EXTENDED MEMORY AREA ON-LINE DIAGNOSTIC

reference manual

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SECTION I
INTRODUCTION

1-1. GENERAL

The on-line diagnostic program confirms the proper operation of the RTE-IV Extended Memory Area (EMA) firmware on an HP 1000 E-Series or F-Series Computer. It operates under the control of the RTE-IV Operating System. For further information on the RTE-IV EMA routines, see the Memory Management Section of the RTE-IV Programmer's Reference Manual. All references to RTE-IV apply to RTE-IV and RTE-IVB.

1-2. REQUIRED HARDWARE

The same hardware is required as for a minimum RTE-IV system plus the EMA firmware. The required hardware includes:

a. HP 1000 E-Series or F-Series Computer with at least 96K bytes of memory;

b. Dynamic Mapping System including Memory Protect;

c. Time Base Generator;

d. Dual Channel Port Controller (DCPC);

e. High speed disc storage;

f. System console device; and

g. Firmware Accessory Board (FAB) or Firmware Expansion Module (FEM) with EMA firmware installed.

Note that although the diagnostic will function in the above system, it will not be able to do a complete check. The diagnostic requires a 38 page partition for a complete check, which is not possible in a 96K byte system.

1-3. REQUIRED SOFTWARE AND DOCUMENTATION

The required software and documentation consists of an RTE-IV Operating System which includes the following items:

a. A relocatable file: %#EMA, part no. 92067-16013; and

b. The following documentation:

1. RTE-IVB Programmer's Reference Manual 92068-90004;
2. RTE-IVB On-Line Generator Reference Manual 92068-90007;
3. RTE-IV Assembler Reference Manual 92067-90003;
4. EMA On-Line Diagnostic Reference Manual 92067-90007; and
5. M-/E-/F-Series Firmware Installation and Reference Manual 12791-90001.

PROGRAM ORGANIZATION

SECTION II

2-1. ORGANIZATION

This on-line diagnostic consists of an Initiation Section and 32 tests. The Initiation Section accepts the Logical Unit of the output device and determines the amount of memory available for the EMA (Extended Memory Area). The 32 tests are described in Table 2-1.

2-2. MESSAGE REPORTING

Three types of messages are displayed: error and information messages from the EMA diagnostic and messages from the RTE-IV System. Error messages are issued to inform the operator if the EMA firmware routines have failed to properly execute a function. Information messages are used to inform the operator of any special occurrences. Both of these types of messages can be sent to any output device in the RTE-IV System. The System error messages may be generated from the EMA firmware, DMS, or other hardware errors and sent to the System Console (LU 1). Some examples of the three types of messages are given in Section IV of this manual.

2-3. TEST DESCRIPTIONS

The 32 tests which the diagnostic performs exercise nearly every branch in the EMA firmware. The only branches not exercised are those that respond to interrupts, approximately 2% of the firmware.

The 32 tests make calls to the EMA routines called MMAP, .EMAP, and .EMIO. The calls are designed to flow through each path of the firmware. The results returned are checked to verify proper operation. A detailed list of the tests is provided in Table 2-1.

The operator should be aware that problems in hardware other than the EMA firmware could cause the diagnostic to report errors. For example, problems in the Dynamic Mapping System could cause .EMAP errors to be reported.

Table 2-1. Test Descriptions

TEST NUMBER	DESCRIPTION
Test 0	Call MMAP with negative offset
Test 1	Call MMAP with negative number of pages
Test 2	Call MMAP and ask for more pages than in MSEG
Test 3	Call MMAP and ask for pages beyond EMA
Test 4	Call MMAP and ask for zero offset and a MSEG number of pages.
Test 5	Call MMAP and ask for one page beyond the end of EMA to check read/write protect bits
Test 6	Call .EMAP to access a non-EMA array from an EMA program
Test 7	Call .EMAP on a zero dimensioned array
Test 8	Call .EMAP with a negative number of dimensions
Test 9	Call .EMAP with subscript below lower bound
Test 10	Call .EMAP with negative dimension size
Test 11	Call .EMAP with offset too large
Test 12	Call .EMAP and ask for element 2,000,001
Test 13	Call .EMAP and cause double precision integer calculation overflow
Test 14	Call .EMAP with displacement too large
Test 15	Call .EMAP with a 2-dimensional EMA array, no errors
Test 16	Call .EMAP with negative dimensions, non-EMA array calculations
Test 17	Call .EMAP with subscript below lower bound, non-EMA array calculations
Test 18	Call .EMAP with dimension size negative, non-EMA array calculations
Test 19	Call .EMAP and force 15 bit overflow in non-EMA array calculations
Test 20	Call .EMAP and force 16 bit overflow in non-EMA array calculations
Test 21	Call .EMAP for a 2-dimensional array, no errors
Test 22	Call .EMAP and cause single precision integer overflow, non-EMA array calculations
Test 23	Call .EMIO and give negative buffer length
Test 24	Call .EMIO with a buffer length that overflows the end of EMA
Test 25	Call .EMIO with a buffer one page greater than an MSEG
Test 26	Call .EMIO with a buffer in a standard MSEG
Test 27	Call .EMIO with a buffer that forces a non-standard MSEG
Test 28	Call .EMAP from a non-EMA program. This is done by going privileged and clearing the ID extension address.
Test 29	Call MMAP from non-EMA program as in test 28
Test 30	Call .EMIO from non-EMA program as in test 28
Test 31	Call MMAP to map in a standard MSEG, then request the last element with .EMAP to check the setting of the non-standard MSEG bit and the read/write protection of the second MSEG page. This test is not performed if EMA software is being used.

2-4. DIAGNOSTIC LIMITATIONS

The diagnostic will only be able to access memory in the partition in which it is running. If this is too small (less than 38 pages) for a complete check, the operator is informed. In this case, the diagnostic will still run, but the double precision address calculations will not occur (tests #24 and #31). The diagnostic will not run at all in a partition which does not provide an EMA (Extended Memory Area) size which is one page larger than the maximum addressable space (32K words – the size of the operating system), unless the Size Command (SZ) is used to reduce the size of the MSEG (Mapping Segment) and the EMA.

Because of restrictions imposed by the RTE-IV system, the diagnostic is not able to test for proper interrupt operation. This is about two percent of the firmware.

It should be noted that the diagnostic locks itself into memory making it unswappable while it is running its tests. It does unlock itself for a short time at the completion of each pass through the tests to allow swapping.

OPERATING PROCEDURE

SECTION III

3-1. LOADING THE DIAGNOSTIC

The following assumes that an RTE-IV Operating System is up and running and that the proper entry points for the EMA firmware were specified during generation (refer to the RTE-IV On-Line Generator Reference Manual). The shaded characters represent the printout from the system and the **bold** characters represent the operator's input to the system. Figure 3-1 is a flowchart for using the EMA diagnostic.

The diagnostic is supplied as a relocatable file which can be initially loaded using the RTE-IV LOADR which is described in the RTE-IV Programmer's Reference Manual. The procedure is as follows:

```
*RU,LOADR,,%#EMA,1,NL
```

This will load #EMA as a type 3 program. It is possible to save this program so that it need not be loaded again on this system by giving the FMGR command SP,#EMA.

Following is an example:

```
*RU,FMGR
:RU,LOADR,,%#EMA,1,NL
:SP,#EMA
:
```

This example, with a "no list" the output option, was performed on the System Console but the diagnostic can be loaded from any terminal in the system.

3-2. OPERATING THE DIAGNOSTIC

Once the diagnostic has been loaded, it can be executed from the FMGR, the RTE-IV System, or any multi-terminal monitor console.

```
*RU,#EMA [,lu [,#times]]
```

Where lu is the output device upon which messages will be written and #times is the number of times the diagnostic will run. If lu is zero or unspecified, it is defaulted to the System Console (LU 1). If #times is not given, the diagnostic is run once. If #times is negative, the program runs continuously until the break flag is set (see below). The following are some examples:

```
*RU,#EMA,6
```

Run the diagnostic once and print any messages on LU 6.

***RU,#EMA,21,10**

Run the diagnostic ten times and print any messages on LU 21.

***RU,#EMA,1,−1**

Run the diagnostic continuously and print messages on the System Console.

To terminate the diagnostic at the end of the next set of tests the operator can set the break flag. This is done by entering as a system command:

***BR,#EMA**

During execution, the octal test number is displayed in the S register.

CAUTION

Because of the possibility of the EMA firmware not working properly and overwriting the operating system, it is not wise to have other critical operations occurring concurrently. For example, the first time the diagnostic is run after the firmware is installed, the system should obviously not be performing any critical tasks.

NOTE

It is possible to execute the diagnostic in a partition which would normally be too small for the diagnostic to run at all. This may be required for RTE-IV systems containing a minimum amount of memory. This is accomplished by using the RTE-IV Size Command (SZ) to reduce the size of the EMA and the MSEG. For example:

***SZ,#EMA,3,2**

This will allow #EMA to run in a 10 page partition (7 pages for the program and 3 pages for the EMA).

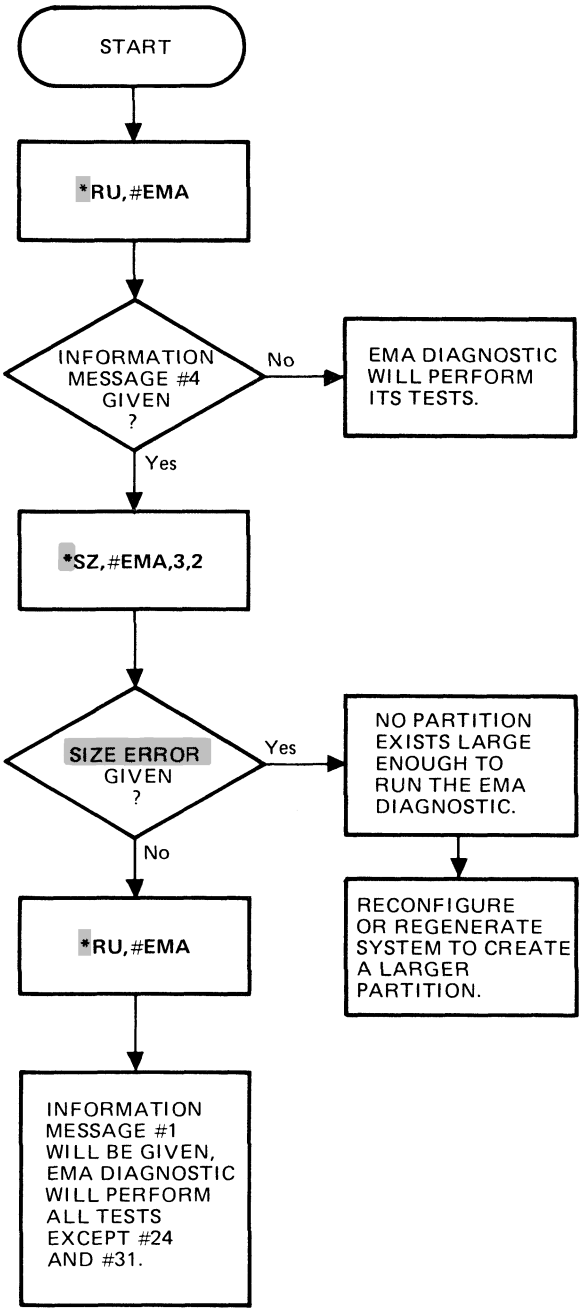

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Figure 3-1. EMA Diagnostic Flowchart

4-1. MESSAGES EXAMPLES

Three types of messages are displayed: error and information messages from the EMA diagnostic and messages from the RTE-IV System. Error messages are issued to inform the operator if the EMA firmware routines have failed to properly execute a function. Information messages are used to inform the operator of any special occurrences. These messages can be sent to any output device on the RTE-IV System. The System error messages may be generated by the EMA firmware, DMS, or other hardware errors and sent to the System Console (LU 1).

Some examples of the three types of messages are listed in the following paragraphs. The shaded characters represent the printout from the system and the **bold** characters represent the operator's input to the system.

a. ERROR MESSAGES FROM THE EMA DIAGNOSTIC.

The general form of the error messages is:

TESTzz:

Followed by one of the following:

name DID NOT DETECT ERROR CONDITION A=xxxxxxB B=xxxxxxB

name INCORRECT ERROR RETURN A=xxxxxxB B=xxxxxxB

MMAP ERROR. FIRST MAP REGISTER TO MISCOMPARE = xx, CONTENTS = xxxx

EMAP ERROR. EXPECTED B = yyyyyyB ACTUAL B = xxxxxxB

EMAP MAPPING ERROR
MAP REG nn = mmmmm
MAP REG jj = kkkkk

EMIO ERROR. EXPECTED B = yyyyyyB ACTUAL B = xxxxxxB

ID EXT. WORD ZERO WRONG. EXPECTED = yyyyyyB ACTUAL = xxxxxxB

Where zz is the test number and name is the name of the failing micro-routine (either MMAP, .EMAP, or .EMIO). The letters A and B refer to the A and B registers. The register contents are provided primarily for an in depth analysis of the EMA firmware and will not, in general, be of use to the average user.

b. INFORMATION MESSAGES FROM THE EMA DIAGNOSTIC.

The information messages are as follows:

1. The following message is issued if the partition in which the diagnostic is running is too small for a complete test. The partition must be 38 pages or more to exercise the double precision calculations (tests #24 and #31).

```
WARNING — PARTITION TOO SMALL FOR COMPLETE TEST.
```

2. The following message is issued at the end of the tests, if all the tests were successful.

```
EMA ON-LINE DIAGNOSTIC SUCCESSFUL COMPLETION.
```

3. The following message is issued at the end of the tests if any errors were discovered.

```
*** EMA FIRMWARE FAILED TO PASS DIAGNOSTIC ***
```

4. The following message is issued if the partition in which the diagnostic is executing is too small (see On-Line Diagnostic Limitations in Section II of this manual).

```
*** THIS PARTITION IS TOO SMALL TO EXECUTE THE ON-LINE DIAGNOSTIC
*** EMA ON-LINE DIAGNOSTIC TERMINATED
```

5. The following message is issued if the diagnostic was loaded with the EMA software routines.

```
WARNING — EMA DIAGNOSTIC USING SOFTWARE INSTEAD OF FIRMWARE
```

   The software version will be used if the proper RP commands to use the firmware were not included at system generation. In this case, the firmware routines can be accessed by loading a file which causes the LOADR to use the firmware opcodes when loading the diagnostic (see the RPL psuedo-instruction in the Assembler Reference Manual).

c. MESSAGES FROM THE RTE-IV SYSTEM.

It is possible that certain errors will cause RTE-IV to abort the diagnostic and issue error messages to the System Console (LU 1). For example:

```
MP INST   iiiiii
ABE = aaaaaa bbbbbb e
XYO = xxxxxx yyyyyy o
MP #EMA   dddddd
```

Where iiiiii is the instruction itself, ABE XYO gives the contents of specified registers, and dddddd is the address of the offending instruction. This could be caused by a problem in the EMA firmware, the Dynamic Mapping System, or the Memory Protect board, among others (see the RTE-IV Programmer's Reference Manual).

```
DM VIOL = vvvvvv
DM INST = iiiiii
ABE = aaaaaa bbbbbb e
XYO = xxxxxx yyyyyy o
DM #EMA   dddddd
```

Where vvvvvv is the contents of the DMS violation register, iiiiii is the offending instruction, ABE XYO gives the contents of the specified registers, and dddddd is the address of the offending instruction. This could be caused by a problem in the EMA or DMS, among others (see the RTE-IV Programmer's Reference Manual).

4-2. SERVICE INFORMATION

Figure 4-1 is a troubleshooting flowchart to follow if errors occur while running the EMA On-Line Diagnostic. Because the EMA firmware uses many other features of the machine, it is possible that the diagnostic will fail even if the firmware is good. Errors could be caused by the EMA firmware, DMS, Memory Protect, or other failing hardware components. Running the appropriate diagnostics will further isolate the problem. If the problem cannot be isolated by following the troubleshooting flowchart, notify the nearest Hewlett-Packard Sales and Service Office.

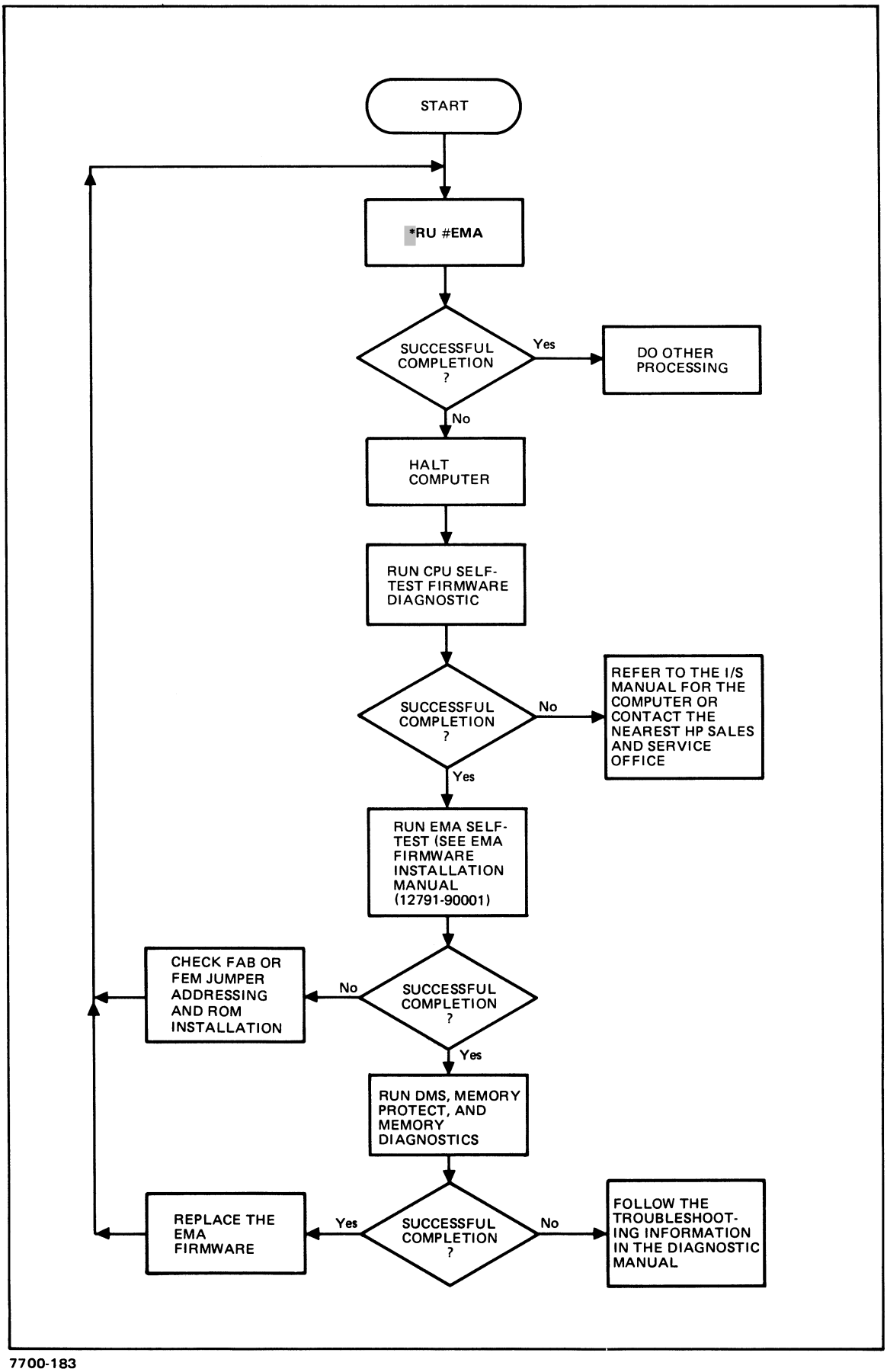

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Figure 4-1. Troubleshooting Flowchart

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