HEWLETT hp PACKARD

MANUAL SUPPLEMENT
DIAGNOSTIC PROGRAM PROCEDURES

for

12581A

MEMORY PROTECT ACCESSORY KIT

(FOR THE 2116B COMPUTER)

Note

This manual is considered part of and should be attached to the 12581A Memory Protect Accessory Kit Operating and Service Manual.

12581-9001

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Printed: JAN 1970

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DIAGNOSTIC PROGRAM PROCEDURES FOR HP 12581A MEMORY PROTECT COMPUTER ACCESSORY KIT

MS-1. This diagnostic test program confirms proper operation of the HP 12581A Memory Protect Option for the Hewlett-Packard 2116B computer.

MS-2. The program is designed for maximum testing speed. The operator may repeat each function test within the diagnostic as often as desired; or he may run the entire program, stopping at the end of each function test to evaluate the results.

MS-3. HARDWARE CONFIGURATION

MS-4. The Memory Protect Diagnostic may be used only in the HP 2116B Computer. The diagnostic requires a buffered teleprinter for I/O instruction testing and for reporting errors and messages to the operator.

MS-5. FUNCTIONAL AND OPERATIONAL CHARACTERISTICS

MS-6. Memory protect diagnostic software requires an SIO Teleprinter Driver which should be configured prior to operation. All program options (suppress printout, suppress halts, etc.) are entered by the switch register, as shown in Table MS-1.

MS-7. If any errors occur, the program types a message and halts with an error condition displayed in the T-Register. Exceptions to this are trap cell halts $1060XX_8$ (located in low memory 4_8 - 77_8) and a special halt 107000_8. (Trap cell halts are irrecoverable and are beyond the scope of this diagnostic.) If the special halt occurs, press RUN and the error will be printed on the teleprinter.

MS-8. The diagnostic checks the memory protect feature which interrupts a string of chained indirect jumps (after the second level). However, the memory protect option will not interrupt a series of jump indirect instructions.

MS-9. For example:

```
LABEL   JMP   ABC,I
ABC     DEF   BCDE
BCDE    JMP   CDE,I
CDE     DEF   LABEI
```

loops endlessly without interrupting. The same holds true for the JSB instruction. If an interrupt occurs during a chained JMP M,I instruction with M in the zero page, the return address from the interrupt routine is lost. (In Phase one, P will set to zero.) The chained indirect JMP and JSB interrupting features of the memory protect option remain in effect (whether the option is turned on or off) as long as the option is physically present in the computer.

Table MS-1. Switch Register Characteristics

SWITCH REGISTER

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

BITS	DESCRIPTION
0-5	Select code for the I/O channel containing the teleprinter.
6-9	Spares
10	Set if the Extended Arithmetic Unit is present.
11	If set to one, error halts will be omitted.
12	If set to one, each separate test within the diagnostic runs and halts (with the appropriate messages typed on the teleprinter). This allows the operator to continue on to the next test or repeat the last test by setting bit 14.
13	If set to one, all printouts (except end-of-diagnostic messages) are suppressed. If set to zero, all messages are typed on the teleprinter.
14	If set to one, the program recycles the current test instead of advancing to the next test within the diagnostic. If set to zero, the program automatically advances to the next test.
15	If set to one, the program recycles entirely (omitting both PRESET tests). If set to zero, the program executes all tests and halts with the appropriate message on the teleprinter at the end of the diagnostic.

MS-10. This diagnostic does not test the PRL feature of the memory protect option. This feature must be checked by some other method.

MS-11. PROGRAM ORGANIZATION

MS-12. Figure MS-1 is a flow chart of the diagnostic subroutines and their execution sequence. Each diagnostic subprogram is summarized.

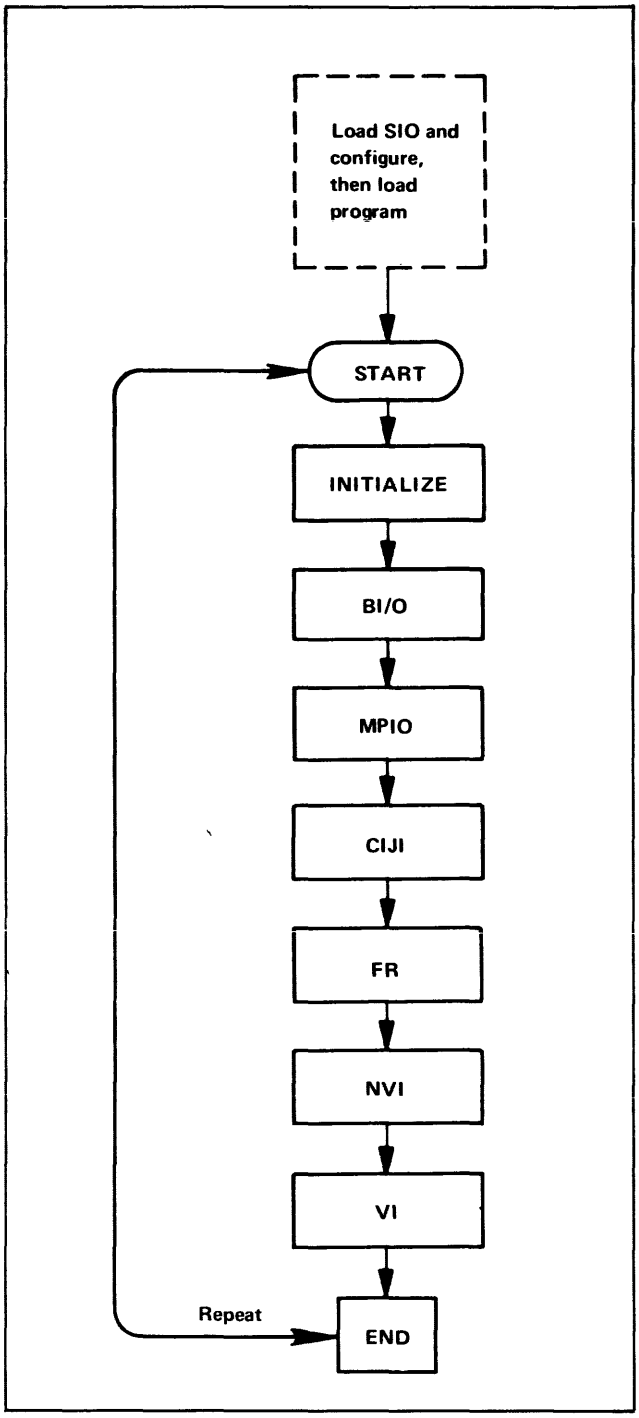

Figure MS-1. Program Flowchart

SUBROUTINE	FUNCTION
BI/O	Tests the ability to set and clear the flags and control bits, and the interrupt operation of the teleprinter. This section contains the PRESET test for the teleprinter.
MPIO	Tests the memory protect I/O instructions, the A- and B-registers, the PRESET switch, wrap-around protection, memory protect interrupting but failing to protect memory, indirect jump interrupt gate MC65D, and indirect addressing through protected areas.
CIJI	Tests the suppress interrupt function for two levels of chained indirect JMP and JSB instructions and then interrupts the sequence during the third level.
FR	Tests memory protection turn-on and then indirectly jumps from below the fence to one instruction above the fence for all of memory above 400_8. Tests for legal and illegal interrupts when executing violation and non-violation instructions on both sides of the fence for all memory above 400_8. At the same time the violation register is checked for all memory above 400_8.
NVI	Tests all non-violation instructions including the EAU instructions (if option selected).
VI	Tests all violation instructions including the EAU instruction (if selected) and the halt instruction that is specially coded (107000_8).

MS-13. OPERATING INSTRUCTIONS

a. Configure the SIO teleprinter driver and load the diagnostic program using the Basic Binary Loader.

b. LOAD ADDRESS 000100_8.

c. Set switch register bits 0-5 to the select code of the I/O channel that contains the teleprinter.

d. Select desired options from Table MS-1 by setting the appropriate bits of the switch register.

e. Press RUN.

f. When the program advances to the PRESET test, a message is typed and the computer HALTS. The operator must press PRESET, then press RUN. The program then advances to the second PRESET test. The program types a

message and loops until the operator presses HALT, PRESET, and RUN. The loop is timed to last for about 15 seconds regardless of when the buttons are pushed, before proceeding to the next test.

g. During execution of the function tests, the program will again halt and self-explanatory messages will be typed on the teleprinter. Both of the PRESET tests are omitted if the automatic option (bit 15 of the switch register set) is selected. After the program has advanced through all the tests, a message indicates completion of the diagnostic program. If the automatic option was selected, the completion message is omitted.

MS-14. ERROR ANALYSIS

MS-15. All messages to the operator typed on the teleprinter are prefixed by an alpha-numeric code. An H prefix indicates an operating instruction while an E prefix indicates an error message.

MS-16. All halts are coded and may be found in Table MS-2 opposite the appropriate T-Register value.

MS-17. If errors occur in test FR, the teleprinter should be allowed to print many of the errors (the fence register increments) before terminating the printout. This will be helpful in diagnosing the error especially if that error is located in the binary adders.

Table MS-2. HP 12581A Diagnostic Error Messages

T-Register	Error No.	Message	Comments
1060XX		(NONE)	Trap cell interrupt. P=memory address when interrupted, xx=the trap cell location.
107000		(NONE)	Press RUN for error printout.
102001	E1	CLF DID NOT CLEAR FLAG OR SFS CAUSED SKIP WITH FLAG CLEAR.	Test the ability to clear the teleprinter flag and test the SFS instruction.
102002	E2	SFC DID NOT SKIP WITH FLAG CLEAR.	Test the ability of the SFC instruction.
102003	E3	STF DID NOT SET FLAG, OR SFC CAUSED SKIP WITH FLAG SET.	Test the ability to set the teleprinter flag and test the SFC instruction.
102004	E4	SFS DID NOT SKIP WITH FLAG SET.	Test the SFS instruction.
102005	E5	DID NOT INTERRUPT.	Test the teleprinter interrupt capability.
102006	E6	THE RETURN ADDRESS IS NOT CORRECT.	Test the return address that was placed in the teleprinter trap cell.
102007	E7	PRESS PRESET, THEN PRESS RUN.	Test to see if the PRESET switch will set the I/O flag.
102010	E10	PRESET DID NOT SET THE FLAG.	The test failed.
102011	H11	END BI/O.	Select options and press RUN.
102012	E12	A AND B REGISTER TEST FAILED WHEN INSTRUCTION XXXXXX WAS EXECUTED AT MEMORY LOCATION XXXXXX. FENCE REGISTER WAS SET TO XXXXXX.	Test to see if MP will allow use of the A- and B-Registers.
(No halt)	H13	PRESS HALT THEN PRESS PRESET THEN PRESS RUN IN LESS THAN 15 SECONDS.	Test the ability for PRESET.
102014	E14	PRESET DID NOT TURN OFF MEMORY PROTECT.	Test failed.
102015	E15	WRAP AROUND PROTECTION FAILED.	Check the MP board for the proper wiring.
102016	E16	INDIRECT JUMP INTERRUPT GATE MC65D FAILED.	Replace part and repeat diagnostic.
102017	E17	NO MEMORY PROTECT INTERRUPT OCCURRED DURING THE INDIRECT JUMP INTERRUPT GATE TEST.	Proceed with test and consult schematic.
102020	E20	INDIRECT ADDRESSING THROUGH PROTECTED AREA FAILED.	Test failed.

Table MS-2. HP 12581A Diagnostic Error Messages (Cont.)

T-Register	Error No.	Message	Comments
102021	E1	I/O TRAP CELL INSTRUCTION ERROR.	Test failed.
102022	E22	NON I/O TRAP CELL INSTRUCTION ERROR.	Test failed.
102024	H24	END MPIO.	Select options and press RUN.
102025	E25	NO INTERRUPT AFTER SECOND LEVEL OF JMP INDIRECT CHAIN.	Test failed.
102026	E26	INCORRECT RETURN ADDRESS FOR CHAINED INDIRECT JMP INTERRUPTS.	Test failed.
102027	E27	NO INTERRUPT AFTER SECOND LEVEL OF JSB INDIRECT CHAIN.	Test failed.
102030	E30	INCORRECT RETURN ADDRESS FOR CHAINED INDIRECT JSB INTERRUPTS.	Test failed.
102031	H31	END CIJI.	Select options and press RUN.
102032	E32	ILLEGAL INTERRUPT. FENCE REGISTER IS XXXXXX, VIOLATION REGISTER IS XXXXXX AND INSTRUCTION IS XXXXXX.	Allow many printouts of this error in case the trouble is in the adder.
102033	E33	NO INTERRUPT. FENCE REGISTER IS XXXXXX.	Failure occurred in FR test. Repeat test.
102034	E34	VIOLATION REGISTER INCORRECT. IS XXXXXX AND SHOULD BE XXXXXX.	Failure occurred in FR test. Repeat test.
103037	H37	END FR.	Select options and press RUN.
103040	E40	INTERRUPT OCCURED WHILE EXECUTING LEGAL INSTRUCTION XXXXXX. FENCE REGISTER IS XXXXXX AND VIOLATION REGISTER IS XXXXXX.	Test failed.
103047	H47	END NVI.	Select options and press RUN.
103050	E50	NO MEMORY PROTECT INTERRUPT AFTER EXECUTING INSTRUCTION XXXXXX AT LOCATION XXXXXX AND FENCE AT XXXXXX.	Test failed.
103051	E51	NO MEMORY PROTECT INTERRUPT AFTER EXECUTING EAU INSTRUCTION XXXXXX AT LOCATION XXXXXX AND FENCE AT XXXXXX.	Test failed.

Table MS-2. HP 12581A Diagnostic Error Messages (Cont.)

T-Register	Error No.	Message	Comments
103053	H53	END VI.	Select options and press RUN.
103060	E60	NO INTERRUPT OCCURRED WHEN MEMORY PROTECT WAS VIOLATED.	Failure occurred in MPIO test.
102061	E61	PROTECTED MEMORY WAS VIOLATED AND THE MEMORY PROTECT INTERRUPT OCCURRED AT THE SAME TIME.	Failure occurred in MPIO test.
102062	E62	NO MEMORY PROTECT INTERRUPT. STC OR OTA INSTRUCTIONS MAY HAVE FAILED OR MP OPTION MAY NOT BE INSTALLED.	Failure occurred in MPIO test.
102063	E63	MEMORY PROTECT INTERRUPT LOCATION DOES NOT AGREE WITH VIOLATION REGISTER. LIA INSTRUCTION MAY HAVE FAILED.	Failure occurred in MPIO test or MP option not installed.
102064	E64	MEMORY PROTECT LOCATION DOES NOT AGREE WITH VIOLATION REGISTER. LIB INSTRUCTION MAY HAVE FAILED.	Failure occurred in MPIO test or MP option not installed.
102065	E65	NO MEMORY PROTECT INTERRUPT. STC OR OTB INSTRUCTIONS MAY HAVE FAILED.	Failure occurred in MPIO test.
102070	E70	PLEASE DISABLE THE LOADER.	Failure in Initialization Program. Corrective action.
102077	H77	MEMORY PROTECT DIAGNOSTIC HAS BEEN COMPLETED.	End of test. Press RUN to recycle the diagnostic.