HEWLETT PACKARD

High Performance Memory Systems

Installation and Service Manual

PRODUCTS COVERED: HP 2102E, HP 2102H, HP 12666H, HP 12699H, HP 12746H, HP 12747H, HP 12749H, HP 12779H, and HP 12780H

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PRINTING HISTORY

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

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

To determine what software manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

Third Edition	Sept 1982	
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ILLUSTRATIONS

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GENERAL INFORMATION

SECTION I

This manual presents installation and service information for Hewlett-Packard high performance memory products. These products combine to make up high performance memory systems, both fault control and non-fault control, that are compatible with HP 1000 E and F-Series Computers. Memory products described in this manual are:

- HP 2102E High Performance Memory Controller
- HP 2102H High Performance Fault Control Memory Controller
- HP 12666H 1M byte (512k word) High Performance Check Bit Array
- HP 12699H 256k byte (128k word) High Performance Memory Module
- HP 12746H 64k byte (32k word) High Performance Memory Module
- HP 12747H 128k byte (64k word) High Performance Memory Module
- HP 12749H 512k byte (256k word) High Performance Memory Module
- HP 12779H 256k byte (128k word) High Performance Check Bit Array
- HP 12780H 512k byte (256k word) High Performance Check Bit Array

In addition to this manual, the following manuals may be helpful in installing or servicing these products.

- HP 13305A Dynamic Mapping System Installation Manual, part no. 13305-90001
- HP 12892B Memory Protect Installation Manual, part no. 12892-90007
- HP 12990B Memory Extender Installation and Service Manual, part no. 12990-90007
- Your computer Reference Manual and Installation and Service Manual

To install or service a non-fault control memory system perform the procedures of Section II (INSTALLATION), or Section III (MAINTENANCE). The procedures for installing or servicing a fault control memory system are contained in Section IV (INSTALLATION), or Section V (MAINTENANCE).

INSTALLATION OF MEMORY SYSTEM (Non-Fault Control)

SECTION II

DESCRIPTION

This section provides installation instructions for a Hewlett-Packard High Performance Memory System (without fault control) to be installed in an HP 1000 E-Series or F-Series Computer mainframe or HP 12990B Memory Extender. This high performance memory system consists of a 2102E Controller, and one or more 12699H/12746H/12747H/12749H memory modules. If the memory system is larger than 32k words, the HP 13305A Dynamic Mapping System (DMS) is also required. To install the memory system complete the following procedure. If this is an add-on installation, review each step to ensure that all jumpers in the memory system are correctly configured. Note that all references in the procedure are to 16-bit words, not 8-bit bytes. The hardware requirements for this memory system are:

- 2102E High Performance Memory Controller, part no. 02102-60002.
- One or more 12746H 64k byte (32k word) Memory Module, part no. 12746-60001.
- One or more 12747H 128k byte (64k word) Memory Module, part no. 12747-60002.
- One or more 12749H 512k byte (256k word) Memory Module, part no. 12749-60001.
- One or more 12699H 256k byte (128k word) Memory Module, part no. 12699-60001.
- Any of these Memory Modules may be mixed in the same installation as long as the address boundary restrictions are adhered to.

Memory Cable Assembly, part no. 02112-60016 or Memory Extender Cable Assembly, part no. 12990-60015 (when 12990B is used).

INSTALLATION PROCEDURE

a. On the computer set the battery switch to OFF. Set the ac power off.

b. Lower the operator panel and remove memory PCA cage cover and remove memory cable assembly if installed (see figure 2-1).

c. Verify that the TEST jumper is not installed (see figure 2-2). If DMS is required (memory larger that 32K words), remove the MX+$\overline{\text{MEM}}$ jumper from the controller.

d. Install the controller in the bottom memory slot with the component side up (see figure 2-1).

COMPUTER	MEMORY SLOT
2109/2111	118
2113/2117	123

e. On the memory module PCAs, the XW1 jumpers or DIP switches are used for memory address assignments. Each memory module must be assigned a unique set of addresses, and addresses must be assigned contiguously starting with zero; there can be no "missing" addresses. See Figures 2-3 through 2-6 for configuration of memory modules.

NOTE

If an HP 12990B Memory Extender is being used, it is recommended that the eight memory extender slots be filled before adding memory modules to the computer mainframe.

f. Install memory modules in the computer or extender memory slots with the component sides up (see figure 2-1).

NOTE

If any other PCA's (DCPC, MEM or Memory Protect) need to be installed, perform those installation procedures at this time and then complete this procedure. Remember, if DMS is to be installed, the jumper in step c of this procedure should be removed.

g. Connect the memory cable assembly (02112-60016) or memory extender cable assembly (12990-60015) between J1 of the controller and J1 of all the memory modules. If desired, the unused connectors may be removed from the cable assembly with a sharp knife or scissors.

h. Verify proper operation of the memory system by performing the test procedure of Section III Maintenance.

i. Replace memory PCA cage cover and power up the system for normal operation.

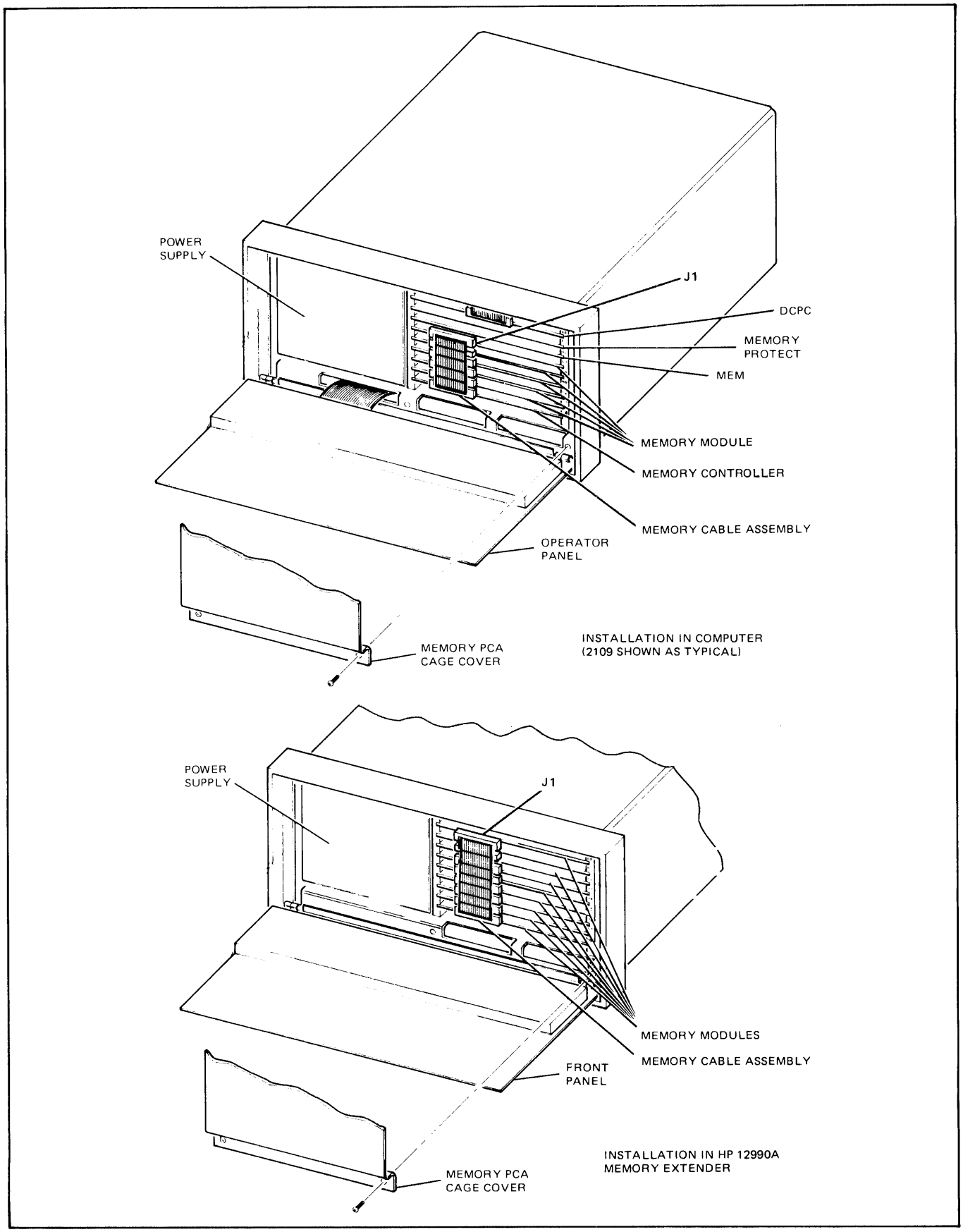


Figure 2-1. Memory System Installation Details (Non-Fault Control)

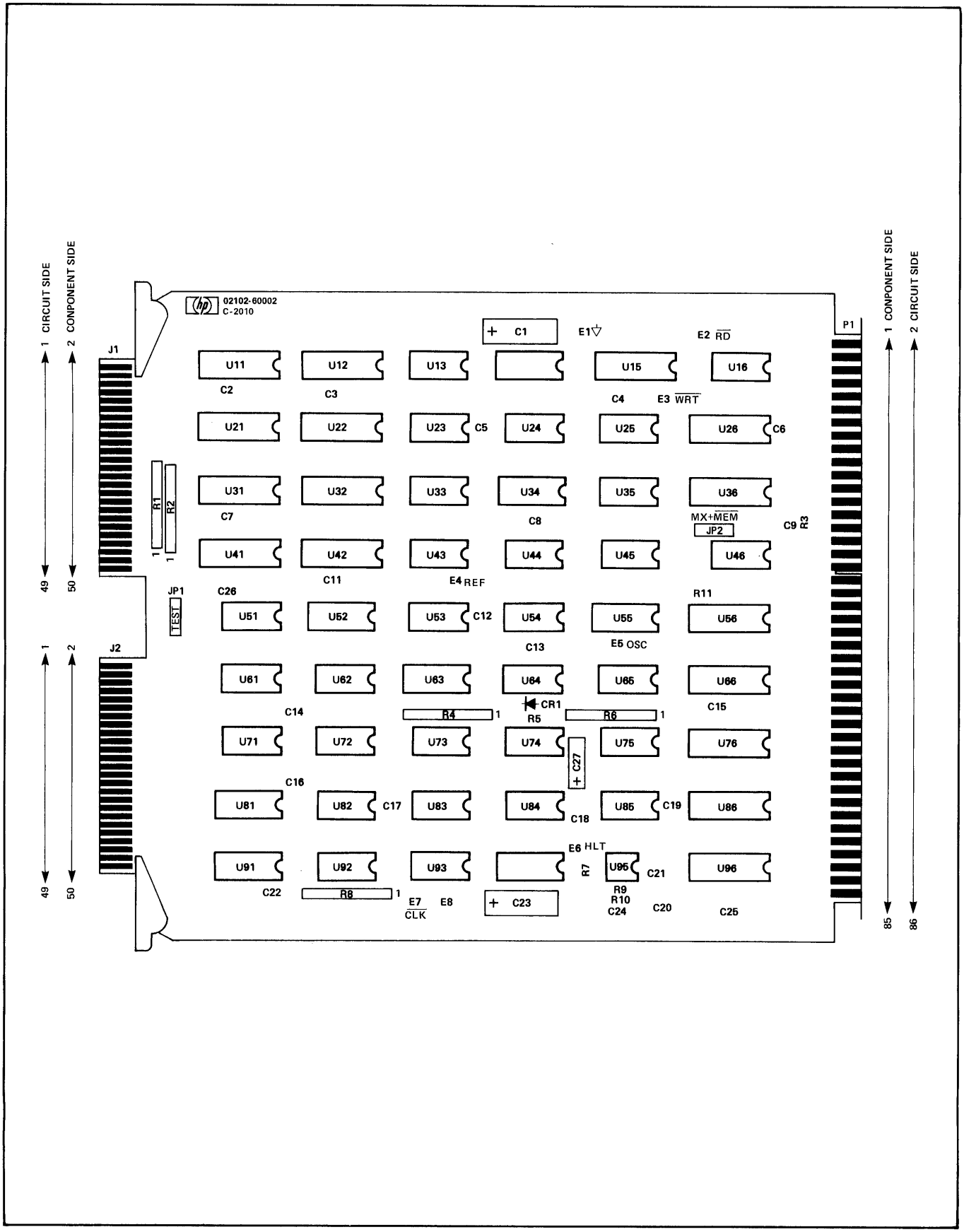
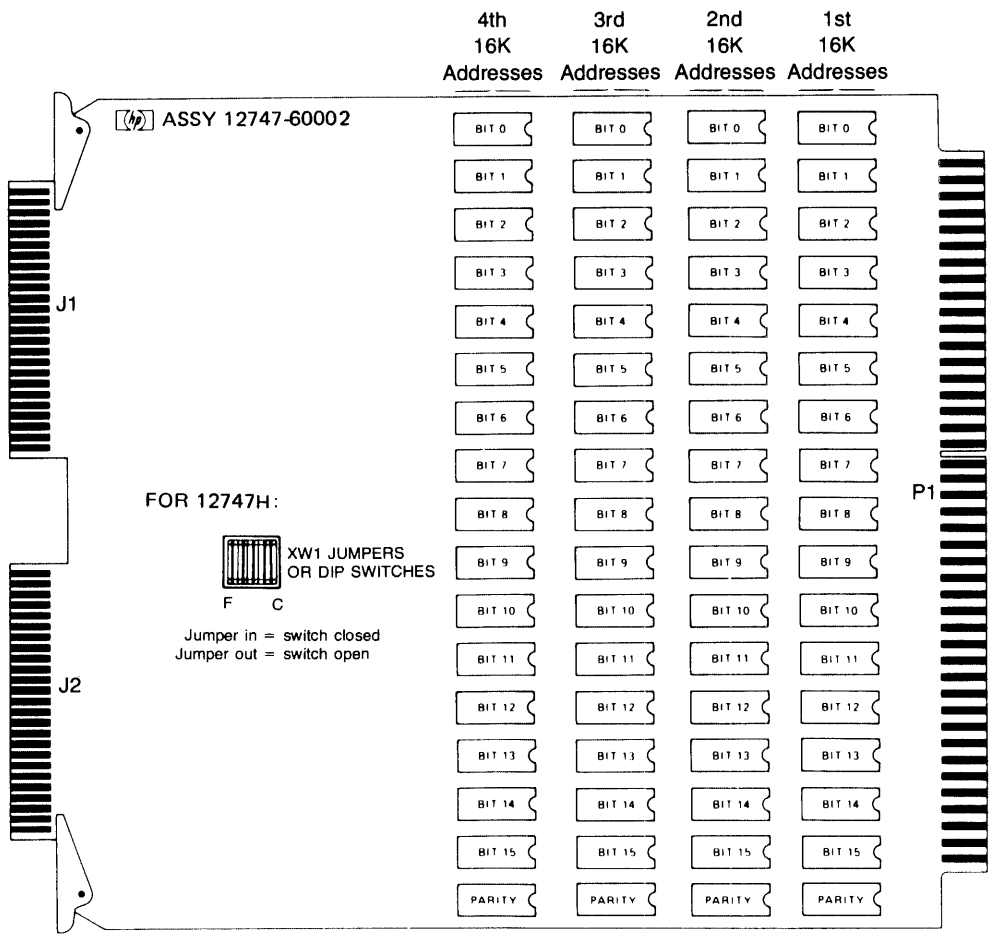
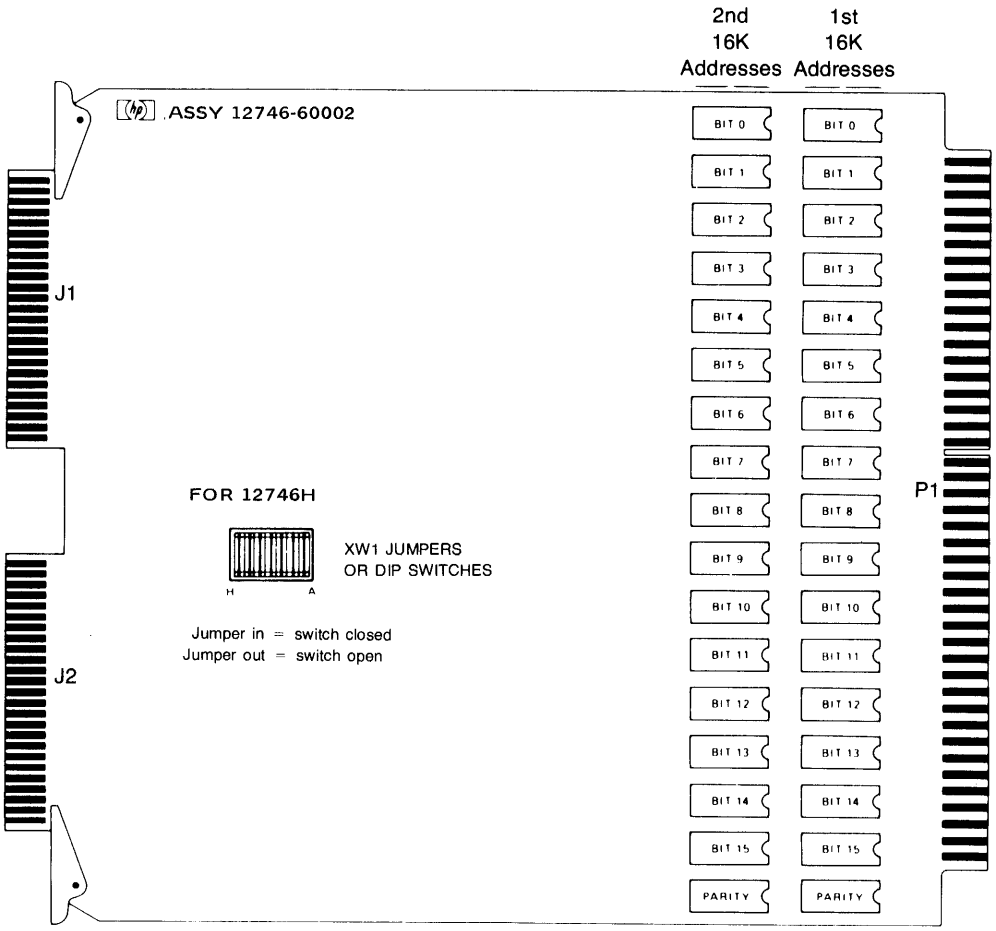


Figure 2-2. 2102E Memory Controller Jumpers



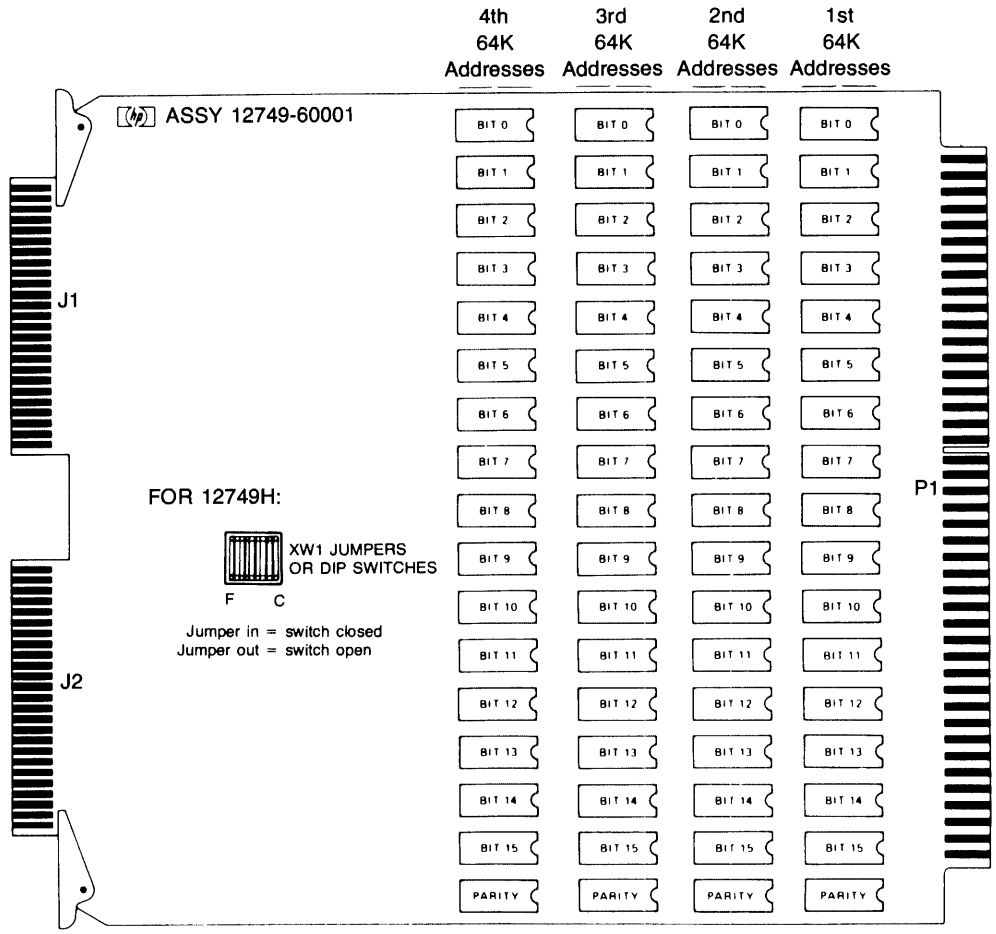
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-64K	HARDWIRED IN	HARDWIRED OUT	IN	IN	IN	IN	HARDWIRED OUT	HARDWIRED OUT
64K-128K			IN	IN	IN	OUT		
128K-192K			IN	IN	OUT	IN		
192K-256K			IN	IN	OUT	OUT		
256K-320K			IN	OUT	IN	IN		
320K-384K			IN	OUT	IN	OUT		
384K-448K			IN	OUT	OUT	IN		
448K-512K			IN	OUT	OUT	OUT		
512K-576K			OUT	IN	IN	IN		
576K-640K			OUT	IN	IN	OUT		
640K-704K			OUT	IN	OUT	IN		
704K-768K			OUT	IN	OUT	OUT		
768K-832K			OUT	OUT	IN	IN		
832K-896K			OUT	OUT	IN	OUT		
896K-960K			OUT	OUT	OUT	IN		
960K-1024K			OUT	OUT	OUT	OUT		

Figure 2-3. 12747H Memory Address Configuration



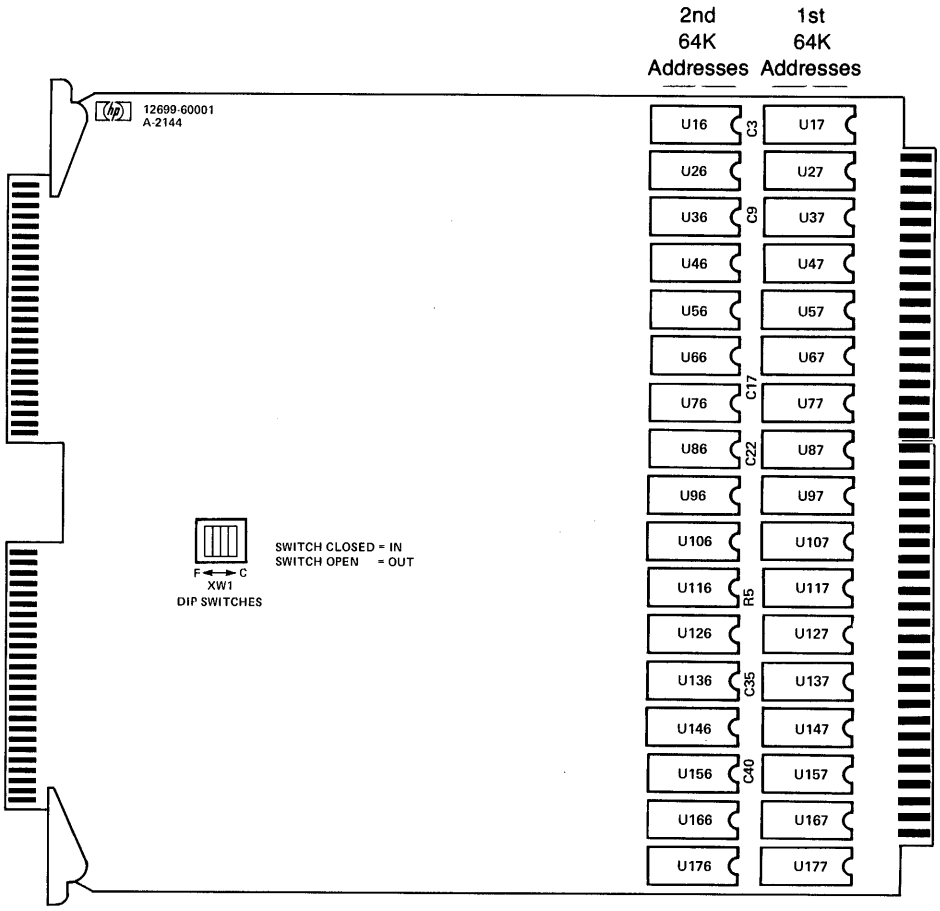
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-32K	ALWAYS IN	ALWAYS OUT	IN	IN	IN	IN	IN	ALWAYS OUT
32K-64K			IN	IN	IN	IN	OUT	
64K-96K			IN	IN	IN	OUT	IN	
96K-128K			IN	IN	IN	OUT	OUT	
128K-160K			IN	IN	OUT	IN	IN	
160K-192K			IN	IN	OUT	IN	OUT	
192K-224K			IN	IN	OUT	OUT	IN	
224K-256K			IN	IN	OUT	OUT	OUT	
256K-288K			IN	OUT	IN	IN	IN	
288K-320K			IN	OUT	IN	IN	OUT	
320K-352K			IN	OUT	IN	OUT	IN	
352K-384K			IN	OUT	IN	OUT	OUT	
384K-416K			IN	OUT	OUT	IN	IN	
416K-448K			IN	OUT	OUT	IN	OUT	
448K-480K			IN	OUT	OUT	OUT	IN	
480K-512K			IN	OUT	OUT	OUT	OUT	

Figure 2-4. 12746H Memory Address Configuration



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-256K	HARDWIRED OUT	HARDWIRED OUT	IN	IN	HARDWIRED OUT	HARDWIRED OUT	HARDWIRED OUT	HARDWIRED OUT
256K-512K			IN	OUT				
512K-768K			OUT	IN				
768K-1024K			OUT	OUT				

Figure 2-5. 12749H Memory Address Configuration



MEMORY ADDRESS ASSIGNMENT (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES			
	F	E	D	C
0-128K	IN	IN	IN	OUT
128K-256K	IN	IN	OUT	OUT
256K-384K	IN	OUT	IN	OUT
384K-512K	IN	OUT	OUT	OUT
512K-640K	OUT	IN	IN	OUT
640K-768K	OUT	IN	OUT	OUT
768K-896K	OUT	OUT	IN	OUT
896K-1024K	OUT	OUT	OUT	OUT

Figure 2-6. 12699H Memory Address Module

MAINTENANCE (Non-Fault Control Memory System)

SECTION III

GENERAL

Maintenance is performed on two levels: 1) regularly scheduled preventive maintenance (PM), and 2) troubleshooting to eliminate faulty operation by isolating and replacing a defective PCA, or correcting a misalignment or incorrect configuration.

PREVENTIVE MAINTENANCE

In order to keep memory system failures at a low level, it is recommended that preventive maintenance be performed on this memory system every six months. Preventive maintenance consists of checking for loose or frayed cables, ensuring that the PCA's are seated properly, and performing the test procedure contained in this section.

TROUBLESHOOTING

Troubleshooting consists of analyzing the problem to isolate it to a particular PCA or determing that the problem is in some other system element. The following self test and diagnostics may be required; the test procedure in this section should be used as a guideline for isolating problems.

a. Self Test — The self test is executed from the front panel; refer to test procedure contained in the following paragraph.

b.

DIAGNOSTIC	MANUAL PART NO.	ABSOLUTE BINARY PROGRAM NO.
Semiconductor Memory	24395-90001	24395-16001*
Memory Protect/ Parity Error	12892-90005	12892-16001*

*The absolute binary code for this diagnostic is contained on one or more media (e.g., paper tape, mini-cartridge, disc, and magnetic tape). The binaries also exist on single as well as multiple files. For current date codes associated with these media, refer to Appendix A in the Diagnostic Configurator Reference Manual, part no. 02100-90157, dated Jan. 1977 or later.

TEST PROCEDURE (NON-FAULT CONTROL MEMORY SYSTEM)

a. If power is off, power up the system.

b. Load and execute the self test from the front panel according to Appendix A.

c. Refer to table 3-1 for analysis of test results, and to the repair procedure in the following paragraph to correct any problem.

NOTE

It may be necessary to execute the self test several times to verify all conditions listed in the table.

REPAIR PROCEDURE

a. Parity Bit Error

This problem can be corrected by swapping the defective memory module with a good module. To find the defective module address the software diagnostic must be run. If the problem still exist, replace the memory controller.

b. Data Bit Error

Isolate the defective memory module using the procedures of Appendix B, then replace the module.

c. CPU Failure

Refer to your computer Installation and Service Manual for service information.

d. Misconfigured or Faulty Memory Module

This problem is most commonly a misconfigured module. Check to insure that all memory modules are configured correctly refer to figure 2-3 through 2-7). If no misconfigured module is found, then the defective module may be isolated by observing the 32k segment count. The faulty modules reside on the skipped segments.

Table 3-1. Analysis of Memory System Self Test (Non-Fault Control)

DISPLAY REGISTERS INDICATORS	DISPLAY REGISTER	PARITY INDICATOR	OVERFLOW INDICATOR	32K SEGMENT COUNT	INDICATION
T-Register indicator lit, all others OFF	100000 (octal)	OFF	ON	Smooth and consecutive	Memory System OK. Return system to normal operating condition
T-Register indicator lit, all others OFF	100000 (octal)	ON	ON	Smooth and consecutive	Parity bit error (Bit 16)
All indicators ON	177777 (octal)		OFF		Data bits error
All indicators ON	177777 (octal)		ON		CPU failure
T-Register indicator lit, all others OFF	100000 (octal)			Not consecutive	Misconfigured or faulty module

NOTE. Any other condition, run the software diagnostics.

INSTALLATION OF FAULT CONTROL MEMORY SYSTEM

SECTION IV

DESCRIPTION

This memory system provides error correction for all single bit errors in the memory. The system's memory controller can be configured to halt on single bit errors (fault control disabled), or to correct all single bit errors and halt on double bit errors (fault control enabled). The system uses an additional 5-check-bits appended to the 16 data-bits and one overall parity bit to provide a distance-4 hamming code. If the memory system is larger than 32K words, the HP 13305A Dynamic Mapping System (DMS) is also required. The hardware requirements for this system are:

2102H High Performance Fault Control Memory Controller, part no. 02102-60004.

At least one HP 12666H (12666-60001), or one HP 12779H (12779-60002), or one HP 12780H (12780-60002) High Performance Fault Control Check Bit Array. The check bit arrays must be configured exactly equal to the amount of words of memory installed in the system.

Include at least 64k bytes (32k words) of HP High Performance Memory, consisting of 12746H 64k byte (12746-60002), 12747H 128k byte (12747-60002), 12749H 512k byte (12749-60001), or 12699H 256k byte (12699-60001) High Performance Memory Modules.

Memory Cable Assembly, part no. 02108-60041.

Memory Cable Assembly, part no. 02112-60016 or Memory Extender Cable Assembly, part no. 12990-60015 if the 12990B Memory Extender is to be used.

To install this memory system follow the installation procedure below; if this is an add-on installation review each step to ensure that all jumpers are correct and that you have all the equipment required for the new amount of memory in the system. Note that all references in the procedure are to 16-bit words not 8-bit bytes.

INSTALLATION PROCEDURE

a. On the rear of the computer set the battery switch to OFF. Set the computer ac power off.

b. Lower the operator panel and remove memory PCA cage cover and remove memory cable assemblies if installed (see figure 4-1).

c. Configure memory controller, Memory Expansion (MEM), and CPU compatibility jumpers as shown in figure 4-2.

d. Disable the fault control feature by removing jumper marked "CORRECT" on the 2102H Memory Controller.

NOTE

Check bit arrays are alwasy required with a 2102H Memory Controller.

e. Install the controller in the bottom memory slot with the component side up (see figure 4-1).

COMPUTER	MEMORY SLOT
2109/2111	118
2113/2117	123

f. Configure Check Bit Arrays to support the memory to be installed in the system; refer to figures 4-4, 4-5 and 4-6, and table 4-2. Some sample check bit array requirements and assignments are listed in table 4-1 and figure 4-3.

NOTE

Check Bit Arrays must be configured exactly equal to the amount of memory (k words) installed in the memory system.

Table 4-1. Sample Check Bit Array Requirements

Memory Size (words)	Check Bit Array Requirements		
	12779	12780	12666
32k	1	0	0
64k	1	0	0
128k	1	0	0
256k	0	1	0
320k	0	0	1
384k	0	0	1
512k	0	0	1
640k	1	0	1
768k	0	1	1
832k	1	1	1
896k	1	1	1
1024k	0	0	2

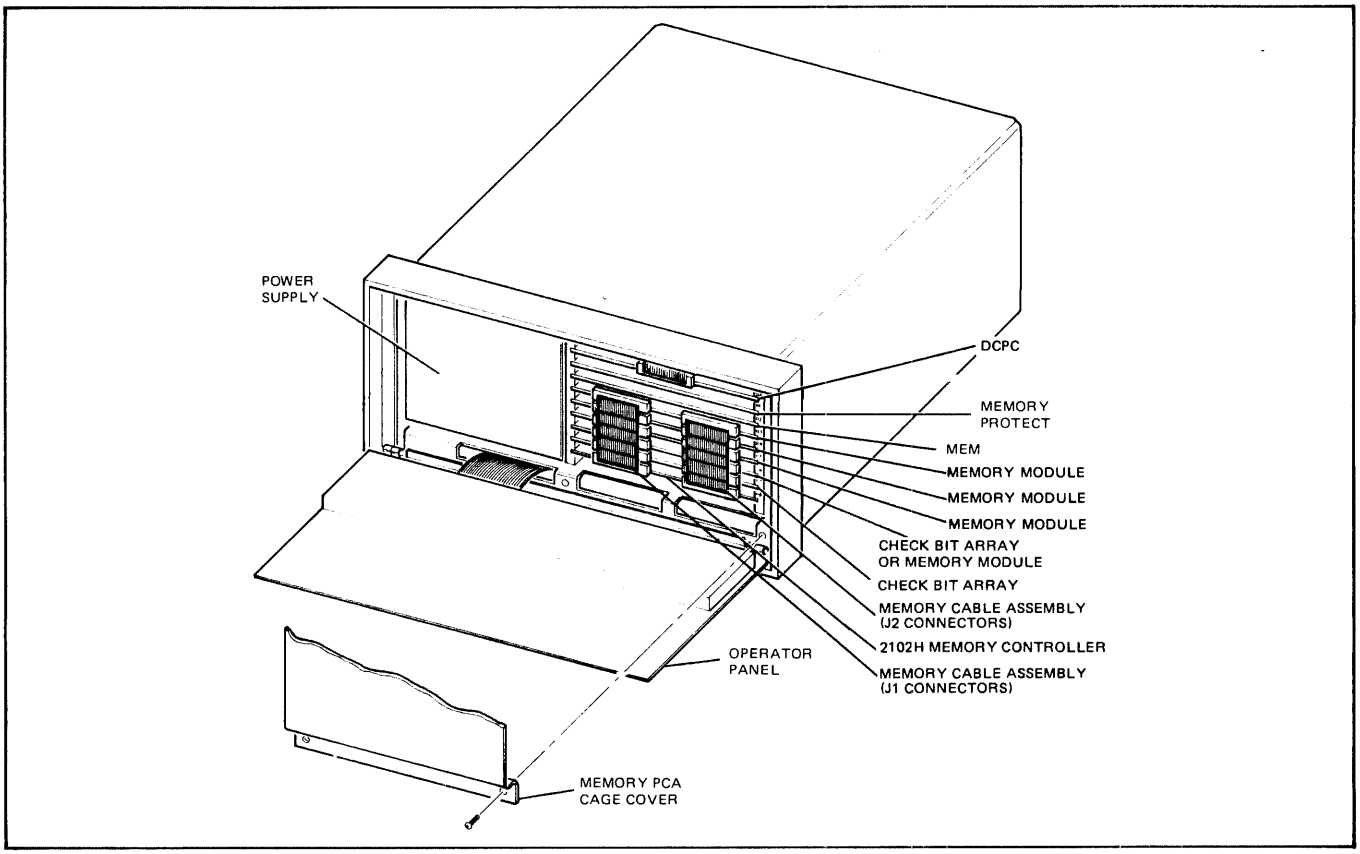
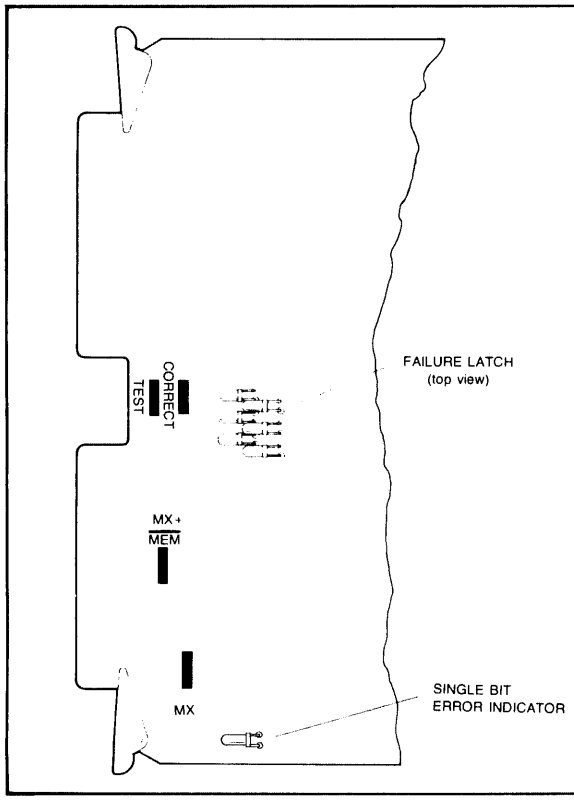


Figure 4-1. Fault Control Memory System Installation Details



Configure jumpers as described in the following table:

COMPUTER	JUMPER	
	MX	MX+$\overline{\text{MEM}}$
Memory Expansion Module (MEM) not installed	OUT	IN
Memory Expansion Module (MEM) installed	OUT	OUT

To disable Fault Control, remove jumper labeled "CORRECT". TEST jumper normally removed. Used for Memory Protect/ Parity Error Diagnostic.

Figure 4-2. 2102H Memory Controller Jumpers

Table 4-2. Check Bit Array Configuration

MEMORY SIZE (WORDS)	CHECK BIT ARRAY REQUIREMENTS (WORDS)	XW1							XW2			
		G	F	E	D	C	B	A	D	C	B	A
32k	12779/12780/12666	IN	IN	IN	IN	IN	IN	IN	OUT	IN	IN	OUT
64k	12779/12780/12666	IN	IN	IN	IN	IN	IN	IN	OUT	OUT	OUT	OUT
128k	12779/12780/12666	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
192k	12779/12780/12666	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
	+12779*/12780/12666	IN	IN	IN	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
256k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	or											
	12779	IN	IN	OUT	IN	IN	IN	IN	OUT	OUT	OUT	OUT
	+12779*	IN	IN	OUT	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
320k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	IN	IN	OUT	IN	IN	OUT	OUT	OUT	OUT
384k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
448k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
	+12779*/12780/12666	IN	IN	IN	IN	OUT	OUT	IN	OUT	OUT	IN	IN
512k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
576k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	IN	OUT	IN	IN	IN	OUT	OUT	IN	IN
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12779/12780/12666	IN	IN	IN	OUT	IN	IN	IN	OUT	OUT	IN	IN
640k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12779/12780/12666	IN	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
896k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12780/12666	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12780/12666	IN	OUT	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT
1024k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12666	OUT	OUT	OUT	OUT	IN	IN	IN	OUT	OUT	IN	IN

NOTES: 1. Only a 12779 with Date Code *1905* or later can be used in this space.
2. Switch H in 12666H is always IN.

Table 4-3. Memory Cage Assignments

Memory Slot	2109/2111 Assignment	2113/2117 Assignment
110	Dual Channel Port Controller	Dual Channel Port Controller
111	Memory Protect PCA	Memory Protect PCA
112	Memory Expansion Module	Memory Expansion Module
113	Memory Module	Memory Module
114	Memory Module	Memory Module
115	Check Bit Array or Memory Module	Memory Module
116	Check Bit Array or Memory Module	Memory Module
117	Check Bit Array	Memory Module
118	2102 Memory Controller	Memory Module
119	—	Check Bit Array or Memory Module
120	—	Check Bit Array or Memory Module
121	—	Check Bit Array or Memory Module
122	—	Check Bit Array
123	—	2102 Memory Controller

g. Install Check Bit Arrays with component sides up in the computer memory slots indicated in figure 4-1 and table 4-3.

h. Disable the fault control feature on the memory controller if it is not already disabled (step d of installation procedure).

i. On the Memory Module PCAs the XW1 jumpers or DIP switches are used for memory address assignments. Each memory module must be assigned a unique set of addresses, and addresses must be assigned contiguously starting with zero; there can be no "missing" addresses. See Figures 2-3 through 2-6 for configuration of Memory Modules.

NOTE

If an HP 12990B Memory Extender is being used, it is recommended that the eight memory extender slots be filled before adding memory modules to the computer mainframe.

j. Install memory modules in the computer or memory extender with component sides up as indicated in figure 4-1 and table 4-3.

NOTE

If any other PCAs (DCPC, MEM, or Memory Protect) need to be installed, perform those installation procedures at this time and then complete this procedure. Remember, if DMS is to be installed, the jumper in step c of this procedure should be removed.

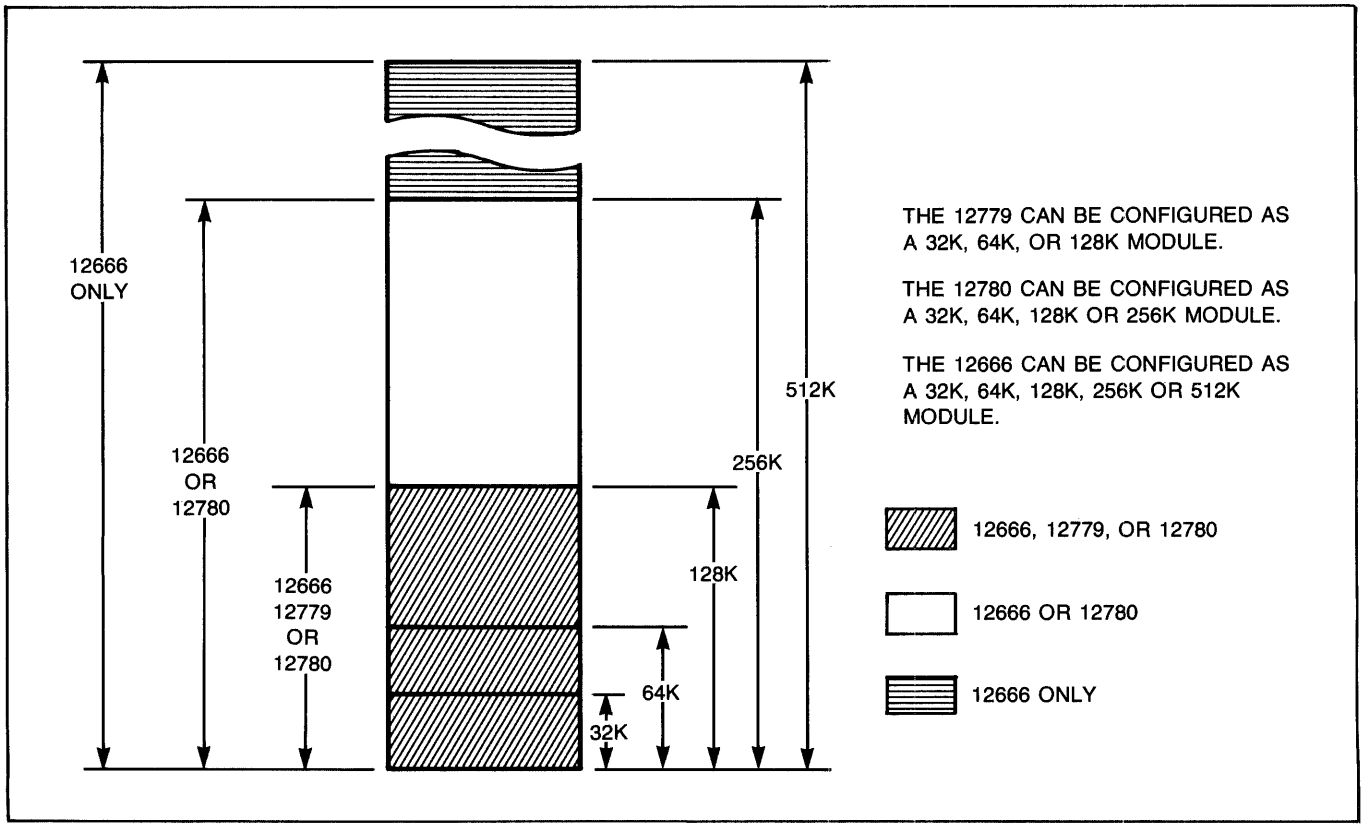


Figure 4-3. Check Bit Array Memory Assignments

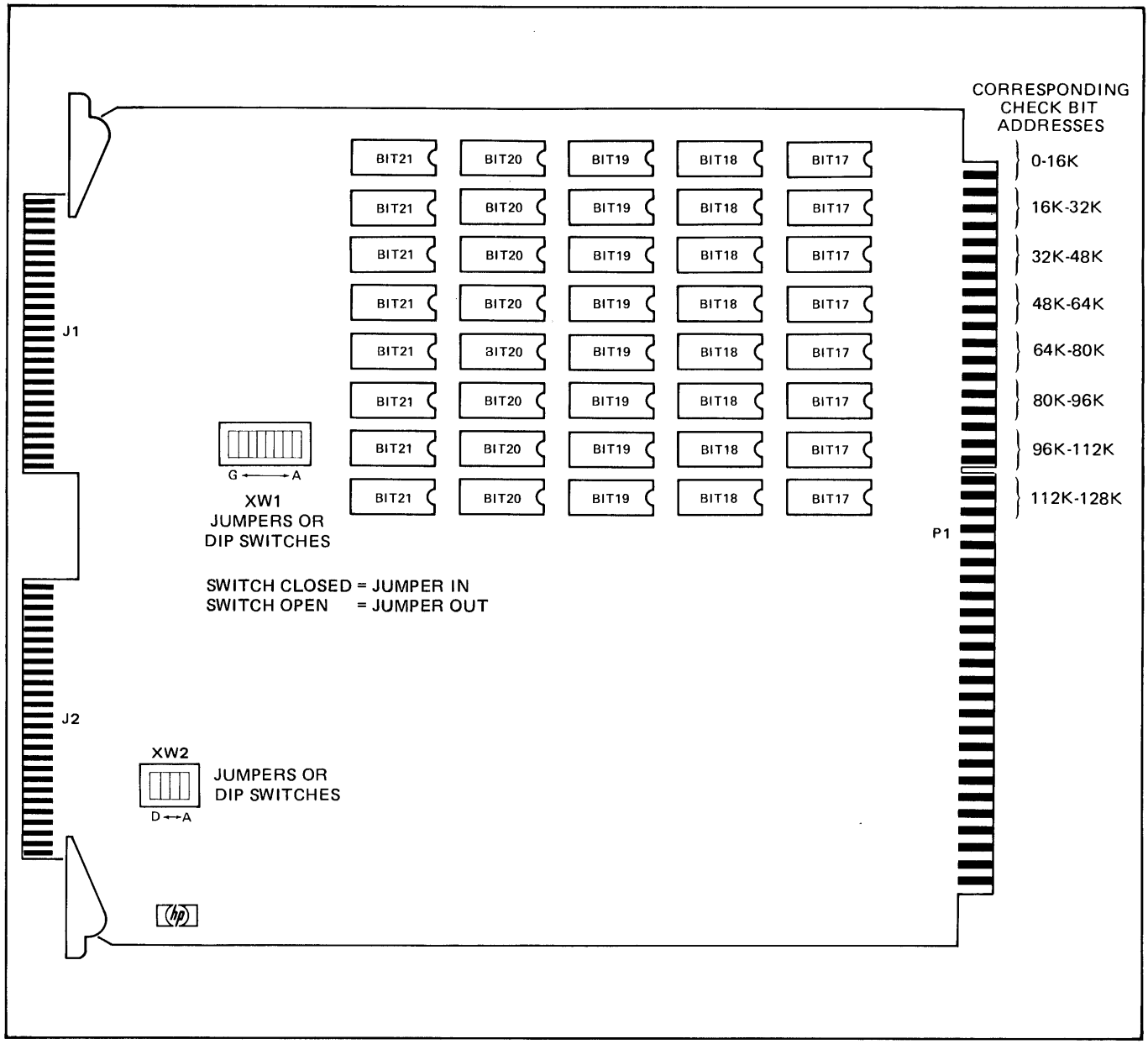


Figure 4-4. 12779H Jumper or DIP Switch Locations

k. Connect the memory cable assembly, part no. 02112-60016, or the memory extender cable, part no. 12990-60015, between the Memory Controller J1 connector and all Check Bit Array and Memory Module J1 connectors.

l. Connect memory cable assembly, part no. 02108-60041, between the Memory Controller J2 connector and all Check Bit Array J2 connectors.

m. Verify proper operation of the memory system by performing the test procedures in Section V (Maintenance).

n. Shut the system power off and reinstall "CORRECT" jumper on the 2102H Memory Controller to enable the fault control feature.

o. Reinstall controller and cables then repeat checkout procedure to ensure proper operation of the memory system.

p. Reinstall memory PCA retainer and power up the system for normal operation.

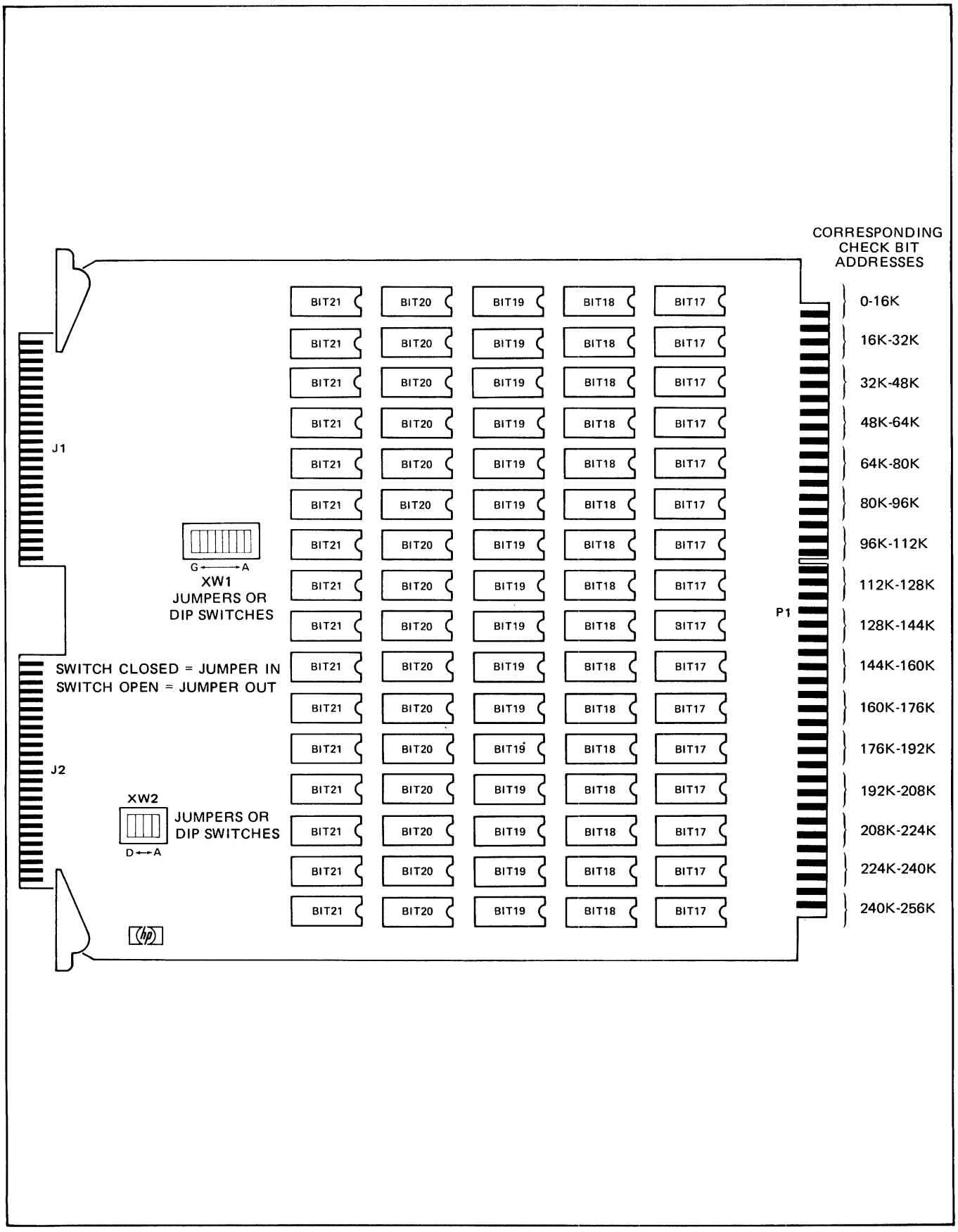


Figure 4-5. 12780H Jumper or DIP Switch Locations

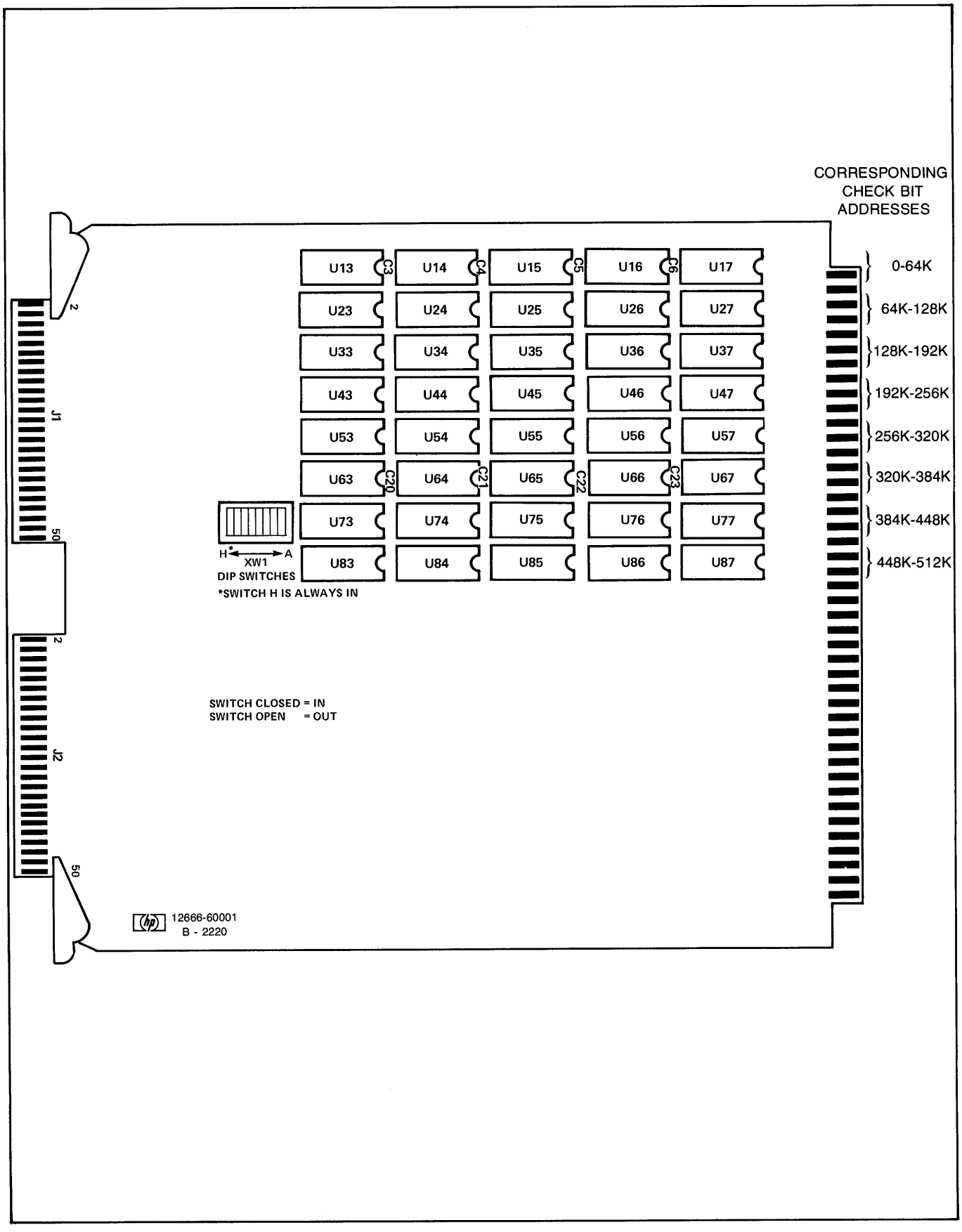


Figure 4-6. 12666H DIP Switch Locations

MAINTENANCE (Fault Control Memory Systems)

SECTION V

GENERAL

Maintenance is performed on two levels: 1) regularly scheduled preventive maintenance (PM), and 2) troubleshooting to eliminate faulty operation by isolating and replacing a defective PCA, or correcting a misalignment or incorrect configuration.

PREVENTIVE MAINTENANCE

In order to keep memory system failures at the lowest level possible, it is recommended that preventive maintenance be performed on this memory system every six months. Preventive maintenance consists of checking for loose or frayed cables, ensuring that the PCA's are seated properly, and performing the necessary test procedure. Perform the steps of the troubleshooting procedure as necessary to verify that the memory system is operating properly.

TROUBLESHOOTING

If an uncorrectable memory fault is detected, the parity indicator on the front panel will light. If the fault control feature is enabled ("CORRECT" jumper in), the status latch LEDs on the controller (see Appendix C) will indicate a double or triple bit error. Single bit memory failures that are corrected by the fault control system do not affect the state of the status latch. By performing the procedures below and comparing the results with table 5-1. Analysis of Self Test Results, these bit errors can be traced and the defective module replaced.

When the Fault Control Feature is not enabled, ("CORRECT" jumper out), a parity error indication will occur for single bit errors. Perform the Self Test and compare the results with table 5-1, Analysis of Self Test Results. Should the Self Test appear to complete successfully, but have the parity indicator lighted, either a check bit or a memory array parity bit has failed. In this case, it is necessary to execute the Software Memory Diagnostic to determine the address of the memory failure. It should be noted that if a double bit error is encountered by the Self Test, Self Test may give the proper error halt without the parity indicator being lit.

The following tests and diagnostics will be needed to troubleshoot the memory system.

a. Self Test — Executed from computer front panel; refer to test procedure contained in the following paragraph.

b.

DIAGNOSTIC	MANUAL PART NO.	ABSOLUTE BINARY PROGRAM NO.
Software Memory	24395-90001	24395-16001*
Memory Protect/ Parity Error	12892-90005	12892-16001*

TEST PROCEDURE (FAULT CONTROL MEMORY SYSTEM)

a. If power is off, power up the system and proceed to step c. If the system power is on process to step b.

b. If this is a maintenance or PM call and the system is powered up note the status of the parity indicator on the front panel. Lower the front panel and check the status latches and single bit failure indicator LED. This will give an indication that a single bit error occurred previously and had been corrected.

c. Preset the computer from the front panel. Lower the front panel and check the status latches and the single bit error correction LED; all should be lit. If any LED's are off the LED's have failed or the controller is defective. Replace the controller.

d. Load and execute the Self Test from the front panel according to Appendix A.

NOTE

It may be necessary to execute the Self Test several times to verify all of the conditions given in one problem area.

e. If the Self Test does not pass according to the conditions given in table 5-1, disable the fault control feature by removing the "CORRECT" jumper from the 2102H Memory Controller (steps e, f, and o of installation procedure) and repeat the test.

f. Check the memory power supply voltages 5M, 12M, and −12M. (Refer to the appropriate computer installation and service manual to check and/or adjust the power supply.)

*The absolute binary code for this diagnostic is contained on one or more media (e.g., paper tape, mini-cartridge tape, disc, and magnetic tape). The binaries also exist on single as well as multiple files. For correct date codes associated with these media, refer to Appendix A in the Diagnostic Configurator Reference Manual, part no. 02100-90157, dated Jan. 1977 or later.

Table 5-1. Analysis of Fault Control Memory System Self Test

DISPLAY INDICATOR LAMPS	DISPLAY REGISTER LAMPS	PARITY LAMP	OVERFLOW LAMP	32K SEGMENT COUNT (DISPLAY REGISTER)	SINGLE BIT ERROR CORRECTION LED	FAULT LATCH LED'S	INDICATION
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Smooth and Consecutive	Remains ON	Remain ON 77 (octal)	Self test passes, memory system OK
T-Register Lamp ON all others OFF	100000 (octal)	ON	ON	Smooth and Consecutive	Goes OFF	Flashing ON and OFF during execution	Misconfigured or faulty check bit array module or bit 16 error on MEM MOD or faulty controller
T-Register Lamp ON all others OFF	100000 (octal)	Flashes ON but does not latch	ON	Smooth and Consecutive	Goes OFF	Latches on octal #'s does not flash	Bad check bit or parity bit on memory module
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Not Consecutive			Misconfigured or faulty memory module
ALL Lamps ON	177777 (octal)	ON	OFF		Goes OFF	Latches on octal #'s does not flash	Data bit failure(s)
ALL Lamps ON	177777 (octal)		ON				CPU failure

g. Execute the Self Test and verify that it passes or fails according to one of the problem areas given in table 5-1.

h. Refer to the appropriate repair procedure given below.

i. Repeat the procedure until all memory problems are corrected.

REPAIR PROCEDURE

a. Self Test Passes

The computer memory system is operating properly. Reinstall the "CORRECT" jumper in the 2102H Memory Controller and reinstall the controller (steps m, n, and p of installation procedure). Verify the memory system proper operation by executing Self Test using Fault control mode.

b. Misconfigured or Faulty Check Bit Array or Faulty Controller

This error can be caused by several problems, the most common of which is a misconfigured check bit array PCA or a bad cable connection. Check to ensure that the Check Bit Array Modules are configured to support the amount of memory in the computer (table 4-2), and confirm that the cables are connected properly. If no problem is found in the configuration of the module, the next step is to swap the Check Bit Array Modules or controller to correct the problem.

c. Bad Check Bit or Parity Bit on Memory Module

This problem can be corrected by swapping modules. The Self Test does not give the address of the failure directly, but it can be found by observing the parity indicator in conjunction with the display register during execution of Self Test. The parity indicator will flash ON when the 32k segment of memory having the bad bit is being tested. The fault latches will give the bit that is bad and the faulty Check Bit Array Module or Memory Module can be swapped (refer to Appendix C). If the problem can not be found in this manner, the Software Semiconductor Diagnostic can be run to give the address of the failure.

d. Misconfigured or Faulty Memory Module

This problem is most commonly a misconfigured module. Check to insure that all memory modules are configured correctly (refer to figures 2-3 through 2-6). If no misconfigured module is found, then the defective module may be isolated by observing the 32k segment count. The faulty modules reside on the skipped segments.

e. Data Bit Failures

This problem can be corrected by swapping modules. Refer to Appendix B to isolate the faulty module and bits.

f. CPU Failure

Refer to your Computer Installation and Service Manual for service information.

MEMORY SYSTEM SELF TEST

APPENDIX A

a. Set P-register = 000000 (octal), press STORE.

b. Set A-register = 100000 (octal), press STORE.

c. Press PRESET.

d. To loop on self test, set LOCK/OPERATE switch to LOCK.

e. Press INSTRUCTION STEP. As the test executes the display register will display the count of each 32k word segment of memory tested, starting at segment 0. If the count is not smooth or there is a skip, the memory module is misconfigured or a failure occurred in that segment. With 32k words or less the display register will remain off.

f. If a data bit failure occurs, all display register lights will be lit and the OVERFLOW light will be off. If OVERFLOW is set (light on), a failure occurred in the CPU not in memory.

   A parity bit or check bit error is indicated when the parity indicator is lit and the display register (data bits) do not light.

g. Refer to table 3-1 for analysis of test indications for a non-fault control memory system.

h. Refer to table 5-1 for analysis of test indications for a fault control memory system.

LOCATION FAULTY BITS ON MEMORY MODULES

APPENDIX B

a. Read upper five bits (14:10) of M-register for map register number where the failures occurred.

b. Press the MODE pushbutton switch once to access the special register display mode.

c. Place upper five bits (14:10) of M-register into the lower five bits of the M-register, clear all other bits (15:5) and press STORE.

d. Read page of failing bits from T-register Bits (9:0) (in octal).

e. The page to module association is determine by the particular configuration of 16k word or 64k word modules within a system. Refer to tables B-1 through B-5 to determine which row of RAMs contains the failing page.

f. To determine the faulty bits in a 2102H fault control memory system refer to Appendix C and the fault control latch on the controller.

   To determine the faulty bits in a 2102E memory system compare the A- and B-registers. Press the MODE pushbutton switch once to return to the standard display mode. The A-register contains the data written to memory, the B-register contains the data read from memory.

g. Refer to appropriate memory address configuration (figures 2-3 through 2-6) to locate the faulty bits on the memory module.

Table B-1. 12747H 64k Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 64K MEMORY ARRAY ASSEMBLY			
			ROW 0	ROW 1	ROW 2	ROW 3
64k	0-77	0	0-17	20-37	40-57	60-77
128k	100-177	1	100-117	120-137	140-157	160-177
192k	200-277	2	200-217	220-237	240-257	260-277
256k	300-377	3	300-317	320-337	340-357	360-377
320k	400-477	4	400-417	420-437	440-457	460-477
384k	500-577	5	500-517	520-537	540-557	560-577
448k	600-677	6	600-617	620-637	640-657	660-677
512k	700-777	7	700-717	720-737	740-757	760-777
576k	1000-1077	10	1000-1017	1020-1037	1040-1057	1060-1077
640k	1100-1177	11	1100-1117	1120-1137	1140-1157	1160-1177
704k	1200-1277	12	1200-1217	1220-1237	1240-1257	1260-1277
768k	1300-1377	13	1300-1317	1320-1337	1340-1357	1360-1377
832k	1400-1477	14	1400-1417	1420-1437	1440-1457	1460-1477
896k	1500-1577	15	1500-1517	1520-1537	1540-1557	1560-1577
960k	1600-1677	16	1600-1617	1620-1637	1640-1657	1660-1677
1024k	1700-1777	17	1700-1717	1720-1737	1740-1757	1760-1777

Table B-2. 12746H 32k Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE SIZE	ROW ON 32K MEMORY	
			ROW 0	ROW 1
32k	0-37	0	0-17	20-37
64k	40-77	1	40-57	60-77
96k	100-137	2	100-117	120-137
128k	140-177	3	140-157	160-177
160k	200-237	4	200-217	220-237
192k	240-277	5	240-257	260-277
224k	300-337	6	300-317	320-337
256k	340-377	7	340-357	360-377
288k	400-437	8	400-417	420-437
320k	440-477	9	440-457	460-477
352k	500-537	10	500-517	520-537
384k	540-577	11	540-557	560-577
416k	600-637	12	600-617	620-637
448k	640-677	13	640-657	660-677
480k	700-737	14	700-717	720-737
512k	740-777	15	740-757	760-777
544k	1000-1037	16	1000-1017	1020-1037
576k	1040-1077	17	1040-1057	1060-1077
608k	1100-1137	18	1100-1117	1120-1137
640k	1140-1177	19	1140-1157	1160-1177
672k	1200-1237	20	1200-1217	1220-1237
704k	1240-1277	21	1240-1257	1260-1277
736k	1300-1337	22	1300-1317	1320-1337
768k	1340-1377	23	1340-1357	1360-1377
800k	1400-1437	24	1400-1417	1420-1437
832k	1440-1477	25	1440-1457	1460-1477
864k	1500-1537	26	1500-1517	1520-1537
896k	1540-1577	27	1540-1557	1560-1577
928k	1600-1637	28	1600-1617	1620-1637
960k	1640-1677	29	1640-1657	1660-1677
992k	1700-1737	30	1700-1717	1720-1737
1024k	1740-1777	31	1740-1757	1760-1777

Table B-3. 12749H 256k Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 64K MEMORY ARRAY ASSEMBLY			
			ROW 0	ROW 1	ROW 2	ROW 3
256k	0-377	0	0-77	100-177	200-277	300-377
512k	400-777	1	400-477	500-577	600-677	700-777
768k	1000-1377	2	1000-1077	1100-1177	1200-1277	1300-1377
1024k	1400-1777	3	1400-1477	1500-1577	1600-1677	1700-1777

Table B-4. 12699H 128k Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 64K MEMORY ARRAY ASSEMBLY	
			ROW 0	ROW 1
128k	0-177	0	0-77	100-177
256k	200-377	1	200-277	300-377
384k	400-577	2	400-477	500-577
512k	600-777	3	600-677	700-777
640k	1000-1177	4	1000-1077	1100-1177
768k	1200-1377	5	1200-1277	1300-1377
896k	1400-1577	6	1400-1477	1500-1577
1024k	1600-1777	7	1600-1677	1700-1777

FAILURE LATCH INDICATIONS

APPENDIX C

The fault control memory controller contains seven failure indicators (LEDs). With all seven LEDs ON, the memory is operating properly without bit failures. The single bit error LED (see figure C-1) in the OFF condition indicates that a single bit errir has occurred. With the fault control feature enabled this is the only single bit error indication. When the computer is preset the LED comes on; when an error occurs the LED goes off and remains off until the next time the computer is preset. If the fault correction feature is enabled, the error will be corrected and the failure latch indicators (cluster of six LEDs) will remain lit. If you observe that the single bit indicator is not lit, note it in the System Support Log to inform the HP Customer Engineer at the next scheduled Preventive Maintenance service call.

When a single bit memory failure occurs with the fault control feature disabled, or an uncorrectable error occurs with fault control enabled, the failure latch will indicate the bit which has failed and the type of failure (single bit fault, double bit fault), and the parity indicator on the font panel will light.

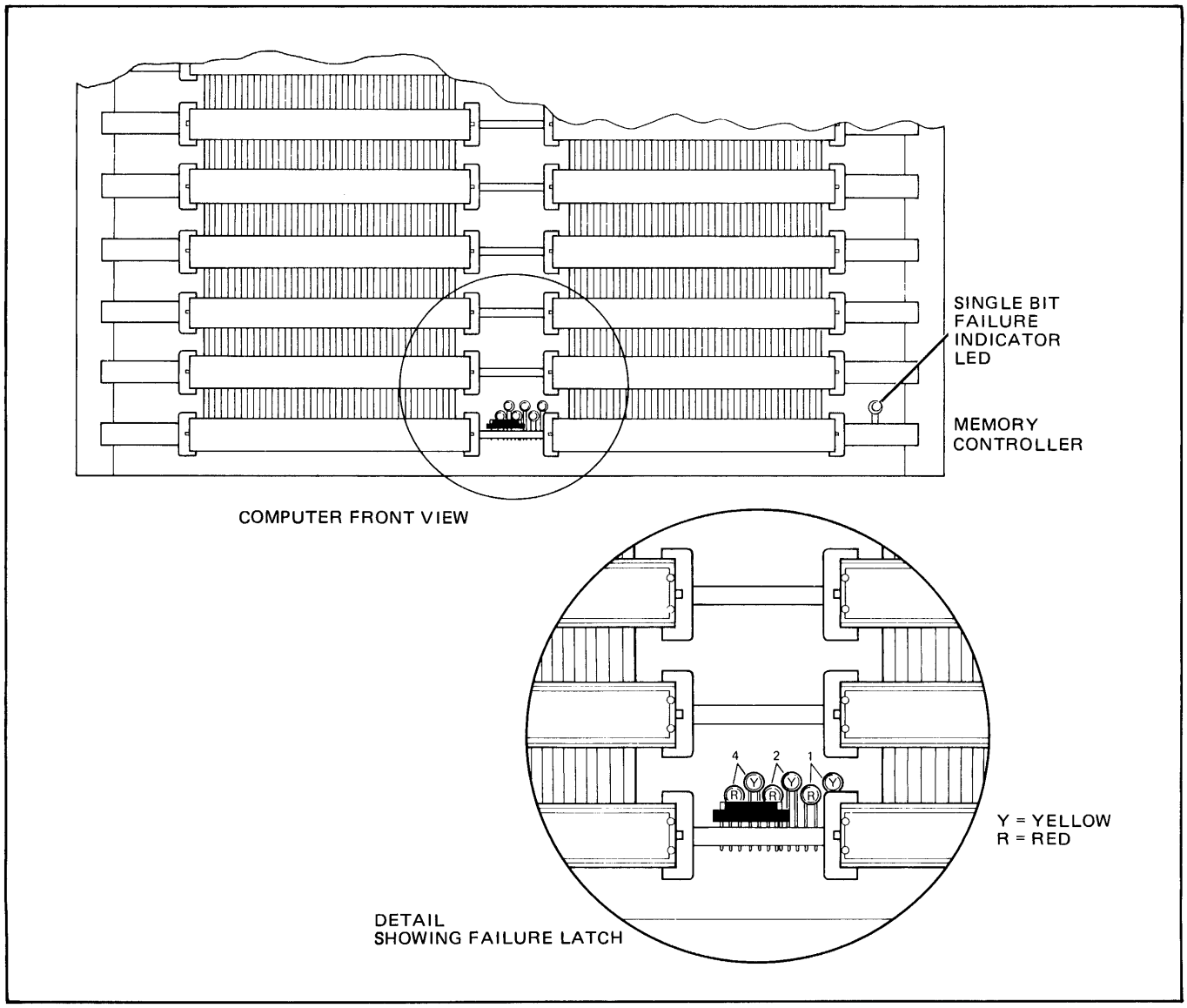


Figure C-1. Failure Latch Indicators

Table C-1. Failure Latch Indications

YELLOW DIGIT	RED DIGIT	ERROR DETECTED		YELLOW DIGIT	RED DIGIT	ERROR DETECTED
X	1	Double (or greater) error, X=don't care		2	4	Bit 10
X	3	Double (or greater) error, X=don't care		3	4	Bit 11
X	5	Double (or greater) error, X=don't care		4	4	Bit 12
				5	4	Triple (or greater) error
0	0	Bit 0		6	4	Triple (or greater) error
1	0	Triple (or greater) error		7	4	Bit 19
2	0	Triple (or greater) error		0	6	Bit 13
3	0	Bit 1		1	6	Bit 14
4	0	Triple (or greater) error		2	6	Triple (or greater) error
5	0	Bit 2		3	6	Bit 18
6	0	Bit 3		4	6	Bit 15
7	0	Bit 4		5	6	Bit 17
0	2	Triple (or greater) error		6	6	Bit 16
1	2	Bit 5		7	6	Bit 21
2	2	Bit 6		0	7	Double (or greater) error
3	2	Triple (or greater) error		1	7	Double (or greater) error
4	2	Bit 7		2	7	Double (or greater) error
5	2	Triple or greater) error		3	7	Double (or greater) error
6	2	Bit 8		4	7	Double (or greater) error
7	2	Bit 20		5	7	Double (or greater) error
0	4	Triple (or greater) error		6	7	Double (or greater) error
1	4	Bit 9		7	7	Normal state and result of PRESET

Six LED's on the 2102H Memory Controller contain the fault information. The three yellow LEDs and three red LEDs are to be read as octal numbers. Figure C-1 shows the location of these LEDs as they appear from the front of the computer. These "yellow digit" and "red digit" indications and the corresponding failure latch indications are listed in table C-1.

Double, Triple, or greater bit errors rarely occur. If the failure latch indicates such a failure, one should suspect the following:

a. Check Bit Arrays or Memory Modules are not configured correctly.

b. The memory system cables are not properly connected.

c. A gross failure of memory controller, memory module, or check bit array has occurred.

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