HEWLETT PACKARD

SPECIAL

HP 93585A DOUBLE INTEGER FIRMWARE PACKAGE

Installation and Programming Manual

This manual reflects information that is compatible with Double Integer Firmware having Date Codes 2004, 2112, and 2313.

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SPECIAL

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GENERAL INFORMATION — SECTION 1

1.1 INTRODUCTION

This manual provides installation and programming instructions for the HP 93585A Double Integer Firmware Package for HP 1000 E-Series Computers. RTE-IVB or RTE-6/VM system configuration requirements are also included. The information is presented with the assumption that the user is familiar with HP 1000 Computers and programming languages and the RTE-IVB or RTE-6/VM operating system.

1.2 DESCRIPTION

Product HP 93585A provides twelve double integer instructions that are implemented in firmware for HP 1000 E-Series Computers. These are normally found only in the F-Series Computer firmware requiring the floating point hardware. The firmware is mounted on the HP 13304A Firmware Accessory Board (FAB) or HP 12791A Firmware Expansion Module (FEM) in the E-Series Computer and after installation, checkout, and system configuration, the computer will execute the instruction micro-routines in lieu of system library routines when the appropriate call is made (section 3 provides programming details).

The micro-routines normally reside in computer Control Memory (CM) modules 40 and 41 (an HP reserved area in E-Series Computers) with entry points to CM through use of machine opcodes in the range 105320 through 105337 (to CM addresses 24000 through 24017). Firmware with date code 2313 micro-routines can be located in other modules (see section 4).

Since these twelve instructions are not recognized by the HP Assembler they must be used in the form JSB x (where x is the instruction). The instructions must be declared as externals at the begining of an Assembly language program (as described in section 3).

For this E-Series Computer enhancement, it is only necessary (after installation) to let the operating system know (during

generation) what the entry points for the micro-routines are (details in section 4). Prerequisites include an HP 1000 E-Series Computer with an HP 13304A FAB or HP 12791A Firmware Expansion Module (FEM), and an RTE-IVB or RTE-6/VM operating system.

1.3 COMPONENTS SUPPLIED

The HP 93585A product consists of the documentation and firmware listed in table 1-1.

Table 1-1. HP 93585A Components Supplied

ROM PART NUMBERS PER FIRMWARE DATE CODES

ROM NO.	DATE CODE 2004	DATE CODE 2112	DATE CODE 2313
1, BITS 0-7	93585-80001	93585-80001	93585-80006
2, BITS 8-15	93585-80002	93585-80005	93585-80007
3, BITS 16-23	93585-80003	93585-80003	93585-80008

HP 93585A Installation and Programming Manual, part no. 93585-90007.

CAUTION

The entire ROM set must be replaced for date code 2313 operation. Prior date code part numbers are shown for support purposes only. New installations will invariably consist of date code 2313 ROM's installed on the FEM.

1.4 REFERENCES

The following reference material may be helpful when installing, using, and maintaining this product. The manuals refer to additional documentation that may be of interest.

a. HP 1000 M/E/F-Series Firmware Installation and Reference Manual, part no. 12791-90001.

b. HP 1000 E-Series Computer Operating and Reference Manual, part no. 02109-90001.

c. HP 1000 E-Series Computer Installation and Service Manual, part no. 02109-90002.

d. HP 1000 F-Series Computer Operating and Reference Manual, part no. 02111-90001.

e. HP 92068A RTE-IVB or RTE-6/VM System Managers Manual, part no. 92068-9000

f. RTE-IVB or RTE-6/VM Programmer's Reference Manual, part no. 92068-90004.

g. RTE Relocatable Library Reference Manual, part no. 24998-90001.

h. RTE-IV Assembler Reference Manual, part no. 92067-90003.

i. HP 1000 E-Series and F-Series Computer Microprogramming Reference Manual, part no. 02109-90004.

j. Macro/1000 Assembler Reference Manual, part no. 92059-90001.

INSTALLATION	SECTION 2

2.1 INTRODUCTION

This section provides installation and checkout information for the HP 93585A Double Integer Firmware Package. The firmware (described in section 1) is installed on the HP 13304A Firmware Accessory Board (FAB) or HP 12791A Firmware Expansion Module (FEM) in HP 1000 E-Series Computers as outlined in the following paragraphs.

2.2 INSTALLATION

Installation consists of mounting three ROM's, part no.'s as defined for date codes in section 1, on the HP 13304A FAB (or HP 12791A FEM), then performing the checkout as described below.

Note the first instructions are provided for the FAB for support purposes only. If you are installing the ROM's on the FEM, proceed to paragraph 2.2.2.

All firmware date codes may use CM modules 40 and 41 and in fact firmware with date codes prior to 2313 must use modules 40 and 41. ROM's with firmware date code 2313, however, may be installed in any available two module block of CM which has 16 software entry points in the lower module.

The instructions for ROM installation on the FAB assume that modules 40 and 41 will be used. If ROM's with date code 2313 are going to be installed on the FAB and will use CM modules other than 40 and 41, refer to the HP 1000 M/E/F-Series Firmware Installation and Reference Manual, part no. 12791-90001, for instructions on which IC sockets to use and which jumpers to set for the new CM modules. Refer to section 4 for configuring information.

2.2.1 HP 13304A FAB INSTALLATION

The CM entry point addresses of the the microprograms (firmware) supplied start at 24000 (octal) (CM module 40). The microprograms are supplied as ROM's (part no.'s in section 1). These three ROM's are to be installed on the 13304A FAB in the three IC sockets designated D1, D2, and D3 (XU101, XU102, and XU104). ROM 1, microinstruction bits 7 through 0, is to be installed in D1 (slot XU101) whereas ROM 2, microinstruction bits 8 through 15, is to be installed in D2 (slot XU102), and ROM 3, microinstruction bits 23 though 16, is to be installed in D3 (slot XU104). The FAB CM address jumpers are to be set as shown below Refer to the HP 1000 E-Series Computer Installation and Service Manual and to the HP 13304A FAB installation instructions in the HP 1000 M/E/F-Series Firmware Installation and Reference Manual (part no. 12791-90001) for instructions on how to remove the FAB, mount the ROM's and reinstall the FAB in the computer. When installation is complete, proceed to the installation checkout instructions in paragraph 2.3.

Table 2-1. HP 13304A Jumper Positions (CM Modules 40/41)

JUMPER	POSITION
10D	0
11D	1
12D	0
13	1

2.2.2 HP 12791A FEM INSTALLATION

Installation instructions described above for the FAB using CM modules 40 and 41 as an example (see the information on firmware date codes and CM module use in paragraph 2.2) are provided for support information only. New installations (with date code 2313 ROM's) will be made on 12791A FEM boards as follows (note that ROMs, date code 2313, must be installed as a set and can not be mixed with older date code ROMs). See the instructions for FEM board installation, etc., in manual part no. 12791-90001 in conjunction with information provided here. Note that this new ROM set is relocatable to a pair of unused modules that have 16 software entry points at the beginning of the first module. The octal instruction codes should be changed accordingly.

It is not necessary to regenerate the system to use other modules (the RPL Assembly Language replacement instruction may be used) as outlined in the information in section 4.

a. Install ROM 1, part no. 93585-80006, in socket A1 (bits 0 - 7) of any completely empty set (A through H) position on the FEM.

b. Install ROM 2, part no. 93585-80007, in socket A2 (bits 8 - 15) in the same set as chosen in step a. (above).

c. Install ROM 3, part no. 93585-80008, in socket A3 (bits 16 - 23) in the same set as chosen in step a. (above).

d. In the set selected for ROM installation, set the Address Switches as follows (used for all date code ROM's being installed which will use CM modules 40 and 41):

1 = open 0 = closed

SWITCH	1	2	3	4	5	6	7	8	9	10
POSITION	1	0	0	1	1	1	0	1	0	0

Other CM addresses may be lelected for ROM's with date code 2313 (see section 4).

e. With power off the computer, reinstall the FEM board outlined in the FEM board instructions in manual part no. 12791-90001.

2.3 CHECKOUT

After installation, the twelve double integer instructions (in firmware) may be checked for proper installation via the operator panel as outlined below. Refer to the E-Series Computer Operating and Reference Manual for a description of computer controls.

a. Store 105320 (octal) in the A-register; or the appropriate address (self test code) if CM modules other than 40 and 41 are used (see section 4 information).

b. Store 0 in the P-register. Store 0 in the S-register.

c. Press PRESET; then press INSTR STEP.

A 102077 (octal) in the display register (S) indicates successful completion of the installation, otherwise, refer to the paragraph below. The X-register has the revision number of the firmware. The original number is 1 (date code 2004), and is incremented to 2, for date code 2112, and incremented to 3 for date code 2313. (Refer to manual part no. 12791-90001 verification instructions for further details.)

After the indication of successful installation (halt 102077 as indicated above) instructions for configuration can be accomplished (new systems) as outlined in section 4 and programming instructions for firmware date code 2313 (with FEM) are identical to those outlined in section 3.

2.4 TROUBLESHOOTING

The checkout procedure in paragraph 2.4 verifies that the double integer ROM's have been installed properly. If the checkout fails to complete as descibed, ensure that the ROM'S are properly installed (proper pack in the proper socket and pins oriented properly) on the FAB (or FEM). Check for bent pins on the IC packages and also ensure that the jumpers have been properly placed according to table 2-1. If the above has been accomplished and there is still a problem, there could be trouble with the FAB (or FEM). Refer to the Firmware Installation and Reference Manual and/or the E-Series Computer Installation and Service Manual for service information.

If the checkout described in paragraph 2.4 completes properly but the instructions do not operate correctly the ROM'S could be bad and should be replaced.

PROGRAMMING	SECTION 3

3.1 INTRODUCTION

This section lists the double integer instructions provided in firmware by product 93585A and the machine opcodes used to execute them. All the instructions also appear as subroutines in the RTE relocatable library. The Relocatable Library Reference Manual, part no. 24998-90001, may be reference for use examples. Note that the HP Assembler does not recognize these new instructions (as mentioned in section 1) so they require different handling in HP Assembly Language programming. Although there are several ways to use the instructions (e.g., using MIC, OCT, the RPL instructions, etc., as explained in manuals referenced in paragraph 1.4), the method descibed in this manual involves calling the instruction using JSB x, where; x equals the instruction. In all but three instructions (.DDE, .DIN, and .DNG) two 16-bit words are involved and a DEF y is used (shown in manual part no. 24998-90001). Note that the instructions (x) must be declared as externals at the beginning of the Assembly Language program in which they are used. Also, since these instructions correspond to library subroutines they must be implemented into the HP RTE-IVB or RTE-6/VM system to enable their execution in hardware-firmware as described in section 4.

3.2 DOUBLE INTEGER INSTRUCTIONS

The double integer instructions allow arithmetic and test operations on 32-bit integer quantities. The data format for double integer values is shown in the Operating and Reference Manual for the computer. Double integer values contained in the (A,B) registers have the most significant bits in the A-register. Values stored in memory require two locations. The operand address in a double integer instruction points to the first memory location, which contains the most significant bits.

Instructions which do not return information in the extend or overflow bits will not alter the state of these flags. Operations which may return an overflow condition will clear overflow at entry.

The instructions are described below. All opcodes for the instructions are octal values.

NOTE

All opcodes listed correspond the the microcode installed in CM module 40. Refer to section 4 if the firmware (i.e., with revision code 2313) is configured to use a different module with different opcodes.

3.2.1 SELF TEST

As per the checkout information in section 2, the instruction has the machine opcode:

105320

See section 2 checkout information.

3.2.2 .DAD, DOUBLE INTEGER ADD

The first word has machine opcode:

105321

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

(A,B) = (A,B) + <OPND>

The contents of <OPND> are unaltered. In the event of overflow, the overflow bit is set and the returned result contains the lower 32-bits of the actual sum, in unsigned form. The extend bit will be set if an unsigned carry out of the A-register occurs.

3.2.3 .DSB, DOUBLE INTEGER SUBTRACT

The first word has the machine opcode:

105327

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

(A,B) = (A,B) - <OPND>

The contents of <OPND> are unaltered. In the event of overflow, the overflow bit is set and the returned result contains the lower 32-bits of the actual difference, in unsigned form. The extend bit will be set if an unsigned borrow out of the A-register occurs.

3.2.4 .DSBR, DOUBLE INTEGER SUBTRACT REVERSE

The first word has the machine opcode:

105334

The second word has the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

P (A,B) = <OPND> - (A,B)

The contents of <OPND> are unaltered. In the event of overflow, the overflow bit is set and the returned result contains the lower 32-bits of the actual difference, in unsigned form. The extend bit will be set if an unsigned borrow out of the operand occurs.

3.2.5 .DMP, DOUBLE INTEGER MULTIPLY

The first word has the machine opcode:

105322

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

(A,B) = (A,B) x <OPND>

The contents of <OPND> are unaltered. If overflow occurs, the result (077777,177777) is returned and overflow is set.

3.2.6 .DDI, DOUBLE INTEGER DIVIDE

The first word has the machine opcode:

105325

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

(A,B) = (A,B) / <OPND>

The contents of <OPND> are unaltered. If overflow or divide by zero occurs, the result (077777,177777) is returned and overflow is set.

3.2.7 .DDIR, DOUBLE INTEGER DIVIDE REVERSE

The first word has the machine opcode:

105326

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

(A,B) = <OPND> / (A,B)

The contents of <OPND> are unaltered. If overflow or divide by zero occurs, the result (077777,177777) is returned and overflow is set.

3.2.8 .DNG, DOUBLE INTEGER NEGATE

The instruction has the machine opcode:

105323

No second operand is involved.

The instruction performs the double integer operation:

(A,B) = - (A,B)

An input value of (100000,000000) is left unchanged and overflow

is set. An input value of zero will cause the extend bit to be set.

3.2.9 .DCO, DOUBLE INTEGER COMPARE

The first word has the machine opcode:

105324

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction compares the double integers (A,B) and <OPND>

If (A,B) = <OPND> Return to P+2
If (A,B) < <OPND> Return to P+3
If (A,B) > <OPND> Return to P+4

where P is the address of the .DCO instruction. The value of both double integers and the overflow bit are unaltered.

3.2.10 .DIN, DOUBLE INTEGER INCREMENT

The instruction has the machine opcode:

105330

No second operand is involved.

The instruction performs the double integer operation:

(A,B) = (A,B) + 1

An input value of (077777,177777) will return a result of (100000,000000) and set overflow. An input value of (177777,177777) will return a result of zero and cause the extend bit to be set.

3.2.11 .DDE, DOUBLE INTEGER DECREMENT

The instruction has the machine opcode:

105331

No second operand is involved.

The instruction performs the double integer operation:

(A,B) = (A,B) - 1

An input value of (100000,000000) will return the result (077777,177777) and set overflow. An input value of zero will return the result (177777,177777) and cause the extend bit to be set.

3.2.12 .DIS, DOUBLE INTEGER INCREMENT & SKIP IF 0

The first word has the machine opcode:

105332

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

<OPND> = <OPND> + 1

If the new value of <OPND> equals zero, the next instruction will be skipped. The value in <OPND> is treated as an unsigned number, and a carry out of the <OPND> is ignored.

3.2.13 .DDS, DOUBLE INTEGER DECREMENT & SKIP IF 0

The first word has the machine opcode:

105333

The second word is the operand memory address with bit 15 the direct/indirect bit.

The instruction performs the double integer operation:

<OPND> = <OPND> - 1

If the new value of <OPND> equals zero, the next instruction will be skipped. The value in <OPND> is treated as an unsigned number, and a borrow out of the <OPND> is ignored.

3.3 EXECUTION TIMES

Typical execution times for the instructions are shown below.

INSTRUCTION	EXECUTION TIME (MICROSECONDS)
.DAD	4.5
.DSB	5.0
.DSBR	6.2
.DMP	14.6
.DDI	9.0
.DDIR	9.1
.DNG	2.4
.DCO	4.9
.DIN	1.7
.DDE	1.7
.DIS	4.5
.DDS	4.3

RTE CONFIGURATION	SECTION 4

4.1 INTRODUCTION

Since the Double Integer instructions are implemented in firmware in the E-Series Computer when product 93585A is installed, certain changes are necessary so that the micro-routines may be executed. The system must be informed which subroutines are implemented in firmware with their instruction opcode equivalents. Changes to the RTE-IVB or RTE-6/VM generation procedure are outlined in paragraph 4.2. Non-generation configuration instructions are in paragraph 4.3.

4.2 GENERATING INTO RTE-IVB or RTE-6/VM

During the parameter input phase of system generation, change the library entry points as shown below using the RP command. Note that this information is for CM module 40 and 41 use (all firmware revision codes may use these if available). Revison code 2313 firmware may use other CM modules as outlined on the next page. Refer to the RTE-IVB or RTE-6/VM system software manuals for complete information on system generation (part numbers are in section 1).

```
CHANGE ENTS?
*
* DOUBLE WORD INTEGER
*
.DAD,RP,105321
.DMP,RP,105322
.DNG,RP,105323
.DCO,RP,105324
.DDI,RP,105325
.DDIR,RP,105326
.DSB,RP,105327
.DIN,RP,105330
.DDE,RP,105331
.DIS,RP,105332
.DDS,RP,105333
.DSBR,RP,105334
```

Control memory allocation for the HP 93585A product is normally assigned to module numbers 40 and 41 with starting address 24000 (octal) (opcode range of 105320 to 105337). If the modules are not available, the following modules may be used to relocate the software entry points (as available) for product HP 93585A that has firmware revision code 2313. (Note that modules 40 and 41 are included in the list for completeness.) This may be accomplished at system generation or at any other time using Assembly Language instructions (e.g., RPL) to change library entry points per RTE implementation instructions outlined in the Programming Information section of the HP 1000 M/E/F-Series Technical Reference Handbook, part no. 5955-0282. See paragraph 4.3 below, for non-generation inclusion of the firmware.

MODULE NO.	STARTING ADDRESS	OPCODE RANGE (OCTAL)
38, 39	23000	105300 - 105317
40, 41	24000	105320 - 105337
46, 47	27000	101440 - 101457 or 105440 - 105457
48, 49	30000	101520 - 101537 or 105520 - 105537
50, 51	31000	101560 - 101577 or 105560 - 105577
56, 57	34000	101600 - 101617 or 105600 - 105617
58, 59	35000	101640 - 101657 or 105640 - 105657
60, 61	36000	105140 - 105157
62, 63	37000	105160 - 105177

4.3 NON-GENERATION CONFIGURATION

If the firmware is installed in the computer and system generation is currently inconvenient, the example program shown below may be used. Configure the BASE opcode according to the location of the firmware modules, assemble the program, and include the resulting relocatable module at load time using the RE command in LOADR or LINK. This module may be included in a

system generation instead of using the RP commands in the answer file. It should be included after all of the library files.

```
PAGE#  1          Macro/1000 Version 2226        10:55 AM  MON.,  6  FEB., 1984

00001                  MACRO,L
00002                        NAM DBRPL,7 DOUBLE INTEGER FIRMWARE RPS
00003*
00004*  THIS IS A SAMPLE SUBROUTINE WHICH MAY BE
00005*  USED AT LOAD TIME WHEN THE RP'S ARE NOT
00006*  GENERATED INTO THE SYSTEM.  IT MAY ALSO
00007*  BE USED AT GENERATION INCLUDED IN A THE SYSTEM GENERATION
00008*  INSTEAD OF THE 'RP' STATEMENTS IN THE
00009*  GENERATION ANSWER FILE.
00010*
00011                        ENT .DAD,.DSB,.DMP,.DDI,.DSBR,.DDIR,.DNG
00012                        ENT .DCO,.DIN,.DDE,.DIS,.DDS
00013*
00014*  BASE CORRESPONDS TO THE MODULE 40 ENTRY POINT.
00015*  BASE CAN BE CHANGED DEPENDING ON THE MODULE
00016*  USED BY THE DOUBLE INTEGER FIRMWARE.
00017*  REFER TO SECTION 4 OF THE 93585A MANUAL
00018*  FOR THE APPROPRIATE VALUE.
00019*
00020*
00021         105320  BASE   EQU 105320B    FIRST SOFTWARE ENTRY POINT (SELF TEST)
00022*
00023         105321S .DAD   RPL BASE+1
00024         105327S .DSB   RPL BASE+7
00025         105322S .DMP   RPL BASE+2
00026         105325S .DDI   RPL BASE+5
00027         105334S .DSBR  RPL BASE+14B
00028         105326S .DDIR  RPL BASE+6
00029         105323S .DNG   RPL BASE+3
00030         105324S .DCO   RPL BASE+4
00031         105330S .DIN   RPL BASE+10B
00032         105331S .DDE   RPL BASE+11B
00033         105332S .DIS   RPL BASE+12B
00034         105333S .DDS   RPL BASE+13B
00035                        END
Macro:  No  errors total
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