DIAGNOSTIC PROGRAM PROCEDURES

POWER FAIL WITH AUTOMATIC RESTART TEST

HP Order No. HP 20428 (current version)

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POWER FAIL WITH AUTOMATIC RESTART

The Power Fail with Automatic Restart Test is a diagnostic program that tests the contents of core and the registers before and after power failures are induced by the operator. The test automatically resumes after each power failure. If an error occurs, the test halts at an error halt giving the probable cause of the error.

HARDWARE CONFIGURATION

This diagnostic program requires an HP 2116 computer with a Power Failure Interrupt with Automatic Restart HP 12588A, an HP 2115A computer with a Power Failure Interrupt with Automatic Restart HP 12586A, or an HP 2114 computer with a Power Fail Interrupt with Automatic Restart (option 008).

PROGRAM ORGANIZATION

After the test is loaded and started, it runs continuously until the operator causes a power failure by one of the following methods:

a. Turn the computer POWER switch OFF.

   CAUTION: Do not use this method on a HP 2115A computer with a serial number prefixed by the number 839 or lower, unless the computer has a POWER switch filter (two resistors and two capacitors) added on the back of the POWER switch.

b. Disconnect the main power cable from the computer.

c. Open the circuit supplying power to the computer (at any safe point).

d. Connect the computer to a metered variable autotransformer (one able to handle 1000-1600 watts) and adjust the voltage so it drops below 100 vac rms.

Power must be restored after each power failure. If there are no errors, the test continues to loop through core. If an error is found, the computer halts with the T-register containing the error code (see Table PFA-2).

NOTE: If the computer contains an Extender (HP 2160A, 2150B or 2151A) induce a power failure in the Extender after the main computer has completed the test. Error codes for the main computer and for the Extender are identical.

OPERATING PROCEDURES

Loading

Load the test from paper tape.

Executing

BASIC TEST-COMPUTER RUNNING

a. Set the Switch Register to indicate the memory size and start the test, as shown in Table PFA-1.

b. Induce a power failure as described in "Program Organization."

c. Restore power.

d. Check the T-register contents and Table PFA-2 for error cause if the computer halts. If the computer does not halt, go on to the next test.

BASIC TEST-COMPUTER HALTED

a. Set the Switch Register to indicate the memory size and start the test, as shown in Table PFA-1.

b. Press HALT.

c. Induce a power failure, as described in "Program Organization."

d. Restore power. The front panel of the computer should include the following:

T-register - 102077
P- and M-registers = 000165
A- and B-registers = 000000 (unless a parity error occurred)
PRESET lamp ON

If the T-register does not contain 102077, see Table PFA-2 for the error cause. If the test is passed, go on to the next test.

RESTART CONTROL TEST ONE

Test the restart circuits as follows:

a. Push PRESET then RUN.
b. With the computer running, simulate a power failure in the computer primary.
c. While holding down HALT, restore power; as soon as the front panel indicators on the computer light, release HALT. (Either the computer does not run, or the PRESET lamp is on.)
d. Press PRESET. (The PRESET lamp goes out.)

RESTART CONTROL TEST TWO

To further test the restart circuits, proceed as follows:

a. Set 000045 in the SWITCH REGISTER.
b. Press LOAD ADDRESS.
c. Press RUN. (The A and B-registers start counting from zero.)
d. With the computer counting, simulate a power failure in the computer primary.
e While holding down PRESET restore power.
f As soon as the front panel indicators on the computer light, release PRESET. (The computer does not run, and the PRESET lamp is off.)

TEST THE HALT MODE (2115A only)

Test the HALT Mode of operation as follows:

a. Turn off the computer POWER switch.
b. Remove the top cover plate of computer.
c. Orient the 48-pin patch connector (Part No. 12586-6002) for the HALT MODE of operation and plug it onto the card portion of the OPTION.
d. Replace the top cover plate of the computer.
e. Simulate a power failure in the computer primary (as before).
f. While watching the front panel of the computer, restore power. (The computer does not run and all registers display random values.)
g. Repeat steps e and f three times.
h. Remove the top cover plate of the computer and orient the 48-pin patch connector for the AUTO RESTART mode of operation.
i. Replace the top cover plate of the computer.

TEST THE HALT MODE (2116 only)

Check the HALT mode of operation on the 2116 as follows:

a. Move the RESTART/HALT switch on the Power Failure Interrupt with Automatic Restart Card to HALT.
b. Turn off the POWER switch on the computer.
c. Turn on the POWER switch. (The computer does not run and the registers display random values.)

Table PFA-1

Test Program Start Procedures

Memory Size In Words	Procedure
4096	Set 000002 in the SWITCH REGISTER. Press LOAD ADDRESS, then PRESET, then RUN.
8192	Set 000003 in the SWITCH REGISTER. Press LOAD ADDRESS, then PRESET, then RUN.
16,384	Set 000024 in the SWITCH REGISTER. Press LOAD ADDRESS. Set 037677 in the SWITCH REGISTER. Press LOAD A, then PRESET, then RUN.
24,576	Set 000024 in the SWITCH REGISTER. Press LOAD ADDRESS. Set 057677 in the SWITCH REGISTER. Press LOAD A, then PRESET, then RUN.
32,768	Set 000024 in the SWITCH REGISTER. Press LOAD ADDRESS. Set 077677 in the SWITCH REGISTER. Press LOAD A, then PRESET, then RUN.

Table PFA-2

Probable Cause of Error Halts

T Register Contents	Probable Cause
102005	Parity Error Interrupt
102006	DMA Interrupt
102007	DMA Interrupt
102010 through 102020	I/O Device Interrupt
102022	Some Memory location modified A Register = Memory Location
102033	A and B Registers not equal
102055	Computer did not complete shut-down routine. A Register = Number of loops computer should have done B Register = Number of loops computer did at power failure
102077	Computer was not running when power failed

LISTING

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PAGE 0001


0001                            ASM B,A,B,L,T
PE          000034
EL          000041
LM          000042
FM          000043
IT          000044
SA          000045
LP          000051
PL          000070
OK          000077
AM          000104
BM          000105
BA          000106
SR          000107
DN          000113
UP          000140
NR          000161
AS          000166
BS          000167
SS          000170
K2          000171
K4          000172
K8          000173
PS          000174
AL          000175
BX          000176
NU          000177
**   NO ERRORS*
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0001                    ASMB,A,B,L,T
0002*                                  4-28-68
0003*    POWER FAIL DIAG. FOR 2115/2116
0004*           AND 2114
0005*
0006  00002                    ORG 2B
0007  00002 024021             JMP 21B        START ADDR. FOR 4K
0008  00003 024023             JMP 23B        START ADDR. FOR 8K
0009  00004 014107             JSB SR         POWER FAIL INTR. LOC.
0010  00005 014034             JSB PE         P.E. INTR. LOC.
0011  00006 102006             HLT 6B         HALT
0012  00007 102007             HLT 7B              IF
0013  00010 102010             HLT 10B
0014  00011 102011             HLT 11B               ANY
0015  00012 102012             HLT 12B
0016  00013 102013             HLT 13B                    OTHER
0017  00014 102014             HLT 14B
0018  00015 102015             HLT 15B                          INTR.
0019  00016 102016             HLT 16B
0020  00017 102017             HLT 17B           (ERROR HALT)
0021  00020 102020             HLT 20B
0022  00021 060172             LDA K4         GET LWAM FOR 4K MACHINE
0023  00022 024024             JMP *+2
0024  00023 060173             LDA K8         GET LWAM FOR 8K MACHINE
0025  00024 070042             STA LM         STORE LAST WORD OF AVAIL. MEM.
0026  00025 060043             LDA FM         GET FIRST AVAIL. WORD OF MEM.
0027  00026 064044             LDB IT         GET PATTERN TO STORE
0028  00027 174000             STB 0,I        STORE ALL MEMORY WITH STA 1000B
0029  00030 050042             CPA LM         DONE ALL MEMORY?
0030  00031 024045             JMP SA
0031  00032 002004             INA            INDEX MEMORY ADDR.
0032  00033 024027             JMP *-4        LOOP BACK TO STORE INSTR.
0033  00034 000000  PE         NOP
0034  00035 070166             STA AS         SAVE A
0035  00036 102505             LIA 5B         GET LOC P.E.
0036  00037 070041             STA EL         SAVE LOC P.E.
0037  00040 102005             HLT 5B         ERROR HALT-P.E.
0038  00041 000000  EL         OCT 0          LOC. OF P.E.
0039  00042 000000  LM         OCT 0          LAST AVAIL. WORD OF MEM.
0040  00043 000200  FM         DEF NU+1       FIRST AVAIL. WORD OF MEM.
0041  00044 071000  IT         STA 1000B      PATTERN TO STORE IN UNUSED MEM.
0042  00045 002400  SA         CLA            CLEAR COUNT IN A
0043  00046 006400             CLB            CLEAR COUNT IN B
0044  00047 070041             STA EL
0045  00050 070034             STA PE
0046  00051 002004  LP         INA            STEP A (START BK GND PROG)
0047  00052 006004             INB            STEP B
0048  00053 102601             CTA 1B         OUTPUT TO SENSE REG. (2114 ONLY)
0049  00054 050001             CPA 1B         CHECK THAT A AND B ARE EQUAL
0050  00055 002001             RSS
0051  00056 102033             HLT 33B        ERROR HALT, A NOT EQUAL TO B
0052  00057 034176             ISZ BX
0053  00060 024057             JMP *-1        LOOP 65,000 TIMES (TIME DELAY)
0054  00061 070104             STA AM         SAVE A
0055  00062 074105             STB BM         SAVE B
0056  00063 060106             LDA BA         GET P.F. SIGNAL
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0057  00064 002002          SZA          CHECK IF YOU HAVE JUST HAD A P.F
0058  00065 024077          JMP OK       DID NOT
0059  00066 060043          LDA FM       GET FIRST AVAIL. WORD OF MEM.
0060  00067 064044          LDB IT       GET PATTERN TO CHECK
0061  00070 154000    PL    CPB 0,I      IS PATTERN RIGHT?
0062  00071 024073          JMP *+2      YES
0063  00072 102022          HLT 22B      MEMORY MODIFIED - ERROR HALT
0064  00073 050042          CPA LM       CHECKED ALL MEMORY?
0065  00074 024077          JMP OK       YES
0066  00075 002004          INA          INDEX MEMORY ADDR.
0067  00076 024070          JMP PL       LOOP BACK TO CHECK NEXT MEM. LOC
0068  00077 003400    OK    CCA
0069  00100 070106          STA BA       RESET P.F. SIGNAL (177777)
0070  00101 060104          LDA AM       RETURN COUNT IN A
0071  00102 064105          LDB BM       RETURN COUNT IN B
0072  00103 024051          JMP LP       LOOP BACK IN BACKGROUND PROG.
0073  00104 000000    AM    OCT 0        TEMP STORAGE FOR A
0074  00105 000000    BM    OCT 0        TEMP STORAGE FOR B
0075  00106 000000    BA    OCT 0        PF SIG.(0AFTER PF;-1 NORMAL)
0076  00107 000000    SR    NOP          START PWR FAIL/RESTART ROUTINE
0077  00110 000000          NOP
0078  00111 102204          SFC 4B       CHECK (POWER FAIL OR RESTART)
0079  00112 024140          JMP UP       RESTART
0080  00113 000000    DN    NOP          POWER FAIL ROUTINE
0081  00114 070166          STA AS       SAVE A REG.
0082  00115 003400          CCA
0083  00116 070175          STA AL       SIGNAL THAT COMPUTER IS RUNNING
0084  00117 060171          LDA K2
0085  00120 070167          STA BS       SET UP NO. TIMES WILL LOOP
0086  00121 002400          CLA
0087  00122 070177          STA NU       SET UP COUNTER TO 0
0088  00123 070106          STA BA       SET P.F. SIGNAL TO 0
0089  00124 002004          INA          STEP A
0090  00125 034177          ISZ NU       STEP COUNTER
0091  00126 050167          CPA BS       LOOPED PROPER NO TIMES ?
0092  00127 024131          JMP *+2      YES
0093  00130 024124          JMP *-4      NO- LOOP BACK TO INA INSTR.
0094  00131 074167          STB BS       SAVE B REG.
0095  00132 060107          LDA SP
0096  00133 070174          STA PS       SAVE P REG.
0097  00134 102501          LIA 1
0098  00135 070170          STA SS       SAVE SENSE REG.
0099  00136 106704          CLC 4B       SET UP FOR RESTART
0100  00137 102004          HLT 4B       NORMAL HALT
0101  00140 060175    UP    LDA AL       RESTART ROUTINE
0102  00141 002003          SZA,RSS      WAS RUNNING WHEN P.F.?
0103  00142 024161          JMP NR       NO
0104  00143 002400          CLA          YES
0105  00144 070175          STA AL       CLEAR SIGNAL TO NOT RUN
0106  00145 060171          LDA K2       GET NO. TIMES SHOULD LOOP
0107  00146 064177          LDB NU       GET NO. TIMES DID LOOP
0108  00147 050177          CPA NU       ARE THEY EQUAL?
0109  00150 024153          JMP *+3      YES
0110  00151 103104          CLF 4        TURN OFF RESTART
0111  00152 102055          HLT 55B      ERROR HALT-NOT DO ALL CYCLES
0112  00153 060170          LDA SS
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0113  00154 102601          OTA 1B          RESTORE SENSE REG. (2114)
0114  00155 060166          LDA AS          RETURN COUNT TO A
0115  00156 064167          LDB BS          RETURN COUNT TO B
0116  00157 102704          STC 4B          SET UP FOR NEXT P.F.
0117  00160 124174          JMP PS,I        RETURN TO BACKGROUND PROGRAM
0118  00161 103104    NR    CLF 4           TURN OFF RESTART
0119  00162 064034          LDB PE          GET P REG WHEN P.E.
0120  00163 060041          LDA EL          GET LOC. OF P.E.
0121  00164 102077          HLT 77B         NOT RUN WHEN P.F.
0122  00165 024045          JMP SA          RESTART
0123  00166 000000    AS    OCT 0           STORAGE FOR A WHEN POWER FAIL
0124  00167 000000    BS    OCT 0           STORAGE FOR B WHEN POWER FAIL
0125  00170 000000    SS    OCT 0           STORAGE FOR SENSE REGISTER
0126  00171 000140    K2    OCT 140         NUMBER OF TIMES IT SHOULD LOOP
0127  00172 007677    K4    OCT 7677        LWAM FOR 4K
0128  00173 017677    K8    OCT 17677       LWAM FOR 8K
0129  00174 000000    PS    OCT 0           STORAGE FOR P WHEN POWER FAIL
0130  00175 000000    AL    OCT 0           SIGNAL IF RUNNING (177777)
0131  00176 000000    BX    OCT 0           TIME DELAY LOOP COUNTER
0132  00177 000000    NU    OCT 0           COUNTER
0133                        END
** NO ERRORS*
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