HP 3000 SERIES II
COMPUTER SYSTEM
MANUAL OF STAND-ALONE DIAGNOSTICS

STAND-ALONE HP 30061A
TERMINAL CONTROLLER
INTERFACE DIAGNOSTIC

Diagnostic No. D438A

HEWLETT **hp** *PACKARD*

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of this diagnostic is to verify the correct operation of the
HP 30061A Terminal Control Interface PCA.

2.0 SIMPLIFIED OPERATING INSTRUCTIONS

1. Remove all connectors from HP 30062A Terminal Controller/Multiplexer connector panel, 30062-60002. Connection will be made between channel pairs by test cable 30062-60003 during the test.

2. Cold load diagnostic D438A from stand-alone diagnostic tape. Program will halt (HALT 6). Push RUN with switch register bit 0 OFF, to run diagnostic with preset configuration. The procedure for re-configuration is given in the Detailed Operating Instructions. In the preset configuration the channel selection is manual.

3. Channel Selection -- The program halts for channel selection with HALT 7 before the execution of the first test and with HALT %16 after the completion of the test for any channel pair. The test will be executed between the two channels whose channel number is entered through the switch register. One channel number should be entered to the first byte of the switch register and the other in the second byte. Both numbers are octal (0-17) and right justified in their respective byte position. The connection should be made between the two specified channels by the test cable.

    In order to make a complete test of the interface (all 16 channels), 8 successive channel selections should be made. The following convient order is recommended by: Channel 0 channel 1 first, channel 2 channel 3 second and so on until channel 14, channel 15.

4. After each channel selection the program will halt again with HALT 6 for switch register option selection. Push RUN (with switch register bit 0 kept OFF).

5. The program will halt after each channel pair test with HALT %16, if the interface is error free. Errors will be indicated by error halts (HALT %12). Error information will be displayed on the "TOS". For details see Section 3-4.

3.0 DETAILED DESCRIPTION

The diagnostic contains 4 test sections.

Test Section 1 tests the I/0 reset function, the operation of the SIN instruction, and the ability of the interface to interrupt.

Test Section 2 tests the addressing logic and the update function.

Test Section 3 checks that control words effect only the addressed channel.

Test Section 4 tests the scan function and the ability of the interface to interrupt through each of the 16 channels.

3.1 HARDWARE CONFIGURATION

The terminal controller interface provides 2 control lines and monitors 2 status lines on each of its 16 channels. For this diagnostic the control lines from one channel are used as status lines for another channel. For convenience the connection between two selected channels is bidirectional, i.e. control lines from channel X are used as status and control lines from channel Y are used as status lines for channel Z.

3.2 CHANNEL SELECTION

The tests are executed between two selected channel ; the first one is used as a control channel and the other as a sense channel, then the direction is reversed. The channel selection is either made by the operator - manual mode - or it is sequenced by the program starting with channel 0 and 1 and successively advancing to channels 2 and 3, 4 and 5, etc. until channels 14 and 15 are tested - automatic mode. In both modes of execution all selected test sections are executed between the two selected channels. In the manual mode the program halts at this point (HALT %16) for new channel selection, while in the automatic mode the channel selection is advanced and the tests are repeated until all channels are tested.

3.3 TEST PASSES

The test sections are further divided into test passes. A pass is a fairly complete test of a particular operation (e.g. all 16 channels are preset, then interrupt condition is enforced by changing the control lines on the selected control channel, in the last step the interrupt conditions are reset). The reason for using several passes is to perform a particular test for various values of the control and status signals. In each section the passes are executed with one of the selected channel used for control and the other for sensing; the second time the role of the two channels are reversed.

3.4 ERROR ANALYSIS

Errors are indicated by error halts (HALT %12)

Further error information will be displayed on the "top of stack". The first word A,(S-0) contains an error number in the first byte and the step number in the second byte.

The interpretation of error number is the following:

1. No response to CIO

2. No response to TIO

3. No response to SIO

4. No response to RIO

5. Wrong Status

6. Multiple Interrupt

7. Failed to Interrupt

For step number refer to the description of the test sections.

The second word, B (S-1) contains the pass number. For the specification of the passes refer to the description of the test sections.

The third word, C (S-2) contains the channel number of the control channel in the first byte and the channel number of the sense channel in the second byte.

The fourth word D, (S-3) contains the status word in error for error 5 and 6. The expected status together with the control words are given in the description of the test sections.

3.5   TEST SECTION 1   (Step numbers 1 - 7)

It tests the I/O reset function, the SIN instruction and the ability of the interface to interrupt. The selected control channel and the sense channel are set by two corresponding CIO-s. The interrupt request is set by a SIN instruction. The correct setting (sense channel) is tested by TIO. Then a Master Clear is applied by a CIO and the clear condition is tested by TIO. Next the "reset interrupt request" is tested by a sequence of SIN, CIO, TIO instructions. Finally the interrupt is tested by a SIN instruction.

Steps range from 1 to 10.

3.6   TEST SECTION 2   (Step numbers 20 - 21)

It tests the addressing logic and the update function. 5 different control and sense channels are in 5 successive passes. In each pass the same control word is used for the control and for the sense channel. The status is checked on the receive channel. For each channel pair selection the test is executed in both directions. The control word and the expected status on the receive channel for the 5 passes are the following:

Pass #	Control Word	Expected Status
0	0001 XXXX 11 11 11 00	1010 XXXX 00 11 11 11
1	0001 XXXX 00 00 00 00	1010 XXXX 00 00 00 11
2	0001 XXXX 11 00 00 11	1010 XXXX 00 00 00 00
3	0001 XXXX 00 11 11 11	1010 XXXX 00 11 11 00
4	0001 XXXX 11 11 11 11	1010 XXXX 00 00 11 11

3.7 TEST SECTION 3   (Step numbers 30 - 32)

It checks that a control word effects only the addressed channel. A
sequence of 4 pairs of control words are used in 4 successive passes.
In each pass the tested channel is preset with the first control
word, then all the other channels are set with the second control
word. Following this the status word from the tested channel is checked.
The sequence of the control word pairs are the following:

Pass #	Control Word For Tested Channel	Control Word For Control Channels
0	0001 XXXX 11 00 00 00	0001 XXXX 11 11 11 11
1	0001 XXXX 11 11 01 10	0001 XXXX 11 00 10 01
2	0001 XXXX 11 00 10 01	0001 XXXX 11 11 01 10
3	0001 XXXX 11 11 11 11	0001 XXXX 11 00 00 00

The expected status for the successive 4 passes are the following:

Pass #	Status
0	0101 XXXX 00 00 00 01
1	0101 XXXX 00 00 01 00
2	0001 XXXX 00 10 10 11
3	0101 XXXX 00 11 11 00

3.8 TEST SECTION 4   (Step numbers 40 - 42)

This section tests the scan function and the ability of the interface to
interrupt through each of the 16 channels. The main sequence of the test
is the following:

1. All 16 channels are preset to an identical state, which presents no
    interrupt condition.

2. The control lines of one selected channel is changed to cause inter-
    rupt on the adjacent channel. At the same time the scan is started.

3. The program goes into a waiting loop and within the time out period
    interrupt should occur.

4. In the interrupt routine the interrupt condition is cancelled but the
    scanning is kept until the end of the time out period. This is done
    to test against unexpected interrupts.

The test is executed successively 8 times, (8 passes in each direction) for each channel, for 4 different combinations of preset states and control words causing interrupt conditions. For each of these 4 combinations two different control words are used to cancel the interrupt conditions. In the first 4 passes the stored status of the interrupting channel is changed to correspond to the actual status seen by the channel and in the last 4 passes (4-7) the interrupt enable bits of the interrupting channels are reset.

The 4 combinations of control words to preset the channels and to cause interrupts are the following:

Pass #	Control Word For Tested Channel	Control Word For Control Channel
0,4	0001 XXXX 11 00 01 00	0010 XXXX 11 01 00 00
1,5	0001 XXXX 11 00 10 00	0010 XXXX 11 10 00 00
2,6	0001 XXXX 11 11 01 11	0010 XXXX 11 10 00 00
3,7	0001 XXXX 11 11 10 11	0010 XXXX 11 01 00 00

The expected status at the interrupt for the 8 passes are the following:

Pass #	Status	Word
0,4	0101 XXXX 00	01 01 01
1,5	0101 XXXX 00	10 10 10
2,6	0101 XXXX 00	01 01 10
3,7	0101 XXXX 00	10 10 01

Control words used to cancel the interrupt condition in successive passes are the following:

Pass #	Control Word
0	0011 XXXX 00 00 11 01
1	0011 XXXX 00 00 11 10
2	0011 XXXX 00 00 11 10
3	0011 XXXX 00 00 11 01
4	0011 XXXX 00 00 10 00
5	0011 XXXX 00 00 01 00
6	0011 XXXX 00 00 10 11
7	0011 XXXX 00 00 01 11

4.0 DETAILED OPERATING INSTRUCTIONS

1. Remove all connectors from HP 30062A Terminal Controller/Multiplexer
    connector panel 30062-60002. For the connection of the tested channels
    test cable 30062-60003 should be used. In manual channel selection
    mode only one test cable is necessary; it will be moved from channel
    pair to channel pair during the execution of the diagnostic. For auto-
    matic mode channel selection, 8 test cables will be channel 0 to channel
    1, channel 2 to channel 3 and so on until channel 14 to channel 15.

2. Cold Load diagnostic D438A from Stand Alone Diagnostic Tape. Pro-
    gram will halt (HALT 6). To run diagnostic with preset configura-
    tion push RUN with switch register bit 0 set OFF.

3. For changing switch register options set bit 0 to ON. The rest of
    the switch register bits will be used to update the switch register
    options. (See Table 1) To change section selection options set bit
    0 and bit 1 of the switch register to ON.

4. Section Selection - diagnostic halts (HALT 5). Enter section select
    options through the operating panel switch register.
    (Refer to Table 4.) Push RUN. The program either halts (HALT 6)
    if reconfiquration is not selected or transfers to the reconfigur-
    ation section.

5. Reconfiguration - Reconfiguration allows the operator to change the
    DRT of the terminal control interface.
    It should be entered through the operating panel switch register.
    The numbers are octal and right justified in the switch register. The
    program halts before reading the DRT (HALT 0).
    After entering the DRT press RUN. The program halts again (HALT 6)
    allowing the resetting of the switch register.

6. Running diagnostic - The program gets into the execution state after
    RUN is pushed following a HALT 6 (Select Switch Register Options). In

automatic mode the selected test sections will be executed in pairs
for all 16 channels. In manual mode the channel selection must be
made by the operator. Before execution, start the program halts
(HALTS 7) for channel selection. The operator must enter the chan-
nel number of the two selected channels through the switch register.
One channel number goes in the first byte of the switch register, and the
other channel to the second byte. The numbers are octal 0-17 and are right
justified in their respective bytes. After channel selection the pro-
gram halts again (HALT 6) allowing the resetting of the switch regis-
ter according to the desired switch register options. Push RUN for
execution. Be sure that the specified two channels are connected by
the test cable. In the manual mode the program will repeatedly
execute the complete test cycle for the selected channel pair until
it is halted by bit 15 of the switch register (HALT AFTER COMPLETE
TEST CYCLE). If switch register option bit 15 is set, the program
will halt (HALT 7) after the completion of one test cycle allowing
the operator to select a different pair of channels and to resume the
test.

7. Errors are indicated by error halts. In case of an error halt, the
error specification is displayed on the "top of stack" as it is
described in Section 3.4.

-9-

TABLE 1.   SWITCH REGISTER ASSIGNMENT

Bit	Function
0	SELECT EXTERNAL SWITCH REGISTER
1	SET TO CHANGE SECTION SELECTION REGISTER (SWITCH BIT 0 ALSO SET)
2	
3	
4	
5	MODE SELECT OFF: AUTOMATIC / ON: MANUAL
6	ONLY INHOUSE USE
7	
8	
9	
10	
11	LOOP ON LAST PASS
12	HALT ON ERROR
13	HALT AT END OF PASS
14	HALT AT END OF SECTION
15	HALT AFTER A COMPLETE PROGRAM CYCLE

TABLE 2.   HALT CODES

00	HALT FOR RECONFIGURE - ENTER DRT
01	
02	
03	
04	
05	HALT TO ENTER SECTION SELECTION REGISTER
06	HALT TO RESTORE SWITCH REGISTER
07	HALT FOR CHANNEL SELECTION (MANUAL MODE)
10	
11	
12	ERROR HALT
13	HALT AFTER PASS
14	HALT AFTER SECTION
15	HALT AFTER COMPLETE PROGRAM CYCLE/AUTOMATIC
16	HALT AFTER COMPLETE PROGRAM CYCLE/MANUAL
17	

TABLE 3. SPECIFIC DB LOCATION PRECONFIGURATION

DB + 0	SWITCH REGISTER	%002011
DB + 1	SECTION SELECT	%074000
DB + 2	VERSION UPDATE	
DB + 3	INTERFACE DRT	%27

TABLE 4. SECTION SELECTION REGISTER

00	Reconfigure (DRT)
01	Section 1
02	Section 2
03	Section 3
04	Section 4
05 - 15	Not Used