HEWLETT PACKARD

HP 1000 M/E/F-Series Firmware

Installation and Reference Manual

The following products are covered:

HP 13304A Firmware Accessory Board
HP 12791A Firmware Expansion Module
HP 13197A Writable Control Store Board
HP 1000E/F-Series Dynamic Mapping System
HP 12731A Memory Expansion Module
HP 13307B Dynamic Mapping Instruction Firmware
HP RTE-IV A/B Extended Memory Area Firmware
HP 13306B E-Series Fast FORTRAN Processor Firmware
HP 1000 F-Series Dynamic Mapping Instructions and Fast FORTRAN Processor Firmware
HP 1000 F-Series Scientific Instruction Set Firmware
HP 12824A/29A Vector Instruction Set Firmware
HP 1000 Loader Extension Firmware
HP 1000 E-Series Base Set and EIG/Floating Point Firmware
HP 1000 F-Series Base Set and EIG/Floating Point Firmware
HP RTE-6VM Operating System/EMA/VMA Firmware

Data Systems Division
11000 Wolfe Road
Cupertino, CA 95014-9974

Manual Part No. 12791-90001
E0885

Printed in U.S.A. February, 1986
Update 1 Incorporated

Printing History

The Printing History below identifies the edition of this manual and any updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this printing history page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the Manual Numbering File or the Computer User's Documentation Index. (The Manual Numbering File is included with your software. It consists of an "M" followed by a five digit product number.)

Third Edition	Jun 1981	
Fourth Edition	Nov 1981	VMA/EMA Firmware
Update 1	Apr 1982	ROM chgs to 91750A,DS/1000-IV
Reprint	Apr 1982	Update 1 Incorporated
Update 2	Dec 1982	
Reprint	Dec 1982	Update 2 Incorporated
Update 3	Sep 1983	Correct Control Memory Map
Reprint	Sep 1983	Update 3 Incorporated
Update 4	May 1984	
Reprint	May 1984	Update 4 Incorporated
Fifth Edition	Aug 1985	Firmware Update
Update 1	Feb 1986	Firmware Chgs to Support 7974A
Reprint	Feb 1986	Update 1 Incorporated

Preface

The firmware described in this manual is standard or optional firmware for the HP 1000 E/F-Series Computer. The 13304A FAB, 12791A FEM, and 13197A WCS are options for M/E/F-Series Computers. M-Series firmware options are not included in this manual, information for these can be found in the following manuals.

a. HP 21MX Computer Series Installation and Service Manual (part no. 02108-90006).

b. HP 21MX Computer Series Reference Manual (part no. 02108-90002).

c. HP 21MX Computer Series Operator's Manual (part no. 02108-90004).

d. HP 21MX M-Series Computer HP 2108B and HP 2112B Operating and Reference Manual (part no. 02108-90037).

e. HP 1000 M-Series Computer HP 2108B and HP 2112B Installation and Service Manual (part no. 02108-90035).

f. HP 12945A M-Series User Control Store Board Installation Manual (part no. 12945-90001).

g. HP 12978A M-Series Writable Control Store Board Reference Manual (part no. 12978-90007).

h. HP 12976B M-Series Dynamic Mapping System Installation Manual (part no. 12976-90005).

i. HP 12977B M-Series Fast FORTRAN Processor Installation Manual (part no. 12977-90008).

j. HP 91740A M-Series Distributed System (DS/1000) Firmware Installation Manual (part no. 91740-90007).

Additional information for E/F-Series Computers is provided in the following manuals.

a. HP 1000 E-Series or F-Series Operating and Reference Manual.

b. HP 1000 E-Series or F-Series Installation and Service Manual.

c. HP 1000 E/F-Series Computer Microprogramming Reference Manual (part no. 02109-90001).

d. HP 12892A Memory Protect Installation Manual (part no. 12892-90007).

Table of Contents

Chapter 13
F-Series BS and EIG/FP ROMs

Chapter 14
E-Series RTE-6/VM OS/VMA/EMA ROMs

Chapter 15
F-Series RTE-6/VM OS/VMA/EMA ROMs

Appendix A
HP 12823F Upgrade Kit

Illustrations

Tables

Chapter 1
HP 13304A FAB

Introduction

This chapter provides installation instructions and service information for the HP 13304A Firmware Accessory Board (FAB) which is an accessory for HP 1000 E/F-Series Computers. Installation and reference information for the various HP firmware options which can be installed on the FAB can be found in the appropriate section of this manual. Additional information is provided in the manuals listed in the preface.

Description

The 16,384 words of addressable control store in the HP 1000 E/F-Series Computer are divided into sixty-four 256-word modules (0 through 63). See Figure 11-2 or 11-3 in Chapter 11 for the allocation of Control Memory. The computer base instruction set is not available to the user microprogrammer. Any other control store module not filled by microprogrammed Hewlett-Packard options are available to the user microprogrammer. It is recommended that the user microprogrammer only use modules which are not HP reserved or specified for HP microprogrammed options.

The HP 13304A Firmware Accessory Board (FAB) includes space for 3,584 words of addressable control memory and consists of 30 integrated-circuit (IC) sockets to accommodate up to 14 modules of control memory. These 14 modules are arranged into four addressable blocks (A, B, C, and D) of control memory. Each addressable block has its own jumper configuration which will determine its associated control memory module addresses.

Block Addressing

Block A (sockets A1 through A12) consists of twelve 1K (256 word by 4 bit) read-only-memory (ROM) IC's which include space for 512 words (two modules) of addressable control memory. ROM IC's to be installed in block A must be configured as two contiguous modules; e.g., modules 46 (sockets A1 through A6) and 47 (sockets A7 through A12). The least significant module (LSM) corresponds to the lower number IC sockets (A1 through A6). The most significant module (MSM) corresponds to the higher number IC sockets (A7 through A12). (See Figure 1-2 and Table 1-1.)

Blocks B, C, and D (sockets B1 through B6, sockets C1 through C6, and sockets D1 through D6, respectively) each consists of six 4K (512 words by 8 bit) ROM IC's; each of these three blocks include space for 1,024 words (four modules) of addressable control memory. ROM IC's to be installed in blocks B, C, or D must be configured as four contiguous modules; e.g., modules 60, 61, 62, and 63. If block B is used, the least significant module pair (LSMP) corresponds to the lower number IC sockets (B1 through B3) and the most significant module pair (MSMP) corresponds to the higher number IC sockets (B4 through B6). (See Figure 1-2 and Table 1-2.) Each ROM IC must be tested, burned, and verified according to the user's need, or purchased from Hewlett-Packard as an option.

Priority

Control Store modules installed on the FAB assembly have lower priority than the HP 13197A Writable Control Store (WCS), the HP 12791A Firmware Expansion Module (FEM), and the base instruction set located on the CPU PCA (modules 0-3). In other words, if the instruction set or the optional WCS, or FEM is enabled and then addressed, control store installed on the FAB assembly is disabled.

Kit Contents

The HP 13304A Firmware Accessory Board Kit consists of the following:

Description	HP Part No.	Quantity
Screw, machine, panhead, no. 6-32, 1/4 in. (with external toothed lockwasher)	2360-0113	4
Jumper, plug	1258-0124	14
Firmware Accessory Board Assembly	5061-1339	1
Ribbon Cable Assembly	5061-1336	1
M/E/F-Series Firmware Installation and Reference Manual	12791-90001	1

MODULE NO.	ADDRESSES		JUMPER PREFIX				UPPER/ LOWER 8K JUMPER
	DECIMAL	OCTAL	NOTE 1 9	10	11	12	NOTE 2 13
0	0-00255	00000-00377	0	0	0	0	0
1	00256-00511	00400-00777	1				
2	00512-00767	01000-01377					
3	00768-01023	01400-01777					
4	01024-01279	02000-02377	0	1	0	0	0
5	01280-01535	02400-02777	1				
6	01536-01761	03000-03377					
7	01762-02047	03400-03777					
8	02048-02303	04000-04377	0	0	1	0	0
9	02304-02559	04400-04777	1				
10	02560-02815	05000-05377					
11	02816-03071	05400-05777					
12	03072-03327	06000-06377	0	1	1	0	0
13	03328-03583	06400-06777	1				
14	03584-03849	07000-07377					
15	03850-04095	07400-07777					
16	04096-04351	10000-10377	0	0	0	1	0
17	04352-04607	10400-10777	1				
18	04608-04863	11000-11377					
19	04864-05119	11400-11777					
20	05120-05375	12000-12377	0	1	0	1	0
21	05376-05631	12400-12777	1				
22	05632-05887	13000-13377					
23	05888-06143	13400-13777					
24	06144-06399	14000-14377	0	0	1	1	0
25	06400-06655	14400-14777	1				
26	06656-06911	15000-15377					
27	06912-07167	15400-15777					
28	07168-07423	16000-16377	0	1	1	1	0
29	07424-07679	16400-16777	1				
30	07680-07935	17000-17377					
31	07936-08191	17400-17777					
32	08192-08447	20000-20377	0	0	0	0	1
33	08448-08703	20400-20777	1				
34	08704-08959	21000-21377					
35	08960-09215	21400-21777					
36	09216-09571	22000-22377	0	1	0	0	1
37	09572-09727	22400-22777	1				
38	09728-09983	23000-23377					
39	09984-10239	23400-23777					
40	10240-10495	24000-24377	0	0	1	0	1
41	10496-10751	24400-24777	1				
42	10752-10917	25000-25377					
43	10918-11263	25400-25777					
44	11264-11519	26000-26377	0	1	1	0	1
45	11520-11775	26400-26777	1				
46	11776-12031	27000-27377					
47	12032-12287	27400-27777					
48	12288-12543	30000-30377	0	0	0	1	1
49	12544-12799	30400-30777	1				
50	12800-13055	31000-31377					
51	13056-13311	31400-31777					
52	13312-13557	32000-32377	0	1	0	1	1
53	13558-13823	32400-32777	1				
54	13824-14079	33000-33377					
55	14080-14335	33400-33777					
56	14336-14591	34000-34377	0	0	1	1	1
57	14592-14847	34400-34777	1				
58	14848-15103	35000-35377					
59	15104-15359	35400-35777					
60	15360-15615	36000-36377	0	1	1	1	1
61	15616-15871	36400-36777	1				
62	15872-16127	37000-37377					
63	16128-16383	37400-37777					

1. Jumper 9 applies to block A only.
2. Jumper 13 selects upper or lower 8K of control store.
3. See figure 1-2 for jumper locations.

Figure 1-1. FAB Assembly Jumper Configurations

One of the following recommended PROMs must be used to ensure reliable operation.

4K PROMS		1K PROMS	
HP Part No.	1816-1142	HP Part No.	1816-0782
Signetics	N82S141F	Signetics	N82S129F
Harris	HMI-7641-5	Harris	HMI-7611-5
		Monolithic Memories	6301

Installation/Removal

Figure 1-2 shows the locations of the addressable block jumpers and ROM IC sockets. The shaded areas show the location of each ROM IC socket. Jumpers are designated 9A through 12A, 10B through 12B, 10C through 12C, 10D through 12D, and 13. The numerical jumper notations represent the ROM address register bits 9 through 13. The alphabetical jumper notations represent the associated block of addressable control store. In other words, jumper notations A, B, C, and D correspond to blocks A, B, C, and D, respectively.

Installation Procedure

CAUTION

ROM IC's may be permanently damaged if oriented incorrectly when installed and power is applied.

a. Consult with the system programmer and determine the starting address and length of control store required for the microprogram.

b. For block A configuration, use Table 1-1 and Figure 1-1 for ROM location and jumper configuration requirements, respectively. Use the following example as a guide:

   1. Assuming the microprogram operates between 27000 and 27777, Figure 1-1 shows that modules 46 and 47 are required.

   2. Determine if the microprogram operates in the least significant module (LSM) or the most significant module (MSM). Module 46 is the LSM and module 47 is the MSM.

   3. If part of the microprogram operates in the LSM (27000 to 27377) install the corresponding six 1K ROM IC's in sockets A1 through A6. If part of the microprogram operates in the MSM (27400 to 27777), install the corresponding six 1K ROM IC's in sockets A7 through A12. (Refer to Table 1-1 and Figure 1-2.) Ensure that the IC's are oriented correctly as shown in Figure 1-2 by matching pin 1 of each IC with the white dot of each IC socket.

4. Determine the jumper requirements to match the module(s) selected. For modules 46 and 47, install jumpers 9A, 10A, 11A, 12A, and 13 as 1, 1, 1, 0, and 1, respectively. (See Figure 1-1.)

Table 1-1. ROM Location for Block A

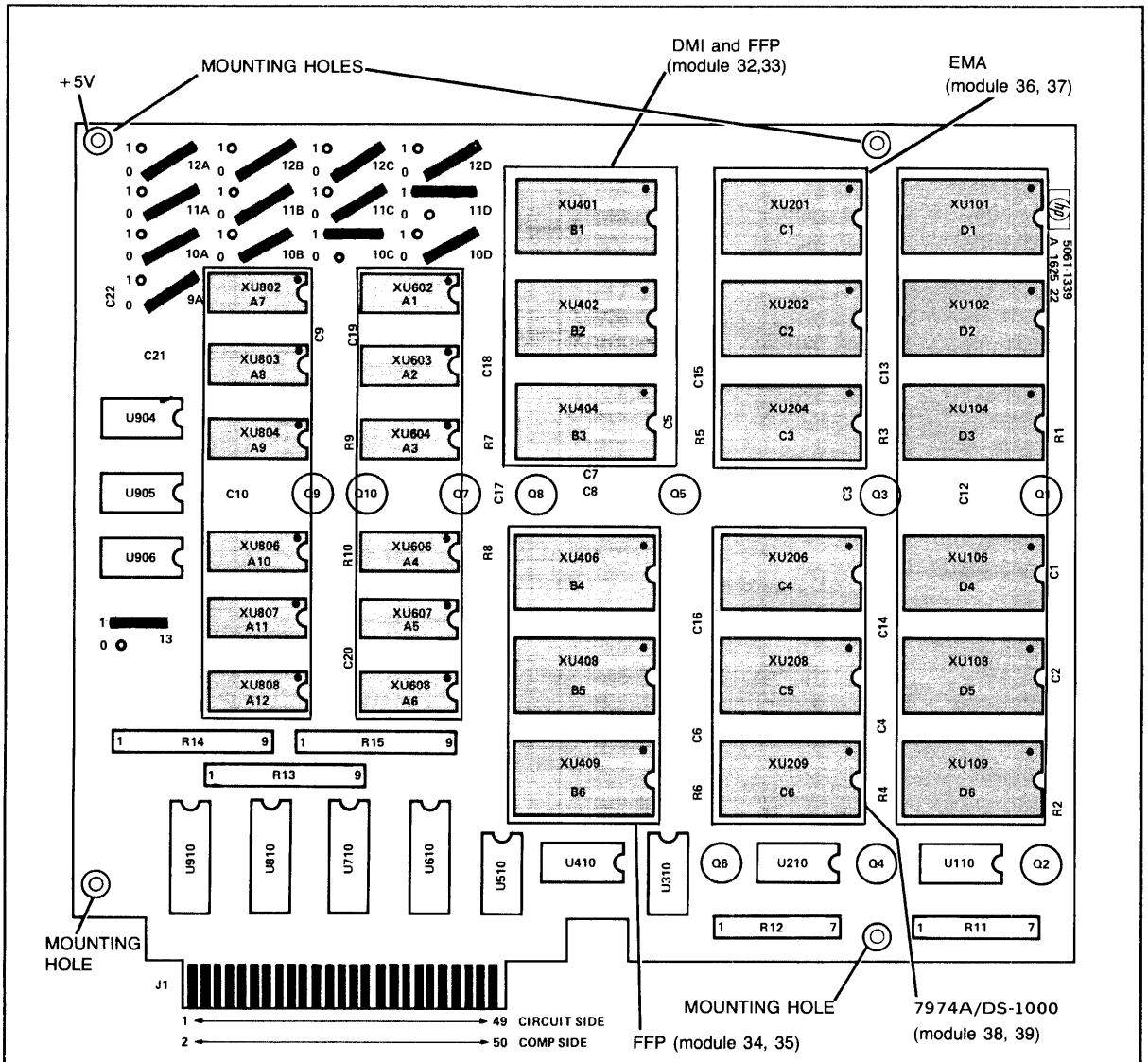
4-Bit Set	ROM Package Location	
	Least Significant Module (LSM)	Most Significant Module (MSM)
23-20 MSB	A6 (XU608)	A12 (XU808)
19-16	A5 (XU607)	A11 (XU807)
15-12	A4 (XU606)	A10 (XU806)
11-8	A3 (XU604)	A9 (XU804)
7-4	A2 (XU603)	A8 (XU803)
3-0 LSB	A1 (XU602)	A7 (XU802)

Notes:
1. Locations A1-A6 are selected first (the lower 1/4K configuration).
2. Locations A7-A12 are selected last (the upper 1/4K configuration).
3. See Figure 1-2 for ROM locations.

Table 1-2. ROM Location for Blocks B, C, and D

8-Bit Set	ROM Package Location	
	Least Significant Module Pair (LSMP)	Most Significant Module Pair (MSMP)
23-16 MSB	B3 (XU404) C3 (XU204) D3 (XU104)	B6 (XU409) C6 (XU209) D6 (XU109)
15-8	B2 (XU402) C2 (XU202) D2 (XU102)	B5 (XU408) C5 (XU208) D5 (XU108)
7-0 LSB	B1 (XU401) C1 (XU201) D1 (XU101)	B4 (XU406) C4 (XU206) D4 (XU106)

Notes:
1. Locations suffixed 1, 2, and 3 are selected first (the lower 1/2K configuration).
2. Locations suffixed 4, 5, and 6 are selected last (the upper 1/2K configuration).
3. See Figure 1-2 for ROM locations.



NOTES: 1. SHADED AREA SHOWS ROM IC SOCKET LOCATIONS.

2. SEE TABLES 1 AND 2 FOR DESIGNATED ROM LOCATIONS.

3. JUMPERS 9A, 10A, 11A, 12A, AND 13 SHOWN CONFIGURED FOR BLOCK A MODULES 32 AND 33. JUMPERS 10B,11B,12B, AND 13 SHOWN CONFIGURED FOR BLOCK B MODULES 32, 33, 34, AND 35 (DMI AND FFP).

4. JUMPERS 10C,11C,12C, & 13 SHOWN CONFIGURED FOR BLOCK C MODULES 36,37,38, AND 39 (EMA AND DS/1000). JUMPERS 10D, 11D, 12D, AND 13 SHOWN CONFIGURED FOR BLOCK D MODULES 40,41,42, AND 43 (SIS).

5. SEE FIGURE 1-1 FOR OTHER JUMPER CONFIGURATIONS.

Figure 1-2. Firmware Accessory Board

c. For block B, C, or D configuration, use Table 1-2 and Figure 1-1 for ROM location and jumper configuration requirements, respectively. Use the following example as a guide:

   1. Assuming the microprogram operates between 34000 and 35777, Figure 1 shows that modules 56, 57, 58, and 59 are required.

   2. Determine if the microprogram operates in the least significant module pair (LSMP) or the most significant module pair (MSMP). Modules 56 and 57 are the LSMP and modules 58 and 59 are the MSMP.

   3. If part of the microprogram operates in the LSMP (34000 to 34777) install the corresponding three 4K ROM IC's in sockets B1 through B3. (Refer to Table 1-2 and Figure 1-2.) If part of the microprogram operates in the MSMP (34000 to 35777), install the corresponding three 4K ROM IC's in sockets B4 through B6. Although blocks B, C, or D may be used, it is recommended that block B be used first, block C second, and block D last. Ensure that the IC's are oriented correctly as shown in Figure 1-2 by matching pin 1 of each IC with the white dot of each IC socket.

   4. Determine the jumper requirements to match the modules selected. For modules 56 through 59, install jumpers 10B, 11B, 12B, and 13 as 0, 1, 1, and 1, respectively. (See Figures 1-1 and 1-2.)

WARNING

Hazardous voltages are present inside the computer mainframe! Before installing the FAB, set the ~LINE and BATTERY switches to OFF and DISCONNECT THE POWER CORD!

d. Set ~LINE and BATTERY switches to OFF and disconnect the power cord.

e. Disconnect I/O extender cable assembly (if present) from CPU PCA edge connector.

f. Loosen screw located in rear fold of bottom cover; slide cover toward rear and remove.

g. Position FAB assembly over the CPU PCA standoffs and fasten it securely with the four screws and lockwashers. (See Figure 1-3.) Note that the FAB assembly obtains its dc power from the CPU PCA standoffs.

h. Connect FAB connector assembly between FAB assembly connector J1 and CPU PCA connector J2.

i. Replace bottom cover.

j. Connect I/O extender cable assembly (if present) to CPU PCA connector J3.

k. Connect power cord to the computer and set ~LINE and BATTERY switches to ON.

l. Check that the +5 CPU voltage, when measured at crossover board test point is 5.15 Volts. Adjust if necessary. The adjustment procedure is located in the appropriate Installation and Service Manual.

Installation is now complete and ready for the user's control store microprogramming application.

Removal Procedure

a. Set ~LINE and BATTERY switches to OFF and disconnect the power cord.

b. Disconnect I/O extender cable assembly (if present) from CPU PCA edge connector.

c. Loosen screw located in rear fold of bottom cover; slide cover toward rear and remove.

d. Remove FAB ribbon connector assembly between FAB assembly connector J1 and CPU PCA connector J2.

e. Remove the four screws and lockwashers (see Figure 1-3) which fasten the FAB to the CPU standoffs.

Removal is now complete, refer to the previous section for configuration and installation procedures.

Service Information

Because of its design, the FAB assembly is field replaceable as an assembly. However, a system failure can be isolated to the FAB-ROM combination by running the appropriate self test and/or diagnostic corresponding to the firmware that is installed on the FAB.

a. If Scientific Instruction Set (SIS), Extended Memory Area (EMA), Dynamic Mapping Instructions (DMS), Fast Fortran Processor (FFP), or Distributed System Firmware (DS/1000) is installed on the FAB, run the associated self-test and/or diagnostic. Self-tests are described in the appropriate section of this manual. For diagnostic operation, the appropriate diagnostic manual must be consulted.

b. If a particular test fails, verify that the address jumpers on the FAB are configured correctly. Ensure that the ribbon cable is correctly seated.

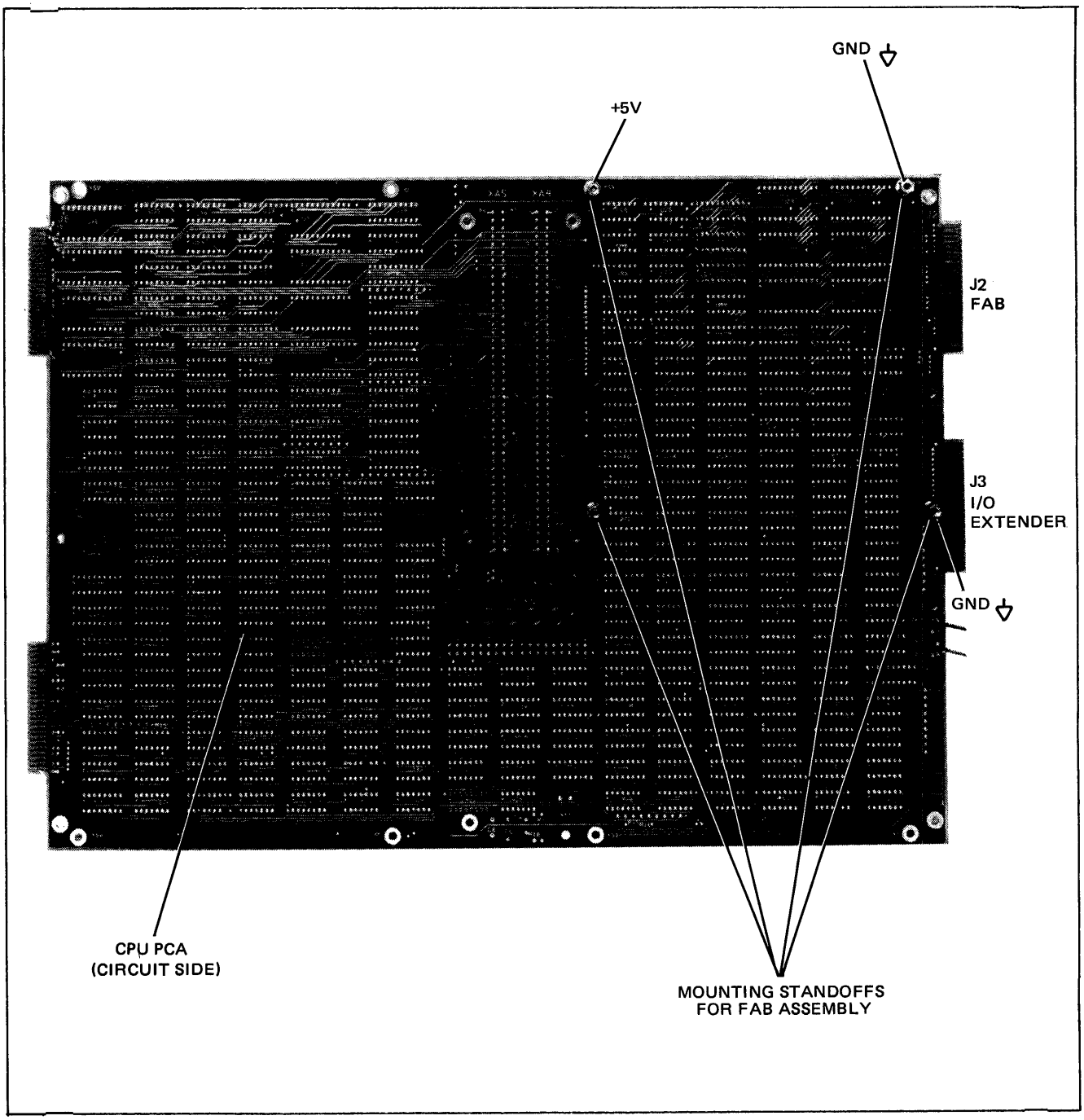


Figure 1-3. Firmware Accessory Board Mounting Details

c. Verify that the +5V CPU voltage is set at the recommended setting of 5.15 volts when measured at the crossover PCA test point. Refer to the appropriate Installation and Service Manual for the power supply voltage adjustment.

d. If the test still fails, insert a known good set of ROMs in the failing locations and rerun the diagnostic and/or self-test.

e. If the test now passes, defective ROMs are indicated. Change one ROM at a time to isolate the defective ROM(s).

   If after installing a new FAB, the test still fails, install a new ribbon cable assembly and run the tests again.

   If the test still fails, a defective FAB or ribbon cable assembly is indicated. Install a new FAB and run the tests.

f. If a failure still exists, contact your nearest Hewlett-Packard Sales and Service Office. A list of HP Sales and Service Offices is provided at the back of this manual.

Chapter 2
HP 12791A FEM

Introduction

This chapter provides installation and service information for the HP 12791A Firmware Expansion Module (FEM) which is standard on the HP 1000 E/F-Series Computers and is an accessory for the HP 1000 M-Series Computer. Installation and reference information for the various HP firmware options which can be installed on the FEM can be found in the appropriate section of this manual. Additional information is provided in the manuals listed in the Preface.

NOTE

Terminology may differ somewhat between the M-Series and E/F-Series computers. The E/F-Series terminology will be used, but the M-Series user should note that the following are synonomous.

E/F-Series	M-Series
Control Memory	Control Store
Control Memory Address Register (CMAR)	ROM Address Register (RAR)
Microinstruction Register (MIR)	ROM Instruction Register (RIR)

Description

The 16,384 words of addressable Control Memory in the HP 1000 E/F-Series computers are divided into sixty-four 256 word modules (0 through 63). The 4,196 words of addressable Control Memory in the HP 1000 M-Series computer are divided into sixteen 256 word modules (0 through 15). See the appropriate Figure, 11-1, 11-2, or 11-3 in Chapter 11 for the allocation of Control Memory. The modules which hold the computer base instruction set are not available to the user microprogrammer (modules 0,1,14,15) in M-Series and modules 0,1,2,3 in E/F-Series computers). Any other Control Memory modules not filled by microprogrammed Hewlett-Packard options are available to the user microprogrammer. It is recommended that the user microprogrammer only use modules which are not HP reserved, or specified for HP microprogrammed options. If the user microprogrammer uses modules which are specified for HP firmware options or HP reserved, he will not be able to use present or future HP microprogrammed options which reside in those Control Memory modules.

The HP 12791A Firmware Expansion Module (FEM) contains 24 integrated-circuit (IC) sockets which are divided into eight sets of three sockets each (see Figure 2-1). Each set of three 24 pin sockets can accommodate 4k (512 x 8) or 8k (1024 x 8) read-only-memory (ROM) ICs. Since each set is individually addressable, up to eight discrete sections (or blocks) of Control Memory can be installed on the FEM. Each set of sockets has a corresponding 10 rocker switch DIP pack which is configured to enable or disable the set, specify the size of ROMs used, and specify the Control Memory modules which will be addressed by these sockets (see Table 2-1 for switch configuration settings).

Block Addressing

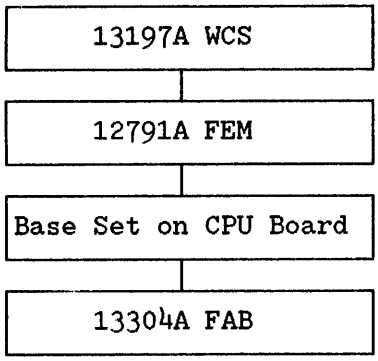
The eight sets of three 24-pin sockets are identified as SETA, SETB, SETC, SETD, SETE, SETF, SETG, and SETH. Within each set, the sockets are designated as sockets 1, 2, or 3 (e.g., A1, A2, and A3). Socket A1 contains the least significant bits (bits 0-7) of the microinstruction, socket A2 contains bits 8-15, and socket A3 contains the most significant bits (bits 16-23). The corresponding 10 rocker switch DIP packs are identified as SWA, SWB, SWC, SWD, SWE, SWF, SWG, and SWH.

If 4k ROMs (512 word by 8 bit) are used in a set, the set contains 512 words (two contiguous modules) of Control Memory. The two contiguous modules begin on an even module number (e.g., 36 and 37, or 52 and 53). If 8k ROMs (1024 word by 8 bit) are used in a set, the set contains 1024 words (four contiguous modules begin on a module number which is an even multiple of 4 (e.g., 24 through 27, or 48 through 51). Both 4k and 8k ROMs can be used on the FEM at the same time, since each set of 3 sockets can be individually configured for ROM size. Switch settings and part locations are shown in Table 2-1 and Figure 2-1, respectively.

Priority

Control Memory modules installed on the FEM assembly have lower priority than the 13197A Writable Control Store (WCS) but higher priority than the base instruction set located on the CPU PCA or the FAB board.

In an E/F-Series Computer the priority is as follows:

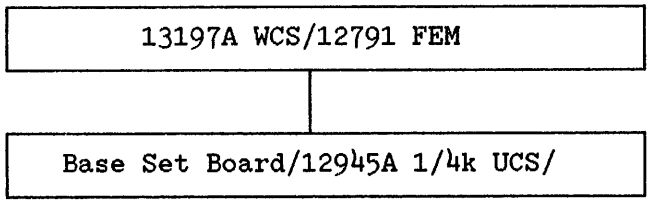


Highest Priority

When a module of Control Memory is addressed on a particular control memory board, all equivalent modules on lower priority boards are disabled.

Lowest priority

In a M-Series Computer the priority is as follows:



Highest Priority

Lowest Priority

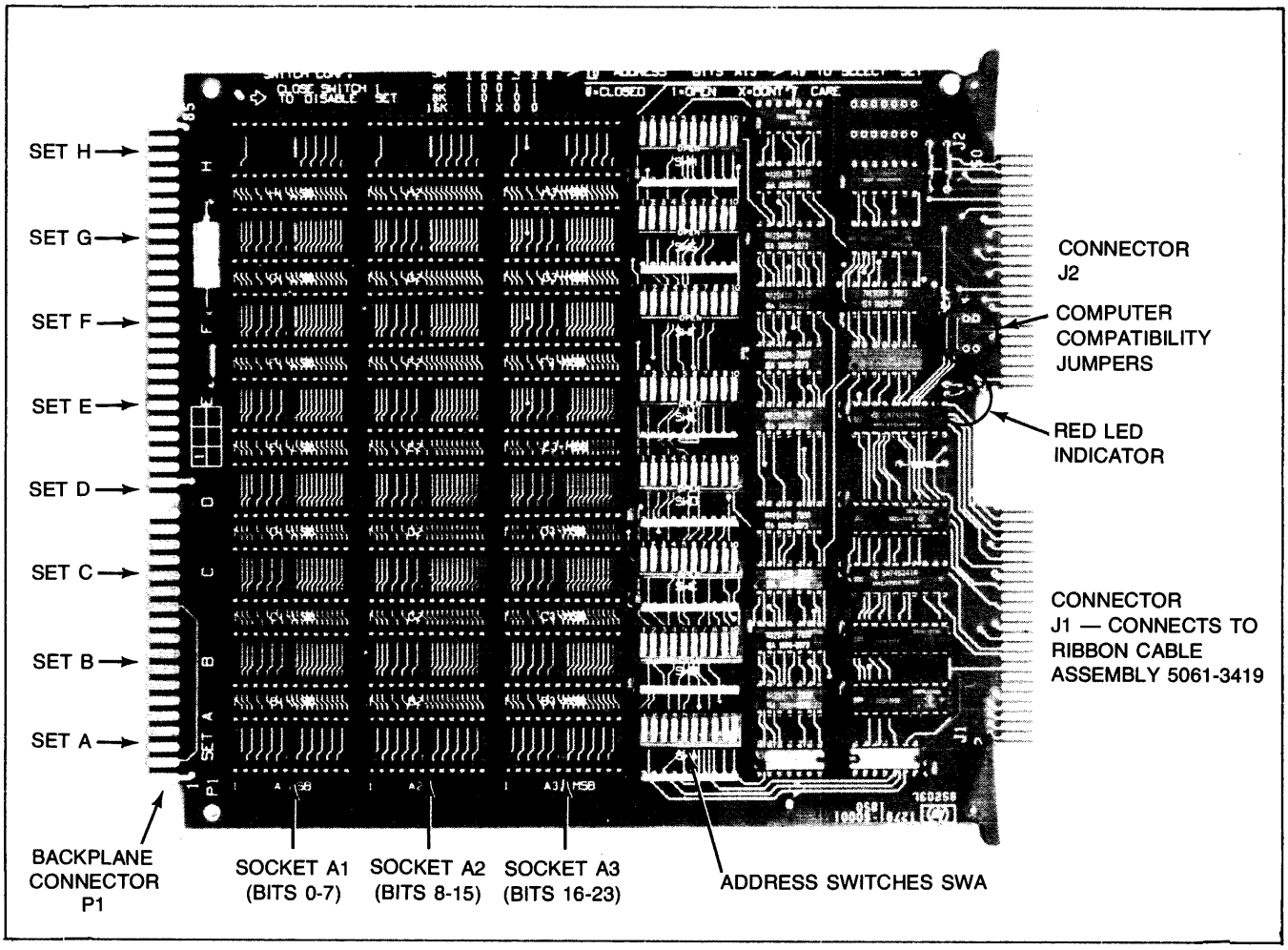


Figure 2-1. Firmware Expansion Module

Product Contents

The HP 12791A Firmware Expansion Module Product consists of the following:

Description	HP Part No.	Quantity
Firmware Expansion Module Assembly	12791-60001	1
Ribbon Cable Assembly	5061-3419	1
HP 1000 M/E/F-Series Firmware Installation and Reference Manual	12791-90001	1

Recommended PROMs

The following are the recommended PROMs for use with the FEM.

	4k PROMs	8k PROMs
HP Part No.	1816-1142	1816-1160
Signetics	N82S141F	N82S181F
Harris	7641	7681
AMD	27S31	27S181

Installation/Removal

Power Requirements

The +5V power required by the Firmware Expansion Module is obtained from the processor I/O backplane. An unloaded FEM (no ROMs installed) sinks 1.20 amperes of +5V I/O current. Each set of three ROMS installed on the FEM sinks an additional .525 amperes of current, regardless if the ROMs are 4k or 8k ROMs. Therefore, a fully loaded FEM will sink 5.4 amperes. Calculate the total current required by the FEM and all other printed-circuit assemblies (PCA's) resident in the processor I/O cage. If the total current requirement is greater than the +5V I/O supply capability, then one or more interface PCA's must be removed and installed in a HP 12979A/B I/O Extender.

NOTE

The processor I/O current availability is given in the appropriate HP 1000 Operating and Reference Manual.

Installation Procedure

Figure 2-1 identifies each set of sockets and the associated address switches. Control Memory allocation is contained in Figures 11-1, 11-2, and 11-3 in Chapter 6. Refer to the appropriate figure to determine the starting address of the Control Memory modules which are to be installed on the FEM. Table 2-1 contains the switch settings which determine the Control Memory modules that will be addressed by the set of sockets.

To install the FEM, proceed as follows:

CAUTION

ROM IC's may be permanently damaged if oriented incorrectly when installed and power is applied.

a. If the firmware is HP supplied optional firmware, see the appropriate figure in Chapter 6 to determine the module number and starting address of the firmware. If user written firmware is to be installed, the microcode should occupy Control Memory modules which are specified for user microprogramming.

b. On the FEM, load the three ROM IC's corresponding to the Control Memory modules to be installed into one of the eight sets of sockets. Ensure that the ROM IC's are oriented with the notched ends facing the same direction as the other IC's on the board (towards backplane connector P1). The ROM containing the least significant bits (bits 0-7) of the microinstruction is to be installed in socket 1, the ROM containing bits 8-15 is to be installed in socket 2, and the ROM containing the most significant bits (bits 16-23) is to be installed in socket 3.

c. Set the associated address switches for the appropriate modules of Control Memory as specified in Table 2-1.

d. Repeat steps a, b, and c for each section of Control Memory which is to be installed.

e. All unused socket sets must be disabled by setting switch S1 of the unused sets to the closed position.

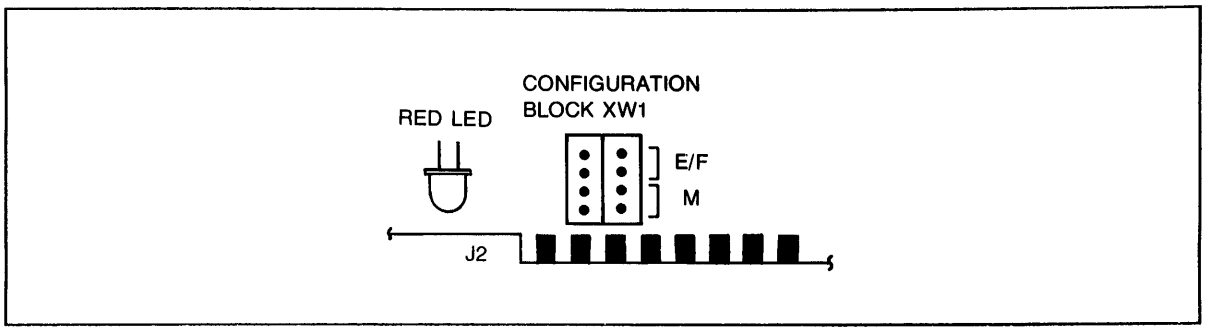
WARNING

Hazardous voltages are present inside the processor mainframe! Before installing the FEM, set the AC LINE AND BATTERY switches to OFF and DISCONNECT THE POWER CORD!

f. Set the computer compatibility jumpers on the FEM as shown below. The jumpers should be in the appropriate sockets to correspond to the type of computer with which the FEM is to be used.

g. Set the AC LINE and BATTERY switches to OFF and disconnect the power cord.

h. Disconnect the battery cable (if present) from the BAT. INPUT connector and remove the I/O cage cover.



i. Disconnect the I/O extender cable assembly (if present) from the CPU PCA edge connector J3.

j. Loosen the screw located in the rear fold of the bottom cover; slide cover toward the rear and remove.

k. Remove the existing connector assembly from the CPU PCA and FAB (E/F-Series), or CPU PCA and ROM PCA (M-Series), if installed. See Figure 2-2.

l. Pass the ribbon cable assembly (part no. 5061-3419) through the opening in chassis below I/O PCA cage cover.

NOTE

The ribbon cable assembly (part no. 5061-3419) supplied with the FEM must be used for reliable operation. Use of any other ribbon cable assembly may result in intermittent or unpredictable errors.

m. Connect the ribbon cable assembly (part no. 5061-3419) to FAB and CPU PCA in a E/F-Series computer, (ROM PCA and CPU PCA in a M-Series computer).

n. Replace bottom cover. Reconnect I/O extender cable assembly (if present) to CPU edge connector J3.

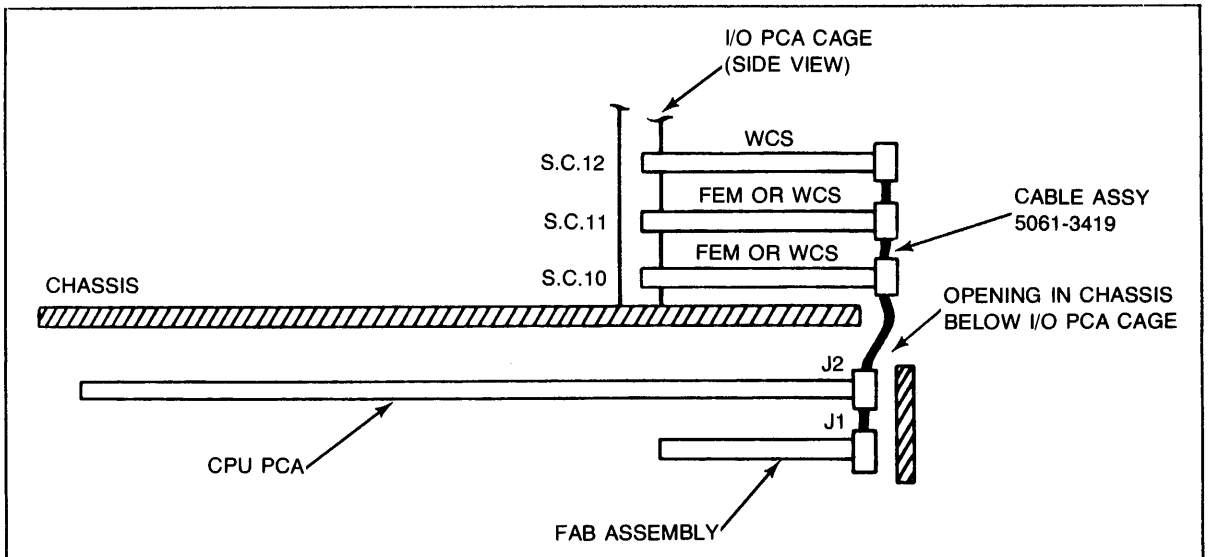
o. Install the FEM in I/O PCA cage slot 10 or 11 depending on whether or not a 13197A Writable Control Store Board (WCS) is present. If no WCS is present, install the FEM in slot 10. If one WCS is present, install the FEM in slot 11.

Table 2-1. FEM Address Switch Settings

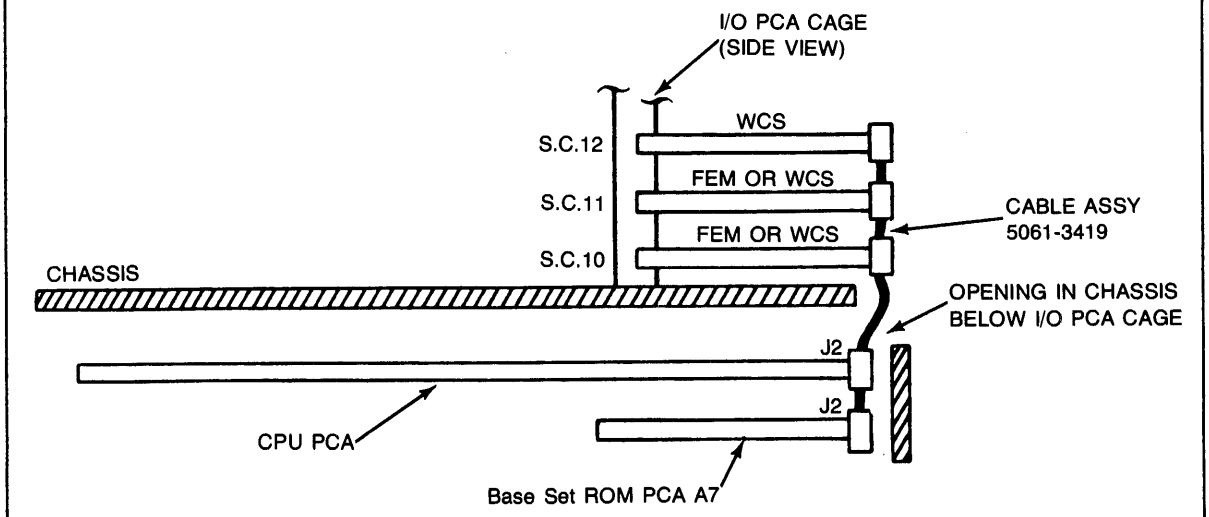
MODULE NO.	ADDRESSES		4K ROMS										8K ROMS									
			SWITCHES										SWITCHES									
	DECIMAL	OCTAL	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
0	0-00255	00000-00377	1	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	X
1	00256-00511	00400-00777																				
2	00512-00767	01000-01377	1	0	0	1	1	0	0	0	0	1										
3	00768-01023	01400-01777																				
4	01024-01279	02000-02377	1	0	0	1	1	0	0	0	1	0	1	0	1	0	1	0	0	0	1	X
5	01280-01535	02400-02777																				
6	01536-01761	03000-03377	1	0	0	1	1	0	0	0	1	1										
7	01762-02047	03400-03777																				
8	02048-02303	04000-04377	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0	X
9	02304-02559	04400-04777																				
10	02560-02815	05000-05377	1	0	0	1	1	0	0	1	0	1										
11	02816-03071	05400-05777																				
12	03072-03327	06000-06377	1	0	0	1	1	0	0	1	1	0	1	0	1	0	1	0	0	1	1	X
13	03328-03583	06400-06777																				
14	03584-03849	07000-07377	1	0	0	1	1	0	0	1	1	1										
15	03850-04095	07400-07777																				
16	04096-04351	10000-10377	1	0	0	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	0	X
17	04352-04607	10400-10777																				
18	04608-04863	11000-11377	1	0	0	1	1	0	1	0	0	1										
19	04864-05119	11400-11777																				
20	05120-05375	12000-12377	1	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	X
21	05376-05631	12400-12777																				
22	05632-05887	13000-13377	1	0	0	1	1	0	1	0	1	1										
23	05888-06143	13400-13777																				
24	06144-06399	14000-14377	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	1	0	X
25	06400-06655	14400-14777																				
26	06656-06911	15000-15377	1	0	0	1	1	0	1	1	0	1										
27	06912-07167	15400-15777																				
28	07168-07423	16000-16377	1	0	0	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	X
29	07424-07679	16400-16777																				
30	07680-07935	17000-17377	1	0	0	1	1	0	1	1	1	1										
31	07936-08191	17400-17777																				
32	08192-08447	20000-20377	1	0	0	1	1	1	0	0	0	0	1	0	1	0	1	1	0	0	0	X
33	08448-08703	20400-20777																				
34	08704-08959	21000-21377	1	0	0	1	1	1	0	0	0	1										
35	08960-09215	21400-21777																				
36	09216-09571	22000-22377	1	0	0	1	1	1	0	0	1	0	1	0	1	0	1	1	0	0	1	X
37	09572-09727	22400-22777																				
38	09728-09983	23000-23377	1	0	0	1	1	1	0	0	1	1										
39	09984-10239	23400-23777																				
40	10240-10495	24000-24377	1	0	0	1	1	1	0	1	0	0	1	0	1	0	1	1	0	1	0	X
41	10496-10751	24400-24777																				
42	10752-10917	25000-25377	1	0	0	1	1	1	0	1	0	1										
43	10918-11263	25400-25777																				
44	11264-11519	26000-26377	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	1	X
45	11520-11775	26400-26777																				
46	11776-12031	27000-27377	1	0	0	1	1	1	0	1	1	1										
47	12032-12287	27400-27777																				
48	12288-12543	30000-30377	1	0	0	1	1	1	1	0	0	0	1	0	1	0	1	1	1	0	0	X
49	12544-12799	30400-30777																				
50	12800-13055	31000-31377	1	0	0	1	1	1	1	0	0	1										
51	13056-13311	31400-31777																				
52	13312-13557	32000-32377	1	0	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	1	X
53	13558-13823	32400-32777																				
54	13824-14079	33000-33377	1	0	0	1	1	1	1	0	1	1										
55	14080-14335	33400-33777																				
56	14336-14591	34000-34377	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	1	1	1	0	X
57	14592-14847	34400-34777																				
58	14848-15103	35000-35377	1	0	0	1	1	1	1	1	0	1										
59	15104-15359	35400-35777																				
60	15360-15615	36000-36377	1	0	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	X
61	15616-15871	36400-36777																				
62	15872-16127	37000-37377	1	0	0	1	1	1	1	1	1	1										
63	16128-16383	37400-37777																				

1. 0 = CLOSED 1 = OPEN X = DON'T CARE
   "CLOSED" AND "OPEN" REFER TO THE SETTINGS ON THE DIP ROCKER SWITCHES.
   WHEN THE SWITCH IS *DEPRESSED* THE CORRESPONDING SETTING IS ENABLED.

2. ALL UNUSED SETS MUST BE DISABLED BY SETTING S1 CLOSED.



a. Installation Details (HP 1000 E/F-Series Computer)



NOTES:

FEM → 12791A FIRMWARE EXPANSION MODULE
FAB → 13304A FIRMWARE ACCESSORY BOARD
WCS → 13197A WRITABLE CONTROL STORE

b. Installation Details (HP 1000 M-Series Computer)

Figure 2-2. Installation Details

p. Connect the cable assembly to FEM board connector J1 and to WCS PCA(s) if present. Any unused connectors shculd be left on if they do not interfere with the I/O PCA cage cover or I/O cable hoods directly above the FEM. If it is necessary, unused connectors can be carefully removed with a sharp knife or scissors. After removal, inspect the ribbon cable to verify that there are no shorts between any ribbon cable conductors.

q. Replace I/O PCA cage cover and reconnect battery cable (if present) to BAT. INPUT connector.

r. Plug processor power cord into power mains receptacle and set AC LINE to ON, and BATTERY switch to INT., if the power fail option is installed. If the battery is discharged upon turning on the AC LINE, it will take a few minutes for the battery to charge up to a minimum level before the processor will begin operation.

The installation is now complete and ready for use of HP optional firmware, or the user's own microprogramming application.

Removal Procedure

a. Set AC LINE and BATTERY switches to OFF and disconnect the power cord.

b. Disconnect battery cable (if present) from BAT. INPUT connector and remove I/O PCA cage cover.

c. Remove ribbon cable connector from FEM board connector J1, and remove FEM from I/O slot.

The removal is now complete, and additional HP optional or user written firmware can be installed as described in the installation procedure.

Verification

If HP supplied optional firmware is installed of the FEM, correct operation can be verified by running the appropriate self-test and/or diagnostic on the installed firmware.

Service Information

A system failure can be isolated to the FEM-ROM combination by running the appropriate self-test and/or diagnostic corresponding to the firmware that is installed on the FEM.

The red LED indicator on the FEM is lit whenever a set of ROMs on the board is being addressed (i.e., the address sent to the board corresponds to the switch settings on one of the enabled sets).

If the base set is installed on the FEM, the LED will appear to be continuously lit when the computer is in the halt mode.

a. If the Scientific Instruction Set (SIS), Extended Memory Area (EMA), Vector Instruction Set (VIS), or Distributed System Firmware (DS/1000) is installed on the FEM, run the associated self-test and/or diagnostic. Self-test are described in the appropriate section of this manual. For diagnostic operation, the appropriate Diagnostic Manual must be consulted.

b. If a particular test fails, verify that the address switches on the FEM are configured correctly. All unused sets of sockets must be disabled by setting switch 1 to the closed position. Ensure that the ribbon cable and FEM are correctly seated.

c. Verify that the +5V CPU voltage is set at the recommended setting of 5.15 volts when measured at the crossover PCA test point. Refer to the appropriate Installation and Service Manual for the power supply voltage adjustment.

d. If the test still fails, insert a known good set of ROMs in the failing locations and rerun the diagnostic and/or self-test.

e. If the test now passes, defective ROMs are indicated. Change one ROM at a time to isolate the defective ROM(s).

   If the test still fails, defective FEM or ribbon cable assembly is indicated. Install a new FEM and run the tests.

   If after installing a new FEM, the test still fails, install a new ribbon cable assembly and run the tests again.

f. If a failure still exists, contact your nearest Hewlett-Packard Sales and Service Office. A list of HP Sales and Service Offices is provided at the back of this manual.

Chapter 3
HP 13197A WCS Kit

Introduction

This chapter describes the HP 13197A Writable Control Store (WCS) Kit used with the HP 1000 M-Series (2105/2108/2112), E-Series (2109/2113), and F-Series (2111/2117) computers. This chapter covers general information, installation, programming, and general theory of operation. It is written for the individual who already has experience as an Assembly language programmer. Additional information is provided in the following manuals.

a. Manuals listed in the Preface of this manual.

b. RTE Driver DVR36 for HP 12978/13197A Writable Control Store Board Programming and Reference Manual (part no. 13197-90001).

The HP 13197A Writable Control Store Kit is fully compatible with the HP 1000 M/E/F-Series computers. The Writable Control store (WCS) holds 1024 words (four control memory modules) and is commonly called a 1K WCS. Computer commands specify which four control memory modules are contained on each HP 13197A WCS printed circuit assembly (PCA).

NOTE

Where installation or operational data for the kit is affected by differences in the HP 1000 M-Series and E/F-Series computers, these differences are noted in text. Also, terminology may differ somewhat between the M-Series and E/F-Series computers. The E/F-Series terminology will be used, but the M-Series user should note the following:

E/F-Series	M-Series
Control Memory	Control Store
Control Memory Address Register (CMAR)	ROM Address Register (RAR)
Microinstruction Register (MIR)	ROM Instruction Register (RIR)

Kit Contents

The HP 13197A WCS Kit consists of the following:

a. Writable Control Store PCA (part no. 13197-60001).

b. Ribbon Cable Assembly (part no. 5061-3419).

c. HP 1000 M/E/F-Series Firmware Installation and Reference Manual (part no. 12791-90001).

The printed circuit assembly and ribbon cable assembly contained in the kit are shown in Figure 3-1.

Specifications

Table 3-1 lists the characteristics and specifications of the HP 13197A Writable Control Store PCA.

Installation/Removal

Power Considerations

The +5V power required by the WCS is obtained from the computer I/O backplane. Each WCS PCA installed requires 2.2 amperes of current. Calculate the total current required by the WCS PCA and all other printed-circuit assemblies resident in the I/O PCA cage. If the total current requirement is greater than the +5V supply capability, then one or more interface PCA's must be removed and installed in a compatible I/O extender.

NOTE

The I/O current availability is given in the appropriate HP 1000 Series Computer Operating and Reference Manual.

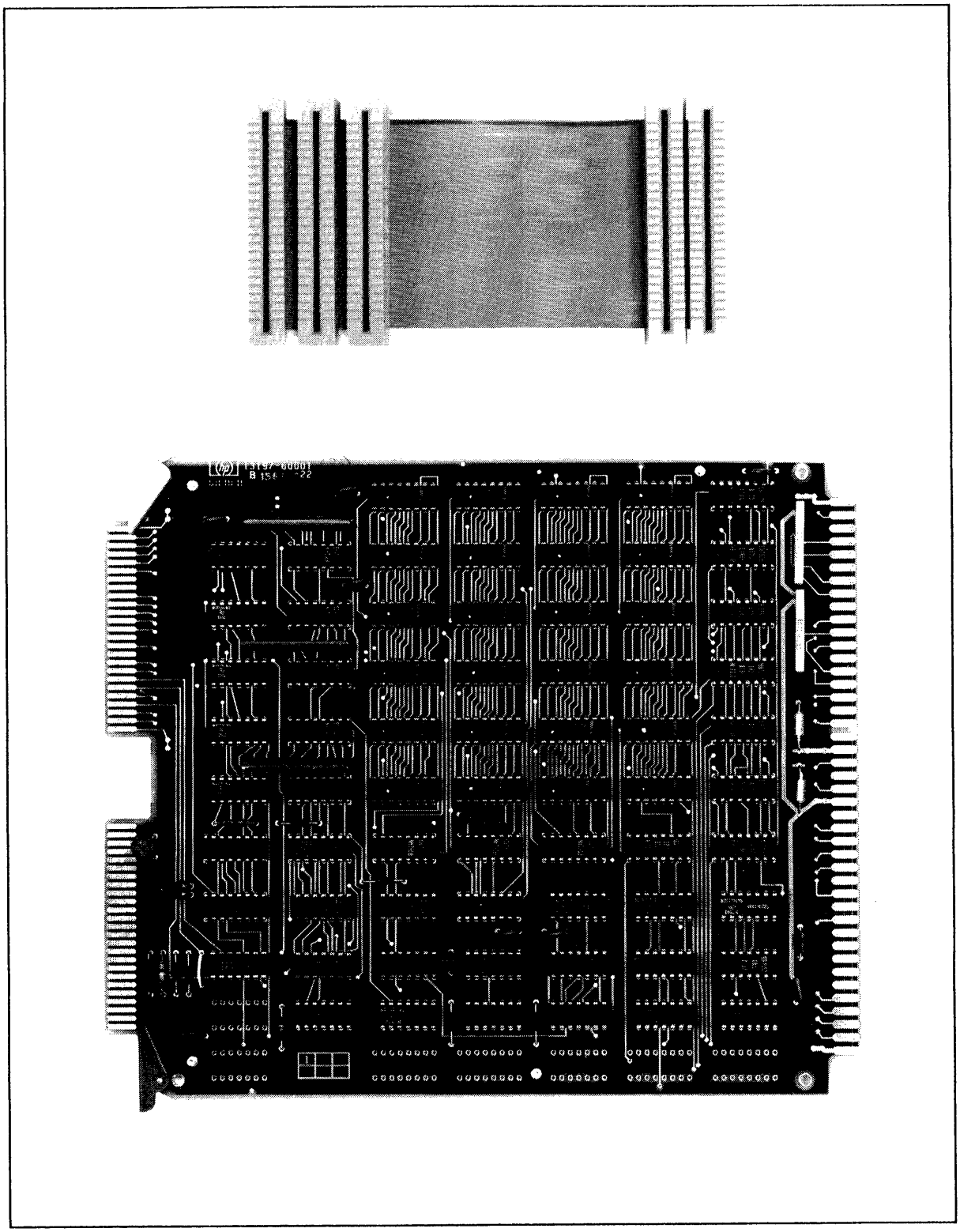


Figure 3-1. HP 13197A Writable Control Store Kit

Installation Procedure

The Base Set ROM PCA occupies position A7 in the HP 1000 M-Series computer as standard equipment. In the HP 1000 E/F-Series computer, position A7 is occupied by the Firmware Accessory Board (FAB). For installation of WCS in the E/F-Series, see Figure 2-2a. For installation in the M-Series, see Figure 2-2b.

Install the Writable Control Store kit as follows:

a. Ensure that the computer operates properly prior to installing the Writable Control Store kit.

b. If WCS is to be installed in an M-Series computer, remove the computer compatibility jumper W1 (see Figure 3-2). If WCS is to be installed in an E/F-Series computer, jumper W1 remains installed.

WARNING

Hazardous voltages are present inside the processor mainframe! Before installing the writable control store board, set the ~LINE and BATTERY switches to off and DISCONNECT THE POWER CORD!!

c. Set the ~LINE and BATTERY switches to OFF and disconnect the power cord.

d. Disconnect the I/O extender cable assembly (if present) from the CPU PCA edge connector J3.

e. Loosen the screw located in the rear fold of the bottom cover; slide the cover toward the rear and remove.

f. Remove the existing connector assembly from the CPU PCA and FAB in an E/F-Series, (CPU PCA and ROM PCA in an M-Series Computer), if installed (see Figure 2-2).

g. Disconnect the battery cable (if present) from the BAT. INPUT the connector and remove the I/O PCA cage.

h. Pass the flat cable assembly (part no. 5061-3419) through opening in the chassis below the I/O PCA cage.

i. Connect the cable assembly to the FAB and CPU PCA in an E/F-Series computer, (ROM PCA and the CPU PCA in an M-Series Computer).

j. Replace processor bottom cover. Reconnect the I/O extender cable assembly (if present) to the CPU PCA edge connector J3.

k. Place the first Writable Control Store PCA in slot number 10 (select code 10) of the I/O section of the computer. Any additional Writable Control Store PCA's should be placed first in slot 11 then in slot 12.

1. Install the connectors of the flat cable assembly to WCS board connector J1 as shown in Figure 2-2.

NOTE

If an I/O PCA that requires a cable (hood) connector on the back is installed immediately above the WCS, double the flat cable assembly back or cut it to make room for the I/O cable connector. The cable may be carefully cut with scissors or a sharp knife. If cut, inspect the cable conductors for possible shorts.

m. Replace the I/O PCA cage cover and reconnect the battery cable (if present) to the BAT.INPUT connector.

n. Plug the processor power cord into the power mains receptacle and set the ~LINE to ON, and the BATTERY switch in INT. if the power fail option is installed.

Table 3-1. HP 13197A Writable Control Store PCA Specifications

CAPACITY	WCS CURRENT REQUIREMENTS
Words Available: 1024 per WCS PCA Maximum WCS PCA's: two per HP 2105; three per 2108/2109/2111/2112/ 2113/2117 Word Size: 24 bits	+5 volt supply: 2.2A rms -2 volt supply: 7 mA rms
MEMORY SPEED	DIMENSIONS Width: 7-3/4 inches (196.8 mm) Height: 8-11/16 inches (220.7mm)
Access: 132 nsec maximum Full Microinstruction Cycle: M-Series: 325 nsec. E/F-Series: 175 or 280 nsec	WEIGHT Net Weight: 18 oz (511.2 gm) (card and cable only) Shipping Weight: 4 lb (2.27 kg)
INSTALLATION	INPUT LEVELS
Each WCS PCA requires the use of one Input/Output slot (slot 10, 11, or 12).	"1" state: 1.9 volts minimum "0" state: 1.1 volts maximum
DATA STORAGE OR READBACK	OUTPUT LEVELS
Input/Output Group instruction or a Dual Channel Port Controller are used to load into or read from the WCS.	"1" state: 2.4 volts minimum "0" state: 0.8 volts maximum

Removal Procedure

a. Set the ~LINE and BATTERY switches to OFF and disconnect the power cord.

b. Remove the connectors of the flat cable assembly from the WCS board edge connector J1 and any other Control Memory board installed in the I/O card cage.

c. Remove the WCS board from the I/O card cage.

Verification

Perform the diagnostic test as outlined in the WCS Diagnostic Reference Manual (part no. 13197-90002). If the diagnostic program is completed without error, the CPA is installed and operating properly. If the diagnostic program indicates errors, halt the computer, turn off power, and recheck all of the above installation procedures. Correct where necessary, then recheck and repeat the diagnostic test.

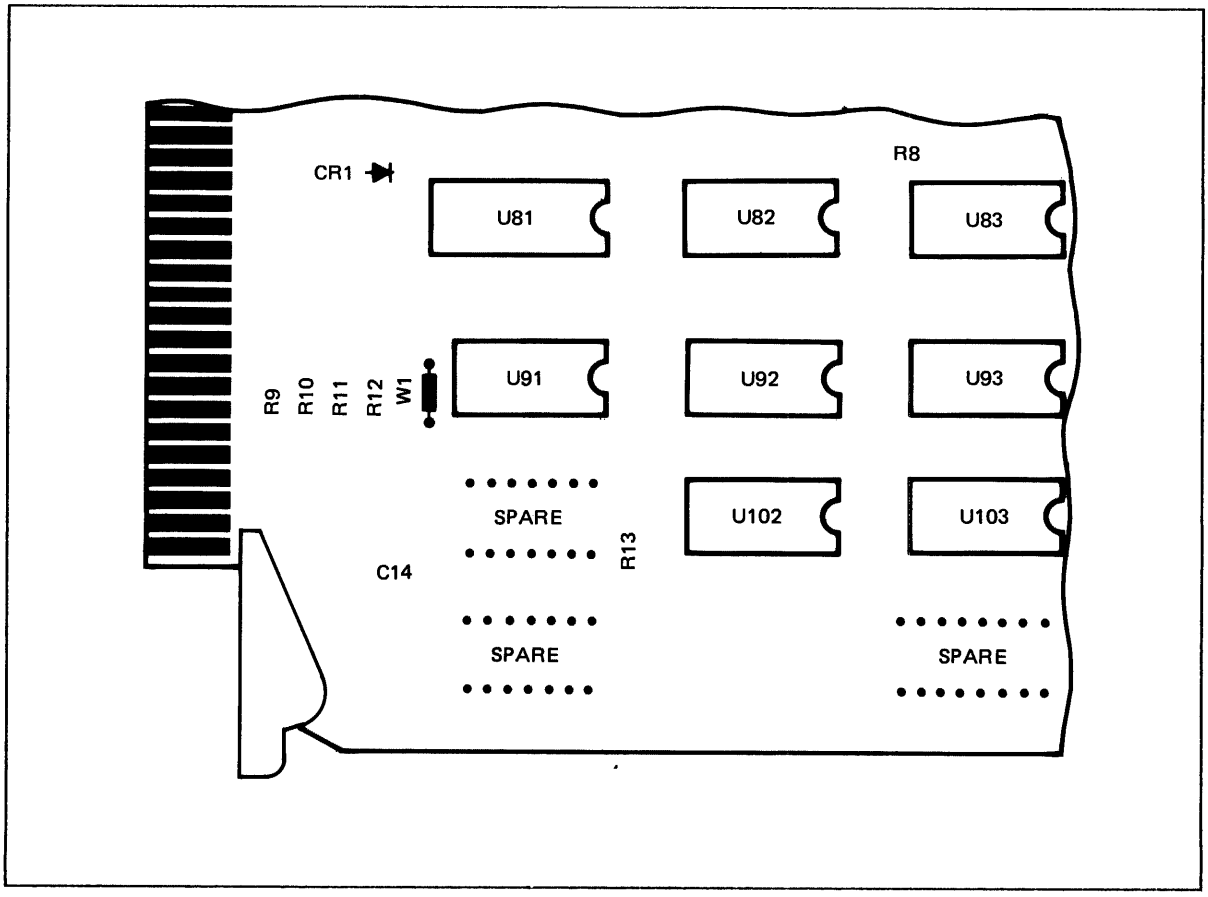


Figure 3-2. Computer Compatibility Jumper W1 Location

Programming

Standard I/O instructions control the HP 13197A WCS operation. The WCS operates in the following states:

1. Control memory operation enabled.

2. Control memory operation disabled.

3. WCS commands accepted (command state).

4. WCS data (i.e., microinstructions) can be read or written (data state).

The first two states (1 and 2) are called minor states. The second two states (3 and 4) are called major states. One minor state and one major state operate concurrently whenever power is applied to the WCS. Upon initial application of power, control memory operation is disabled (state 2), and WCS commands are accepted (state 3).

Data can be transferred via the Dual Channel Port Controller (DCPC) while in the data state.

Enabling Control Memory Operation

To allow microinstructions stored in the WCS to execute, control memory operation must be enabled. Control memory operation is enabled by the execution of a Set Flag instruction to the WCS select code (SC):

```
STF SC
```

When this instruction is executed, the WCS is enabled sometime during T5 of the I/O cycle.

Disabling Control Memory Operation

To prevent microinstructions stored in the WCS from executing, control memory operation must be disabled. This is accomplished by execution of a Clear Flag instruction to the WCS select code (SC):

```
CLF SC
```

WCS does not become disabled until sometime during T5 of the I/O cycle.

The operation of the WCS is temporarily disabled when any I/O instruction is executed in the WCS select code. Thus, if the microprocessor is executing microcode, contained in the WCS, no I/O instructions (except CLF, as above) may be executed to or from the WCS. This means that no microinstructions stored in a WCS can execute I/O instruction to itself.

NOTE

Since WCS does not return the FLG signal to the I/O backplane, the enable disable status of the board cannot be determined by executing an SFS instruction.

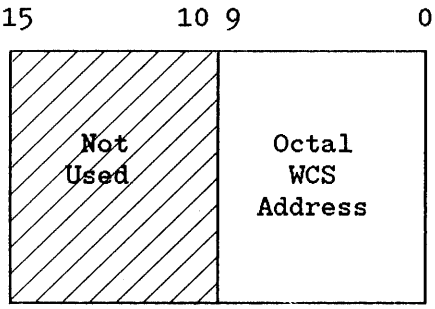
Sending Commands

When the WCS is in the command state, two commands are accepted, each of which is in the form of a 16-bit word. The first word is interpreted as a WCS address specification. The second word is interpreted as a specification for the four control memory module numbers. WCS interprets words received in the command state as alternately address or module numbers until the data state is initiated. Thus, the third word is interpreted as a WCS address, the four as module numbers, etc.

The command state is initiated by execution of a Clear Control Instruction to the WCS select code (SC):

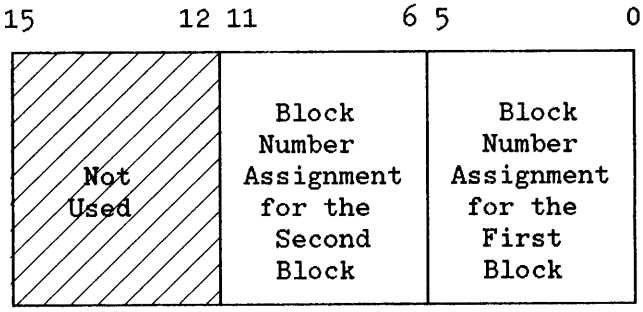
```
CLC SC
```

The WCS address word commands the WCS to set the WCS Address Register to the specified address. The WCS Address Register value determines which WCS location is read from or written into when the WCS is in the data state. The format of the WCS address word is the following:



This address is octal and is relative to the first location in the WCS. The first location is at address 0 (zero). The last location is at address 1777.

The four control memory module numbers are assigned by blocks. The 1024 words contained in the WCS are divided into two blocks of 512 words each. Each block is in turn divided into two 256-word modules. WCS address 0-511 (0-777 octal) are contained in the first block; addresses 512-1023 (1000-1777 octal) are contained in the second block. The modules assignment word specifies which two control memory modules are stored in each block. The module assignment word has the following format.



Bits 5-0 determine the control memory module numbers assigned to the two modules in the first block. Bits 11-6 determine the module numbers assigned to the two modules in the second block. The number of the first module is given by multiplying the block number by 2. Thus, the module number of a block is always even. For example, if bits 5-0 specify 5 for the block number assignment, the first block serves as control memory for modules 10 and 11.

The two blocks may be assigned block numbers that are not adjoining. For example, the first block can be assigned as block 5 (control memory modules 10 and 11) and the second block can be assigned as block 2 (control memory modules 4 and 5).

Control memory modules available to the user for HP 1000 M/E/F-Series computers are shown in Tables 11-1, 11-2 and 11-3, respectively.

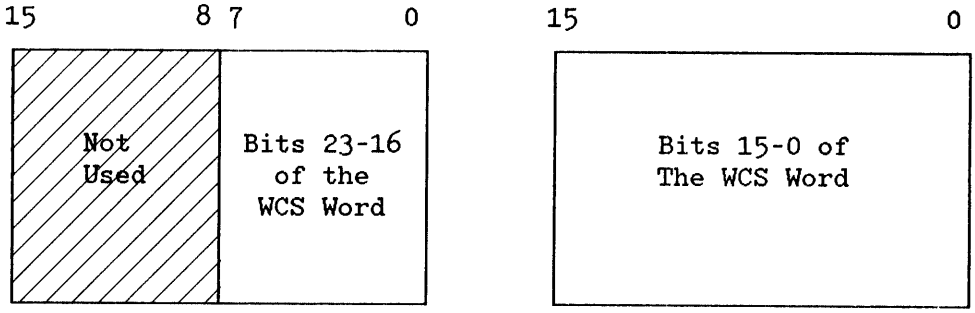
Reading and Writing WCS Data

When the WCS is in the data state, data (microinstructions) can be read from and written into the WCS Random Access Memory (RAM) by standard I/O instructions. The address of the location transferred is contained in the WCS Address Register. The WCS Address Register is automatically incremented by one after each pair of input or output instructions.

The data state is initiated by execution of a Set Control instruction to the WCS select code (SC):

```
STC SC
```

Two 16-bit words are required to transfer each 24-bit WCS word. Bits 7-0 of the first word transferred hold bits 23-16 of the WCS word. Bits 15-8 of the first word are not used. The second word holds bits 15-0 of the WCS word. The format of the word pair is the following:



Thus, the WCS data requires a main memory buffer of up to 512 words per control memory module (2048 words to transfer the entire WCS contents).

Programming Examples

The following Assembly language programs illustrate how to use the WCS facility.

Loading WCS from Memory

The following program disables control memory operation and then loads the WCS with microinstructions stored in main memory.

Note: "SC" indicates the WCS select code.

```
        CLC SC          Puts the WCS in the command state (readies the WCS to
                        accept command).

        LDA ADDR        Places the address of the first WCS location to be
                        loaded in the A-Register.

        OTA SC          Sends the beginning address to the WCS.

        STC SC          Puts the WCS in the data state (reads WCS to accept
                        data).

LOOP1   DLD BUFFP,I     Places first word pair to be sent to WCS in the A- and
                        B-Registers.

        ISZ BUFFP       Increments main memory buffer pointer to next word
                        pair.

        ISZ BUFFP

        OTA SC          Outputs first word to WCS.

        OTB SC          Outputs second word to WCS.
```

```
        ISZ COUNT       Increments negative WCS word count; if 0, skip because
                        load is complete.

        JMP LOOP1       Repeats loop to load two more words.
```

Reading WCS Into Memory

The following program reads microinstructions stored in WCS and stores them in main memory.

```
        CLC SC          Puts WCS in command state.

        LDA ADDR        Places address of first WCS location to be read in the
                        A-Register.

        OTA SC          Sends the beginning address to the WCS.

        STS SC          Puts the WCS in the data state.

LOOP2   LIA SC          Reads bits 23-16 of WCS location into bits 7-0 of the
                        A-Register.

        LIB SC          Reads bits 15-0 of WCS location into bits 15-0 of the
                        B-Register.

        DST BUFFP,I     Stores two words (holding contents of single WCS
                        location) into main memory buffer.

        ISZ BUFFP       Increments main memory buffer pointer to next word
                        pair.

        ISZ BUFFP

        ISZ COUNT       Increments negative WCS word count; if 0, skip because
                        read is complete.

        JMP LOOP2       Repeats loop to read the next WCS location.
```

Setting Block Numbers and Control Memory Operation

The following program assigns block numbers and, hence, control memory module numbers to the WCS. Then the program enables the WCS for operation as control memory.

```
        CLC SC          Puts WCS in the command state.

        LDA BLKN        Places block numbers in the A-Register.

        OTB SC          Outputs to the WCS a relative address; the block
                        numbers must be output in the second word.
```

```
        OTA SC          Sends the block numbers from the A-Register to the WCS.

        STF SC          Initiates control memory operation of WCS at T5 of this
                        I/O instruction; address 0-511 become modules 10 and 11
                        and addresses 512-1023 become modules 4 and 5.

          .
          .
          .

BLKn    OCT 00205       This constant specifies that the first block is block
                        number 5 and the second block is block number 2.
```

Reading WCS into Memory Using DCPC

To read the WCS using the Dual Channel Port Controller (DCPC), replace LOOP2 in the Reading WCS into Memory Section with the DCPC initialization sequence. Issue the Set Control (STC) to the WCS select code after starting DCPC. DCPC will use every I/O cycle until the entire block of data is read from the WCS into main memory.

The STC and CLC options of DCPC (contained in Control Word 1) should not be utilized for transfers to/from WCS, as each STS or CLC reinitializes the WORD flip-flop.

Note that DCPC issues a CLF after each word transferred, disabling operation of the board as control memory.

The following program is an example of using DCPC channel 1 to read a block of 1000 words from the WCS on select code 10 into main memory starting at address 10,000.

```
        CLC 10          Puts WCS in the command state.

        LDA ADDR        Places address of first location to be read in the
                        A-Register.

        OTA 10          Sends the beginning address to the WCS.

(LOOP2) LDA CW1         Gets the first DCPC control word from main memory and
                        loads it into the A-Register.

        OTA 6           Sends the first DCPC control word to DCPC channel 1.

        CLC 2           Prepares DCPC channel 1 to receive the second DCPC
                        control word.

        LDA CW2         Gets the second DCPC control word from main memory and
                        loads it into the A-Register.

        OTA 2           Sends the second DCPC control word to DCPC channel 1.
```

```
        STC 2           Prepares the DCPC channel to receive the third DCPC
                        word.

        LDA CW3         Gets the third DCPC control word.

        OTA 2           Sends the third DCPC control word to DCPC channel 1.

        STC 6,C         Turns on the selected DCPC channel.

        STC 10          Starts the DCPC transfer.

        SFS 6           Tests for completion of the transfer.

        JMP* -1         Loops until transfer complete.
         .
         .
         .
CW1     OCT 10

CW2     OCT 110000      Specifies DCPC input and the starting address (10,000)
                        of the block to be output.

CW3     OCT 177000      Specifies two's complement of the number (1000) of
                        computer words to be transferred.
```

Using WCS as Module 0

When attempting to use the WCS as module 0, special care must be taken when enabling and disabling the WCS operation because of the use of the IOG signal to select the address presented to the RAM's. When an I/O instruction is being executed referencing the WCS select code, the on-board address counter is selected to supply the RAM address; if not, then the Control Memory Address Register (CMAR) is selected to supply the RAM address. The two instructions STF and CLF, respectively, enable and disable WCS operation and cause the IOG signal to be asserted. Thus, when executing a STF with WCS containing module 0 code, the IOG signal disappears at the same time that WCS becomes enabled. When trying to disable operation of WCS as module 0, there is a more troublesome problem. Here, as soon as IOG comes up when executing the CLF instruction to the board, the on-board address counter is selected to specify the RAM address. To avoid problems encountered by executing the microinstruction at the address contained in the on-board counter, the counter should be set to the address of some harmless microinstruction (such as a jump to FETCH) contained in WCS. When WCS is finally disabled, the base-set ROM's will again function, starting from the address specified in the CMAR.

General Theory of Operation

Writable Control Store (WCS) consists of a bipolar semiconductor Random Access Memory (RAM) containing 24 integrated-circuit (IC) packages mounted on a printed circuit assembly (PCA). Also included is the flat jumper cable assembly necessary for complete mechanization within the computer. The WCS PCA should be installed only in slots 10 (standard), 11, and 12 of the computer I/O slots. Each IC package is configured in 1024 bits and organized as one bit per word. Thus, one module of WCS can be configured to be addressed as any four of the computer's control memory modules. Two WCS PCA's can be installed on an HP 2105 Computer. Three WCS PCA's can be installed on an HP 2108, 2109, 2111, 2112, 2113, or 2117 Computer.

WCS Module Identification

For proper addressing of WCS, an integrated-circuit comparator and two block number registers are used on the WCS PCA to identify the PCA as particular modules of control memory. For example, if the WCS board is configured for block 2, the PCA will be enabled when the Control Memory Address Register (CMAR) contains the pattern "000010" in its six most-significant bits (14-9), and will be disabled otherwise. When enabled, the word in WCS addressed by CMAR bits 8-0 will be sent to the Microinstruction Register (MIR) as signals ROM0 through ROM23. The computer will then execute this word (microinstruction) as though it came from standard control memory.

WCS Connection

WCS is connected to the computer CPU through the I/O structure (for loading and checking), and also through a 50-conductor ribbon cable connector. It is this connector that enables WCS to be used as an extension of the computer's basic control memory. The cable connects one, two or three WCS PCA's to the CPU PCA and the FAB in the HP 1000 E/F-Series. (In an M-Series, WCS connects to CPU and ROM PCA.) The CMAR on the CPU sends a 14-bit address (12-bit address in an M-Series) to the WCS PCA(s) through this cable and the addressed WCS then sends its data (microinstruction) from that address back through this cable to the MIR.

WCS Addressing

The WCS Address Register determines which address is loaded or read while the WCS is in the data state. Thus, before loading or reading the WCS Random Access Memory, the WCS Address Register must be set. This is accomplished by sending the WCS address to the WCS while it is in the command state. Refer to the Programming section for the explanation of how to set the WCS Address Register.

WCS Operation as Control Memory

Once loaded and enabled, WCS becomes an extension of control memory. Microprograms stored in the WCS are executed exactly as those stored in ROM. Since the WCS can be loaded via standard I/O instructions, it may be used to debug and store additions to the computer instruction set while the computer is in an operating condition. This feature permits dynamic expansion of the computer instruction set.

WCS Timing Diagram

Figure 3-3 illustrates HP 13197A WCS timing.

NOTE

Pressing the PRESET switch on the operator panel, or executing the CLC 0 instruction, issues the CRS signal to all I/O boards installed in HP 1000 Series computers. The CRS signal disables all WCS boards from operation as control memory.

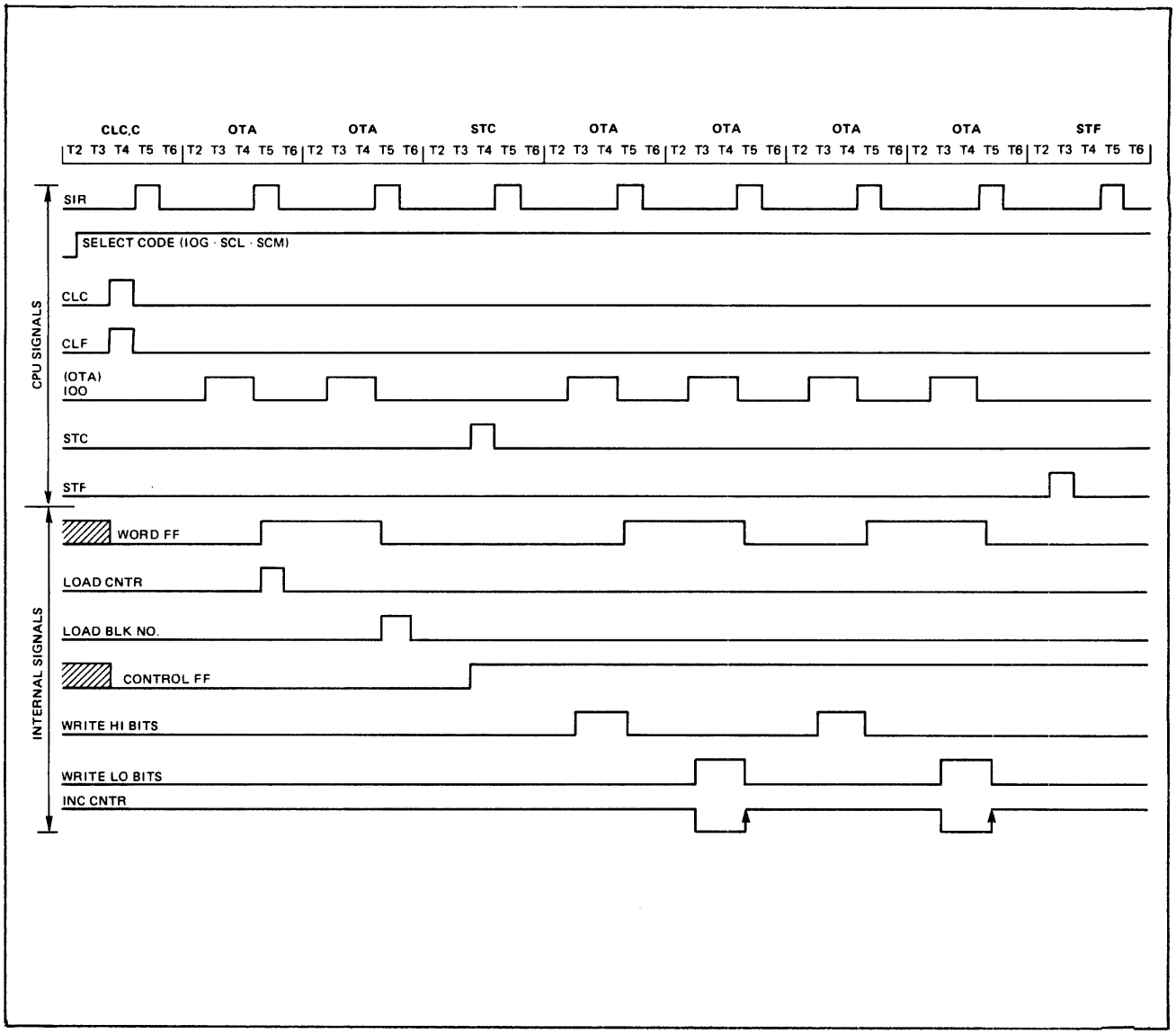


Figure 3-3. HP 13197A WCS Timing Diagram

Chapter 4
E/F-Series DMS

Introduction

This chapter provides installation instructions for the HP Dynamic Mapping System, which is an accessory for the HP 1000 E/F-Series Computers. Additional information is provided in the manuals listed in the Preface.

Description

The Dynamic Mapping System consists of the following hardware:

Description	HP Part No.	HP Product No.
Memory Expansion Module	12731-60001	12731A
Memory Protect PCA	12892-60003	12892B
4K ROM IC (bits 7-0)	13307-80036	13307B (Standard on E-Series)
4K ROM IC (bits 15-8)	13307-80037	
4K ROM IC (bits 23-16)	13307-80038	
8K ROM IC (bits 7-0)	5180-0141	F-Series (Standard)
8K ROM IC (bits 15-8)	5180-0142	
8K ROM IC (bits 23-16)	5180-0143	

Required Hardware

One of the following accessories is required for the installation of the three ROM ICs in the E/F-Series Computer.

a. HP 13304A Firmware Accessory Board Kit for E-Series only.

b. HP 12791A Firmware Expansion Module for E- or F-Series.

The 12791A Firmware Expansion Module is standard in 2109E, 2113E, 2111F, 2117F Computers.

Installation

Install the memory expansion module (MEM) and memory protect PCA in the computer memory PCA cage as follows:

a. On MEM, ensure that jumpers W1 through W4 are configured as shown in Figure 4-1. The functions of these jumpers are described in Table 4-1.

b. On memory protect PCA, ensure that configuration jumper block U21 is configured as shown in Figure 4-2.

c. On the rear of the computer set the battery EXT/INT OFF switch to OFF.

d. Switch the ~LINE ON/OFF switch to OFF, and disconnect the power cord.

e. Remove memory PCA retainer and install memory expansion module (part no. 12731-60001), in slot 112.

f. Install memory protect PCA (part no. 12892-60003), in slot 111; replace memory PCA retainer.

The three E-Series 4K ROM integrated circuits (ICs) are allocated to control store modules 32 and 33 (decimal) and can be installed on either the HP 13304A Firmware Accessory Board (FAB) or the HP 12791A Firmware Expansion Module (FEM). Install the ROM ICs as described in one of the following two procedures.

The three F-Series 8K ROM ICs are allocated to control store modules 32, 33, 34, and 35. These ROMs contain the DMI instructions and the Fast FORTRAN Processor instructions. These ROMs must be installed on the FEM. Refer to Chapter 7 of this manual for the installation of these ROMs.

Firmware Accessory Board

a. Refer to Chapter 1 of this manual for the FAB removal procedure.

b. Install the following 4K ROM ICs in the specified sockets on the FAB and set the jumpers as shown below to correspond to Control Memory module 32 (decimal).

Location	ROM IC	Bits	Module No.
B1	13307-80036	7-0	32, 33
B2	13307-80037	15-8	
B3	13307-80038	23-16	

Jumper	Setting
10B	0
11B	0
12B	0
13	1

c. Install the FAB following the procedures in Chapter 1.

d. Perform verification as described in the Verification section.

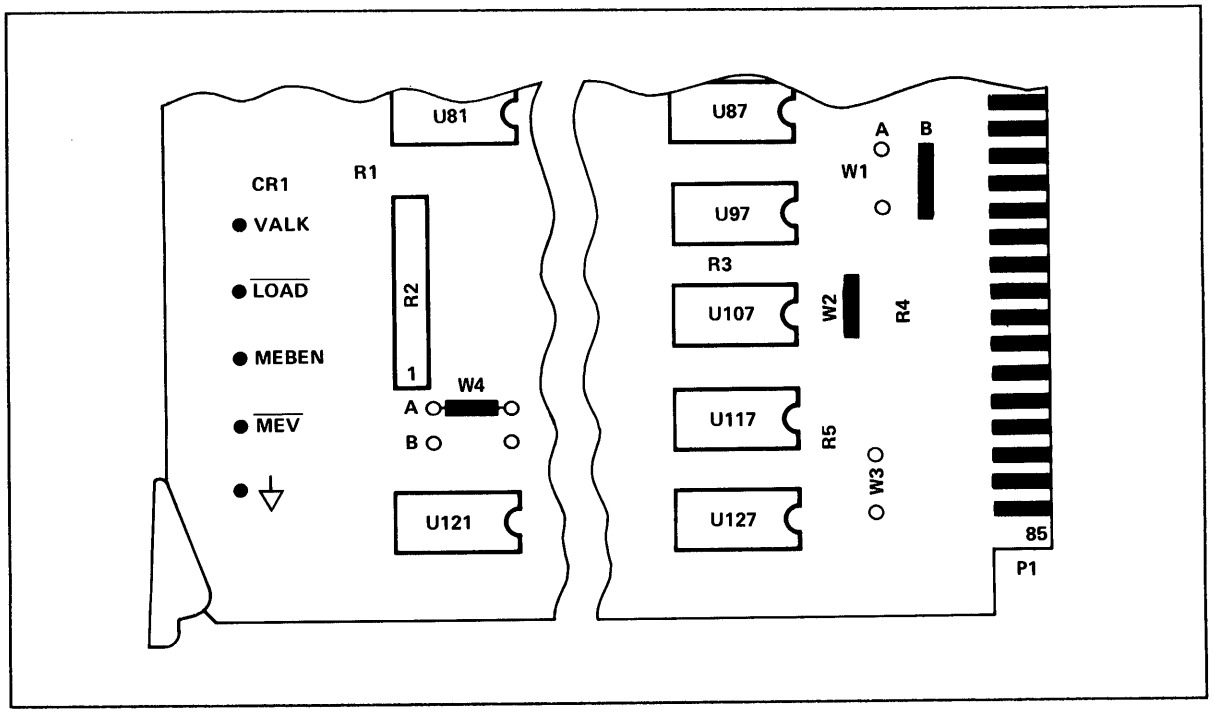


Figure 4-1. MEM Configuration Jumpers

Table 4-1. Memory Expansion Module Jumper Functions

Jumper	Description
W1	Plug-in jumper; selects computer compatibility as follows: W1 = A = HP 1000 M-Series Computer (2108/2112) W1 = B = HP 1000 E/F-Series Computer (2109/2113/2111/2117)
W2	Plug-in jumper; factory test only: W2 = IN = Normal operation W2 = OUT = Factory test
W3	Hardwired jumper; factory test only: W3 = IN = Factory test W3 = OUT = Normal operation
W4	Hardwired jumper: Reset Memory Expansion Module. With the Memory Protect enabled and the computer issues IAK (Interrupt Acknowledge) in response to an IRQ (Interrupt Request), Memory Protect is turned off and the Memory Expansion Module (MEM) is switched automatically to the System Map. If an I/O instruction is in the trap cell allocated to the interrupting device, Memory Protect is turned back on and asserts the RME signal which controls the following: W4 = A = MEM remains in System Map. W4 = B = MEM returns to same map in use prior to IAK being issued. Note: MEM jumper W4 and Memory Protect RME jumper must be configured alike to respond to the RME signal. That is, if the Memory Protect RME jumper is OUT, MEM jumper W4 must be in position "A"; if the Memory Protect RME jumper is IN, MEM jumper W4 must be in position "B".

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for FEM removal procedure.

b. The three DMI ROMs can be installed in any available socket set on the FEM. For example assume we are going to install the ROMs in SET A. Refer to Figure 2-1 for location of the sockets.

Location	ROM IC	Bits	Module
A1	13307-80036	7-0	32,33
A2	13307-80037	15-8	
A3	13307-80038	23-16	

c. Configure the Set A control memory address switches, SWA, for modules 32 and 33. See Figure 2-1 and Table 2-1 for reference.

SWA

Switch	Setting
S1	1
S2	0
S3	0
S4	1
S5	1
S6	1
S7	0
S8	0
S9	0
S10	0

d. Refer to Chapter 2 of this manual for the FEM installation procedure.

e. Perform verification as described in the next section.

Verification

Verify the Dynamic Mapping System operation by running the following diagnostics.

Diagnostic	Manual	Absolute Binary No.
Memory Protect-Parity Error	12892-90005	12892-16001
Memory Expansion Module Test	12929-90003	12929-16001

If the diagnostic tests are completed without an error halt, the DMS is operating correctly. If the tests indicate an error halt, refer to the FAB section or FEM for troubleshooting information. If trouble still persists, contact your nearest HP Sales and Service Office. (A list of HP Sales and Service Offices is given in the HP 1000 E/F-Series Computer Operating and Reference Manual, and the HP 1000 E/F-Series Computer Installation and Service Manual.

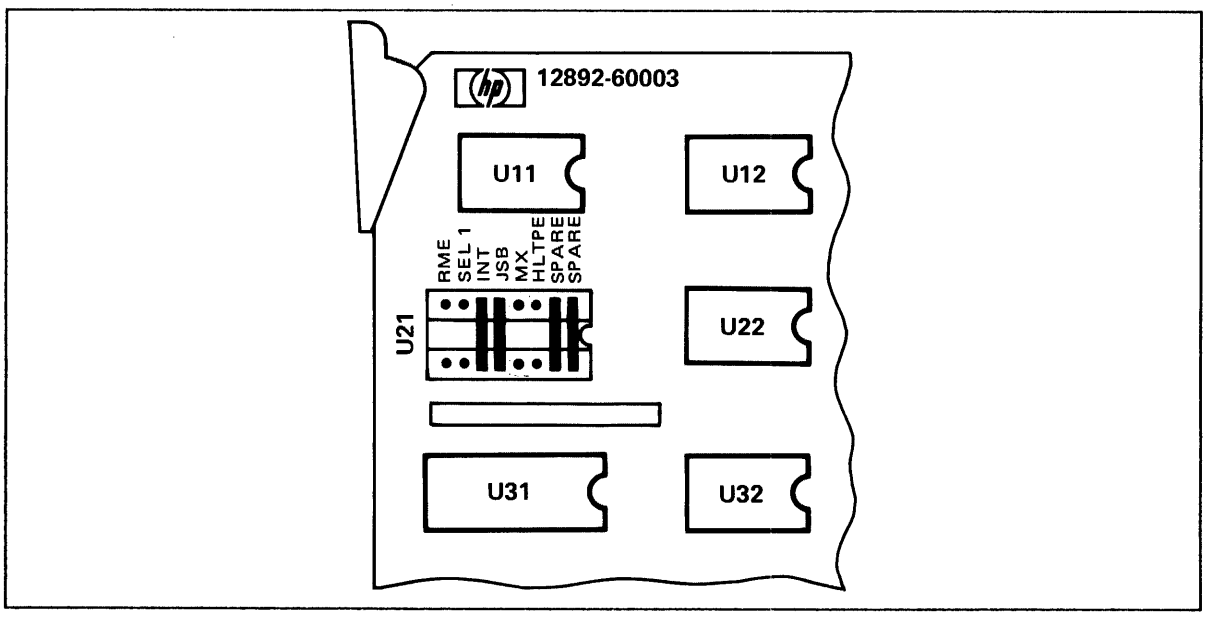


Figure 4-2. Memory Protect Configuration Jumpers

Chapter 5
RTE-IVA/B EMA

Introduction

This chapter provides installation instructions for the HP Extended Memory Area (EMA) Firmware. This firmware is to be installed in an E-Series Computer or an F-Series Computer for use with RTE-IV A/B: Additional information is provided in the manuals listed in the Preface.

Description

The HP EMA firmware consists of three 4K ROMs that are installed on the FAB board or FEM board. The firmware routines handle map switching (if required) and addressing to data words located in extended memory. The HP EMA firmware consists of the following:

Description	Part No.
4K ROM IC (Bits 23-16)	92067-80003
4K ROM IC (Bits 15-8)	92067-80002
4K ROM IC (Bits 7-0)	92067-80001

Installation

The three EMA ROMs can be installed on the HP 13304A Firmware Accessory Board (FAB) or the HP 12791A Firmware Expansion Module (FEM). If a FEM with an unused block of sockets is available, it may be desirable to install the ROMs on the FEM to facilitate future access to the ROMs.

Firmware Accessory Board

a. Refer to Chapter 1 of this manual for the FAB removal procedure.

b. Install the following ROM ICs in the specified sockets on the FAB and set the jumpers to correspond to Control Memory modules 36 and 37.

NOTE

Sockets C1 through C3 are recommended for the EMA firmware location, due to location requirements of other HP firmware accessories, such as the HP 13306B Fast FORTRAN Processor.

If Loader Extension ROMs (part nos. 91740-80070, 91740-80071, and 91740-80072), are presently installed on the FAB board, they should be residing in the MSMP of blocks B, C, or D. Whem this is the case, the EMA ROMs should be installed in the LSMP of this block. For example, if Loader Extension ROMs are occupying C4, C5, and C6, then the EMA ROMs should be installed in sockets C1, C2, and C3 (refer to the table below and Figure 1-2 to install each EMA ROM in the correct socket).

Location	Rom IC	Bits	Module No.
B1 (XU401) C1 (CU201) D1 (XU101)	92067-80001 (EMA ROM)	7-0	36, 37
B2 (XU402) C2 (XU202) D2 (XU102)	92067-80002 (EMA ROM)	15-8	
B3 (XU404) C3 (XU202) D3 (XU104)	92067-80003 (EMA ROM)	23-16	
B4 (XU406) C3 (XU206) D4 (XU106)	91740-80070 (Loader Extension ROM)	7-0	38, 39
B5 (XU408) C5 (XU208) D5 (XU108)	91740-80071 (Loader Extension ROM)	15-8	
B6 (XU409) C6 (XU209) D6 (XU109)	91740-80072 (Loader Extension ROM)	12-16	

c. Set jumpers 10 through 13 as shown below. Jumper notations A, B, C, and D correspond to blocks A, B, C, and D, respectively.

Jumper	Setting
10C	1
11C	0
12C	0
13	1

d. Refer to Chapter 1 of this manual for the FAB installation procedure.

e. Perform the verification as described in the Verification section.

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for the FEM removal and installation procedure.

b. Install the three ROM ICs in any available set of sockets and configure the switches as shown in Table 2-1 for Control Memory modules 36 and 37. The following are the switch settings for Control Memory modules 36 and 37.

Switch	Settings
S1	1
S2	0
S3	0
S4	1
S5	1
S6	1
S7	0
S8	0
S9	1
S10	0

c. Refer to Chapter 2 for the FEM installation procedure.

d. Perform verification as described in the next section.

Verification

Installation

After installing the EMA ROMs, verify correct installation by running the EMA self-test. The EMA self-test checks for correct IC orientation and correct EMA firmware addressing.

To execute the EMA self-test proceed as follows:

a. Store 105242 (octal) in the A-Register.

b. Store 0 in the P-Register.

c. Store 0 in the S-Register.

d. Press PRESET.

e. Press INSTR STEP.

If the EMA self-test completes with the S-Register equal to 102077 then the firmware is operational. If the test completes with the S-Register NOT EQUAL to 102077, then check for the following conditions:

a. Incorrect IC orientation on the FAB or FEM.

b. Incorrect jumper positioning on the FAB board, or switch settings on the FEM.

c. IC pin(s) are bent under or broken off.

If a failure still exists, refer to the Service Information paragraph of the FAB or FEM section of this manual for troubleshooting procedures.

Operation

To verify functional operation of the EMA firmware, the EMA on-line diagnostic should be run. Refer to the EMA On-Line Diagnostic Reference Manual (part no. 92067-90007), for operating instructions. Follow the troubleshooting procedures recommended in the EMA On-Line Diagnostic Reference Manual if a failure exists.

Chapter 6
HP 13306B FFP

Introduction

This chapter provides installation instructions for the HP 1000 Fast FORTRAN Processor firmware, which is an accessory for the HP 1000 E-Series Computer. Additional information is provided in the manuals listed in the Preface.

Description

The HP 1000 Fast FORTRAN Processor (FFP) firmware consists of six read-only-memory (ROM) integrated-circuits (IC's). Three 4K ROM IC's are allocated to control memory module 32 and 33 (decimal) and three 4K ROM IC's are allocated to control memory modules 34 and 35 (decimal).

E-Series computers with a serial prefix of 21xx or greater contain the ROMs listed below under option 100 as a standard part of the computer.

13306B standard includes.

Description	Part No.
4K ROM IC (Bits 7-0)	5090-0589
4K ROM IC (Bits 15-8)	5090-0590
4K ROM IC (Bits 23-16)	5090-0591

Option 100 adds the following three ROMS:

4K ROM IC (Bits 7-0)	13307-80036
4K ROM IC (Bits 15-8)	13307-80037
4K ROM IC (Bits 23-16)	13307-80038

Installation

The HP 13304A Firmware Accessory Board or HP 13791A Firmware Expansion Module is required for the installation of the six FFP ROM IC's.

Firmware Accessory Board

a. Refer to Chapter 1 of this manual for removal of the FAB.

b. On the FAB, install the six ROM IC's in the following locations (see Figure 2-1):

Location	ROM IC	Bits	Module No.
B1 (XU401)	13307-80036	7-0	32, 33
B2 (XU402)	13307-80037	15-8	
B3 (XU404)	13307-80038	23-16	
B4 (XU406)	5090-0589	7-0	34, 35
B5 (XU408)	5090-0590	15-8	
B6 (XU409)	5090-0591	23-16	

Ensure that the IC's are oriented correctly as shown in Figure 1-2 by matching pin 1 of each IC with the white dot on each IC socket.

c. Configure the control store module address jumpers for modules 32, 33, 34, and 35 as shown below. Figures 1-1 and 1-2 can be used for reference.

Jumper	Setting
10B	0
11B	0
12B	0
13	1

d. Refer to Chapter 1 for the FAB installation procedure.

e. Perform verification as described below.

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for the FEM removal and installation procedure.

b. The six FFP ROMs can be installed in any available socket set on the FEM. For example, assume we are going to install the ROMs in SET A and SET B. Refer to Figure 2-1 for location of the sockets.

Location	ROM IC	Bits	Module No.
A1	13307-80036	7-0	
A2	13307-80037	15-8	32, 33
A3	13307-80038	23-16	
B1	5090-0589	7-0	
B2	5090-0590	15-8	34, 35
B3	5090-0591	23-16	

c. Configure the SET A and SET B control memory address switches, SWA and SWB for modules 32, 33 and 34, 35, respectively. See Figure 2-1 and Table 2-1 for reference.

SWA		SWB	
Switch	Setting	Switch	Setting
S1	1	S1	1
S2	0	S2	0
S3	0	S3	0
S4	1	S4	1
S5	1	S5	1
S6	1	S6	1
S7	0	S7	0
S8	0	S8	0
S9	0	S9	0
S10	0	S10	1

d. Refer to Chapter 1 of this manual for the FEM installation procedure.

e. Perform the verification as described below.

Verification

After installing the FFP, verify proper operation by performing the Fast FORTRAN Processor diagnostic test described in the Diagnostic Reference Manual. Part numbers for the diagnostic test are as follows:

Diagnostic	Manual	Absolute Binary Program No.
Fast FORTRAN Processor	12977-90002	12977-16004 12977-16005

If the diagnostic test is completed without an error halt, the FFP is operating correctly. If the diagnostic test indicates an error halt, refer to the FAB or FEM section of this manual for troubleshooting information.

Chapter 7
F-Series DMI/FFP ROMs

Introduction

This chapter provides installation and reference information for the F-Series Dynamic Mapping Instructions and Fast FORTRAN Processor. Additional information is provided in the manuals listed in the Preface.

Description

The F-Series DMI/FFP consists of three 8K read-only-memory (ROM) integrated-circuits (IC's). The DMI instructions are contained within these three ROMs.

Description	HP Part No.
8K ROM IC (Bits 7-0)	5180-0141
8K ROM IC (Bits 15-8)	5180-0142
8K ROM IC (Bits 23-16)	5180-0143

Installation

The F-Series DMI/FFP ROMs are standard on the F-Series Computer. They are installed on the HP 12791A Firmware Expansion Module (FEM). To install or remove the DMI/FFP ROMs, proceed as follows.

a. Refer to Chapter 2 of this manual for the FEM removal procedure.

b. The three ROM IC's can be installed in any vacant socket set. For example, assume we will use SETA.

Location	ROM IC	Bits	Module No.
A1	5180-0141	7-0	
A2	5180-0142	15-8	32, 33
A3	5180-0143	23-16	34, 35

c. Configure control memory address switches SWA for modules 32, 33, 34, and 35 as shown below. Figures 2-1 and 2-2 can be used for reference.

Switch	Setting
S1	1
S2	0
S3	1
S4	0
S5	1
S6	1
S7	0
S8	0
S9	0
S10	X (Don't Care)

d. Refer to Chapter 2 for the FEM installation procedure.

e. Perform verification as described below.

Verification

Installation

After installing the DMI/FFP ROMs, verify proper installation by running the firmware self-test. The firmware self-test checks for correct IC orientation and if the DMI/FFP firmware is correctly addressed.

To execute the FFP self-test proceed as follows:

a. Store 105200 (octal) in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

One of three results should be displayed in the S-Register.

a. S = 102077 indicates successful completion.

b. S = 102001 indicates module 33 defective or missing.

c. S = 102002 indicates module 35 defective or missing.

Any other indication in the S-Register indicates that DMI/FFP is defective or not installed properly. If other than a 102077B is displayed on the S-Register, check for the following conditions.

a. Incorrect IC orientation on the FEM.

b. Incorrect switch settings on the FEM.

c. IC pin(s) are bent under or broken off.

If a failure still exists, refer to the Service Information paragraph of the FEM section of this manual (Chapter 1) for troubleshooting procedure.

Operation

To verify functional operation of the DMI/FFP firmware, the FFP/Floating Point Processor/Scientific Instruction Set and the Memory Expansion Module off-line diagnostics should be run. Refer to the appropriate Diagnostic Reference Manual for execution procedure.

Diagnostic	Manual	Absolute Binary No.
Floating Point Processor/ Scientific Instruction Set/ Fast FORTRAN Processor	12740-90004	12740-16001
Memory Expansion Module Test	12929-90003	12929-16001

If the diagnostic test is complete without an error halt, the DMI/FFP is operating correctly. If the diagnostic test indicates an error halt, refer to the FEM section of this manual for troubleshooting information.

Chapter 8
F-Series SIS ROMs

Introduction

This chapter provides installation and reference information for the F-Series Scientific Instruction Set (SIS) firmware. Additional information is provided in the manuals listed in the Preface.

Description

The Scientific Instruction Set (SIS) firmware consists of six read-only-memory (ROM) integrated-circuits (IC's). The three ROMs are allocated to control memory modules 40, 41, 42, and 43 as follows:

Description	HP Part No.
8K ROM IC (Bits 7-0)	12823-80019
8K ROM IC (Bits 15-8)	12823-80020
8K ROM IC (Bits 23-16)	12823-80021

Installation

The F-Series SIS ROMs are standard on the F-Series Computer. They are installed on the HP 12791A Firmware Expansion Module. To install or remove the SIS ROMs, proceed as follows.

a. Refer to Chapter 2 of this manual for the FEM removal procedure.

b. The three SIS ROMs can be installed in any vacant socket set. For example, assume we will use SETA. Refer to Figure 2-2 in Chapter 2 for socket locations.

Location	ROM IC	Bits	Module No.
A1	12823-80019	7-0	40, 41, 42, 43
A2	12823-80020	15-8	
A3	12823-80021	23-16	

c. Configure control memory address switches SWA for modules 40, 41, 42, and 43 as shown below. Figures 2-1 and 2-2 can be used for reference.

Switch	Setting
S1	1
S2	0
S3	1
S4	0
S5	1
S6	1
S7	0
S8	1
S9	0
S10	X (Don't Care)

d. Refer to Chapter 2 for the FEM installation procedure.

e. Perform verification as described below.

Verification

Installation

After installing the SIS ROMs, verify proper installation by running the firmware self-test. The firmware self-test checks for correct IC orientation and correct SIS firmware addressing.

To execute the SIS self-test proceed as follows:

a. Store 105337 (octal) in the A-Register.

b. Store 0 in the P-Register.

c. Press RESET.

d. Press INSTR STEP.

A 102077 (octal) in the S-Register indicates successful completion. Any other value displayed in the S-Register indicates the SIS firmware self-test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

S = 102001 Indicates floating point PCA's not cabled or not powered.

S = 102002 Indicates a numerical error in the diagnostic calculation; defective floating point PCA(s) or ROMs.

Operation

To verify functional operation of the SIS firmware, the FPP/SIS/FFP off-line diagnostic should be run. Refer to the FPP/SIS/FFP Diagnostic Reference Manual for execution procedure.

Diagnostic	Manual	Absolute Binary No.
Floating Point Processor/ Scientific Instruction Set/ Fast FORTRAN Processor	12740-90004	12740-16001

If the diagnostic test is complete without an error halt, the SIS is operating correctly. If the diagnostic test indicates an error halt, refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

Chapter 9
HP 12824A/29A VIS ROMs

Introduction

This chapter provides installation and reference information for the HP 12824A/29A Vector Instruction Set (VIS) firmware, which is an option for the F-Series Computer. Additional information is provided in the manuals listed in the Preface. The HP 12824A is for RTE-IVB Operating Systems and the HP 12829A is for RTE-6/VM Operating Systems.

Description

The Vector Instruction Set (VIS) firmware consists of three read-only-memory (ROM) integrated-circuits (IC's) the three ROM's are allocated to control memory modules 12, 13, 14, and 15.

Description	HP Part No.
8K ROM IC (Bits 7-0)	12824-80007
8K ROM IC (Bits 15-8)	12824-80008
8K ROM IC (Bits 23-16)	12824-80009

The 12791A Firmware Expansion Module is an accessory which is required for the installation of the three 8K ROMs in a F-Series Computer.

Installation

The VIS ROMs are installed on the 12791A Firmware Expansion Module (FEM). To install or remove the three VIS ROMs, proceed as follows.

a. Refer to Chapter 2 of this manual for the FEM removal procedure (if necessary).

b. The three VIS ROMs can be installed in any available socket set on the FEM. For example, assume we are going to install the ROMs in SETA. Refer to Figure 2-1 for the location of the sockets.

Location	ROM IC	Bits	Module No.
A1	12824-80007	7-0	12, 13, 14, 15
A2	12824-80008	15-8	
A3	12824-80009	23-16	

c. Configure the SETA control memory address switches, SWA, for modules 12, 13, 14, and 15. Refer to Figure 2-1 and Table 2-1 for reference.

SWA

Switch	Setting
S1	1
S2	0
S3	1
S4	0
S5	1
S6	0
S7	0
S8	1
S9	1
S10	X (Don't Care)

d. Refer to Chapter 2 for the FEM installation procedure.

e. Perform verification as described below.

Verification

Installation

After installing the VIS ROMs, verify proper installation by running the firmware self-test. The firmware self-test checks for correct IC orientation and correct VIS firmware addressing.

To execute the VIS self-test proceed as follows:

a. Store 105477 (octal) in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

A 102077 (octal) in the S-Register indicates successful completion. Any other value displayed in the S-Register indicates the VIS firmware self-test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

Operation

To verify functional operation of the VIS firmware, the VIS on-line diagnostic should be run. Refer to the VIS Users Manual (part no. 12824-90001), for operating instructions. Troubleshooting procedures are recommended in the FEM section of this manual.

Chapter 10
Loader Extension Firmware

Introduction

This chapter provides installation information about the Loader Extension Firmware which may be installed either on the HP 13304A Firmware Accessory Board (FAB Board) or on the HP 12791A Firmware Expansion Module (FEM Board) to support the operation of the HP 7974A Digital Magnetic Tape Unit. The FAB and FEM Boards are Printed Circuit Assembly (PCA) accessories for the Central Processor Unit (CPU), which provide available IC sockets and related circuitry for the installation of optional firmware packages. When used, the FAB Board is mounted below the CPU PCA, while the FEM Board will be in an available CPU I/O slot. For further information, on FAB or FEM Boards, refer to Chapters 1 or 2, respectively, of this manual.

NOTE

If you do not currently have networking capabilities on your CPU, you need not read this NOTE. If you want to add the HP 7974A to your E/F-Series system, go to the the installation instructions later in this chapter. When you want to add networking, check with your nearest HP Sales and Service Office for HP 91750A or HP 91751A: point-to-point or packet switching network software, respectively.

If you have the HP 91740B Distributed System (DS/1000) Firmware installed in your CPU and the HP 7974A is required (on the same CPU), this NOTE applies to you because the HP 91740B is in "support life" (no longer in production) and you need to replace some firmware. User networks may continue to use the HP 91740B with a similar level of HP support until its support life status ends (consult the nearest Hewlett-Packard Sales and Service Office for information on this). To continue support of DS/1000 and add support of the HP 7974A, the following two requirements must be met:

1. *An HP 12992L Loader ROM (for the HP 7974A) and an HP 91740B Communications Bootstrap Loader (CBL) ROM (for DS/1000) are required on the CPU PCA to use both products.*

2. *The three DS/1000 Driver ROMs (installed either on your FAB or FEM Board) must be replaced with the ROM part numbers in Table 10-1. The new Loader Extension Firmware supports both DS/1000 and the HP 7974A.*

For additional information on the:

1. HP 12992L: consult the HP 12992 Loader ROM Installation Manual (part no. 12992-90001).

2. HP 91740B: consult the HP 91740B Distributed System (DS/1000) Firmware Manual (part no. 91740-90009).

Description

The Loader Extension Firmware consists of one Loader ROM (HP 12992L) and three Loader Extension ROMs (see Table 10-1). The Loader ROM is an Initial Binary Loader (IBL) ROM that is installed in one of the IC sockets on the CPU PCA. The 128-word IBL program exceeds the capacity of the Loader ROM, so the first 64-words are stored in the Loader ROM while the second 64-words are installed in main memory by the Loader Extension Firmware. Loader Extension Firmware is supported on the HP 1000 E/F-Series but not on the M-Series CPU. The Loader Extension Firmware and DS/1000 are two of the HP-reserved Control Memory Modules (38 and 39). Refer to Figures 11-2 (E-Series) or 11-3 (F-Series) for a comprehensive map of HP-reserved and user-reserved Control Memory Module allocations.

Hardware Required

With the exception of the ROMs listed in Table 10-1, all of the hardware required was previously furnished with your E/F-Series CPU.

Table 10-1. Loader Extension Firmware

PRODUCT NUMBER	FUNCTION	TYPE	HP PART NUMBER
12992L	IBL Loader	1K	12992-80011
N/A	Loader Extension ROM (bits 0-7)	4K	91740-80070
N/A	Loader Extension ROM (bits 8-15)	4K	91740-80071
N/A	Loader Extension ROM (bits 16-23)	4K	91740-80072

Installation

The HP 12992L Loader ROM is installed on the CPU board as described in the HP 12992 Loader ROMs Installation Manual (part no. 12992-90001). The Loader Extension Firmware may be installed either on the FAB Board (standard in the M-Series computer) or on the FEM Board (standard in the E/F-Series computer) using one of the following two installation procedures.

FAB Board, Loader Extension ROM Installation

To install the three 4k ROMs on the FAB Board, proceed as follows:

NOTE

If the HP 12992L IBL Loader ROM has not been installed on the CPU board, install it now following instructions given in the HP 12992 Loader ROMs Installation Manual (part no. 12992-90001).

WARNING

Hazardous voltages are present in the CPU mainframe. Before attempting to install a Loader ROM on the CPU Board or removing the FAB Board to install the Loader Extension ROMs, switch OFF all computer and battery power (if installed), and disconnect the AC power cord. Failure to comply may result in serious injury.

1. Remove the FAB Board following instructions given in the Chapter 1 Installation/Removal procedure.

CAUTION

ROM ICs can be permanently damaged by static discharge unless:

a. ICs are stored in "antistatic" carriers.

b. A body-ground device, a grounded conductive working surface, and a grounded conductive floor mat is used while handling FAB Boards or FAB Board components.

2. Install the three Loader Extension ROMs in the Most Significant Module Pair (MSMP) sockets of Block C. Refer to Table 10-2 for the correct ROM part numbers and Figure 10-2 for the correct ROM IC socket locations. The shaded sockets in Figure 10-2 are the designated locations of the Loader Extension ROM ICs. It is important that each ROM is installed, by part number, in its correct location. Refer to Chapter 1 of this manual for information on the Block Addressing required by DS/1000.

CAUTION

ROM ICs can be permanently damaged if installed incorrectly and line power is applied. Be sure that the notched end of the installed IC packs are oriented in the same direction as the other ICs on the FAB Board and that pin 1 of each IC pack matches the white dot locator on each socket.

3. Set jumpers 10C through 12C as shown in Table 10-3. Jumper locations can be seen in the upper lefthand corner of Figure 10-2.

4. Reinstall the FAB Board following instructions given in the Chapter 1 Installation/Removal procedure.

5. Connect the power cord, turn on computer and battery power.

6. Verify this procedure by performing the self-tests and/or diagnostics discussed in the Verification section of this chapter.

Table 10-2. Loader Extension Firmware Locations (FAB Board)

HP PART NUMBER	BIT NUMBER	TYPE	MSMP SOCKET NUMBER
91740-80070	Bits 7-0	4K	C4 (XU206)
91740-80071	Bits 15-8	4K	C5 (XU208)
91740-80072	Bits 23-16	4K	C6 (XU209)

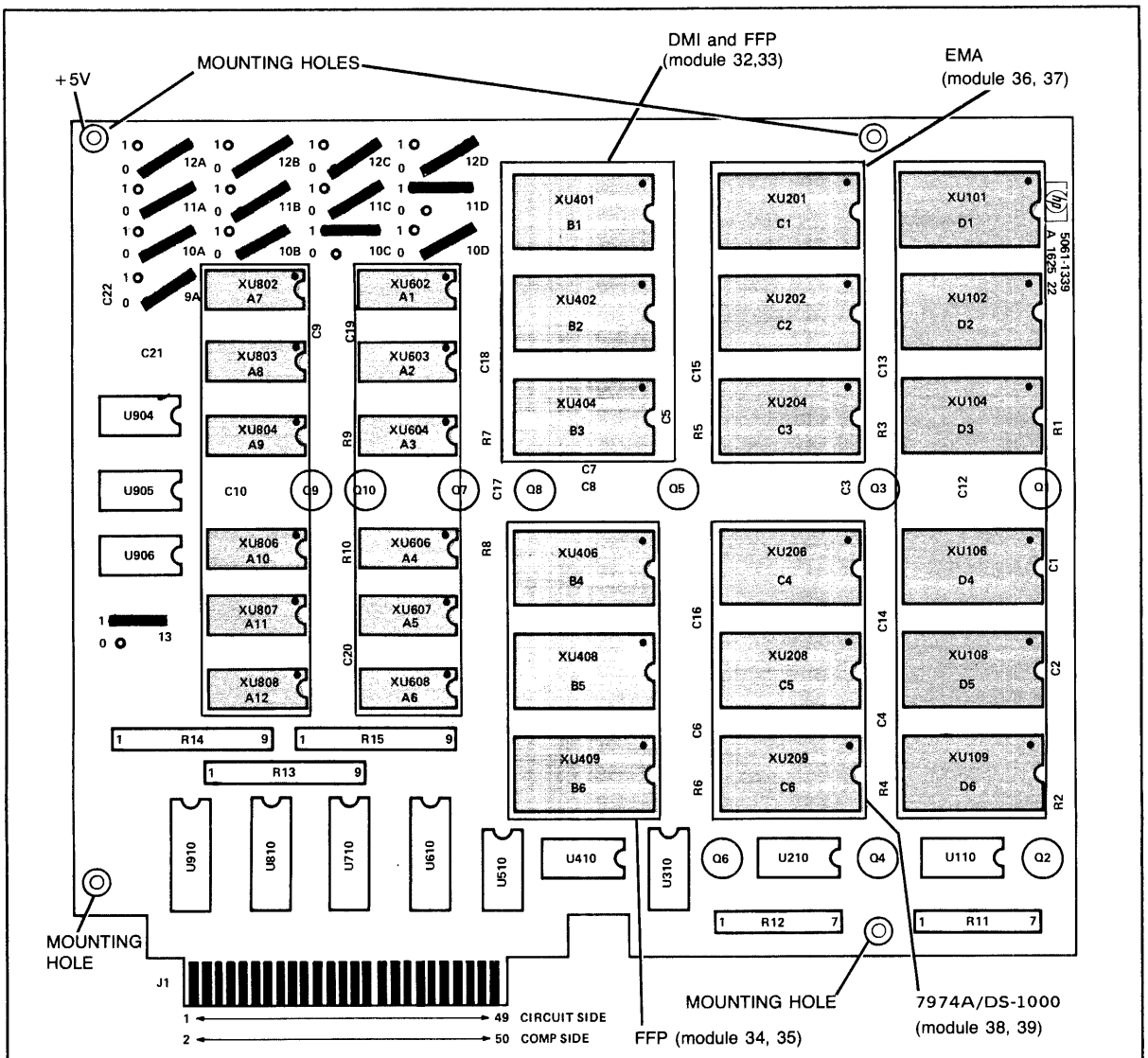
Table 10-3. Control Store Module Allocation and Jumper Configurations (FAB Board)

MODULE NUMBER	ADDRESS		JUMPERS			UPPER/LOWER 8K
	DECIMAL	OCTAL	10C	11C	12C	JUMPER 13
38	09728-09983	23000-23377	1	0	0	1
39	09984-10239	23400-23777				

MODULE NO.	ADDRESSES		JUMPER PREFIX				UPPER/ LOWER 8K JUMPER
	DECIMAL	OCTAL	NOTE 1 9	10	11	12	NOTE 2 13
0	0-00255	00000-00377	0	0	0	0	0
1	00256-00511	00400-00777					
2	00512-00767	01000-01377	1				
3	00768-01023	01400-01777					
4	01024-01279	02000-02377	0	1	0	0	0
5	01280-01535	02400-02777					
6	01536-01761	03000-03377	1				
7	01762-02047	03400-03777					
8	02048-02303	04000-04377	0	0	1	0	0
9	02304-02559	04400-04777					
10	02560-02815	05000-05377	1				
11	02816-03071	05400-05777					
12	03072-03327	06000-06377	0	1	1	0	0
13	03328-03583	06400-06777					
14	03584-03849	07000-07377	1				
15	03850-04095	07400-07777					
16	04096-04351	10000-10377	0	0	0	1	0
17	04352-04607	10400-10777					
18	04608-04863	11000-11377	1				
19	04864-05119	11400-11777					
20	05120-05375	12000-12377	0	1	0	1	0
21	05376-05631	12400-12777					
22	05632-05887	13000-13377	1				
23	05888-06143	13400-13777					
24	06144-06399	14000-14377	0	0	1	1	0
25	06400-06655	14400-14777					
26	06656-06911	15000-15377	1				
27	06912-07167	15400-15777					
28	07168-07423	16000-16377	0	1	1	1	0
29	07424-07679	16400-16777					
30	07680-07935	17000-17377	1				
31	07936-08191	17400-17777					
32	08192-08447	20000-20377	0	0	0	0	1
33	08448-08703	20400-20777					
34	08704-08959	21000-21377	1				
35	08960-09215	21400-21777					
36	09216-09571	22000-22377	0	1	0	0	1
37	09572-09727	22400-22777					
38	09728-09983	23000-23377	1				
39	09984-10239	23400-23777					
40	10240-10495	24000-24377	0	0	1	0	1
41	10496-10751	24400-24777					
42	10752-10917	25000-25377	1				
43	10918-11263	25400-25777					
44	11264-11519	26000-26377	0	1	1	0	1
45	11520-11775	26400-26777					
46	11776-12031	27000-27377	1				
47	12032-12287	27400-27777					
48	12288-12543	30000-30377	0	0	0	1	1
49	12544-12799	30400-30777					
50	12800-13055	31000-31377	1				
51	13056-13311	31400-31777					
52	13312-13557	32000-32377	0	1	0	1	1
53	13558-13823	32400-32777					
54	13824-14079	33000-33377	1				
55	14080-14335	33400-33777					
56	14336-14591	34000-34377	0	0	1	1	1
57	14592-14847	34400-34777					
58	14848-15103	35000-35377	1				
59	15104-15359	35400-35777					
60	15360-15615	36000-36377	0	1	1	1	1
61	15616-15871	36400-36777					
62	15872-16127	37000-37377	1				
63	16128-16383	37400-37777					

1. Jumper 9 applies to block A only.
2. Jumper 13 selects upper or lower 8K of control store.
3. See figure 1-2 for jumper locations.

Figure 10-1. FAB Board Jumper Configurations



NOTES: 1. SHADED AREA SHOWS ROM IC SOCKET LOCATIONS.

2. SEE TABLES 1 AND 2 FOR DESIGNATED ROM LOCATIONS.

3. JUMPERS 9A, 10A, 11A, 12A, AND 13 SHOWN CONFIGURED FOR BLOCK A MODULES 32 AND 33. JUMPERS 10B,11B,12B, AND 13 SHOWN CONFIGURED FOR BLOCK B MODULES 32, 33, 34, AND 35 (DMI AND FFP).

4. JUMPERS 10C,11C,12C, & 13 SHOWN CONFIGURED FOR BLOCK C MODULES 36,37,38, AND 39 (EMA AND DS/1000). JUMPERS 10D, 11D, 12D, AND 13 SHOWN CONFIGURED FOR BLOCK D MODULES 40,41,42, AND 43 (SIS).

5. SEE FIGURE 1-1 FOR OTHER JUMPER CONFIGURATIONS.

Figure 10-2. FAB Board Topology

FEM Board, Loader Extension ROM Installation

To install the three 4k ROMs on the FEM Board, proceed as follows:

NOTE

If the HP 12992L IBL Loader ROM has not been installed on the CPU board, install it now following instructions given in the HP 12992 Loader ROMs Installation Manual (part no. 12992-90001).

WARNING

Hazardous voltages are present in the CPU mainframe. Before attempting to install a Loader ROM on the CPU Board or removing the FEM Board to install the Loader Extension ROMs, switch OFF all computer and battery power (if installed) and disconnect the AC power cord. Failure to comply may result in serious injury.

1. Remove the FEM Board following instructions given in the Chapter 2 Installation/Removal procedure.

CAUTION

ROM ICs can be permanently damaged by static discharge unless:

a. ICs are stored in "antistatic" carriers.

b. A body-ground device, a grounded conductive working surface, and a grounded conductive floor mat is used while handling FEM Boards or FEM Board components.

2. Install the three Loader Extension ROMs in a set of three available, contiguous sockets. Refer to Table 10-1 for the correct ROM part numbers and Figure 10-4 for the correct ROM IC socket locations,

CAUTION

ROM ICs can be permanently damaged if installed incorrectly and line power is applied. Be sure that the notched end of the installed IC packs are oriented in the same direction as the other ICs on the FEM Board and that pin 1 of each IC pack matches the white dot locator on each socket.

3. Set the address switches on the FEM Board for Control Memory Modules 38 and 39 (reserved for HP 7974 and DS/1000) as follows. Refer to Figure 10-3 for a comprehensive list of FEM Board Address settings by Control Memory Module allocation.

Switch	Setting
S1	1
S2	0
S3	0
S4	1
S5	1
S6	1
S7	0
S8	0
S9	1
S10	0

4. Reinstall the FEM Board following instructions given in the Chapter 2 Installation procedure.

5. Connect the power cord, turn on computer and battery power.

6. Verify this procedure by performing the self-tests and/or diagnostics discussed in the Verification section of this chapter.

Verification

After reinstalling the computer, run the following self-test to check for correct ROM IC orientation and switch settings, and to see that firmware is correctly addressed. This self-test does not test the HP 12992L Loader ROM.

1. Turn the computer ON, select the A-Register and set it to 105304 (octal).

2. Set both the P- and S-Registers to zero.

3. Press PRESET and then INSTR STEP.

4. If the firmware passes self-test, the S-Register will display the latest released date code in octal as shown in Table 10-4.

If the above self-test (or any of the checks suggested in the following Service Information section) locates a problem, correct it, and run self-test again. If the failure still exists, isolate the defective ROM IC(s) by substituting known good component(s) and run self-test again.

Table 10-4. Display Register, FAB/FEM Board Self-Test Passed

BCD	2				5				4				0			
LAMPS ON BITS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
			*			*		*		*						
OCTAL	0		2			2			5			0			0	

Service Information

If the Display Register indicates any value other than the date code in octal:

1. The 12992L Loader ROM should be self-tested and inspected as suggested in the HP 12992 Loader ROMs Installation Manual (part no. 12992-90001).

2. The FAB or FEM Board (whichever you have installed) should be removed and inspected for one or more of the following defects:

Defect	Suggested Action
Incorrect ROM IC orientation	Check that the notched end of all IC packs are oriented in the same direction and that the white dot locator on each IC pack matches pin 1 of its IC socket.
Incorrect jumper positioning (FAB Board) or switch setting (FEM Board)	See Figure 10-1 of the FAB Board or Figure 10-3 of FEM Board for the correct settings.
Bent or broken ROM IC pin(s)	Remove and inspect IC pack.
Incorrect Firmware part numbers	See Table 10-1 for correct ROM part number.
ROM(s) installed in the wrong socket numbers	See Figure 10-2 for FAB Board or Figure 10-4 for FEM Board.
Damaged parts	Thoroughly inspect the PCA and each component.
Incorrect Display Register value	Possible CPU failure, run diagnostics for your model CPU.

Depending upon whether you have a FAB or FEM board installed in your computer, refer to the section in this manual on Service Information in Chapters 1 or 2 respectively and follow the instructions given there. If the failure still persists, contact your nearest Hewlett-Packard Sales and Service Office (listed at the back of this manual).

MODULE NO.	ADDRESSES		4K ROMS										8K ROMS									
			SWITCHES										SWITCHES									
	DECIMAL	OCTAL	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
0	0-00255	00000-00377	1	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	X
1	00256-00511	00400-00777																				
2	00512-00767	01000-01377	1	0	0	1	1	0	0	0	0	1										
3	00768-01023	01400-01777																				
4	01024-01279	02000-02377	1	0	0	1	1	0	0	0	1	0	1	0	1	0	1	0	0	0	1	X
5	01280-01535	02400-02777																				
6	01536-01761	03000-03377	1	0	0	1	1	0	0	0	1	1										
7	01762-02047	03400-03777																				
8	02048-02303	04000-04377	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0	X
9	02304-02559	04400-04777																				
10	02560-02815	05000-05377	1	0	0	1	1	0	0	1	0	1										
11	02816-03071	05400-05777																				
12	03072-03327	06000-06377	1	0	0	1	1	0	0	1	1	0	1	0	1	0	1	0	0	1	1	X
13	03328-03583	06400-06777																				
14	03584-03849	07000-07377	1	0	0	1	1	0	0	1	1	1										
15	03850-04095	07400-07777																				
16	04096-04351	10000-10377	1	0	0	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	0	X
17	04352-04607	10400-10777																				
18	04608-04863	11000-11377	1	0	0	1	1	0	1	0	0	1										
19	04864-05119	11400-11777																				
20	05120-05375	12000-12377	1	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	X
21	05376-05631	12400-12777																				
22	05632-05887	13000-13377	1	0	0	1	1	0	1	0	1	1										
23	05888-06143	13400-13777																				
24	06144-06399	14000-14377	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	1	0	X
25	06400-06655	14400-14777																				
26	06656-06911	15000-15377	1	0	0	1	1	0	1	1	0	1										
27	06912-07167	15400-15777																				
28	07168-07423	16000-16377	1	0	0	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	X
29	07424-07679	16400-16777																				
30	07680-07935	17000-17377	1	0	0	1	1	0	1	1	1	1										
31	07936-08191	17400-17777																				
32	08192-08447	20000-20377	1	0	0	1	1	1	0	0	0	0	1	0	1	0	1	1	0	0	0	X
33	08448-08703	20400-20777																				
34	08704-08959	21000-21377	1	0	0	1	1	1	0	0	0	1										
35	08960-09215	21400-21777																				
36	09216-09571	22000-22377	1	0	0	1	1	1	0	0	1	0	1	0	1	0	1	1	0	0	1	X
37	09572-09727	22400-22777																				
38	09728-09983	23000-23377	1	0	0	1	1	1	0	0	1	1										
39	09984-10239	23400-23777																				
40	10240-10495	24000-24377	1	0	0	1	1	1	0	1	0	0	1	0	1	0	1	1	0	1	0	X
41	10496-10751	24400-24777																				
42	10752-10917	25000-25377	1	0	0	1	1	1	0	1	0	1										
43	10918-11263	25400-25777																				
44	11264-11519	26000-26377	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	1	X
45	11520-11775	26400-26777																				
46	11776-12031	27000-27377	1	0	0	1	1	1	0	1	1	1										
47	12032-12287	27400-27777																				
48	12288-12543	30000-30377	1	0	0	1	1	1	1	0	0	0	1	0	1	0	1	1	1	0	0	X
49	12544-12799	30400-30777																				
50	12800-13055	31000-31377	1	0	0	1	1	1	1	0	0	1										
51	13056-13311	31400-31777																				
52	13312-13557	32000-32377	1	0	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	1	X
53	13558-13823	32400-32777																				
54	13824-14079	33000-33377	1	0	0	1	1	1	1	0	1	1										
55	14080-14335	33400-33777																				
56	14336-14591	34000-34377	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	1	1	1	0	X
57	14592-14847	34400-34777																				
58	14848-15103	35000-35377	1	0	0	1	1	1	1	1	0	1										
59	15104-15359	35400-35777																				
60	15360-15615	36000-36377	1	0	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	X
61	15616-15871	36400-36777																				
62	15872-16127	37000-37377	1	0	0	1	1	1	1	1	1	1										
63	16128-16383	37400-37777																				

1. 0 = CLOSED 1 = OPEN X = DON'T CARE
   "CLOSED" AND "OPEN" REFER TO THE SETTINGS ON THE DIP ROCKER SWITCHES.
   WHEN THE SWITCH IS *DEPRESSED* THE CORRESPONDING SETTING IS ENABLED.

2. ALL UNUSED SETS MUST BE DISABLED BY SETTING S1 CLOSED.

Figure 10-3. FEM Board Address Switch Settings

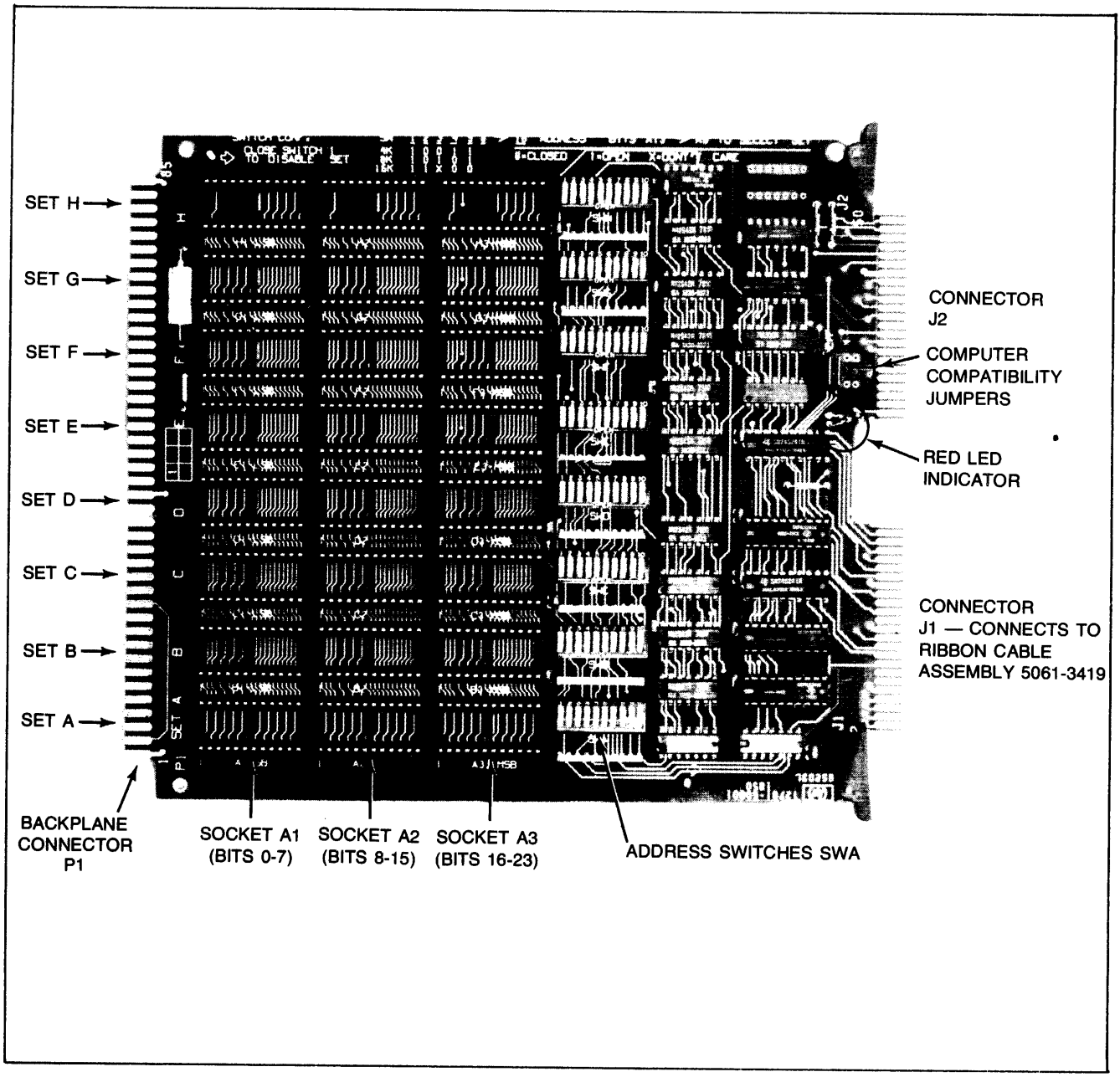


Figure 10-4. FEM Board Topology

Chapter 11
M/E/F-Series CMA

Control Memory Maps

This chapter contains the Control Memory allocation for HP 1000 M/E/F-Series computers.

CONTROL MEMORY MODULE ALLOCATION	MODULE NO.	ADDRESS		SOFTWARE ENTRY POINT	
		DECIMAL	OCTAL		
HP BASE SET	0	0-00255	00000-00377	YES	1K
	1	00256-00511	00400-00777	YES	
HP DYNAMIC MAPPING INSTRUCTIONS→	2	00512-00767	01000-01377	YES	
	3	00768-01023	01400-01777	YES	
HP FAST FORTRAN PROCESSOR	4	01024-01279	02000-02377	YES	2K
	5	01280-01535	02400-02777	YES	
	6	01536-01761	03000-03377	YES	
	7	01762-02047	03400-03777	YES	
HP RESERVED	8	02048-02303	04000-04377	YES	3K
	9	02304-02559	04400-04777	YES	
	10	02560-02815	05000-05377	YES	
DS/1000	11	02816-03071	05400-05777	YES	
RECOMMENDED FOR USER MICROPROGRAMMING	12	03072-03327	06000-06377	YES	4K
	13	03328-03583	06400-06777	YES	
HP BASE SET	14	03584-03849	07000-07377	YES	
	15	03850-04095	07400-07777	YES	

Figure 11-1. M-Series Control Memory Map

CONTROL MEMORY MODULE ALLOCATION	MODULE NO.	ADDRESS		SOFTWARE ENTRY POINT	
		DECIMAL	OCTAL		
HP BASE SET	0	0-00255	00000-00377	YES	1K
	1	00256-00511	00400-00777	YES	
	2	00512-00767	01000-01377	YES	
	3	00768-01023	01400-01777	YES	
AVAILABLE FOR USER MICROPROGRAMMING	4	01024-01279	02000-02377	NO	2K
	5	01280-01535	02400-02777	NO	
	6	01536-01761	03000-03377	NO	
	7	01762-02047	03400-03777	NO	
	8	02048-02303	04000-04377	NO	3K
	9	02304-02559	04400-04777	NO	
	10	02560-02815	05000-05377	NO	
	11	02816-03071	05400-05777	NO	
	12	03072-03327	06000-06377	NO	4K
	13	03328-03583	06400-06777	NO	
	14	03584-03849	07000-07377	NO	
	15	03850-04095	07400-07777	NO	
	16	04096-04351	10000-10377	NO	5K
	17	04352-04607	10400-10777	NO	
	18	04608-04863	11000-11377	NO	
	19	04864-05119	11400-11777	NO	
	20	05120-05375	12000-12377	NO	6K
	21	05376-05631	12400-12777	NO	
	22	05632-05887	13000-13377	NO	
	23	05888-06143	13400-13777	NO	
	24	06144-06399	14000-14377	NO	7K
	25	06400-06655	14400-14777	NO	
	26	06656-06911	15000-15377	NO	
	27	06912-07167	15400-15777	NO	
	28	07168-07423	16000-16377	NO	8K
	29	07424-07679	16400-16777	NO	
HP DYNAMIC MAPPING SYSTEM	30	07680-07935	17000-17377	NO	
	31	07936-08191	17400-17777	NO	
HP FAST FORTRAN PROCESSOR	32	08192-08447	20000-20377	YES	9K
	33	08448-08703	20400-20777	NO	
	34	08704-08959	21000-21377	YES	
	35	08960-09215	21400-21777	YES	
RTE-IV EMA OR RTE-6/VM EMA/VMA 7974A/DS-1000	36	09216-09571	22000-22377	YES	10K
	37	09572-09727	22400-22777	YES	
	38	09728-09983	23000-23377	YES	
	39	09984-10239	23400-23777	YES	
HP RESERVED	40	10240-10495	24000-24377	YES	11K
	41	10496-10751	24400-24777	NO	
	42	10752-10917	25000-25377	NO	
	43	10918-11263	25400-25777	NO	
RTE-6/VM OPERATING SYSTEM	44	11264-11519	26000-26377	YES	12K
	45	11520-11775	26400-26777	YES	
	46	11776-12031	27000-27377	YES	
	47	12032-12287	27400-27777	YES	
RECOMMENDED FOR USER MICROPROGRAMMING	48	12288-12543	30000-30377	YES	13K
	49	12544-12799	30400-30777	YES	
	50	12800-13055	31000-31377	YES	
	51	13056-13311	31400-31777	NO	
	52	13312-13557	32000-32377	NO	14K
	53	13558-13823	32400-32777	NO	
	54	13824-14079	33000-33377	NO	
	55	14080-14335	33400-33777	NO	
	56	14336-14591	34000-34377	YES	15K
	57	14592-14847	34400-34777	YES	
	58	14848-15103	35000-35377	YES	
	59	15104-15359	35400-35777	YES	
	60	15360-15615	36000-36377	YES	16K
	61	15616-15871	36400-36777	NO	
	62	15872-16127	37000-37377	YES	
	63	16128-16383	37400-37777	NO	

Figure 11-2. E-Series Control Memory Map

CONTROL MEMORY MODULE ALLOCATION	MODULE NO.	ADDRESS		SOFTWARE ENTRY POINT	
		DECIMAL	OCTAL		
HP BASE SET	0	0-00255	00000-00377	YES	1K
	1	00256-00511	00400-00777	YES	
	2	00512-00767	01000-01377	YES	
	3	00768-01023	01400-01777	YES	
HP RESERVED	4	01024-01279	02000-02377	YES	2K
	5	01280-01535	02400-02777	NO	
	6	01536-01761	03000-03377	NO	
	7	01762-02047	03400-03777	NO	
	8	02048-02303	04000-04377	YES	3K
	9	02304-02559	04400-04777	NO	
	10	02560-02815	05000-05377	NO	
	11	02816-03071	05400-05777	NO	
VECTOR INSTRUCTION SET	12	03072-03327	06000-06377	YES	4K
	13	03328-03583	06400-06777	NO	
	14	03584-03849	07000-07377	NO	
	15	03850-04095	07400-07777	NO	
RTE-6/VM OPERATING SYSTEM	16	04096-04351	10000-10377	YES	5K
	17	04352-04607	10400-10777	NO	
	18	04608-04863	11000-11377	YES	
	19	04864-05119	11400-11777	NO	
HP RESERVED	20	05120-05375	12000-12377	YES	6K
	21	05376-05631	12400-12777	NO	
	22	05632-05887	13000-13377	NO	
	23	05888-06143	13400-13777	NO	
	24	06144-06399	14000-14377	NO	7K
	25	06400-06655	14400-14777	NO	
	26	06656-06911	15000-15377	NO	
	27	06912-07167	15400-15777	NO	
AVAILABLE FOR USER MICROPROGRAMMING	28	07168-07423	16000-16377	NO	8K
	29	07424-07679	16400-16777	NO	
	30	07680-07935	17000-17377	NO	
	31	07936-08191	17400-17777	NO	
HP DYNAMIC MAPPING SYSTEM →	32	08192-08447	20000-20377	YES	9K
HP FAST FORTRAN PROCESSOR	33	08448-08703	20400-20777	NO	
	34	08704-08959	21000-21377	YES	
	35	08960-09215	21400-21777	YES	
RTE-IV EMA OR RTE-6/VM EMA/VMA 7974A/DS-1000	36	09216-09571	22000-22377	YES	10K
	37	09572-09727	22400-22777	NO	
	38	09728-09983	23000-23377	YES	
	39	09984-10239	23400-23777	NO	
SCIENTIFIC INSTRUCTION SET	40	10240-10495	24000-24377	YES	11K
	41	10496-10751	24400-24777	NO	
	42	10752-10917	25000-25377	NO	
	43	10918-11263	25400-25777	NO	
HP RESERVED	44	11264-11519	26000-26377	NO	12K
	45	11520-11775	26400-26777	NO	
	46	11776-12031	27000-27377	YES	
	47	12032-12287	27400-27777	YES	
RECOMMENDED FOR USER MICROPROGRAMMING	48	12288-12543	30000-30377	YES	13K
	49	12544-12799	30400-30777	YES	
	50	12800-13055	31000-31377	YES	
	51	13056-13311	31400-31777	NO	
	52	13312-13557	32000-32377	NO	14K
	53	13558-13823	32400-32777	NO	
	54	13824-14079	33000-33377	NO	
	55	14080-14335	33400-33777	NO	
	56	14336-14591	34000-34377	YES	15K
	57	14592-14847	34400-34777	YES	
	58	14848-15103	35000-35377	YES	
	59	15104-15359	35400-35777	YES	
	60	15360-15615	36000-36377	YES	16K
	61	15616-15871	36400-36777	NO	
	62	15872-16127	37000-37377	YES	
	63	16128-16383	37400-37777	NO	

Figure 11-3. F-Series Control Memory Map

Chapter 12
E-Series BS and EIG/FP ROMs

Introduction

This chapter provides installation and reference information for the E-Series Base Set (BS) and Extended Instruction Group/Floating Point (EIG/FP) Firmware. Additional information is provided in the manuals listed in the Preface.

Description

The E-Series Base Set and EIG/Floating Point ROMs (BS and EIG/FP) consists of three read-only-memory (ROM) integrated-circuits (IC's).

Description	HP Part No.
8K ROM IC (bits 7-0)	02113-80006
8K ROM IC (bits 15-8)	02113-80007
8K ROM IC (bits 23-16)	02113-80008

Installation

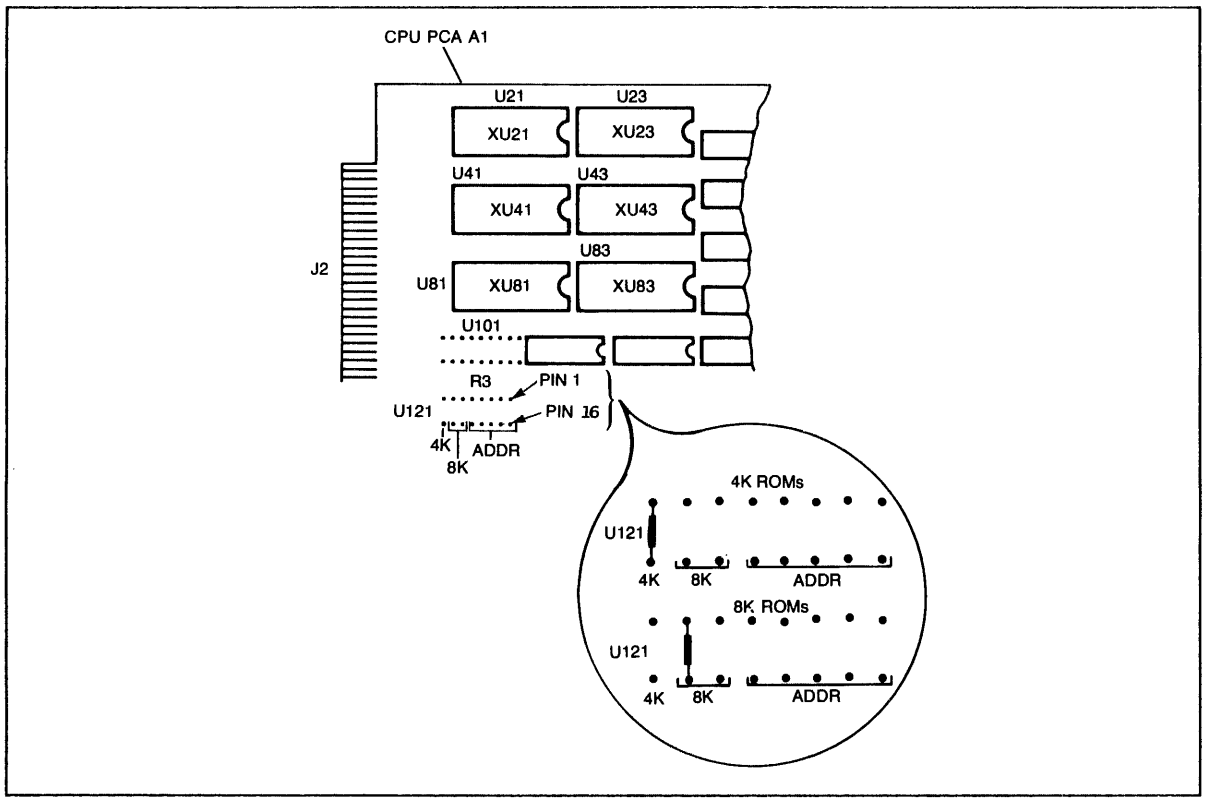
The BS and EIG/FP ROMs can be installed on the CPU board or a Firmware Expansion Module (FEM). If a FEM is available, it is recommended that the ROMs be installed here to facilitate future service.

CPU Board

a. Remove the CPU board as described in the appropriate Installation and Service Manual.

b. The ROMs must be installed in the following locations.

Location	ROM IC	Bits	Module No.
U21	Vacant	--	--
U41	Vacant	--	--
U81	Vacant	--	--
U23	02113-80006	7-0	0, 1, 2, 3
U43	02113-80007	8-15	
U83	02113-80008	16-23	



7700-519

c. Configure the CPU board for operation with 8K ROMs.

   Only the 8K jumper nearest the 4K jumper must be in (pins 7 and 10 of IC location U121). All other jumpers must be out. The silk screen indicating a second 8K jumper (pins 6 and 11) is in error, and this jumper must be out.

d. Install the CPU board as described in the appropriate Installation and Service Manual.

e. Perform the verification as described later in this chapter.

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for the FEM removal procedure (if necessary).

b. The ROMs can be installed in any available socket set on the FEM. For example, assume we are going to use SET A.

Location	ROM IC
A1	02113-80006
A2	02113-80007
A3	02113-80008

c. Configure SWA for 8K ROMs modules 0, 1, 2, 3. Refer to Figure 2-1 and Table 2-1.

All unused socket sets must have switch S1 closed.

SWA

Switch	Setting
S1	1
S2	0
S3	1
S4	0
S5	1
S6	0
S7	0
S8	0
S9	0
S10	X (Don't Care)

d. Install the FEM board.

e. Perform the verification as described below.

Verification

Installation

After installing the ROMs, verify proper installation by running the firmware self-test.

The base set includes three tests that quickly test the computer and memory. These firmware self-tests are not designed as a substitute for more complex software diagnostics and it may frequently be the case that you require a more thorough and detailed testing than provided by these standard self-test routines.

Test 1 tests most of the computer registers and functions. This test will not alter or destroy the contents of any working register or memory. An error condition will set all display register indicator bits (A, B, M, T, P, S) and the overflow register. The execution time is negligible.

Test 2 is a fast microprogrammed memory test that checks the presently enabled memory space (up to 32k words). The microprogram reads each memory location, complements the data and writes it back, reads it, compares it to expected data, then complements it and writes it back into memory. The execution time is negligible and is non-destructive to memory data. An error condition is usually accompanied by a parity error indication and will set all display register indicator bits and clear the overflow register. The A-Register will contain the expected (good) data, the B-Register will contain the actual (bad) data, and the M-Register will contain the logical memory location of the failure.

Test 3 is a significantly more sophisticated microprogrammed memory test. All memory installed in the computer will be tested. Execution time is dependent on the amount of memory installed; approximately one second per 32k words. The display register will increment as each 32k words of memory are tested. Error reporting is the same as in Test 2 except the S-Register will contain the number of the 32k words where the memory failure occurred.

On a cold power-up (as described below), Tests 1 and 3 will each be executed once. Pressing the IBL/TEST switch on the operator panel will not only perform the loader function, it will also cause the execution of Tests 1 and 2.

Executing the octal instruction 100000 via the INSTR STEP switch on the operator panel with the LOCK/OPERATE switch in the OPERATE position will execute Tests 1 and 3 once. The information contained in the S-Register (when selected) will be in the final background pattern used to test memory. This may also be used to easily load the entire memory with the same bit pattern. While the tests are executing, the LOCK/OPERATE switch may be set to the LOCK position and the microprogrammed self-tests will loop continuously until the LOCK/OPERATE switch is returned to the OPERATE position. A memory failure, of course, will terminate the test and report the error.

To check most computer registers and functions and all physical memory, perform the cold power-up procedure as follows:

a. Set ~POWER switch to OFF. If computer is equipped with an optional power fail recovery system, set BATTERY switch to OFF.

b. Set the LOCK/OPERATE switch to OPERATE. Wait approximately six seconds and then set ~POWER switch to ON.

c. Set the BATTERY switch to INT (if installed).

d. The self-test will begin execution and the Display Register can be observed incrementing if a dynamic mapping system (DMS) is installed.

e. Upon successful completion, the T-Register will automatically be selected for display.

f. If a computer failure is detected, the Display Register, all six working register indicators (A, B, M, T, P, S) are lighted and the OVERFLOW indicator is not lighted. Refer to the appropriate Installation and Service manual for troubleshooting procedure.

g. If a memory failure is detected, the Display Register, and all six working register indicators (A, B, M, T, P, S) are lighted and the OVERFLOW indicator is not lighted. To isolate the memory failure, refer to the appropriate Memory Systems Installation and Service Manual.

To execute tests 1 and 3 once from the operator panel:

a. Store 100000 (octal) in the A-Register.

b. Store 0 in the P-Registe.r

c. Press PRESET.

d. Press INSTR STEP.

Upon successful completion, the T-Register will automatically be selected for display. A failure will result in the conditions indicated in steps f and g above.

Operation

To verify operation of the CPU and all Base Set instructions, refer to the Diagnostic Configurator Reference Manual (part no. 02100-90157), Table A-1 or A-2, and run the appropriate instruction group diagnostic.

Description	Manual	Absolute Binary No.
Memory Reference Installation Group	02100-90218	24315-16001
Alter Skip Instruction Group	02100-90211	24316-16001
Shift Rotate Instruction Group	02100-90212	24317-16001
EAU Instruction Group	02100-90214	24319-16001
Floating Point Instruction Group	24320-90001	24320-16001
I/O Instruction Group/I/O Extender	02100-90213	24318-16001
Extended Instruction Group (Index)	12943-90004	12943-16002
Extended Instruction Group (Word, Byte, Bit)	12943-90004	12943-16001

Chapter 13
F-Series BS and EIG/FP ROMs

Introduction

This chapter provides installation and reference information for the F-Series Base Set (BS) and Extended Instruction Group/Floating Point (EIG/FP) Firmware. Additional information is provided in the manuals listed in the Preface.

Description

The F-Series Base Set and EIG/Floating Point ROMs (BS and EIG/FP) consists of three read-only-memory (ROM) integrated-circuits (IC's).

Description	HP Part No.
8K ROM IC (bits 7-0)	02117-80016
8K ROM IC (bits 15-8)	02117-80017
8K ROM IC (bits 23-16)	02117-80018

Installation

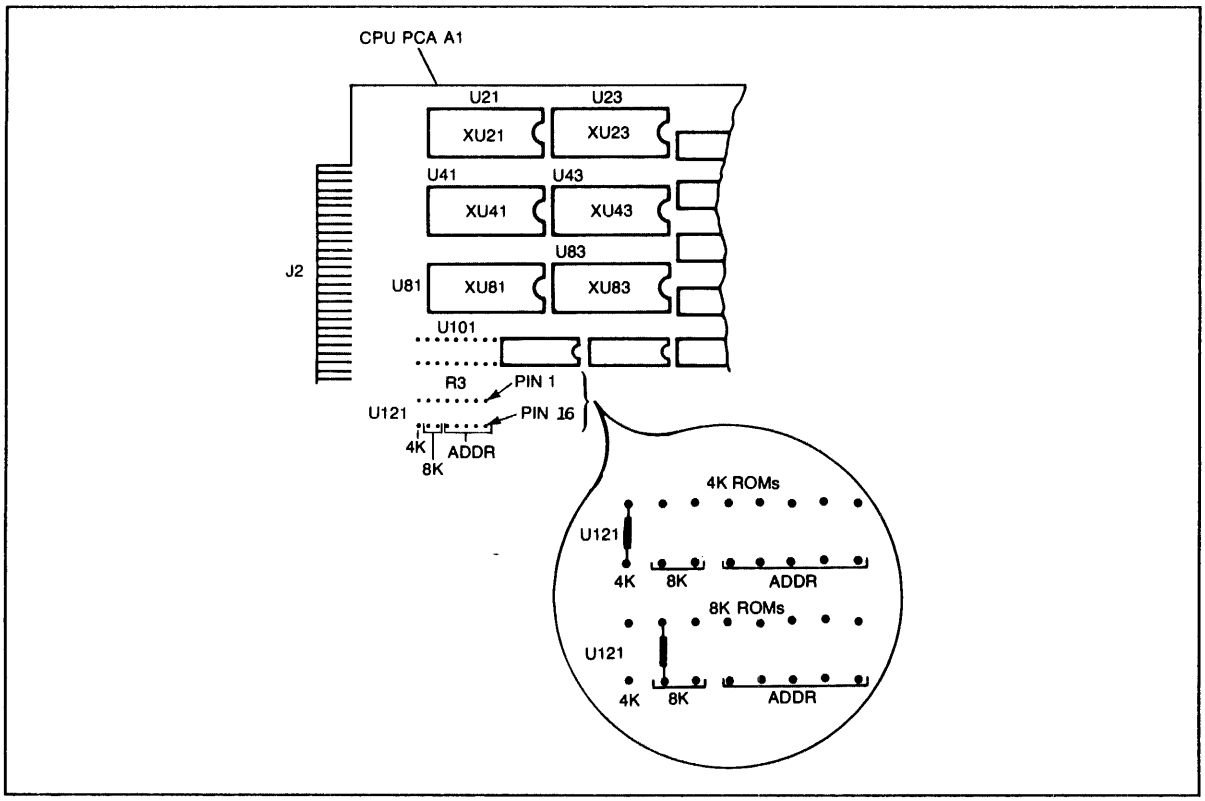
The BS and EIG/FP ROMs can be installed on the CPU board or a Firmware Expansion Module (FEM). If a FEM is available, it is recommended that the ROMs be installed here to facilitate future service.

CPU Board

a. Remove the CPU board as described in the appropriate Installation and Service Manual.

b. The ROMs must be installed in the following locations.

Location	ROM IC	Bits	Module No.
U21	Vacant	--	--
U41	Vacant	--	--
U81	Vacant	--	--
U23	02117-80016	7-0	0, 1, 2, 3
U43	02117-80017	15-8	
U83	02117-80018	23-16	



7700-519

c. Configure the CPU board for operation with 8K ROMs.

   Only the 8K jumper nearest the 4K jumper must be in (pins 6 and 9 of IC location U121). All other jumpers must be out. The silk screen indicating a second 8K jumper is in error.

d. Install the CPU board as described in the appropriate Installation and Service Manual.

e. Perform the verification as described below.

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for the FEM removal procedure (if necessary).

b. The ROMs can be installed in any available socket set on the FEM. For example, assume we are going to use SET A.

Location	ROM IC
A1	02117-80016
A2	02117-80017
A3	02117-80018

c. For 8K ROM configuration, configure SWA for modules 0, 1, 2, 3. Refer to Figure 2-1 and Table 2-1 for reference.

All unused socket sets must have switch S1 closed.

SWA

Switch	Setting
S1	1
S2	0
S3	1
S4	0
S5	1
S6	0
S7	0
S8	0
S9	0
S10	X (Don't Care)

d. Install the FEM board.

e. Perform the verification as described below.

Verification

Installation

After installing the ROMs, verify proper installation by running the firmware self-test.

CPU and Memory

The base set includes three tests that quickly test the computer and memory. These firmware self-tests are not designed as a substitute for more complex software diagnostics and it may frequently be the case that you require a more thorough and detailed testing than provided by these standard self-test routines.

Test 1 tests most of the computer registers and functions. This test will not alter or destroy the contents of any working register or memory. An error condition will set all display register indicator bits (A, B, M, T, P, S) and the overflow register. The execution time is negligible.

Test 2 is a fast microprogrammed memory test that checks the presently enabled memory space (up to 32k words). The microprogram reads each memory location, complements the data and writes it back, reads it, compares it to expected data, then complements it and writes it back into memory. The execution time is negligible and is non-destructive to memory data. An error condition is usally accompanied by a parity error indication and will set all display register indicator bits and clear the overflow register. The A-Register will contain the expected (good) data, the B-Register will contain the actual (bad) data, and the M-Register will contain the logical memory location of the failure.

Test 3 is a significantly more sophisticated microprogrammed memory test. All memory installed in the computer will be tested. Execution time is dependent on the amount of memory installed; approximately one second per 32k words. The display register will increment as each 32k words of memory are tested. Error reporting is the same as in Test 2 except the S-Register will contain the number of the 32k words where the memory failure occurred.

On a cold power-up (as described below), Tests 1 and 3 will each be executed once. Pressing the IBL/TEST switch on the operator panel will not only perform the loader function, it will also cause the execution of Tests 1 and 2.

Executing the octal instruction 100000 via the INSTR STEP switch on the operator panel with the LOCK/OPERATE switch in the OPERATE position will execute Tests 1 and 3 once. The information contained in the S-Register (when selected) will be in the final background pattern used to test memory. This may also be used to easily load the entire memory with the same bit pattern. While the tests are executing, the LOCK/OPERATE switch may be set to the LOCK position and the microprogrammed self-tests will loop continuously until the LOCK/OPERATE switch is returned to the OPERATE position. A memory failure, of course, will terminate the test and report the error.

To check most computer registers and functions and all physical memory, perform the cold power-up procedure as follows:

a. Set the ~POWER switch to OFF. If the computer is equipped with an optional power fail recovery system, set the BATTERY switch to OFF.

b. Set the LOCK/OPERATE switch to OPERATE. Wait approximately six seconds and then set the ~POWER switch to ON.

c. Set the BATTERY switch to INT (if installed).

d. The self-test will begin execution and the Display Register can be observed incrementing if a dynamic mapping system (DMS) is installed.

e. Upon successful completion, the T-Register will automatically be selected for display.

f. If a computer failure is detected, the Display Register, all six working register indicators (A, B, M, T, P, S) are lighted and the OVERFLOW indicator is not lighted. Refer to the appropriate Installation and Service Manual for troubleshooting procedure.

g. If a memory failure is detected, the Display Register, and all six working register indicators (A, B, M, T, P, S) are lighted and the OVERFLOW indicator is not lighted. To isolate the memory failure, refer to the appropriate Memory Systems Installation and Service Manual.

To execute Tests 1 and 3 once from the operator panel:

a. Store 100000 (octal) in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

Upon successful completion, the T-Register will automatically be selected for display. A failure will result in the conditions indicated in steps f and g above.

Floating Point

The F-Series computer includes a firmware self-test for testing the floating point PCA's. This self-test detects obvious trouble symptoms but is not intended as a substitute for the more comprehensive software diagnostic. (The self-test can only be executed in the single-step front panel mode; if entered in the run-mode, a NOP is performed.) To execute the firmware self-test, proceed as follows:

a. Store 105004 (octal) in the A-Register.

b. Store 0 in the P-Register and press PRESET. If the OVFL light remains on, check that the FPP-MPP cable is installed correctly (not twisted). Otherwise, a defective CPU, floating point PCA, or FPP is indicated. Use software diagnostics for further troubleshooting.

c. Press INSTR STEP.

d. A 102077 (octal) in the display register (S) indicates successful completion. If 10200X (octal) is returned in the display register, the firmware test failed and the halt code is interpreted as shown in Table 13-1. If the firmware test returns an error halt code, use software diagnostics for further troubleshooting.

Table 13-1. Floating Point Self-Test Error Halts

HALT	Probable Problem
102001	a. Power not supplied to floating-point PCA7s. b. FPP-MPP cable not properly connected. Refer to the Installation and Reference Manual. c. Floating point CONTROL PCA not installed or not connected properly. d. If the A-Register is not 177777 (octal) and the B-Register is not 0 then the floating point ROMs are defective.
102002	a. If A- and B-Registers are equal to 0 and OVFL is lit, then FFP-MPP cable is twisted. b. If A- and B-Registers equal 177777 (octal), then floating point ARITH PCA not connected properly or CPU-MPP cable not connected.
102003	a. Floating point PCA, ALU PCA, or cables defective.
102004	a. Floating point PCA, ALU PCA, or cables defective.
XXXXXX	a. If the display register does not indicate any of the above halts, either the floating point ROMs are not present, ROMs are defective, or the computer is defective.

Operation

To verify operation of the CPU and all Base Set instructions, and HFPP, refer to the Diagnostic Configurator Reference Manual (part no. 02100-90157), Table A-1 or A-2, and run the appropriate instruction group diagnostic.

Description	Manual	Absolute Binary No.
Memory Reference Installation Group	02100-90218	24315-16001
Alter Skip Instruction Group	02100-90211	24316-16001
Shift Rotate Instruction Group	02100-90212	24317-16001
EAU Instruction Group	02100-90214	24319-16001
I/O Instruction Group/I/O Extender	02100-90213	24318-16001
Extended Instruction Group (Index)	12943-90004	12943-16002
Extended Instruction Group (Word, Byte, Bit)	12943-90004	12943-16001
F-Series FPP/SIS/FFP	12740-90004	12740-16001

Chapter 14
E-Series RTE-6/VM OS/VMA/EMA ROMs

Introduction

This chapter provides installation and reference information for the HP RTE-6/VM Operating System/Extended Memory Area/Virtual Memory Area (OS/VMA/EMA) Firmware for the HP 1000 E-Series. See Chapter 15 for similar information for an HP 1000 F-Series. Additional information is provided in the manuals listed in the Preface.

Description

The HP RTE-6/VM OS/VMA/EMA firmware consists of six 4K ROMs that are installed on the FEM board. The six ROMs are divided into two groups, a set of three 4K ROMs for the RTE-6/VM Operating System firmware allocated to control memory modules 44 and 45, and a set of three 4K ROMs for the RTE-6/VM VMA/EMA firmware allocated to control memory modules 36 and 37 as follows:

Description	HP Part No.	Control Memory Module No.
4K ROM IC (bits 7-0)	92084-80007	44, 45
4K ROM IC (bits 15-8)	92084-80008	44, 45
4K ROM IC (bits 23-16)	92084-80009	44, 45
4K ROM IC (bits 7-0)	92084-80004	36, 37
4K ROM IC (bits 15-8)	92084-80005	36, 37
4K ROM IC (bits 23-16)	92084-80006	36, 37

Installation

The six RTE-6/VM OS/VMA/EMA ROMs can be installed on the HP 13304A Firmware Accessory Board (FAB) or the HP 12791A Firmware Expansion Module (FEM). If a FEM with an unused block of sockets is available, it may be desirable to install the ROMs on the FEM to facilitate future access to the ROMs.

NOTE

The RTE-IV EMA firmware is allocated to the same Control Store modules as the RTE-6/VM VMA/EMA firmware. Therefore, RTE-6/VM VMA/EMA and RTE-IV EMA firmware must not both be installed in the same computer.

Firmware Accessory Board

a. Install the six ROM ICs in the following locations on the FAB (see Figure 1-2):

Location	ROM IC	Bits	Module No.
D1 (XU101)	92084-80007	7-0	44, 45
D2 (XU102)	92084-80008	15-8	44, 45
D3 (XU103)	92084-80009	23-16	44, 45
C1 (XU201)	92084-80004	7-0	36, 37
C2 (XU202)	92084-80005	15-8	36, 37
C3 (XU203)	92084-80006	23-16	36, 37

NOTE

If DS/1000 ROMs 91740-80064, 91740-80065, and 91740-80066 are located on the FAB board, they must be located in sockets C4, C5, and C6, respectively.

c. Set jumpers on FAB as follows:

Jumper	Setting
10C	1
11C	0
12C	0
10D	1
11D	1
12D	0
13	1

d. Refer to Chapter 1 for the FAB installation procedure.

e. Perform verification as described later in this chapter.

Firmware Expansion Module

a. Refer to Chapter 2 of this manual for the FEM removal and installation procedure.

b. Install the six ROM ICs in any available set of sockets and configure the switches as shown in Table 2-1 for Control Memory modules 36, 37, 44, and 45.

c. Refer to Chapter 2 for the FEM installation procedure.

d. Perform verification as described below.

Verification

After reinstalling the computer in your system, verify correct RTE-6/VM OS/VMA/EMA Firmware installation by running the two RTE-6/VM Firmware Self-Tests. Both Self-Tests check for correct IC orientation and firmware addressing - one checks the RTE-6/VM OS firmware and the other checks the RTE-6/VM VMA/EMA firmware. To execute the RTE-6/VM OS Firmware Self-Test proceed as follows:

a. Store 105355B in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-Register. The contents of the x-Register will indicate the revision of the installed firmware. Any other value displayed in the S-Register indicates the RTE-6/VM OS Firmware Self-Test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

To execute the RTE-6/VM VMA/EMA Firmware Self-Test proceed as follows:

a. Store 105242B in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-Register. The contents of the x-Register will indicate the current revision of the installed firmware. Any other value displayed in the S-Register indicates the RTE-6/VM VMA/EMA Firmware Self-Test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

Chapter 15
F-Series RTE-6/VM OS/VMA/EMA ROMs

Introduction

This chapter provides installation and reference information for the HP RTE-6/VM Operating System/Extended Memory Area/Virtual Memory Area (OS/VMA/EMA) Firmware for the HP 1000 F-Series. See Chapter 14 for similar information for an HP 1000 E-Series. Additional information is provided in the manuals listed in the Preface.

Description

The HP RTE-6/VM OS/VMA/EMA firmware consists of six 4K ROMs that are installed on the FEM board. The six ROMs are divided into two groups, a set of three 4K ROMs for the RTE-6/VM Operating System firmware allocated to control memory modules 16 and 17, and a set of three 4K ROMs for the RTE-6/VM VMA/EMA firmware allocated to control memory modules 36 and 37 as follows:

Description	HP Part No.	Control Memory Module No.
4K ROM IC (bits 7-0)	92084-80007	16, 17
4K ROM IC (bits 15-8)	92084-80008	16, 17
4K ROM IC (bits 23-16)	92084-80009	16, 17
4K ROM IC (bits 7-0)	92084-80004	36, 37
4K ROM IC (bits 15-8)	92084-80005	36, 37
4K ROM IC (bits 23-16)	92084-80006	36, 37

Installation

The RTE-6/VM OS/VMA/EMA ROMs are installed on the 12791A Firmware Expansion Module (FEM). To install or remove the six RTE-6/VM ROMs, proceed as follows.

a. Refer to Chapter 2 of this manual for the FEM removal and installation procedure.

b. Install the six ROM ICs in any available set of sockets and configure the switches as shown in Table 2-1 for Control Memory modules 36, 37, 16, and 17.

c. Refer to Chapter 2 for the FEM installation procedure.

d. Perform verification as described below.

NOTE

The RTE-IV EMA firmware is allocated to the same Control Store modules as the RTE-6/VM VMA/EMA firmware. Therefore, the RTE-6/VM VMA/EMA and the RTE-IV firmware must not both be installed in the same computer.

Verification

After reinstalling the computer in your system, verify correct RTE-6/VM OS/VMA/EMA Firmware installation by running the two RTE-6/VM Firmware Self-Tests. Both Self-Tests check for correct IC orientation and firmware addressing - one checks the RTE-6/VM OS firmware and the other checks the RTE-6/VM VMA/EMA firmware. To execute the RTE-6/VM OS Firmware Self-Test proceed as follows:

a. Store 1053355B in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-Register. The contents of the x-Register will indicate the revision of the installed firmware. Any other value displayed in the S-Register indicates the RTE-6/VM OS firmware self-test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

To execute the RTE-6/VM VMA/EMA Firmware Self-Test proceed as follows:

a. Store 105242B in the A-Register.

b. Store 0 in the P-Register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-Register. The contents of the x-Register will indicate the current revision of the installed firmware. Any other value displayed in the S-Register indicates the RTE-6/VM VMA/EMA Firmware Self-Test failed. Refer to the Service Information paragraph of the FEM section of this manual (Chapter 2) for troubleshooting procedure.

Appendix A
HP 12823F Upgrade Kit

Description

The HP 12823F F-Series Enhancement Upgrade Kit allows the customer to upgrade a F-Series Computer (2111F or 2117F) which was shipped with a serial prefix less than 1920 with the enhanced Base Set, enhanced FFP, and enhanced SIS ROMs. The 12823F product consists of the eighteen read-only-memory (ROM) integrated circuits (ICs) which are listed under the designation "New part No." below.

Base Instruction Set

Description	New Part No.	Location
8K ROM IC (bits 7-0)	02117-80016	A1U23
8K ROM IC (bits 15-8)	02117-80017	A1U43
8K ROM IC (bits 23-16)	02117-80018	A1U83
	VACANT	A1U21
	VACANT	A1U41
	VACANT	A1U81

Fast FORTRAN Processor (FFP)

Description	New Part No.
8K ROM IC (bits 7-0)	12823-80019
8K ROM IC (bits 15-8)	12823-80020
8K ROM IC (bits 23-16)	12823-80021

Scientific Instruction Set (SIS)

Description	New Part No.
8K ROM IC (bits 7-0)	5180-0141
8K ROM IC (bits 15-8)	5180-0142
8K ROM IC (bits 23-16)	5180-0143

Installation

a. For installation of the Base Instruction Set, refer to Chapter 13 of this manual.

b. For installation of the Scientific Instruction Set ROMs, refer to Chapter 8 of this manual.

c. For installation of the Fast FORTRAN Processor ROMs, refer to Chapter 7 of this manual.

d. Perform the appropriate self-test and diagnostic to verify installation and functional operation of the firmware.

SALES & SUPPORT OFFICES
Arranged alphabetically by country

Product Line Sales/Support Key

Key Product Line
A Analytical
CM Components
C Computer Systems
E Electronic Instruments & Measurement Systems
M Medical Products
P Personal Computation Products
*** Sales only for specific product line**
**** Support only for specific product line**

IMPORTANT:These symbols designate general product line capability.They do not insure sales or support availability for all products within a line, at all locations.Contact your local sales office for information regarding locations where HP support is available for specific products.

HEADQUARTERS OFFICES

If there is no sales office listed for your area, contact one of these headquarters offices.

NORTH/CENTRAL AFRICA

Hewlett-Packard S.A.
7, rue du Bois-du-Lan
CH-1217 **MEYRIN** 1, Switzerland
Tel: (022) 83 12 12
Telex: 27835 hmea
Cable: HEWPACKSA Geneve

ASIA

Hewlett-Packard Asia Ltd.
47/F, 26 Harbour Rd.,
Wanchai, **HONG KONG**
G.P.O. Box 863, Hong Kong
Tel: 5-8330833
Telex: 76793 HPA HX
Cable: HPASIAL TD

CANADA

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 069-8644

EASTERN EUROPE

Hewlett-Packard Ges.m.b.h.
Lieblgasse 1
P.O.Box 72
A-1222 **VIENNA,** Austria
Tel: (222) 2500-0
Telex: 1 3 4425 HEPA A

NORTHERN EUROPE

Hewlett-Packard S.A.
V. D. Hooplaan 241
P.O.Box 999
NL-1183 AG **AMSTELVEEN**
The Netherlands
Tel: 20 547999
Telex: 18 919 hpner

SOUTH EAST EUROPE

Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis Casai
1215 Cointrin, **GENEVA,** Switzerland
Tel: (022) 98 96 51
Telex: 27225 hpser

MEDITERRANEAN AND MIDDLE EAST

Hewlett-Packard S.A.
Mediterranean and Middle East Operations
Atrina Centre
32 Kifissias Ave.
Paradissos-Amarousion, **ATHENS**
Greece
Tel: 682 88 11
Telex: 21-6588 HPAT GR
Cable: HEWPACKSA Athens

UNITED KINGDOM

Hewlett-Packard Ltd.
Nine Mile Ride
Easthampstead, **WOKINGHAM**
Berkshire, IRGll 3LL
Tel: 0344 773100
Telex: 848805

EASTERN USA

Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370

MIDWESTERN USA

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800

SOUTHERN USA

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

WESTERN USA

Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600

OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
Tel: (415) 857-1501
Telex: 034-8300
Cable: HEWPACK

ALGERIA

Bureau de Liaison
Hewlett-Packard Alger
Villa des Lions
9, Hai Galloul
DZ-BORDJ EL BAHRI
Tel: 76 03 36
Telex: 51260 dliondz

ANGOLA

Telectra Angola LDA
Empresa Técnica de Equipamentos
Rua Barbosa Rodrigues, 41-1 DT.
Caixa Postal 6487
LUANDA
Tel: 35515,35516
Telex: 3134
E,P

ARGENTINA

Hewlett-Packard Argentina S.A.
Montaneses 2140/50
1428 **BUENOS AIRES**
Tel: 781-4059/69
Cable: HEWPACKARG
A,C,E,P

Biotron S.A.C.I.M.e.I.
Av. Paso Colon 221, Piso 9
1399 **BUENOS AIRES**
Tel: 541-333-490,
541-322-587
Telex: 17595 BIONAR
M

Laboratorio Rodriguez
Corswant S.R.L.
Misiones, 1156 - 1876
Bernal, Oeste
BUENOS AIRES
Tel: 252-3958, 252-4991
A

Argentina Esanco S.R.L.
A/ASCO 2328
1416 **BUENOS AIRES**
Tel: 541-58-1981, 541-59-2767
Telex: c/o 9400 HPARGENTINA
A

AUSTRALIA

Adelaide, South Australia Office

Hewlett-Packard Australia Ltd.
153 Greenhill Road
PARKSIDE, S.A. 5063
Tel: 272-5911
Telex: 82536
Cable: HEWPARD Adelaide
A*,C,CM,E,P

Brisbane, Queensland Office

Hewlett-Packard Australia Ltd.
10 Payne Road
THE GAP, Queensland 4061
Tel: 30-4133
Telex: 42133
Cable: HEWPARD Brisbane
A,C,CM,E,M,P

Canberra, Australia Capital Territory Office

Hewlett-Packard Australia Ltd.
Thynne Street, Fern Hill Park
BRUCE, A.C.T. 2617
P.O. Box 257,
JAMISON, A.C.T. 2614
Tel: 51 6999
Telex: 62650
Cable: HEWPARD Canberra
C,CM,E,P

Melbourne, Victoria Office

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
P.O. Box 221
BLACKBURN, Victoria 3130
Tel: 895-2895
Telex: 31-024
Cable: HEWPARD Melbourne
A,C,CM,E,M,P

Perth, Western Australia Office

Hewlett-Packard Australia Ltd.
261 Stirling Highway
CLAREMONT, W.A. 6010
Tel: 383-2188
Telex: 93859
Cable: HEWPARD Perth
C,CM,E,P

Sydney, New South Wales Office

Hewlett-Packard Australia Ltd.
17-23 Talavera Road
P.O. Box 308
NORTH RYDE, N.S.W. 2113
Tel: 888-4444
Telex: 21561
Cable: HEWPARD Sydney
A,C,CM,E,M,P

AUSTRIA

Hewlett-Packard Ges.m.b.h.
Verkaufsbuero Graz
Grottenhofstrasse 94
A-8052 **GRAZ**
Tel: (0316) 28-30-66
Telex: 312375
C,E

Hewlett-Packard Ges.m.b.h.
Lieblgasse 1
P.O. Box 72
A-1222 **VIENNA**
Tel: (0222) 2500-0
Telex: 134425 HEPA A
A,C,CM,E,M,P

BAHRAIN

Green Salon
P.O. Box 557
MANAMA
Tel: 255503-250950
Telex: 84419
P

Wael Pharmacy
P.O. Box 648
MANAMA
Tel: 256123
Telex: 8550 WAEL BN
E,M

SALES & SUPPORT OFFICES

Arranged alphabetically by country

BAHRAIN (Cont'd)
Zayani Computer Systems
218 Shaik Mubarak Building
Government Avenue
P.O. Box 5918
MANAMA
Tel: 276278
Telex: 9015 plans bn
P

BELGIUM
Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
Tel: (02) 762-32-00
Telex: 23-494 paloben bru
A,C,CM,E,M,P

BERMUDA
Applied Computer Technologies
Atlantic House Building
Par-La-Ville Road
HAMILTON 5
Tel: 295-1816
Telex: 380 3589/ACT BA
P

BOLIVIA
Arrellano Ltda
Av. 20 de Octubre #2125
Casilla 1383
LA PAZ
Tel: 368541
M

BRAZIL
Hewlett-Packard do Brasil
I.e.C. Ltda.
Alameda Rio Negro, 750
ALPHAVILLE
06400 Barueri SP
Tel: (011) 421.1311
Telex: (011) 33872 HPBR-BR
Cable: HEWPACK Sao Paulo
A,C,CM,E,M,P
Hewlett-Packard do Brasil
I.e.C. Ltda.
Praia de Botafago 228
6° Andar-conj 614
Edificio Argentina - Ala A
22250 **RIO DE JANEIRO,** RJ
Tel: (02l) 552-6422
Telex: 21905 HPBR-BR
Cable: HEWPACK Rio de Janeiro
A,C,CM,E,P*
Convex/Van Den
Rua Jose Bonifacio
458 Todos Os Santos
CEP 20771
RIO DE JANEIRO, RJ
Tel: 591-0197
Telex: 33487 EGLB BR
A
ANAMED I.C.E.I. Ltda.
Rua Bage, 103
04012 **SAO PAULO,** SP
Tel: (011) 572-6537
Telex: 24720 HPBR-BR
M
Datatronix Electronica Ltda.
Av. Pacaembu 746-C11
SAO PAULO, SP
Tel: (118) 260111
CM

BRUNEI
Komputer Wisman Sdn Bhd
Room 1
3rd Floor, Tumasek Plaza
Jalan Tutong
BANDAR SERI BEGAWAN
Tel: 23918,25603
C,E,P

CAMEROON
Beriac
B. P. 23
DOUALA
Tel: 420153
Telex: 5351
C,P

CANADA

Alberta
Hewlett-Packard (Canada) Ltd.
3030 3rd Avenue N.E.
CALGARY, Alberta T2A 6T7
Tel: (403) 235-3100
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
11120-178th Street
EDMONTON, Alberta T5S 1P2
Tel: (403) 486-6666
A,C,CM,E,M,P

British Columbia
Hewlett-Packard (Canada) Ltd.
10691 Shellbridge Way
RICHMOND,
British Columbia V6X 2W8
Tel: (604) 270-2277
Telex: 610-922-5059
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
121 - 3350 Douglas Street
VICTORIA, British Columbia V8Z 3L1
Tel: (604) 381-6616
C

Manitoba
Hewlett-Packard (Canada) Ltd.
1825 Inkster Blvd.
WINNIPEG, Manitoba R2X 1R3
Tel: (204) 694-2777
A,C,CM,E,M,P*

New Brunswick
Hewlett-Packard (Canada) Ltd.
814 Main Street
MONCTON, New Brunswick E1C 1E6
Tel: (506) 855-2841
C

Nova Scotia
Hewlett-Packard (Canada) Ltd.
Suite 111
900 Windmill Road
DARTMOUTH, Nova Scotia B3B 1P7
Tel: (902) 469-7820
C,CM,E*,M,P*

Ontario
Hewlett-Packard (Canada) Ltd.
3325 N. Service Rd., Unit W03
BURLINGTON, Ontario L7N 3G2
Tel: (416) 335-8644
C,M*
Hewlett-Packard (Canada) Ltd.
496 Days Road
KINGSTON, Ontario K7M 5R4
Tel: (613) 384-2088
C
Hewlett-Packard (Canada) Ltd.
552 Newbold Street
LONDON, Ontario N6E 2S5
Tel: (519) 686-9181
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 069-8644
A,C,CM,E,M,P
Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA, Ontario K2B 8K1
Tel: (613) 820-6483
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
The Oaks Plaza, Unit #9
2140 Regent Street
SUDBURY, Ontario, P3E 5S8
Tel: (705) 522-0202
C
Hewlett-Packard (Canada) Ltd.
3790 Victoria Park Ave.
WILLOWDALE, Ontario M2H 3H7
Tel: (416) 499-2550
C,E

Quebec
Hewlett-Packard (Canada) Ltd.
17500 Trans Canada Highway
South Service Road
KIRKLAND, Quebec H9J 2X8
Tel: (514) 697-4232
Telex: 058-21521
A,C,CM,E,M,P*
Hewlett-Packard (Canada) Ltd.
1150 rue Claire Fontaine
QUEBEC CITY, Quebec G1R 5G4
Tel: (418) 648-0726
C
Hewlett-Packard (Canada) Ltd.
130 Robin Crescent
SASKATOON, Saskatchewan S7L 6M7
Tel: (306) 242-3702
C

CHILE
ASC Ltda.
Austria 2041
SANTIAGO
Tel: 223-5946, 223-6148
Telex: 340192 ASC CK
C,P
Jorge Calcagni y Cia
Av. Italia 634 Santiago
Casilla 16475
SANTIAGO 9
Tel: 222-0222
Telex: 440283 JCYCL CZ
CM,E,M
Metrolab S.A.
Monjitas 454 of. 206
SANTIAGO
Tel: 395752, 398296
Telex: 340866 METLAB CK
A
Olympia (Chile) Ltda.
Av. Rodrigo de Araya 1045
Casilla 256-V
SANTIAGO 21
Tel: 225-5044
Telex: 340892 OLYMP
Cable: Olympiachile Santiagochile
C,P

CHINA, People's Republic of
China Hewlett-Packard Co., Ltd.
47/F China Resources Bldg.
26 Harbour Road
HONG KONG
Tel: 5-8330833
Telex: 76793 HPA HX
Cable: HP ASIA LTD
A*,M*
China Hewlett-Packard Co., Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory Main Bldg.
Shuang Yu Shou, Bei San Huan Road
Hai Dian District
BEIJING
Tel: 28-0567
Telex: 22601 CTSHP CN
Cable: 1920 Beijing
A,C,CM,E,M,P
China Hewlett-Packard Co., Ltd.
CHP Shanghai Branch
23/F Shanghai Union Building
100 Yan An dong Lu
SHANG-HAI
Tel: 265550
Telex: 33571 CHPSB CN
Cable: 3416 Shanghai
A,C,CM,E,M,P

COLOMBIA
Instrumentación
H. A. Langebaek & Kier S.A.
Carrerra 4A No. 52A-26
Apartado Aereo 6287
BOGOTA 1, D.E.
Tel: 212-1466
Telex: 44400 INST CO
Cable: AARIS Bogota
CM,E,M
Nefromedicas Ltda.
Calle 123 No. 9B-31
Apartado Aereo 100-958
BOGOTA D.E., 10
Tel: 213-5267, 213-1615
Telex: 43415 HEGAS CO
A
Compumundo
Avenida 15 # 107-80
BOGOTA D.E.
Tel: 214-4458
Telex: 45466 SUMA CO
P
Carvajal, S.A.
Calle 29 Norte No. 6A-40
Apartado Aereo 46
CALI
Tel: 368-1111
Telex: 55650
C,E,P

CONGO
Seric-Congo
B. P. 2105
BRAZZAVILLE
Tel: 815034
Telex: 5262

COSTA RICA
Cientifica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
SAN JOSÉ
Tel: 24-38-20, 24-08-19
Telex: 2367 GALGUR CR
CM,E,M

O. Fischel R. Y. Cia. S.A.
Apartados 434-10174
SAN JOSE
Tel: 23-72-44
Telex: 2379
Cable: OFIR
A

CYPRUS
Telerexa Ltd.
P.O. Box 1152
7 A Afroditis Avenue
NICOSIA
Tel: 45 628, 62 698
Telex: 2894 LEVIDO CY
E,M,P

DENMARK
Hewlett-Packard A/S
Kongevejen 25
DK-3460 **BIRKEROED**
Tel: (02) 81-66-40
Telex: 37409 hpas dk
A,C,CM,E,M,P

Hewlett-Packard A/S
Rolighedsvej 32
DK-8240 **RISSKOV,** Aarhus
Tel: (06) 17-60-00
Telex: 37409 hpas dk
C,E

DOMINICAN REPUBLIC
Microprog S.A.
Juan Tomás Mejía y Cotes No. 60
Arroyo Hondo
SANTO DOMINGO
Tel: 565-6268
Telex: 4510 ARENTA DR (RCA)
P

ECUADOR
CYEDE Cia. Ltda.
Avenida Eloy Alfaro 1749
y Belgica
Casilla 6423 CCI
QUITO
Tel: 245-0975, 243-052
Telex: 22548 CYEDE ED
E,P

Medtronics
Valladolid 524 Madrid
P.O. 9171, **QUITO**
Tel: 2-238-951
Telex: 2298 ECUAME ED
A

Hospitalar S.A.
Robles 625
Casilla 3590
QUITO
Tel: 545-250, 545-122
Telex: 2485 HOSPTL ED
Cable: HOSPITALAR-Quito
M

Ecuador Overseas Agencies C.A.
Calle 9 de Octubre #818
P.O. Box 1296, Guayaquil
QUITO
Tel: 306022
Telex: 3361 PBCGYE ED
M

EGYPT
Sakrco Enterprises
P.O. Box 259
ALEXANDRIA
Tel: 802908, 808020, 805302
Telex: 54333
C

International Engineering Associates
24 Hussein Hegazi Street
Kasr-el-Aini
CAIRO
Tel: 23829, 21641
Telex: 93830 IEA UN
Cable: INTEGASSO
E

Sakrco Enterprises
70 Mossadak Street
Dokki, Giza
CAIRO
Tel: 706 440, 701 087
Telex: 9337
C

S.S.C. Medical
40 Gezerat El Arab Street
Mohandessin
CAIRO
Tel: 803844, 805998, 810263
Telex: 20503 SSC UN
M*

EL SALVADOR
IPESA de El Salvador S.A.
29 Avenida Norte 1223
SAN SALVADOR
Tel: 26-6858, 26-6868
Telex: 301 20539 IPESA SAL
A,C,CM,E,P

ETHIOPIA
Seric-Ethiopia
P.O. Box 2764
ADDIS ABABA
Tel: 185114
Telex: 21150
C,P

FINLAND
Hewlett-Packard Oy
Piispankalliontie 17
02200 **ESPOO**
Tel: 00358-0-88721
Telex: 121563 HEWPA SF
C,CM,P

FRANCE
Hewlett-Packard France
Z.I. Mercure B
Rue Berthelot
13763 Les Milles Cedex
AIX-EN-PROVENCE
Tel: (42) 59-41-02
Telex: 410770F
A,C,E,M

Hewlett-Packard France
64, Rue Marchand Saillant
61000 **ALENCON**
Tel: (33) 29 04 42
C**

Hewlett-Packard France
Batiment Levitan
2585, route de Grasse
Bretelle Autoroute
06600 **ANTIBES**
Tel: (93) 74-59-19
C

Hewlett-Packard France
28 Rue de la République
Boite Postale 503
25026 **BESANÇON**
Tel: (81) 83-16-22
Telex: 361157
C,E*

Hewlett-Packard France
13 Place Napoléan III
29000 **BREST**
Tel: (98) 41-87-90
E

Hewlett-Packard France
Chemin des Mouilles
Boite Postale 162
69131 **ECULLY** Cedex (Lyon)
Tel: (78) 133-81-25
Telex: 310617F
A,C,E,M,P*

Hewlett-Packard France
Parc d'activités du Bois Briard
Avenue du Lac
91040 **EVRY** Cedex
Tel: (60) 77-83-83
Telex: 692315F
C

Hewlett-Packard France
5, avenue Raymond Chanas
38320 **EYBENS** (Grenoble)
Tel: (76) 62-57-98
Telex: 980124 HP GRENOB EYBE
C

Hewlett-Packard France
Rue Fernand. Forest
Z.A. Kergaradec
29239 **GOUESNOU**
Tel: (98) 41-87-90

Hewlett-Packard France
Parc Club des Tanneries
Batiment B4
4, Rue de la Faisanderie
67380 **LINCOLSHEIM**
(Strasbourg)
Tel: (88) 76-15-00
Telex: 890141F
C,E*,M*,P*

Hewlett-Packard France
Centre d'affaires Paris-Nord
Bâtiment Ampère
Rue de la Commune de Paris
Boite Postale 300
93153 **LE BLANC-MESNIL**
Tel: (1) 865-44-52
Telex: 211032F
C,E,M

Hewlett-Packard France
Parc d'activités Cadéra
Quartier Jean-Mermoz
Avenue du Président JF Kennedy
33700 **MÉRIGNAC** (Bordeaux)
Tel: (56) 34-00-84
Telex: 550105F
C,E,M

Hewlett-Packard France
3, Rue Graham Bell
BP 5149
57074 **METZ** Cedex
Tel: (87) 36-13-31
Telex: 860602F
C,E

Hewlett-Packard France
Miniparc-ZIRST
Chemin du Vieux Chêne
38240 **MEYLAN** (Grenoble)
Tel: (76) 90-38-40
C

Hewlett-Packard France
Bat.A l'Erable
Bureau vert du Bois Briand
44085 **NANTES** Cedex
Tel: (40) 50-32-22
Telex: 711085F
A,C,E,CM*,P

Hewlett-Packard France
125, Rue du Faubourg Bannier
45000 **ORLÉANS**
Tel: (38) 62-20-31
E,P*

Hewlett-Packard France
Zone Industrielle de Courtaboeuf
Avenue des Tropiques
91947 **LES ULIS** Cedex (Orsay)
Tel: (69) 07-78-25
Telex: 600048F
A,C,CM,E,M,P**

Hewlett-Packard France
15, Avenue de L'Amiral-Bruix
75782 **PARIS** Cedex 16
Tel: (1) 45-02-75-00
Telex: 613663F
C,P*

Hewlett-Packard France
124, Boulevard Tourasse
64000 **PAU**
Tel: (59) 80-38-02
Telex: 550365F
C,E*

Hewlett-Packard France
6, Place Sainte Croix
86000 **POITIERS**
Tel: (49) 41-27-07
Telex: 792335F
C, E*

SALES & SUPPORT OFFICES

Arranged alphabetically by country

FRANCE (Cont'd)

Hewlett-Packard France
47, Rue de Chativesle
51100 **REIMS**
Tel: (26) 88-69-79
C, P*

Hewlett-Packard France
Parc d'activités de la Poterie
Rue Louis Kerautel-Botmel
35000 **RENNES**
Tel: (99) 51-42-44
Telex: 740912F
A*,C,E,M,P*

Hewlett-Packard France
98 Avenue de Bretagne
76100 **ROUEN**
Tel: (35) 63-57-66
Telex: 770035F
C,E

Hewlett-Packard France
4, Rue Thomas-Mann
Boite Postale 56
67033 **STRASBOURG** Cedex
Tel: (88) 28-56-46
Telex: 890141F
C,E,M,P*

Hewlett-Packard France
Le Péripole
3, Chemin du Pigeonnier de la Cépière
3108 **TOULOUSE** Cedex
Tel: (61) 40-11-12
Telex: 531639F
A,C,E,M,P*

Hewlett-Packard France
Les Cardoulines
Batiment B2
Route des Dolines
Parc d'activite de Valbonne
Sophia Antipolis
06560 **VALBONNE** (Nice)
Tel: (93) 65-39-40
C

Hewlett-Packard France
9, Rue Baudin
26000 **VALENCE**
Tel: (75) 42-76-16
C**

Hewlett-Packard France
Carolor
ZAC de Bois Briand
57640 **VIGY** (Metz)
Tel: (8) 771 20 22
C

Hewlett-Packard France
Parc d'activité des Prés
1, Rue Papin
59658 **VILLENEUVE D'ASCQ** Cedex
Tel: (20) 47 78 78
Telex: 160124F
C,E,M,P

Hewlett-Packard France
Parc d'activités Paris-Nord 11
45, Rue des 3 Soeurs
93420 **VILLEPINTE**
Tel: (1) 48 63 80 80
Telex: 211032F
C,E,M,P*

GABON

Sho Gabon
P.O. Box 89
LIBREVILLE
Tel: 721 484
Telex: 5230

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebszentrum Mitte
Hewlett-Packard-Strasse
D-6380 **BAD HOMBURG**
Tel: (06172) 400-0
Telex: 410 844 hpbhg
A,C,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 **BERLIN** 30
Tel: (030) 21 99 04-0
Telex: 018 3405 hpbln d
A,C,E,M,P

Hewlett-Packard GmbH
Vertriebszentrun Südwest
Schickardstrasse 2
D-7030 **BÖBLINGEN**
Tel: (07031) 645-0
Telex: 7265 743 hep
A,C,CM,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND**-41
Tel: (0231) 45001
Telex: 822858 hepdad
A,C,E

Hewlett-Packard GmbH
Vertriebszentrum Nord
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
A,C,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (0511) 5706-0
Telex: 092 3259
A,C,CM,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: (0621) 70 05-0
Telex: 0462105
A,C,E

Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
Tel: (0731) 70 73-0
Telex: 0712816 HP ULM-D
A,C,E*

Hewlett-Packard GmbH
Geschäftsstelle
Emmericher Strasse 13
D-8500 **NÜRNBERG** 10
Tel: (0911) 5205-0
Telex: 0623 860 hpnbg
C,CM,E,M,P

Hewlett-Packard GmbH
Vertriebszentrum West
Berliner Strasse 111
D-4030 **RATINGEN** 3
Tel: (02102) 494-0
Telex: 589 070 hprad
A,C,E,M,P

Hewlett-Packard GmbH
Vertriebszentrum Süd
Eschenstrasse 5
D-8028 **TAUFKIRCHEN**
Tel: (089) 61 20 7-0
Telex: 0524985
A,C,CM,E,M,P

Hewlett-Packard GmbH
Geschäftsstelle
Ermlisallee
7517 **WALDBRONN** 2
Tel: (07243) 602-0
Telex: 782 838 hepk
A,C,E

GREAT BRITAIN

See United Kingdom

GREECE

Hewlett-Packard A.E.
178, Kifissias Avenue
6th Floor
Halandri-**ATHENS**
Greece
Tel: 6471543, 6471673, 6472971
Telex: 221 286 HPHLGR
A,C,CM**,E,M,P

Kostas Karaynnis S.A.
8, Omirou Street
ATHENS 133
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A,C*,CM,E

Impexin
Intelect Div.
209 Mesogion
11525 **ATHENS**
Tel: 6474481/2
Telex: 216286
P

Haril Company
38, Mihalakopoulou
ATHENS 612
Tel: 7236071
Telex: 218767
M*

Hellamco
P.O. Box 87528
18507 **PIRAEUS**
Tel: 4827049
Telex: 241441
A

GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 317853,66471/5
Telex: 3055765 IPESA GU
A,C,CM,E,M,P

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG
E,C,P

CET Ltd.
10th Floor, Hua Asia Bldg.
64-66 Gloucester Road
HONG KONG
Tel: (5) 200922
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
18th Floor, Great Eagle Centre
23 Harbour Road, Wanchai
HONG KONG
Tel: 5-8330222
Telex: 74766 SCHMC HX
A,M

ICELAND

Hewlett-Packard Iceland
Hoefdabakka 9
110 **REYKJAVIK**
Tel: (1) 67 1000
A,C,CM,E,M,P

INDIA

Computer products are sold through Blue Star Ltd.All computer repairs and maintenance service is done through Computer Maintenance Corp.

Blue Star Ltd.
B. D. Patel House
Near Sardar Patel Colony
AHMEDABAD 380 014
Tel: 403531, 403532
Telex: 0121-234
Cable: BLUE FROST
A,C,CM,E

Blue Star Ltd.
40/4 Lavelle Road
BANGALORE 560 001
Tel: 57881, 567780
Telex: 0845-430
Cable: BLUESTAR
A,C*,CM,E

Blue Star Ltd.
Band Box House
Prabhadevi
BOMBAY 400 025
Tel: 4933101, 4933222
Telex: 011-71051
Cable: BLUESTAR
A,M

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
BOMBAY 400 025
Tel: 430-6155, 430-6556
Telex: 011-71193 BSSS IN
Cable: FROSTBLUE
A,CM,E,M

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Alkapuri, **BORODA,** 390 005
Tel: 65235, 65236
Cable: BLUE STAR
A

Blue Star Ltd.
7 Hare Street
CALCUTTA 700 001
Tel: 230131, 230132
Telex: 031-61120 BSNF IN
Cable: BLUESTAR
A,M,C,E

Blue Star Ltd.
133 Kodambakkam High Road
MADRAS 600 034
Tel: 472056, 470238
Telex: 041-379
Cable: BLUESTAR
A,M

Blue Star Ltd.
13 Community Center
New Friends Colony
NEW DELHI 110 065
Tel: 633182, 636674
Telex: 031-61120
Cable: BLUEFROST
A,C*,CM,E,M

Blue Star Ltd.
15/16 C Wellesley Rd.
PUNE 411 011
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057, 72058
Telex: 0155-459
Cable: BLUEFROST
A,C,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthunkuzhi
TRIVANDRUM 695 013
Tel: 65799, 65820
Telex: 0884-259
Cable: BLUESTAR
E

Computer Maintenance Corporation Ltd.
115, Sarojini Devi Road
SECUNDERABAD 500 003
Tel: 310-184, 345-774
Telex: 031-2960
C**

INDONESIA

BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA
P

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 11th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 343989
Telex: 46748 BERSAL IA
A,C,E,M,P

BERCA Indonesia P.T.
Jalan Kutai 24
SURABAYA
Tel: 67118
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A*,E,M,P

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 9B/3/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAIRAQ IK
C

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 608800
Telex: 30439
C,E,P

Cardiac Services Ltd.
128 Dublin Industrial Estate
DUBLIN 11
Tel: (01) 307499
Telex: 32254
M

ISRAEL

Eldan Electronic Instrument Ltd.
P.O.Box 1270
JERUSALEM 91000
16, Ohaliav St.
JERUSALEM 94467
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A,M

Computation and Measurement Systems (CMS) Ltd.
11 Masad Street
67060
TEL-AVIV
Tel: 388 388
Telex: 33569 Motil IL
C,CM,E,P

ITALY

Hewlett-Packard Italiana S.p.A
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
C,M

Hewlett-Packard Italiana S.p.A.
Via Emilia, 51/C
I-40011 **BOLOGNA** Anzola Dell'Emilia
Tel: (051) 731061
Telex: 511630
C,E,M

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
Tel: (095) 37-10-87
Telex: 970291
C

Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
20094 **CORSICO** (Milano)
Tel: (02) 448351

Hewlett-Packard Italiana S.p.A.
Viale Brigata Bisagno 2
16129 **GENOVA**
Tel: (010) 541141

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 **GENOVA PEGLI**
Tel: (010) 68-37-07
Telex: 215238
C,E

Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
I-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: (02) 923691
Telex: 334632
A,C,CM,E,M,P

Hewlett-Packard Italiana S.p.A.
Via Nuova Rivoltana 95
20090 **LIMITO** (Milano)
Tel: (02) 92761

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco a Capodimonte, 62/A
I-80131 **NAPOLI**
Tel: (081) 7413544
Telex: 710698
A**,C,E,M

Hewlett-Packard Italiana S.p.A.
Via Orazio 16
80122 **NAPOLI**
Tel: (081) 7611444

Hewlett-Packard Italiana S.p.A.
Via Pellizzo 15
35128 **PADOVA**
Tel: (049) 8070166
Telex: 430315
A,C,E,M

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 **ROMA EUR**
Tel: (06) 54831
Telex: 610514
A,C,E,M,P*

Hewlett-Packard Italiana S.p.A.
Via di Casellina 57/C
I-50018 **SCANDICCI-FIRENZE**
Tel: (055) 753863
C,E,M

Hewlett-Packard Italiana S.p.A.
Corso Svizzera, 185
I-10144 **TORINO**
Tel: (011) 74 4044
Telex: 221079
A*,C,E

IVORY COAST

S.I.T.E.L.
Societe Ivoirienne de Telecommunications
Bd. Giscard d'Estaing
Carrefour Marcory
Zone 4.A.
Boite postale 2580
ABIDJAN 01
Tel: 353600
Telex: 43175
E

S.I.T.I.
Immeuble "Le General"
Av. du General de Gaulle
01 BP 161
ABIDJAN 01
Tel: 321227
C,P

JAPAN

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (0462) 25-0031
C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Chiba Bldg.
3-1 Hon Chiba-Cho
CHIBA, 280
Tel: (0472) 25 7701
C,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: (082) 241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
C,E

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg.
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Dalichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO, 860
Tel: (0963) 54-7311
C,E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shiokoji-cho
Karasuma-Nishiiru
Shiokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
C,E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
C,CM,E

SALES & SUPPORT OFFICES

Arranged alphabetically by country

JAPAN (Cont'd)

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Kokubun Bldg.
7-8 Kokubun, 1 Chome, Sendai
MIYAGI, 980
Tel: (0222) 25-1011
C,E

Yokogawa-Hewlett-Packard Ltd.
Gohda Bldg. 2F
2-10 Gohda 1 Chome
Okaya-Shi
NAGANO, 394
Tel: (0266) 23 0851
C,E

Yokogawa-Hewlett-Packard Ltd.
Nagoya Kokusai Center Building
47-1, Nagono, 1 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
C,CM,E,M

Yokogawa-Hewlett-Packard Ltd.
Sai-Kyo-Ren Building
1-2 Dote-cho
OHMIYA OHMIYA, Saitama 330
Tel: (0486) 45-8031

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624
C,CM,E,M,P*

Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Motoshiro-cho Dai-ich Seimei Bldg. 1F
219-21 Motoshiro-cho,
Hamamatsu-shi
SHIZUOKA, 430
Tel: (0534) 56 1771
C,E

Yokogawa-Hewlett-Packard Ltd.
Daiichi Seimei Bldg.
7-1, Nishi Shinjuku, 2 Chome
Shinjuku-ku,**TOKYO** 160
Tel: 03-348-4611
C,E,M

Yokogawa Hewlett-Packard Ltd.
9-1, Takakura-cho
Hachioji-shi, **TOKYO,** 192
Tel: 0426-42-1261
C,E

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-6111
Telex: 232-2024 YHPTOK
C,CM,E,P*

Yokogawa Hokushin Electric Corporation
Shinjuku-NS Bldg. 10F
4-1 Nishi-Shinjuku 2-Chome
Shinjuku-ku
TOKYO, 163
Tel: (03) 349-1859
Telex: J27584
A

Yokogawa Hokushin Electric Corp.
9-32 Nokacho 2 Chome
2 Chome Musashino-shi
TOKYO, 180
Tel: (0422) 54-1111
Telex: 02822-421 YEW MTK J
A

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei
Utsunomiya Oodori Building
1-5 Oodori, 2 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 33-1153
C,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
Kanagawa-ku, **YOKOHAMA** 221
Tel: (045) 312-1252
C,CM,E

JORDAN

Scientific and Medical Supplies Co.
P.O. Box 1387
AMMAN
Tel: 24907, 39907
Telex: 21456 SABCO JO
C,E,M,P

KENYA

ADCOM Ltd., Inc., Kenya
P.O.Box 30070
NAIROBI
Tel: 331955
Telex: 22639
E,M

KOREA

Samsung Hewlett-Packard Co. Ltd.
Dongbang Yeoeuldo Building
12-16th Floors
36-1 Yeoeuido-Dong
Youngdeungpo-Ku
SEOUL
Tel: 784-4666, 784-2666
Telex: 25166 SAMSAN K
C,CM,E,M,P

Young In Scientific Co., Ltd.
Youngwha Building
547 Shinsa Dong, Kangnam-Ku
SEOUL 135
Tel: 546-7771
Telex: K23457 GINSCO
A

Dongbang Healthcare Products Co. Ltd.
Suite 301 Medical Supply Center
Bldg. 1-31 Dongsungdong
Jong Ro-gu, **SEOUL**
Tel: 764-1171, 741-1641
Telex: K25706 TKBKO
Cable: TKBEEPKO
M

KUWAIT

Al-Khaldiya Trading & Contracting
P.O. Box 830
SAFAT
Tel: 424910, 411726
Telex: 22481 AREEG KT
Cable: VISCOUNT
E,M,A

Gulf Computing Systems
P.O. Box 25125
SAFAT
Tel: 435969
Telex: 23648
P

Photo & Cine Equipment
P.O. Box 270
SAFAT
Tel: 2445111
Telex: 22247 MATIN KT
Cable: MATIN KUWAIT
P

W.J. Towell Computer Services
P.O. Box 5897
SAFAT
Tel: 2462640/1
Telex: 30336 TOWELL KT
C

LEBANON

Computer Information Systems S.A.L.
Chammas Building
P.O. Box 11-6274 Dora
BEIRUT
Tel: 89 40 73
Telex: 42309
C,E,M,P

LIBERIA

Unichemicals Inc.
P.O. Box 4509
MONROVIA
Tel: 224282
Telex: 4509
E

MADAGASCAR

Technique et Precision
12, rue de Nice
P.O. Box 1227
101 **ANTANANARIVO**
Tel: 22090
Telex: 22255
P

LUXEMBOURG

Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
Tel: (02) 762-32-00
Telex: 23-494 paloben bru
A,C,CM,E,M,P

MALAYSIA

Hewlett-Packard Sales (Malaysia) Sdn. Bhd.
9th Floor
Chung Khiaw Bank Building
46, Jalan Raja Laut
50350 **KUALA LUMPUR**
Tel: 2986555
Telex: 31011 HPSM MA
A,C,E,M,P*

Protel Engineering
P.O.Box 1917
Lot 6624, Section 64
23/4 Pending Road
Kuching, **SARAWAK**
Tel: 36299
Telex: 70904 PROMAL MA
Cable: PROTELENG
A,E,M

MALTA

Philip Toledo Ltd.
Birkirkara P.O. Box 11
Notabile Rd.
MRIEHEL
Tel: 447 47, 455 66, 4915 25
Telex: Media MW 649
E,M,P

MAURITIUS

Blanche Birger Co. Ltd.
18, Jules Koenig Street
PORT LOUIS
Tel: 20828
Telex: 4296
P

MEXICO

Hewlett-Packard de Mexico, S.A. de C.V.
Rio Nio No. 4049 Desp. 12
Fracc. Cordoba
JUAREZ
Tel: 161-3-15-62
P

Hewlett-Packard de Mexico, S.A. de C.V.
Condominio Kadereyta
Circuito del Mezon No. 186 Desp. 6
COL. DEL PRADO - 76030 Qro.
Tel: 463-6-02-71
P

Hewlett-Packard de Mexico, S.A. de C.V.
Monti Morelos No. 299
Fraccionamiento Loma Bonita 45060
GUADALAJARA, Jalisco
Tel: 36-31-48-00
Telex: 0684 186 ECOME
P

Microcomputadoras Hewlett-Packard, S.A.
Monti Pelvoux 115
LOS LOMAS, Mexico, D.F.
Tel: 520-9127
P

Microcomputadoras Hewlett-Packard, S.A. de C.V.
Monte Pelvoux No. 115
Lomas de Chapultepec, 11000
MEXICO, D.F.
Tel: 520-9127
P

Hewlett-Packard de Mexico, S.A. de C.V.
Monte Pelvoux No. 111
Lomas de Chapultepec
11000 **MEXICO, D.F.**
Tel: 5-40-62-28, 72-66, 50-25
Telex: 17-74-507 HEWPACK MEX
A,C,CM,E,M,P

Hewlett-Packard De Mexico (Polanco)
Avenida Ejercito Nacional #579
2da y 3er piso
Colonia Granada 11560
MEXICO D.F.
Tel: 254-4433
P

Hewlett-Packard de Mexico,
S.A. de C.V.
Czda. del Valle
409 Ote. 4th Piso
Colonia del Valle
Municipio de Garza Garcia Nuevo Leon
66220 **MONTERREY,** Nuevo León
Tel: 83-78-42-40
Telex: 382410 HPMY
C

Infograficas y Sistemas del Noreste, S.A.
Rio Orinoco #171 Oriente
Despacho 2001
Colonia Del Valle
MONTERREY
Tel: 559-4415, 575-3837
Telex: 483164
A,E

Hewlett-Packard de Mexico,
S.A. de C.V.
Blvd. Independencia No. 2000 Ote.
Col. Estrella
TORREON, COAH.
Tel: 171-18-21-99
P

MOROCCO

Etablissement Hubert Dolbeau & Fils
81 rue Karatchi
B.P. 11133
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2, rue Agadir
Boite Postale 156
CASABLANCA 01
Tel: 272093, 272095
Telex: 23 739
P

Sema-Maroc
Dept. Seric
6, rue Lapebie
CASABLANCA
Tel: 260980
Telex: 21641
C,P

NETHERLANDS

Hewlett-Packard Nederland B.V.
Startbaan 16
NL-1187 XR **AMSTELVEEN**
P.O. Box 667
NL-1180 AR **AMSTELVEEN**
Tel: (020) 547-6911
Telex: 13 216 HEPA NL
A,C,CM,E,M,P

Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK **CAPELLE A/D IJSSEL**
P.O. Box 41
NL 2900AA **CAPELLE A/D IJSSEL**
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
C,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV **EINDHOVEN**
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: (040) 326911
Telex: 51484 hepae nl
C,E,P

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: 687-159
Cable: HEWPAK Auckland
C,CM,E,P*

Hewlett-Packard (N.Z.) Ltd.
184-190 Willis Street
WELLINGTON
P.O. Box 9443
Courtenay Place, **WELLINGTON 3**
Tel: 877-199
Cable: HEWPACK Wellington
C,CM,E,P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A,M

Northrop Instruments & Systems Ltd.
110 Mandeville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 488-873
Telex: 4203
A,M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Ghuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A,M

NIGERIA

Elmeco Nigeria Ltd.
46, Calcutta Crescent Apapa
P.O. Box 244and
LAGOS
E

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 76621 hpnas n
C,E,M

Hewlett-Packard Norge A/S
Osterndalen 16-18
P.O. Box 34
N-1345 **OEŠTERAAS**
Tel: 0047/2/24 60 90
Telex: 76621 hpnas n
A,C,CM,E,M,P

Hewlett-Packard Norge A/S
Boehmergt. 42
Box 2470
N-5037 **SOLHEIMSVIK**
Tel: 0047/5/29 00 90

OMAN

Khimjil Ramdas
P.O. Box 19
MUSCAT/SULTANATE OF OMAN
Tel: 795 901
Telex: 3489 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT/SULTANATE OF OMAN
Tel: 734 201-3
Telex: 5274 BAHWAN MB
E

Imtac LLC
P.O. Box 9196
MINA AL FAHAL/SULTANATE OF OMAN
Tel: 561 695, 5602078, 561010
Telex: 5298 Tawoos On
A,C,M

PAKISTAN

Mushko & Company Ltd.
House No. 16, Street No. 16
Sector F-6/3
ISLAMABAD
Tel: 824545
Cable: FEMUS Islamabad
A,E,P*

Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
A,E,P*

PANAMA

Electronico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 64-2700
Telex: 3483 ELECTRON PG
CM,E,M,P

PERU

Cía Electro Médica S.A.
Los Flamencos 145
San Isidro
Casilla 1030
LIMA 1
Tel: 41-4325, 41-3705
Telex: Pub. Booth 25306 PEC PISIDR
CM,E,M,P

SAMS S.A.
Arenida Republica de Panama 3534
San Isidro, **LIMA**
Tel: 419928/417108
Telex: 20450 PE LIBERTAD
A,C,P

PHILIPPINES

The Online Advanced Systems Corp.
2nd Floor, Electra House
115-117 Esteban Street
Legaspi Village, Makati
Metro **MANILA**
Tel: 815-38-10 (up to 16)
Telex: 63274 ONLINE PN
A,C,E,M,P

PORTUGAL

Mundinter Intercambio
Mundial de Comércio S.A.R.L.
Av. Antonio Augusto Aguiar 138
Apartado 2761
LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M

Soquimica
Av. da Liberdade, 220-2
1298 **LISBOA** Codex
Tel: 56-21-82
Telex: 13316 SABASA
A

Telectra-Empresa Técnica de
Equipmentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
LISBON 1
Tel: (19) 68-60-72
Telex: 12598
CM,E

C.P.C.S.I.
Rua de Costa Cabral 575
4200 **PORTO**
Tel: 499174/495173
Telex: 26054
C,P

PUERTO RICO

Hewlett-Packard Puerto Rico
101 Muñoz Rivera Av
Esu. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800
A,C,CM,M,E,P

QATAR

Computer Arabia
P.O. Box 2750
DOHA
Tel: 428555
Telex: 4806 CHPARB
P

Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 422170
Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronics Establishment
Hewlett-Packard Division
P.O. Box 281
Thuobah
AL-KHOBAR 31952
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
C,E,M

SALES & SUPPORT OFFICES
Arranged alphabetically by country

SAUDI ARABIA (Cont'd)
Modern Electronics Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 96 28
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
A,C,CM,E,M,P

Modern Electronics Establishment
Hewlett-Packard Division
P.O.Box 22015
RIYADH 11495
Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
C,E,M

Abdul Ghani El Ajou Corp.
P.O. Box 78
RIYADH
Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND
See United Kingdom

SENEGAL
Societe Hussein Ayad & Cie.
76, Avenue Georges Pompidou
B.P. 305
DAKAR
Tel: 32339
Cable: AYAD-Dakar
E

Moneger Distribution S.A.
1, Rue Parent
B.P. 148
DAKAR
Tel: 215 671
Telex: 587
P

Systeme Service Conseil (SSC)
14, Avenue du Parachois
DAKAR ETOILE
Tel: 219976
Telex: 577
C,P

SINGAPORE
Hewlett-Packard Singapore (Sales) Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
Alexandra P.O. Box 58
SINGAPORE, 9115
Tel: 4731788
Telex: 34209 HPSGSO RS
Cable: HEWPACK, Singapore
A,C,E,M,P

Dynamar International Ltd.
Unit 05-11 Block 6
Kolam Ayer Industrial Estate
SINGAPORE 1334
Tel: 747-6188
Telex: 26283 RS
CM

SOUTH AFRICA
Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place **CAPE PROVINCE** 7430
Pine Park Center, Forest Drive
Pinelands
CAPE PROVINCE 7405
Tel: (021) 53 7954
Telex: 57-20006
A,C,CM,E,M,P

Hewlett-Packard So Africa (Pty.) Ltd.
2nd Floor Juniper House
92 Overport Drive
DURBAN 4067
Tel: (031) 28-4178
Telex: 6-22954
C

Hewlett-Packard So Africa (Pty.) Ltd.
6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6001
Tel: 041-301201
Telex: 24-2916
C

Hewlett-Packard So Africa (Pty.) Ltd.
Fountain Center
Kalkoen Str.
Monument Park Ext 2
PRETORIA 0105
Tel: (012) 45 5725
Telex: 32163
C,E

Hewlett-Packard So Africa (Pty.) Ltd.
9 Eastern Service Road
Eastgate Ext. 3
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877 SA
Cable: HEWPACK Johannesburg
A,C,CM,E,M,P

SPAIN
Hewlett-Packard Española, S.A.
Calle Entenza, 321
08029 **BARCELONA**
Tel: 3/322 24 51, 321 73 54
Telex: 52603 hpbee
A,C,E,M,P

Hewlett-Packard Española, S.A.
Calle San Vicente S/N
Edificio Albia II-7B
48001 **BILBAO**
Tel: 4/423 83 06
A,C,E,M

Hewlett-Packard Española, S.A.
Crta. de la Coruña, Km. 16, 400
Las Rozas
E-MADRID
Tel: (1) 637.00.11
Telex: 23515 HPE
C,M

Hewlett-Packard Española, S.A.
Avda. S. Francisco Javier, S/N
Planta 10. Edificio Sevilla 2
41005 **SEVILLA**
Tel: 54/64 44 54
Telex: 72933
A,C,M,P

Hewlett-Packard Española, S.A.
Isabel La Catolica, 8
46004 **VALENCIA**
Tel: (96) 351 59 44
Telex: 63435
C,P

Hewlett-Packard Española, S.A.
Av. de Zugazarte, 8
Edificio El Abra 4
Las Arenas-Guecho
VIZCAYA
Tel: (94) 464 3255, 464 2933
Telex: 33032

SWEDEN
Hewlett-Packard Sverige AB
Östra Tullgatan 3
S-20011 **MALMÖ**
Box 6132
Tel: (040) 70270
Telex: (854) 17886 (via Spånga office)
C,P

Hewlett-Packard Sverige AB
Våstra Vintergatan 9
S-70344 **ÖREBRO**
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga office)
C

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 **SPÅNGA**
Tel: (08) 750-2000
Telex: (854) 17886
Telefax: (08) 7527781
A,C,CM,E,M,P

Hewlett-Packard Sverige AB
Box 266
Topasgatan 1A
S-42123 **VÄSTRA-FRÖLUNDA**
(Gothenburg)
Tel: (031) 89-10-00
Telex: (854) 17886 (via Spånga office)
A,C,CM,E,M,P

SUDAN
Mediterranean Engineering & Trading Co. Ltd.
P.O. Box 1025
KHARTOUM
Tel: 41184
Telex: 24052
C,P

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 **BASEL**
Tel: (61) 33-59-20
A,C,E,P

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case postale 365
CH-1217 **MEYRIN** 1
Tel: (0041) 22-83-11-11
Telex:27333 HPAG CH
A,C,CM,E,M,P

Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 **WIDEN**
Tel: (0041) 57 31 21 11
Telex: 53933 hpag ch
Cable: HPAG CH
A,C,CM,E,M,P

Hewlett-Packard (Schweiz) AG
Schwamendingenstrasse 10
8050 **ZURICH**
Tel: (0041) 1 315 81 81
Telex: 823 537 HPAG CH
C,P

SYRIA
General Electronic Inc.
Nuri Basha Ahnaf Ebn Kays Street
P.O. Box 5781
DAMASCUS
Tel: 33-24-87
Telex: 411 215
Cable: ELECTROBOR DAMASCUS
E

Middle East Electronics
P.O.Box 2308
Abu Rumaneh
DAMASCUS
Tel: 33 45 92
Telex: 411 771
M

TAIWAN
Hewlett-Packard Taiwan Ltd.
THM Office
2, Huan Nan Road
CHUNG LI, Taoyuan
Tel: (034) 929-666
C

Hewlett-Packard Taiwan Ltd.
Kaohsiung Office
11/F, 456, Chung Hsiao 1st Road
KAOHSIUNG
Tel: (07) 2412318
C,E

Hewlett-Packard Taiwan Ltd.
8th Floor, Hewlett-Packard Building
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable:HEWPACK Taipei
A,C,CM,E,M,P

Ing Lih Trading Co.
6th Floor, 112, Sec. 1,
Chung Hsiao East Road
TAIPEI 100
Tel: (02) 394-8191
Telex: 22894 SANKWANG
A

THAILAND
Unimesa Co. Ltd.
30 Patpong Ave., Suriwong
BANGKOK 10500
Tel: 235-5727, 234-0991/3
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok
A,C,E,M

Bangkok Business Equipment Ltd.
5/5-6 Dejo Road
BANGKOK
Tel: 234-8670, 234-8671
Telex: 87699-BEQUIPT TH
Cable: BUSIQUIPT Bangkok
P

TOGO

Societe Africaine De Promotion
B.P. 12271
LOME
Tel: 21-62-88
Telex: 5304
P

TRINIDAD & TOBAGO

Caribbean Telecoms Ltd.
Corner McAllister Street &
Eastern Main Road, Laventille
P.O. Box 732
PORT-OF-SPAIN
Tel: 624-4213
Telex: 22561 CARTEL WG
Cable: CARTEL, PORT OF SPAIN
CM,E,M,P

Computer and Controls Ltd.
P.O. Box 51
66 Independence Square
PORT-OF-SPAIN
Tel: 623-4472
Telex: 3000 POSTLX WG, ACCT
LOOGO AGENCY 1264
A,P

Feral Assoc.
8 Fitzgerald Lane
PORT-OF-SPAIN
Tel: 62-36864, 62-39255
Telex: 22432 FERALCO
Cable: FERALCO
M

TUNISIA

Tunisie Electronique S.A.R.L.
31 Avenue de la Liberte
TUNIS
Tel: 280-144
C,E,P

Tunisie Electronique S.A.R.L.
94, Av. Jugurtha, Mutuelleville
1002 **TUNIS-BELVEDERE**
Tel: 280144
Telex: 13238
C,E,P

Corema S.A.
1 ter. Av. de Carthage
TUNIS
Tel: 253-821
Telex: 12319 CABAM TN
M

TURKEY

E.M.A
Mediha Eldem Sokak No. 41/6
Yenisehir
ANKARA
Tel: 319175
Telex: 42321 KTX TR
Cable: EMATRADE ANKARA
M

Teknim Company Ltd.
Iran Caddesi No. 7
Karaklidere
ANKARA
Tel: 275800
Telex: 42155 TKNM TR
C,E

Kurt & Kurt A.S.
Mithatpasa Caddesi No. 75
Kat 4 Kizilay
ANKARA
Tel: 318875/6/7/8
Telex: 42490 MESR TR
A

Saniva Bilgisayar Sistemleri A.S.
Buyukdere Caddesi 103/6
Gayrettepe
ISTANBUL
Tel: 1673180
Telex: 26345 SANI TR
C,P

Best Inc.
Esentepe, Gazeteciler Sitesi
Keskin Kalem
Sokak 6/3, Gayrettepe
ISTANBUL
Tel: 172 1328, 173 3344
Telex: 42490
A

UNITED ARAB EMIRATES

Emitac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591181
Telex: 68136 EMITAC EM
Cable: EMITAC SHARJAH
E,C,M,P,A

Emitac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 820419-20
Cable: EMITACH ABUDHABI

Emitac Ltd.
P.O. Box 8391
DUBAI,
Tel: 377591

Emitac Ltd.
P.O. Box 473
RAS AL KHAIMAH
Tel: 28133, 21270

UNITED KINGDOM

ENGLAND

Hewlett-Packard Ltd.
Miller House
The Ring, **BRACKNELL**
Berks RG12 1XN
Tel: 0344 424898
Telex: 848733
E

Hewlett-Packard Ltd.
Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
Telex: 8952716
C,E

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton **BRISTOL,** Avon BS8 2BN
Tel: 0272 736806
Telex: 444302
C,E,P

Hewlett-Packard Ltd.
9 Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
C,P

Hewlett-Packard Ltd.
Pontefract Road
NORMANTON, West Yorkshire WF6 1RN
Tel: 0924 895566
Telex: 557355
C,P

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDHILL, Surrey RH1 1PS
Tel: 0737 68655
Telex: 947234
C,E,P

Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, **SOLIHULL,** West Midlands
B90 4BL
Tel: 021 745 8800
Telex: 339105
C,E,P

Hewlett-Packard Ltd.
Heathside Park Road
Cheadle Heath
STOCKPORT
Cheshire
SK3 ORB
Tel: 061-428-0828
Telex: 668068
A,C,E,M,P

Hewlett-Packard Ltd.
Harmon House
No. 1 George Street
UXBRIDGE, Middlesex UX8 1YN
Tel: 895 720 20
Telex: 893134/5
C,CM,E,M,P

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178
A,C,E,M,P

NORTHERN IRELAND

Hewlett-Packard (Ireland) Ltd.
Carrickfergus Industrial Centre
75 Belfast Road, Carrickfergus
CO. ANTRIM BT38 8PM
Tel: 09603 67333
C,E

Cardiac Services Company
95A Finaghy Road South
BELFAST, BT10 OBY
Tel: 0232-625566
Telex: 747626
M

SCOTLAND

Hewlett-Packard Ltd.
1/3 Springburn Place
College Milton North
EAST KILBRIDE, G74 3NU
Tel: 03552-49261
Telex: 779615
C,E

Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682
C,CM,E,M,P

UNITED STATES

Alabama

Hewlett-Packard Co.
2100 Riverchase Center
Building 100 - Suite 118
BIRMINGHAM, AL 35244
Tel: (205) 988-0547
A,C,M,P*

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
Tel: (205) 830-2000
C,CM,E,M*

Alaska

Hewlett-Packard Co.
3601 C St., Suite 1416
ANCHORAGE, AK 99503
Tel: (907) 563-8855
C,E

Arizona

Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
A,C,CM,E,M,P

Hewlett-Packard Co.
3400 East Britannia Dr.
Bldg. C, Suite 124
TUCSON, AZ 85706
Tel: (602) 573-7400
C,E,M**

California

Hewlett-Packard Co.
99 South Hill Dr.
BRISBANE, CA 94005
Tel: (415) 330-2500
C

Hewlett-Packard Co.
5060 E. Clinton Avenue, Suite 102
FRESNO, CA 93727
Tel: (209) 252-9652
C,M

Hewlett-Packard Co.
1421 S. Manhattan Av.
FULLERTON, CA 92631
Tel: (714) 999-6700
C,CM,E,M

Hewlett-Packard Co.
7408 Hollister Ave. #A
GOLETA, CA 93117
Tel: (805) 685-6100
C,E

SALES & SUPPORT OFFICES
Arranged alphabetically by country

UNITED STATES (Cont'd)

Hewlett-Packard Co.
2525 Grand Avenue
LONG BEACH, CA 90815
Tel: (213) 498-1111
C

Hewlett-Packard Co.
5651 West Manchester Ave.
LOS ANGELES, CA 90045
Tel: (213) 337-8000
Telex: 910-325-6608
C,M

Hewlett-Packard Co.
3155 Porter Drive
PALO ALTO, CA 94304
Tel: (415) 857-8000
C,E

Hewlett-Packard Co.
4244 So. Market Court, Suite A
SACRAMENTO, CA 95834
Tel: (916) 929-7222
A*,C,E,M

Hewlett-Packard Co.
9606 Aero Drive
SAN DIEGO, CA 92123
Tel: (619) 279-3200
C,CM,E,M

Hewlett-Packard Co.
5725 W. Las Positas Blvd.
PLEASANTON, CA 94566
Tel: (415) 460-0282
C

Hewlett-Packard Co.
3003 Scott Boulevard
SANTA CLARA, CA 95054
Tel: (408) 988-7000
Telex: 910-338-0586
A,C,CM,E

Hewlett-Packard Co.
2150 W. Hillcrest Dr.
THOUSAND OAKS, CA 91320
(805) 373-7000
C,CM,E

Colorado

Hewlett-Packard Co.
2945 Center Green Court South
Suite A
BOULDER, CO 80301
Tel: (303) 499-6655
A,C,E

Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
A,C,CM,E,M

Connecticut

Hewlett-Packard Co.
500 Sylvan Av.
BRIDGEPORT, CT 06606
Tel: (203) 371-6454
C,E

Hewlett-Packard Co.
47 Barnes Industrial Road South
WALLINGFORD, CT 06492
Tel: (203) 265-7801
A,C,CM,E,M

Florida

Hewlett-Packard Co.
2901 N.W. 62nd Street
FORT LAUDERDALE, FL 33309
Tel: (305) 973-2600
C,E,M,P*

Hewlett-Packard Co.
6800 South Point Parkway
Suite 301
JACKSONVILLE, FL 32216
Tel: (904) 636-9955
C*,M**

Hewlett-Packard Co.
255 East Drive, Suite B
MELBOURNE, FL 32901
Tel: (305) 729-0704
CM,E

Hewlett-Packard Co.
6177 Lake Ellenor Drive
ORLANDO, FL 32809
Tel: (305) 859-2900
A,C,CM,E,P*

Hewlett-Packard Co.
4700 Bayou Blvd.
Building 5
PENSACOLA, FL 32503
Tel: (904) 476-8422
A,C,M

Hewlett-Packard Co.
5550 W. Idlewild, #150
TAMPA, FL 33614
Tel: (813) 884-3282
C,E,M,P

Georgia

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500
Telex: 810-766-4890
A,C,CM,E,M,P*

Hewlett-Packard Co.
3607 Parkway Lane
Suite 300
NORCROSS, GA 30092
Tel: (404) 448-1894
C,E,P

Hawaii

Hewlett-Packard Co.
Kawaiahao Plaza, Suite 190
567 South King Street
HONOLULU, HI 96813
Tel: (808) 526-1555
A,C,E,M

Idaho

Hewlett-Packard Co.
11309 Chinden Blvd.
BOISE, ID 83707
Tel: (208) 323-2700
C

Illinois

Hewlett-Packard Co.
304 Eldorado Road
P.O. Box 1607
BLOOMINGTON, IL 61701
Tel: (309) 662-9411
A,C,E,M**

Hewlett-Packard Co.
525 W. Monroe, #1308
CHICAGO, IL 60606
Tel: (312) 930-0010
C

Hewlett-Packard Co.
1200 East Diehl Road
NAPERVILLE, IL 60566
Tel: (312) 357-8800
C

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Telex: 910-687-1066
A,C,CM,E,M

Indiana

Hewlett-Packard Co.
11911 N. Meridian St.
CARMEL, IN 46032
Tel: (317) 844-4100
A,C,CM,E,M

Hewlett-Packard Co.
111 E. Ludwig Road
Suite 108
FT. WAYNE, IN 46825
Tel: (219) 482-4283
C,E

Iowa

Hewlett-Packard Co.
4070 22nd Av. SW
CEDAR RAPIDS, IA 52404
Tel: (319) 390-4250
C,E,M

Hewlett-Packard Co.
4201 Corporate Dr.
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
A**,C,M**

Kansas

Hewlett-Packard Co.
7804 East Funston Road, Suite 203
WICHITA, KS 67207
Tel: (316) 684-8491
C,E

Kentucky

Hewlett-Packard Co.
10300 Linn Station Road, Suite 100
LOUISVILLE, KY 40223
Tel: (502) 426-0100
A,C,M

Louisiana

Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
P.O. Box 1449
KENNER, LA 70063
Tel: (504) 467-4100
A,C,E,M,P

Maryland

Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Telex: 710-862-1943
A,C,CM,E,M

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
A,C,CM,E,M

Massachusetts

Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (617) 682-1500
A,C,CM,E,M,P*

Hewlett-Packard Co.
32 Hartwell Avenue
LEXINGTON, MA 02173
Tel: (617) 861-8960
C,E

Michigan

Hewlett-Packard Co.
4326 Cascade Road S.E.
GRAND RAPIDS, MI 49506
Tel: (616) 957-1970
C,M

Hewlett-Packard Co.
39550 Orchard Hill Place Drive
NOVI, MI 48050
Tel: (313) 349-9200
A,C,E,M

Hewlett-Packard Co.
1771 W. Big Beaver Road
TROY, MI 48084
Tel: (313) 643-6474
C

Minnesota

Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
A,C,CM,E,M

Missouri

Hewlett-Packard Co.
1001 E. 101st Terrace Suite 120
KANSAS CITY, MO 64131-3368
Tel: (816) 941-0411
A,C,CM,E,M

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100
A,C,E,M

Nebraska

Hewlett-Packard
11626 Nicholas St.
OMAHA, NE 68154
Tel: (402) 493-0300
C,E,M

New Jersey

Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07653
Tel: (201) 265-5000
A,C,CM,E,M

Hewlett-Packard Co.
20 New England Av. West
PISCATAWAY, NJ 08854
Tel: (201) 562-6100
A,C,CM,E

New Mexico

Hewlett-Packard Co.
7801 Jefferson N.E.
ALBUQUERQUE, NM 87109
Tel: (505) 823-6100
C,E,M

Hewlett-Packard Co.
1460 Trinity Dr., Suite 3
LOS ALAMOS, NM 87544
Tel: (505) 662-6700
C,E

New York

Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
A,C,E,M

Hewlett-Packard Co.
9600 Main Street
CLARENCE, NY 14031
Tel: (716) 759-8621
C,E

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
A,C,CM,E,M

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
A,C,CM,E,M

Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 8th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
C,M*

Hewlett-Packard Co.
15 Myers Corner Rd.
Hollowbrook Park, Suite 2D
WAPPINGER FALLS, NY 12590
Tel: (914) 298-9125
CM,E

Hewlett-Packard Co.
2975 Westchester Avenue
PURCHASE, NY 10577-2590
Tel: (914) 935-6300
C,CM,E

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 682-7800
A,C,CM,E,M

North Carolina

Hewlett-Packard Co.
305 Gregson Dr.
CARY, NC 27511
Tel: (919) 467-6600
C,CM,E,M,P*

Hewlett-Packard Co.
9600-H Southern Pine Blvd.
CHARLOTTE, NC 28210
Tel: (704) 527-8780
C*

Hewlett-Packard Co.
5605 Roanne Way
GREENSBORO, NC 27420
Tel: (919) 852-1800
A,C,CM,E,M,P*

Ohio

Hewlett-Packard Co.
2717 S. Arlington Road
AKRON, OH 44312
Tel: (216) 644-2270
C,E

Hewlett-Packard Co.
4501 Erskine Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
C,M

Hewlett-Packard Co.
15885 Sprague Road
CLEVELAND, OH 44136
Tel: (216) 243-7300
A,C,CM,E,M

Hewlett-Packard Co.
9080 Springboro Pike
MIAMISBURG, OH 45342
Tel: (513) 433-2223
A,C,CM,E*,M

Hewlett-Packard Co.
One Maritime Plaza, 5th Floor
720 Water Street
TOLEDO, OH 43604
Tel: (419) 242-2200
C

Hewlett-Packard Co.
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
Tel: (614) 891-3344
C,CM,E*

Oklahoma

Hewlett-Packard Co.
3525 N.W. 56th St.
Suite C-100
OKLAHOMA CITY, OK 73112
Tel: (405) 946-9499
C,E*,M

Hewlett-Packard Co.
3840 S. 103rd E. Ave., #100
TULSA, OK 74146
Tel: (918) 665-3300
A**,C,E,M*,P*

Oregon

Hewlett-Packard Co.
9255 S. W. Pioneer Court
WILSONVILLE, OR 97070
Tel: (503) 682-8000
A,C,E*,M

Pennsylvania

Hewlett-Packard Co.
50 Dorchester Rd.
HARRISBURG, PA 17112
Tel: (717) 657-5900
C

Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
A,C,E,M

Hewlett-Packard Co.
2750 Monroe Boulevard
VALLEY FORGE, PA 19482
Tel: (215) 666-9000
A,C,CM,E,M

South Carolina

Hewlett-Packard Co.
Brookside Park, Suite 122
1 Harbison Way
COLUMBIA, SC 29210
Tel: (803) 732-0400
C,M

Hewlett-Packard Co.
545 N. Pleasantburg Dr.
Suite 100
GREENVILLE, SC 29607
Tel: (803) 232-8002
C

Tennessee

Hewlett-Packard Co.
One Energy Centr. Suite 200
Pellissippi Pkwy.
KNOXVILLE, TN 37932
Tel: (615) 966-4747
A,C,M

Hewlett-Packard Co.
3070 Directors Row
Directors Square
MEMPHIS, TN 38131
Tel: (901) 346-8370
A,C,M

Hewlett-Packard Co.
220 Great Circle Road, Suite 116
NASHVILLE, TN 37228
Tel: (615) 255-1271
A,C,E,M,P

Texas

Hewlett-Packard Co.
1826-P Kramer Lane
AUSTIN, TX 78758
Tel: (512) 835-6771
C,E,P*

Hewlett-Packard Co.
5700 Cromo Dr
EL PASO, TX 79912
Tel: (915) 833-4400
C,E*,M**

Hewlett-Packard Co.
3952 Sandshell Drive
FORT WORTH, TX 76137
Tel: (817) 232-9500
C

Hewlett-Packard Co.
10535 Harwin Drive
HOUSTON, TX 77036
Tel: (713) 776-6400
A,C,E,M,P*

Hewlett-Packard Co.
3301 Royal Lane
IRVING, TX 75063
Tel: (214) 869-3377
C,E

Hewlett-Packard Co.
109 E. Toronto, Suite 100
McALLEN, TX 78503
Tel: (512) 630-3030
C

Hewlett-Packard Co.
930 E. Campbell Rd.
RICHARDSON, TX 75081
Tel: (214) 231-6101
A,C,CM,E,M,P*

Hewlett-Packard Co.
1020 Central Parkway South
SAN ANTONIO, TX 78232
Tel: (512) 494-9336
A,C,E,M,P*

Utah

Hewlett-Packard Co.
3530 W. 2100 South St.
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700
A,C,E,M

Virginia

Hewlett-Packard Co.
840 Greenbrier Circle
Suite 101
CHESAPEAKE, VA 23320
Tel: (804) 424-7105
C,E,M

Hewlett-Packard Co.
4305 Cox Road
GLEN ALLEN, VA 23060
Tel: (804) 747-7750
A,C,E,M,P*

Hewlett-Packard Co.
Tanglewood West Bldg.
Suite 240
3959 Electric Road
ROANOKE, VA 24018
Tel: (703) 774-3444
C,E,P

Washington

Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVUE, WA 98006
Tel: (206) 643-4000
A,C,CM,E,M

Hewlett-Packard Co.
North 708 Argonne Road
SPOKANE, WA 99212-2793
Tel: (509) 922-7000
C

West Virginia

Hewlett-Packard Co.
501 56th Street
CHARLESTON, WV 25304
Tel: (304) 925-0492
A,C,M

Wisconsin

Hewlett-Packard Co.
275 N. Corporate Dr.
BROOKFIELD, WI 53005
Tel: (414) 794-8800
A,C,E*,M

URUGUAY

Pablo Ferrando S.A.C. e I.
Avenida Italia 2877
Casilla de Correo 370
MONTEVIDEO
Tel: 80-3805
Telex: Public Booth 901
A,CM,E,M

SALES & SUPPORT OFFICES

Arranged alphabetically by country

URUGUAY (Cont'd)

Olympia de Uruguay S.A.
Maquines de Oficina
Avda. del Libertador 1997
Casilla de Correos 6644
MONTEVIDEO
Tel: 91-1809, 98-3807
Telex: 6342 OROU UY
P

VENEZUELA

Hewlett-Packard de Venezuela C.A.
3A Transversal Los Ruices Norte
Edificio Segre 2 & 3
Apartado 50933
CARACAS 1050
Tel: (582) 239-4133
Telex: 251046 HEWPACK
A,C,CM,E,M,P

Hewlett-Packard de Venezuela, C.A.
Centro Ciudad Comercial Tamanaco
Nivel C-2 (Nueva Etapa)
Local 53H05
Chuao, **CARACAS**
Tel: 928291
P

Albis Venezolana S.R.L.
Av. Las Marias, Ota. Alix,
El Pedregal
Apartado 81025
CARACAS 1080A
Tel: 747984, 742146
Telex: 24009 ALBIS VC
A

Tecnologica Medica del Caribe, C.A.
Multicentro Empresarial del Este
Ave. Libertador
Edif. Libertador
Nucleo "C" - Oficina 51-52
CARACAS
Tel: 339867/333780
M

Hewlett-Packard de Venezuela C.A.
Residencias Tia Betty Local 1
Avenida 3 y con Calle 75
MARACAIBO, Estado Zulia
Apartado 2646
Tel: (5861) 80304
Telex: 62464 HPMAR
C,E*

Hewlett-Packard de Venezuela C.A.
Urb. Lomas de Este
Torre Trebol — Piso 11
VALENCIA, Estado Carabobo
Apartado 3347
Tel: (5841) 222992
C,P

YUGOSLAVIA

Do Hermes
General Zdanova 4
YU-11000 **BEOGRAD**
Tel: (011) 342 641
Telex: 11433
A,C,E,M,P

Do Hermes
Celovska 73
YU-61000 **LJUBLJANA**
Tel: (061) 553 170
Telex: 31583
A,C,E,M,P

Elektrotehna
Titova 51
YU-61000 **LJUBLJANA**
CM

Do Hermes
Kralja Tomislava 1
YU-71000 **SARAJEVO**
Tel: (071) 35 859
Telex: 41634
C**,P

ZAIRE

Computer & Industrial Engineering
25, Avenue de la Justice
B.P. 12797
KINSHASA, Gombe
Tel: 32063
Telex: 21552
C,P

ZAMBIA

R.J. Tilbury (Zambia) Ltd.
P.O. Box 32792
LUSAKA
Tel: 215590
Telex: 40128
E

ZIMBABWE

Field Technical Sales (Private) Limited
45, Kelvin Road North
P.O. Box 3458
SALISBURY
Tel: 705 231
Telex: 4-122 RH
E,P

August 1986

READER COMMENT SHEET

HP 1000 Computers

HP 1000 M/E/F-Series Firmware
Installation and Reference Manual

12791-90001 February, 1986

We welcome your evaluation of this manual. Your comments and suggestions help us to improve our publications. Please explain your answers under comments, below, and use additional pages if necessary.

Is this manual technically accurate? ☐ YES ☐ NO

Are the concepts and wording easy to understand? ☐ YES ☐ NO

Is the format of this manual convenient in size, arrangement, and readability? ☐ YES ☐ NO

Comments:

This form requires no postage stamp if mailed in the U.S. For locations outside the U.S., your local HP representative will ensure that your comments are forwarded.

FROM: Date _____

Name _____

Company _____

Address _____

_____

_____

FOLD FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 0141 CUPERTINO, CA

POSTAGE WILL BE PAID BY ADDRESSEE

Customer Information Manager
Hewlett-Packard Company
Data Systems Division
11000 Wolfe Road
Cupertino, CA 95014-9974

FOLD FOLD