TERMINAL INTERFACE CONTROLLER

Diagnostic Manual

HEWLETT PACKARD

5, AVENUE RAYMOND CHANAS, 38320 EYBENS - FRANCE

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 the user-inserted update information. New editions of this manual will contain new information, as well as updates.

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LIST OF EFFECTIVE PAGES

The List of Effective Pages gives the date of the most recent version of each page in the manual. To verify that your manual contains the most current information, check the dates printed at the bottom of each page with those listed below. The date on the bottom of each page reflects the edition or subsequent update in which that page was printed.

Effective Pages	Date
all	Sep 1985
1-1	Apr 1986
all	Aug 1987

CONVENTIONS USED IN THIS MANUAL

NOTATION	DESCRIPTION

NOTATION   **DESCRIPTION**

`nonitalics`   Words in syntax statements which are not in italics must be entered exactly as shown. Punctuation characters other than brackets, braces and ellipses must also be entered exactly as shown. For example:

          `EXIT;`

italics   Words in syntax statements which are in italics denote a parameter which must be replaced by a user-supplied variable. For example:

          `CLOSE` *filename*

[ ]   An element inside brackets in a syntax statement is optional. Several elements stacked inside brackets means the user may select any one or none of these elements. For example:

        $\begin{bmatrix} A \\ B \end{bmatrix}$ User *may* select A or B or neither.

{ }   When several elements are stacked within braces in a syntax statement, the user must select one of those elements. For example:

        $\begin{Bmatrix} A \\ B \\ C \end{Bmatrix}$ User *must* select A or B or C.

. . .   A horizontal ellipsis in a syntax statement indicates that a previous element may be repeated. For example:

          `[,`*itemname*`]...;`

    In addition, vertical and horizontal ellipses may be used in examples to indicate that portions of the example have been omitted.

    A shaded delimeter preceding a parameter in a syntax statement indicates that the delimeter *must* be supplied whenever (a) that parameter is included or (b) that parameter is omitted and any *other* parameter which follows is included. For example:

          itema`[`*itemb*`][,`*itemc*`]`

    means that the following are allowed:

          itema
          itema,itemb
          itema,itemb,itemc
          itema,,itemc

Δ   When necessary for clarity, the symbol Δ may be used in a syntax statement to indicate a required blank or an exact number of blanks. For example:

$$\text{SET}[(modifier)]\Delta(variable);$$

underlining   When necessary for clarity in an example, user input may be underlined. For example:

NEW NAME? ALPHA

In addition, brackets, braces or ellipses appearing in syntax or format statements which must be entered as shown will be underlined. For example:

LET $var[[subscript]]$ = $value$

shading   Shading represents inverse video on the terminal's screen. In addition, it is used to emphasize key portions of an example.
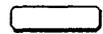
⬚   The symbol ⬚ may be used to indicate a key on the terminal's keyboard. For example, (RETURN) indicates the carriage return key.

(CONTROL)*char*   Control characters are indicated by (CONTROL) followed by the character. For example, (CONTROL)Y means the user presses the control key and the character Y simultaneously.

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1.1 INTRODUCTION

This manual describes the diagnostic program for the Terminal Interface Controller (TIC) and the Advanced Terminal Processor (ATP/M). The TIC is also referred to as the ATP37. The ATP/M is the Advanced Terminal Processor for the HP MICRO 3000 Series and the HP 3000 Series 37 computer systems. The ATP37 (or TIC) is the predecessor to the ATP/M. It is only supported on the HP 3000 Series 37.

Note that throughout this manual the ATP37 and the ATP/M are referred to as an Advanced Terminal Processor (ATP), unless a distinction is required.

TICDIAG is an off-line diagnostic program used to troubleshoot and verify the operation of both the ATP/M and the ATP37. It is written in SPL and is part of the Diagnostic/Utility System (DUS) for the MICRO 3000 Series and 3000 Series 37.

Note: Throughout this manual a reference to an ATP/M may also be treated as a reference to an ATP37/M, as they are equivalent.

1.2 TIC IDENTIFICATION

TICDIAG tests and diagnoses the ATP37 and all three versions of the ATP/M. The TIC type must be correctly identified (type 0, 1, 2 or 3) during the TICDIAG configuration dialogue (see 2.7 TIC Type Selection) in order that the selected tests are performed correctly.

Refer to Table 1-1 to identify the TIC type to be tested.

1.3 REQUIRED HARDWARE

The hardware required to run the TICDIAG is the MICRO 3000 or 3000 Series 37 minimum configuration:

    Console (connected to the ATP at slot 1, port 0)
    HP-IB Tape Drive
    SPU (with the following board set): CPU
                                         Memory
                                         PIC*
                                         TIC**

        *needed as a coldload path to load DUS
       **must work well enough to initiate TICDIAG

For details of the loopback hoods required for AIB loopback testing refer to 1.4 Loopback Hoods.

1-1

TIC Type	Product Name	Product/Option Number	TIC Identification
0	ATP37	30460A	6 Direct Connect Ports (3 Pin) + 1 Modem Port (25 Pin) (No separate connector panel)
1	ATP/M	40290A Opt 125	4 Direct Connect Ports (25 Pin) + 4 Modem Ports (25 Pin)
2	ATP/M	40290A Opt 103	7 Direct Connect Ports (3 Pin) + 1 Modem Port (25 Pin)
3	ATP/M	40290A Opt 105	7 Direct Connect Ports (5 Pin) + 1 Modem Port (25 Pin) (RS-422 version)

Table 1-1 TIC Identification

1.4 LOOPBACK HOODS

If any AIB tests are selected the user is prompted for the ports to be tested. By specifying only the port(s) fitted with a loopback hood, devices may remain connected to the other ports during testing with TICDIAG.

The ATP/M (TIC types 1, 2 and 3) offers two methods of loopback testing:

- To test one or more specified ports the loopback hood(s) may be fitted directly to the ports on the connector panel.

- To test all ports simultaneously, a 50-pin loopback hood is available for fitting directly to the ATP/M PCA (card) connector at the rear of the SPU or the I/O Extender. Note that as the connector panel is not tested using this method, all the device cables may remain connected to it and a second ATP must be specified to support the system console.

The loopback hoods are specific to the TIC type, the electrical interface (modem or direct connect) and the type of port connector. Table 1-2 lists the loopback hoods required for testing each type of TIC.

TIC Type	Product Name	TIC Ports Identification	Use Loopback Hood Part Number:
0	ATP37	6 RS-232-C Direct Connect Ports (3 Pin): 1 RS-232-C Modem Port (25 Pin): (No separate connector panel)	30148-60002 30146-60002
1	ATP/M	4 RS-232-C Direct Connect Ports (25 Pin): 4 RS-232-C Modem Ports (25 Pin): To test all ports (excluding connector panel) at 50 Pin cable connector, use:	40290-60009 40290-60009 40290-60007
2	ATP/M	7 RS-232-C Direct Connect Ports (3 Pin): 1 RS-232-C Modem Port (25 Pin): To test all ports (excluding connector panel) at 50 Pin cable connector, use:	30148-60002 40290-60009 40290-60007
3	ATP/M	7 RS-422 Direct Connect Ports (5 Pin): 1 RS-232-C Modem Port (25 Pin): To test all ports (excluding connector panel) at 50 Pin cable connector, use:	30147-60002 40290-60009 40290-60008

Table 1-2 Loopback Hoods

1.5 REQUIRED SOFTWARE

Version V2.00 (or later) of the TICDIAG diagnostic is required.

1.6 DIAGNOSTIC PROGRAM STRUCTURE

TICDIAG is divided into separate test modules each of which tests a specific function of the Advanced Terminal Processor. The tests may be selected to run individually or in any combination, but the order in which they are performed is fixed.

The TICDIAG tests are split into two major groups; the SIB (System Interface Board) tests and the AIB (Asynchronous Interface Board) tests. The SIB tests (if any are specified) are run before the AIB tests. The order of the tests in each group is always maintained as each test relies on circuitry tested by the previous test(s).

The tests in the SIB section test the circuitry between the SIMB and the Lynx Bus (L-Bus). They affect all ports. The tests in the AIB section test the circuitry from the Lynx Bus to the connector panel device port. The AIB tests affect only one selected port at a time except for the Real Loopback Test which is run on all the specified ports at once.

The TICDIAG loop is very simple. It calls Get'Test'Data to get input from the user. The SIB is then initialized and the selected SIB tests (if any) are run. If the SIB section is successfully completed, the AIB is initialized for testing and the selected AIB tests (if any) are run. If the Real Loopback Test (Test 30) is selected with other AIB tests then it is not performed until the other tests are successfully completed. Some of the data from Get'Test'Data is used by the main program, but most of the data is passed directly to the Test' SIB and Test'AIB sections.

Figure 1-1 is a structure chart of the main program body.
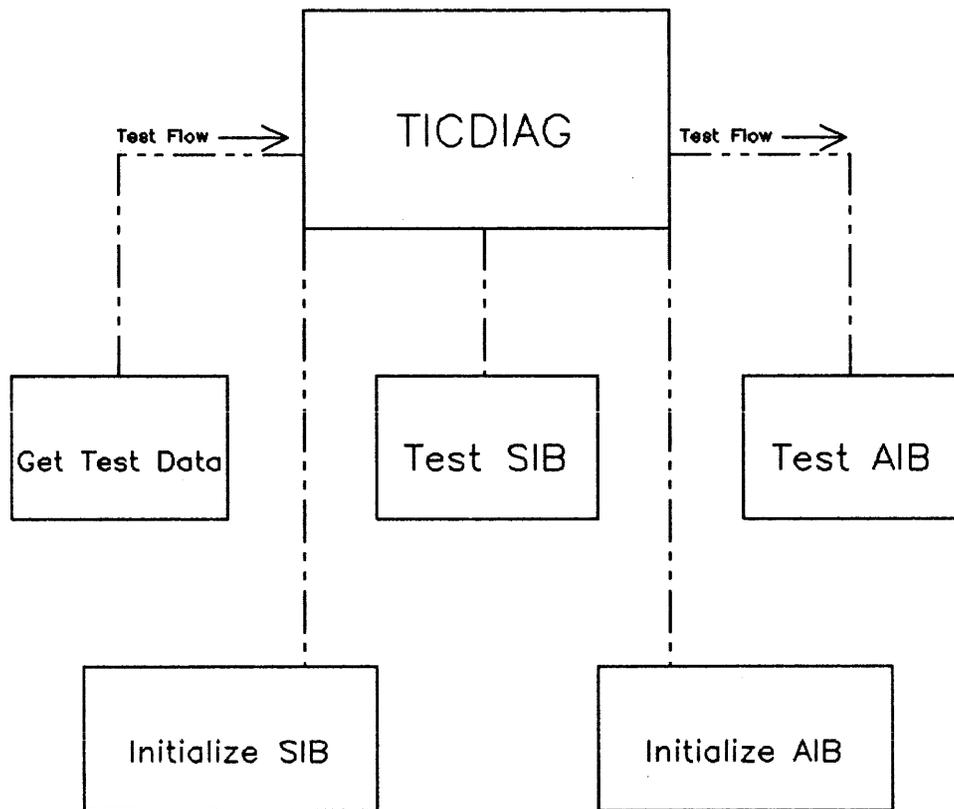
Figure 1-1. TICDIAG Structure

1.7 SYSTEM CONFIGURATIONS

TICDIAG provides the environment required to test the ATP in any of the HP MICRO 3000 Series or HP 3000 Series 37 system configurations.

If the ATP under test is supporting the system console, the user is prompted for directions to redirect the TICDIAG message printout. TICDIAG messages may be sent to an HP-IB printer or a second ATP may be specified to support the system console. If the message output is directed to the printer and the ATP under test is supporting the system console then a (CONTROL) [Y] break is not allowed.

Table 1-3 lists the TICDIAG tests which are allowed in each system configuration.

Channel Number Of TIC Under Test	Output Directed To	Channel Number Of Console	Tests Allowed
1	Console	1	All AIB Tests except Port 0 (Stop on error allowed)
Other than 1	Console	1	All Tests (SIB and AIB) (Stop on error allowed)
1	Printer	1	All Tests (SIB and AIB) (No Control-Y Break)
Other than 1	Printer	1	All Tests (SIB and AIB)
1	Console	Other than 1	All Tests (SIB and AIB) (Stop on error allowed)

Table 1-3 TICDIAG System Configurations

1.8 TEST LIMITATIONS

The Remote Operator Interface (ROI) circuitry of the ATP is not tested by the TICDIAG. This circuitry includes the LOCAL/REMOTE circuitry and the Disconnect circuitry. The functions of the ROI circuitry can be tested using a manual procedure.

Control B and warmstart circuitry are not tested by TICDIAG.

2.1 INTRODUCTION

This section describes how to operate TICDIAG.

TICDIAG contains numerous test routines each of which test a specific function of the ATP. These test routines can be run individually or in various combinations. The SIB tests, if selected, run before the AIB tests and the order of the tests in each group is always maintained.

TICDIAG prompts you to input the ATP channel number, the type of ATP to be tested (TIC type) and then the type of information to be output. You are then prompted to direct the output information to either the printer or the system console before selecting the tests which are to be performed. If any AIB tests are selected then you are prompted for the ports to be tested before TICDIAG starts testing the ATP.

All input to the TICDIAG is done via the system console.

2.2 OUTPUT CONTROL

You may specify the type and degree of information to be output by TICDIAG. The message output can be simply displayed at the system console or directed to an HP-IB printer to obtain a printout.

The output options are to print all "pass messages", "failure messages", and/or "troubleshooting messages". Field personnel are likely to select only the pass and failure messages in order to verify the operation of the ATP. The troubleshooting messages are primarily intended to help isolate faulty components on the ATP as test progress information is also provided.

TICDIAG then prompts you to direct the message output to either the printer or the system console (default). If the ATP under test is supporting the system console, the user is prompted for directions to redirect the TICDIAG message output. TICDIAG messages may be sent to an HP-IB printer or a second ATP may be specified to support the system console. If the message output is directed to the printer and the ATP under test is supporting the system console then a (CONTROL) [Y] break is not allowed.

2.3 LOOPING

You can select one of two types of looping.

The first type loops the number of times that you specify in response to the prompt. The loop count can be any number from 1 to 32,767. Alternatively you can specify continuous looping by entering a 0. Continuous looping cannot be specified if SIB and AIB tests are both selected as the tests in each section are run the number of times specified. Similarly, continuous looping cannot be specified if the Real Loopback Test is selected with other AIB tests.

The second type loops only on failure. If you specify this option, the test which fails is looped continuously.

2.4 USER INTERFACE

TICDIAG prompts you to input the testing parameters, except where default values are indicated. You specify the tests to be performed and the program control which can be either "loop on error" or "stop on error". Note that "stop on error" is not available if the system console is supported by the ATP under test or if the message output is directed to the printer.

A (CONTROL) [Y] break may be entered to terminate the TICDIAG program except when the message output is directed to the printer and the ATP under test is supporting the system console.

In response to the prompts for testing parameters you may type HELP and a help message is displayed. The help messages indicate the acceptable responses and the resulting action of each response. If EXIT is entered in response to any prompt TICDIAG checks that you wish to stop testing and then returns control to the DUS. If STATUS is entered in response to any prompt TICDIAG displays the current program status. The status information includes the channel under test, the configuration parameters, the selected tests and the port(s) to be tested.

All input to TICDIAG is done through the system console and is performed either before or after the testing as there is no prompt for input while testing is in progress. The TICDIAG message output goes to the system console (default) or can be redirected to the printer.

2.5 RUNNING DUS

To run TICDIAG the DUS must be loaded and run as follows:

1)   Perform MPE shutdown to logoff every user, if applicable.

2)   Run console self-test using the [Terminal Test] option of [Service Keys].

3)   Fully reset console by pressing (SHIFT) (CONTROL) (RESET).

4)   Install a DUS tape on the tape coldload device.

5)   If loopback testing is to be performed, attach the loopback hood(s) on the port(s) to be tested (see 1.4 Loopback Hoods).

6)   Power-on the MICRO 3000 Series or 3000 Series 37 system by turning the keyswitch to one of the ON positions (NORMAL, LOCAL or REMOTE). Use NORMAL if the console is local and it is to be Port 0 of an ATP fitted in Channel 1 when the system comes up. REMOTE and LOCAL are to be used only if an ATP other than the one in channel 1 is to be tested. The Microdiagnostic will run and you must then type L in response to the prompt to load DUS. Type H if you require HELP.

Alternatively, switch to LOCAL and use a (CONTROL) [B] sequence to load DUS, following the above procedure. Return the keyswitch back to NORMAL.

7)   The Diagnostic/Utility system will display a welcome message and prompt:

```
DIAGNOSTIC/UTILITY SYSTEM (REVISION XX.00)

ENTER YOUR PROGRAM NAME (TYPE HELP FOR PROGRAM INFORMATION)
:
```

2.6 RUNNING TICDIAG

8)   Type `TICDIAG` in response to the prompt.

9)   TICDIAG will load and execute. Note that throughout the program the ATP is referred to as a TIC. The following message is displayed:

```
Terminal Interface Card Offline Diagnostic          V-02.00 (or later)
```

Enter `HELP` in response to any question for an explanation of what is required.

Enter `EXIT` in response to any question to terminate the program.

Enter `STATUS` in response to any question for a display of the current diagnostic configuration. See page 2. 8 for an example of the diagnostic configuration display provided in response to the STATUS command.

10)   TICDIAG then prompts you for all the information needed to run the tests.

The first prompt asks for the channel number of the ATP under test (1 to 5 or 9 to 13). If the channel number is one, TICDIAG will later prompt the user to redirect the printout. If redirected, you must select Port 0.

```
Enter the Channel Number of the TIC Under Test:
```

2.7 TIC TYPE SELECTION

11)   TICDIAG then prompts you to input the TIC type under test. Refer to Table 1-1 or type HELP for TIC identification information.

```
What is the TIC Type ?   :

-0- The 7 Port ATP37    with  1 Modem Port        ?
-1- The 8 Port ATP37/M with  4 Modem Ports       ?
-2- The 8 Port ATP37/M with  3 Pin Connectors    ?
-3- The 8 Port ATP37/M with  5 Pin Connectors    ?
```

2.8 OPTIONS SELECTION

12) TICDIAG then prompts you to select the amount and type of message output that you want printed. Answer these prompts with YES or NO.

   `Print Failure Messages (Default = NO) ?`

   `Print Pass Messages (Default = NO) ?`

   `Print Troubleshooting Messages (Default = NO) ?`

13) TICDIAG then prompts you for the list device. If the line printer is not specified by responding YES to the off-line prompt, the listing is sent to the system console. The user may change the system console if the ATP under test has the system console on it and there is another ATP board in the system.

   `Output Results to Line Printer (Default = NO) ?`

   If the system console is on the ATP under test and the output is not directed to the line printer, TICDIAG will ask if the user wishes to change the system console to another ATP and port.

   `Change the System Console Channel Number (Default = NO) ?`

   If answered YES:

   `Channel Number of TIC to switch the System Console to:`

14) If the console is the list device you may select to stop on errors.

   `Stop on Errors (Default = NO) ?`

   If you answered YES then when an error is detected, you are prompted to either cancel testing or to continue.

   `Do you wish to Halt the Tests (Default = NO) ?`

15) You can select to loop on a failure. TICDIAG will then continuously loop the test which detected a failure.

   `Loop on Error (Default = NO) ?`

16) You are then prompted for a loop count to specify the number of times each test is repeated. The maximum value is 32,767 and zero indicates that continuous looping should be performed.

   `Loop Count - (Zero for continuous looping/Default = 1):`

2.9 TESTS SELECTION

17) TICDIAG then prompts you for the SIB tests to run. If the system console is on the ATP under test then no SIB tests can be performed. The tests are entered by name or ALL or NONE may be specified.

```
Enter SIB Tests to be Run:
(Default = last set of tests Run, if any)
>
```

The possible tests are:

```
            IMB-SIB COMMUNICATION       (IM)
            INITIAL REGISTER VALUES     (INI)
            ERROR CIRCUITRY             (E)
            RESET/INIT                  (RES)
            IRQ LOGIC                   (IR)
            MEMORY                      (M)
            SEQUENCING                  (SE)
            TIMEOUT                     (TIM)
            BOARD ENABLE                (BO)
            PORT POINTER                (P)
            FREEZE                      (FR)
            TIC BUS BUFFERS             (TIC)
            DIRECT COMMAND              (DI)
            FIFO                        (FI)
            STATE COUNTER               (ST)
            DMA ADDRESS COUNTER         (DM)
            COMP/CTR LOOPBACK           (C)
            READ IMB                    (REA)
            WRITE IMB                   (W)
            BEGIN FLAG/LEFT-RIGHT FLAG  (BE)

            ALL                         (AL)
            NONE                        (N)
            (RETURN)
```

The test names may be abbreviated as indicated. You may enter a list of tests, separated by semicolons. ALL indicates that all available SIB tests are to be run. NONE indicates that no testing of the SIB is performed. Pressing (RETURN) in response to this question will cause the last SIB tests specified (if any) to be retained.

ALL is the recommended response when using TICDIAG in the field.

18) TICDIAG prompts for the AIB tests to be run.

```
Enter AIB Tests to be Run:
(Default = last set of tests Run, if any)
>
```

The possible tests are:

```
            PCC  SELF  TEST           (PCC  S)
            PCC  DUMP                  (PCC  D)
            MCC  SELF  TEST           (MCC  S)
            MCC  DUMP                  (MCC  D)
            PCC  MCC  COMMUNICATION   (PCC  M)
            DIAGNOSTIC  LOOPBACK      (D)
            BAUD  RATE                (B)
            MODEM  SIGNALS            (MO)
            MSC  PORT  ADDRESSING     (MS)
            LOOPBACK                  (L)

            ALL                        (A)
            ALL  NO  LOOPBACK         (ALL  N)
            NONE                       (N)
            (RETURN)
```

The test names may be abbreviated as indicated. You may enter a list of tests, separated by semicolons. ALL indicates that all available AIB tests are to be run. If ALL tests are selected then continuous looping should not be specified. ALL NO LOOPBACK indicates that all AIB tests, except those which require a loopback hood (the Modem Signals Test, Modem Address Test, and Real Loopback Test) are to be run. NONE indicates that no testing of the AIB is to be performed. Pressing (RETURN) in response to this question will cause the last AIB tests specified (if any) to be retained. ALL NO LOOPBACK is the recommended response when using TICDIAG in the field. (Use ALL if loopback hoods have been installed).

2.10 PORTS SELECTION

19) If any AIB tests are selected, you are prompted for the ports to be tested. Ports which still have devices attached should not be selected. If the system console is on the ATP under test then Port 0 may not be specified.

```
Enter Ports to be Tested:
(Default = last set of ports)
>
```

Ports to be tested are specified by entering a list of the port numbers.
The format is:

```
<integer>[/<integer>][,<integer>[/<integer>],...]
```

If the list of ports is omitted the last set of ports selected will be tested by pressing (RETURN). The list of ports can include individual numbers and ranges of numbers. For example: 1,2,4/7 is a valid list of numbers specifying that ports 1,2,4,5,6 and 7 are to be tested.

20) TICDIAG then proceeds to test the ATP. Upon completion of testing a message is displayed as shown below. During the execution of TICDIAG the specified output messages are sent to the list device.

```
Testing Completed.
Channel/Loop Count/Output Changes (Default = NO) ?
```

You can run the tests again and change the test parameters by responding YES and then answering the prompts.

21) The message output displayed in response to entering the STATUS command is shown on the following page:

```
CURRENT STATUS
      Channel Under Test:                  (1 to 5 or 9 to 13)
      TIC Type Under Test:                 (0,1,2 or 3)
      OPTIONS
       Print Pass Messages:                vvv
       Print Fail Messages:                vvv
       Print Troubleshooting Messages:     vvv          (Where vvv is
       Results to Line Printer:            vvv           YES  or  NO.)
       Stop On Error:                      vvv
       Loop On Error:                      vvv
       Loop Count:                         yyyyy        (Where yyyyy is
                                                         between 0 - 32767.)
      TESTS TO BE RUN:
      SIB:
            IMB-SIB Communication Test
            Initial Register Value Test
            Error Circuitry Test
            Reset/INIT Test
            IRQ Logic Test
            SIB Memory Test
            Lynx Bus sequencing Test
            DMA Timeout Test
            Board Enable Test
            Port Pointer Test
            Freeze Bit Test
            Lynx Bus Buffers Test
            Direct Command Test
            FIFO Test
            DMA State Counter Test
            DMA Address Counter Test
            Comp Reg/Addr Counter Test
            IMB Read Test
            IMB Write Test
            BeginFlag/LRFlag Test

      AIB:
            PCC Self Test
            PCC Dump Test
            PCC/MCC/MSC Self Test
            MCC Dump Test
            PCC-MCC Communications Test
            Diagnostic Loopback Test
            Baud Rate Test
            Modem Signal Test
            MSC Port Addressing
            Real Loopback Test
                              01234567
      PORTS TO BE TESTED:     xxxxxxxx          (There is an "x" only for
                                                 the ports to be tested.)
```

NOTE: ONLY THE TESTS SELECTED TO RUN ARE LISTED.

3.1 INTRODUCTION

This section describes the test sections of TICDIAG.

3.2 GET TEST DATA

Get'Test'Data provides prompts for all the test parameters that the user must input before any tests can commence. Because this routine may have already been called, an option is provided to retain the parameters that have been specified previously. Get'Test'Data then prompts for the tests to be run and, if any AIB tests are selected, the ports to be tested.

3.3 SYSTEM INTERFACE BOARD (SIB) TESTS

The SIB test section comprises a series of tests that are applied to the SIB. The SIB is the system interface section of the ATP card. The SIB test section returns a logical value to indicate that all the tests succeeded so that the AIB tests can begin.

Test'SIB calls a procedure for each test that is specified by the parameters passed to it from Get'Test' Data. Check'Error, Print'Error'Prefix, and Print'Error'Status are utility procedures that are invoked by all of the tests. Test'SIB loops through its testing sequence the number of times specified by the loop count passed from Get'Test'Data.

Test 1.   IMB-SIB COMMUNICATION -- Tests the SIB to insure that all the allowable Intermodule Bus (IMB) commands work correctly. As each IMB command is executed, two types of error messages can be printed. The first type indicates that the instruction was not successful. The second type indicates that the SIB response was not the expected response.

Test 2.   INITIAL REGISTER VALUES -- Tests the values that are obtained from the SIMB registers after initialization. The value of each register to be checked is read. This value is then compared with the expected value for the register. If there is not a match, an error message is output.

Test 3.   ERROR CIRCUITRY -- Tests the error circuitry on the SIB. It issues an illegal command and verifies that it is detected. It then checks the Error Clear mechanism of Register !A.

Test 4.   RESET/INIT -- Checks to make certain that an INIT command causes a reset of the registers and of the error detection circuitry. First, the loopback bit of Register !A, the Diagnostic Control Register, is written with a "0". An INIT command is issued and should set the loopback bit. Register !A is read to confirm this. Next, an illegal address command is issued and the error bit is set. An INIT is issued to clear the error bit. This tests the operation of the MRSTA line.

Test 5.   IRQ LOGIC -- Tests the interrupt logic on the SIB. First, the external interrupts are turned off. An SMSK command is issued, disabling the ATP, and then an illegal address command is issued. The illegal command should generate an error (but not an interrupt, since the mask is disabled). The mask bit is checked by performing an RIOA of the channel with an RMSK command. This results in the hardware mask being returned and not the memory image. An IPOLL is then issued to verify that the IRQ line is not set. The interrupt mask is now set to enable the ATP. The process is repeated, and the IRQ is checked to verify that it is set.

Test 6.   SIB MEMORY -- Tests the SIB memory by running a checkerboard test (writing to each register of each port with the Memory Diagnostic bit set and then cleared) and an address test. The SIB memory is used as the DMA registers for the I/O ports.

Test 7.   LYNX BUS SEQUENCING -- Single-steps the Lynx Bus State Machine and then checks the state after each cycle. An error message is output if the test fails.

Test 8.   DMA TIMEOUT -- Tests the Lynx Bus timeout logic, which terminates the wait for either BusEnd from the Lynx Bus, or HALT from the DMA state machine. The timeout occurs when the Lynx Bus handshake does not finish in the required time limit.

Test 9.   BOARD ENABLE -- Tests the board enable logic that is on the SIB section of the ATP. This logic includes the board enable register and the Lynx Bus State Machine. The tests are as follows:

1) An INIT command is issued to clear the board.

2) The Diagnostic Control Register is set up to single-step and turn LOOPEN off.

3) Single-steps the board and checks that the FPLA (Lynx Bus State Machine) cycles between States 0 and 4.

4) Enables the board by writing to Register 8, the Board Enable Register.

5) Single-steps to make certain that the Lynx Bus State Machine goes to State 1 after State 4.

6) Turns on LOOPEN and completes the Lynx Bus Cycle.

Test 10.   PORT POINTER -- Tests the Port Pointer logic. This is done as follows:

1) An INIT command is issued to clear the board.

2) Sets up the Diagnostic Control Register for single-stepping and LOOPEN off.

3) Sets up an illegal port pointer in the Port Pointer Register (8).

4) Single-steps the Lynx Bus State Machine and checks that BUSGO is not asserted.

5) Waits an appropriate amount of time and checks that a timeout has occurred. The Lynx Bus State Machine waits for the handshake in reply to the BUSGO.

Test 11.   FREEZE BIT -- Tests the actions of the freeze bit of Register !A (the Diagnostic Control Register). This bit causes the Lynx Bus State Machine to cycle between states 0 and 4, and causes the PCCs to halt.

Test 12. LYNX BUS BUFFERS -- Tests the Lynx Bus buffers. It uses DMA test code to write data to the Lynx Bus and read the looped back data. Then the looped back port pointer data is checked for a match with the value written into the Port Pointer Register.

Test 13. DIRECT COMMAND -- Tests the data paths that carry a direct command to the Lynx Bus. The testing sequence follows:

1) Writes an INIT to reset the board and clear the FIFO.

2) Sets up the Diagnostic Control Register (Register !A) with timeouts disabled, ROM Test 2, LOOPEN off, and Free Running. The State Machine switches between Lynx Bus States 0 and 4 because Board Enable is off.

3) Writes an illegal port pointer to the Port Pointer Register. This prevents the Lynx Bus handshake by holding off the BUSGO signal on the ATP.

4) Issues the Direct command. This takes the Lynx Bus State Machine out of State 0.

5) The Lynx Bus State Machine then halts in State 5, waiting for a BUSEND. The BUSEND will not occur and a timeout will result, but the timeouts are disabled so that the error bits are not set. Checks that the POLL bit indicates that a direct command is being executed (POLL not active).

6) Writes to the Diagnostic Control Register (!A) and sets LOOPEN. This allows the Lynx Bus State Machine to continue and ROM Test 2 is executed, writing the Direct command back into the SIB memory where it is checked for accuracy.

Note that the Direct Command Test FAILS if the output is redirected to a printer or if the console is not on Channel 1.

Test 14. FIFO -- Tests the operation of the FIFO. It checks the following:

1) That an interrupt is not present after channel INIT;

2) that an interrupt is present after State 0 of the Lynx Bus State Machine;

3) that the interrupt is not present after Register 9 is read. A read of Register 9 clears the current interrupts.

4) That the correct port data is passed through the FIFO; and

5) that an indication is received when the FIFO is full.

The FIFO stores the number of each interrupting port and is three deep.

Test 15. DMA STATE COUNTER -- Checks that the DMA state counter increments each time until it reaches the halt command, at which point it resets to zero.

Test 16. DMA ADDRESS COUNTER -- Tests the DMA address counter by checking each bit carry as it counts.

Test 17. COMP REG/ADDR COUNTER -- Tests the DMA logic's COMP register and address counter. It loads a pattern into memory, runs the DMA test that loads the DMA registers from memory, and then runs the test which dumps the registers back into memory.

Test 18.   IMB READ -- Verifies operation during an IMB read. It uses the diagnostic DMA routine (DMA test 4) that reads a single word from the IMB and puts it in SIB RAM. The data is then checked.

Test 19.   IMB WRITE -- Verifies operation during an IMB write. It uses the diagnostic DMA routine (DMA test 5) that writes a single word from SIB RAM into main memory.

Test 20.   BEGIN FLAG/LEFT-RIGHT FLAG -- Tests the operation of the Begin Flag and Left/Right Flag Circuitry of the SIB. It uses the diagnostic DMA routine that increments the address counter a different number of times for each state of BF and LRF. It then stores the count in memory. The test is used to check that the flags are automatically updated.

3.4 ASYNCHRONOUS INTERFACE BOARD (AIB) TESTS

The AIB tests test the asynchronous interface section of the ATP card. The main program determines which ports to test and which tests are to run. The loop count is passed to Test'AIB to indicate the number of times to run each test.

The AIB tests are divided into two groups: (1) the tests that run on one port at a time, and (2) the test that runs on all of the ports to be tested (real loopback). This test section first executes the first group of tests on each port. The tests are executed the number of times specified by the loop count. The MCC Dump, PCC/MCC/MSC Self-Test, MCC-PCC Communications, Modem Signal and Modem Port Addressing tests execute the number of times specified by the loop count if a modem port is specified to be tested. Finally, the real loopback test is executed on all selected ports. After the testing is completed, a report is printed that indicates the ports which passed and failed.

Test 21.   PCC SELF-TEST -- Performs a self-test on one port and checks the results returned from that port's PCC. It checks:

1) That an interrupt is received;

2) that it is the correct interrupt;

3) that the interrupt came from the correct port;

4) that the correct number of bytes were transferred; and

5) that the results of self-test are correct.

Test 22.   PCC DUMP -- Checks the operation of a dump on a PCC. It returns a logical value to indicate that the test passed. It performs the following:

1) The Read Data DMA pointers for the port that is being dumped are set up.

2) A Halt I/O is sent to the port so that the initiation of the dump will be controlled by a later Start I/O.

3) A Freeze Port and a Start I/O are performed to initiate the dump.

4) Checks are made to insure that an interrupt occurred, that it was the correct one, and that it came from the correct port.

Test 23. PCC/MCC/MSC SELF-TEST -- Initiates a self-test of the MCC, PCC, and MSC if any modem port is to be tested. The self-tests are initiated by disabling the MCC and MSC and then issuing an MCC self-test control order to set the most significant bit. This routine waits for an interrupt, checks that it is the correct one (15), and checks that it came from the port that had been sent the control order. Finally, the pass/fail bit of each byte returned is checked for any problems during self-test.

Test 24. MCC DUMP -- Checks the operation of an MCC dump if any modem port is to be tested. The dump is performed by first issuing a Freeze Modem Direct command and then starting a Dump MCC/MSC control program. The interrupt code is 19 (PCC or MCC/MSC dump completed). If the interrupt is correct, the beginning of the MCC and MSC dump areas are checked for MCC error codes that indicate problems while dumping MCC/MSC. The error code in MCC dump will be Non-Maskable Interrupt In Progress. The error code in MSC will be Link Error.

Test 25. PCC-MCC COMMUNICATION -- Tests the communication between the PCC and the MCC if any modem port is to be tested. It requests a dump of the MCC/MSC without having issued a modem disable. The PCC sends a single byte to the MCC that rejects the request. The expected interrupt is the same as that for a successful dump (19). The receive buffer contains the MCC's error code "invalid PCC message".

Test 26. DIAGNOSTIC LOOPBACK -- Executes the PCC's diagnostic loopback test. The diagnostic loopback control is used to test the hardware path from main memory to the PCC and back to main memory. A block of 256 characters are read by the PCC from main memory and then are written back into memory. The PCC checks that each byte is one greater than the previous byte and will interrupt if an error is detected. This routine verifies the data that is written back into memory by the PCC. It also checks that a valid interrupt is received from the correct port and that the correct number of bytes are transferred.

Test 27. BAUD RATE -- Tests the baud rate logic on the AIB section of the ATP. It tests the baud rates one port at a time by testing how long it takes to do a blind write of a given number of characters. The baud rate is calculated and compared to an acceptable range. If it falls outside the given range, an error is reported.

Test 28. MODEM SIGNALS -- Performs a loopback of the modem control signals on a modem port. For each pattern to be tested, a control program is created and sent to the PCC. This control program consists of a Set Port Protocol control order followed by a Set Modem Controls control order followed by a Perform I/O control order. The pattern to be looped back is placed in the output field of the Set Modem Controls order. These outputs will be looped back to the inputs by the loopback hood. To guarantee that a modem change interrupt occurs immediately after the Perform I/O is executed, the reference mask is set to the complement of the outputs and the control mask is set to FF. This routine also checks that the interrupt actually occurred and that it came from the correct port. TICDIAG tests the DCD, RI, DSR and CTS input modem signals and the DTR and RTS output modem signals.

Test 29. MSC PORT ADDRESSING -- Tests the addressing of a modem port by the MSC. In the first part of the test, a control program that contains the Set Modem control order is used to set the modem outputs for each port to that port's address. A loopback hood loops back the outputs to the modem inputs. In the second part of the test, a Read Modem Inputs control program reads back the inputs from each port. If an addressing error has occurred, it is detected when the wrong address is read from one or more ports.

Test 30. REAL LOOPBACK -- Executes a loopback through a fitted loopback hood. The AIB main procedure initiates the test by starting a control program for each port to be tested. This control program contains a Perform I/O control order that specifies concurrent read/write without flush. These control programs will generate interrupts that are then processed by this routine. If no interrupts occur before a timer expires then errors for all ports with pending control programs are reported. If an interrupt does occur, the cause of the interrupt is checked. Next, the Receive Buffer is checked to make certain that it matches the Send Buffer. Because the Perform I/O is done without flush, the Receive Buffer may begin with some data from the previous operation. The last step is to try to find individual ports that have not interrupted in a long period of time. This is done by maintaining a timer for each port. The timers for all ports are decremented each time any port interrupts. If the timer for a port reaches zero, an error is reported on that port. Note that if this test is selected with other AIB tests then it is not executed until the other tests have successfully completed.

4.1 ERROR MESSAGE DISCRIPTION

TICDIAG traps many errors that would normally result in interrupts and system failures. In many cases, the TICDIAG program creates the circumstances in which these errors occur.

Each failure detected by TICDIAG results in an error message. The error message contains the following information:

1) the test that detected the error;

2) the symptoms of the error (e.g. incorrect register contents);

3) the functional block of circuitry that failed; and

4) an error number that indexes the possible failed component(s).

EXAMPLE:

```
Lynx bus logic not in state 000 after INIT.
Current State is:  001.
LBus State Machine/Reset Logic failure.
Error number 22.

Lynx Bus Sequencing test failed.
```

If an error occurs during execution of TICDIAG and it is not an error trapped by the TICDIAG program, a DUS error message is displayed. This should only occur under unusual circumstances (e.g. some part of the system other than the ATP under test failed to function properly).

HEWLETT
PACKARD