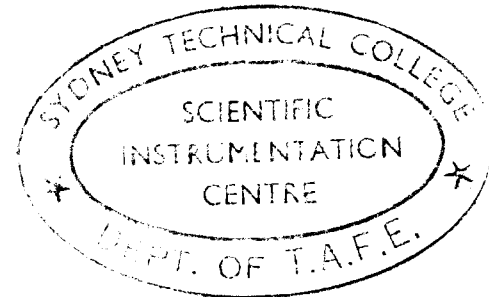ABSOLUTE BINARY PROGRAM NO. 92900-16001
DATE CODE 1814

HP 92900B
DATA CAPTURE/DATA RETRIEVAL
TERMINAL SUBSYSTEM DIAGNOSTIC

reference manual

For HP 2100A/S and HP 1000 Series Computers

**HEWLETT
PACKARD**

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```

1-1 GENERAL INFORMATION

The HP 92900B Diagnostic verifies proper operation of the 92900B
Data Capture/Data Retrieval Terminal Subsystem (40280A Controller
Interface and 3070A or 3070B associated terminals) used with HP
2100A/S or 1000 Series Computers. The basic I/O portion of the
card and most functions of the subsystem are exercised. Some
tests are provided to allow verification of the installation.

1-2 REQUIRED HARDWARE

The minimum required hardware consists of the following:

-   An HP 2100A/S or 1000 Series Computer with a minimum of 16K
    bytes of memory.

-   An HP 40280A Serial Link Controller.

-   An HP 3070B Terminal.

-   A loading device for loading the diagnostic program.

-   A system console device is optional but recommended for message
    and error reporting.

-   An HP 92900-60000 test cable or user installation cable set-up
    with 92901A connection boxes.

-   An HP 03070-60007 Terminal to HP-IB link cable.

1-3 REQUIRED SOFTWARE

The required software consists of the following:

-   Diagnostic Configurator, part no. 24296-60001.

-   Diagnostic Configurator Manual, part no. 02100-90157.

-   HP 92900B Subsystem Diagnostic, part no. 92900-16001.

-   HP 92900B Subsystem Diagnostic Manual, part no. 92900-90003.

The Diagnostic Serial Number (DNS) is contained in memory location
126 of the program. The DSN for this program is 104117.

1-4   TEXT CONVENTIONS

All halt codes, select codes, and addresses mentioned in this
manual are octal unless specifically shown otherwise.

```
-----------------------------------------------------------------
|                                             |   SECTION   |
|               PROGRAM ORGANIZATION          | ----------- |
|                                             |     II      |
-----------------------------------------------------------------
```

2-1 ORGANIZATION

This diagnostic program contains an initialization section, a
control section, twelve standard tests and three optional tests.
The tests are called in execution as sequential or selected
subroutines.

NOTE

When a test runs differently for a 3070A, the
differences are specified with a ###NOTE###.

The following functions are placed under test by this diagnostic:

- Flag and Control (Basic I/O)   TST 00
- Controller and RAM alone   TST 01
- Communication Module (ISP)   TST 02
- Self Test   TST 03
- Terminal Functions   TST 04
- Prompting Lights   TST 05
- Display   TST 06
- Keyboard Keys   TST 07
- Special Function Keys   TST 10
- Printer   TST 11
- Multifunction Reader   TST 12
- Serial LINK Address Test   TST 13
- Cable Quality and Transmission Test   TST 14
- Extended Cable/Controller Test   TST 15
- Total Installation Test   TST 16

2-2 TEST CONTROL AND EXECUTION

The program executes the tests according to the options selected
in the S-register by the operator. The control section mainly
supervises S-register bits 15, 13, and 12.

The program also keeps count of the number of passes that have
been completed and will load the A-register with the pass count at
the end of each pass.

The count is cleared whenever the program is restarted. The sections are executed, one after another, in each diagnostic pass (sequentially or selectively according to operator intervention).

2-3   SELECTION OF TESTS BY OPERATOR

User selection or default will determine which test sections will be executed. The operator may select his own test(s) for execution via S-register bit 9. Paragraph 3-3 outlines the test section.

2-4   MESSAGE REPORTING

There are two types of messages - error and information. Error messages are used to inform the operator of a failure within the hardware. Information messages are used to inform the operator of the progress of the diagnostic or to instruct the operator to perform some operation related to the unit's function.

An associated halt will occur to allow the operator time to perform the function; the operator must then press RUN.

When a console device is used, the printed message is proceeded by an E (error) or H (information) letter prefix and a number (octal). The number is the same as the last two octal digits of an associated halt code.

Example: Error with halt
           Message: E 001
           Halt code: 102001 (T-register)

Example: Information with halt
           Message: H 027
           Halt code: 102027 (T-register)

Example: Information without halt
           Message: H 054
           Halt code: None

Error messages can be suppressed by S-register bit 11 and error halts can be suppressed by S-register bit 14. Information messages are suppressed by S-register bit 10.

2-5   PROGRAM LIMITATIONS

Interface capability for receiving, passing, and denying priority (priority string logic) is not completely checked by this diagnostic. If the interface does not receive priority (i.e., PRM from the next lower select code) an error E014 (NO INT) will

occur. To check this, remove an interface of a lower select code and run the basic I/O test. The above mentioned error should occur. Checking the interface capability to pass or deny priority is beyond the scope of this diagnostic. Also the Direct Memory Access (DMA) or Dual Channel Port Controller (DCPC) portion of the interface is not tested by this diagnostic. Finally, it does not test HP-IB beyond the terminal.

3-1   RUNNING THE DIAGNOSTIC

NOTE

1. TST 01 must be run either with no terminal
    connected to the Serial LINK or with all
    connected terminals switched off.

2. TST 02 through TST 12 and TST 14 must be
    run with one terminal having its Serial
    LINK address set to 63 (77 octal).

3. The tests TST 13 and TST 15 can be run
    with one terminal having its Serial LINK
    address defined by the user.

4. TST 16, and ONLY TST 16, can be run with
    more than one terminal switched on the
    HP-IB LINK at any given time. Each
    terminal address is either defined by the
    user for the diagnostic or can correspond
    to "real" use.

A flowchart of the operating procedure is provided in figure 3-1.

The diagnostic must be configured with the 40280A Controller
Interface select code and the transfer rate clock under test.

The diagnostic will execute according to the options selected in
the S-register. By default, TST00 through TST13 are executed with
the HP-IB Keyboard/display address set to 35. Refer to Section IV
for diagnostic messages and halt codes, and for test descriptions
and execution times.

At the completion of each pass of the diagnostic, the pass count
is output to the A-register for operator information.
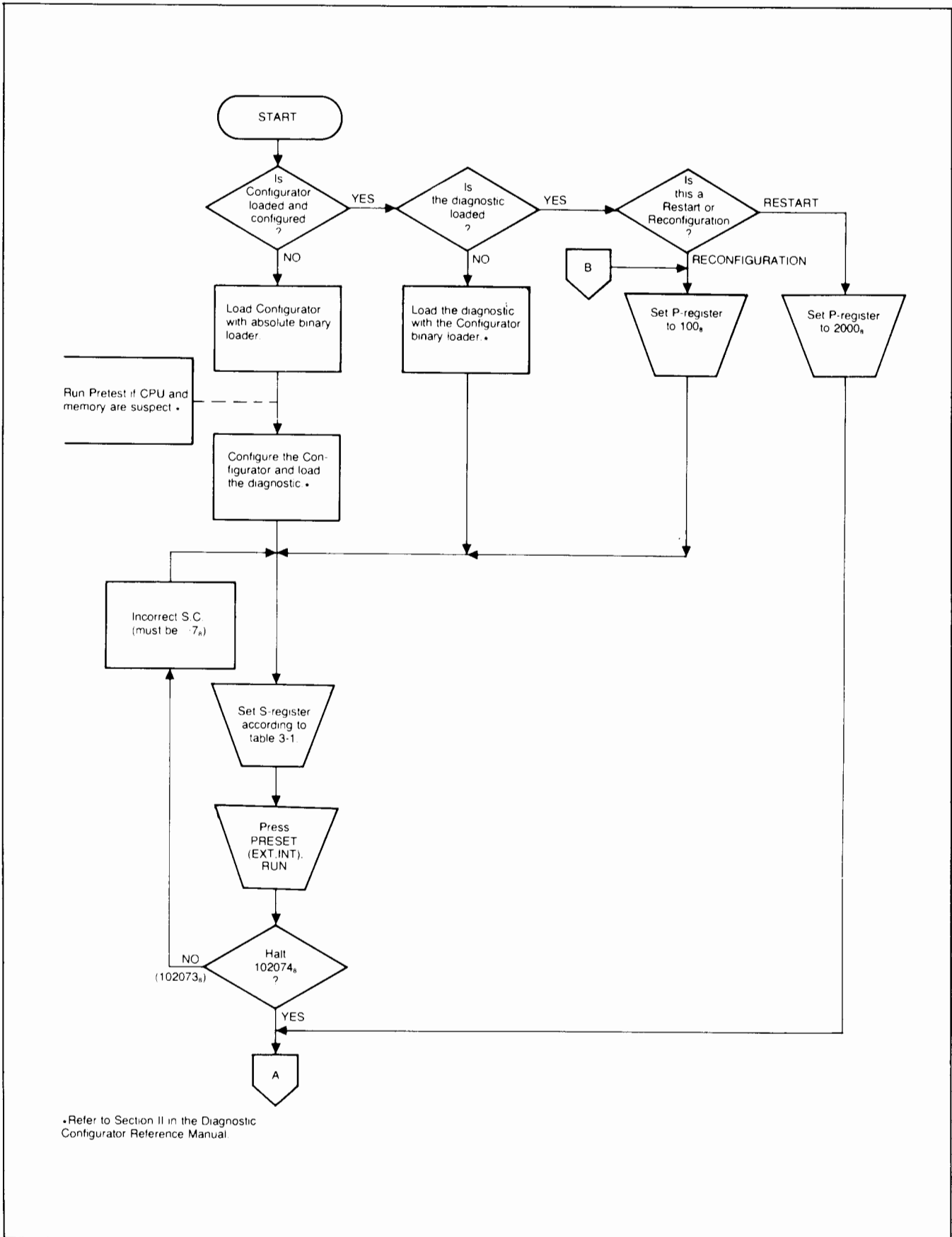
Figure 3-1. Operating Procedure Flowchart (Sheet 1 of 2)
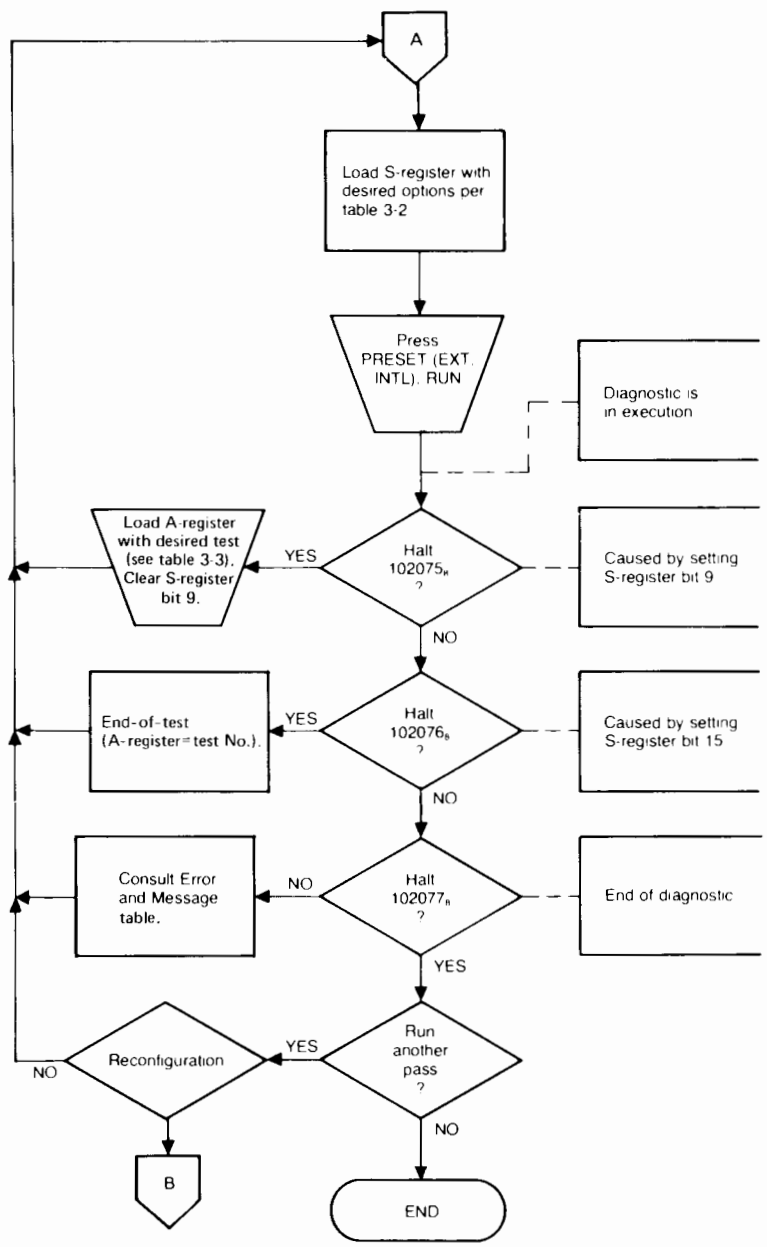
Figure 3-1. Operating Procedure Flowchart (Sheet2 of 2)

7700-44

3-2 RESTARTING

The program may be restarted by setting the P-register to 2000,
selecting the desired program options per table 3-2 in the
S-register, and pressing PRESET, RUN. The program may be
reconfigured and restarted by setting the P-register to 100,
setting the S-register according to table 3-1 to select the
program configuration, and pressing PRESET, RUN. (Refer to figure
3-1.)

3-3 TEST SELECTION BY OPERATOR

The control portion of the program allows the operator to select a
test, or sequence of test to be run. The operator sets the
S-register bit 9 and presses RUN. If the computer is running when
bit 9 is set, the test in progress is completed and the computer
will halt with 102075. The operator loads the A-register with the
tests defined per table 3-3. If the A-register is cleared, the
default set of tests (TST 00 through TST 13) are run.

After selecting the desired tests, the operator must clear
S-register bit 9 and press RUN. The operator selected tests are
then executed. (If bit 9 is not cleared, the computer will again
halt with 102075.)

Table 3-1 Program Configuration S-Register Settings.

```
--------------------------------------------------------------------
| Bits     Function                                                 |
|------------------------------------------------------------------ |
| 0-5      Enter the select code of HP 40280A Serial Link           |
|          Controller.  This must be an octal number greater        |
|          than 7 and less than or equal to 77.                     |
|                                                                   |
| 7-6      Transfer Rate Clock:                                     |
|                                                                   |
|          0 0       Standard 200 kHz                               |
|          0 1       100 kHz clock                                  |
|          1 0       Standard 200 kHz                               |
|          1 1       400 kHz clock                                  |
|                                                                   |
| 8-15     Reserved                                                 |
--------------------------------------------------------------------
```

Table 3-2 S-Register Program Options

```
-------------------------------------------------------------------
| Bits     Meaning if set                                         |
|-----------------------------------------------------------------|
| 0-6      HP-IB keyboard/display address for tests TST 02        |
|          through TST 15 (defaulted to 35 if S-register equals   |
|          0).  Highest Serial LINK address to be polled during   |
|          TST 16 (defaulted to 77 if S-register equals 0).       |
|          HP-IB keyboard/display address must be set to 35 for   |
|          for all terminals during TST 16.                       |
|                                                                 |
| 7        Abort current test and continue the diagnostic         |
|          sequences.                                             |
|                                                                 |
| 8        Suppress tests requiring operator intervention (tests  |
|          are entered and immediately exited).                   |
|                                                                 |
| 9        Select a particular set of tests.  When a test is      |
|          currently executing*, bit 9 set aborts diagnostic      |
|          execution at the end of current test section and halts |
|          102075.  User may specify a new group of tests in the  |
|          A-register (see table 3-3).  Clear S-register bit 9,   |
|          and press RUN.                                         |
|                                                                 |
| 10       Suppress non-error messages.                           |
|                                                                 |
| 11       Suppress error messages.                               |
|                                                                 |
| 12       Loop on diagnostic and suppress tests requiring        |
|          operator intervention.  Message "Pass XXXX" is printed |
|          if a console is present and bit 10 is clear.           |
|                                                                 |
| 13       Repeat last test executed (loop on test).              |
|                                                                 |
| 14       Suppress error halts.                                  |
|                                                                 |
| 15       Halt 102076 at the end of each test.  The A-register   |
|          contains the test number in octal.                     |
|-----------------------------------------------------------------|
|                                                                 |
| (*) If computer is not running, press RUN to get halt 102075.   |
-------------------------------------------------------------------
```

Table 3-3 A-Register Test Selection Summary

```
---------------------------------------------------------------------
| A-reg bit       If set will execute                                |
|-------------------------------------------------------------------|
|     0           TST 00     Basic I/O                               |
|     1           TST 01     Controller test                        |
|     2           TST 02     Communication module test              |
|     3           TST 03     "Self-Test" test (3070B only)          |
|     4           TST 04     Terminal functions test               |
|     5           TST 05     Prompting lights test                  |
|     6           TST 06     Display test                           |
|     7           TST 07     Keyboard Test                          |
|     8           TST 10     Special function key test              |
|     9           TST 11     Printer test                           |
|    10           TST 12     Multifunction reader test             |
|    11           TST 13     Address test                           |
|    12           TST 14     Cable test                             |
|    13           TST 15     Extended cable/controller test        |
|    14           TST 16     Total installation test               |
|    15           Not used                                          |
|                                                                    |
| B-reg bit                                                          |
|   0-15          Not used                                           |
|-------------------------------------------------------------------|
| Note:  If the A-register is cleared, the default set of tests     |
|        (TST 00 through TST 13) are run.  TST 14 through TST        |
|        16, which are optional, are not run.                        |
---------------------------------------------------------------------
```

4-1   GENERAL

The tests in this diagnostic are described in the following
paragraphs.

Figure 4-1 illustrates the command formats and interface link
status for each terminal data transfer table word. Table 4-1
summarizes halt codes. Table 4-2 provides additional details on
the content of each test and messages/halts signification. Table
4-3 contains the various test execution times.

4-2   BASIC I/O TST 00

Subtest 1

Checks the ability to clear, set and test the interrupt system.
The following instruction combinations are tested:

CLF 0 - SFC 0
CLF 0 - SFS 0
STF 0 - SFC 0
STF 0 - SFS 0

Errors in the above sequence produce error messages E000 - E003 as
shown in table 4-2.

Subtest 2

Checks the ability to clear, set and test the interface Flag. The
following instruction combinations are tested:

CLF SC - SFC SC
CLF SC - SFS SC
STF SC - SFC SC
STF SC - SFS SC

Errors in the above sequence produce error messages E005 - E010 as
shown in table 4-2.

Test Descriptions

Subtest 3

Checks that the test select code does not cause an interrupt with
the Flag and Control set on the interface, and the interrupt
system off. The sequence of instructions is shown below:

```
STF  0
STF  SC
STC  SC
CLF  0
```

The CLF 0 instruction should inhibit an interrupt from occuring.
Error message E004 occurs if CLF 0 fails.

Subtest 4

Checks that the Flag of the interface under test is not set when
all other code Flags are set. Error message E011 occurs if a Flag
is set incorrectly.

Subtest 5

Checks the ability of the interface to interrupt. With the Flag
and Control set and the interrupt system on, there should be an
interrupt from the Select Code. If not, error message E014 occurs.
Check that the interrupt occurred where expected. The interrupt
should not occur before a string of priority affecting
instructions are executed. The following instructions are used to
check the hold-off operation:

```
STC  1
STF  1
CLC  1
CLF  1
JMP  *+1,I
DEF  *+1
JSB  *+1,I
DEF  *+1
NOP
```

Error messages E012 and/or E015 will occur if the hold-off fails.
This test also checks that another interrupt does not occur when
the interrupt system is turned back on. Error message E013 will
occur if an interrupt does occur. Check that no instruction was
missed during the interrupt (E026 INT EXECUTION ERROR).

Subtest 6

Check that with the interrupt system on and the SC Control and
Flag set, there is no interrupt following a CLC SC instruction.
The following sequence of instructions are used:

STC SC
STF SC
STF 0
CLC SC

If the CLC SC fails to inhibit an interrupt, error message E016
occurs.

Subtest 7

Checks that the CLC 0 instruction inhibits interrupts when the SC
Control and Flag are set. The following sequence of instructions
are used:

CLF SC
STC SC
STF SC
STF 0
CLC 0

If the CLC 0 fails to inhibit an interrupt, error message E017
will occur.

Subtest 8

Checks that the PRESET (EXTERNAL and INTERNAL if applicable)
switches on the operator panel perform the following actions:

1. Sets the interface Flag (EXTERNAL)
2. Clears the interface Control (EXTERNAL)
3. Turns off the interrupt system (INTERNAL)
4. Clears the I/O data lines (EXTERNAL).

4-3   CONTROLLER TEST (TST 01)

This test exercises the RAM, shifters, serializer, flowcharts
(main, input, link) and input circuits. Total execution time: 5
seconds. There is no checking of the synchronization, cyclic
redundancy checking, line drivers and input synchronization
circuits.

The test is run with either no terminal connected to the Serial
LINK, or all terminals connected are powered off. The test sends
data patterns to the controller, simulating a transfer. Data
patterns are stored in the controller's RAM, serialized and sent
back to the CPU. Contents are checked against initial patterns.
Some hardware flowcharts are exercised on the controller at the

same time. Upon error detection a halt (102036) occurs. B-register
contains faulty RAM address as indicated on the console's message;
after pressing RUN a second halt (102037) occurs with the actual
pattern in A-register and the expected pattern in B-register.
According to the nature of the problem (lost bits and number of
address in error) it is possible to localize the defect on the
controller.

<center>NOTE</center>

> The test must be run with all terminals OFF
> (or with controller alone) because the
> acknowledgement bit (OK bit) must return with
> a logical zero level.

4-4   COMMUNICATION MODULE TEST (TST 02)

This test is run with one terminal and its Serial LINK address set
to 77 (octal). This terminal should be connected to the computer
via the test cable (HP part no. 92900-60000). This test verifies
that the communication module is operating correctly in both
output and input modes for commands or data. Each output is a
different pattern of all possible combinations of bits (from
110000 to 114000) and alternates with an input. In case of error,
a halt occurs (see table 4-2) and an error message is given with
the terminal address found in error in the B-register. After
pressing RUN a second halt occurs. A-register contains the actual
data and B-register the expected data. The execution time is 5
minutes. To shorten this test section, set S-register bit 7.

4-5   SELF-TEST TEST (TST 03)

<center>###NOTE###</center>

> There is no self-test check for a 3070A since
> this function is not implemented in this
> terminal.

This test is run with the same set-up as for TST 02. This test
triggers the self-test with the remote command and waits until
self-test completion, then gets and analyses the status byte. The
test completes without a message if the status byte is OK.

4-6   TERMINAL FUNCTION TEST (TST 04)

This test is run with the same set-up as for TST 02. This test
exercises the main functions of the terminal which are;
configuration and deconfiguration of display and communication
module as listeners, the keyboard as a talker, the ability to send
an SRQ, the ability to stay in Idle state, and reset on the IFC
command.

A first halt (102042) is an indication to the user to verify that
the display is clear and the keyboard is configured. If yes, press
RUN. A second halt (102043) is an indication to ensure that the
keyboard is deconfigured If yes, press RUN. After halt 102044,
press RUN and type up to 15 characters on the keyboard, than
terminate by ENTER. After ENTER is pressed, a halt 102045 occcurs.
Ensure that the display is cleared. If yes, press RUN. Previous
typed characters will be displayed.

After halt 102046, press RUN and type up to 15 characters within
15 seconds. After this delay, if no errors are detected, a halt
102047 occurs. Press the Service Request key within 15 seconds. If
no errors are detected, test TST 03 completes. (Errors are data
received when not expected or allowed.)

4-7 PROMPTING LIGHTS TEST (TST 05)

This test is run with the same set-up as for TST 02. This test
verifies proper operations of the prompting lights. It exercises
the unique relationship between a specific "ON" command and the
associated light with all lights off, and a specific "OFF" command
and the associated light with all lights on. The user must check
that a specific "ON" command of the sequence does not turn-on
other lights, and that a specific "OFF" command does not
extinguish other lights.

4-8 DISPLAY TEST (TST 06)

###NOTE###

    The 3070A display is 16 digits long hence,
    there is no display of the full line of "-"
    characters.

This test is run with the same set-up as for TST 02. This test
allows a visual check of each possible digit, and at the same time
verifies the ability to display variable line length and listen
configuration/deconfiguration capability. The user checks the
proper execution in the following sequence:

 - Display of a full line of "8" characters.

 - Display of a full line of "-" characters.

 - Display of variable length lines (character "8" goes from right
   to left, preceeded by "-" character).

 - Display of a full "." line.

 - Display of a line with all the displayable characters
   (123456789 -.E).

At the end, a halt 102057 prompts the user to ensure that the display is cleared and remains clear while the test writes on the deconfigured display. Test completes on halt 102060.

4-9   NUMERIC KEYPAD TEST (TST 07)

This test is run with the same set-up as for TST 02. This test exercises the keyboard keys and the keyboard talker function by control of:

- Absence of keyboard deconfiguration between two characters input.

- Keyboard deconfiguration (or disabled) after ENTER code keying.

- Proper character code generation.

The terminal display prompts the operator with the key to be pressed, and displays the received code. If an error is detected, "EE" is displayed. The indicated key has to be pressed after the keyboard is enabled for input (WAIT light off). The order of pressing is:

         0,1,2,3,4,5,6,7,8,9,.,-, DELETE, ENTER.

The operator must then key-in a data sequence (numerics in ascending order, starting with 0 up to a maximum of 9) terminated at any time with ENTER (e.g. 0,1,2,3,4,ENT). This must be executed twice, after the buzzer has sounded and the keyboard is enabled (WAIT light off).

                      ###NOTE###

        The last two inputs are not made with a 3070A.
        Keyboard is enabled when the green READY light
        is on.

4-10   SPECIAL FUNCTION KEYS TEST (TST 10)

                      ###NOTE###

        3070A SFK's are numbered from 1 to 10
        according to the diagram below.

| ----- | ----- | ----- | ----- | ----- |
1	2	3	4	5

| ----- | ----- | ----- | ----- | ----- |
6	7	8	9	10

The second part of the test is not executed since SFK's cannot be locally programmed as input terminator(s).

This test is run with the same set-up as for TST 02. This test is based on the same scheme as for the keyboard test and the operator has to press the keys in a given order. A prompting light is turned on to indicate which SFK the user has to press. If the code received is not correct, "EE" is displayed. Otherwise, the next prompting light, corresponding to the next SFK to be pressed, is turned on. In order to light prompting light number 10 the SFK's must be pressed in the following sequence:

    SFK 2,3,4,...,10,11.

3070B SFK's are numbered as shown below:

```
-----    -----    -----    -----    -----
  2        3        4        5        6
-----    -----    -----    -----    -----


-----    -----    -----    -----    -----
  7        8        9       10       11
-----    -----    -----    -----    -----
```

Test of enabling any SFK as input terminator is done sequentially. The order in which these keys are to be pressed is indicated by the prompting lights as described above.

4-11 PRINTER TEST (TST 11)

This test is run with the same set-up as for TST 02. It can only be run with a standard HP 3070B or one with option 002; if not, the test is skipped. This test exercises all the features of the printer in the following manner.

 - End of paper detection after halt 106001.

 - Paper right after halt 106002.

 - Automatic printing after receipt of 20 characters (halt 106003).

 - Double buffer to store a line while another line is being printed (halt 106004).

 - Buffer printing upon receipt of the terminator character (Line Feed) (halt 106005).

 - Line feed upon receipt of the terminator character (halt 106006).

 - Printer buffer cleared by delete character (halt 106007).

Test Descriptions

- Printer buffer cleared by Device Clear Command (halt 106006).

- The complete 64-character set from SPACE(40[8]) to UNDERLINE(137[8]).

The test completes after the last 106006 halt.

The Printer Test listing is listed below:

```
   !"#$%&´()*+,-./0123
   456789:;<=>?@ABCDEFG
   HIJKLMNOPQRSTUVWXYZ[
   ~]{}

   ABCD
```

4-12   MULTIFUNCTION READER TEST (TST 12)

This test is run with the same set-up as for TST 02. It can only be run with a standard HP 3070B. This test exercises the major functions of the multifunction reader in the following manner:

- The display shows the card # to be introduced. The minus character indicates that the card must be fed-in backwards (by its trailing edge, with the cut corner always to the left).

- Card 1 must be introduced twice. The first pass tests clock after data, marks, 80-column density, image mode, and the second pass tests the Device Clear.

- Card 2 must be introduced three times. The first pass tests no clock, holes, 80-column density, and ASCII mode. The second pass tests clock on data, holes, 80-column density, ASCII mode both with trailing blanks suppression. The third pass tests no clock, holes, 80-column density, ASCII, reject disabled mode when card is entered backwards.

The test completes after the fifth card read with no message.

4-13   ADDRESS TEST (TST 13)

This test is run with one terminal connected to the computer via the test cable (HP part no. 92900-60000). The terminal must be turned on and its Serial LINK address set to any value between 1 and 77 octal.

The test checks for proper operation of the terminal addressing process. The operator sets an address during a halt, than presses RUN. The terminal display indicates the address of the responding terminal while information is sent to the prompting lights 100 times. A halt then occurs to allow a change of address on the terminal, and shows the last address tested in the A-register. It

is recommended to first test addresses 21 and 42 (decimal) [25 and 52 (octal), 010101 and 101010 (binary)].

To abort this test section, set bit 7 on S-register.

4-14 CABLE TEST (TST 14 OPTIONAL)

This test is run with only one terminal connected to the Serial LINK under test. The terminal is switched on. The terminal address must be set to 77 (octal).

The test is made to measure the quality of transmission on a given cable. While the test runs, the terminal displays the number of retransmission requests for the last thousand outputs and the total number of retransmission tests (both quantities in octal). Quantities are updated every thousand transmissions.

```
+---------------------------------------------+
|     XXXX                        XXXX        |
+---------------------------------------------+
 Retransmission          Total retransmission
 requests (octal)        requests
 for the last
 1000 outputs.
```

Typically the transmission rate should not exceed 0.5% in a low electrical noise environment and with a short Serial LINK cable (~50 feet).

To abort test, set bit 7 of S-register.

4-15 EXTENDED CABLE/CONTROLLER TEST (TST 15 OPTIONAL)

This test is run with only one terminal, under test, connected to the Serial LINK. The terminal is switched on and its address is set to any desired value between 1 and 77 (octal).

This test allows verification of the resynchronization function of the controller refered to as Perfect bit detection (page 4-1 of the 40280A Controller Manual, reference number 40280-90001). A failure on the Perfect bit detection can be interpreted by the user as a non-response of the addressed terminal at specific locations along the HP-IB LINK (muting zones).

The operator presses RUN, the terminal address is displayed and the keyboard configured. The operator keys-in up to 15 characters plus ENTER within 15 seconds. The keyboard input passes through the cable, the controller, to the CPU and returns to the terminal to be displayed along with the terminal address. The operator may now select a new address or a new position on the LINK and enter new data. The first data character received by the CPU generates a halt with an error message due to the address change. To continue

this test and to verify proper operation of this new installation, press RUN. To abort this test section, set S-register bit 7 and press ENTER.

4-16 TOTAL INSTALLATION TEST (TST 16 OPTIONAL)

NOTE

For this test the HP-IB keyboard/display
address, switch S2, must be set to 35 octal.

This test allows verification of simultaneous operation of up to 63 terminals connected to the same Serial LINK in the following manner:

 - Detects service request from any terminal keyboard.

 - Clears the request via a Serial Poll sequence.

 - Turns ON, then OFF, all prompting lights.

 - Displays terminal LINK address.

 - Configures the terminal for input keying.

 - Accepts input from:

   - An SFK. Corresponding prompting light is turned on from a CPU command.

   - A numeric data terminated by Line Feed generated by ENTER key. Upon receipt of a Line Feed, data is sent back to the terminal's display.

   - The DEL and ENTER key sequence of characters. A message is sent to the printer (if present) which indicates: either to press the SRQ key to restart, if there is no multifunction reader or to read a document from the reader according to its configuration switch S3. If the 3070B does not have a printer this last sequence does not function.

###NOTE###

Test of a 3070A is equivalent to a 3070B
option 003 (e.g. without printer and
multifunction reader).

 - Deconfigures the terminal and waits for another service request. THIS TEST ALLOWS A COMPLETE INSTALLATION CHECK WITHOUT THE NEED FOR A CONFIGURED RTE SYSTEM).

- Running this test:

    - Once the test has been selected from the S-register (see
      paragraph 3-3 and table 3-3) the computer halts with
      T-register = 106032. Operator sets the A-register to define
      the highest terminal address to be polled on the HP-IB LINK in
      bits 5-0, then presses RUN.

    - Each terminal is tested by pushing the Service Request key and
      following the sequence described above.

    - To abort this test, set S-register bit 7 to 1.

Table 4-1 Data Transfer Table Word Format

```
+------------------------------------------------------------------------------,
  OUTPUT WORD
    15   14   13   12  11  10   9    8   7   6   5   4   3   2   1   0
  +---------------------------------------------------------------------+
    STOP      IDLE  1  IFC  REN  EOI ATN  D   A   T   A   B   Y   T   E
  +---------------------------------------------------------------------+


  INPUT WORD (TYPE 1 Data Word)
    15   14   13   12  11  10   9    8   7   6   5   4   3   2   1   0
  +---------------------------------------------------------------------+
   STOP ACK IDLE   0        VALDA EOI ATN  D   A   T   A   B   Y   T   E
  +---------------------------------------------------------------------+


         (Type 2 SRQ Set)
    15   14   13   12  11  10   9    8                                0
  +---------------------------------------------------------------------+
   STOP ACK IDLE   0        0    SRQ
  +---------------------------------------------------------------------+


         (Type 3 Status Byte)
    15   14   13   12  11  10   9    8   7   6   5   4   3   2   1   0
  +---------------------------------------------------------------------+
   STOP ACK IDLE  0         1 |   |   |   |   |   |   |   |   |   |   |
  +---------------------------------------------------------------------+
                                 |    |   |   |   |   |   |   |
                     No SRQ  0}   |    |   |   |   |   |   |   |
                              }-----+   |   |   |   |   |   |   |
                     SRQ set  1}        |   |   |   |   |   |   |
                                        |   |   |   |   |   |   |
              Printer paper OK  0}       |   |   |   |   |   |   |
                              }--------+  |   |   |   |   |   |   |
     Printer off or end of paper  1}        |   |   |   |   |   |   |
                                           |   |   |   |   |   |   |
          Last self-test incorrect  0}       |   |   |   |   |   |
                              }-------------+  |   |   |   |   |   |
           Last self-test correct  1}          |   |   |   |   |   |
                                              |   |   |   |   |   |
             Printer buffer empty  0}          |   |   |   |   |   |
                              }----------------+  |   |   |   |   |
  Printer busy or printer buffer  1}               |   |   |   |
  not empty                                        |   |   |   |
                     No printer  0}                 |   |   |   |
                              }--------------------+  |   |   |
                        Printer  1}                    |   |   |
                                                      |   |   |
                     No reader  0}                      |   |   |
                              }------------------------------+   |
                        Reader  1}                               |
                                                                 |
                          3070A  0}                               |
                              }------------------------------------+
                          3070B  1}
  +---------------------------------------------------------------------+
```

Table 4-1 (Cont´d)
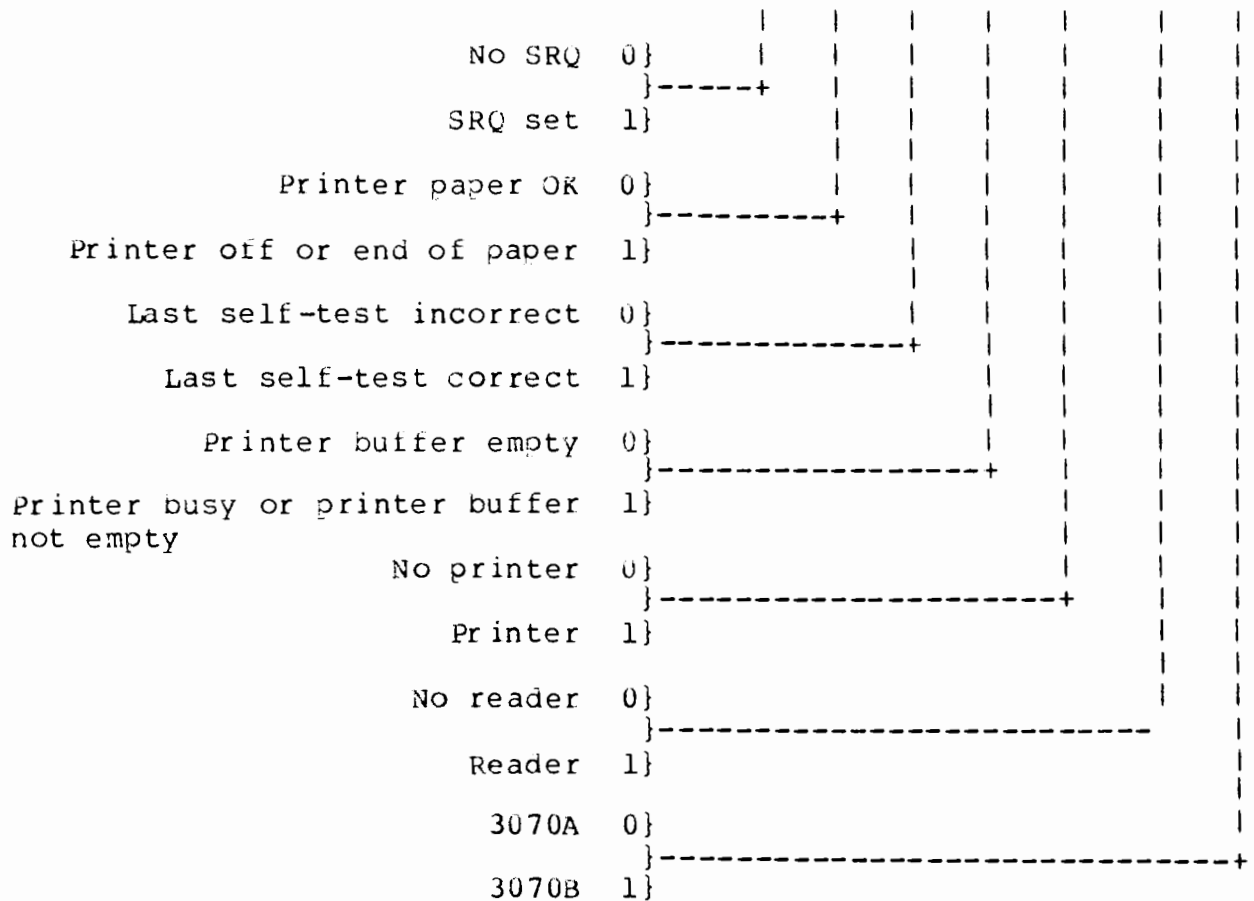+--+

STOP   = 0 last   }
          1 not last } Data Transfer Table Word

ACK   = 0 Transmission error
          1 Transmission alright

IDLE   = 1 Output: Set terminal idle
          1 Input: Terminal is idle

        = 0 Output: Set terminal working
          0 Input: Terminal is working

VALDA   = 0 No data byte transfered for this input
          1 Bit 0-9 valid and reflecting data lines plus
            control lines of HP-IB.

SRQ   = 0 No SRQ pending on HP-IB
          1 SRQ pending on HP-IB in conjunction with VALDA = 0

IFC   = 1 Causes the bus signal line IFC (Interface Clear) to
            be low on the HP-IB which unaddresses all Talkers and Listeners,
            clears the Serial Poll mode and deactivates all
            other controllers. Must be followed by an output with
            NUL data to set the IFC line high.
        = 0 Inactive.

REN   = 1 Causes the Bus signal line Remote Enable to be low on the HP-IB.
            This enables all devices on the Bus to switch to remote
            control when addressed to listen to their remote
            programming codes.
          0 Inactive.

EOI   = 1 Causes the Bus signal line End Or Identity to be low.
            This indicates that the next byte sent as a Talker is the
            last in the string or, when ATN = ´1´, initiates a
            parallel poll
          0 Inactive.

ATN   = 1 Causes the Bus line Attention to be low. This puts the
            Bus into the Command Mode which enables the computer
            to send Commands and Addresses.
          0 Allows the Bus signal line Attention to be high. This
            puts the Bus into the Data Mode so that the Talker
            may transmit data.

Table 4-1 Summary of Halt Codes.

```
+-------------------------------------------------------------------+
 Halt              Meaning
+-------------------------------------------------------------------+
 Tests 0 to 13

 102000-102067    Error(E) & Information(H) messages 00 - 67
 106000-106027    Error(E) & Information(H) messages 100 - 127

 Control
 102072           HP 3070 HP-IB address input error (see table 3-2 for
                  correct values.
 102073           Select Code input error or wrong transfer rate clock
                  setting.
 102074           Select Code input and transfer rate clock setting
                  complete.
 102075           User Test Selection Request.
 102076           End of Test (A-register = test number).
 102077           End of Diagnostic Run.
 106077           Trap Cell halts in location 2-77.
+-------------------------------------------------------------------+
 NOTE: See table 4-2 for complete explanation of individual halts.
+-------------------------------------------------------------------+
```

Table 4-2 Halts and Messages.

Halt Code	Test	Message	Comments
None	Test Control	START 92900B Subsystem Diagnostic	Header message. Output at initial start of diagnostic.
None	Test Control	Test XX	Information message before error message (XX = test number). Message occurs only once within a test and is suppressed for any subsequent messages within the same test.
102000	Test 0	E000 CLF0-SFC0	CLF/SFC0 combination failed. CLF did not clear flag or SFC caused no skip with flag clear.
102001	Test 0	E001 CLF0-SFS0	CLF/SFS0 combination failed. CLF did not clear flag or SFS caused no skip with flag clear.
102002	Test 0	E002 STF0-SFC0	STF/SFC0 combination failed. with flag set.
102003	Test 0	E003 STF0-SFS0	STF/SFS0 combination failed. STF did not set flag or SFS caused skip with flag set.
102004	Test 0	E004 CLF0 did not inhibit int.	With interface flag and control set, CLF0 did not turn off interrupt system.
102005	Test 0	E005 CLF SC-SFC SC	CLF/SFS SC combination failed. CLF did not clear flag or SFC caused no skip with flag clear.
102006	Test 0	E006 CLF SC-SFS SC	CLF/SFC SC combination failed. CLF did not clear flag or SFS caused skip with flag clear.
102007	Test 0	E007 STF SC-SFC SC	STF/SFC SC combination failed. STF did not set flag or SFC caused skip with flag set.

Table 4-2 Halts and Messages (cont'd)

Halt Code	Test	Message	Comments
102010	Test 0	E010 STF SC-SFS SC	STF/SFC SC combination failed. STF did not set flag or SFS caused no skip with flag set.
102011	Test 0	E011 STF XX Set card flag	Select Code screen test failed. A-register contains XX, where XX = select code that caused the interface flag to set.
102012	Test 0	E012 int during hold-off instr.	Interrupt occured during an I/O instruction or a JMP/JSB indirect instruction.
102013	Test 0	ER013 second int. occured	Card interrupted a second time after initial interrupt was processed and interrupt system was turned back on.
102014	Test 0	E014 no int	No interrupt occured with interface flag and control set and the interrupt system on. Ensure that each lower select code is filled with an I/O card.
102015	Test 0	E015 int RTN address	Interrupt did not store the correct return address in memory.
102016	Test 0	E016 CLC SC	CLC SC did not clear interface control with the interrupt control on.
102017	Test 0	E017 CLC0	CLC0 did not clear interface control.
102020	Test 0	E020 preset (EXT) did not set flag	Preset (EXT) did not set the interface flag.
102021	Test 0	E021 preset (INT) did not disable ints.	Preset (INT) did not disable the interrupt system.
102022	Test 0	E022 preset (EXT) did not clear control	Preset (EXT) did not clear control.
102023	Test 0	E023 preset (EXT) did not clear I/O lines	Preset did not clear I/O data lines. Data lines should be zero.

Table 4-2 Halts and Messages (Cont´d)

Halt Code	Test	Message	Comments
102024	Test 0	H024 press preset, (EXT & INT) run	Press preset (External, Internal) then RUN.
None	Test 0	H025 Basic I/O comp.	Basic I/O tests completed.
102026	Test 0	E026 int execution	Interrupt was not processed correctly and one or several instructions have been processed incorrectly during the interrupt.
None	Test 1	Test 01 Controller Test	Begin test 1 execution.
102030	Test 1	H030 terminals on LINK must be off, press RUN	All terminals connected to the LINK must be turned off (to test bit 14 returns with logic level 0 for each terminal address). Then press RUN.
102031	Test 1	H031 end test 01: set one terminal on with address 77 octal, press RUN.	End of test 1, switch one terminal on for the following tests. Address must be 63 (77 octal).
102032	Test 1	E032 flag not set within the required time	Controller flag did not set within the appropriate time delay after forced completion of a polling cycle. Controller is faulty.
102033	Test 1	E033 flag not set, should be set (input).	Controller flag did not set during OTA SC,C sequence (when transfering data from memory to controller RAM).
102034	Test 1	E034 flag not set, should be set (output)	Controller flag should be set during LIA SC,C sequence (when transfering data from controller RAM to memory).
102035	Test 1	E035 Bit 15 set in last transfer table word.	Bit 15 was set to "0" in last Transfer Table word and must remain "0". Found with logic level "1" here, controller is faulty.

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Message	Comments
102036	Test 1	E036 data received different from data sent (B= RAM address) press run.	Controller returns bad data from a RAM address (B-register = address), (A-register = bits in error), after OTA SC, LIA SC sequence. Press RUN to have more information.
102037	Test 1	E037 data received different from data sent A=received, B=sent, press run	This halt follows halt E036. A-register = Data Received. B-register = Data sent.
None	Test 2	Test 02 communication module test	Begin communication Module Test.
None	Test 3	Test 03 "Self-Test" Test	Triggers remote self-test.
None	Test 4	Test 04 terminal functions test	Begin General Funtions Test for Terminal.
102042	Test 4	H042 ensure display is cleared, press RUN.	If display not cleared, logic responding to IFC faulty. If keyboard not configured, logic responding to "configure talker" or keyboard addressing faulty.
102043	Test 4	H043 ensure keyboard is disabled, press RUN	If keyboard not deconfigured, logic responding to IFC faulty. (deconfigure talker).
102044	Test 4	H044 press run, ensure display stays clear while typing characters plus ENTER	If display not clear when typing in any characters plus ENTER, logic responding to IFC faulty. (deconfigure listener).

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Messages	Comments
102045	Test 4	H045 ensure display is clear & press run to display characters typed in	Display must be clear before pressing run because not yet configured as listener. If not display circuits or addressing faulty.
102046	Test 4	H046 press run, press any key within 15 sec.	Press RUN and type in any characters within 15 sec. To test that nothing is transmitted from the HP-IB to the Serial Link because the communication module is not configured as a listener. If not, listener of communication module faulty.
102047	Test 4	H047 press run, press service request key (golden key) within 15 sec.	Press RUN and press SRQ key to verify request is received with every thing deconfigured. If not, SRQ circuits faulty.
None	Test 4	H050 Terminal Functions Test complete.	General Test completed. (SRQ and IDLE are ok).
102051	Test 4	E051 character received with comm. module deconfigured	Communication Module not deconfigured as listener Logic responding to IFC faulty.
102052	Test 4	E052 no service request during delay	Error if service request key actually pressed (SRQ circuit faulty). Otherwise press RUN then press service request key as required.
102053	Test 4	E053 ack received when not allowed	Controller received response (bit 14) from terminal placed in IDLE STATE (bit 13). Controller or communication module faulty.
102055	Test 5	Test 05 prompting light test H055 press run, check according to manual.	Start of Prompting Light Test.

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Messages	Comments
102057	Test 6	Test 06 display test H057 press run, check according to manual	Start Display Test.
102060	Test 6	H060 ensure display is cleared & stays clear, press run	If display not clear, logic responding to "clear display" faulty. Display must stay clear because it has been deconfigured as listener.
102061	Test 6	H061 if display not clear = error, press run	If display not clear, logic responding to "deconfigure listener" or display addressing faulty.
102063	Test 7	Test 07 keyboard test H063 press run, check according to manual.	Begin keyboard test.
102065	Test 10	Test 10 special function keys test. H065 press run check according to manual	Begin Special Function Keys test.
102066	Test 10	E066 Not terminator code sent after SFK's Code	Terminal did not sent terminator after SFK's code when SFK configured as input terminator.
102067	Test 7 or 10	E067 Keyboard anti-bouncing failure	Terminal sent more than one character with the last depressed key.
102072	Test 2 to Test 15	None	Terminal HP-IB address entered in S-register bit 5 is invalid. Must be greater than 1 and smaller than 36. Re-enter a valid HP-IB address and press RUN.

Table 4-2 Halts and Messages (Cont´d)

Halt Code	Test	Messages	Comments
102073	Config.	None	I/O Select Code entered at config. is invalid. Must be greater than 7. Re-enter a valid select code and press Run.
102074	Config.	None	Select code entered during config. valid. Enter program options S-reg. and press PRESET, RUN.
102075	Control	None	Test selection request resulting from S-register bit 9 being set. Enter into A- and B-registers the desired test (S) to be run (see table 3-3). Clear S-register bit 9 and press RUN.
102076	Control	None	End of test halt resulting from S-reg. bit 15 being set. The A-Register contains the test number of the test number of the test just executed.
102077	Control	Pass XXXXX	Pass number XXXXX of the diagnostic is complete. A-Register contains the pass count equal to XXXXX, Press RUN to execute another pass.
None	Test 11	Test 11 Thermal Printer Test	Start Printer Test.
106001	Test 11	H101 Remove paper, press run.	Remove printer paper roll, or set Printer switch to OFF in order to test Terminal's ability to set "end of paper" bit in status byte.
106002	Test 11	H102 Insert paper, press run.	Insert printer paper and set Printer switch to ON in order to run the test.
106003	Test 11	H103 First line printed	Halt to check that line one is printed according to paragraph 4-11.
106004	Test 11	H104 Second and third lines printed now	Halt to check that lines two and three are printed according to paragraph 4-11.

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Messages	Comments
106005	Test 11	H105 Fourth line printed now	Halt to check that line four is printed according to paragraph 4-11
106006	Test 11	H106 Line feed now	Halt to check that printer has fed line.
106007	Test 11	H107 "ABCD" printed now	Halt to check that delete acts properly on printer buffer. Only ABCD characters must be printed.
106010	Test 11	E110, No E-O-P bit or busy bit in status byte.	End of Paper detection failure, busy bit failure, or bad terminal status report.
106011	Test 11	E111 E-O-P bit or busy bit still in status byte.	Paper present detection failure, busy bit failure, or bad terminal status report.
None	Test 12	Test 12 Multifunction Reader test.	Start of Multifunction Reader test. Insert Diagnostic Card 1 (03070-90011) and Diagnostic Card 2 (03070-90012) as required. See paragraph 4-12.
106013	Test 12	E113 Read fail = A-register received, B-register expected.	Reader did not read expected data from Diagnostic Card. Ensure card is not misfed and restart Test 12.
106014	Test 12	E114 Device Clear inactive	Device Clear did not clear the reader buffer.
None	Test 03	Test 03 Self-Test Test	Start remote triggered Self-Test.
106016	Test 03	E116 Self-Test timed out	Ensure terminal is configured for Power on Self-Test. If yes terminal is faulty.
106017	Test 03	E117 Bad status byte after self-test.	Status byte received after self-test completion is wrong.

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Messages	Comments
None	Test 13	Test 13 address test	Begin Address Test.
106021	Test 13	H121 set terminal address you want to test, press run	It is recommended to always test terminal addresses 21 (10) and 42 (10) (25 and 52 octal) which are basic test patterns for address switch.
106022	Test 13	H122 test ok (A-register = addr) change terminal address, press run	ACK received from only one origin. Origin address displayed on terminal and stored in A-register. New Address test possible: Change terminal address and Press RUN.
106023	Test 13	E125 terminal addr variation: A actual, B expected, press run	Unexpected ACK found during last polling cycle. A-reg = Time window address. B-reg = normal time window address. (Replace terminal unit to isolate failures in Controller or Terminal).
None	Test 14	Test 14 cable quality test	Start of Cable Quality and Transmission test.
106025	Test 14	H125 set terminal address (77 octal), press run	Technical halt for terminal address setting at 63 (77 octal) press run.
106026	Test 14	E126 terminal addr variation A actual, B expected, press run	Ensure terminal address is 77, if so unexpected ACK found during last polling cycle. Replace terminal unit to isolate faulty terminal or (controller) device. A-reg. = erroneous response address. B-reg = 63 (77 octal) normal address.
None	Test 15	Test 15 extended cable/ controller test	Start of Extended Cable/Controller Test.
106030	Test 15	H130 set termial address (see manual), press run	Technical halt to allow terminal setting between 1 and 63. Refer to paragraph 4-15

Table 4-2 Halts and Messages (Cont´d)

Halt Code	Test	Messages	Comments
None	Test 16	Test 16 global installation test	Start of Total Installation Test.
106032	Test 16	H132 enter max terminal addr (S-reg bit 5-0) press run	Halt to allow specification of polling cycle length. (1 to N,N = octal number < 77 in S-register bit 5-0). If left to 0: equivalent to 77 (max polling cycle length)
None	Test 16	Global install. test complete	End of test 16 occurs due to S-reg. bit 7 set.
106034	Test 16	E134 Invalid response during serial poll.	Ensure keyboard/display HP-IB address is set to 35 octal. If yes, terminator is faulty.
106035	Test 2 to 12, Test 14	E135 No Valda for Status byte serial poll.	Ensure HP-IB keyboard/display address is set according to S-reg bit 5-0. See table 3-2 bits 5-0. If value is ok, terminal is faulty.
106036	Test 2 to 15	E136 flag not set	Controller flag did not set during OTA SC,C sequence (when transferring data from memory to controller RAM).
106037	Test 2 to 15	E137 flag not required time	Controller did not set its flags within the appropriate time delay after forced completion of last polling cycle or LIA SC, C instruction. May be no terminal address in polling cycle, (check if terminal is ON).
106040	Test 2	E140 data received different from data sent (B=address) Press run	Controller returns bad data from a RAM address (B-register = address) (A-register = bad data). Press RUN to get bad data and expected data.

Table 4-2 Halts and Messages (Cont'd)

Halt Code	Test	Messages	Comments
106041	Test 2	E141 data received different from data sent A=RCVD, B=SENT press run	Controller returns bad data from a RAM address: (A-Reg=bad data), (B-reg=data expected). See data Transfer Table Word format to analyze signification of bits.
106042	Test 2 to Test 12 Test 14 Test 15	E142 Hardware failure or no key pressed within delay, Press run	Controller did not set its flag within .1 sec for an output or Controller did not set its flag within 15 sec delay for an input. Error if character actually typed in (logic flag set responding faulty). If no character typed in press RUN and continue. Ensure terminal is ON. If it is, controller is faulty.
106043	Test 14	E143 more than one ACK received, Press RUN.	Controller has detected two or more acknowledgements when only one is expected during this polling cycle.
106044	Test 13 Test 15	E144 no ACK from address 77 Press RUN	Controller did not find any acknowledge-ment when one was expected during the last polling cycle. (Check if terminal is on.
106045	Test 2 to 15	E145 bit 15 in Last Transfer Table Word.	Bit 15 was set to "0" in Last Transfer Table Word and must remain "0". If found with logic level "1" here, Controller is faulty.
106046	Test 2 to 15	E146 bit 15 clear and not Last Transfer Table Word	Bit 15 was set to "1" in Transfer Table Word and must remain "1". If found with logic level "0" here Cotroller is faulty.
106047	Test 2 to 12, 14, 15.	E147 terminal address variation, Press RUN.	Acknowledgement received at the wrong time window during the last polling cycle.
106050	Test 2 to 12, 14, 15.	E150 SRQ detected when not expected.	Operator has to press SRQ key only during test 3 or 13. If SRQ has not been depressed inadvertently then a faulty SRQ has happened.

Table 4-2 Halts and Messages (Cont´d)

Halt Code	Test	Messages	Comments
106051	Test 2 to 12, 14, 15.	E151 invalid interrupt.	Controller sets flag when the following logic condition is verified: OK.IDLE.(INT+VALDA+COI). Flag is set with logic condition not verified.
106052	Test 2 to 12, 14, 15	E152 VALDA and Service Request simultaneously received.	VALDA bit and SRQ bit both set to 1. Illegal possibility with terminal alone (VALDA=1 and COI=1=>EOI) tested only with 3070A.
106053	Test 2 to 12, 14, 15.	E153 ACK received but not from proper address.	Controller finds the ACK condition in a different polling cycle time window. (Not an error if it happens after a terminal address change in Test 15).
106054	Test 7 Test 10	E154 data received from unexpected address	Data byte and acknowledgment condition received at the wrong time window during the last polling cycle.
106055	Test 4, 10, 15.	E155 No EOI sent with terminator.	3070B Terminal did not set EOI low with last terminator.
106056	Test 12	E156 EOI not yet received, or no terminator	Reader sent EOI or did not send terminator character with last diagnostic card.
106057	Test 12	E157 Reader should talk more quickly	Reader did not send data quick enough (one data at each polling cycle) or has no more data to send.
106060	Test 11	E160 SRQ or VALDA set when not expected.	Test found data on the terminal while printer is configured. Something wrong if SRQ was not pressed.
106061	Test 7	E161 Mode II keyboard failure or sequence error	Test did not receive the correct data from terminal keyboard. Ensure data is keyed in from 0 to 9 terminated at any time by ENTER (i.e. 0,1,2,3 ENT)

Table 4-3 Test Execution Time

Test Section	Execution Time
TST 00 Basic I/O	1 Second
TST 01 Controller test	5 Seconds
TST 02 Communication Module test	5 Minutes
TST 03 Self-test test	2 Seconds
TST 04 Terminal functions	***
TST 05 Prompting lights	30 Seconds
TST 06 Display	1 minute
TST 07 Keyboard	***
TST 10 Special function keys	***
TST 11 Printer test	***
TST 12 Reader test	***
TST 13 Address test	****
TST 14 Cable test	****
TST 15 Extended cable/Controller test	****
TST 16 Total installation test	****

```
+--------------------------------------------------------------------+
 ***    Depends upon operator response time.
 ****   Depends upon operator decision to end this test.
+--------------------------------------------------------------------+
```