

INSTALLATION MANUAL

12901A

FLOATING-POINT HARDWARE ACCESSORY KIT

(FOR 2100 COMPUTER)

Note

This manual should be retained with the applicable computer system documentation.

1. INTRODUCTION.

2. This manual provides field installation instructions for the HP 12901A Floating-Point Hardware Accessory Kit, an accessory for the Hewlett-Packard 2100 Computer. Further information about the accessory is provided as follows: For theory of operation and maintenance information, refer to the *Installation and Maintenance Manual* for the computer; for schematic and component location diagrams, refer to the *Diagrams Manual*; for replacement parts information, refer to the computer *Illustrated Parts Breakdown Manual*; for a description of programming requirements and a sample assembly language program, refer to the computer *Reference Manual*.

3. DESCRIPTION.

4. The HP 12901A Floating Point Hardware Accessory Kit provides the computer with the necessary logic to perform floating-point mathematical operations. The floating-point microprogram is contained in six ROM packs installed in the module 1 position (U25, U26, U27, U35, U37, and U65) on ROM Control Card A2. Mapping to the correct ROM starting address for execution of the floating-point user instructions is accomplished by the proper configuration of jumpers W4 and W5 in the ROM mapper circuits. The configuration of jumpers W1, W2, W3, and W6 in the Non-Existent ROM (NER) FF circuits are also changed to include ROM module 1.

5. The HP 12901A Kit consists of the following:

- a. Six ROM integrated circuit packages, part numbers 1816-0054 through 1816-0059.
- b. Six integrated circuit sockets, part number 1200-0767.
- c. Six socket insulators, part number 0340-0788.
- d. One product identifier, part number 12901-80001.
- e. Installation Manual, part number 12901-90001.

6. UNPACKING AND INSPECTION.

7. If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the parts are unpacked. Inspect the parts for damage (cracked, broken, etc.). If the parts are damaged and fail to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection. The HP Sales and Service Office will arrange for the repair or replacement of the damaged parts without waiting for any claims against the carrier to be settled.

8. IDENTIFICATION.

9. Hewlett-Packard uses five digits and a letter (00000A) for standard kit designations. If the designation of your kit does not agree with that on the title page of this manual, there are differences between your kit and the kit described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Sales and Service Office. These offices are listed at the back of this manual.

10. Printed-circuit card revisions are identified by a letter, a date code, and a division code stamped on the card (e.g., A-1103-22). The letter code identifies the version of the etched trace pattern on the unloaded card. The date code (four middle digits) refers to the electrical characteristics of the loaded card. The division code (last two digits) identifies the Hewlett-Packard division that manufactured the card. If the date code stamped on the printed-circuit card does not agree with the date code shown on the appropriate schematic diagram in the computer *Diagrams Manual*, there are differences between your card and the card described in the *Diagrams Manual*. These differences are described in manual supplements available at the nearest HP Sales and Service Office.

11. INSTALLATION.

12. Install the floating-point hardware accessory as follows:

- a. Turn off power at the computer.
- b. Remove the top access cover from the computer.
- c. Remove all cable connectors (if any) attached to the top of the ROM control card (part no. 02100-60002) in slot 2 of the computer.
- d. Remove the ROM control card from slot 2, and check that the proper jumpers are installed on the card. (Refer to table 1. Floating-point is installed as module one.)

Table 1. ROM Control Card A2 Jumper Connections for Various Module Configurations

MODULES	JUMPERS TO BE INSTALLED					
	W1	W2	W3	W4	W5	W6
0	A to B	D to K	E to F	in	none	H to L
0,1 (floating point)	A to B	none	none	in	none	H to L

e. Install the six integrated circuit sockets and insulators in the positions allotted to U25, U26, U27, U35, U37, and U65 and plug in the six ROM integrated circuits as follows (see *Diagrams Manual*):

- (1) Part no. 1816-0054 into XU37
- (2) Part no. 1816-0055 into XU35
- (3) Part no. 1816-0056 into XU25
- (4) Part no. 1816-0057 into XU65
- (5) Part no. 1816-0058 into XU27
- (6) Part no. 1816-0059 into XU26

f. Replace the ROM control card (with floating-point ROM's installed) in slot 2 of the computer and install the product identifier (part no. 12901-80001) over connector J2 of the card. (Connector J2 is the connector closest to the back of the computer.)

g. Replace all cable connectors removed in step c above.

h. Replace the top access cover of the computer.

13. INSTALLATION CHECKOUT.

14. Turn on power at the computer and perform the diagnostic test as outlined in the Diagnostic Program Procedures (part no. 02100-90064) contained in the *Manual of Diagnostics*. If the diagnostic program is completed without error, the card is installed and operating properly, and is ready for normal program operation. If the diagnostic program indicates errors, halt the computer, turn off power and remove the floating-point hardware card. Recheck all installation steps and repeat the diagnostic test.

15. MAINTENANCE.

16. If the results of the diagnostic test indicate that the floating-point hardware accessory does not operate properly, refer to the computer *Installation and Maintenance Manual* for maintenance information pertaining to the floating-point feature.

17. SHIPPING AND STORAGE.

18. If an item from the kit is to be shipped to Hewlett-Packard for service or repair, attach a tag to the item identifying the owner and indicating the service or repair to be accomplished. Include the number of the kit.

19. Package the item in the original factory packaging material, if available. If the original material is not available, standard factory packaging material can be obtained from a local Hewlett-Packard Sales and Service Office.

20. If standard factory packaging material is not used, wrap the item in Air Cap TH-240 cushioning (or equivalent) manufactured by Sealed Air Corp., Hawthorne, N.J., and place in a corrugated carton (200 pound test material). Seal the shipping carton securely and mark it "FRAGILE" to assure careful handling.

Note: In any correspondence, identify the kit by number. Refer any questions to the nearest Hewlett-Packard Sales and Service Office.

21. If the kit is to be stored before use, package it as described above to prevent accidental damage.

OPERATING AND SERVICE MANUAL

12901A

FLOATING-POINT HARDWARE ACCESSORY KIT

(FOR 2100A COMPUTER)

Card Assembly

12901-60001 Rev. 1143 and 1144

Note

This manual should be retained with the applicable computer system documentation.

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GENERAL INFORMATION

SECTION
I

1-1. INTRODUCTION.

1-2. The Hewlett-Packard (HP) 12901A Floating-Point Hardware Accessory Kit provides the 2100A Computer with the necessary logic to perform floating-point mathematical operations. Sections II through V of this manual provide installation and programming, theory of operation, maintenance and replaceable parts information for the kit.

1-3. KIT CONTENTS.

1-4. The 12901A Kit consists of the following:

- a. ROM Control Card (with Floating Point), part no. 12901-60001, also called floating-point hardware card.
- b. Operating and Service Manual, part no. 12901-90001.
- c. Update Return Form, part no. 9320-1634. (Not included if accessory is factory-installed.)

1-5. IDENTIFICATION.

1-6. Hewlett-Packard uses five digits and a letter (00000A) for standard kit designations. If the designation of your kit does not agree with that on the title page of this manual, there are differences between your kit and the kit described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Sales and Service Office. These offices are listed at the back of this manual.

1-7. Printed-circuit card revisions are identified by a letter, a revision code, and a division code stamped on the board (e.g. A-1106-22). The letter code identifies the version of the etched trace pattern on the unloaded card. The revision code (four middle digits) refers to the electrical characteristics of the loaded card. The division code (last two digits) identifies the Hewlett-Packard division which manufactured the card. If the revision code stamped on the printed-circuit card does not agree with the revision

code shown on the title page of this manual, there are differences between your card and the card described in this manual. These differences are described in change sheets and manual supplements available at the nearest HP Sales and Service Office.

1-8. Manuals and manual supplements are identified by title and part number on the title page of the document.

1-9. SPECIFICATIONS.

1-10. Table 1-1 lists the characteristics and specifications of the floating-point hardware card.

Table 1-1. ROM Control Card (with Floating Point), Specifications

CHARACTERISTICS	SPECIFICATIONS
Output Levels: "1" state "0" state	≥ 2.4 volts ≤ 0.5 volt
Input Levels: "1" state "0" state	≥ 2.2 volts, ≤ 5.0 volts ≤ 0.8 volt, ≥ -0.2 volt
Current Requirements in Addition to the Computer Basic Requirements: +4.85V	780 ma
Card Dimensions: Width Height	7-3/4 inches (196,8 mm) 8-11/16 inches (220,7 mm)

2-1. INTRODUCTION.

2-2. This section provides procedures and information for unpacking and inspection, installation, and programming of the floating-point hardware card.

2-3. UNPACKING AND INSPECTION.

2-4. If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the card is unpacked. Inspect the card for damage (cracked, broken parts, etc.). If the card is damaged and fails to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection. The HP Sales and Service Office will arrange for the repair or replacement of the damaged card without waiting for any claims against the carrier to be settled.

2-5. INSTALLATION.

2-6. Install the floating-point hardware card as follows:

- a. Turn off power at the computer.
- b. Remove the top access cover from the computer.
- c. Remove all cable connectors (if any) attached to the top of the ROM control card (part no. 02100-60002) in slot 2 of the computer.
- d. Remove the ROM control card from slot 2, and fill in the applicable blanks of the Update Return Form (part no. 9320-1634) included in the kit. Package the card according to paragraph 2-9 and return both the card and completed form to Hewlett-Packard.
- e. Remove the floating-point hardware card from its packaging and check that the proper jumpers are installed on the card. Only those shown on the parts location diagram figure 4-1 (W1 positions A to B, W4, and W6 positions H to L) should be installed.
- f. Install the floating-point hardware card (part no. 12901-60001) in slot 2 of the computer.
- g. Replace all cable connectors removed in step "c" above.
- h. Replace the top access cover of the computer.

- i. Turn on power at the computer and perform the diagnostic test as outlined in the Diagnostic Program Procedures (part no. 02100-90064) contained in the Manual of Diagnostics. If the diagnostic program is completed without error, the card is installed and operating properly, and is ready for normal program operation. If the diagnostic program indicates errors, halt the computer, turn off power and remove the floating-point hardware card. Recheck all installation steps and repeat the diagnostic test.

2-7. RESHIPMENT.

2-8. If an item of the kit is to be shipped to Hewlett-Packard for service or repair, attach a tag to the item identifying the owner and indicating the service or repair to be accomplished. Include the accessory number of the kit.

2-9. Package the item in the original factory packaging material, if available. If the original material is not available, standard factory packaging material can be obtained from a local Hewlett-Packard Sales and Service Office.

2-10. If standard factory packaging material is not used, wrap the item in Air Cap TH-240 Cushioning (or equivalent) manufactured by Sealed Air Corp., Hawthorne, N.J. and place in a corrugated carton (200 pound test material). Seal the shipping carton securely and mark it "FRAGILE" to ensure careful handling.

Note: In any correspondence, identify the kit by accessory number. Refer any questions to the nearest Hewlett-Packard Sales and Service Office.

2-11. PROGRAMMING.

2-12. The following is a list of programming criteria for the floating-point hardware accessory.

- a. It is installed as Module 1.
- b. It adds six HP Assembly language instructions to the computer's basic set of instructions. These additional instructions are FAD, FSB, FMP, FDV, FIX, and FLT. (These additional instructions are fully explained in Section III of this manual.)

THEORY OF OPERATION



3-1. INTRODUCTION.

3-2. A schematic diagram of the ROM control card is shown in Section IV of the 2100A Diagrams Manual (part no. 02100-90003) and includes the optional floating point ROM integrated circuit packages U25, U26, U27, U35, U37, and U65. A parts location diagram and replaceable parts list are located in Section IV of this manual.

3-3. FLOATING-POINT OPERATION.

3-4. Floating-point processing is a method of mathematically manipulating numbers written in exponential form. Within the computer this process applies to numbers written in binary form and normalized (that is, for positive numbers, the first digit to the right of the binary point is one and all digits to the left of the binary point are zeros. For negative numbers, the first digit to the right of the binary point is zero and all digits to the left of the binary point are ones). A floating-point number is a decimal number which has two components; a signed or unsigned leading number (integer or fraction or both) and a signed or unsigned exponent. The exponent specifies the power of 10 by which the leading number is multiplied. The floating-point number may have any of the following formats:

$$\pm n.n, \pm n., \pm n.E\pm e, \pm n.E\pm e, \pm n.nE\pm e, \pm nE\pm e$$

("E" separates the exponential part from the leading number part.)

3-5. The floating-point number is converted to binary form, normalized, and stored in two computer words referred to as the floating-point quantity. The floating-point quantity is composed of two parts; the fraction and the exponent. If either the fraction or the exponent is negative, that part is stored in the two's complement form. Figure 3-1 explains the binary format of a floating-point quantity.

3-6. FLOATING-POINT INSTRUCTIONS.

3-7. Floating point has a repertoire of six instructions. They are as follows:

Note: In FAD, FSB, FMP, and FDV, add 980 ns to the execution time for each level of indirect.

FAD; floating-point addition. Add the two-word floating-point quantity in the A- and B-registers to the two-word floating-point quantity in the specified locations. Store the two-word floating-point sum in the A- and B-registers.

Machine Code: 105000 octal
Calling Sequence: FAD
DEF Y [,I]
Execution Time: 23.52 usec minimum
(fetch and execute) 59.78 usec maximum

Error Conditions: If the result is outside the range of representable floating-point numbers: $[-2^{127}, 2^{127} (1 - 2^{-23})]$. The overflow flag is set and the result $2^{128} (1 - 2^{-23})$ is returned to the A- and B-registers. If an underflow occurs (result within the range $[-2^{129} (1 + 2^{-22}), 2^{-129}]$), the overflow flag is set and the result 0 is returned.

FSB; floating-point subtraction. Subtract the two-word floating-point quantity in the specified location from the two-word floating-point quantity in the A- and B-registers and store the difference in the A- and B-registers.

Machine Code: 105020 octal
Calling Sequence: FSB
DEF Y [,I]
Execution Time: 24.50 usec minimum
(fetch and execute) 60.76 usec maximum

Error Conditions: Same as FAD

FMP; floating-point multiplication. Multiply the two-word floating-point quantity in the A- and B-registers by the two-word floating-point quantity in the specified locations. Store the two-word floating-point product in the A- and B-registers.

Machine Code: 105040 octal
Calling Sequence: FMP
DEF Y [,I]
Execution Time: 33.32 usec minimum
(fetch and execute) 41.16 usec maximum

Error Conditions: Same as FAD

FDV; floating-point division. Divide the two-word floating-point quantity in the A- and B-registers by the two-word floating-point quantity in the specified locations. Store the two-word floating-point quotient in the A- and B-registers.

Machine Code: 105060 octal
 Calling Sequence: FDV
 DEF Y [,I]
 Execution Time: 51.94 usec minimum
 (fetch and execute) 55.86 usec maximum
 Error Conditions: Same as FAD

Error Conditions: If the floating-point number is ≤ 0 , the integer 0 is returned. If the floating-point number is $\geq 2^{15}$, the decimal integer 32767 (= 077777 octal) is returned to the A-register and the overflow flag is set.

FIX; floating-point to integer format. Change the floating-point quantity in the A- and B-registers from floating-point format to integer format and place the integer in the A-register.

Machine Code: 105100 octal
 Calling Sequence: FIX
 Execution Time: 5.88 usec minimum
 (fetch and execute) 8.87 usec maximum

FLT; integer to floating-point format. Change the number in the A-register from integer format to floating-point format and place the floating-point quantity in the A- and B-registers.

Machine Code: 105120 octal
 Calling Sequence: FLT
 Execution Time: 9.8 usec minimum
 (fetch and execute) 24.5 usec maximum
 Error Conditions: None

3-8. These instructions are non-interruptable. Any attempted interrupt is held off for the full execution time of the currently active floating-point instruction. However, DMA transfers are not held off.

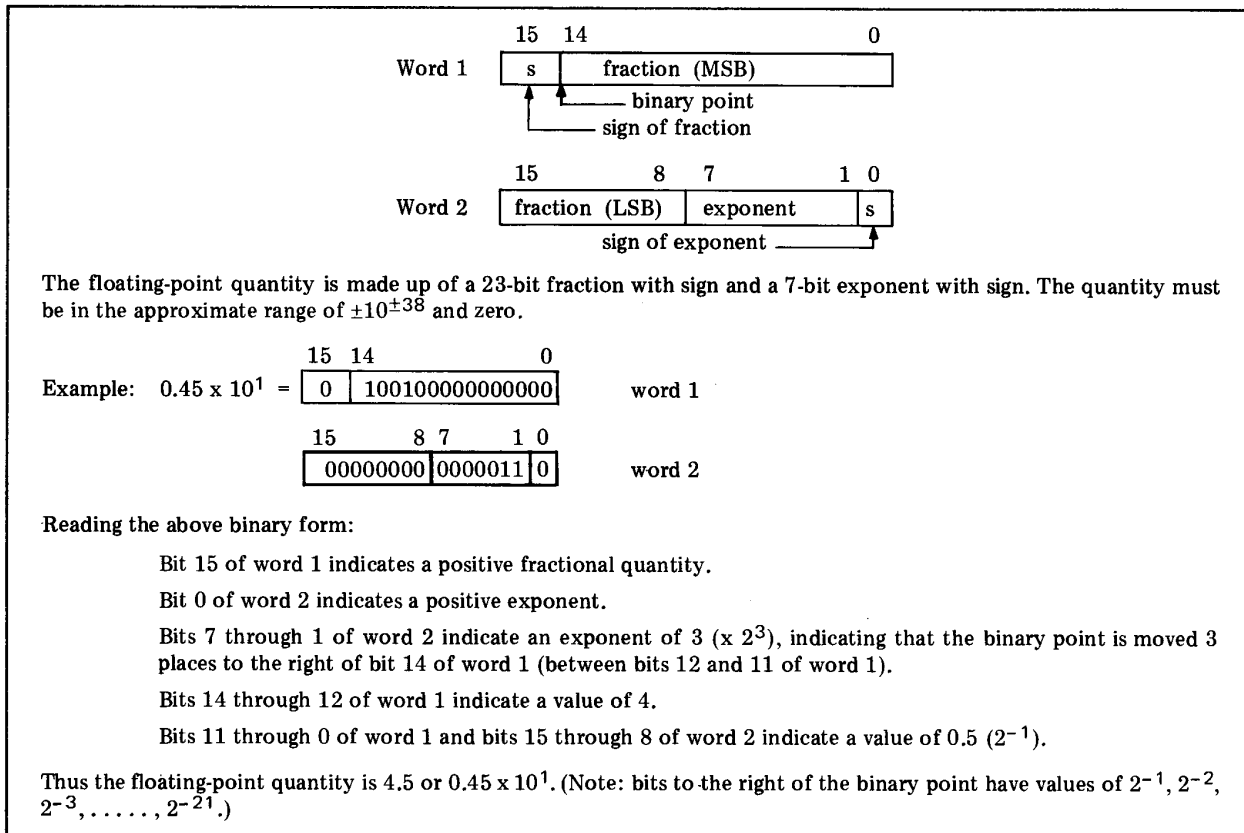


Figure 3-1. Binary Format of a Floating-Point Quantity

4-1. INTRODUCTION.

4-2. This section contains information on diagnostics and troubleshooting for the floating-point hardware kit.

4-3. PREVENTIVE MAINTENANCE.

4-4. Detailed preventive maintenance procedures and schedules are provided in appropriate Hewlett-Packard computer documentation. There are no separate preventive maintenance procedures to be performed on this kit.

4-5. DIAGNOSTICS.

4-6. The floating-point hardware may be checked using the Diagnostic Program Procedure, part no. 02100-90064, contained in the Manual of Diagnostics. The diagnostic checks the functional operation of the floating-point hardware by generating known input data and comparing the generated results with the expected results. All floating-point instructions are tested as well as memory protect fence and multiple indirect execution of the floating-point add (FAD). Error messages are generated dependent on the switch register settings. The diagnostic program procedure should be consulted for a detailed explanation of the diagnostic program, its switch register settings, and error messages.

4-7. TROUBLESHOOTING.

4-8. Troubleshooting for the floating-point hardware is accomplished by performing the tests in the diagnostic program and analyzing any error messages that occur as the test is being run. Table 4-1 contains a parts list for the floating-point hardware card with parts listed in alphanumeric order by reference designation. The schematic diagram for the ROM control card shown in Section IV of the 2100A Diagrams Manual, includes the optional floating-point ROM integrated circuit packages U25, U26, U27, U35, U37, and U65.

Note: If diagnostic error conditions occur, check the following signals and gates prior to replacing the floating-point hardware card. The signal FLAG generated at pin 23 of microinstruction decoder 2 card (part no. 02100-60022) in slot 4 of the computer is used specifically by floating-point operations as are the signals CL and CR generated at pins 13 and 15, respectively, of microinstruction decoder 1 card (part no. 02100-60004) in slot 3 of the computer. These last two signals are gating signals used by "and" gates U77A and U77B of the floating-point hardware card in slot 2 of the computer.

Table 4-1. A2 ROM Control Card (with Floating Point), Replaceable Parts

REFERENCE DESIGNATION	HP PART NO.	QTY	DESCRIPTION	MFR CODE	MFR PART NO.
A2	12901-60001	1	ROM CONTROL (WITH FLOATING POINT) CARD ASSY	28480	12901-60001
A2C1	0160-2055	26	C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C2	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C3	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C4	0180-0197	6	C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C5	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C6	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C7	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C8	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C9	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C10	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C11	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C12	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C13	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C14	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C15	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C16	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C17	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C18	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C19	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C20	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C21	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C22	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C23	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C24	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C25	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C26	0180-0197		C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS
A2C27	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C28	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C29	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C30	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C31	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2C32	0160-2055		C:FXD CER 0,01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH
A2E1	0360-0294	3	TERMINAL:SOLDER POINT	28480	0360-0294
A2E2	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A2E3	0360-0294		TERMINAL:SOLDER POINT	28480	0360-0294
A2R1	0698-7229	42	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R2	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R3	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R4	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R5	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R6	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R7	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R8	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R9	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R10	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R11	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R12	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R13	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R14	0698-7226	2	R:FXD FLM 383 OHM 2% 1/8W	28480	0698-7226

Table 4-1. A2 ROM Control Card (with Floating Point), Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NO.	QTY	DESCRIPTION	MFR CODE	MFR PART NO.
A2R15	0698-7229	6	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R16	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R17	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R18	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R19	0698-7236		R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A2R20	0698-7236		R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A2R21	0698-7229	15	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R22	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R23	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R24	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R25	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R26	0698-7236		R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A2R27	0698-7225		R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225
A2R28	0698-7225		R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225
A2R29	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R30	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R31	0698-7225		R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225
A2R32	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R33	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R34	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R35	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R36	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R37	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R38	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R39	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R40	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R41	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R42	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R43	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R44	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R45	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R46	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R47	0698-7236	R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236	
A2R48	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R49	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R50	0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	
A2R51	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R52	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R53	0698-7236	R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236	
A2R54	0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	
A2R55	0698-7220	2	R:FXD FLM 215 OHM 2% 1/8W	28480	0698-7220
A2R56	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R57	0698-7225	1	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225
A2R58	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R59	0698-7234		R:FXD FLM 825 OHM 2% 1/8W	28480	0698-7234
A2R60	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R61	0698-7229	2	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R62	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R63	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R64	0698-7221		R:FXD FLM 237 OHM 2% 1/8W	28480	0698-7221

Table 4-1. A2 ROM Control Card (with Floating Point), Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NO.	QTY	DESCRIPTION	MFR CODE	MFR PART NO.
A2R65	0698-7221		R:FXD FLM 237 OHM 2% 1/8W	28480	0698-7221
A2R66	0698-3440	1	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A2R67	0698-7225		R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225
A2R68	0698-7229		R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A2R69	0698-7222	3	R:FXD FLM 261 OHM 2% 1/8W	28480	0698-7222
A2R70	0698-7222		R:FXD FLM 261 OHM 2% 1/8W	28480	0698-7222
A2R71	0698-7222		R:FXD FLM 261 OHM 2% 1/8W	28480	0698-7222
A2R72	0698-7226		R:FXD FLM 383 OHM 2% 1/8W	28480	0698-7226
A2R73*	0698-7236		R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A2U13	1820-0971	4	IC:CTL DUAL 2W-2-INPT AND/OR GATE	02763	U6A997179X
A2U14	1820-0966	12	IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U15	1816-2062	1	IC:ROM #2062	28480	1816-2062
A2U16	1816-2065	1	IC:ROM #2065	28480	1816-2065
A2U17	1816-2064	1	IC:ROM #2064	28480	1816-2064
A2U23	1820-0971		IC:CTL DUAL 2W-2-INPT AND/OR GATE	07263	U6A997179X
A2U24	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U25	1816-0008	1	IC:ROM #0008	28480	1816-0008
A2U26	1816-0011	1	IC:ROM #0011	28480	1816-0011
A2U27	1816-0010	1	IC:ROM #0010	28480	1816-0010
A2U31	1820-0953	4	IC:CTL TRIPLE 2-2-3 INPT AND GATE	14433	MIC 953
A2U32	1820-0231	3	IC:TTL 4-BIT SYNC BINARY COUNTER	07263	U6B931659X
A2U34	1820-0996		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U35	1816-0007	1	IC:ROM #0007	28480	1816-0007
A2U36	1820-0437	2	IC:TTL QUAD D F/F	04713	MC4015P
A2U37	1816-0006	1	IC:ROM #0006	28480	1816-0006
A2U41	1820-0379	4	IC:TTL HS 4W 2-2-2-3 INPT AND/OR GATE	01295	SN74H52N
A2U42	1820-0301	3	IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N
A2U44	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U45	1816-2061	1	IC:ROM #2061	28480	1816-2061
A2U46	1820-0437		IC:TTL QUAD D F/F	04713	MC4015P
A2U47	1816-2060	1	IC:ROM #2060	28480	1816-2060
A2U51	1820-0379		IC:TTL HS 4W 2-2-2-3 INPT AND/OR GATE	01295	SN74H52N
A2U52	1820-0231		IC:TTL 4-BIT SYNC BINARY COUNTER	07263	U6B931659X
A2U53	1820-0231		IC:TTL 4-BIT SYNC BINARY COUNTER	07263	U6B931659X
A2U54	1820-0301		IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N
A2U55	1816-2063	1	IC:ROM #2063	28480	1816-2063
A2U56	1820-0604	1	IC:TTL DUAL 4-INPT NAND POWER GATE	04713	MC3025P
A2U57	1820-0374	1	IC:TTL HS DUAL 4-INPT AND GATE	01295	SN74H21N
A2U61	1820-0379		IC:TTL HS 4W 2-2-2-3 INPT AND/OR GATE	01295	SN74H52N
A2U62	1820-0301		IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N
A2U63	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U64	1820-0996		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U65	1816-0009	1	IC:ROM #0009	28480	1816-0009
A2U66	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U67	1820-0971		IC:CTL DUAL 2W-2-INPT AND/OR GATE	07263	U6A997179X
A2U71	1820-0379		IC:TTL HS 4W 2-2-2-3 INPT AND/OR GATE	01295	SN74H52N
A2U72	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U73	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U74	1820-0971		IC:CTL DUAL 2W-2-INPT AND/OR GATE	07263	U6A997179X
A2U75	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U76	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966

* Resistor A2R73 first used on card revision 1144.

Table 4-1. A2 ROM Control Card (with Floating Point), Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NO.	QTY	DESCRIPTION	MFR CODE	MFR PART NO.
A2U77	1820-0186	4	IC:CTL DUAL 2-INPT AND GATE	07263	U6A985649X
A2U81	1820-0141	2	IC:TTL QUAD 2-INPT AND GATE	04713	MC3001P
A2U82	1820-0370	2	IC:TTL HS QUAD 2-INPT NAND GATE	01295	SN74H00N
A2U83	1820-0965	2	IC:CTL QUAD 1-INPT AND GATE	07263	U6A996579X
A2U84	1820-0186		IC:CTL DUAL 2-INPT AND GATE	07263	U6A985649X
A2U85	1820-0424	1	IC:TTL HS HEX INVERTER	04713	SN74H04N
A2U86	1820-0141		IC:TTL QUAD 2-INPT AND GATE	04713	MC3001P
A2U87	1820-0370		IC:TTL HS QUAD 2-INPT NAND GATE	01295	SN74H00N
A2U91	1820-0186		IC:CTL DUAL 2-INPT AND GATE	07263	U6A985649X
A2U92	1820-0371	1	IC:TTL HS TRIPLE 3-INPT NAND GATE	01295	SN74H10N
A2U93	1820-0953		IC:CTL TRIPLE 2-2-3 INPT AND GATE	14433	MIC 953
A2U94	1820-0965		IC:CTL QUAD 1-INPT AND GATE	07263	U6A996579X
A2U95	1820-0966		IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966
A2U96	1820-0372	1	IC:TTL TRIPLE 3-INPT AND GATE	28480	1820-0372
A2U97	1820-0186		IC:CTL DUAL 2-INPT AND GATE	07263	U6A985649X
A2U101	1820-0953		IC:CTL TRIPLE 2-2-3 INPT AND GATE	14433	MIC 953
A2U102	1820-0953		IC:CTL TRIPLE 2-2-3 INPT AND GATE	14433	MIC 953
A2U103	1820-0954	1	IC:CTL DUAL 4-INPT AND GATE	07263	U6A995479X
A2U104	1820-0239	1	IC:TTL QUAD 2-INPT NOR GATE	28480	1820-0239
A2U105	1820-0485	1	IC:CTL HEX LEVEL RESTORER	07263	U6B981649X
A2U106	1820-0451	1	IC:TTL DUAL J-K F/F	04713	MC3062P
A2U107	1820-0187		IC:CTL DUAL 2-INPT NOR GATE	07263	U6A985249X
A2W1	8159-0005	3	JUMPER WIRE	28480	8159-0005
A2W4	8159-0005		JUMPER WIRE	28480	8159-0005
A2W6	8159-0005		JUMPER WIRE	28480	8159-0005

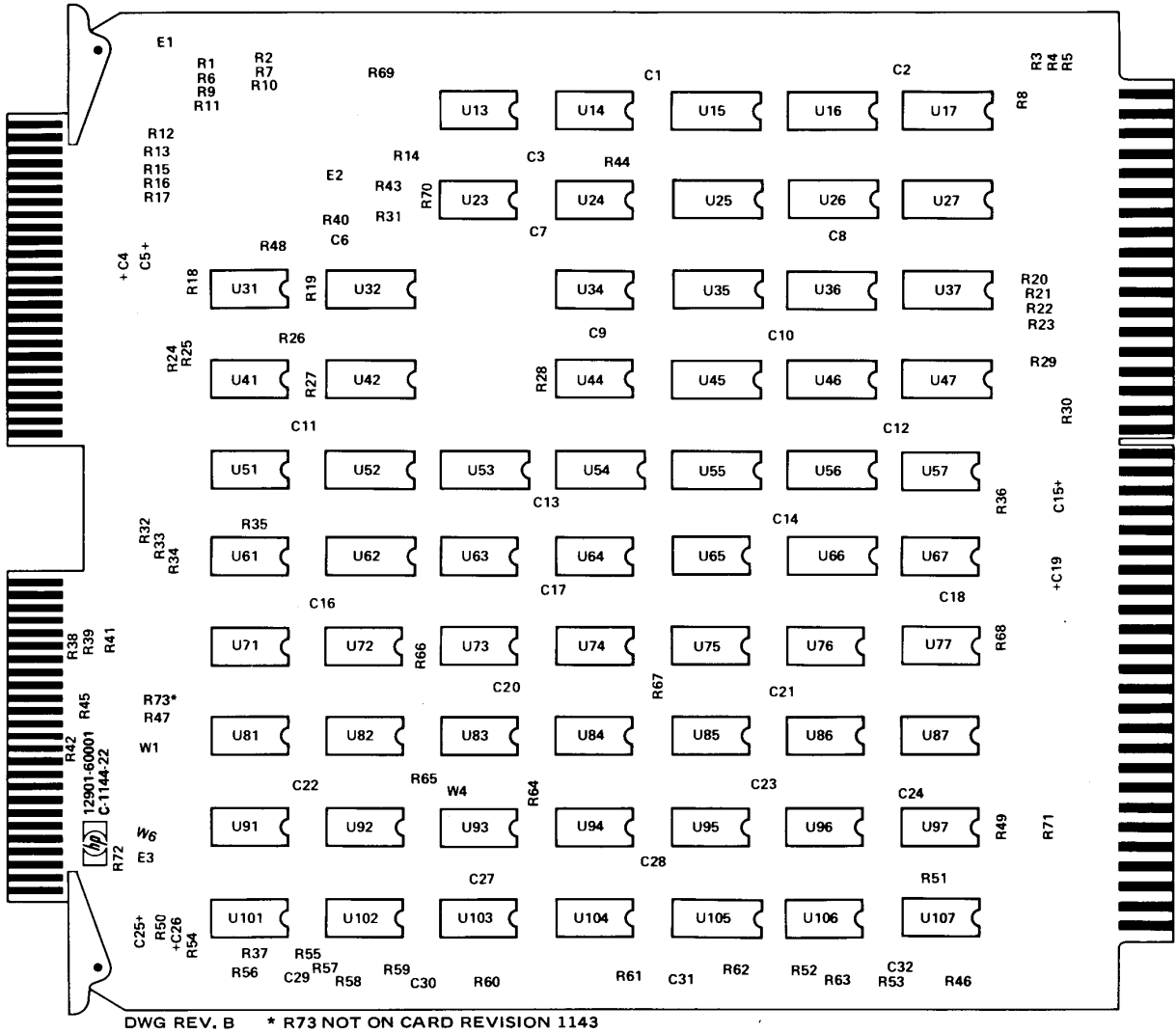


Figure 4-1. ROM Control Card (with Floating-Point), Parts Location Diagram

REPLACEABLE PARTS



5-1. INTRODUCTION.

5-2. This section contains information for ordering replacement parts for the kit. Table 5-1 is a numerical listing of all items supplied in the kit, and table 5-2 is a numerical listing of all replaceable parts on the ROM control card with floating point. The parts in tables 5-1 and 5-2 are listed in numerical order by part number.

5-3. A replaceable parts list and a parts location diagram for the ROM control card with floating point are provided in Section IV of this manual.

5-4. Table 4-1, 5-1, and 5-2 list the following information for each part:

- a. Reference designation of the part (table 4-1 only).
- b. Hewlett-Packard part number.
- c. Description of the part. (Refer to table 5-4 for an explanation of abbreviations used in the DESCRIPTION column.)

- d. A five-digit code that corresponds to the manufacturer of the part. (Refer to table 5-3 for a listing of the manufacturers that correspond to the codes.)
- e. Manufacturer's part number.
- f. Total quantity of each part used in the kit or assembly (tables 5-1 and 5-2 only).

5-5. ORDERING INFORMATION.

5-6. To order replacement parts, address the order or inquiry to the local Hewlett-Packard Sales and Service Office. These offices are listed at the back of this manual. Specify the following information for each part ordered:

- a. Equipment model and serial number.
- b. Hewlett-Packard part number for each part.
- c. Description of each part.
- d. Circuit reference designation (if applicable).

Table 5-1. Numerical Listing of Floating-Point Hardware Kit Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
12901-60001	ROM Control Card (with Floating Point)	28480	12901-60001	1
12901-90001	Operating and Service Manual	28480	12901-90001	1
9320-1634	Update Return Form	28480	9320-1634	1

Table 5-2. Numerical Listing of ROM Control Card (with Floating Point) Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0160-2055	C:FXD CER 0.01 UF +80 -20% 100 VDCW	56289	C023F101F103ZS22-CDH	26
0180-0197	C:FXD ELECT 2.2 UF 10% 20 VDCW	56289	150D225X9020A2-DYS	6
0360-0294	TERMINAL:SOLDER POINT	28480	0360-0294	3
0698-7220	R:FXD FLM 215 OHM 2% 1/8W	28480	0698-7220	2
0698-7221	R:FXD FLM 237 OHM 2% 1/8W	28480	0698-7221	2
0698-7222	R:FXD FLM 261 OHM 2% 1/8W	28480	0698-7222	3
0698-7225	R:FXD FLM 348 OHM 2% 1/8W	28480	0698-7225	15
0698-7226	R:FXD FLM 383 OHM 2% 1/8W	28480	0698-7226	2
0698-7229	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229	42
0698-7234	R:FXD FLM 825 OHM 2% 1/8W	28480	0698-7234	1
0698-7236	R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236	6
1816-0006	IC:ROM #0006	28480	1816-0006	1
1816-0007	IC:ROM #0007	28480	1816-0007	1
1816-0008	IC:ROM #0008	28480	1816-0008	1
1816-0009	IC:ROM #0009	28480	1816-0009	1
1816-0010	IC:ROM #0010	28480	1816-0010	1
1816-0011	IC:ROM #0011	28480	1816-0011	1
1816-2060	IC:ROM #2060	28480	1816-2060	1
1816-2061	IC:ROM #2061	28480	1816-2061	1
1816-2062	IC:ROM #2062	28480	1816-2062	1
1816-2063	IC:ROM #2063	28480	1816-2063	1
1816-2064	IC:ROM #2064	28480	1816-2064	1
1816-2065	IC:ROM #2065	28480	1816-2065	1
1820-0141	IC:TTL QUAD 2-INPT AND GATE	04713	MC3001P	2
1820-0186	IC:CTL DUAL 2-INPT AND GATE	07263	U6A985649X	4
1820-0231	IC:TTL 4-BIT SYNC BINARY COUNTER	07263	U6B931659X	3
1820-0301	IC:TTL QUAD BI-STABLE D-LATCH	01295	SN7475N	3
1820-0370	IC:TTL HS QUAD 2-INPT NAND GATE	01295	SN74H00N	2
1820-0371	IC:TTL HS TRIPLE 3-INPT NAND GATE	01295	SN74H10N	1
1820-0372	IC:TTL TRIPLE 3-INPT AND GATE	28480	1820-0372	1
1820-0374	IC:TTL HS DUAL 4-INPT AND GATE	01295	SN74H21N	1
1820-0379	IC:TTL HS 4W 2-2-2-3 INPT AND/OR GATE	01295	SN74H52N	4
1820-0425	IC:TTL HS HEX INVERTER	04713	SN74H04N	1
1820-0437	IC:TTL QUAD D F/F	04713	MC4015P	2
1820-0451	IC:TTL DUAL J-K F/F	04713	MC3062P	1
1820-0485	IC:CTL HEX LEVEL RESTORER	07263	U6B981649X	1
1820-0604	IC:TTL DUAL 4-INPT NAND POWER GATE	04713	MC3025P	1
1820-0953	IC:CTL TRIPLE 2-2-3 INPT AND GATE	14433	MIC 953	4
1820-0954	IC:CTL DUAL 4-INPT AND GATE	07263	U6A995479X	1
1820-0965	IC:CTL QUAD 1-INPT AND GATE	07263	U6A996579X	2
1820-0966	IC:CTL DUAL 2-INPT AND 2W AND/OR GATE	14433	MIC 966	12
1820-0971	IC:CTL DUAL 2W-2-INPT AND/OR GATE	07263	U6A997179X	4
8159-0005	JUMPER	28480	8159-0005	3

Table 5-3. Code List of Manufacturers

Code No.	Manufacturer	Address	Code No.	Manufacturer	Address
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas	14433	ITT Semiconductor, A Div. of Int. Telephone and Telegraph Corp.	West Palm Beach, Fla.
04713	Motorola, Inc., Semiconductor Products Div.	Phoenix, Arizona	28480	Hewlett-Packard Co.	Palo Alto, Calif.
07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Calif.	56289	Sprague Electric Co.	North Adams, Mass.

UPDATING SUPPLEMENT FOR OPERATING AND SERVICE MANUAL

14 JUNE 1972

MANUAL IDENTIFICATION

Manual Serial No. Prefix: NA
 Manual Printed: JAN 1972
 Manual Part Number: 12901-90001

SUPPLEMENT DESCRIPTION

The purpose of this supplement is to adapt the manual to instruments containing production improvements made subsequent to the printing of the manual and to correct manual errors. Enter the new information (or the Change Number, if more convenient) into the appropriate places in the manual, identified at left.

INSTRUMENT CHANGES

Serial No. Prefix	Change
ALL	1 thru 13

ASSEMBLY CHANGES

Ref Des	Description	HP Part No.	Rev	Changes

Changes 1 through 12 dated 17 March 1972.
 Change 13 dated 14 June 1972.

US-1

CHANGE

DESCRIPTION

- | CHANGE | DESCRIPTION |
|--------|---|
| 1 | Title page. Delete the reference "Card Assembly 12901-60001 Rev. 1143 and 1144". |
| 2 | Page 1-1, paragraph 1-4. Change the paragraph to read as follows:

"The 12901A Kit consists of the following:

a. Six ROM integrated circuit packages, part numbers 1816-0054 through 1816-0059.

b. Six integrated circuit sockets, part number 1200-0767.

c. Six socket insulators, part number 0340-0788.

d. One product identifier, part number 12901-80001.

e. Operating and Service Manual, part number 12901-90001." |
| 3 | Page 1-1, paragraph 1-7. Delete the complete paragraph. |
| 4 | Page 2-1, paragraph 2-4. Change the paragraph to read as follows:

"If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the parts are unpacked. Inspect the parts for damage (cracked, broken, etc.). If the parts are damaged and fail to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection. The HP Sales and Service Office will arrange for the repair or replacement of the damaged parts without waiting for any claims against the carrier to be settled." |
| 5 | Page 2-1, paragraph 2-6. Change the paragraph and steps "d", "e", and "f" to read as follows:

"Install the floating-point hardware accessory as follows:

d. Remove the ROM control card from slot 2, and check that the proper jumpers are installed on the card. (Refer to table US-1 of this supplement. Floating-point is installed as module one.)

e. Install the six integrated circuit sockets and insulators in the positions allotted to U25, U26, U27, U35, U37, and U65 and plug in the six ROM integrated circuits as follows:

(1) Part no. 1816-0054 into XU37
(2) Part no. 1816-0055 into XU35
(3) Part no. 1816-0056 into XU25
(4) Part no. 1816-0057 into XU65
(5) Part no. 1816-0058 into XU27
(6) Part no. 1816-0059 into XU26

f. Replace the ROM control card (with floating-point ROMs installed) in slot 2 of the computer and install the product identifier (part no. 12901-80001) over connector J2 of the card. (Connector J2 is the connector closest to the back of the computer.)" |

CHANGE

DESCRIPTION

6 Page 4-4, table 4-1. Change the HP part no., description, and mfr part no. columns for the following reference designations as follows:

“A2U25, 1816-0056, IC: ROM 4 x 256, 1816-0056;
 A2U26, 1816-0059, IC: ROM 4 x 256, 1816-0059;
 A2U27, 1816-0058, IC: ROM 4 x 256, 1816-0058;
 A2U35, 1816-0055, IC: ROM 4 x 256, 1816-0055;
 A2U37, 1816-0054, IC: ROM 4 x 256, 1816-0054;
 A2U65, 1816-0057, IC: ROM 4 x 256, 1816-0057.”

7 Page 4-5, table 4-1. Add the following to the appropriate columns:

“A2XU25, 1200-0767, 6, SOCKET: IC, 91506, 316AG5D-3R;
 A2XU26, 1200-0767, -, SOCKET: IC, 91506, 316AG5D-3R;
 A2XU27, 1200-0767, -, SOCKET: IC, 91506, 316AG5D-3R;
 A2XU35, 1200-0767; -, SOCKET: IC, 91506, 316AG5D-3R;
 A2XU37, 1200-0767, -, SOCKET: IC, 91506, 316AG5D-3R;
 A2XU65, 1200-0767, -, SOCKET: IC, 91506, 316AG5D-3R.”

8 Page 4-6. Replace figure 4-1 of the manual with figure US-1 of this supplement.

9 Page 5-1, table 5-1. Change the table to read as follows:

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0340-0788	Insulator: IC Socket	91506	316-6PI	6
1200-0767	Socket: IC	91506	316AG5D-3R	6
12901-80001	Product Identifier	28480	12901-80001	1
12901-90001	Operating and Service Manual	28480	12901-90001	1
1816-0054	ROM Integrated Circuit, 4 x 256	28480	1816-0054	1
1816-0055	ROM Integrated Circuit, 4 x 256	28480	1816-0055	1
1816-0056	ROM Integrated Circuit, 4 x 256	28480	1816-0056	1
1816-0057	ROM Integrated Circuit, 4 x 256	28480	1816-0057	1
1816-0058	ROM Integrated Circuit, 4 x 256	28480	1816-0058	1
1816-0059	ROM Integrated Circuit, 4 x 256	28480	1816-0059	1

10 Page 5-2, table 5-2. Add the following in the appropriate columns of the table.

“0340-0788, INSULATOR: IC SOCKET, 91506, 316-6PI, 6;
 1200-0767, SOCKET: IC, 91506, 316AG5D-3R, 6.”

11 Page 5-2, table 5-2. Change the ROM integrated circuit part numbers and descriptions as follows:

“1816-0006 to 1816-0054, IC ROM 4 x 256
 1816-0007 to 1816-0055, IC ROM 4 x 256
 1816-0008 to 1816-0056, IC ROM 4 x 256
 1816-0009 to 1816-0057, IC ROM 4 x 256
 1816-0010 to 1816-0058, IC ROM 4 x 256
 1816-0011 to 1816-0059, IC ROM 4 x 256”

CHANGE

DESCRIPTION

12

Page 5-2, table 5-3. Add the following in the appropriate columns of the table.

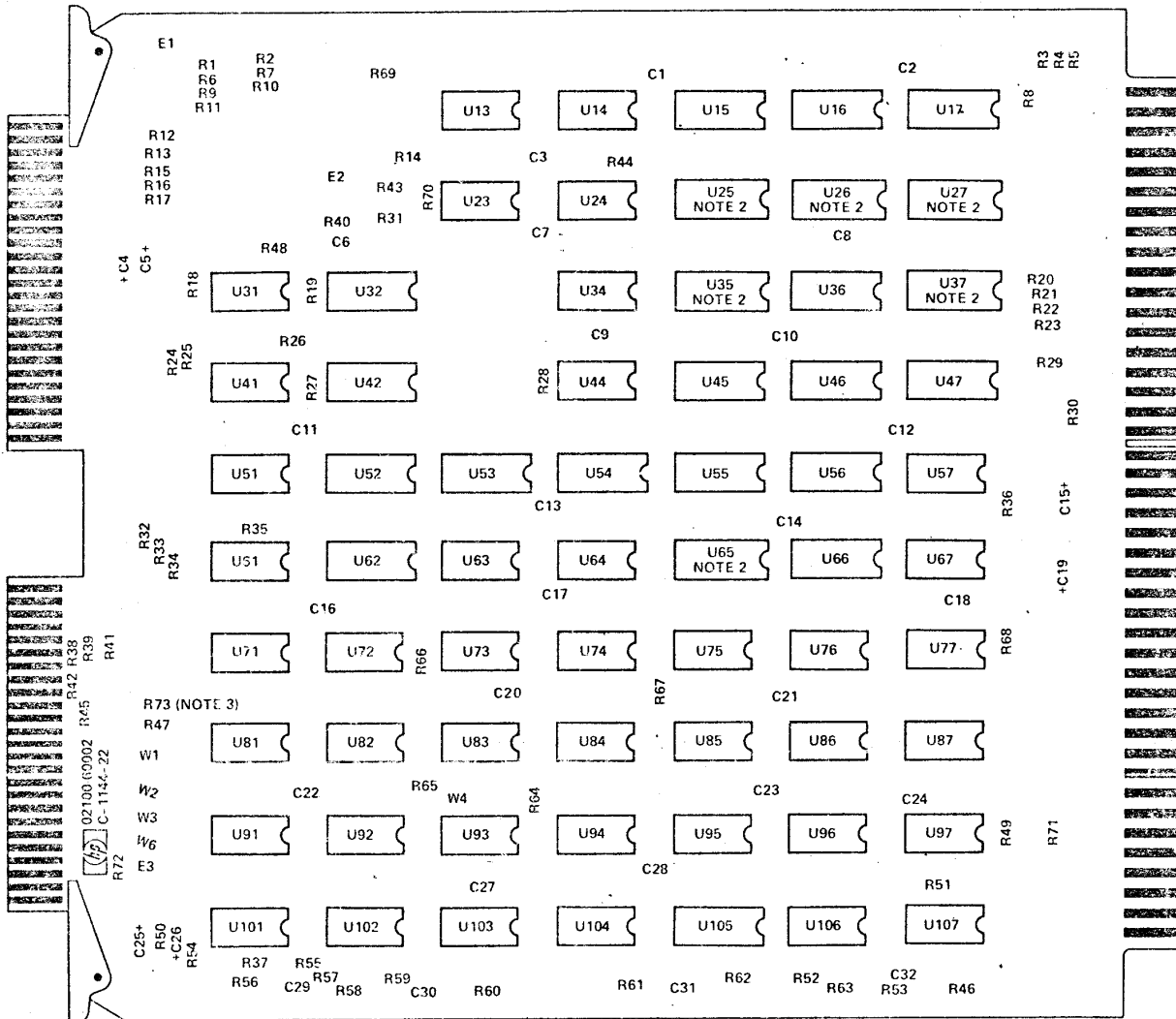
"91506, Augat Inc. Attleboro, Mass."

Table US-1. ROM Control Card A2 Jumper Connectors for Various Module Configurations

MODULES	JUMPERS TO BE INSTALLED					
	W1	W2	W3	W4	W5	W6
0	A to B	D to K	E to F	X	none	H to L
0,1 (floating point)	A to B	none	none	X	none	H to L

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Page 3-2. Change the FIX instruction error conditions to read, "If floating-point exponent is <0 , the integer 0 is returned."



DWG REV. C

- NOTES: 1. THIS DIAGRAM ALSO APPLIES TO CARD REV. A-1106-22 AND B-1132-22.
2. U25, U26, U27, U35, U37, AND U65 USED ONLY FOR OPTIONS SUCH AS FLOATING-POINT CAPABILITY.
3. R73 FIRST USED ON CARD REV. C-1144-22.

Figure US-1. ROM Control Card (with Floating-Point), Parts Location Diagram

HP 2100A FLOATING POINT DIAGNOSTIC

HP Product No. HP 24251



11000 Wolfe Road
Cupertino, California 95014

Manual of Diagnostics
Diagnostic Program Procedure
02100-90064

November 1971

HP 2100A FLOATING POINT DIAGNOSTIC

This diagnostic tests the HP 12901A Floating Point Option for the HP 2100A computer. It is a GO-NOGO test, exercising the Floating Point Option by comparing actual results with software-derived expected results. The diagnostic does not perform fault isolation; it does determine whether the Floating Point Option is working properly.

The information obtained by executing this diagnostic is not reliable if the following HP 2100A Diagnostics cannot successfully be executed prior to running this test.

<u>Diagnostic</u>	<u>Product No.</u>	<u>Document No.</u>
HP 2100A ALTER-SKIP INSTRUCTION TEST	HP 24208	02100-90019
HP 2100A MEMORY REF. INSTRUCTION TEST	HP 24209	02100-90018
HP 2100A SHIFT-ROTATE INSTRUCTION TEST	HP 24210	02100-90017
HP 2100A TTY TEST	HP 24201	5951-1365
HP 2100A MEMORY PROTECT TEST	HP 24222	02100-90006
HP 2100A EXTENDED ARITH. UNIT TEST	HP 24214	02100-90007

HARDWARE CONFIGURATION

This diagnostic runs on a 2100A computer with the HP 12901A option and a teleprinter.

SOFTWARE REQUIREMENTS

A SIO teleprinter driver is required in addition to the binary object tape containing the diagnostic.

OPERATIONAL CHARACTERISTICS

The diagnostic consists of the following seven tests.

Test

1. Fence and Indirect Test
2. FAD - Floating Add
3. FSB - Floating Subtract
4. FMP - Floating Multiply
5. FDV - Floating Divide
6. FIX - Floating to Fixed Point Number Conversion
7. FLT - Fixed to Floating Point Number Conversion

Normally the tests are run in the sequence: FAD, FSB, FMP, FDV, FIX and FLT. At the beginning of each 100 cycles, the Fence (memory protect boundary) and Indirect (indirect ADD) Test is executed. The diagnostic is controlled through the switch register and any of the tests except Fence and Indirect can be included or excluded in any particular cycle of the diagnostic. Switch register settings are shown in Table FPD-1.

At the start of each test, new arguments are produced by an internal random number generator (unless the generator is turned off via the switch register). The arguments are used to produce actual results and expected results (via software). The results are compared and any difference constitutes an error. Also, at the start of each test, the overflow register is cleared. The expected OV result is compared with the actual OV result and any difference is considered an error.

On the first test and at the beginning of each 100 cycles a multi-level indirect ADD test is executed. Successful execution of this test ensures that indirects are being handled properly and the fence value is properly restored.

Table FPD-1
Switch Register Settings

<u>Switch</u>	<u>Meaning If Set (or on)</u>
0	Add test will be executed.
1	Subtract test will be executed.
2	Multiply test will be executed.
3	Divide test will be executed.
4	Fix test will be executed.
5	Float test will be executed.
6	New random number will not be generated.
7	Not used
8	Not used
9	Display number of cycles and errors.
10	Terminate program.
11	Supress error messages.
12	Halt at end of 100 cycles.
13	Loop back to last executed test.
14	Halt on each error.
15	Halt after each test.

NOTE: If switches 0 through 5 are not set, all tests are executed in the normal sequence.

OPERATING INSTRUCTIONS

The diagnostic can be run in either of two ways: under control of the switch register or under control of an "internal switch register." To use the "internal switch register," the diagnostic must first be configured. Note that after configuration is complete, all switch register switches must be off for the "internal switch register" to be effective. If one or more switches of the switch register are set when the diagnostic is executed, the contents of the "internal switch register" are ignored and the diagnostic executes under control of the switch register.

At any time during the execution of a configured diagnostic, the run can be halted (by pushing HALT) and the diagnostic can be re-configured. When the diagnostic is run under control of the switch register, the user need not halt execution to select a different set of tests and/or options. In this case, the user need only set the switch register to the desired setting and the diagnostic executes those tests and/or options.

Configure And Execute

- a. Using BBL or BBDL, load and configure the appropriate SIO Teleprinter Driver.
- b. Load the diagnostic.
- c. Set starting address 2_8 .
- d. Consult Table FPD-1 to determine which tests and options are desired. Set the switch register accordingly.
- e. Push RUN.
 - (1) If the computer halts with 107001_8 displayed, the switch register is not properly set.
 - (2) If the computer halts with 107077_8 displayed, the "internal switch register" is set and the diagnostic is configured.
- f. Set all switch register switches off, if the diagnostic is to be run as configured. Prior to running the configured diagnostic, however, the user can set the switch register to any desired setting and run under control of the switch register by pushing RUN. Afterward, all the switch register switches can be set off and the diagnostic can be executed as it was configured.

Execute Non-configured Diagnostic

- a. Using BBL or BBDL, load and configure the appropriate SIO Teleprinter Driver.
- b. Load the diagnostic.
- c. Set starting address 100_8 .
- d. Consult Table FPD-1 to determine which tests and options are desired. Set the switch register accordingly.
- e. Push RUN.

NOTE: The SIO System Dump program can be used to make a binary tape of the configured SIO Teleprinter Driver and the diagnostic if desired.

MESSAGES

The program provides two types of messages; diagnostic and error description. Message data, except for cycle and error counts, is in octal; cycle and error counts are in decimal.

Diagnostic Messages

Except for the cycle and error messages, the diagnostic messages are switch-independent. To obtain the cycle and error messages, switch 11 must be on.

<u>Message</u>	<u>Remarks</u>
H1 2100 FLOATING POINT DIAGNOSTIC	Printed at start of diagnostic

<u>Message</u>	<u>Remarks</u>
H2 THIS IS NOT A LEGAL SWITCH SETTING H3 SET SWITCH REGISTER AGAIN, PUSH RUN	This message will only occur during configuration if (a) switch 10 is on, or (b) if all switches other than 10, 8, and 7 are off.
H4 <i>xxxxx</i> CYCLES WITH <i>yyyyy</i> ERRORS H5 END OF 2100 FLOATING POINT DIAGNOSTIC H6 FOR RESTART S.A.100B, FOR RECONFIGURATION S.A.2B	This message is printed when the diagnostic is terminated by setting switch 10 on. <i>xxxxx</i> = number of cycles up to $32,767_{10}$ <i>yyyyy</i> = number of errors up to $32,767_{10}$ If <i>x</i> or <i>y</i> exceeds $32,767_{10}$ the value is reset to zero. If switch 9 is on and switch 11 is off, the H4 line is printed when the diagnostic is terminated.

Error Description Messages

To obtain any of the following messages, switch 11 must be off.

<u>Message</u>	<u>Remarks</u>
E1 MEMORY PROTECT BOUNDARY TOO HIGH	Will occur during Fence and Indirect Test (test 1) if the floating point hardware changed the memory protect fence value to a higher value.
E2 MEMORY PROTECT BOUNDARY TOO LOW	Will occur during test 1 if the floating point hardware changed the memory protect fence value to a lower value.
E3 STORE ON BOUNDARY DID NOT WORK PROPERLY	Will occur during test 1 if an attempted store on the memory protect boundary did not work properly.

<u>Message</u>				<u>Remarks</u>
E4	INDIRECT ADDITION			Will occur in test 1 if an error occurs in the indirect address type of floating add.
E5	ADDEND1	123456	102102	
E6	ADDEND2	177777	021340	
E7	EXPECTED	1 177777	111111	
E8	ACTUAL	0 177777	111111	
E9	ADDITION			Will occur if an error occurs in a floating add (FAD) test.
E5	ADDEND1	123456	123456	
E6	ADDEND2	654321	654321	
E7	EXPECTED	1 177731	123456	
E8	ACTUAL	1 143210	123456	
E10	SUBTRACTION			Will occur if an error occurs in a floating subtract (FSB) test.
E11	MINUEND	123456	154321	
E12	SUBTRAHEND	000123	054321	
E7	EXPECTED	0 111111	111111	
E8	ACTUAL	0 000000	000000	
E13	MULTIPLICATION			Will occur if an error occurs in a floating multiply (FMP) test.
E14	MULTIPLICAND	123456	152433	
E15	MULTIPLIER	012345	001000	
E7	EXPECTED	1 101230	123322	
E8	ACTUAL	1 010320	112233	
E16	DIVISION			Will occur if an error occurs in a floating divide (FDV) test.
E17	DIVIDEND	144322	123331	
E18	DIVISOR	001111	002136	
E7	EXPECTED	0 111111	111111	
E8	ACTUAL	1 111111	111111	
E19	FIX			Will occur if an error occurs in the FIX test.
E20	OPERAND	155555	333333	
E21	EXPECTED	0 123456		
E22	ACTUAL	0 123456		
E23	FLOAT			Will occur if an error occurs in the FLT test.
E24	OPERAND	123321		
E7	EXPECTED	0 112211	125521	
E8	ACTUAL	0 143512	161631	

HALTS

The halt codes and their meanings are shown in Table FPD-2.

Table FPD-2
Halt Codes

HALT	MEANING
107001B	Error in switch setting during configuration
107077B	End of configuration section
102002B	Memory protect did not interrupt on an illegal store operation
102003B	Memory protect interrupted on a store in the fence boundary
102004B	Memory protect did not interrupt on an illegal store operation
102010B	End of first test
102011B	End of floating addition test
102012B	End of floating subtraction test
102013B	End of floating multiplication test
102014B	End of floating division test
102015B	End of FIX test
102016B	End of Float test
102020B	Indirect floating addition error
102021B	Floating add error
102022B	Floating subtract error
102023B	Floating multiply error
102024B	Floating divide error
102025B	Fix error
102026B	Float error
102076B	End of 100 cycles
102077B	End of test