HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

12581A

MEMORY PROTECT ACCESSORY KIT

(FOR THE 2116B COMPUTER)

Note

This manual should be retained with Volume Two of the 2116B Computer documentation.

12581-9001

HEWLETT-PACKARD COMPANY
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CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This operating and service manual covers general information, installation, programming, theory of operation, maintenance instructions, and replaceable parts for the Hewlett-Packard 12581A Memory Protect Computer Accessory Kit.

1-3. GENERAL DESCRIPTION.

1-4. The memory protect accessory kit consists of a single printed-circuit card (part no. 12581-6001) that plugs into slot 21 of the HP 2116B Computer. The card protects a selected block of memory of any size from 1 to 32,768 words against alteration by memory reference instructions. It also gives a program in memory exclusive control of the input/output (I/O) section of the computer. The kit also includes the HP 20418B Memory Protect Diagnostic Tape.

1-5. MEMORY PROTECTION.

1-6. Memory location 000001 is the lower boundary of protected memory. The upper boundary is selected by loading an address from the A- or B-register of the computer into the fence register of the memory protect card. All memory locations below the fence register address are then protected except 000000 and 000001 (the A- and B-register addresses). When a program instruction directly references protected memory, the card inhibits execution of the instruction and stores the effective address of the instruction in the A- or B-register.

1-7. EXCLUSIVE INPUT/OUTPUT CONTROL.

1-8. To give a program in memory exclusive control of the I/O section of the computer, the memory protect card limits I/O instructions to one-phase instructions in interrupt locations and instructions that reference select code 01 (switch and overflow registers). This feature is necessary for systems where the program must have exclusive control of the I/O section of the computer (such as the Hewlett-Packard real-time executive system).

1-9. IDENTIFICATION.

1-10. Printed-circuit card revisions are identified by a letter and a date code stamped on the card. The letter code identifies the version of the etched trace pattern on the unloaded card. The date code refers to the electrical characteristics of the loaded card. If the date code stamped on the memory protect printed-circuit card does not agree with the date code shown on the schematic in 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.

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains unpacking and inspection, and installation information for the memory protect accessory kit. Before installing the kit, preliminary steps to ensure compatibility of the kit with the computer should be performed. Paragraph 2-5 contains information regarding computer compatibility and paragraph 2-7 contains instructions for connecting jumper wires on the memory protect card. Refer to these paragraphs before installing the 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 (cracks, broken parts, etc.). If the card is damaged or 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. COMPUTER COMPATIBILITY.

2-6. All HP 2116B Computers with a serial number prefix of 846- or lower contain a power failure interrupt card in slot 1 that is not compatible with the memory protect card. The incompatible card is identified by part no. 02116-6175, revision letter C or earlier, and date code 821 or lower. Before the memory protect card is installed, the incompatible card must be replaced by one of the following:

CAUTION

Always turn off the computer POWER switch before removing or inserting cards in computer slots to prevent damage to card components.

a. Power Failure Interrupt Card, part no. 02116-6175, revision letter D or later, date code 821 or higher.

b. Power Failure Interrupt with Automatic Restart Card (part of the HP 12588A Accessory Kit).

2-7. JUMPER WIRE CONNECTIONS.

2-8. I/O CONTROL CARD.

2-9. Before installing the memory protect card, turn off the computer POWER switch and remove the I/O Control Card, part no. 02116-6041 from slot 201. Make sure jumper wire W3 is removed from the I/O control card. (The jumper wire is labeled on the component side of the card.) When jumper wire W3 has been removed, return the I/O control card to slot 201.

2-10. MEMORY PROTECT CARD.

2-11. The lower-right corner on the component side of the memory protect card contains three jumper wires labeled W1, W2, and W3. (See figure 2-1.) The positions of these jumper wires adapt the memory protect card to various sizes of core memory. Table 2-1 indicates the proper positions of the jumper wires for memory sizes of 8K to 32K. Install the three jumper wires according to the size of the computer memory, verify that the computer POWER switch is off, and plug the memory protect card into slot 21 in the computer.

2-12. INSTALLATION CHECKOUT.

2-13. After installing the memory protect card, check the operation of the card by running the memory protect diagnostic program. Instructions for running this program are contained in the manual supplement attached to the back of this manual.

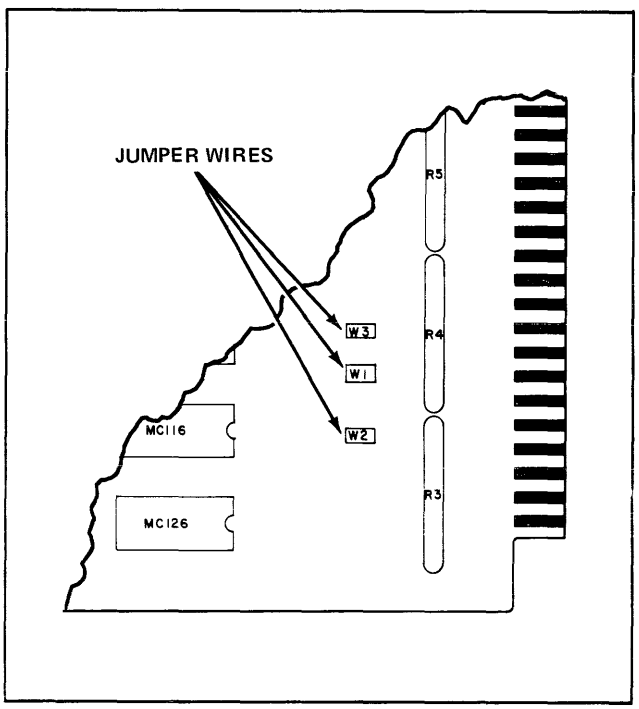


Figure 2-1. Jumper Wire Locations on the Memory Protect Card

Table 2-1. Memory Protect Card Jumper Wire Connections

CORE MEMORY CAPACITY	CONNECT JUMPER WIRE W3 FROM MC56 PIN 4 TO	CONNECT JUMPER WIRE W2 FROM MC56 PIN 7 TO	CONNECT JUMPER WIRE W1 FROM MC56 PIN 11 TO
32K	Card Pin 72	Card Pin 77	Card Pin 74
24K	Card Pin 72	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 74
16K	Card Pin 1,2,85,86 (Ground)	Card Pin 77	Card Pin 74
8K	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 74

SECTION III
PROGRAMMING

3-1. INTRODUCTION.

3-2. This section contains information for programming the memory protect card.

3-3. GENERAL PROGRAMMING RULES.

3-4. The memory protect card is programmed by using the five I/O instructions listed in table 3-1. The card can be enabled only by a STC 05 instruction. It can be disabled by pressing the PRESET switch on the computer front panel while the computer is in the halt mode, or by an interrupt. Each interrupt that occurs, except an interrupt to a memory location containing a one-phase instruction, disables memory protect. To enable the memory protect card after an interrupt, interrupt subroutines should end with a STC 05 instruction before the JMP, I instruction.

3-5. MEMORY REFERENCE INSTRUCTIONS.

3-6. ILLEGAL INSTRUCTIONS.

3-7. Any of the following memory reference instructions is illegal if it references a protected memory location: a read-modify-write instruction (ISZ and JSB), a clear-write instruction (STA and STB), and a jump instruction (JMP). Any of these instructions causes the memory protect card to store the effective address of the illegal instruction, inhibit its execution, and request an interrupt to location 000005. When the interrupt is acknowledged, the memory protect card control is reset, turning off the memory protect card.

3-8. LEGAL INSTRUCTIONS.

3-9. An instruction indirectly referenced through protected memory is legal if its effective address is outside protected memory. The indirect linking address can be inside protected memory, but the address ultimately affected must be outside. For example, with effective addresses outside protected memory the following instructions are legal: ISZ,I; JSB,I; STA,I; and JMP,I. Legal indirect instructions do not cause the memory protect card to inhibit their execution or request an interrupt.

3-10. INPUT/OUTPUT INSTRUCTIONS.

3-11. ILLEGAL INSTRUCTIONS.

3-12. When the memory protect card is enabled, a halt instruction (HLT) is always illegal.

3-13. LEGAL INSTRUCTIONS.

3-14. The only legal I/O instructions are one-phase instructions in interrupt locations, and instructions referencing select code 01 (switch and overflow registers). These two types of instructions do not cause the memory protect card to either store their effective address, inhibit their execution, or request an interrupt.

Table 3-1. Instructions Used to Program the Memory Protect Card

INSTRUCTION	MACHINE LANGUAGE	DEFINITION
STC 05	102705	Turn on the Memory protect card.
OTA 05	102605	Set the fence register; the A-register contains the address of the word next above those to be protected.
OTB 05	106605	Set the fence register; the B-register contains the address of the word next above those to be protected.
LIA 05	102505	Load the effective address of the illegal instruction into the A-register.
LIB 05	106505	Load the effective address of the illegal instruction into the B-register.

3-15. PARITY ERRORS.

3-16. IDENTIFYING PARITY ERRORS.

3-17. When the memory protect card is used simultaneously with the HP 12591A Parity Check Accessory Kit in the HP 2116B Computer, the memory protect card identifies the location of parity errors. The memory location containing the parity error is loaded into the violation register of the memory protect card and the parity check card requests an interrupt to location 000005. The two cards share select code 05. When an interrupt occurs, it is necessary to determine which of the two cards originated it. This is done by an SSA or SSB instruction (checks the sign of bit 15 of the A- or B-register). First an LIA or LIB instruction loads the contents of the violation register of the card into the A- or B-register. Then the SSA or SSB instruction checks the sign of bit 15. If it is a logic 0, a violation of protected memory has been attempted; if it is a logic 1, a parity error has occurred.

3-18. SAMPLE SUBROUTINE.

3-19. Table 3-2 provides a sample interrupt subroutine for use with HP 2116B Computers that contain both the HP 12581A Memory Protect Accessory Kit and the HP 12591A Parity Check Accessory Kit. A JSB instruction referencing this subroutine is assumed to be stored in location 000005.

3-20. MEMORY PROTECT FLOWCHART.

3-21. Figure 3-1 provides a flowchart illustrating the decisions made and the events that occur when the memory protect card is enabled.

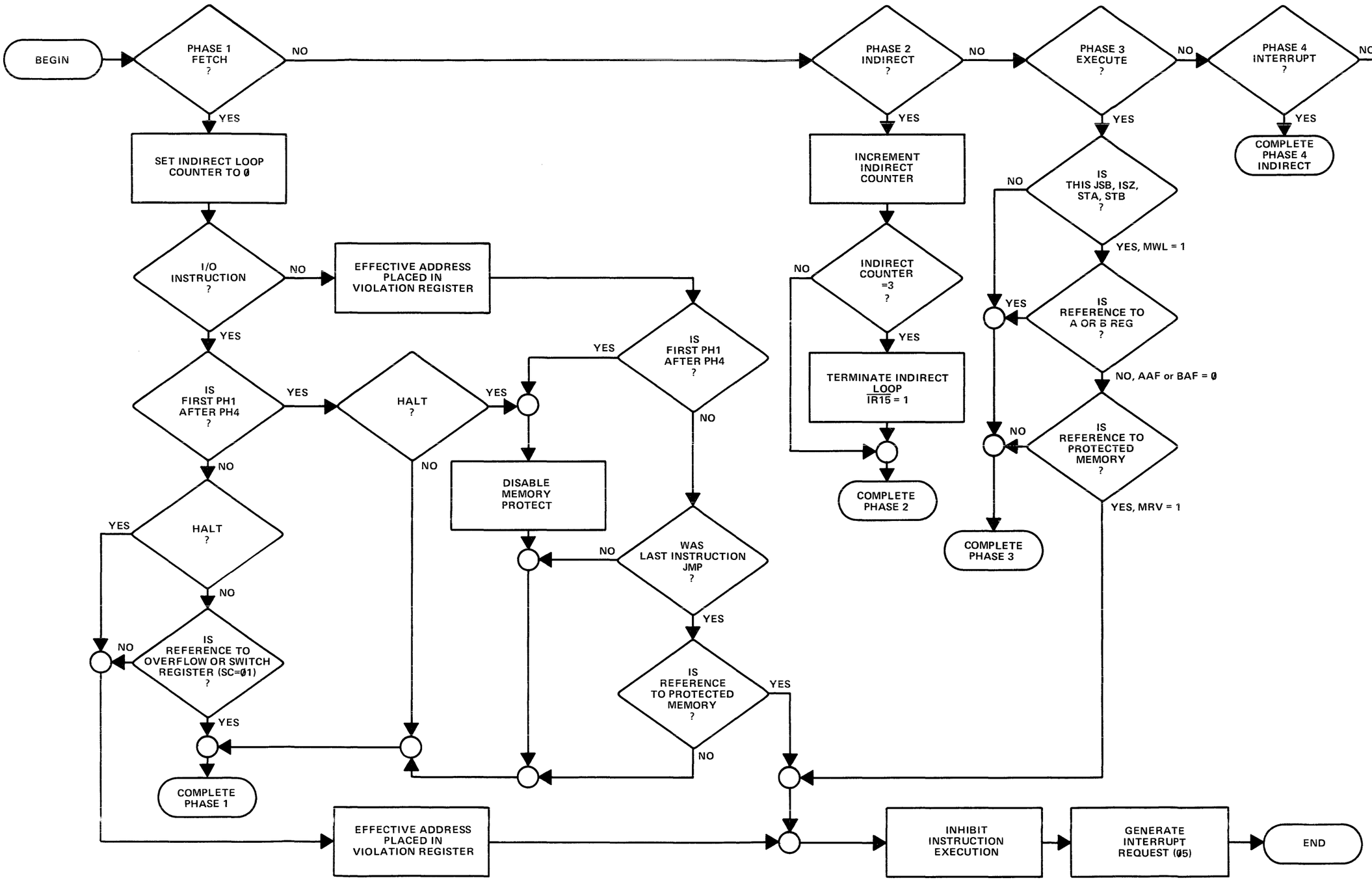


Figure 3-1. Memory Protect Card Flowchart

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains detailed theory of operation for the memory protect card. See the schematic diagram for the card at the end of section V of this manual when referencing the theory presented in the following paragraphs.

4-3. DETAILED THEORY OF OPERATION.

4-4. MEMORY VIOLATION.

4-5. The summing network consists of four 4-bit binary adders and a "nor" gate. The adders are fed the following signals: the memory address from the M-Register (M0 through M14), the fence register address (FR0 through FR14), and +4.5 volts. Only the carry outputs of the adders are used. The carry outputs provide a memory violation (MEV) signal at the output of "nor" gate MC54A. The summing network checks the M-register address for attempted violation of protected memory and provides a true MEV signal if the effective address is inside protected memory. To make the check, the summing network adds the M-register address to the two's complement of the fence register address. If the M-register address is outside protected memory, a true carry output results. The true carry output is inverted by MC54A to provide a false MEV signal that permits execution of the instruction addressed. If the M-register address is inside protected memory, a false carry results. The false carry is inverted by MC54A and provides a true MEV signal that prevents execution of the instruction.

4-6. The following are examples of the testing sequence:

a. Memory violation not attempted:

04001	M-register address.
04000	Fence register address.
73777	One's complement of the fence register address.
+1	Add 1 (+4.5 volts).
74000	Two's complement of the register address.
+04001	Add M-register address.
1 00001	Provides true carry output.

Note

When the true carry output is inverted by the "nor" gate in the summing network, it provides a false MEV signal that permits execution of the instruction.

b. Memory violation attempted:

03777	M-register address.
04000	Fence register address.
73777	One's complement of the fence register address.
+1	Add 1 (+4.5 volts).
74000	Two's complement of the fence register address.
+03777	Add M-register address.
0 77777	Provides false carry output.

Note

When the false carry output is inverted by the "nor" gate in the summing network, it provides a true MEV signal that prevents execution of the instruction.

4-7. A true MEV signal, through associated logic circuits, inhibits execution of an attempted memory violation and causes an interrupt. When the MEV signal is true, it enables the memory reference violation circuit to provide a memory reference violation (MRV) signal to the interrupt circuit and the inhibit circuit. The inhibit circuit inhibits the instruction register, preventing completion of the instruction. The interrupt circuit provides an interrupt request (IRQ) signal to the input/output address card to form part of the service request address (000101) of the memory protect card. When the interrupt is acknowledged, the interrupt acknowledge (IAK) signal causes the I/O violation circuit to reset the control flip-flop (FF), turning off the memory protect card.

4-8. ENABLING MEMORY PROTECT.

4-9. The memory protect card is enabled by the I/O set control instruction to select code 05 (STC 05). This instruction causes three signals to feed into the memory protect

control logic: set control (STC), select code most significant octal digit 0 (SCM0), and select code least significant octal digit 5 (SCL5). The SCM0 and SCL5 signals, from the I/O address card, are "anded" in the I/O violation circuit and fed to gate MC75A in the memory protect control circuit. The STC signal from the shift logic card is also fed to this gate. When the three signals are true, gate MC75A sets the control FF, which enables the memory protect card. During the various machine timing phases of the computer, the enabled card tests words that are in the T-register and counts indirect instructions.

4-10. PHASE 1.

4-11. During the fetch phase (phase 1) the option resets indirect counter FF's IC1 and IC2 and tests for I/O violation and unconditional jump (JMP) violation attempts. To detect I/O and JMP violation attempts, the I/O violation circuit first determines whether or not the word in the T-register is an I/O instruction. If it is, the input/output group (IOG) signal from the instruction decoder card is true.

4-12. If the IOG signal is false, the word is not an I/O instruction. The IOG signal feeds four "and" gates in the I/O violation circuit: MC44C, MC35A, MC35B, and MC43A. If the word is not an I/O instruction, the false IOG signal disables MC44C, MC35A, MC35B, and MC43A. This causes MC34A to output a true signal to "and" gate MC45B on the register control circuit. At time period 4 (T4), the T4 generator FF makes the fourth input to MC45B true and the MC45B output clocks the effective address of the instruction into the violation register. Also at T4, if the instruction is a jump unconditionally (JMP), a JMP signal from the instruction decoder card sets the jump protect FF in the jump violation circuit. A JMP instruction assures that the next phase will also be a phase 1. During the second phase 1, the jump violation circuit tests the jump protect FF set output and the memory violation (MEV) signal from the summing network. If the MEV signal is false, the JMP instruction is not referenced to protected memory and it will be completed. If the MEV signal is true, the JMP instruction is referenced to protected memory, gate MC55C is enabled, and a jump violation (JMV) signal is provided to the memory reference violation circuit. This enables the memory reference violation circuit to generate a memory reference violation (MRV) signal.

4-13. The MRV signal enables the inhibit and interrupt circuits on the memory protect card. By inhibiting the instruction register on the instruction decoder card, the inhibit circuit prevents completion of the instruction. The enabled interrupt circuit causes an interrupt to memory location 000005.

4-14. If the IOG signal is true, the word in the T-register is an I/O instruction. One-phase instructions in interrupt locations are read during the first phase 1 (fetch) after a phase 4 (interrupt). All I/O instructions are one-phase. To determine whether or not the I/O instruction is in an interrupt location, the I/O violation circuit tests the interrupt acknowledge (IAK) signal from the I/O control card. If the I/O instruction is in an interrupt location, the preceding phase was a phase 4, the IAK signal has set the IAK FF, and the instruction will be completed. The true set output of the IAK FF "anded" with the IOG signal by gate MC43A inhibits "nor" gate MC34A. The "nor" gate inhibits "and" gate MC44C from providing a violation register clock enable (VRCE) signal that would enable the register control circuit to clock the effective address of the instruction into the violation register. At this same time the false reset output of the IAK FF inhibits gate MC44D from providing an input/output violation (IOV) signal that would enable the inhibit circuit to prevent completion of the instruction and enable the interrupt circuit to cause an interrupt to location 000005.

4-15. If the preceding phase was not a phase 4, the I/O violation circuit tests for the illegal HLT instruction and prevents its completion. To do this, the I/O violation circuit tests the halt instruction decoded (HIN) signal from the shift logic card. A HLT instruction makes the HIN signal true, and the IOG signal enables the HIN signal to gate through MC44C at T3 to provide a VRCE signal. The MC44C gate output also provides an IOV signal at the output of MC44D. The VRCE signal enables the register control circuit to clock the effective address of the instruction into the violation register. The IOV signal enables the inhibit circuit to prevent completion of the instruction and the interrupt circuit to cause an interrupt to location 000005.

4-16. If the I/O instruction is not a HLT, the I/O violation circuit determines whether or not the instruction is one of the second class of legal instructions: those referencing the overflow or the switch register (select code 01). If it is, the instruction will be completed. To identify a select code 01 instruction, the I/O violation circuit tests the following two signals from the I/O address card: select code most significant octal digit 0 (SCM0) and select code least significant octal digit 1 (SCL1). If the instruction references select code 01, SCM0 and SCL1 signals are gated through MC22A, are "anded" with the IOG signal in MC35B, and generate a false output at MC34A. The false output inhibits gate MC44C from providing an IOV signal, enabling completion of the instruction.

4-17. If the instruction does not reference select code 01, "nor" gate MC34A does not output a false signal, and its true output enables one input of gate MC44C. The IOG signal enables a second input of the gate, and T3TS enables the third input. The true output of the MC44C buffered by MC63B, becomes the VRCE signal. The output of MC44C is also "anded" with the true reset output of the IAK FF in MC44D to generate the IOV signal. The VRCE signal enables the register control circuit to clock the effective address of the instruction into the violation register. The IOV signal enables the inhibit circuit to prevent completion of the instruction and enables the interrupt circuit to cause an interrupt to location 000005.

4-18. PHASE 2.

4-19. During phase 2, the memory protect card counts the levels of indirect addressing. After three, the card re-

enables interrupt. After four, interrupt is disabled. The phase 2 indirect (PH2) signal from the timing generator card is applied to gate MC23B in the indirect counter. The set interrupt request (SIR) signal is also applied to gate MC23B after being buffered by MC65A in the I/O violation circuit. At T5 the SIR signal enables the PH2 signal to gate through to the IC1 FF. At the end of T5, the negative going SIR signal switches the IC1 FF from the reset state, produced by the last PH1 signal, to a set state. As the set output of the IC1 FF goes true, it makes one input of "and" gate MC23A true, but does not change the state of the IC2 FF. If a second indirect phase occurs, the negative-going T5 will reset the IC1 FF. The false set output of the signal at the end of T5 will reset the IC1 FF. The false set output of the IC1 FF sets the IC2 FF. The reset IC1 FF disables MC23A. If a third indirect phase occurs, at the end of T5 the negative-going PH2 signal will set the IC1 FF, and IC2 remains set. The true set outputs of the two FF's MC23A output a true signal. The output, $\overline{IR15}$, enables the interrupt system, but does not force an interrupt.

4-20. PHASE 3.

4-21. While in the execute phase (phase 3), the memory protect card checks all memory reference instructions except JMP (which is checked while in phase 1). The effective address of all memory reference instructions is clocked into the violation register during phase 1. In phase 3 of a memory reference instruction that has two or more phases, the memory protect card determines whether or not the instruction is one of four that alter the contents of memory. The four are the read-modify-write instructions, ISZ and JSB, and the clear-write instructions, STA and STB. To detect one of these instructions, the card checks four signals: memory reference violation (MEV), memory write level (MWL), A-addressable flip-flop (AAF), and B-addressable flip-flop (BAF).

4-22. In the memory reference violation circuit, the MWL signal from the timing generator card is buffered by MC55B and fed into "and" gate MC55A, which feeds "and" gate MC45A. A second input to MC45A is the MEV signal from the summing network. The other two inputs are T1 and TS. When MC45A is enabled, it provides an MRV signal that enables the inhibit circuit logic to prevent completion of the instruction and enables the interrupt circuit to cause an interrupt to location 000005. When either the MWL or the MEV signal is false, MC45A cannot provide the MRV signal and the instruction will be completed. If the MWL signal is false, the instruction is not one of the four that would alter the contents of memory (ISZ, JSB, STA, or STB). If the MWL signal is true, the instruction will be checked to see if it is addressed protected memory or to the A- or B-register.

4-23. An instruction addressed to the A-register makes the AAF signal true. An instruction addressed to the B-register makes the BAF signal true. The AAF and BAF signals feed "nor" gate MC34B. If either AAF or BAF is true, MC34B outputs a false signal, which disables "and" gate MC55A. MC55A will then keep "and" gate MC45A from providing an MRV signal. Because the ISZ, JSB, STA, or STB signal is referencing the A- or B-register and not protected memory, the instruction will be completed. If neither the AAF nor the BAF signal is true, a violation attempt is indicated and the output of MC34B is true. At T1 an MRV signal is generated by MC45A that enables the inhibit circuit and the interrupt circuit. The instruction will not be completed and its effective address will remain stored in the violation register.

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains troubleshooting and preventive maintenance information for the memory protect card.

5-3. PREVENTIVE MAINTENANCE.

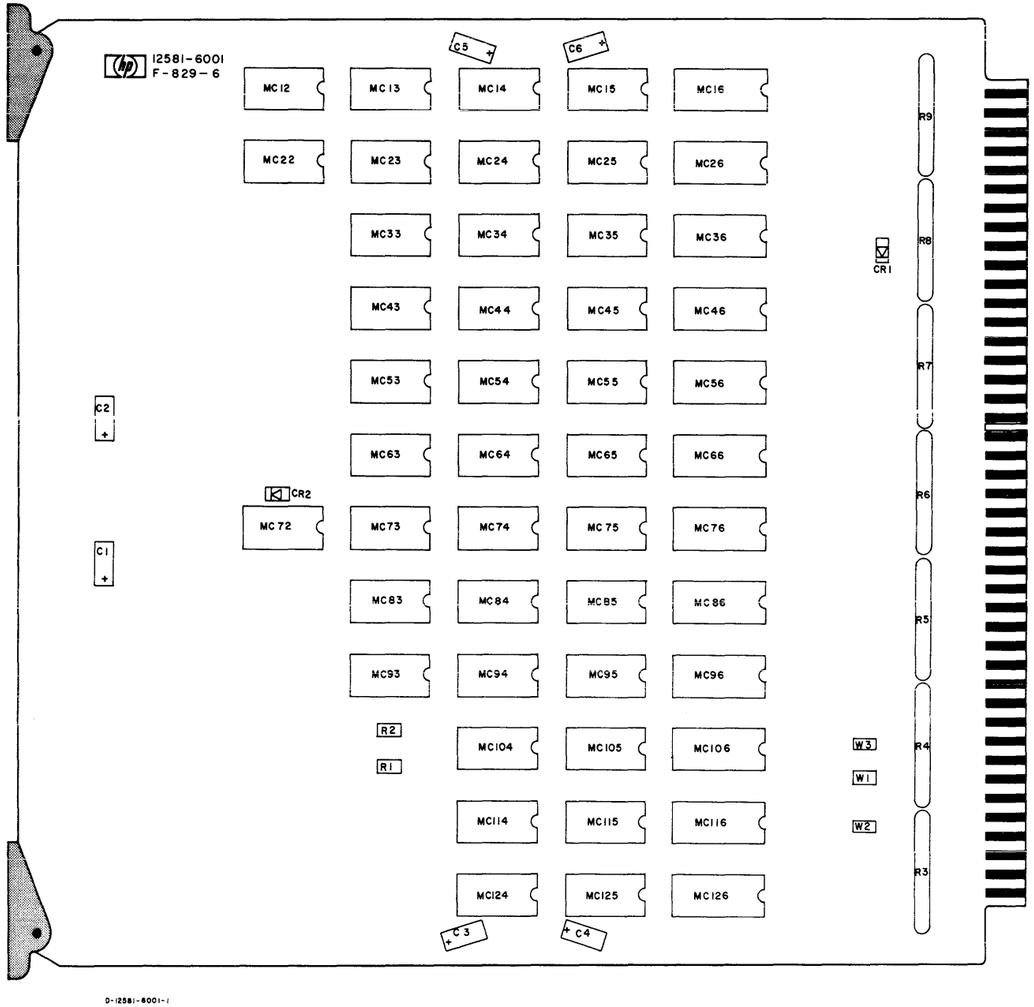
5-4. There are no regular preventive maintenance procedures to be performed on the memory protect card. However, as a periodic confidence check of the card, it is desirable to run the memory protect diagnostic program. Compiete diagnostic test procedures are contained in the manual supplement attached to the back of this manual.

5-5. TROUBLESHOOTING.

5-6. Troubleshooting the memory protect card is accomplished by performing the diagnostic tests contained in the manual supplement attached to this manual and analyzing the error halts that occur as the test is being run. To further isolate trouble, refer to the schematic and parts location diagrams in figure 5-1. Table 5-1 contains a complete parts list for the memory protect card with parts listed in alphanumeric order of reference designation. Refer to Volumes Two and Three of the HP 2116B Operation and Maintenance Manual for additional information on backplane wiring, signal data, etc., not included in this manual.

Table 5-1. Memory Protect Card (12581-6001) Replaceable Parts

REFERENCE DESIGNATION	HP STOCK NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C6	0180-0197	Capacitor, Fxd, Elect, 2.2μf, 10%, 20 VDCW	28480	0180-0197
CR1	1901-0040	Diode, Si, 30mA	07263	FDG1088
CR2	1910-0022	Diode, Germanium, 5 wiv	28480	1910-0022
MC12, 13, 14, 24, 72, 73,84	1820-0967	Integrated Circuit, CTL	07263	SL3464
MC15, 23	1820-0966	Integrated Circuit, CTL	07263	SL3463
MC16, 36, 66, 86, 96, 106, 116, 126	1820-0301	Integrated Circuit, TTL	01295	SN7475N
MC22	1820-0971	Integrated Circuit, CTL	07263	SL3467
MC25, 55	1820-0964	Integrated Circuit, CTL	07263	SL3461
MC26, 46, 56, 76	1820-0305	Integrated Circuit, TTL	01295	SN7472N
MC33, 34, 53	1820-0952	Integrated Circuit, CTL	07263	SL3455
MC35, 85, 93, 94, 95, 104, 105, 114, 115, 124, 125	1820-0956	Integrated Circuit, CTL	07263	SL3459
MC43, 44, 75	1820-0953	Integrated Circuit, CTL	07263	SL3456
MC45	1820-0954	Integrated Circuit, CTL	07263	SL3457
MC63, 65, 83	1820-0965	Integrated Circuit, CTL	07263	SL3462
MC74	1820-0957	Integrated Circuit, CTL	07263	SL3460
R1, 2	0683-6805	Resistor, Fxd, Comp, 68 ohms, 5%, 1/4w	01121	CB6805
R3 thru R9	1810-0020	Resistor Network, Met Flm (7 res)	28480	1810-0020
W1, 2, 3	8159-0005	Jumper Wire	28480	8159-0005



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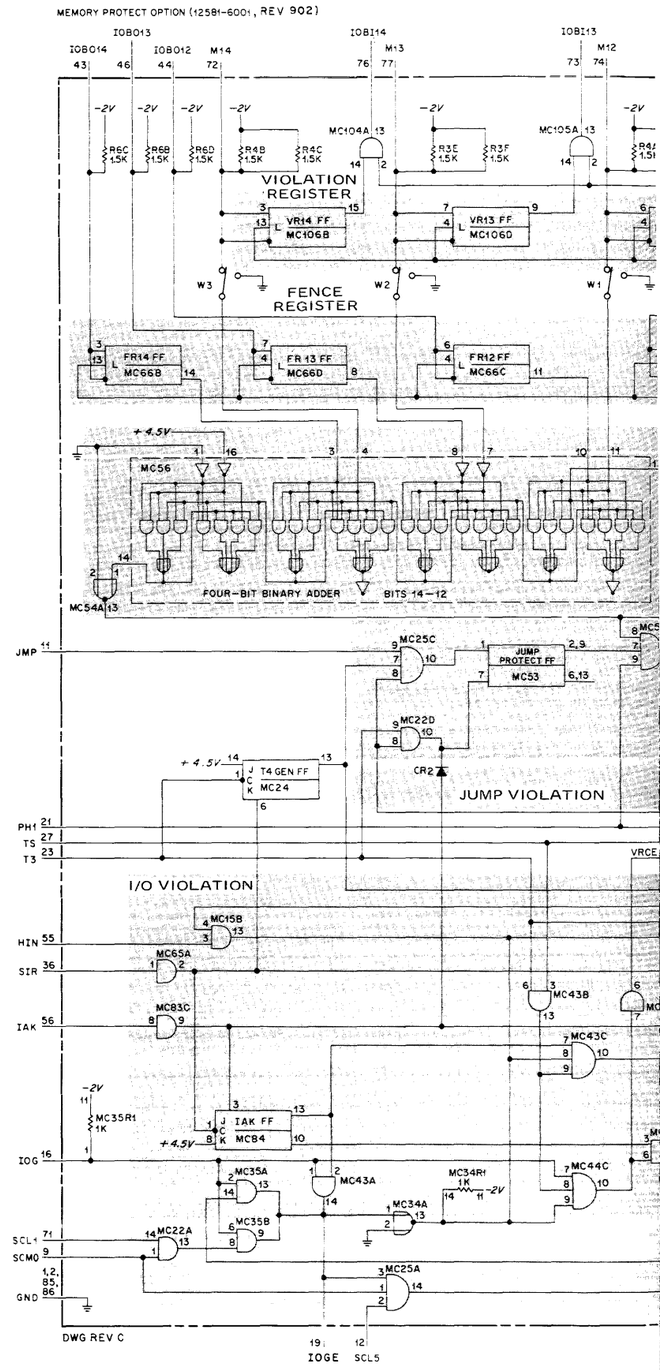

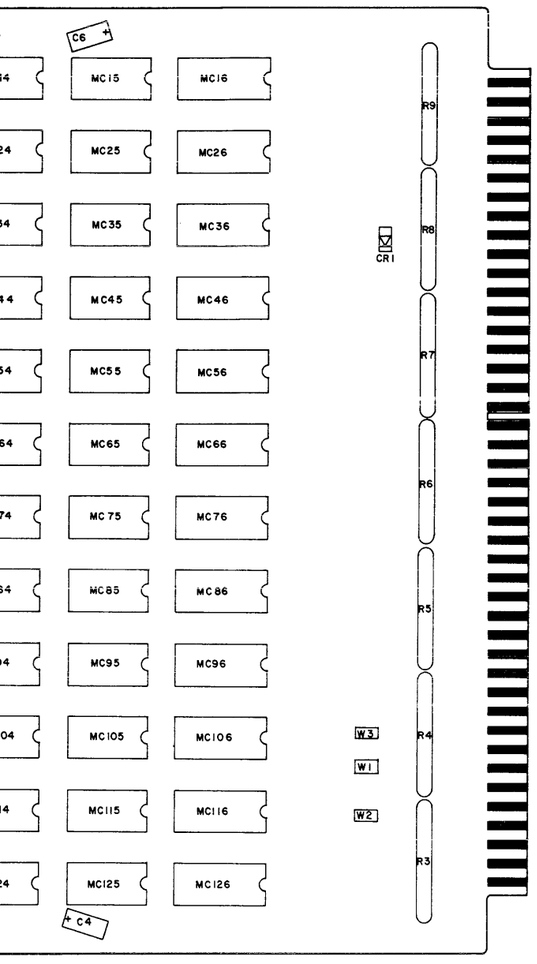
C6
MC15
MC16
MC25
MC26
MC35
MC36
CR1
MC45
MC46
MC55
MC56
MC65
MC66
MC75
MC76
MC85
MC86
MC95
MC96
MC105
MC106
W3
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W2
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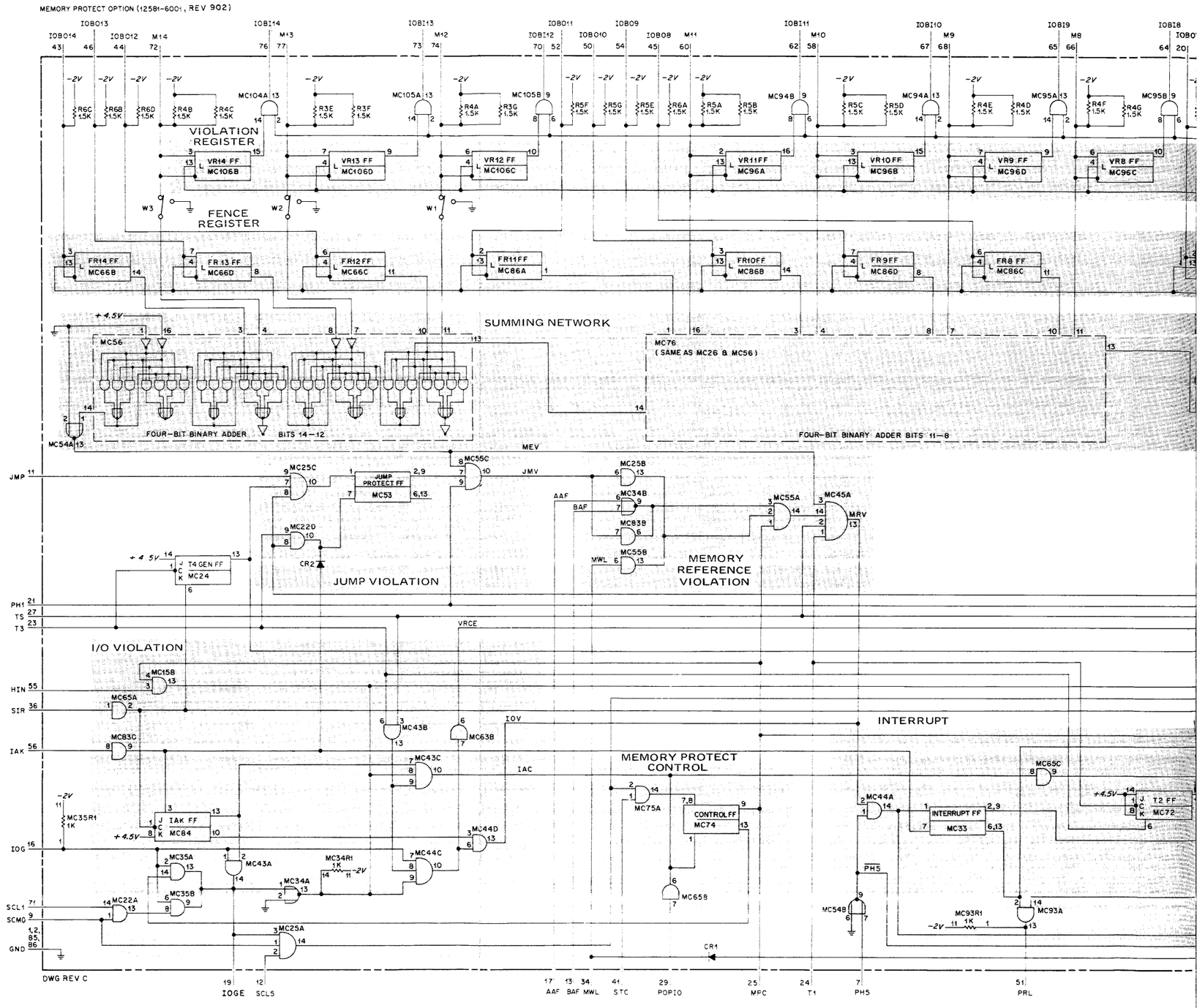
R7
R6
R5
R4
R3


MEMORY PROTECT OPTION (12581-6001, REV 902)
VIOLATION REGISTER
FENCE REGISTER
SUMMING NETWORK
FOUR-BIT BINARY ADDER
BITS 14-12
FOUR-BIT BINARY ADDER BITS 11-8
JUMP VIOLATION
MEMORY REFERENCE VIOLATION
I/O VIOLATION
MEMORY PROTECT CONTROL
INTERRUPT
DWG REV C

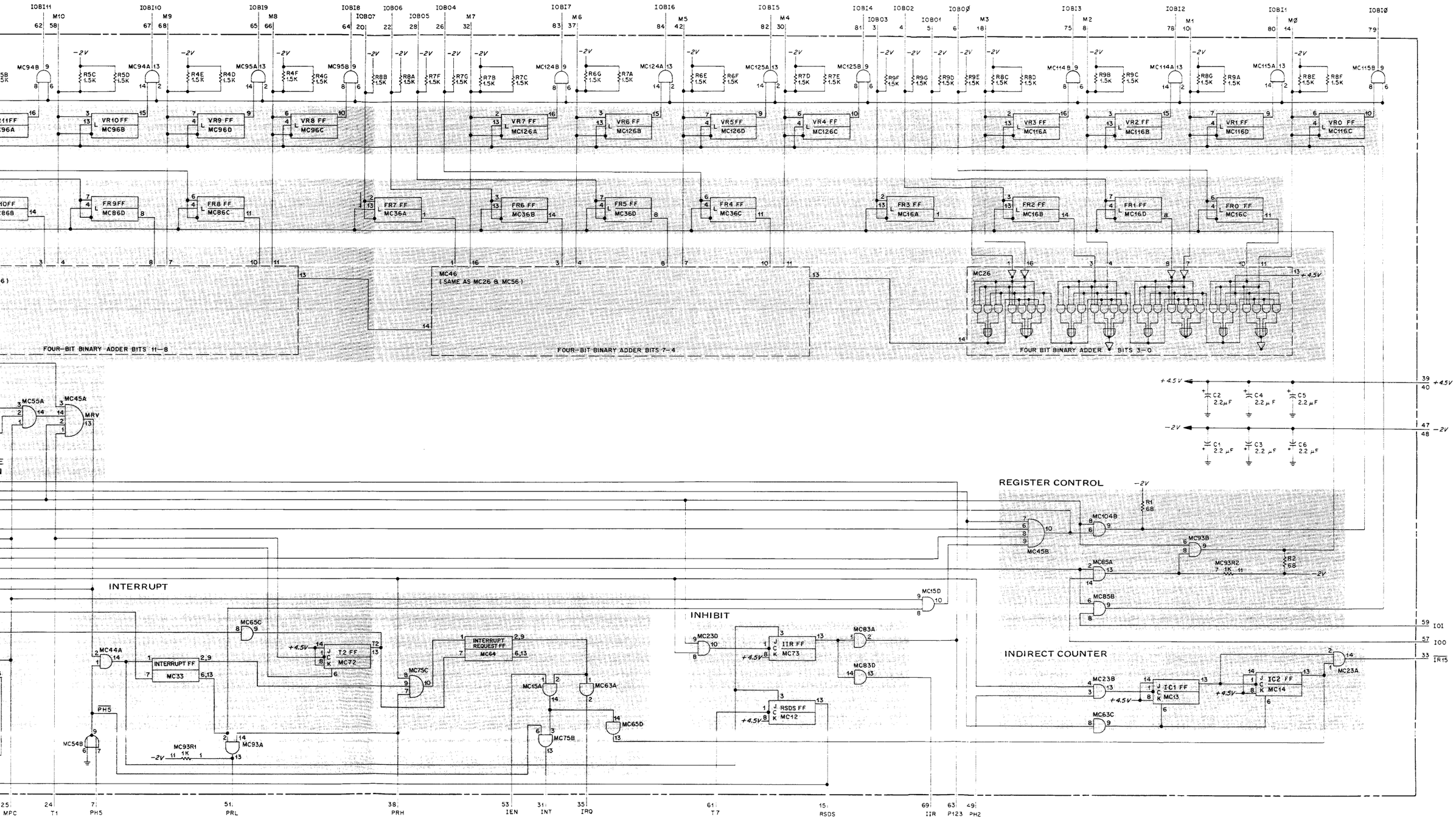


Figure 5-1. Memory Protect Card Schematic and Parts Location Diagrams

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts for the HP 12581A Memory Protect Accessory Kit. Table 6-1 lists parts in alphanumeric order of the HP stock numbers and lists the following information on each part:

a. Description of the part. (Refer to table 6-2 for an explanation of abbreviations and reference designations used in the DESCRIPTION column.)

b. Typical manufacturer of the part in a five-digit code; refer to list of manufacturers in table 6-3.

c. Manufacturer's part number.

d. Total quantity of each part used in the accessory kit.

6-3. A separate parts list is provided along with the parts location diagram for the memory protect card in section V of this manual. This parts list lists the parts in alphanumeric order of reference designation.

6-4. ORDERING INFORMATION.

6-5. To order replacement parts, address the order or inquiry to the local Hewlett-Packard Sales and Service Office. (Refer to the list at the end of this manual for addresses.) Specify the following information for each part ordered:

a. Instrument model and serial number.

b. Hewlett-Packard stock number for each part.

c. Description of each part.

d. Circuit reference designation.

Table 6-1. HP 12581A Memory Protect Accessory Kit Replaceable Parts

HP PART NO.	DESCRIPTION	MFR	MFR PART NO.	TQ
0180-0197	Capacitor, Fxd, Elect, 2.2 μf, 10% 20 VDCW	28480	0180-0197	6
0683-6805	Resistor, Fxd, Comp 68 ohms, 5% 1/4w	01121	CB 6805	2
1810-0020	Resistor, Network, Met Flm (7 resistors)	28480	1810-0020	7
1820-0301	Integrated Circuit, TTL	01295	SN7475N	8
1820-0305	Integrated Circuit, TTL	01295	SN7472N	4
1820-0952	Integrated Circuit, CTL	07263	SL3455	5
1820-0953	Integrated Circuit, CTL	07263	SL3456	3
1820-0954	Integrated Circuit, CTL	07263	SL3457	1
1820-0956	Integrated Circuit, CTL	07263	SL3459	11
1820-0957	Integrated Circuit, CTL	07263	SL3460	1
1820-0964	Integrated Circuit, CTL	07263	SL3461	2
1820-0965	Integrated Circuit, CTL	07263	SL3462	3
1820-0966	Integrated Circuit, CTL	07263	SL3463	2
1820-0967	Integrated Circuit, CTL	07263	SL3464	7
1820-0971	Integrated Circuit, CTL	07263	SL3467	1
1901-0040	Diode, Silicon, 30 mA	07263	FDG1088	1
1910-0022	Diode, Germanium, 5 wiv	28480	1910-0022	1
8159-0005	Jumper Wire	28480	8159-0005	3
12581-6001	Memory Protect Card	28480	12581-6001	1

Table 6-2. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A = assembly	J = receptacle connector	TB = terminal board
B = motor	K = relay	TP = test point
BT = battery	L = inductor	U = integrated circuit
C = capacitor	M = meter	V = vacuum tube, neon bulb, photocell, etc.
CP = coupler	MC = microcircuit	
CR = diode	P = plug connector	VR = voltage regulator
DL = delay line	Q = transistor	W = cable, jumper
DS = device signaling (lamp)	R = resistor	X = socket
E = misc hardware	RT = thermistor	Y = crystal
F = fuse	S = switch	Z = tuned cavity, network
FL = filter	T = transformer	

ABBREVIATIONS

A = amperes	IMPG = impregnated	P/O = part of
AC = alternating current	IN. = inch, inches	POLY = polystyrene
AFC = automatic frequency control	INCD = incandescent	PORC = porcelain
ALUM = aluminum	INCL = include(s)	POS = position(s)
AL-ELECT = aluminum electrolytic	INS = insulation(ed)	POT = potentiometer
ASSY = assembly	INT = internal	PP = peak-to-peak
	I/O = input/output	PT = point
BFO = beat frequency oscillator		PWV = peak working voltage
BE CU = beryllium copper	K = kilo = 1000	
BH = binder head		
BP = bandpass	LH = left hand	R = resistor
BRS = brass	LIN = linear taper	RECT = rectifier
BWO = backward wave oscillator	LK WASH = lock washer	RF = radio frequency
	LOG = logarithmic taper	RH = round head or right hand
C = capacitor	LPF = low pass filter	RMO = rack mount only
CCW = counterclockwise		RMS = root-mean square
CER = ceramic	M = milli = 10^{-3}	RWV = reverse working voltage
CMO = cabinet mount only	MEG = mega = 10^{6}	
COEF = coefficient	MET FLM = metal film	
COM = common	MET OX = metal oxide	S-B = slow-blow
COMP = composition	MFR = manufacturer	SCR = screw
COMPL = complete	MHz = megahertz	SE = selenium
CONN = connector	MINAT = miniature	SECT = section(s)
CP = cadmium plate	MOM = momentary	SEMICON = semiconductor
CRT = cathode-ray tube	MTG = mounting	SI = silicon
CTL = capacitor-transistor logic	MY = Mylar	SIL = silver
CW = clockwise		SL = slide
	N = nano (10^{-9})	SPDT = single-pole, double-throw
DC = direct current	N/C = normally closed	SPG = spring
DEPC = deposited carbon	NE = neon	SPL = special
DPDT = double-pole, double-throw	NI PL = nickel plate	SPST = single-pole, single-throw
DPST = double-pole, single-throw	NO. = number	SR = split ring
DR = drive	N/O = normally open	SST = stainless steel
	NPN = negative-positive-negative	STL = steel
ELECT = electrolytic		
ENCAP = encapsulated	NPO = negative positive zero (zero temperature coefficient)	TA = tantalum
EXT = external		TD = time delay
		TGL = toggle
F = farads	NRFR = not recommended for field replacement	THD = thread
FH = flat head		TI = titanium
FIL H = fillister head	NSR = not separately replaceable	TOL = tolerance
FXD = fixed		TRIM = trimmer
	OBD = order by description	TTL = transistor-transistor logic
G = giga (10^{9})	OD = outer diameter	TWT = traveling wave tube
GE = germanium	OH = oval head	
GL = glass	OX = oxide	U (μ) = micro = 10^{-6}
GND/GRD = ground(ed)		
	P = peak	VAR = variable
H = henries	PC = printed circuit	VDCW = direct current working volts
HDW = hardware	PF = picofarads = 10^{-12} farads	
HEX = hexagonal	PH = Phillips head	W/ = with
HG = mercury	PH BRZ = phosphor bronze	W = watts
HR = hour(s)	PHL = Phillips	WIV = working inverse voltage
HZ = hertz	PIV = peak inverse voltage	WW = wirewound
	PNP = positive-negative-positive	W/O = without
ID = inner diameter		
IF = intermediate frequency		

Table 6-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp. Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co.	Newark, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Calif.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div. Finderne Plant	Sumerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04673	Dakota Engr. Inc.	Culver City, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Blinn, Delbert Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div of C.B.S. Inc.	Lowell, Mass.
08806	General Electric Co. Miniat. Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13103	Thermalloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dublier Electric Corp.	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Farmington, Mich.
16352	Computer Diode Corp.	Lodi, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Calif.
16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokoma, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
17554	Components Inc.	Biddeford, Ma.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.

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Revised: April, 1969

From: FSC. Handbook Supplements

Table 6-3. Code List of Manufacturers (Continued)

Code No.	Manufacturer	Address
17870	McGraw-Edison Co.	Manchester, N.H.
1804Z	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
24796	Parelco Inc.	San Juan Capistrano, Calif.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26851	Compac Hollister Co.	Hollister, Calif.
26992	Hamilton Watch Co.	Lancaster, Pa.
27251	Specialities Mfg. Co., Inc.	Stratford, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Groov-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78424	Speciality Leather Prod. Co.	Newark, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Any brand Tube meeting EIA Standards-Washington, DC.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio

Table 6-3. Code List of Manufacturers (Continued)

Code No.	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	. . . . .
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N,J,
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83014	Hartwell Corp.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Wesbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Siemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Calif.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.,	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96306	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
96881	Thomson Ind. Inc.	Long Is., N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Troncis, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlington, Calif.
000YY	S.K. Smith Co.	Los Angeles, Calif.

00015-47
Revised: April, 1969

From: FSC. Handbook Supplements

HEWLETT hp PACKARD

12581A

MEMORY PROTECT ACCESSORY KIT

(FOR THE 2116B COMPUTER)

UPDATING SUPPLEMENT FOR OPERATING AND SERVICE MANUAL

1 JULY 1970

MANUAL IDENTIFICATION

Manual Serial No. Prefix: NA

Manual Printed: JAN 1970

Manual Part Number: 12581-9001

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

ASSEMBLY CHANGES

Ref Des	Description	HP Part No.	Rev	Changes

Change 1 dated 20 February 1970.

Changes 2 through 12 dated 1 July 1970.

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CHANGE	DESCRIPTION

1 Page 1-1, paragraph 1-4, line 8. Change "HP 20418B" to "HP 20418D". The diagnostic program procedures in the manual supplement are not affected by this change.

2 Page 5-2, table 5-1. Change REFERENCE DESIGNATION entry MC33, 34, 53 to read as follows: MC33, 34, 53, 54, 64.

3 Page 1-1. Add the following note after paragraph 1-4.

Note

Early versions of the memory protect accessory kit used the 12581-6001 Memory Protect Card. Except as noted, all information in this manual applies to both cards. When ordering a new card, the 12581-60021 should always be specified.

4 In list of tables, delete the part number from title of table 5-1.

5 Page 1-1, paragraph 1-4. Change the second line to read as follows:

single printed-circuit card (part no. 12581-60021) that plugs

6 Page 2-1, paragraph 2-11. Change the first sentence to read as follows:

The lower right-hand corner on the component side of the memory protect card contains four jumper wires labeled W1 through W4.

7 Page 2-1, paragraph 2-11. Change the seventh line to read as follows:

8K to 32K. Install the four jumper wires according to the

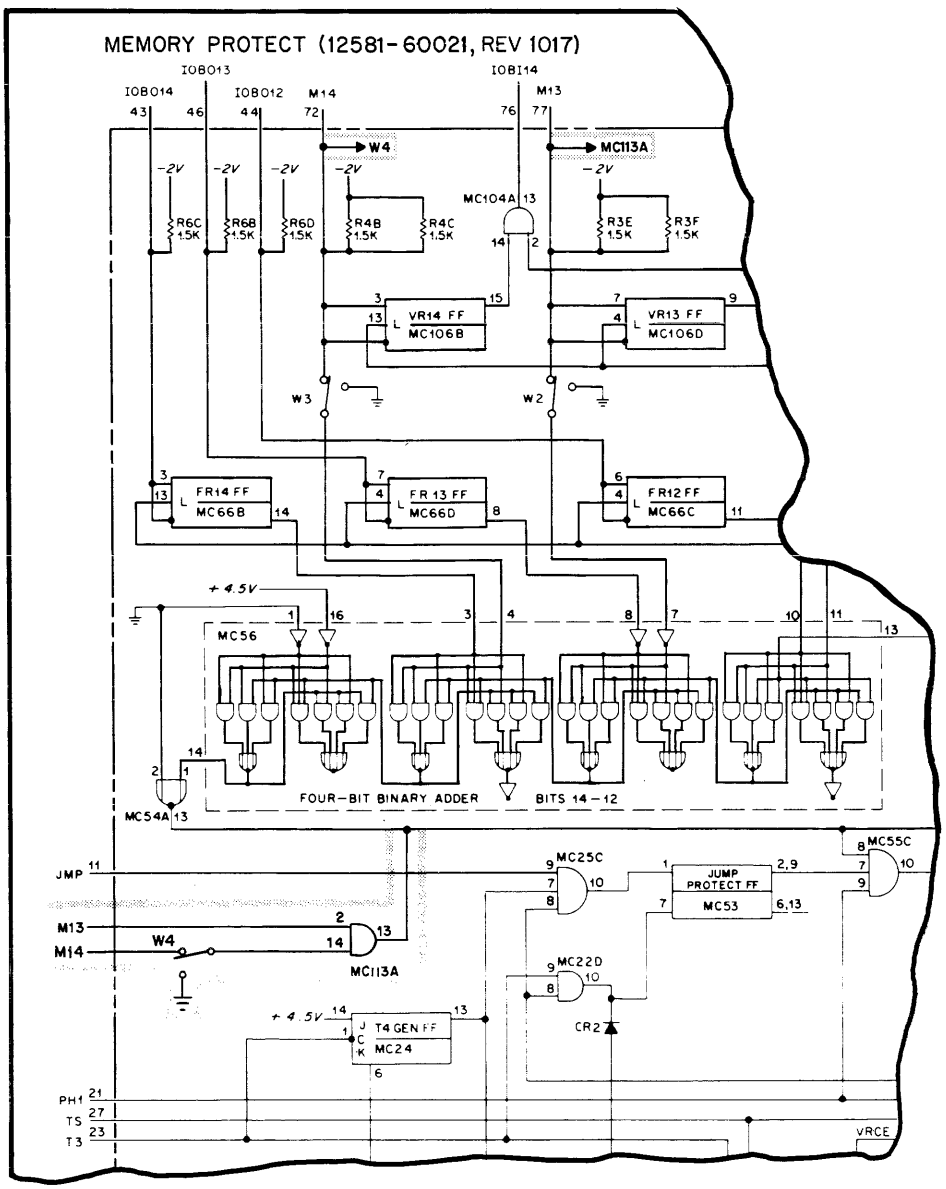
8 Page 2-1, figure 2-1. Change figure by adding a symbol for jumper wire W4 approximately 1/4-inch below W2. Also, add an arrow pointing from the callout "JUMPER WIRES" to the location of W4.

9 Page 2-2, table 2-1. Change table 2-1 to add a column for jumper wire W4 and correct the column for W2 as follows:

CORE MEMORY CAPACITY	CONNECT JUMPER WIRE W4* FROM MC113 PIN 14 TO	CONNECT JUMPER WIRE W3 FROM MC56 PIN 4 TO	CONNECT JUMPER WIRE W2 FROM MC56 PIN 7 TO	CONNECT JUMPER WIRE W1 FROM MC56 PIN 11 TO
32K	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 72	Card Pin 77	Card Pin 74
24K	Card Pin 72	Card Pin 72	Card Pin 77	Card Pin 74
16K	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 77	Card Pin 74
8K	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 1, 2, 85, 86 (Ground)	Card Pin 74

*W4 is not used on 12581-6001.

CHANGE	DESCRIPTION
10	Page 5-2, table 5-1. Delete part number from the title of the table. Add reference designation MC113 to entry of MC35, 85, 93, 94, 95, 104, 105, 114, 115, 124, 125. Add reference designation W4 to entry of W1, 2, 3.
11	Page 5-3, figure 5-1. On printed-circuit card layout, add a new integrated circuit symbol for MC113 next to MC114 and add a new jumper wire symbol for W4 approximately 1/4-inch below W2. Add a note that MC113 and W4 are not used on 12581-6001. On printed-circuit card layout, change part number and identification code to read as follows: 12581-60021 A-1017-22 OR 12581-6001 H-902-22 Change upper left-hand corner of schematic diagram as shown below. Changes include a new card part number and revision number, connections to card pins 72 and 77 (for W4 and MC113A), and the addition of MC113A and W4.



CHANGE	DESCRIPTION
12	Page 6-2, table 6-1. Change TQ column for HP part no. 1820-0956 from 11 to 12; change TQ column for HP part no. 8159-0005 from 3 to 4; and change 12581-6001 in the HP and MFR PART NO. columns to 12581-60021. Add the following note after the table. Note When ordering replacement parts, always order Memory Protect Card part no. 12581-60021 to replace part no. 12581-6001.

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