
 570 GOSB 730             !! NO - ERROR
 572 LET  H=0             !! LETS FIND SOME DISCS:
                          !! INITIALIZE CONTANTS
 574 LET  P=-1            !!
 575 LET  P(1)=@31004,@21777
                          !! SET UP INTERRUPT MASK FOR FIFO BYTE AV.
 576 LET  Q(1)=@51000,0,P(!),-2
                          !! OUTPUT DMA QUAD
 577 GOSB 810             !! CLEAR DMA
 578 GOSB 820             !! START IT
 579 GOSB 825             !! CHECK FOR PROPER COMPLETION
 580 GOSB 730             !! DIDN'T SO ERROR
 583 LET  P(1)=@476,@537!! CONTROLLER LISTEN & UNTALK
 585 LET  P=P+1           !! FIRST HP-IB ADDRESS
 586 LET  D=@60063        !! INITIALIZE OUTBOUND FIFO
 587 GOSB 805             !! DO IT
 588 LET  D=@60042        !! REMOVE THE BIT AND SET FOR OUTPUT
 589 GOSB 805             !! DO IT
 590 LET  P(3)=P+@540     !! MAKE PROPER SEC.
 591 SKIF P @10           !! IF EQUAL TO OCTAL 10 ALL DONE
 592 GOTO 900             !! DIAGNOSTIC COMPLETE
                          !!
 599 REM  INTERACTIVE TEST
                          !!
 600 OTA  @31 0           !! CLEAR CONTROL WORD
 601 LET  P(4)=@1002,@60040
                          !! ACCEPT TWO BYTES AND SET PHI FOR INPUT
 602 LET  Q(4)=-5         !! FIVE DMA WORDS
 603 GOSB 810             !! CLEAR DMA
 604 GOSB 820             !! START IT
 605 GOSB 825             !! CHECK FOR PROPER COMPLETION
 606 GOSB 730             !! DIDN'T SO ERROR
 609 OTA  @31 4           !! ENABLE PHI INT.
                          !!
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                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 610 SFS  @30             !! DID 30 SET (BYTES AVAILABLE?)
 611 GOTO 575             !! NO - TRY NEXT ADDRESS
 612 OTA  @31 @120000     !! LOOK AT INTERRUPTS
 613 GOSB 815             !! DO IT
 614 SKIF D=@121004       !! PHI INT? FIFO BYTE?
 615 GOSB 730             !! NO - ERROR
 616 OTA  @31 @100000     !! READ FIRST BYTE
 617 GOSB 815             !! GET FIRST BYTE
 618 LET C=D.@377*@400    !! MOVE TO UPPER BYTE
 619 GOSB 815             !! GET SECOND BYTE
 620 LET C=D.@377+C       !! PUT INTO IDENTIFY WORD
 621 PRNT 1220 P C        !! PRINT THE ADDR. AND IDENTIFY WORD
 622 SKIF 0=C.@177400     !! WAS THE TOP BYTE ZERO?
 623 GOTO 575             !! NOT A DISC - TRY AGAIN
 628 GOSB 750             !! CHECK IDENTIFY CODES
 629 GOTO 575             !! NOT A DISC - TRY AGAIN
 630 PRNT 1040 P          !! PRINT WHAT DISC ADDRESS UNDER TEST
 631 LET  H=1             !! SET H
 632 LET  P=P(3)          !! SAVE HP-IB ADDRESS
 633 LET  P(1)=@537,@477,@536
                          !! BUILD HP-IB ADDRESS
                          !! STRING(UNT,UNL,CNTRL TLK)
 634 LET  P(4)=P.@477     !! CREATE PROPER LISTEN ADDRESS
 635 LET  P(5)=@576       !! SEC. FOR WRITE LOOPBACK
 636 IBP  P(6) P(15)  R1!! INITIALIZE BUFFER WITH ROTATING '1'S
 637 IBP  P(14) P(22) IP!! INITIALIZE TEST OF BUFFER WITH INCRE. PAT.
 638 LET  P(22)=P(22)+@1000
                          !! LET P(22) BE LAST DATA PATTERN (SET EOI)
 639 LET  P(23)=@477,@537,@476
                          !! UNL,UNT,CONTROLLER LSTN
 640 LET  P(26)=P.@537    !! MAKE CORRECT TALK ADDR.
 641 LET  P(27)=@576,@1020,@537,@477,@60040
                          !! SEC.,20 BYTES,UNT,UNL,PHI INPUT
 642 OTA  @31 0           !! CLEAR CONTROL
 643 LET  P(14)=@252,@125
                          !! MAKE TWO DATA PATTERNS
                          !! ALTERNATING ONES AND ZEROS
 644 LET  D=@60042        !! ENABLE PHI FOR OUTPUT
 645 GOSB 805             !! DO IT
 646 LET  Q(1)=@51000,@1400,P(!),-31
                          !! DMA OUTPUT QUAD
 648 GOSB 810             !! CLEAR DMA
 649 GOSB 820             !! START THE TRANSFER
 650 GOSB 825             !! CHECK FOR PROPER COMPLETION
                          !!
```

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                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
=================================================================
                          !!
 651 GOSB 735             !! DIDN'T COMPLETE SO ERROR
 654 LET  Q(1)=@51200,@101000,R(!),-16
                          !! DMA INPUT TRANSFER
 655 IBP  R(1) R(20)  CL!! CLEAR THE INPUT BUFFER
 656 GOSB 810             !! CLEAR DMA
 657 GOSB 820             !! START THE INPUT TRANSFER
 658 GOSB 825             !! CHECK FOR COMPLETION
 659 GOSB 735             !! DIDN'T COMPLETE SO ERROR
 662 CPBF P(6) R(1) 16 @177400
                          !! COMPARE OUTPUT AND INPUT BUFFER
 663 GOSB 735             !! DIDN'T COMPARE SO ERROR
 664 SKIF @1000=R(16).@1000
                          !! LAST DATA BYTE TAGGED WITH BIT 9?
 665 GOSB 735             !! NO - ERROR
 666 OTA  @31 0           !! CLEAR CARD CONTROL WORD
 667 CLF  @30             !! AND 30
 668 LET  P=P.@7          !! CREATE ADDRESS AGAIN
 669 SKIF P=@7            !! LAST ADDRESS
 670 GOTO 575             !! NO - TRY NEXT ONE
 672 GOTO 900             !! YES - DIAGNOSIC COMPLETE
 700 PRNT 1010            !! ERROR MESAGE AREA:
                          !! THIS AREA PRINTS THE PROPER
 702 STF  @2              !! ERROR MESSAGE THEN JUMPS
                          !! TO LINE 702 FOR A STOP
 704 STOP                 !! THESE ERROR MESSAGES ARE
                          !! CALLED AS SUBROUTINES
 705 PRNT 1011            !! FROM THE MAIN PROGRAM
 706 GOTO 702             !!
 710 PRNT 1020            !!
 711 GOTO 702             !!
 715 PRNT 1020            !!
 716 GOTO 702             !!
 725 PRNT 1030            !!
 726 GOTO 702             !!
 730 PRNT 1035            !!
 732 GOTO 702             !!
 735 PRNT 1060            !!
 736 GOTO 702             !!
 740 PRNT 1021            !!
 742 GOTO 702             !!
 745 PRNT 1111            !!
 746 GOTO 702             !!
 750 SKIF D @101403       !! DISC IDENTIFY ROUTINE:
                          !! IF PROPER ID FOUND, RETURN
                          !!
```

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                          !!
    PROGRAM               !!       COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 751 RTN  1               !! PLUS ONE OTHER WISE RETURN PLUS ZERO
 752 SKIF D @101601       !! LOWER BYTE HAS ID CODE:    3=7906
 753 RTN  1               !!                          : @201=7902
 754 SKIF D @101401       !!                          :    1=7910
 755 RTN  1               !!
 756 SKIF D @101604       !!
 757 RTN  1               !!
 770 RTN                  !! ID DIDN'T MATCH ANYTHING SO RETURN
 795 PRNT 1099            !! PRINT "CARD NOT. . . . " MESSAGE
 796 PRNT 1098            !!
 797 GOTO 6               !! CHECK FOR ANOTHER CARD
                          !!
 800 REM  SUBROUTINES     !!
                          !!
 801 CLCC 0               !! INITIALIZE I/O SUBROUTINE:
                          !! CRS AND ENABLE GLOBAL REG.
 802 OTAC @2 Z            !!
 803 RTN                  !! DONE
 805 OTAC @30 D           !! PHI OUTPUT SUBROUTINE
                          !! OUTPUT WORD AND SET CONTROL
 806 STCC @30             !!
 807 RTN                  !! DONE
 810 CLCC @23             !! DMA CLEAR SUBROUTINE:
                          !! DO CLEAR CONTROL, CLEAR FLAG
 811 CLCC @21             !! ON BOTH 23 AND 21
 812 RTN                  !! ALL DONE
 815 STCC @30             !! READ PHI SUBROUTINE
                          !! DO A STCC AND AN LIA FROM 30
 816 LIAC @30 D           !!
 817 RTN                  !! DONE
 820 OTAC @20 Q(!)        !! START DMA SUBROUTINE:
                          !! OUTPUT QUAD ADDRESS TO 20
 821 STCC @20             !! AND STCC ON 20
 822 RTN                  !! DONE
 825 WFI  Z 2000          !! DMA COMPLETION ROUTINE
                          !! WAIT FOR COMPLETION INT.
 826 RTN                  !! AND CHECK THAT 20 SET
                          !! IF GOOD RETURN + 1; IF NOT
 827 SFS  @20             !! RETURN PLUS 0
 828 RTN                  !!
 829 RTN  1               !! DONE
 850 OTA  @31 0           !! START DMA ON INT. ROUTINE
                          !!
```

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                          !!
    PROGRAM               !!        COMMENTS
    STATEMENTS            !!
================================================================
                          !!
 851 LET  D=@30777        !! MASK INTERRUPTS
 852 GOSB 805             !! DO IT
 853 GOSB 820             !! START DMA
 854 GOSB 825             !! CHECK FOR COMPLETION
 855 GOTO 857             !! DIDN'T COMPLETE WHICH IS CORRECT!
 856 RTN                  !! IT COMPLETED & IT SHOULDN'T HAVE- ERROR
 857 GOSB 810             !! CLEAR DMA
 858 LET  D=@31100        !! UNMASK INTERRUPTS FROM PHI
 859 GOSB 805             !! DO IT
 860 GOSB 820             !! START DMA AGAIN
 861 RTN  1               !! RETURN TO MAIN PROGRAM
 870 LET  A=0             !! CLEAR A
 871 SFC  @20             !! HAS DMA COMPLETED?
 872 RTN  1               !! YES - RETURN +2
 873 LET  A=A+1           !! BUMP A
 874 SKIF A=1000          !! OVER 1000 TIMES?
 875 GOTO 871             !! NO - TRY AGAIN
 876 RTN                  !! YES SO RETURN ANYWAY
 880 LET  X=0             !! CLEAR THE
 881 LET  Y=0             !! THREE
 882 LET  Z=0             !! SELECT CODE REGISTERS
 883 RTN                  !! RETURN
 900 SKIF H=1             !! CHECK IF HP-IB DISCS FOUND (H=1)
 901 PRNT 1050            !! NONE FOUND - SO INDICATE
 948 OTAC @2 Z            !! SET UP SELECT CODE AGAIN
 950 LIA  @32 B           !! READ SWITCHES
 952 SKIF @201=B.@377     !! IS IT SET FOR CARD-CARD TEST?
 953 GOTO 6               !! NO - CHECK ANOTHER CARD
 954 LET  X=Y             !! SET X
 955 LET  Y=Z             !! AND SAVE NEW SELECT CODE
 956 SKIF X 0             !! ARE THERE TWO SELECT CODES?
 957 GOTO 6               !! NO - CHECK ANOTHER CARD
 982 SKIF X#Y             !! SAME SELECT CODES?
 983 GOTO 6               !! YES - CHECK ANOTHER CARD
1010 FMT  ("ERROR - CONTROL REGISTER CHECK"/)
1011 FMT  ("ERROR - CARD RESET"/)
1020 FMT  ("ERROR - CARD BUS CHECK"/)
1021 FMT  ("ERROR - DMA CHECK"/)
1030 FMT  ("ERROR - PHI CHIP/HP-IB CARD FAILURE"/)
1035 FMT  ("ERROR - ON-LINE TEST FAILURE"/)
1040 FMT  ("DISC CONTROLLER LOOPBACK TEST ON HP-IB ADDR. "I1/)
1050 FMT  ("NO HP-IB DISCS FOUND"/)
                          !!
```

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                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
=================================================================
                          !!
1060 FMT  ("ERROR - HP-IB INTERACTIVE TEST FAILURE"/)
1098 FMT  ("ON-LINE TEST NOT EXECUTED"/)
1099 FMT  ("CARD NOT SYSTEM CONTROLLER"/)
1100 FMT  ("CARD-CARD TEST: SELECT CODES ",K2)
1101 FMT  (" AND ",K2/)
1102 FMT  ("PASS COMPLETE"/)
1111 FMT  ("ERROR -  CARD-CARD TEST FAILURE"/)
1220 FMT  ("ADDR. "I1" IDENTIFIES WITH "K6" OCTAL"/)
1999 PRNT 1102
2000 REM  CARD-CARD TEST
2001 PRNT 1100 X          !! PRINT THE SELECT CODES
2002 PRNT 1101 Y          !! UNDER TEST
2003 LET  F=0             !! CLEAR PASS FLAG
2004 CLCC 0               !! INITIALIZE THE WORLD
2005 IBP  R(1) R(64)  CL!! AND CLEAR THE DEST. BUFFER
2006 LET  P(1)=@537,@477,@536,@440
                          !! UNT,UNL,T36B,L00B
2008 IBP  P(5) P(12)  R1!! TEST PATTERN OF ROTATING 1'S
2010 LET  P(13)=@252,@125,@377,@1000,@537
                          !! PATTERNS + UNT
2011 LET  P(18)=@477      !! AND UNL
2012 OTAC @2 X            !! SET CRD #1
2014 LET  D=@70200        !! PUT IT ON-LINE
2016 GOSB 805             !! DO IT
2018 LET  D=@60062        !! IFC
2020 GOSB 805             !! DO IT
2022 LET  D=@60042        !! REMOVE IFC AND SET FOR OUTPUT
2024 GOSB 805             !! DO IT
2030 OTAC @2 Y            !! SET CRD #2
2032 LET  D=@70200        !! PUT IT ON-LINE
2034 GOSB 805             !! DO IT
2038 LET  Q(1)=@41000,@0,P(!),-18
                          !! OUTPUT DMA QUAD FOR #1
2040 LET  Q(5)=@51200,@101000,R(!),-16
                          !! INPUT DMA QUAD FOR #2
2042 LET  Q=Q(!)+4        !! CALCULATE SECOND QUAD ADDRESS
2044 OTAC @20 Q           !! GIVE IT TO #2
2046 STCC @20             !! AND START IT
2048 OTAC @2 X            !! SET CRD #1
2050 OTAC @20 Q(!)        !! GIVE IT FIRST CARD
2052 STCC @20             !! AND TURN IT ON
                          !!
```

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                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
2054 OTAC @2 X            !! RE-ESTABLISH CARD ONE
2058 GOSB 870             !! WAIT FOR COMPLETION FLAG
2061 GOSB 745             !! DIDN'T COMPLETE - ERROR
2062 OTAC @2 Y            !! CHECK CARD #2
2066 GOSB 870             !! CHECK IF ITS DMA COMPLETED
2069 GOSB 745             !! IT DIDN'T - ERROR
2070 SKIF Q(8)=-4         !! CORRECT RESIDUE WRITTEN?
2071 GOSB 745             !! NO - ERROR
2072 CPBF P(5) R(1) 12 @177400
2072 CPBF P(5) R(1) 12 @177400
                          !! IS DATA CORRECT?
2073 GOSB 745             !! NO -ERROR
2080 OTAC @2 X            !! CARD #1
2082 GOSB 805             !! MAKE SURE ON-LINE
2084 LET  D=@40200        !! SET P.P MASK
2086 GOSB 805             !! DO IT
2088 OTAC @2 Y            !! CRD #2
2090 LET  D=@60010        !! RESPOND TO P.P.
2092 GOSB 805             !! DO IT
2094 OTAC @2 X            !! CRD #1
2096 OTA  @31 @100000     !! READ INBOUND FIFO
2098 GOSB 815             !! DO IT
2100 SKIF @200=D.@200     !! IS IT RESPONDING?
2101 GOSB 745             !! NO - ERROR
2110 OTAC @2 Y            !! CRD #2
2112 LET  D=@60004        !! RESPOND SRQ
2114 GOSB 805             !! DO IT
2116 OTAC @2 X            !! CARD #1
2118 LIA  @32 B           !! READ STATUS
2120 SKIF @1000=B.@1000   !! WAS IT DETECTED?
2121 GOSB 745             !! NO - ERROR
2128 LET  R(1)=@537,@477,@430,@476,@500
                          !! UNT,UNL,SPE,L36B,TOOB
2130 LET  R(6)=@1,@431,@537,@477
                          !! 1 BYTE,SPD,UNT,UNL
2132 LET  Q(1)=@41000,@0,R(!),-9
                          !! DMA QUADS TO DO SERIAL POLL
2134 OTAC @20 Q(!)        !! DMA QUADS
2136 STCC @20             !! START IT
2138 GOSB 870             !! WAIT FOR COMPLETION FLAGS
2140 GOSB 745             !! DIDN'T COMPLETE - ERROR
2142 OTA  @31 @100000     !! READ INBOUND FIFO
2144 GOSB 815             !! DO IT
                          !!
```

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                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
=============================================================
                          !!
2146 SKIF @1100=D.@1777 !! DID IT RESPOND CORRECTLY?
2147 GOSB 745           !! NO -ERROR
2150 CLCC 0             !! INITIALIZE AGAIN
2152 OTAC @2 X          !! CRD #1
2154 LET  D=@70200      !! PUT IT ON-LINE
2156 GOSB 805           !! DO IT
2158 LET  D=@60062      !! DO IFC
2160 GOSB 805           !! DO IT
2162 LET  D=@60002      !! SET FOR OUTPUT AGAIN
2164 GOSB 805           !! DO IT
2166 OTAC @2 Y          !! CRD #2
2168 LET  D=@70200      !! PUT IT ON-LINE
2170 GOSB 805           !! DO IT
2172 LET  D=@60042      !! SET IT FOR OUTPUT
2174 GOSB 805           !! DO IT
2230 OTAC @2 X          !! CRD #1
2232 LET  P(3)=@476,@500,@13
                          !! L36B,T00B,13 BYTES
2234 LET  Q(1)=@41000,@0,P(!),-5
                          !! DMA QUAD FOR #1
2235 OTA  @31 1         !!
2236 OTAC @20 Q(!)      !! OUTPUT ADDRESS
2238 STCC @20           !! AND START IT
2240 WFI  X 2000        !! WAIT FOR COMPLETION INTERRUPT
2241 GOSB 745           !! IT DIDN'T - ERROR
2242 LET  Q(1)=@51200,@101000,R(!),-18
                          !! DMA INPUT QUAD FOR #1
2243 IBP  R(1) R(18)  CL!! CLEAR DESC. BUFFER
2244 LET  Q(5)=@41000,@0,P(!)+5,-11
                          !! OUTPUT DMA QUAD FOR #2
2246 LET  D=@60040      !! SET #1 FOR INPUT
2248 GOSB 805           !! DO IT
2250 LET  D=@21004      !! INTERRUPT ON FIFO BYTE AVAILABLE
2252 GOSB 805           !! DO IT
2254 OTAC @20 Q(!)      !! GIVES STARTING QUAD
2256 STCC @20           !! AND START #1
2258 OTAC @2 Y          !! CRD #2
2260 LET  Q=Q(!)+4      !! CALCULATE STARTING ADDRESS FOR #2
2262 OTAC @20 Q         !! GIVE TO DMA
2264 STCC @20           !! AND START #2
2268 GOSB 870           !! WAIT FOR COMPLETION INTERRUPT
                          !!
```

```
                          !!
     PROGRAM              !!        COMMENTS
     STATEMENTS           !!
=================================================================
                          !!
2271 GOSB 745             !! DIDN'T - ERROR
2272 OTAC @2 X            !! CRD #1
2276 GOSB 870             !! WAIT FOR COMPLETION
2278 GOSB 745             !! DIDN'T - ERROR
2280 CPBF P(6) R(1) 11 @177400
                          !! IS TRANSFERRED DATA VALID?
2282 GOSB 745             !! NO - ERROR
2300 LET  A=X             !! SWITCH X
2302 LET  X=Y             !! AND
2303 LET  Y=A             !! Y
2304 SKIF F=0             !! FIRST TIME?
2305 GOTO 6               !! NO - ALL DONE !!
2306 LET  F=1             !! SET FLAG
2307 GOTO 2004            !! AND DO CARD-CARD TEST AGAIN
                          !!
3000 PRGM A PHI REGISTER ACCESS
                          !!
3001 LET Z=0              !!
3002 GTSC @4000 Z         !! GET SELECT CODE
3003 GOSB 800             !! OUTPUT IT TO THE GLOBAL REGISTER
3005 PRNT 3098            !! ASK FOR READ/WRITE/STOP TO WHAT REGISTER
3006 INPT $M @N           !! GET THE INFORMATION
3007 SKIF M#$S            !! IF "S" THEN
3009 SKIF M=$W            !! IF OTHER THAN W THEN ASSUME READ AT 1530
3010 GOTO 3030            !!
3011 PRNT 3097            !! ASK FOR DATA
3012 INPT @O              !! GET IT
3014 SKIF O=>0            !! IF ITS LESS THAN ZERO,
                          !! DATA ENTRY COMPLETE
3015 GOTO 3005            !! SO BACK TO R/W/S MESSAGE
3016 OTA  @31 0           !! CLEAR CONTROL WORD
3017 LET  O=O.@1777       !! MASK OUT THE UPPER 6 BITS
3018 LET  D=N*4096+O      !! CREATE CORRECT DATA WORD TO WRITE
3020 GOSB 805             !! DO IT
3022 SKIF N 0             !! IF WRITE WAS TO ZERO, ASK FOR DATA AGAIN
3023 GOTO 3011            !! OTHERWISE, READ PHI REGISTER WRITTEN TO.
3030 LET  X=N*4096+@100000
                          !! PHI READ CONTROL WORD
3032 OTA  @31 X           !! SEND IT TO CONTROL
                          !!
```

```
                          !!
     PROGRAM              !!       COMMENTS
     STATEMENTS           !!
================================================================
                          !!
3034 GOSB 815             !! DO A READ
3036 LET  D=D.@1777       !! MASK OUT UPPER 6 BITS
3038 PRNT 3096 N D        !! PRINT THE REGISTER AND THE DATA
3040 SKIF N=0             !! IF REGISTER READ WAS 1-7,
                          !! GOTO R/W/S STATEMENT
3042 GOTO 3005            !!
3044 PRNT 3095            !! REGISTER READ FROM ZERO,
                          !! ASK IF ANOTHER READ DESIRED
3045 YES? 3030            !! YES - DO IT AGAIN
3046 GOTO 3005            !! NO - BACK TO R/W/S STATEMENT
3095 FMT  ("AGAIN? ")
3096 FMT  ("REGISTER "I1" = "K4" OCTAL"/)
3097 FMT  ("DATA? -1 TO END ENTRY: ")
3097 FMT  ("DATA? -1 TO END ENTRY: ")
3098 FMT  ("R/W/S REGISTER? ")
```

Section 6
HP 12153A Writable Control Store (WCS) Diagnostic

6.1 General Information

The Writable Control Store (WCS) diagnostic provides a test of both the I/O backplane interface and the microinstruction frontplane interface on the WCS card. The diagnostic also checks the address counter, map RAM, and data RAMs on the card.

NOTE:~~Always execute the IOM diagnostic before running WCS, to ensure proper operation of I/O Master functions.

6.2 Functional Tests

Testing begins with the lowest priority WCS card (adjacent to processor card) installed in the computer system, and tests each WCS card in turn from the lowest to the highest priority.

The WCS diagnostic testing sequence begins via the backplane I/O interface, by issuing a CLCC 0. The CLCC 0 causes a reset to be applied to all cards in the computer, and will clear and initialize the card hardware. The test then loads the select code of that particular WCS card into a buffer, completes a write/read test of the address counter, and verifies proper operation of the address overflow protection circuits. The map RAM is then tested with a write/read sequence. Data RAMs on the WCS card are tested with a 0/1 and a 1/0 checker board pattern using Direct Memory Access (DMA) data transfer.

The frontplane interface is tested by first loading known data into the data RAMs via the backplane I/O interface (WCS card turned off). The WCS card is then turned on, and an I/O subroutine reads the data RAMs via the card frontplane for a data transfer accuracy check.

Prior to testing the frontplane interface of WCS cards, the diagnostic reads the select code of the first WCS card in the system and saves that code in a select code buffer created by the test. When a WCS card is then accessed from the frontplane, its select code is read and compared to the select code buffer contents previouly stored in memory. If the select code just read does not match the expected select code as the next in the frontplane priority series, a WCS access error message is returned to the operator. This ensures that the frontplane priority is functioning properly.

Appendix 6A
Error Messages

The following provides an example of the error messages returned during the WCS diagnostic, and a definition of their meaning:

WCS IS NOT OFF

WCS did not power-up in the OFF state

ADDRESS COUNTER READ OR WRITE INCORRECT

Data read from the counter does not match data written to the counter

ADDRESS OVERFLOW NOT PROTECTED

DMA transfer was not ended when the address exceeded 4096

ERROR IN MAP RAM

Data read from Map RAM did not match data written to Map RAM

TIME-OUT IN DMA

DMA transfer took longer than one second

ERROR IN DATA RAM BANK X

Data read from bank X does not match data written to bank X of data RAMs

WCS DID NOT TURN ON

The WCS card did not turn ON (enable frontplane) when programmed

INCORRECT FRONTPLANE READ

Data read over frontplane does not match data expected. Data read was compared to expected data from each of the WCS cards tested in the system.

WCS ACCESS IS XX SHOULD BE YY

Data read over the frontplane matches data expected from a WCS card other than the one currently under test.

Appendix 6B
Program Listing


```
 1 FMT  ("12153A WRITABLE CONTROL STORE DIAGNOSTIC"/)
 2 REM  (C) HEWLETT-PACKARD CO.  ALL RIGHTS RESERVED
 3 REM  SERVICE  24612-16032 REV. 2213
10 PRNT 1
15 LET  W=0                      !!W holds select code of current test
20 LET  Z=0                      !!Z holds count of cards in system
25 LET  S=0                      !!S will get select code
30 BUF  P(4) C(4) M(18) L(16)    !! set up buffers
35 BUF  D(2050) G(2048) F(96)    !!
40 IBP  P(1) P(4)  CL            !!buffer P keeps SC as tested
45 CLCC 0                        !!initialize system
50 GTSC @60000 S                 !!get select code
55 LET  S=S.@77                  !!mask to just SC
60 SKIF S#W                      !!does SC match card just tested
65 GOTO 130                      !!yes, then in loop
70 LET  W=S                      !!save current select code
75 SKIF Z#0                      !!is it first card under test?
80 GOTO 120                      !!yes, then bypass
85 LET  Y=1                      !!set temp counter
90 OTAC 2 P(Y)                   !!enable GR to WCS prev. checked
95 OTA  @32 @100000              !!turn it ON
100 SKIF Y#Z                     !!are all checked WCS's ON?
105 GOTO 120                     !!yes, continue diagnostic
110 LET Y=Y+1                    !!increment temp counter
115 GOTO 90                      !!jump back
120 LET  Z=Z+1                   !!add 1 to count of cards
125 LET  P(Z)=S                  !!store SC in buffer
130 OTAC 2 S                     !!load and enable GR
135 LIA  @32 A                   !!read status of card
140 SKIF 0=A.@100000             !!check if it is off
145 GOTO 1800                    !!if not jump to error
150 OTA  @31 @105252             !!load address counter
155 LET  A=0                     !!clear variable A
160 LIA  @31 A                   !!read address
165 SKIF A=@105252               !!check it with one written
170 GOTO 1815                    !!jump to error if not
175 CLCC @30                     !!clear Flag 30,in case it was set
180 LET  C(1)=@51200             !!
185 LET  C(2)=3584               !!  set up DMA to test
190 LET  C(3)=G(!)               !!  address overflow
195 LET  C(4)=-2048              !!  protection
200 CLCC @30                     !!clear flag 30
205 OTA  @20 C(!)                !!  start DMA
```

```
210 STCC @20                        !!
215 WFI  S 1000                     !!time out if DMA error
220 GOTO 1860                       !!jump to error if times out
225 SFC  @30                        !!check if overflow detected
230 SKIF C(4)<0                     !!check if residue left
235 GOTO 1830                       !!jump to error if no
240 IBP  M(1) M(18)  AH             !!set up buffer for map test
245 LET  B=1                        !!B is counter
250 LET  A=@40000                   !!set A to address map
255 OTA  @31 A                      !!load address counter map 0
260 OTA  @30 M(B)                   !!load map locations
265 STC  @30                        !! increment address
270 STC  @30                        !! twice
275 LET  B=B+1                      !!increment counter
280 SKIF B=17                       !!do it 16 times
285 GOTO 260                        !!
290 CLCC @30                        !!clear flag 30
295 IBP  L(1) L(16)  CL             !!clear buffer to read map
300 LET  B=1                        !!initialize counter
305 LET  A=@40000                   !!set A to address map
310 OTA  @31 A                      !!load address of map 0
315 LIA  @30 L(B)                   !!read map location
320 STC  @30                        !! increment address
325 STC  @30                        !! twice
330 LET  B=B+1                      !!increment counter
335 SKIF B=17                       !!do it 16 times
340 GOTO 315                        !!
345 CLCC @30                        !!
350 IBP  L(1) L(16)  CM             !!complement data read (map does)
355 CPBF M(1) L(1) 16 @177760       !!compare to data written
360 GOTO 1845                       !!error if no compare
365 LET  B=2                        !!initialize counter to next pattern
370 LET  A=@40000                   !!A gets map address
375 OTA  @31 A                      !!load address of map 0
380 OTA  @30 M(B)                   !!load map
385 STC  @30                        !! increment address
390 STC  @30                        !! twice
395 LET  B=B+1                      !!increment counter
400 SKIF B=18                       !!do it 16 times
405 GOTO 380                        !!
410 CLCC @30                        !!
415 LET  B=1                        !!
420 LET  A=@40000                   !!A gets map address
425 OTA  @31 A                      !!load address counter
430 LIA  @30 L(B)                   !!read map
435 STC  @30                        !! increment address
440 STC  @30                        !! twice
445 LET  B=B+1                      !!increment counter
450 SKIF B=17                       !!do it 16 times
455 GOTO 430                        !!
460 CLCC @30                        !!
```

```
465 IBP  L(1) L(16)  CM          !!complement map data
470 CPBF M(2) L(1) 16 @177760    !!compare with data written
475 GOTO 1845                    !!error if no compare
480 IBP  G(1) G(2048)  AH        !!initialize buffer for data rams
485 LET  B=1                     !!
490 LET  C=1                     !!  set up data buffers to
495 LET  T=C+1                   !!  provide 32 bits alternating
500 LET  D(C)=G(B)               !!  ones for output to WCS
505 LET  D(T)=G(B)               !!  need 2K buffer for 1K WCS
510 LET  B=B+1                   !!
515 LET  C=T+1                   !!
520 SKIF C>2050                  !!
525 GOTO 495                     !!
530 LET  L=-2048                 !!count for DMA transfer
535 LET  N=0                     !!
540 GOSB 1600                    !!  DMA to WCS 1K at a
545 LET  N=1024                  !!  time, then read and
550 GOSB 1600                    !!  compare buffers.  Do
555 LET  N=2048                  !!  2 alternating patterns
560 GOSB 1600                    !!  over all 4K of WCS
565 LET  N=3072                  !!
570 GOSB 1600                    !!
575 LET  K=&D203                 !! set up microcode
580 IBP  D(1) D(2048)  CL &2080  !! that loads A with zero,
585 LET  B=2                     !! fetches p then
590 LET  D(B)=K                  !! returns
595 LET  B=B+2                   !!
600 SKIF B>2048                  !!
605 GOTO 590                     !!
610 LET  M=D(!)                  !!  DMA it to WCS 1K at a
615 LET  O=@41400                !!  time over the whole
620 LET  N=1024                  !!  4K
625 GOSB 1500                    !!
630 LET  N=0                     !!
635 GOSB 1500                    !!
640 LET  N=3072                  !!
645 GOSB 1500                    !!
650 LET  N=2048                  !!
655 GOSB 1500                    !!
660 OTA  @31 &7FE                !! programmed I/O to put
665 OTA  @30 &1880               !! LDA SC, fchp, rtn
670 STC  @30                     !! in WCS in microcode
675 OTA  @30 S                   !! in .FWID locations
680 STC  @30                     !!
685 OTA  @30 &2094               !!
690 CLCC @30                     !!
695 IBP  M(1) M(16)  CL          !!clear buffer to load map
700 LET  M(14)=@12               !!set logical module 13 to bank 1
705 LET  M=M(!)                  !!
710 LET  O=@61400                !! DMA to map ram
715 LET  N=@40000                !!
```

```
 720 LET  L=-32                    !!
 725 GOSB 1500                     !!
 730 OTA  @32 @100000              !!turn on WCS
 735 LIA  @32 K                    !!
 740 LET  K=K.@100000              !! check that it is on
 745 SKIF K=@100000                !!
 750 GOTO 1905                     !! error if not
 755 LET  K=13                     !!
 760 IOCA                          !!clear I/O sub area
 765 IOA  LDB K                    !! I/O routine to jump
 770 IOA  OCT 105301               !! to WCS on frontplane
 775 IOA  STA P                    !! using .FWID opcode
 780 IORA                          !!
 785 LET P=P/4                     !!right shift A so sc is correct
 790 SKIF P=S                      !!check frontplane read
 795 GOTO 840                      !!incorrect, goto 2nd check
 800 SKIF Z=1                      !!if not first card
 805 GOTO 825                      !!jump
 810 PRNT 815                      !!else print
 815 FMT  (/"LOWEST PRIORITY WCS DIAGNOSTIC COMPLETE"/)
 820 GOTO 45                       !!go check for another
 825 PRNT 830                      !!first card, print
 830 FMT  (/"NEXT HIGHEST PRIORITY WCS DIAGNOSTIC COMPLETE"/)
 835 GOTO 45                       !!go check for another
 840 LET  B=0                      !!initialize count of cards
 845 LET  B=B+1                    !!increment count
 850 SKIF B<4                      !! check if it is
 855 GOTO 1890                     !! another WCS card
 860 SKIF P=P(B)                   !! that has been
 865 GOTO 845                      !! checked,if yes print,
 870 PRNT 875 P S                  !! else error
 875 FMT  ("ERROR - WCS ACCESSED IS "K2"  SHOULD BE "K2/)
 880 CLCC 0                        !!turn OFF all WCS cards
 885 STOP                          !!
1500 LET  C(1)=0                   !!DMA subroutine
1505 LET  C(2)=N                   !!  ``
1510 LET  C(3)=M                   !!  ``
1515 LET  C(4)=L                   !!  ``
1520 OTA  @20 C(!)                 !!  ``
1525 STCC @20                      !!  ``
1530 WFI  S 1000                   !!  ``
1535 GOTO 1860                     !!  ``
1540 OTA  @31 0                    !!  ``
1545 CLCC @30                      !!  ``
1550 RTN                           !!  ``
1600 LET  M=D(!)                   !! subroutine for writing,
1605 LET  O=@41400                 !! reading and comparing data
1610 GOSB 1500                     !! rams
1615 IBP  G(1) G(2048)  CL         !!  ``
1620 LET  M=G(!)                   !!  ``
1625 LET  O=@41200                 !!  ``
```

```
1630 GOSB 1500                      !!  ``
1631 LET  Q=N/1024                  !!  ``
1635 CPBF D(1) G(1) 2048 0          !!  ``
1640 GOTO 1875                      !!  ``
1645 LET  M=D(!)+1                  !!  ``
1650 LET  O=@41400                  !!  ``
1655 GOSB 1500                      !!  ``
1660 IBP  G(1) G(2048)  CL          !!  ``
1665 LET  M=G(!)                    !!  ``
1670 LET  O=@41200                  !! ``
1675 GOSB 1500                      !! ``
1680 CPBF D(2) G(1) 2048 0          !! ``
1685 GOTO 1875                      !! ``
1690 RTN                            !! ``
1800 PRNT 1805                      !!ERROR MESSAGES
1805 FMT  ("ERROR - WCS IS NOT OFF"/)
1810 GOTO 1925
1815 PRNT 1820
1820 FMT  ("ERROR - ADDRESS COUNTER READ OR WRITE INCORRECT"/)
1825 GOTO 1925
1830 PRNT 1835
1835 FMT  ("ERROR - ADDRESS OVERFLOW NOT PROTECTED"/)
1840 GOTO 1925
1845 PRNT 1850
1850 FMT  ("ERROR - ERROR IN MAP RAM"/)
1855 GOTO 1925
1860 PRNT 1865
1865 FMT  ("ERROR - TIME-OUT ON DMA"/)
1870 GOTO 1925
1875 PRNT 1880 Q
1880 FMT  ("ERROR - ERROR IN DATA RAM BANK "I2/)
1885 GOTO 1925
1890 PRNT 1895
1895 FMT  ("ERROR - INCORRECT FRONTPLANE READ"/)
1900 GOTO 1925
1905 PRNT 1910
1910 FMT  ("ERROR - WCS DID NOT TURN ON"/)
1925 CLCC 0                         !!turn OFF all WCS cards
1930 STOP
```

Section 7
HP 12022A Disc Interface Card Diagnostics

7.1 General Information

The Disc Interface Diagnostic (DID) provides complete diagnostic testing of the disc interface card hardware functions, and a basic operational check of peripheral devices interfaced to the disc interface card, but does not test the I/O processor chip. All I/O processor and supporting logic circuits are tested by the I/O Master (IOM) diagnostic (refer to the Kernal Diagnostic Manual).

The DID operates under control of the Diagnostic Design Language (DDL) interpreter module, a part of the Diagnostic Control System (DCS). Operating procedures for loading and executing the DCS, Kernal diagnostic A/L-Series Diagnostic Operating and Troubleshooting Manual (Part no. 24612-90001).

Refer to the HP 1000 DDL Programming and Reference Manual (part no. 24612-90002, for user diagnostic programming information.

The diagnostic operating procedures provided in this section assume that a VCP terminal is connected and enabled.

7.2 Diagnostic Operation

Load and execute the Diagnostic Control System (DCS) and the disc interface card diagnostic program (DID), using the diagnostic operating mode desired (refer to the diagnostic operating and troubleshooting manual). When the DID diagnostic is ready to run, refer to the additional operating procedures in this section.

NOTE

Without at least one peripheral device attached, the DID program will abort with an error following testing of the card logic, and at the start of the card-to-peripheral testing.

Automatic Execution

To initiate automatic execution of the DID, enter the runstring command of either RUN or RUN !, following the DDL prompt >, to run the complete test sequence. The RUN command will ask for the select code of the disc interface card to be tested, and will then test only that card; the RUN ! command will run the complete DID test sequence on all disc interface cards installed in the computer system being tested before terminating.

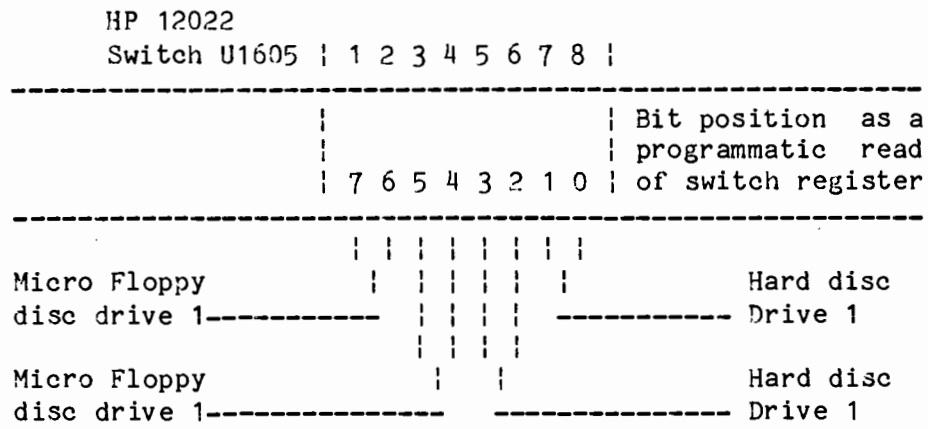
The test sequence for the DID is:

1. Enter the runstring RUN<cr> or RUN !<cr>.

2. The message DISC INTERFACE CARD DIAGNOSTIC will be returned, with INPUT SELECT CODE returned if the RUN command alone is entered.

3. Enter the select code; self-test is completed automatically.

4. System configuration switch register is read and displayed, as below:



Each two bit data field in the switch register describes the disc type and whether it is connected or not. See Table for bit assignment.

Micro Floppy
Bit Assignment Table

00	no disc connected
01	single sided disc connected
10	reserved
11	reserved

Hard Disc
Bit Assignment Table

00	no disc connected
01	10 Mb disc connected
10	15 Mb disc connected
11	reserved

5. A simple programmed I/O read of register is completed.

6. Pattern test data path to registers is tested.

7. Seek/Restore command is tested if a disc is available. Otherwise skip the Restore command test.

8. All disc combinations are accessed and compared with the disc units shown in the system configuration switch register.

NOTE

The diagnostic only tests that there are discs present where the configuration switch indicates there are, it does not ascertain that the disc type is correct. For example, if there is a 15 megabyte disc connected as drive 0 and the system configuration switch is set to indicate a 10 megabyte disc, the diagnostic will not flag this as a misconfiguration.

9. Test returns to 2 for next select code entry.

7.3 Interactive Diagnostic Operation

The interactive manual mode consists of 17 individual tests. Each test has the ability to loop, with the exception of the test that changes the select code under test. A description of each test is provided below.

Set SDH Register — Test 1

This test prompts the user through a sequence of questions to place the appropriate information in the SDH register. The user thus has the ability to select any one of the 4 possible drives, drive heads, and (if applicable) use of either ECC or CRC. Because all media is formatted to have 256 byte sectors the bit field that is assigned to sector size is not user definable.

Set Cylinder High Register — Test 2

This test sets the cylinder high register to some value ranging between 0 and 3. All other values are not valid, hence are rejected.

Set Cylinder Low Register — Test 3

This test checks that the cylinder low register can be set to any value between 0 and 255.

Set Sector Number Register — Test 4

This test checks that sector numbers between 0 and 255 are possible, and that for a hard disc, value 0 to 32 are valid, and for a micro floppy-disc 0 to 16 are valid.

Sector Count Register — Test 5

This test checks that the sector count can set between 1 and 255 (but because the diagnostic only uses single sector read/write commands sector counts of 1 are the best choice).

Set Write Precomp Register — Test 6

This test checks that the write precomp register can be set to values between 0 and 255. For the hard disc write precomp must be set to at least 32 (40 octal). For the micro floppy write precomp need not be set at all.

Read all Registers — Test 7

This routine dumps the contents of the SDH, cylinder high, cylinder low, sector number, sector count, status, and error registers in octal format.

Read Status Register — Test 8

In this test the status register is polled until the busy bit goes low and the contents of both, the Status and Error registers, are dumped in octal format.

Rear System Configuration Register — Test 9

This test checks the register that contains the information for the system to determine which drives are installed on the system.

Seek to Track — Test 10

The Seek to track command test requires that the register by setup prior to the execution of this command. There are two ways this can be done. The first way is using Tests 1 thru 6 to set the individual registers prior to doing test 10, and if the registers were not previously set, then the second way is giving the track number during the execution of test 10.

Restore to Track 00 — Test 11

In this test, the drive that is currently selected is restored to track zero and then the status/error registers are interrogated to see that track zero was found.

Reset Card — Test 12

This test initializes all the registers on the controller and resets the entire card. The self-test is also invoked at this time. Following the self-test, status is polled to verify that the self-test completed without error.

Test New Card — Test 13

This test gets the select code of a new card to be tested.

Read Sector — Test 14

For a read command there are two options; either the registers have been previously set up and are to be used or the user must provide a track and sector. The read command then reads one sector form the selected disc and stores it in the input buffer.

Write Sector — Test 15

The basic operation for a write is the same as that for a read, with the data pattern coming from the output buffer. The user can define one of five fixed patterns or one of the users choice.

Dump Input Buffer — Test 16

The dump routine outputs the input buffer contents to the terminal. PASS COMPLETE NN is the pass count in decimal.

CPMPARE I/O Buffers — Test 17

The input buffer and the output buffer are compared for any differences. If mismatch occurs, the contents of both buffers at that point and the element number are output to the terminal.

7.4 Run-Time Messages

Run-time messages for the RUN command include:

```
DDL>RUN<cr>                      Where :
INPUT SELECT CODE XX <cr>         XX is the select code in octal.
PASS COMPLETE                     NN is the pass count in decimal.
INPUT SELECT CODE XX <cr>
        .                         XX = 0 Exits the program.
        .
        .
PASS NN
```

"Run Test"

The "RUN TEST" command has an optional runstring to pass parameters to any of the 17 individual tests. The parameters are entered in the form.

RU T [test] [select code] [track] [sector offset]

where:

test = 1 thru 17.

select code = S/C of card under test (@XX octal).

track = 0 thru max track for the desired disc.

sector offset = the offset within the defined track.

Track and sector offset are used only for tests 10, 14, and 15. If set when using other test they are ignored. Test 11 (restore) requires that the SDH register be set prior to executing this test. Each test prompts the user for the necessary data for that test.

The following provides an example run of the DID, using the RUN T command string.

```
DDL>RU T <cr>
 5000 PRGM TEST FUNC. #500=TEST# #501=S/C #502=TRACK #503=SECTOR

INPUT SELECT CODE 32

TEST #      TEST DESCRIPTION
   1     SET SDH REGISTER
   2     SET CYLINDER HIGH REGISTER
   3     SET CYLINDER LOW REGISTER
   4     SET SECTOR NUMBER REGISTER
   5     SET SECTOR COUNT REGISTER
   6     SET WRITE PRECOMP REGISTER
   7     READ ALL REGISTERS
   8     READ STATUS REGISTER
   9     READ SYSTEM CONFIGURATION
  10     SEEK TO TRACK
  11     RESTORE TO TRACK 0
  12     RESET CARD
  13     TEST NEW CARD
  14     READ SECTOR
  15     WRITE SECTOR
  16     DUMP INPUT BUFFER
  17     COMPARE I/O BUFFERS
  -1     EXIT
```

Set SDH Register — Test 1

uFloppy

```
ENTER TEST NUMBER : 1

ENTER DRIVE SELECT

0 = HARD DISC 0
1 = HARD DISC 1
2 = MICRO FLOPPY
: 2

ENTER DRIVE SELECT

0 = MICRO FLOPPY 0
1 = MICRO FLOPPY 1
: 1

IS THIS A SINGLE SIDED DISC ? YES

ENTER HEAD : 0
```

Fixed Disc

```
ENTER TEST NUMBER : 1

ENTER DRIVE SELECT

0 = HARD DISC 0
1 = HARD DISC 1
2 = MICRO FLOPPY
: 0

DO YOU WANT ECC ON ? YES

IS THIS A 15 MB DISC ? YES

ENTER HEAD : 3

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set Cylinder High — Test 2

```
ENTER TEST NUMBER : 2

ENTER CYLINDER HIGH (octal) : 0

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set Cylinder Low — Test 3

```
ENTER TEST NUMBER : 3

ENTER CYLINDER LOW  (octal) : 127

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set Sector Number — Test 4

```
ENTER TEST NUMBER : 4

ENTER SECTOR NUMBER (octal) : 14

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set Sector Count — Test 5

```
ENTER TEST NUMBER : 5

ENTER SECTER COUNT (octal) : 1

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set Write PRECOMP Register — Test 6

```
ENTER TEST NUMBER : 6

ENTER PRECOMP VALUE (octal) : 40

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Set precomp to 0 for Micro Floppy and to 40 for fixed disc. Note that the controller defaults the above values.

Read All Registers — Test 7

```
ENTER TEST NUMBER : 7

SDH = 203
CYL. HIGH = 000
CYL. LOW  = 127
SECT. NUMBER = 014
SECT. COUNT  = 001
STATUS = 120
ERROR  = 000

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Read Status and Error Registers — Test 8

```
ENTER TEST NUMBER : 8

STATUS = 120
ERROR  = 000

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Read System Configuration Switch Register — Test 9

```
ENTER TEST NUMBER : 9

SWITCH REGISTER = 125

PASS NUMBER 1

ENTER LOOP COUNT :
```

Seek to Give Track — Test 10

```
ENTER TEST NUMBER : 10

ARE THE REGISTERS SET ? NO        Registers not previously set.

ENTER TRACK NUMBER : 40

ENTER DRIVE SELECT

0 = HARD DISC 0
1 = HARD DISC 1
2 = MICRO FLOPPY : 0

DO YOU WANT ECC ON ? YES

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

```
ENTER TEST NUMBER : 10
ARE THE REGISTERS SET ? YES      With registers previously set.
PASS NUMBER 1
ENTER LOOP COUNT : 0
```

Restore to Track 00 — Test 11

```
ENTER TEST NUMBER : 11
PASS NUMBER 1
ENTER LOOP COUNT : 0
```

Reset Card and Invoke Self-Test — Test 12

```
ENTER TEST NUMBER : 12
PASS NUMBER 1
ENTER LOOP COUNT : 0
```

Test New Card — Test 13

```
ENTER TEST NUMBER : 13
INPUT SELECT CODE 32
PASS COMPLETE
```

Read Sector — Test 14

```
ENTER TEST NUMBER : 14
ARE THE REGISTERS SET ? NO
ENTER TRACK NUMBER : 0
ENTER SECTOR OFFSET : 0
ENTER DRIVE SELECT
0 = HARD DISC 0
1 = HARD DISC 1
2 = MICRO FLOPPY : 2
```

```
ENTER DRIVE SELECT

0 = MICRO FLOPPY 0
1 = MICRO FLOPPY 1 : 1

PASS NUMBER 1

ENTER LOOP COUNT : 0


ENTER TEST NUMBER : 14

ARE THE REGISTERS SET ? YE

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Write Sector — Test 15

```
ENTER TEST NUMBER : 15

ARE THE REGISTERS SET ? NO

ENTER TRACK NUMBER : 500

ENTER SECTOR OFFSET : 3

ENTER DRIVE SELECT

0 = HARD DISC 0
1 = HARD DISC 1
2 = MICRO FLOPPY : 0

DO YOU WANT ECC ON ? YES


SET BUFFER TO THE FOLLOWING

 1 - CLEAR BUFFER
 2 - ALTERNATE HORIZONTAL
 3 - ALTERNATE VERTICAL
 4 - INCREMENTAL PATTERN
 5 - ASCII PATTERN
 6 - PICK A PATTERN

ENTER NUMBER : 5
```

```
PASS NUMBER 1

ENTER LOOP COUNT : 0

ENTER TEST NUMBER : 15

ARE THE REGISTERS SET ? YES

SET BUFFER TO THE FOLLOWING

 1 - CLEAR BUFFER
 2 - ALTERNATE HORIZONTAL
 3 - ALTERNATE VERTICAL
 4 - INCREMENTAL PATTERN
 5 - ASCII PATTERN
 6 - PICK A PATTERN

ENTER NUMBER : 4

PASS NUMBER 1

ENTER LOOP COUNT : 0
```

Dump Input Buffer Contents — Test 16

```
ENTER TEST NUMBER : 16

  1 000000 000001 000002 000003     000004 000005 000006 000007
  9 000010 000011 000012 000013     000014 000015 000016 000017
 17 000020 000021 000022 000023     000024 000025 000026 000027
 25 000030 000031 000032 000033     000034 000035 000036 000037
 33 000040 000041 000042 000043     000044 000045 000046 000047
 41 000050 000051 000052 000053     000054 000055 000056 000057
 49 000060 000061 000062 000063     000064 000065 000066 000067
 57 000070 000071 000072 000073     000074 000075 000076 000077
 65 000100 000101 000102 000103     000104 000105 000106 000107
 73 000110 000111 000112 000113     000114 000115 000116 000117
 81 000120 000121 000122 000123     000124 000125 000126 000127
 89 000130 000131 000132 000133     000134 000135 000136 000137
 97 000140 000141 000142 000143     000144 000145 000146 000147
105 000150 000151 000152 000153     000154 000155 000156 000157
113 000160 000161 000162 000163     000164 000165 000166 000167
121 000170 000171 000172 000173     000174 000175 000176 000177

PASS COMPLETE
```

Compare Input and Output Buffers — Test 17

```
ENTER TEST NUMBER : 17

PASS COMPLETE
```

Exiting from Run Test

```
ENTER TEST NUMBER : -1
DDL>
```

7.5 Register Definitions

Status Register

The status register is a read only register which contains the status of the last command executed on the drive specified in the SDH register. Status remains valid until another command is issued to the selected drive.

7	6	5	4	3	2	1	0
Busy	Drive Ready	Write Fault	Seek Done	Data Req.	Data Error Corr.	Write Prot.	Error

Busy - This bit is set when the card is busy executing command. Whenever Busy is set, no other status bits are valid.

Drive Ready - This bit indicates the status of the ready line of the selected drive. No command can be executed until this bit is set.

Write Fault - Indicates the state of the write fault line on the selected drive. No command can be executed while this bit is set. This is a fatal drive error.

Seek Done - Indicates the state of the seek complete line for the selected drive.

Data Request - This bit, when set, indicates that the board is ready to send or accept data for a read or write.

Data Error Corrected - This bit indicates that a successful data error correction has occurred on the data read from the hard disc. This is not applicable to floppies.

Write Protect - This bit indicates the state of the selected Floppy drive write protect.

Error - This bit indicates that the error register has one or more errors which should be read by the host.

Error Register

The error register is a read only register which contains error information when the low order byte of the status register is set.

7	6	5	4	3	2	1	0
Bad Block	ECC/ CRC Error	Self-test Error	ID Not Found	Not Used	Abort Comnd	TR00 Error	DAM Not Found

Bad Block - This bit indicates that a bad block mark has been found in the specified ID field. If the command is a write, no writing will be done. If the command is a read, no read will be done. If the flaw is in the ID field the bad block will not be detected.

ECC / CRC Error - This bit indicates that an ECC or CRC error was encountered in a data field during a read command, and was not correctable.

ID Not Found - This bit indicates that an ID field containing a specified head, cylinder, sector number or sector size was not found after retries.

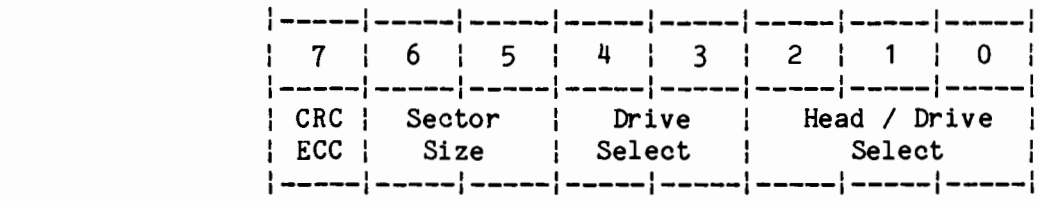
Abort Command - This bit indicates that a valid command has been received that cannot be executed based on status information from the drive, such as drive not ready, seek complete not asserted, or write fault. Status and/or Error register will show the cause.

TR00 Error - This bit indicates that the controller was unable to find track zero on a restore. The controller sends up to 1023 step pulses on the hard disc and 255 step pulses on the micro floppy before setting this bit if TR00 is not detected.

DAM Not Found - This bit will be set on a read command if, after successfully identifying the ID field, the Data Address Mark was not detected within 16 bytes of the ID field.

SDH Register

The SDH register contains the sector size, drive select, head select, and ECC/CR5 select bits. This is a read/write register which is organized as follows:



CRC/ECC:
- 0 - CRC on
- 1 - ECC on

Sector Size:
- 0 - 256 bytes
- 1 - 512 bytes
- 2 - 1024 bytes
- 3 - 128 bytes

Drive Select:
- 0 - hard disc drive 1
- 1 - hard disc drive 2
- 2 - reserved
- 3 - floppy drive select

Head Select: Hard Disc
- 0 - head 0
- 1 - head 1
- 2 - head 2
- 3 - head 3
- 4 - head 4
- 5 - head 5
- 6 - head 6
- 7 - head 7

Head / Drive Select: Floppy Discs
- 0 - floppy drive 0, head select 0
- 1 - floppy drive 0, head select 1
- 2 - floppy drive 1, head select 0
- 3 - floppy drive 1, head select 1

Appendix 7A
Error Messages

This section provides error messages that could be returned to the user display when running the DID.

Error Messages in Automatic Mode

TIME OUT - CONTROLLER BUSY/HUNG

After giving the controller a command, the status is pulled for completion of the command. In this case the controller has not completed the command in a timely manner. This error message is followed with a STOP command in DDL, so that the area of code can be backtracked to the error-creating command.

SELF-TEST ERROR

ERROR-

STATUS = XXX ERROR = XXX Where XXX = octal value

This error condition indicates a failure found by the self-test. The error register will be set to a value between 41 and 45. The status register should have bit 0 set for an error flag. The following table indicates the meaning of the values in the error register.

ERROR REGISTER CONTENTS AFTER SELF-TEST FAILURE

Error Number (octal)	Error Description
0	No error found
41	2797 Floppy controller failure
42	1010 Winchester controller failure
43	Sector buffer failure
44	1014 error detection failure
45	1015 control processor failure

```
ERROR-

STATUS = XXX ERROR = XXX Where XXX = octal values
```

This message is similar to the above, but it does not reflect an error found in the self-text. During the execution of the diagnostic if the controller/disc fail to do a command correctly, the error is logged in the status register. Periodically, the diagnostic polls this register to see if the error bit is set. If it is, then the above message is generated. Refer to Register Definitions, above, for a description of the bit fields for the status and error registers.

```
ERROR-

EXPECTED     ACTUAL
  DATA         DATA
  XXX          XXX       Where XXX = octal value
```

In the automatic mode, the diagnostic completes a pattern test on the data bus and on some of the controller registers by using programmed I/O. This error indicates a problem in that area.

```
DMA XFER FAILED

EXPECTED     ACTUAL     Where XXX = octal value
  DATA         DATA
                        Note that 125 is the pattern
  125          XXX      used in this test
```

After completing testing using programmed I/O, the next step is to use DMA to pass commands and data to the controller. This error indicates that data modified during transfer to one of the controller registers. Prior to this, the data paths and registers under test have been pattern tested to this error was due to the DMA.

```
DMA TRANSFER FAILED

OUTPUT     INPUT     BUFFER
 DATA       DATA     ELEMENT
                                 Where XXX = octal value
 XXX        XXX        YYY             YYY = decimal value
```

The above message indicates an error in transferring data to or from the local sector buffer on the disc controller. The basic data path has been checked at this point (with the exception of toggling hi/lo data bytes), so the error points to the sector buffer RAM.

```
EXPECTED SYSTEM
CONFIGURATION = XXX
```

DETERMINED SYSTEM
CONFIGURATION = XXX Where XXX = octal value

This is not a fatal error. The message indicates that either the system configuration switch U1605 has been misconfigured, or that there is a disc failure. The failure may be a dead disc or simply a disconnected disc cable. The controller still can talk to the system configured discs. Check that the switch (U1605) is set properly and that power, control, and data cables are connected correctly.

NOTE

The above error message only reports a basic misconfiguration in the system configuration register. If the switch is misconfigured for a 10 megabyte disc instead of a 15 megabyte disc, the diagnostic will not detect the misconfiguration.

Error Messages in Interactive Mode

In this mode the error messages are similar to those in the automatic mode, but it is up to the user to seek out status after giving a command. This allows the user to fix a series of tests (write, read, restore, status) that are tailored to a given error condition. The error messages are self-explanatory and are not presented here.

Appendix 7B
Program Listing

```
 10 FMT  ("DISC INTERFACE CARD DIAGNOSTIC"/)
 20 REM  (C) HEWLETT-PACKARD CO. ALL RIGHTS RESERVED
 30 REM  SOURCE: 24612-18052 REV. 2326
 35 REM   8:43 AM  WED., 25  MAY , 1983
 40 PRNT 10
 50 BUF                )                       )
    60 GOSB 15130
 70 LET  #24=-256              !! DMA TRANSFER SIZE
 80 LET  S(3)=0                !! DRIVE NUMBER
 90 LET  S=0                   !! INIT S/C VALUE
110 LET  #30=0                 !!
120 CLCC 0                     !! ABORT/RESET EVERYBODY
130 GTSC @023000 S             !! GET SELECT CODE WITH ID
140 SKIF S#-1                  !!
150 GOTO 32766                 !!
164 REM
166 REM  PULL STATUS
168 REM
170 GOSB 11000                 !! GET STATUS & ERROR REGISTER
180 GOSB 330                   !! REPORT TIME OUT
190 GOSB 15400                 !! REPORT ERROR BIT SET
200 REM
210 REM  GET CONFIG. SWITCH REG.
220 REM
230 OTAC 2 S
240 LIA  @32 #20               !! GET REGISTER 32 & SAVE IT
250 LET  #20=#20.@377          !! LOW BYTE ONLY
260 REM
270 REM  READ A REGISTER
280 REM
290 LET  K(1)=@3000            !! READ SDH REG. COMMAND
300 GOSB 10000                 !! DO IT
310 GOTO 330                   !! GOSB RETURNS HERE IF TIMEOUT ERROR
320 GOTO 400                   !! OR HERE IF NO ERROR
330 PRNT 340
340 FMT  (/"TIME OUT - CONTROLLER BUSY/HUNG"/)
350 STOP
360 REM
370 REM  DO READ/WRITE TO CHECK DATA PATH FROM IOM TO
380 REM  DISC CONTROLLER AND CHECK SOME OF THE CHIP REG.
390 REM
400 IBP  O(1) O(300)  IN
410 LET  M=2
```

```
420 LET  M=M+1
430 SKIF M#5
440 GOTO 610
450 LET  N=1
460 LET  K(1)=O(N).@377:K(M):@4000    !! BUILD COMMAND
470 GOSB 10300
480 GOTO 330                          !! TIME OUT ON WRITE TO REG.
490 LET  K(1)=K(M)                    !! BUILD READ COMMAND
500 GOSB 10000
510 GOTO 330                          !! TIME OUT ON READ OF REG.
520 SKIF O(N)#C(1)                    !! IS DATA VALID ??
530 GOTO 570                          !! YES
540 LET  C(2)=O(N)                    !! NO
550 GOSB 15010
560 STOP
570 LET  N=N+1                        !! GET NEXT PATTERN
580 SKIF N=257
590 GOTO 460
600 GOTO 420
610 LET  K(1)=@7000                   !! RESET SDH (JUST TO BE SAFE)
620 GOSB 10300
630 GOSB 330
640 REM
650 REM  PULL STATUS
660 REM
670 GOSB 11000
680 GOSB 330                          !! TIME OUT - ERROR
690 GOSB 15400                        !! ERROR BIT SET
700 REM
710 REM  FIND A DISC TO TRY A SEEK/RESTORE WITH
720 REM  IF NO DISC FOUND SKIP THE RESTORE
730 REM
740 REM  SET UP REG.S
750 REM
760 LET  #41=-1                        !! SET FLAG TO NO DRIVE FOUND
770 LET  S(1)=0,0,0,0,0,0,0,1          !! INIT. REG. CONTENTS
780 LET  S(6)=@77                      !! SET CYL. LO
790 SKIF S(3)=>@30                     !! IS THIS A MICRO ??
800 LET  S(6)=@377
810 GOSB 18500                         !! GO SET UP THE REGISTERS
820 REM
830 REM  TRY THE SEEK COMMAND
840 REM
850 LET  K(1)=@7560                   !! NOW DO THE SEEK
860 LET  #25=0                        !! SET A LOOP COUNTER
870 GOSB 10300
880 GOTO 990                          !! TRY ANOTHER DRIVE
890 GOSB 11000                        !! GET STATUS AGAIN
900 GOSB 330                          !! TIME OUT ERROR
910 REM                                !!
920 SKIF 0=C(1).@20                   !! SEEK COMPLETE ??
```

```
 930 GOTO 1060                    !! YES, TRY DOING A RESTORE
 940 SKIF 0=C(2).4                !! DID THE COMMAND GET ABORTED ??
 950 GOTO 990                     !! YES, TRY NEXT DRIVE
 960 LET  #25=#25+1               !! IF SEEK NOT DONE  THEN
 970 SKIF #25=1000                !!     GIVE LOTS OF CHANCES.
 980 GOTO 890                     !!     AFTER THAT QUIT AND
 990 GOSB 15600                   !! GET NEXT DRIVE
1000 GOTO 1080                    !! ALL DRIVES USED (NO DRIVES HOOKED UP)
1010 OTAC @31 @100000             !! DO AN ABORT
1020 GOTO 780                     !! NOW TRY AGAIN
1030 REM
1040 REM  NOW DO THE RESTORE
1050 REM
1060 LET  #41=0                   !! SET FLAG TO FOUND DRIVE
1070 GOSB 16200                   !! GO TO THE RESTORE ROUTINE
1080 OTAC @31 @100000             !! RESET CARD
1090 GOSB 11000                   !! WAIT FOR SELF-TEST
1100 GOSB 330                     !!
1110 GOSB 15400                   !!
1120 REM
1130 REM  NOW VERIFY THAT A DMA'ED COMMAND WORKS
1140 REM
1150 LET  K(1)=@2000              !! TRY GETTING THE SDH REG.
1160 GOSB 20010                   !! THIS IS A DMA ROUTINE
1170 STOP
1180 GOSB 11000                   !! CHECK STATUS
1190 GOSB 330                     !! TIME OUT
1200 GOSB 15400                   !! ERROR DETECTED
1210 LET  K(1)=@6125              !! NOW WRITE AND READ IT
1220 GOSB 20110
1230 STOP
1240 LET  K(1)=@2000              !! READ SDH REGISTER
1250 GOSB 20010
1260 STOP
1270 LET  I(1)=I(1).@377          !! SAVE LOWER BYTE
1280 GOSB 11000                   !! NOW CHECK STATUS
1290 GOSB 330
1300 GOSB 15400
1310 SKIF @125#I(1)               !! VERIFY DATA
1320 GOTO 1420                    !! ITS OKAY TRY THE NEXT TEST
1330 PRNT 1340
1340 FMT  (/"DMA XFER FAILED "//"EXPECTED   ACTUAL"/)
1350 PRNT 1360 I(1)
1360 FMT  ("  DATA      DATA"//XXX"125"8XK3//)
1370 STOP
1380 REM
1390 REM  XFER DATA TO SOME NON-EXISTENT SECTOR
1400 REM
1410 REM  SETUP REG.S
1420 REM
1430 GOSB 11000                   !! CHECK STATUS JUST TO BE SAFE
```

```
1440 GOSB 330
1450 GOSB 15400
1460 LET  S(6)=@37                !! GET VALID TRK# FOR DRIVE TYPE
1470 SKIF S(3)=>@30
1480 LET  S(6)=@377
1490 LET  S(1)=0,0,S(3),0,0,S(6),@77,1  !! INIT. REGISTER CONTENTS
1500 GOSB 18500                   !! SET UP REGISTERS
1510 IBP  O(1) O(512)  AH          !! SETUP TEST PATTERN
1520 IBP  I(1) I(512)  CL
1530 REM
1540 REM  DO DMA WRITE
1550 REM
1560 LET  K(1)=@7460
1570 GOSB 20210                   !! START THE DMA
1580 STOP
1590 GOSB 11000                   !! WAIT FOR NOT BUSY
1600 GOSB 330                     !! TIME OUT ERROR
1610 REM  IT SHOULD COME HERE WITH ID NOT FOUND ERROR
1620 REM
1630 REM  DO DMA READ
1640 LET  #31=0                !! PRNT OFF
1650 LET  K(1)=@7440
1660 GOSB 20310
1670 STOP
1680 GOSB 20630                   !! WAIT FOR IRQ
1690 STOP
1700 LET  M=0
1710 CPBF O(1) I(1) 128 0 M       !! DID READ AND WRITE COMPARE
1720 GOTO 15700
1730 SKIF #41=0                    !! ARE ANY DRIVES OUT THERE ??
1740 GOTO 2440                     !! NO, DON'T TRY LOOKING FOR THEM
1750 REM
1760 REM  NOW DO A RESTORE
1770 REM
1780 GOSB 16200                    !! GO TO THE RESTORE ROUTINE
1790 GOSB 11000                    !! CHECK STATUS
1800 GOSB 330
1810 GOSB 15400
1820 LET  #31=-1                   !! PRNT ON
1830 REM  READ ALL 4 DISC COMB.
1840 REM  USING TRACK 0 ; SECTOR 0
1850 REM
1860 LET  S(3)=0                   !! INIT DRIVE NUMBER
1870 LET  #30=0                    !! INIT SOFT CONFIG SWITCH
1880 LET  S(1)=0,0,S(3),0,0,0,0,1 !! INIT. REGISTER CONTENTS
1882 SKIF S(3)=>@30                !! IF uFLOPPY DONT SET ECC
1884 LET  S(1)=@200                !! FIXED DISC SET ECC
1890 GOSB 18500                    !! SET REGISTERS
1900 IBP  I(1) I(512)  CL          !! INIT. INPUT BUFFER
1910 GOSB 11000                    !! INSURE CONTROLLER NOT BUSY
1920 GOSB 330
```

```
1930 GOSB 15400                    !! TRAP ON ALL ERRORS
1940 LET  K(1)=@7440               !! SETUP THE READ COMMAND
1950 GOSB 20310                    !! AND DO IT
1960 GOSB 2360                     !! T.O. NO DISC !!!???
1970 GOSB 20630                    !! WAIT FOR IRQ
1980 GOTO 2360                     !! NO IRQ, HENCE NO DISC
1990 GOSB 11000                    !! CHECK STATUS
2000 REM
2010 GOTO 2050                     !! ERROR FOUND DISC IS THERE !!?
2020 SKIF 0#C(1).@100              !! NO ERROR, IS DRIVE READY ??
2030 GOTO 2360                     !! NO, SO NO DRIVE FOUND
2040 GOTO 2190                     !! YES, SO DRIVE FOUND
2050 SKIF 0#C(2).4                 !! IF COMMAND ABORTED, NO DISC
2060 GOTO 2190                     !! I THINK THERE IS A DISC
2070 GOTO 2360                     !! NO DISC
2080 SKIF 0#C(1).@20               !! NO ERRORS CHECK FOR DRIVE
2090 GOTO 2360                     !! SEEK NOT DONE, NO DRIVE !!?
2100 SKIF 0#C(1).@100              !! IS DRIVE READY
2110 GOTO 2130                     !! DR. NOT READY; MICRO FLOPPY ??
2120 GOTO 2190
2130 SKIF S(3)>@27                 !! IS THIS A MICRO FLOPPY ??
2140 GOTO 2360                     !! NO, THEN DRIVE NOT PRESENT
2150 GOTO 2190
2160 REM
2170 REM  ADD DISC TO LIST
2180 REM
2190 SKIF S(3)=0
2200 GOTO 2220
2210 LET  #30=#30+1                !! SET SOFT CONFIG. FOR DRIVE #1
2220 SKIF S(3)=@10
2230 GOTO 2250
2240 LET  #30=#30+4                !! ADD IN DRIVE #2
2250 SKIF S(3)>@27
2260 GOTO 2360
2270 SKIF 1=>S(3).3                !! IF ITS A MICRO CONTINUE
2280 GOTO 2310
2290 LET  #30=#30+16
2300 GOTO 2360
2310 LET  #30=#30+64
2320 GOTO 2360
2330 REM
2340 REM  GET NEXT DRIVE OR COMPARE CONFIG.
2350 REM
2360 GOSB 16200                    !! RESTORE
2370 OTAC @31 @100000              !! ISSUE AN ABORT
2380 GOSB 11000                    !! CHECK STATUS (SELF-TEST)
2390 GOSB 330
2400 GOSB 15400
2402 DLY  1000                     !! WAIT FOR uFLOPPY TO SET
2410 GOSB 15600                    !! IS THERE A NEXT DRIVE ??
2420 GOTO 2440                     !! NO MORE DRIVES COMPARE CONFIGS
```

```
2430 GOTO 1880                    !! YES GO TRY IT
2440 SKIF #20##30                 !! DID I FIND ALL THE CONFIGURED DISCS ?
2450 GOTO 120                     !! YES
2460 GOSB 15500                   !! NO TELL US ABOUT IT
2470 GOSB 16900
2480 GOTO 110                     !! TRY AGAIN
5000 PRGM TEST FUNC. #500=TEST# #501=S/C #502=TRACK #503=SECTOR
5002 PRNT
5010 BUF  I(1024) O(1024) Q(40) K(40) S(10) C(10)
5020 LET  #24=-256
5030 LET  S(3)=0                  !! INIT. DRIVE SELECT
5040 LET  S(2)=0                  !! INIT. SECTOR SIZE TO 256 BYTES
5050 CLCC 0                       !! INIT I/O SYSTEM
5060 LET  S=#501
5070 SKIF #501=0                  !! IF S/C PROVIDED THEN
5080 GOTO 5120                    !! DONT GET SELECT CODE
5090 GTSC @023000 S               !! GET A S/C
5100 SKIF S#-1                    !!
5110 GOTO 32766                   !!
5120 REM
5130 REM  CHECK FOR VALID TEST NO.
5140 REM
5150 SKIF #500=0                  !!
5160 GOTO 5200                    !! VALID TEST NUMBERS RANGE
5170 GOSB 16300                   !! FROM 1 TO 15.
5180 PRNT 16850                   !!
5190 INPT #500                    !!    IF TEST NUMBER = 0
5200 SKIF #500#-1                 !!      THEN PRINT HELP FILE
5210 GOTO 32766                   !!
5220 SKIF #500#@100000            !!    SPECIAL CASE GTSC TEST
5230 GOTO 8000                    !!
5250 SKIF #500>17                 !!    IF TEST NUMBER = -1
5260 SKIF #500>0                  !!      THEN EXIT
5270 GOTO 5170                    !!
5300 LET #498=-1
5354 REM
5356 REM  SET SDH REG.
5358 REM
5360 SKIF #500=1                  !! IS THIS TEST 1 ??
5370 GOTO 5600
5380 LET  #499=1                  !! SET PASS COUNTER
5390 GOSB 17000                   !! GET REG. VALUES
5400 LET  K(1)=@7000:S(1):S(2):S(3):S(4)
5410 GOSB 10300
5420 GOSB 330
5430 GOSB 17400                   !! LOOP AGAIN ??
5450 GOTO 8000                    !! NO, GET NEXT TEST
5460 GOTO 5390                    !! YES, DO IT AGAIN
5590 REM
5592 REM  SET CYL. HIGH REG.
5594 REM
```

```
5600 SKIF #500=2                !! CHECK FOR TEST NUMBER
5610 GOTO 5770
5620 LET  #499=1                !! INIT LOOP COUNT
5630 PRNT 16900                 !! ASK FOR CYL. NUMBER
5640 INPT @S(5)
5650 SKIF S(5)>3                 !! CHECK FOR VALID ENTRY
5660 SKIF S(5)>-1
5670 GOTO 5630                  !! IF NOT VALID TRY AGAIN
5680 LET  K(1)=@6400:S(5)        !! BUILD COMMAND
5690 GOSB 10300
5700 GOSB 330
5710 GOSB 17400                 !! LOOP AGAIN ??
5720 GOTO 8000                  !! NO, GET NEXT TEST
5730 GOTO 5630                  !! YES, DO IT AGAIN
5740 REM
5750 REM  SET CYL. LOW REG.
5760 REM
5770 SKIF #500=3                !! IS THIS TEST 3 ??
5780 GOTO 5940
5790 LET  #499=1
5800 PRNT 16910                 !! ASK FOR CYL. NUMBER
5810 INPT @S(6)                   !!
5820 SKIF S(6)>@377              !!
5830 SKIF S(6)>-1                !! CHECK FOR VALID ENTRY
5840 GOTO 5800                  !! IF NOT VALID TRY AGAIN
5850 LET  K(1)=@6000:S(6)        !! BUILD THE COMMAND
5860 GOSB 10300
5870 GOSB 330
5880 GOSB 17400                 !! LOOP AGAIN ??
5890 GOTO 8000                  !! NO
5900 GOTO 5800                  !! YES
5910 REM
5920 REM  SET SECT. NO.
5930 REM
5940 SKIF #500=4                !! IS THIS TEST 4 ??
5950 GOTO 6110
5960 LET  #499=1
5970 PRNT 16920                 !! ASK FOR SECTOR NUMBER
5980 INPT @S(7)                   !!
5990 SKIF S(7)>@377
6000 SKIF S(7)>-1                !! CHECK FOR VALID ENTRY
6010 GOTO 5970
6020 LET  K(1)=@5400:S(7)        !! BUILD THE COMMAND
6030 GOSB 10300
6040 GOSB 330
6050 GOSB 17400                 !! LOOP AGAIN ??
6060 GOTO 8000                  !! NO
6070 GOTO 5970                  !! YES
6080 REM
6090 REM  SET SECT. COUNT
6100 REM
```

```
6110 SKIF #500=5                !! IS THIS TEST 5 ??
6120 GOTO 6280
6130 LET  #499=1
6140 PRNT 16930                 !! ASK FOR SECTOR COUNT
6150 INPT @S(8)
6160 SKIF S(8)>@377
6170 SKIF S(8)>0                 !! CHECK FOR VALID ENTRY
6180 GOTO 6140
6190 LET  K(1)=@5000:S(8)        !! BUILD COMMAND
6200 GOSB 10300
6210 GOSB 330
6220 GOSB 17400                 !! LOOP AGAIN ??
6230 GOTO 8000                  !! NO
6240 GOTO 6140                  !! YES
6250 REM
6260 REM  SET WRITE PRECOMP
6270 REM
6280 SKIF #500=6                !! IS THIS TEST 6 ??
6290 GOTO 6450
6300 LET  #499=1
6310 PRNT 16940                 !! ASK FOR VALID ENTRY
6320 INPT @S(9)
6330 SKIF S(9)>@377
6340 SKIF S(9)>-1                !! CHECK FOR VALID ENTRY
6350 GOTO 6310
6360 LET  K(1)=@4400:S(9)        !! BUILD COMMAND
6370 GOSB 10300
6380 GOSB 330
6390 GOSB 17400                 !! LOOP AGAIN ??
6400 GOTO 8000                  !! NO
6410 GOTO 6310                  !! YES
6420 REM
6430 REM  DUMP ALL REG.S
6440 REM
6450 SKIF #500=7                !! IS THIS TEST 7 ??
6460 GOTO 6550
6470 LET  #499=1
6480 GOSB 15800                 !! DUMP REGISTERS
6490 GOSB 17400                 !! LOOP AGAIN ??
6500 GOTO 8000                  !! NO
6510 GOTO 6480                  !! YES
6520 REM
6530 REM  GET STATUS AND ERROR REG.
6540 REM
6550 SKIF #500=8                !! IS THIS TEST 8
6560 GOTO 6650                  !!
6570 LET  #499=1                !!
6572 PRNT                       !!
6580 GOSB 16000                 !! GET STATUS AND ERROR REG.
6590 GOSB 17400                 !! LOOP AGAIN ??
6600 GOTO 8000                  !! NO
```

```
6610 GOTO 6580                  !! YES
6620 REM
6630 REM  GET THE CONFIG. SWITCH REG.
6640 REM
6650 SKIF #500=9                !! IS THIS TEST 9
6660 GOTO 6780                  !!
6670 LET  #499=1                !!
6680 LIA @32 #20                !! GET THE REGISTER CONTENTS
6690 LET  #20=#20.@377          !! SAVE ONLY THE LOWER BYTE
6700 PRNT 6710 #20              !!
6710 FMT  (/"SWITCH REGISTER = "K3/)
6720 GOSB 17400                 !! LOOP AGAIN ??
6730 GOTO 8000                  !! NO
6740 GOTO 6680                  !! YES
6750 REM
6760 REM  SEEK TO USER DEFINED TRACK
6770 REM
6780 SKIF #500=10               !! IS THIS TEST 10 ??
6790 GOTO 6950                  !!
6800 LET  #499=1                !!
6810 GOSB 18000                 !! WAS A TRACK SPECIFIED ??
6820 GOSB 18200                 !! NO, GO SET IT ALL UP
6830 GOSB 18400                 !! NOW CALC. REG. VALUES
6840 LET  K(1)=@7560            !! DO THE COMMAND
6850 GOSB 10300
6860 GOSB 330
6870 GOSB 17400                 !! LOOP AGAIN ??
6880 GOTO 6900                  !! GET READY TO LEAVE
6890 GOTO 6820                  !! GET NEW TRACK NUMBER
6900 LET  #502=0
6910 GOTO 8000                  !! GET NEW TEST NUMBER
6920 REM
6930 REM  RESTORE TO TRACK 00 AND CHECK STATUS FOR TRK 00
6940 REM
6950 SKIF #500=11               !! IS THIS TEST 11 ??
6960 GOTO 7060
6970 LET  #499=1
6980 GOSB 16200                 !! DO THE RESTORE COMMAND
6990 GOSB 17400                 !! TRY AGAIN ??
7000 GOTO 8000                  !! NO
7010 GOTO 6980                  !! YES
7030 REM
7040 REM  RESET THE CARD
7050 REM
7060 SKIF #500=12               !! IS THIS TEST 12
7070 GOTO 7190                  !!
7080 LET #499=1                 !!
7090 OTAC @31 @100000           !! RESET
7100 GOSB 11000                 !! WAIT FOR BUSY/SELF TEST
7110 GOSB 330                   !!
7120 GOSB 15400                 !!
```

```
7130 GOSB 17400                 !!
7140 GOTO 8000                  !!
7150 GOTO 7090                  !!
7160 REM
7170 REM  GET SELECT CODE OF NEXT TEST CARD
7180 REM
7190 SKIF #500=13               !! IS THIS TEST 13 ??
7200 GOTO 7270                  !!
7202 PRNT                       !!
7210 PRNT 7212                  !! GET NEW SELECT CODE
7212 FMT  ("INPUT SELECT CODE ")!!
7214 INPT @S                    !!
7216 SKIF S<@20                 !! RANGE CHECK S/C
7218 SKIF S<@100                !!
7220 GOTO 7210                  !!
7230 GOTO 8000                  !!
7240 REM
7250 REM  DO A READ OF ONE SECTOR
7260 REM
7270 SKIF #500=14               !! IS THIS TEST 14 ??
7280 GOTO 7440                  !!
7290 LET #499=1                 !!
7300 GOSB 18000                 !! IS TRK & SECT SET ??
7310 GOSB 18200                 !! NO, SO GET THEM
7320 GOSB 18400                 !! NOW SET REGISTERS
7330 LET  K(1)=@7440            !! SET UP THE COMMAND
7340 GOSB 20310                 !! DO THE READ
7350 STOP                       !!
7360 GOSB 20630                 !! WAIT FOR IRQ
7370 STOP                       !!
7380 GOSB 17400                 !! LOOP AGAIN ??
7390 GOTO 7402                  !! NO
7400 GOTO 7310                  !! YES
7402 LET  #502=0                !!
7404 LET  #503=0                !!
7406 GOTO 8000                  !!
7410 REM
7420 REM  WRITE TO A SECTOR ON THE DISC
7430 REM
7440 SKIF #500=15               !! IS THIS TEST 15
7450 GOTO 7600                  !!
7460 LET #499=1                 !!
7470 GOSB 18000                 !!
7480 GOSB 18200                 !!
7490 GOSB 18400                 !!
7500 GOSB 18700                 !! GET A PATTERN TO OUTPUT
7510 LET  K(1)=@7460            !! SET THE COMMAND
7520 GOSB 20210                 !! DO IT
7530 STOP                       !!
7540 GOSB 20630                 !! WAIT FOR IRQ
7550 STOP                       !!
```

```
7560 GOSB 17400                  !! LOOP AGAIN ??
7570 GOTO 7582                   !! NO
7580 GOTO 7480                   !! YES
7582 LET  #502=0                 !!
7584 LET  #503=0                 !!
7586 GOTO  5180                  !!
7590 REM
7592 REM  DUMP INPUT BUFFER
7594 REM
7600 SKIF #500=16                !! IS THIS TEST 16
7610 GOTO 7770                   !!
7620 LET  #499=1                 !!
7630 LET  N=1                    !!
7640 PRNT                        !!
7644 LET  P=N+4                  !!
7650 PRNT 7660 N I(N) I(P)       !!
7660 FMT  (I3X4K6,5X4K6/)        !!
7670 LET  N=N+8                  !!
7680 SKIF N>121                  !!
7690 GOTO 7644                   !!
7700 PRNT                        !!
7710 LET  #498=0                 !!
7720 GOTO 8000                   !!
7740 REM
7750 REM  COMPARE I/O BUFFERS
7760 REM
7770 SKIF #500=17                !! IS THIS TEST 17
7780 GOTO 8000                   !!
7790 LET  #499=1                 !!
7800 LET  M=0                    !!
7810 CPBF O(1) I(1) 128 0 M      !!
7820 GOSB 15696                  !!
7830 LET  #498=0                 !!
7840 GOTO 8000
8000 PRNT 16895
8010 GOTO 5180
9990 REM
9992 REM  START PROGRAMMED I/O SUB.S
9996 REM  READ REG. USING PROGRAMMED I/O
9998 REM
10000 LET  F=0                   !! SETUP PROGRAMMED I/O TO
10010 OTAC 2 S                   !! SET GR
10020 OTAC @31 @4000             !! SEND CARD CONTROL WORD
10030 OTAC @30 K(1)              !! SEND COMMAND
10040 GOSB 15300                 !! SEND OUT COMMAND
10050 RTN                        !! TIME OUT
10100 LET  F=0                   !!
10110 OTAC @31 0                 !! GET THE REGISTER IN QUESTION
10120 GOSB 15300                 !! WAIT
10140 RTN                        !! TIME OUT
10180 LIA  @30 C(1)              !! GET REG. CONTENTS
```

```
10190 LET  C(1)=C(1).@377          !! MAKE IT 8 BITS ONLY
10200 RTN  1
10292 REM
10294 REM  WRITE TO REG. USING PROGRAMMED I/O
10296 REM
10300 LET  F=0                     !!
10340 GOSB 15290                   !! WAIT
10350 RTN                          !! TIME OUT
10360 RTN  1                       !!
10992 REM
10994 REM  GET STATUS AND ERROR IN C(1) & C(2)
10996 REM
11000 LET  P=0
11002 LET  C(1)=0
11004 LET  C(2)=0
11010 LET  K(1)=@3400              !! GET STATUS
11020 GOSB 10000
11030 RTN                          !! TIME OUT  IN READ REGISTER
11040 SKIF 0#C(1).@200             !!
11050 GOTO 11120
11060 LET  P=P+1
11070 SKIF P#30000
11080 RTN                          !! TIME OUT -- CONTROLLER BUSY
11090 GOTO 11020
11120 SKIF 0#C(1).1                !! IS THERE AN ERROR
11130 RTN  2                       !! YES
11140 LET  C(3)=C(1)
11150 LET  K(1)=@400               !! SET COMMAND TO GET ERROR
11160 GOSB 10000
11170 RTN
11180 LET  C(2)=C(1)               !! CLEANUP BEFORE RETURNING
11190 LET  C(1)=C(3)
11200 RTN  1
15000 REM
15006 REM  PRINT ERROR INFO FOR REG. MISMATCH
15008 REM
15010 PRNT 15020
15020 FMT  (/"ERROR -"//2X"EXPECTED"6X"ACTUAL"/)
15030 PRNT 15040
15040 FMT  (4X"DATA"9X"DATA"//)
15050 PRNT 15060 C(2) C(1)
15060 FMT  (4XK3,10XK3/)
15070 RTN
15100 REM
15110 REM  SET BUFFER COMMAND
15120 REM
15130 LET  K(2)=@3000              !! SDH COMMAND
15140 LET  K(3)=@2000              !! CYLINDER LOW COMMAND
15150 LET  K(4)=@1400              !! SECTOR ADDRESS COMMAND
15160 LET  K(5)=@1000              !! NUMBER OF SECTORS COMMAND
15170 RTN
```

```
15280 REM
15282 REM  WAIT FOR I/O SUBROUTINE
15284 REM
15290 OTAC 2 S                    !! SET GOBAL REGISTER
15292 OTAC @31 @44000             !! CARD CONTROL WORD
15294 OTAC @30 K(1)               !! WRITE COMMAND
15300 STCC @30
15310 SKIF F#10000
15320 RTN
15330 LET  F=F+1
15340 SFS  @30
15350 GOTO 15310
15360 RTN  1
15390 REM
15392 REM  PRINT OUT ROUTINE FOR ERROR FOUND BY STATUS
15394 REM
15400 SKIF @40=C(2).@40           !! WAS THIS SELF-TEST ERROR ??
15410 GOTO 15450                  !! NO
15420 PRNT 15430                  !! YES, SAY SO
15430 FMT  (/"SELF-TEST ERROR -"/)
15440 GOTO 15470
15450 PRNT 15460
15460 FMT  (/"ERROR -"/)
15470 PRNT 15480 C(1) C(2)
15480 FMT  (/"STATUS = "K3,4X"ERROR = "K3//)
15490 STOP
15491 REM
15492 REM  PRINT OUT THE SYSTEM CONFIG.
15494 REM
15500 LET  #20=#20.@377           !! GET LOWER 8 BITS
15510 PRNT 15520 #20
15520 FMT  (/"EXPECTED SYSTEM"/"CONFIGURATION = "K3/)
15580 RTN
15590 REM
15592 REM  SELECT NEW DRIVE IN SEQUENCIAL ORDER
15594 REM
15600 SKIF S(3)#@32               !! IS THIS MICRO DRIVE 1 ??
15610 GOTO 15682                  !! YES, QUIT, BUT FIRST!
15620 SKIF S(3)#@30               !! MICRO DRIVE 0 ??
15630 LET  S(3)=@32               !! YES, SET TO MICRO DRIVE 1
15640 SKIF S(3)#@10               !! DRIVE 1 ??
15650 LET  S(3)=@30               !! YES, SET TO MICRO DRIVE 1
15660 SKIF S(3)#0                 !! DRIVE 0 ??
15670 LET  S(3)=@10               !! YES, SET TO DRIVE 1
15680 RTN  1
15682 LET  S(3)=0                 !! SELECT DRIVE 0
15684 RTN
15690 REM
15692 REM  BUFFER MISMATCH REPORT ERROR AND TERMINATE
15694 REM
15696 LET  #44=0
```

```
15698 GOTO 15700
15700 LET  #44=-1
15702 PRNT 15710
15710 FMT  (/"DMA TRANSFER FAILED"//)
15720 PRNT 15730
15730 FMT  (" OUTPUT    INPUT    BUFFER"/)
15740 PRNT 15750
15750 FMT  ("  DATA      DATA    ELEMENT"//)
15760 PRNT 15770 O(M) I(M) M
15770 FMT  (XK6,4XK6,6X%I6//)
15780 SKIF O=#44                 !! MANUAL TESTING ??
15782 STOP                       !! NO
15784 RTN                        !! YES
15790 REM
15792 REM  DUMP REGISTER CONTENT
15794 REM
15800 LET  K(1)=@3000
15810 GOSB 10000
15820 GOSB 330
15830 PRNT 15840 C(1)            !! GET AND PRINT SDH
15840 FMT  (/"SDH = "K3/)
15850 LET  K(1)=@2400
15860 GOSB 10000
15870 GOSB 330
15880 PRNT 15881 C(1)            !! GET AND PRINT CYL. HIGH
15881 FMT  ("CYL. HIGH = "K3/)
15882 LET  K(1)=@2000
15884 GOSB 10000
15886 GOSB 330
15888 PRNT 15890 C(1)            !! GET AND PRINT CYL. LOW
15890 FMT  ("CYL. LOW  = "K3/)
15900 LET  K(1)=@1400
15910 GOSB 10000
15920 GOSB 330
15930 PRNT 15940 C(1)            !! GET AND PRINT CLY. LOW
15940 FMT  ("SECT. NUMBER = "K3/)
15950 LET  K(1)=@1000
15960 GOSB 10000
15970 GOSB 330
15980 PRNT 15990 C(1)            !! GET AND PRINT SECTOR NUMBER
15990 FMT  ("SECT. COUNT  = "K3/)
16000 LET  K(1)=@3400
16010 GOSB 10000
16020 GOSB 330
16030 PRNT 16040 C(1)            !! GET AND PRINT STATUS
16040 FMT  ("STATUS = "K3/)
16050 LET  K(1)=@400
16060 GOSB 10000
16070 GOSB 330
16080 PRNT 16090 C(1)            !! GET AND PRINT ERROR
16090 FMT  ("ERROR  = "K3//)
```

```
16100 RTN
16190 REM
16192 REM  RESTORE TO TRK 00, WAIT FOR IRQ, AND CHECK STATUS
16194 REM
16200 LET  K(1)=@7420            !! DO RESTORE
16210 GOSB 10300
16220 GOSB 330
16230 GOSB 20630                 !! WAIT FOR CARD TO SEND IRQ
16240 RTN
16250 GOSB 11000                 !! PULL STATUS AGAIN
16260 GOSB 330                   !! TIME OUT ERROR
16270 GOTO 16282                 !! CHECK ERROR BIT SETTING
16280 RTN
16282 SKIF 1=C(2).2              !! IS THIS A TRK 00 ERROR ??
16284 RTN                        !! NO
16286 GOSB 15400                 !! YES, STOP AND SHOW IT
16290 REM
16292 REM  HELP FILE
16294 REM
16300 PRNT 16600
16310 PRNT 16610
16320 PRNT 16620
16330 PRNT 16630
16340 PRNT 16640
16350 PRNT 16650
16360 PRNT 16660
16370 PRNT 16670
16380 PRNT 16680
16390 PRNT 16690
16400 PRNT 16700
16410 PRNT 16710
16420 PRNT 16720
16422 PRNT 16722
16424 PRNT 16724
16430 PRNT 16730
16440 PRNT 16740
16450 PRNT 16750
16460 PRNT 16760
16470 PRNT 16800
16480 RTN
16600 FMT  (/" TEST             TEST          "/)
16610 FMT  ("NUMBER         DESCRIPTION      "//)
16620 FMT  ("  1  SET SDH REGISTER"/)
16630 FMT  ("  2  SET CYLINDER HIGH REGISTER"/)
16640 FMT  ("  3  SET CYLINDER LOW REGISTER"/)
16650 FMT  ("  4  SET SECTOR NUMBER REGISTER"/)
16660 FMT  ("  5  SET SECTOR COUNT REGISTER"/)
16670 FMT  ("  6  SET WRITE PRECOMP REGISTER"/)
16680 FMT  ("  7  READ ALL REGISTERS"/)
16690 FMT  ("  8  READ STATUS REGISTER"/)
16700 FMT  ("  9  READ SYSTEM CONFIGURATION"/)
```

```
16710 FMT  (" 10  SEEK TO TRACK"/)
16720 FMT  (" 11  RESTORE TO TRACK 0"/)
16722 FMT  (" 12  RESET CARD"/)
16724 FMT  (" 13  TEST NEW CARD"/)
16730 FMT  (" 14  READ SECTOR"/)
16740 FMT  (" 15  WRITE SECTOR"/)
16750 FMT  (" 16  DUMP INPUT BUFFER"/)
16760 FMT  (" 17  COMPARE I/O BUFFERS"/)
16800 FMT  (/" -1  EXIT"//)
16850 FMT  (/"ENTER TEST NUMBER : ")
16860 FMT  (/"ENTER LOOP COUNT : ")
16870 FMT  (/"ENTER TRACK NUMBER : ")
16880 FMT  (/"ENTER SECTOR OFFSET : ")
16890 FMT  ("PASS NUMBER "%I6/)
16895 FMT  (/"PASS COMPLETE"/)
16900 FMT  (/"ENTER CYLINDER HIGH (octal) : ")
16910 FMT  (/"ENTER CYLINDER LOW  (octal) : ")
16920 FMT  (/"ENTER SECTOR NUMBER (octal) : ")
16930 FMT  (/"ENTER SECTER COUNT  (octal) : ")
16940 FMT  (/"ENTER PRECOMP VALUE (octal) : ")
16950 REM
16952 REM  PRINT DETERMINED SYSTEM CONFIG.
16954 REM
16960 PRNT 16970 #30
16970 FMT  (/"DETERMINED SYSTEM"/"CONFIGURATION = "K3/)
16980 PRNT
16990 RTN
16992 REM
16994 REM  SET SDH SUB
16996 REM
17000 LET  S(1)=0                !! INIT. ECC OFF
17002 GOSB 17150
17004 LET  #40=7
17006 SKIF S(3)<@30
17008 LET  #40=1
17010 PRNT 17020
17020 FMT  (/"ENTER HEAD : ")
17030 INPT S(4)
17040 SKIF S(4)>#40              !! INSURE VALID INPUTS
17050 SKIF S(4)=>0
17060 GOTO 17010
17070 RTN
17142 REM
17144 REM  SELECT DRIVE
17146 REM
17150 PRNT 17160
17160 FMT  (/"ENTER DRIVE SELECT "/)
17170 PRNT 17180
17180 FMT  (/"0 = HARD DISC 0"/"1 = HARD DISC 1"/)
17190 PRNT 17200
17200 FMT  ("2 = MICRO FLOPPY : ")
```

```
17202 LET  S(10)=0                  !! INIT MICRO FLOPPY DRIVE
17210 INPT @S(3)
17220 SKIF S(3)<0                   !!
17230 SKIF S(3)<3                   !! GET DRIVE SELECT
17240 GOTO 17150                    !! VERIFY IT
17250 SKIF S(3)#2                   !!
17260 LET  S(3)=3                   !!
17270 LET  S(3)=S(3)*@10            !! POSITION IT
17272 SKIF S(3)=@30                 !! IS THIS A MICRO FLOPPY ??
17274 GOTO 17294                    !! NO, SEE IF WE WANT ECC
17276 PRNT 17160                    !! YES, GET DRIVE
17278 PRNT 17280
17280 FMT  (/"0 = MICRO FLOPPY 0"/"1 = MICRO FLOPPY 1 : ")
17282 INPT S(10)                    !!
17284 SKIF S(10)>1                  !! CHECK FOR VALID ENTRY
17286 SKIF S(10)>-1                 !!
17288 GOTO 17276                    !!
17290 LET  S(3)=S(10)*2+S(3)        !! POSITION DRIVE BIT
17292 RTN                           !!
17294 PRNT 17296                    !!
17296 FMT  (/"DO YOU WANT ECC ON ? ")
17298 LET  S(1)=@200                !!
17300 YES? 17310                    !!
17302 LET  S(1)=0                   !!
17310 PRNT                          !!
17320 RTN                           !!
17390 REM
17392 REM  LOOP COUNT ROUTINE
17394 REM
17400 SKIF #499#1                   !! FIRST TIME THOUGH ??
17402 PRNT                          !! GIVE A LINE FEED
17404 PRNT 16890 #499               !!
17410 SKIF #498=-1                  !! FIRST TIME THROUGH ??
17412 GOTO 17430                    !!
17420 GOSB 17500                    !! YES, SEE IF WE LOOP
17422 GOTO 17470                    !!
17430 SKIF #499##498                !! ARE WE DONE LOOPING ?
17440 GOTO 17470                    !! YES
17450 LET  #499=#499+1              !!
17460 RTN 1                         !! NO
17470 LET  #498=-1                  !!
17480 RTN                           !!
17490 REM
17492 REM  CHECK FOR VALID LOOP COUNT
17494 REM
17500 PRNT 16860                    !!
17510 INPT #498                     !!
17520 SKIF #498#0                   !! IF IT IS ZERO
17530 RTN                           !! NO LOOP
17540 SKIF #498>1                   !! IS IT VALID ??
17550 GOTO 17500                    !! NO TRY AGAIN
```

```
17560 RTN 1                        !!
17990 REM
17992 REM  VERIFY TRACK & SECTOR OR USE PRESET REG. VALUES
17994 REM
18000 SKIF #502#0                  !! TRACK NOT SET , USE REG.S ??
18010 GOTO 18120                   !!
18020 SKIF #502>1225               !!
18030 SKIF #502>0                  !! RANGE CHECK TRACK VALUE
18040 GOTO 18090                   !!
18050 SKIF #503>32                 !!
18060 SKIF #503>-1                 !! RANGE CHECK SECTOR NUMBER
18070 GOTO 18090                   !!
18080 RTN 1                        !! TRK & SECT. OKAY
18090 PRNT 18100                   !!
18100 FMT  (/"BAD PARAMETER FOR TRK. OR SECT."/)
18110 RTN                          !! TRK & SECT. BAD, GET NEW ONE
18120 PRNT 18130                     !!
18130 FMT  (/"ARE THE REGISTERS SET ? ")
18140 YES? 18160                   !!
18150 RTN                          !! NO, GET TRK & SECT.
18160 RTN 2                        !! YES, USE REGISTER AS IS
18170 REM                          !!
18180 REM  GET TRACK & SECTOR
18190 REM                          !!
18200 PRNT 16870                   !!
18210 INPT #502                    !!
18220 SKIF #502>1225               !!
18230 SKIF #502>-1                 !! RANGE CHECK TRACK VALUE
18240 GOTO 18200                   !!
18250 SKIF #500#10                 !! IS THIS FROM TEST 10 ??
18260 RTN                          !! YES, THEN WE ARE DONE
18270 PRNT 16880                   !!
18280 INPT #503                    !!
18290 SKIF #503>32                 !!
18300 SKIF #503>-1                 !! RANGE CHECK SECTOR NUMBER
18310 GOTO 18270                   !!
18320 RTN                          !!
18370 REM
18380 REM  GET DRV. NO. THEN CALC. AND SET REG.S
18390 REM
18400 GOSB 17150                    !! DO A DRIVE SELECT
18410 LET  W=4                      !!
18420 SKIF S(3)#@30                 !! SET NUMBER OF HEADS
18430 LET  W=1                      !!
18440 LET  S(7)=#503.@377           !! GET SECTOR NUMBER
18450 LET  S(4)=#502/W*W*-1+#502    !! DETERMINE WHICH HEAD TO USE
18460 LET  S(6)=#502/W.@377         !! GET CYLINDER LOW
18470 LET  S(5)=#502/W.@1400/@377   !! GET CYLINDER HIGH
18480 LET  S(8)=1                   !! SECTOR COUNT
18486 REM
18488 REM  WRITE TO ALL REG.S
```

```
18490 REM
18500 LET  K(1)=@7000:S(1):S(2):S(3):S(4) !! SDH
18510 GOSB 10300                          !!
18520 GOSB 330                            !!
18530 LET  K(1)=@6400:S(5)                !! CYLINDER HIGH
18540 GOSB 10300                          !!
18550 GOSB 330                            !!
18560 LET  K(1)=@6000:S(6)                !! CYLINDER LOW
18570 GOSB 10300                          !!
18580 GOSB 330                            !!
18590 LET  K(1)=@5400:S(7)                !! SECTOR NUMBER
18600 GOSB 10300                          !!
18610 GOSB 330                            !!
18620 LET  K(1)=@5000:S(8)                !! SECTOR COUNT
18630 GOSB 10300                          !!
18640 GOSB 330                            !!
18650 GOSB 11000                          !! WAIT FOR BUSY (AND ANY POSSIBLE ERROR)
18660 GOSB 330                            !!
18670 GOSB 15400                          !!
18680 RTN                                 !!
18690 REM
18692 REM  SET UP THE OUTPUT BUFFER FOR DMA WRITE
18694 REM
18700 PRNT 18800
18710 PRNT 18810
18720 PRNT 18820
18730 PRNT 18830
18740 PRNT 18840
18750 PRNT 18850
18760 PRNT 18860
18770 PRNT 18870
18780 REM
18790 REM
18800 FMT  (/"SET BUFFER TO THE FOLLOWING"//)
18810 FMT  (" 1 - CLEAR BUFFER"/)
18820 FMT  (" 2 - ALTERNATE HORIZONTAL"/)
18830 FMT  (" 3 - ALTERNATE VERTICAL"/)
18840 FMT  (" 4 - INCREMENTAL PATTERN"/)
18850 FMT  (" 5 - ASCII PATTERN"/)
18860 FMT  (" 6 - PICK A PATTERN"/)
18870 FMT  (/"ENTER NUMBER : ")
18880 INPT P
18890 SKIF P>6
18900 SKIF P>0
18910 GOTO 18700
18920 SKIF P#1
18930 IBP O(1) O(128) CL
18940 SKIF P#2
18950 IBP O(1) O(128) AH
18960 SKIF P#3
18970 IBP O(1) O(128) AV
```

```
18980 SKIF P#4
18990 IBP O(1) O(128) IN
19000 SKIF P#5
19100 IBP O(1) O(128) C2
19110 SKIF P=6
19120 RTN
19130 PRNT 19140
19140 FMT  (/"ENTER THE PATTERN (octal) : ")
19150 INPT @P
19160 IBP O(1) O(128) CL P
19170 RTN
19990 REM
19992 REM  ROUTINES TO SET UP AND DO DMA'S
19994 REM
20000 REM  READ REGISTER DATA
20002 REM
20010 LET  Q(1)=@141400,@4000,K(!),-1,@41200,0,I(!),-1
20015 GOTO 20410
20020 REM
20100 REM  WRITE REGISTER
20102 REM
20110 LET  Q(1)=@41400,@44000,K(!),-1
20115 GOTO 20410
20120 REM
20200 REM  WRITE DATA BUFFER
20202 REM
20210 LET  Q(1)=@41400,@44000,K(!),-1
20212 GOSB 20410
20214 STOP
20220 LET  Q(1)=@61400,@50000,O(!),#24
20230 GOSB 20410
20240 REM
20250 RTN 1
20300 REM  READ DATA BUFFER
20302 REM
20310 LET  Q(1)=@141400,@44000,K(!),-1
20320 LET  Q(5)=@61200,@10000,I(!),#24
20330 GOTO 20410
20340 REM
20400 REM  DO THE DMA HERE
20402 REM
20410 OTAC 2 S                      !!
20420 OTAC @20 Q(!)                 !! STANDARD DMA START AND WAIT LOOP
20422 LET  #25=0
20424 LET  #25=#25+1
20440 LET  F=1                      !!
20450 STCC @20                      !!
20460 SFS  @20                      !!
20470 GOTO 20490                    !!
20480 RTN  1                        !!
20490 LET  F=F+1                    !!
```

```
20500 SKIF F=10000                    !!
20510 GOTO 20460                      !!
20512 SKIF #25>1
20514 GOTO 20424
20520 PRNT 20530                      !!
20530 FMT  ("CONTROLLER HUNG "/)      !!
20540 CLCC @23                        !!
20550 RTN                             !!
20600 REM
20610 REM  WAIT FOR IRQ
20620 REM
20630 CLCC @23                        !! TERMINATE DMA
20640 CLC  @20                        !!
20650 CLC  @21                        !!
20660 LET  F=0                        !!
20670 CLF  @30                        !! CLEAR FLAG
20680 SFC  @30                        !! NOW WAIT FOR IT TO SET
20690 RTN  1                          !! IT DID NOW ON WITH THE SHOW
20700 LET  F=F+1                      !! IT DIDN'T
20710 SKIF F=30000                    !! HAVE WE TIMED OUT YET ?
20720 GOTO 20680                      !! NO, KEEP TRYING
20730 SKIF #31=-1                     !! DONT PRINT IF NOT -1
20740 RTN
20750 PRNT 20760
20760 FMT  (/"IRQ NOT GENERATED"/)
20770 RTN
32766 REM THE END
```

Section 8
HP 12205A Control Store Card (CSIC) Diagnostic

8.1 General Information

The Control Store Card (CSIC) diagnostic (A900 Computer) provides tests to enable and disable the control store card and writable control store bank, complete read/write testing of the control store card, execute microcode from the control store card, and download user developed microcode.

As two 4k buffers are used in CSIC diagnostic, the operator must enter a CLEAR command from the BCM prompt, prior to loading the CSIC diagnostic. This ensures that there are enough memory locations to hold all buffer spaces.

The RAM LED, located on the control store card, is illuminated only when both the control store card and WCS bank are in the on condition. Note, also, that the WCS bank cannot be turned-on while the control store card is on; the read/write test must to be done while the control store card is off.

In the AUTO run mode of diagnostic execution, the CSIC diagnostic gets the select code of the control store card automatically and prints the select code under test. During operator interactive (manual), execution, the operator must enter the control store card octal select code following the message INPUT SELECT CODE. After the first pass of the CSIC diagnostic, when the INPUT SELECT CODE message is again requested, enter 0 for termination or <cr> for looping the CSIC diagnostic on the same select code.

Under the single test diagnostic operation (RUN T mode in the diagnostic operation and troubleshooting manual), the select code can be entered from runstring, as shown in the following example:

```
RU T x y z
```

where:

x = test number (see detailed list below)
y = loop number
z = select code of control store card

The CSIC diagnostic contains five separate tests, and include the following:

TEST #	TEST DESCRIPTION
1	Turn Control Store Card On
2	Turn Control Store Card Off
3	Read/Write Test
4	Frontplane Test
5	Download and Execute Microcode

8.2 Turn Control Store Card On, Test 1

In this test CSIC diagnostic turns on both the control store card and the the writable control store bank (set module address to 7 to ensure that it is beyond the firmware baseset 8k module).

Following test execution, the RAM LED on the control store card must be illuminated. The status of the card is checked against the control store card on/off, the writable control store bank on/off, and the module address.

8.3 Turn Control Store Card Off, Test 2

This test turns both the control store card and the writable control store bank off. After the test is executed, the status of the control store card is checked for both control store card and writable control store bank on/off.

8.4 Read/Write Test, Test 3

This test turns the control store card and the writable control store bank off to ensure that the read/write test can be executed correctly.

In this test, two 4k buffers are used to write data to the control store card and read it back. Six different data patterns are used and the results are checked.

8.5 Frontplane Test, Test 4

In this test, forty five words of hard coded microcode is initialized to the buffer, then written to the control store card. The card is then enabled and the code executed.

After the test is executed, the A Register is checked for the correct result. The message HARDWARE FAILURE OR FRONTPLANE CONNECTOR NOT INSTALLED will be printed if the result is incorrect.

8.6 Download and Execute Microcode, Test 5

This section downloads user written microcode from the device to the control store card, and executes the code.

NOTE

If any microcode is loaded within the first 8k address block, it will take over the A900 processor firmware baseset when microcode is executed from the control store card. This test is not executed in the AUTO run mode.

Appendix 8A
Error Messages

The following provides an example of the error messages returned during the CSIC diagnostic execution, and their definitions:

CAN'T TURN CS BOARD OFF

Could be caused by one or both of the following:

- Control store card is not off.
- Writable control store bank is not off.

CAN'T TURN CS BOARD ON

Could be caused by one or any combination of the following:

- Control store card is not on.
- Writable control store bank is not on.
- Module address not setup correctly.

TIME OUT ON DMA WRITE

DMA write took longer than one second.

TIME OUT ON DMA READ

DMA read took longer than one second.

HARDWARE FAILURE OR FRONT CONNECTOR NOT INSTALLED

Microcode did not execute correctly.

ERROR AT WORD XX CS ACCESSED IS YY SHOULD BE ZZ

Read/write test failed.

CHECKSUM ERROR

Microcode that loaded did not have the correct checksum.

ADDRESS OUT OF RANGE

Microcode address is out of user-defined module address.

Appendix 8B
Program Listing

```
  1 FMT  ("12205A CONTROL STORE INTERFACE DIAGNOSTIC"/)
  2 REM  (C) HEWLETT-PACKARD CO.  ALL RIGHTS RESERVED
  3 REM  SOURCE: 24612-18051 REV. 2326  <830628.1157>
  4 PRNT 1
  5 REM  ************************************************
  6 REM  * IN AUTO MODE CSIC DIAGNOSTIC DOES :           *
  7 REM  * 1. TURN CS CARD OFF                           *
  8 REM  * 2. TURN CS CARD ON                            *
  9 REM  * 3. WRITE/READ DATA TO RAM AND COMPARES BUF    *
 10 REM  * 4. DUMP MICROCODE TO CS CARD AND EXECUTE THE  *
 11 REM  *    LED BLINKING TEST                          *
 12 REM  ************************************************
 13 REM
 15 CLCC 0                          !! RESET SYSTEM
 20 BUF  I(6144) O(6144) X(4) Y(4)  !! DEFINE BUFFERS
 30 GTSC @61000 S                   !! S HOLDS CURRENT SELECT CODE
 40 OTAC 2 S                        !! ENABLE BR
 70 GOSB 1520                       !! TURN CS BOARD OFF
 75 LET  X=7                        !! SETUP MODULE ADDR UP HIGH
 80 GOSB 1800                       !! TURN CS BOARD ON
 90 GOSB 1520                       !! TURN CS BOARD OFF
100 GOSB 730                        !! READ/WRITE TEST
110 GOSB 800                        !! FRONTPLANE TEST
120 GOSB 1520                       !! TURN BOARD OFF
130 GOTO 30                         !! GET NEXT HIGHER PRIORITY CARD
140 REM
396 REM  INIT BUF WITH MICROCODE
399 REM
400 IBP  I(1) I(6144) CL            !! INIT INPUT BUFFER
410 LET  I(1)=&6A00,&800F,&800D,&F000,&830F,&8001,&7000,&870F
420 LET  I(9)=&8001,&7000,&8B0F,&8020,&6A0C,&810F,&8000,&6A00
430 LET  I(17)=&802F,&8000,&EA01,&4109,&8000,&EA00,&800F,&8000
440 LET  I(25)=&8780,&800F,&8006,&7000,&8B05,&8001,&EA00,&800F
450 LET  I(33)=&8000,&8F80,&800F,&800D,&9401,&8309,&8004,&6A00
460 LET  I(41)=&800F,&9000,&6A30,&C10C,&7004
490 RTN
495 REM
497 REM  DUMP MICROCODE TO CS BOARD
499 REM
500 GOSB 1520                       !! TURN CS OFF JSUT TO MAKE SURE
510 LET  G=0                        !! SET DMA TRANSFER ADDRESS
520 LET  B=I(!)                     !! SET DMA BUFFER ADDRESS
```

```
530 LET  C=-6144                        !! SET BYTE COUNT
540 GOSB 3530                           !! START DMA WRITE
550 LET  X=2                            !! SET CS BOARD MODULE ADDRESS
560 GOSB 1800                           !! TURN CS BOARD ON
570 RTN                                 !! RETURN TO CALLER
592 REM  EXECUTE CS BOARD MICROCODE
598 REM
600 IOCA                                !! CLEAR IO ROUTINE
610 IOA  CCB                            !! INIT 8B-REG WITH ALL ONE'S
620 IOA  STB B                          !! INIT DDL VARIABLE B
630 IOA  CLA                            !! INIT 8A-REG WITH ZERO
640 IOA  OCT 105600                     !! CS EXECUTION
650 IOA  STA B                          !! SAVE 8A-REG (SHOULD BE HEX20)
660 IOA  NOP                            !! DOES NOTHING
670 IORA                                !! START IO ROUTINE
680 SKIF B @40                          !! WAS 8A-REG AS EXPECTED ?
690 RTN                                 !! RETURN TO CALLER
700 PRNT 7080                           !! FRONTPLANE CONNECTOR NOT ON
710 GOTO 4000                           !! QUIT
712 REM
724 REM  READ/WRITE TO THE RAMS
728 REM
730 GOSB 1520                           !! TURN CARD OFF (IF SINGLE TEST)
735 LET  G=0                            !! TEST UPPER PORTION OF RAM
740 GOSB 2500                           !! SETUP DATA PATTERN FOR DMA
750 LET  G=6144                         !! TEST LOWER PORTION OF RAM
760 GOSB 2500                           !! SETUP DMA TEST
770 RTN                                 !! RETURN TO CALLER
794 REM  FRONTPLANE TEST
798 REM
800 GOSB 400                            !! SETUP MICROPROGRAM
810 GOSB 500                            !! WRITE TO RAM
820 PRNT 7090                           !! ENABLE WCS MICROCODE ECECUTION
830 GOSB 600                            !! START WCS EXECUTION
840 RTN                                 !! RETURN TO CALLER
852 REM  SINGLE TEST SECTION
856 REM
880 PRGM T SINGLE TEST SECTION
883 LET   1=1                           !! INIT VARIABLE
884 LET  Y=0                            !! INIT LOOP COUNT
885 LET  S= 502                         !! GET SC FROM RUN STRING
886 LET  X=7                            !! SET ADDR BEYOUND BASESET
894 SKIF  500 0                         !! TEST NUMBER SPECIFIED ?
895 GOSB 1200                           !! GET TEST NUMBER
896 BUF                                 !! CLEAR BUFFER
897 BUF I(6144) O(6144) X(4) Y(4)       !! DEFINE BUFFER
898 SKIF  502=0                         !! CHECK FOR DEFAULT VALUE
899 GOTO 902
900 PRNT 7115                           !! GET SELECT CODE
901 INPT @S                             !!
902 SKIF  501 0                         !! LOOP COUNT SPECIFIED ?
```

```
904 GOSB 1000                    !! GET LOOP COUNT
906 GOSB 1232                    !! VALIDATE LOOP COUNT
911 SKIF  500 1                  !! TEST NUMBER 1 ?
912 GOSB 1800                    !! TURN CS BOARD OFF
914 SKIF  500 2                  !! TEST NUMBER 2 ?
916 GOSB 1520                    !! TURN CS BOARD ON
918 SKIF  500 3                  !! TEST NUMBER 3 ?
920 GOSB 730                     !! READ/WRITE TEST
922 SKIF  500 4                  !! TEST NUMBER 4 ?
924 GOSB 800                     !! FRONTPLANE TEST
926 SKIF  500 5                  !! TEST 5 ?
928 GOSB 5010                    !! DOWN LOAD MICROCODE
930 LET   501= 501-1             !! DECREMENT LOOP COUNT
932 LET  Y=Y+1
934 PRNT 7110 Y                  !! PASS COUNT
936 SKIF  501=0                  !! DONE ?
940 GOTO 911                     !! NO, GO BACK
941 SKIF  1=0                    !! WAS TEST   SPECIFIED ?
942 GOTO 8000                    !! YES, ALL DONE
943 LET   501=0                  !! RESET LOOP COUNT
944 GOSB 1227                    !! GET TEST
946 LET  Y=0                     !! RESET LOOP COUNT
947 LET   502=S                  !! SET SELECT CODE
948 GOTO 896                     !! DO NEXT TEST
952 REM
990 REM  GET LOOP COUNT
992 REM
1000 PRNT 7035                   !! GET LOOP COUNT
1010 INPT  501                   !!
1020 SKIF  501 0                 !! CHECK FOR ZERO COUNT
1030 GOTO 8000
1040 RTN
1190 REM
1198 REM  PRINT TEST
1200 LET   1=0                   !! TEST   NOT SPECIFIED
1203 PRNT 7000                   !! TEST NUMBER
1205 PRNT 7005                   !! PRINT
1210 PRNT 7010                   !!     TEST
1215 PRNT 7015                   !!         NUMBER
1220 PRNT 7022                   !!     AND
1222 PRNT 7024
1225 PRNT 7025                   !!   TEST
1227 PRNT 7030                   !! DESCRIPTION
1230 INPT  500                   !! GET TEST NUMBER
1232 SKIF  500 -1                !! EXIT RUN T MODE
1234 GOTO 8000                   !! NO MORE
1240 SKIF  500=>1                !! CHECK TEST NUMBER
1250 GOTO 1200                   !! INVALID TEST NUMBER
1260 SKIF  500<6                 !! CHECK TEST NUMBER
1270 GOTO 1200                   !! INVALID TEST NUMBER
1280 RTN                         !! RETURN TO CALLER
```

```
1484 REM  TURN CS BOARD AND WCS BANK OFF
1501 REM
1520 OTAC 2 S                          !! ENABLE GR
1530 OTA  @31 @0                       !! TURN CS BOARD OFF
1540 OTA  @32 @0                       !!
1545 OTA  @31 @0                       !! TURN WCS OFF
1550 LIA  @31 A                        !! READ STATUS
1560 SKIF @30000 A.@170000             !! CHECK CS ON/OFF
1570 RTN                               !! CS BOARD IS OFF
1580 PRNT 7020                         !! CAN'T TURN CS BOARD OFF
1600 GOTO 4000                         !! ERROR
1790 REM
1794 REM  TURN CS BOARD AND WCS BOARD ON
1796 REM  ALSO, SET MODULE ADDRESS
1798 REM
1800 GOSB 1520                         !! TURN CS OFF JUST TO MAKE SURE
1805 OTAC 2 S                          !! ENABLE GR
1810 LET  Z=@170000:X                  !! STATUS WITH ADDRESS SET
1820 LET  X=@60000:X                   !! OR IN MODULE ADDRESS
1830 OTA  @31 X                        !! TURN BOTH CS AND WCS ON
1840 OTA  @32 @0                       !!
1850 LIA  @31 A                        !! READ STATUS
1860 SKIF Z A                          !! CHECK STATUS WITH ADDRESS
1870 RTN                               !! CS BOARD IS ON
1880 PRNT 7040                         !! CAN'T TURN CS BOARD ON
1890 GOTO 4000                         !! ERROR
2392 REM
2396 REM  INIT INPUT BUFFER WITH DATA PATTERN
2401 REM
2500 IBP  O(1) O(6144) AV              !! INITIALIZE OUTPUT BUF
2510 IBP  I(1) I(6144) CL              !! ALL 0'S
2520 GOSB 3000                         !! DMA TRANSFER
2530 IBP  I(1) I(6144) AH              !! ALTERNATE HORIZONTAL
2540 GOSB 3000                         !! DMA TRANSFER
2550 IBP  I(1) I(6144) AV              !! ALTERNATE VERTICAL
2560 GOSB 3000                         !! DMA TRANSFER
2570 IBP  I(1) I(6144) R1              !! ROTATE 1
2580 GOSB 3000                         !! DMA TRANSFER
2590 IBP  I(1) I(6144) R0              !! ROTATE 0
2600 GOSB 3000                         !! DMA TRANSFER
2610 IBP  I(1) I(6144) IN              !! INTEGER INCREMENT
2620 GOSB 3000                         !! DMA TRANSFER
2630 RTN
2992 REM  SETUP DMA BUF ADDRESS AND BYTE COUNT
2995 REM
3000 LET  B=I(!)                       !! SETUP INPUT BUFFFER ADDRESS
3010 LET  C=-6144                      !! SETUP BYTE COUNT
3020 GOSB 3530                         !! DMA WRITE
3025 LET  B=O(!)                       !! SETUP OUTPUT BUF ADDRESS
3030 GOSB 3820                         !! DMA READ
3040 CPBF I(1) O(1) 6144 0 I           !! COMPARE INPUT/OUTPUT BUF
```

```
3050 GOTO 3070                          !! EROR
3060 RTN                                !! RETURN TO CALLER
3070 PRNT 7050 I                        !! INPUT/OUTPUT BUFFER
3080 PRNT 7055 O(I) I(I)                !! NOT COMPARED
3090 GOTO 4000                          !! TERMINATES CSIC DIAG
3494 REM  **********
3496 REM  DMA WRITE
3501 REM
3530 OTAC 2 S                           !! ENABLE GR
3540 LET  X(1)=@41400,G,B,C             !! SETUP DMA QUAD
3560 OTA  @20 X(!)                      !! SEND  DMA QUAD
3570 STCC @20                           !! START DMA TRANSFER
3580 WFI  S 1000                        !! WAIT FOR DMA COMPLETION
3590 GOTO 3610                          !! TIME OUT
3600 RTN                                !! GOOD COMPLETION
3610 PRNT 7060                          !! DMA WRITE DIDN'T COMPLETE
3630 GOTO 4000
3796 REM  *********
3798 REM  DMA READ
3801 REM
3820 OTAC 2 S                           !! ENABLE GR
3830 LET  Y(1)=@41200,G,B,C             !! SETUP DMA QUAD
3850 OTA  @20 Y(!)                      !! SEND  DMA QUAD BUF ADDRESS
3860 STCC @20                           !! START DMA TRANSFER
3870 WFI  S 1000                        !! WAIT FOR DMA COMPLETION
3880 GOTO 3900                          !! TIME OUT
3890 RTN                                !! GOOD RETURN
3900 PRNT 7070                          !! DMA READ DIDN'T COMPLETE
3905 REM
3906 REM  ERROR TERMINATION
4000 SKIF 0= 510.1                      !! CHECK AUTO RUN MODE
4010 STOP                               !! HALT IF AUTO RUN MODE
4020 CLCC 0                             !! RESET SYSTEM
4030 GOTO 8000                          !! ALL DONE
4999 REM
5005 REM  PROGRAM CONVERTS OUTPUT MPARA AND STORES
5006 REM  MICROWORDS IN A 16X12288 BUFFER
5009 REM
5010 OTAC 2 S                           !! ENABLE GR
5017 BUF                                !! CLEAR BUFFER
5020 BUF  D(12288) B(128) X(4)          !! DEFINE BUFFERS
5022 PRNT 5024
5024 FMT  ("ENTER MODULE ADDRESS (0 THRU 7) ")
5026 INPT L                             !! GET MODULE ADDRESS
5027 SKIF L=>0                          !! MODULE
5028 GOTO 5022                          !! ADDRESS
5029 SKIF L<8                           !! BOUNDARY
5030 GOTO 5022                          !! CHECK
5032 LET  L=L*4096                      !! SETUP LOWER ADDRESS LIMIT
5033 LET  U=L+4095                      !! SETUP UPPER ADDRESS LIMIT
5035 IBP  D(1) D(12288)  CL             !! CLEAR D BUFFER
```

```
5040 PRNT 5420
5050 INPT R $Z Q
5060 SKIF Z=$:
5070 GOTO 5040
5080 DVIO 0 0 0
5090 DVRQ R Q -1
5100 LET  C=-256
5110 DVIO R C B(!)
5120 SKIF C -1
5130 GOTO 5395
5140 LET  B(1)=B(1)/256
5150 LET  C=B(1)-3
5160 LET  Z=B(2)
5170 LET  P=4
5180 LET  Z=Z+B(P)
5190 LET  P=P+1
5200 LET  C=C-1
5210 SKIF C=0
5220 GOTO 5180
5230 SKIF Z B(3)
5240 GOTO 5270
5250 PRNT 5440
5270 SKIF @161400=B(2).@161400
5280 GOTO 5100
5282 SKIF L=<B(4)
5284 PRNT 5460
5286 SKIF U=>B(4)
5287 PRNT 5460
5290 LET  X=B(2).@77
5300 LET  X=B(5).@377*X
5301 REM
5310 LET  M=B(4).@7777*3
5315 LET  P=M+1
5320 LET  I=6
5330 LET  D(P)=B(I)
5340 LET  P=P+1
5350 LET  I=I+1
5360 LET  X=X-1
5370 SKIF X=0
5380 GOTO 5330
5390 GOTO 5100
5395 DVRQ R -1 0
5399 REM
5401 GOSB 1520
5402 LET  G=0
5403 LET  B=D(!)
5404 LET  C=-12288
5406 GOSB 3530
5408 LET  X=L/4096
5409 GOSB 1800
5410 PRNT 5450
```

```
!! SETUP
!!       INPUT
!!             DEVICE


!! REQUEST DEVICE AND OPEN FILE
!! SETUP COUNTER FOR TRANSFER
!! OF BYTES TO THE D BUFFER
!! IF LAST RECORD
!! DONE
!! MOVE   OF WORDS TO LOWER BYTE
!! SETUP
!!      COUNT
!!           FOR
!!              CHECKSUM
!! AND
!!     PERFORM
!!             CHECKSUM
!! GET NEXT WORD
!! IF CHECKSUM
!!          ERROR
!!             PRINT MESSAGE
!! CHECK RECORD TYPE, IF NOT
!! RIGHT, READ NEXT RECORD
!! CHECK
!!     FOR
!!       ADDRESS
!!             BOUNDRIES
!! GET   OF UWORDS
!! MULTIPLY IT BY   OF WORDS
!! IN MICROWORD
!! MASK OFF UPPER ADDRESS BITS
!! SETUP A POINTER FOR D BUF
!! SETUP A POINTER FOR B BUF
!! START
!!      TO
!!        FILL UP
!!               D BUF
!!
!! GET NEXT WORD
!! GET NEXT RECORD
!! CLOSE FILE

!! TURN CS AND RAM OFF
!! SETUP ADDRESS FOR DMA TRANSFER
!! SETUP BUFFER ADDRESS
!! SETUP BYTE COUNT
!! LOAD FROM MEMORY TO RAM
!! SETUP MODULE ADDR
!! TURN CS ON
```

```
5413 GOSB 600                          !! EXECUTE WCS
5414 RTN                               !! RETURN TO CALLER
5415 REM
5420 FMT  ("INPUT DEVICE & FILE ")
5440 FMT  ("CHECKSUM ERROR"/)
5450 FMT  ("DOWN LOAD COMPLETE"/)
5460 FMT  ("ADDRESS OUT OF RANGE"/)
7000 FMT  ("TEST      TEST DESCRIPTION"//)
7005 FMT  ("  1       TURN CS BOARD ON"/)
7010 FMT  ("  2       TURN CS BOARD OFF"/)
7015 FMT  ("  3       READ/WRITE TEST"/)
7020 FMT  ("CAN'T TURN CS BOARD OFF"/)
7022 FMT  ("  4       FRONTPLANE TEST"/)
7024 FMT  ("  5       DOWNLOAD & EXEC MICROCODE"/)
7025 FMT  (" -1       EXIT RUN T MODE"//)
7030 FMT  (/"ENTER TEST NUMBER ")
7035 FMT  (/"ENTER LOOP COUNT ")
7040 FMT  ("CAN'T TURN CS BOARD ON"/)
7050 FMT  ("ERROR AT WORD "%I6/)
7055 FMT  ("CS ACCESSED IS "K6" SHOULD BE "K6/)
7060 FMT  ("TIME OUT ON DMA WRITE"/)
7070 FMT  ("TIME OUT ON DMA READ"/)
7080 FMT  ("HARDWARE FAILURE OR FRONT CONNECTOR NOT INSTALLED"/)
7090 FMT  ("ENABLE CS MICROCODE EXECUTION"/)
7110 FMT  ("PASS "%I6" COMPLETE"/)
7115 FMT  ("ENTER SELECT CODE (IN OCTAL) ")
7995 REM
8000 REM  THE END
```

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~~Source = Table C~~

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