



**INSTALLATION AND SERVICE
MANUAL**

**STANDARD PERFORMANCE
MEMORY SYSTEMS**

Manual part no. 5955-4310

Printed in U.S.A. APRIL 1979

PRODUCTS COVERED

HP 2102B, HP 2102C, HP 12746A, HP 12747A,
HP 12779A, HP 12780A, HP 12994A, HP 12998A, and
HP 13187A/B

LIST OF EFFECTIVE PAGES

Changed pages are identified by a change number adjacent to the page number. Changed information is indicated by a vertical line in the outer margin of the page. Original pages do not include a change number and are indicated as change number 0 on this page. Insert latest changed pages and destroy superseded pages.

Change 0 (Original) April 1979

NOTICE

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied or reproduced without the prior written consent of Hewlett-Packard Company.

Copyright © 1979 by HEWLETT-PACKARD COMPANY

**Library Index Number
02102.030.5955-4310**

CONTENTS

Section I	Page	Troubleshooting E-Series Computer, 2102C	
GENERAL INFORMATION		Controller With "STOP" Jumper	5-3
Introduction	1-1	Test Procedure	5-3
		Repair Procedure	5-4
		Troubleshooting M-Series Computers	5-4
		Test Procedure	5-4
Section II	Page	Section VI	Page
INSTALLATION OF MEMORY SYSTEM		MEMORY MODULE CONFIGURATION	
(NON-FAULT CONTROL)		Description	6-1
Description	2-1	Memory Modules	6-1
Installation Procedure	2-1	12994A — 4K Word Memory Module	6-1
		12998A — 8K Word Memory Module	6-1
		13187A/B — 16K Word Memory Module	6-1
		12746A — 32K Word Memory Module	6-1
		12747A — 64K Word Memory Module	6-1
Section III	Page	Appendix A	Page
MAINTENANCE (NON-FAULT CONTROL		MEMORY SYSTEM SELF TEST	
MEMORY SYSTEM)		(E-SERIES ONLY)	A-1
General	3-1		
Preventive Maintenance	3-1		
Troubleshooting	3-1		
Test Procedure (Non-Fault Control Memory			
System E-Series Computer)	3-1		
Repair Procedure (Non-Fault Control Memory			
System E-Series Computer)	3-1		
Section IV	Page	Appendix B	Page
INSTALLATION OF FAULT CONTROL		LOCATING FAULTY BITS ON MEMORY	
MEMORY SYSTEM		MODULES IN E-SERIES COMPUTERS	B-1
Description	4-1		
Installation Procedure	4-1		
Section V	Page	Appendix C	Page
MAINTENANCE (FAULT CONTROL		FAILURE LATCH INDICATIONS (2102C	
MEMORY SYSTEMS)		CONTROLLER WITH "CORRECT" JUMPER) ..	C-1
General	5-1		
Preventive Maintenance	5-1		
Troubleshooting	5-1		
Troubleshooting E-Series Computer, 2102C			
Controller With "CORRECT" Jumper	5-1		
Test Procedure	5-1		
Repair Procedure	5-2	Appendix D	Page
		FAILURE LATCH INDICATIONS (2102C	
		CONTROLLER WITH "STOP" JUMPER)	D-1

ILLUSTRATIONS

Title	Page	Title	Page
Memory System Installation Details (Non-Fault Control)	2-2	12998A 8K Word Memory Address Configuration ...	6-3
2102B Memory Controller Jumper Configuration ...	2-3	13187A 16K Word Memory Address Configuration ..	6-4
Fault Control Memory System		13187B 16K Word Memory Address Configuration ..	6-5
Installation Details	4-3	12747A 64K Word Memory Address Configuration ..	6-6
2102C Memory Controller Jumpers	4-4	12746A 32K Word Memory Address Configuration ..	6-7
12779A Jumper or DIP Switch Locations	4-5	Failure Latch Indications (2102C Date Code 1820 or Higher)	C-1
12780A Jumper or DIP Switch Locations	4-6	Failure Latch Indications (2102C Date Code 1721)	D-1
12994A 4K Word Memory Address Configuration ...	6-2		

TABLES

Title	Page	Title	Page
Analysis of E-Series Memory System Self Test (Non-Fault Control)	3-2	8K Word Memory Module Page Table	B-1
Sample Check Bit Array Requirements	4-1	16K Word Memory Module Page Table	B-2
Check Bit Array Configuration	4-2	64K Word Memory Module Page Table	B-3
Memory Card Cage Assignments	4-3	32K Word Memory Module Page Table	B-4
Analysis of Fault Control Memory System Self Test (PCAs With "CORRECT" Jumper)	5-2	Failure Latch Indications ("CORRECT" Jumper)	C-2
Analysis of Fault Control Memory System Self Test (PCAs With "STOP" Jumper)	5-3	Failure Latch Indications ("STOP" Jumper)	D-2

1-1 INTRODUCTION

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

- HP 2102B Standard Performance Memory Controller
- HP 2102C Standard Performance Fault Control Memory Controller
- HP 12994A 8K byte (4K word) Memory Module
- HP 12998A 16K byte (8K word) Memory Module
- HP 13187A/B 32K byte (16K word) Memory Module
- HP 12746A 64K byte (32K word) Memory Module
- HP 12747A 128K byte (64K word) Memory Module
- HP 12779A 256K byte (128K word) Check Bit Array
- HP 12780A 512K byte (256K word) 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 or

HP 12976B Dynamic Mapping System Installation Manual, part no. 12976-90005

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), Section III (MAINTENANCE) or Section VI (MEMORY MODULE CONFIGURATION). The procedures for installing or servicing a fault control memory system are contained in Section IV (INSTALLATION), Section V (MAINTENANCE) or Section VI (MEMORY MODULE CONFIGURATION).

INSTALLATION OF MEMORY SYSTEM (Non-Fault Control)

SECTION

II

2-1. DESCRIPTION

This section provides installation instructions for a Hewlett-Packard Standard Performance Memory System (without fault control) to be installed in an HP 1000 E-Series or M-Series Computer mainframe or HP 12990B Memory Extender. If the memory system is larger than 32K words, an HP Dynamic Mapping System (DMS) is also required. Refer to your Computer Reference Manual to determine which DMS is used with your Computer. 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:

2102B Standard Performance Memory Controller, part no. 02102-60001.

*One or more Standard Performance Memory Modules.

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

*Refer to Section VI for Memory Module Configuration and Compatibility information

2-2. 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. Configure the 2102B for the computer model and PCA revision you have as shown in figure 2-2.
 - d. Install the controller in the bottom memory slot with the component side up (see figure 2-1).
- | COMPUTER | MEMORY SLOT |
|-----------|-------------|
| 2105 | 115 |
| 2108/2109 | 118 |
| 2112/2113 | 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. Refer to Section VI for memory address configuration and compatibility details.
- NOTE
- If an HP 12990B Memory Extender is being used, it is recommended that the nine memory extender slots be filled before adding memory modules to the computer mainframe.
- f. Install memory module(s) in the computer or extender memory slots with the component side(s) 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.
- 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.

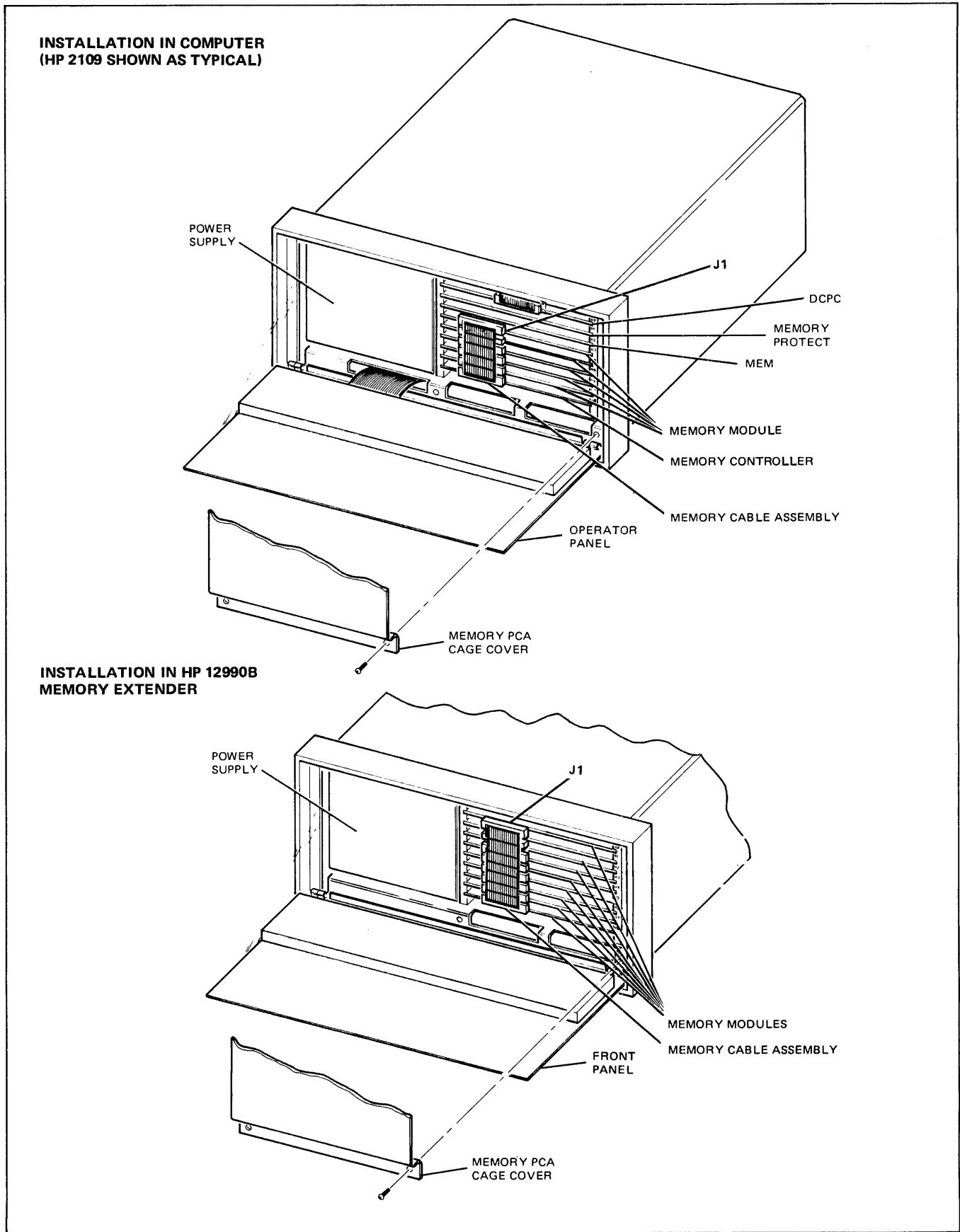
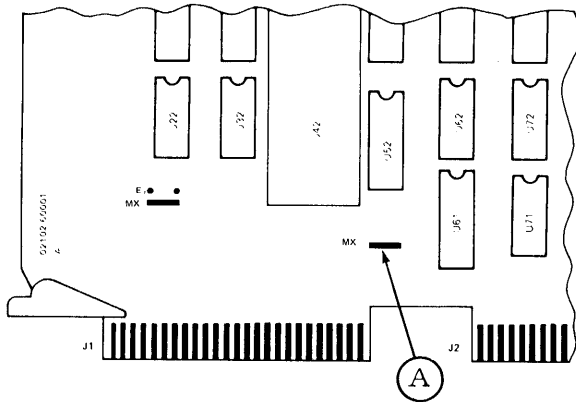


Figure 2-1. Memory System Installation Details (Non-Fault Control)



Install jumpers in indicated positions

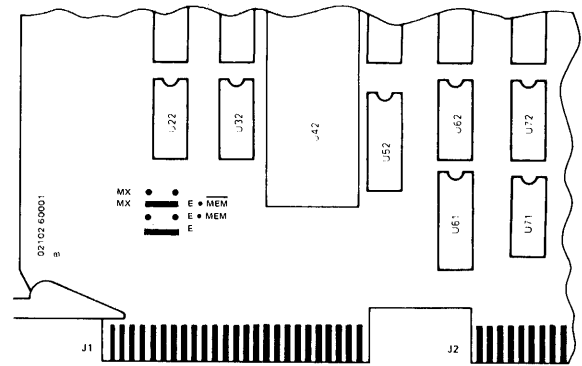
MX = HP 1000 M-Series Computer

E = HP 1000 E-Series Computer

A For HP 1000 E-Series Computer with Memory Expansion Module (MEM) not installed, also install "MX" jumper near U61.

Board as shown configured for HP 1000 M-Series Computer.

Revision "A" Board



Install jumpers in indicated positions

(There will always be 2 jumpers installed)

MX = HP 1000 M-Series
 MX+(E • MEM) = HP 1000 M-Series with or without MEM installed or HP 1000 E-Series without MEM installed
 (E • MEM) = HP 1000 E-Series with MEM installed
 E = HP 1000 E-Series Computer.

Board as shown configured for a HP 1000 E-Series Computer, MEM not installed.

Revision "B" or "C" Board

Figure 2-2. 2102B Memory Controller Jumper Configuration

MAINTENANCE (Non-Fault Control Memory System)

SECTION

III

3-1. 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.

3-2. 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.

3-3. TROUBLESHOOTING

Troubleshooting consists of analyzing the problem to isolate it to a particular PCA or determining 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 of E-Series Computers; refer to test procedure contained in the following paragraph. M-Series computers are not equipped with the firmware Self Test, therefore, the diagnostic tests must be performed.

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 code(s) associated with these media, refer to Appendix A in the Diagnostic Configurator Reference Manual, part no. 02100-90157, dated Jan. 1977 or later.

3-4. TEST PROCEDURE (NON-FAULT CONTROL MEMORY SYSTEM E-SERIES COMPUTER)

NOTE

M-Series computers are not equipped with the firmware Self Test, therefore the diagnostic tests must be used for troubleshooting and repair.

- 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.

3-5. REPAIR PROCEDURE (NON-FAULT CONTROL MEMORY SYSTEM E-SERIES COMPUTER)

- 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 exists, replace the memory controller.
- b. Data Bit(s) 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 Section VI and figure 2-2). If no misconfigured module is found, then the defective module may be isolated by observing the 32K segment count. The faulty module(s) reside on the skipped segment(s).

Table 3-1. Analysis of E-Series 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 O.K. 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 bit(s) 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

4-1. 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, a Dynamic Mapping System (DMS) is also required. The hardware requirements for this system are:

2102C Standard Performance Fault Control Memory Controller, part no. 02102-60003.

At least one HP 12779A (12779-60001) or one HP 12780A (12780-60001) Standard 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.

At least 64K bytes (32K words) of HP Standard Performance Memory, that is compatible with the 2102C Fault Control Memory System (refer to Section VI).

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.

4-2. INSTALLATION PROCEDURE

- On the rear of the computer set the battery switch to OFF. Set the computer ac power off.
- Lower the operator panel and remove memory PCA cage cover and remove memory cable assemblies if installed (see figure 4-1).
- Configure memory controller, Memory Expansion (MEM), and CPU compatibility jumpers as shown in figure 4-2.

- Disable the fault control feature by removing jumper marked "CORRECT" or "STOP" on the 2102C Memory Controller (see figure 4-2).

NOTE

Check bit arrays are always required with a 2102C Memory Controller.

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

COMPUTER	MEMORY SLOT
2108/2109	118
2112/2113	123

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

NOTE

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

- Install Check Bit Array(s) with component side(s) up in the computer memory slots indicated in figure 4-1 and table 4-3.
- Disable the fault control feature on the memory controller if it is not already disabled (step d of installation procedure).

Table 4-1. Sample Check Bit Array Requirements

Memory Size (words)	Check Bit Array Requirements	
	12779	12780
32K	1	0
64K	1	0
128K	1	0
256K	0	1
320K	1	1
384K	1	1
512K	0	2
640K	1	2
768K	0	3
832K	1	3
896K	1	3

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 or 12780	IN	IN	IN	IN	IN	IN	IN	OUT	IN	IN	OUT
64K	12779 or 12780	IN	IN	IN	IN	IN	IN	IN	OUT	OUT	OUT	OUT
128K	12779 or 12780	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
192K	12779 or 12780	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
	12779* or 12780	IN	IN	IN	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
256K	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	or 12779	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
	12779*	IN	IN	OUT	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
320K	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	12779 or 12780	IN	IN	IN	IN	OUT	IN	IN	OUT	OUT	OUT	OUT
384K	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	12779 or 12780	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
448K	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	12779 or 12780	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
	12779* or 12780	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
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 or 12780	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 or 12780	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	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT
	12779 only	IN	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT

*Only a 12779 with Date Code 1905 or later can be used in this space.

- 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. Refer to Section VI for configuration and compatibility information of memory modules.

NOTE

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

- j. Install memory module(s) in the computer or memory extender with component side(s) up as indicated in figure 4-1 and table 4-3.

NOTE

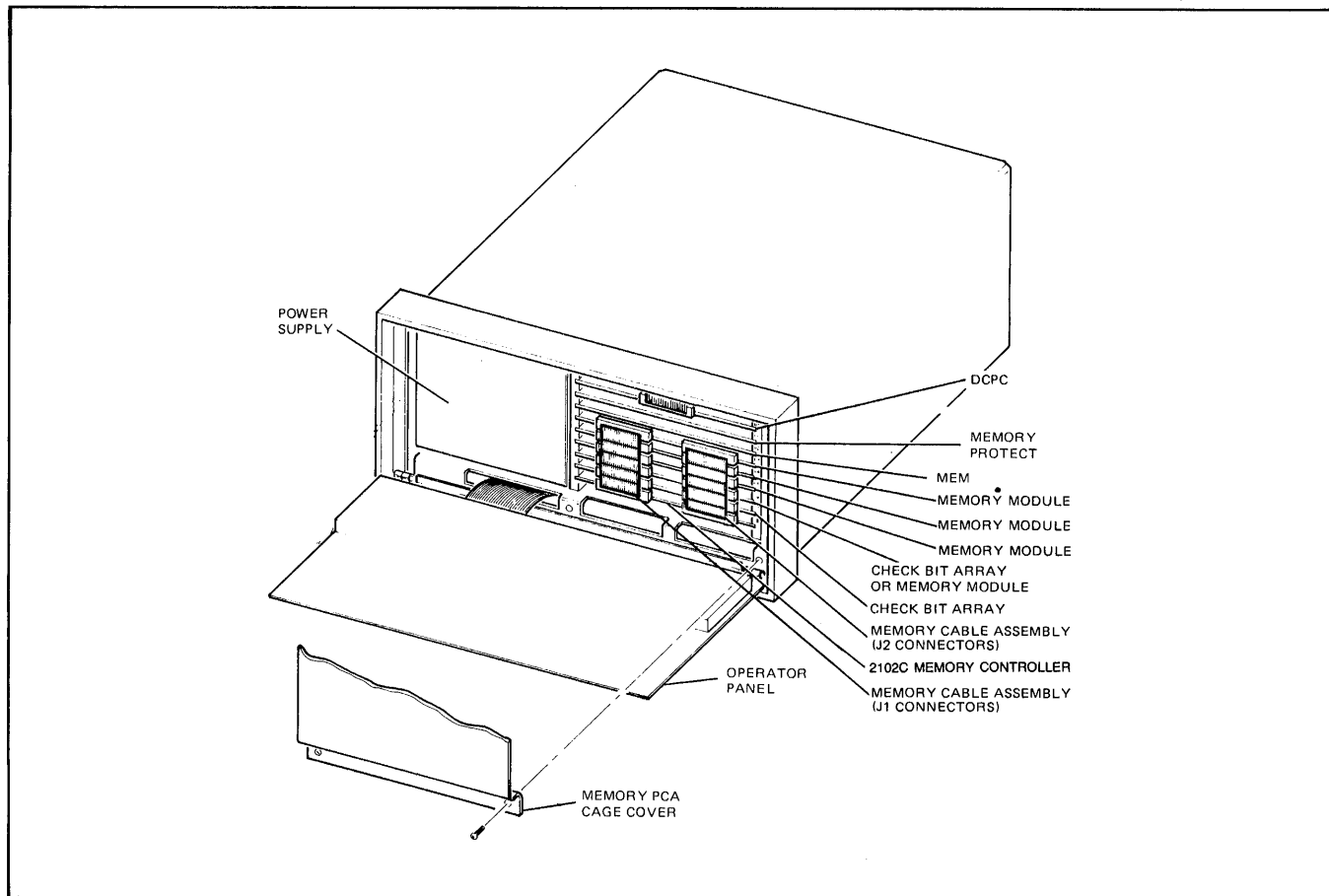
If any other PCAs (DCPC, MEM, or Memory Protect need to be installed, perform those installation procedures at this time and then complete this procedure. Remember, if DMS is to be installed, the jumper in step c of this procedure should be removed.

- k. Connect the memory cable assembly, part no. 02112-60016, or the memory extender cable, part no.

Table 4-3. Memory Cage Assignments

Memory Slot	2108/2109 Assignment	2112/2113 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

- 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" or "STOP" jumper on the 2102C 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.



7700-200

Figure 4-1. Fault Control Memory System Installation Details

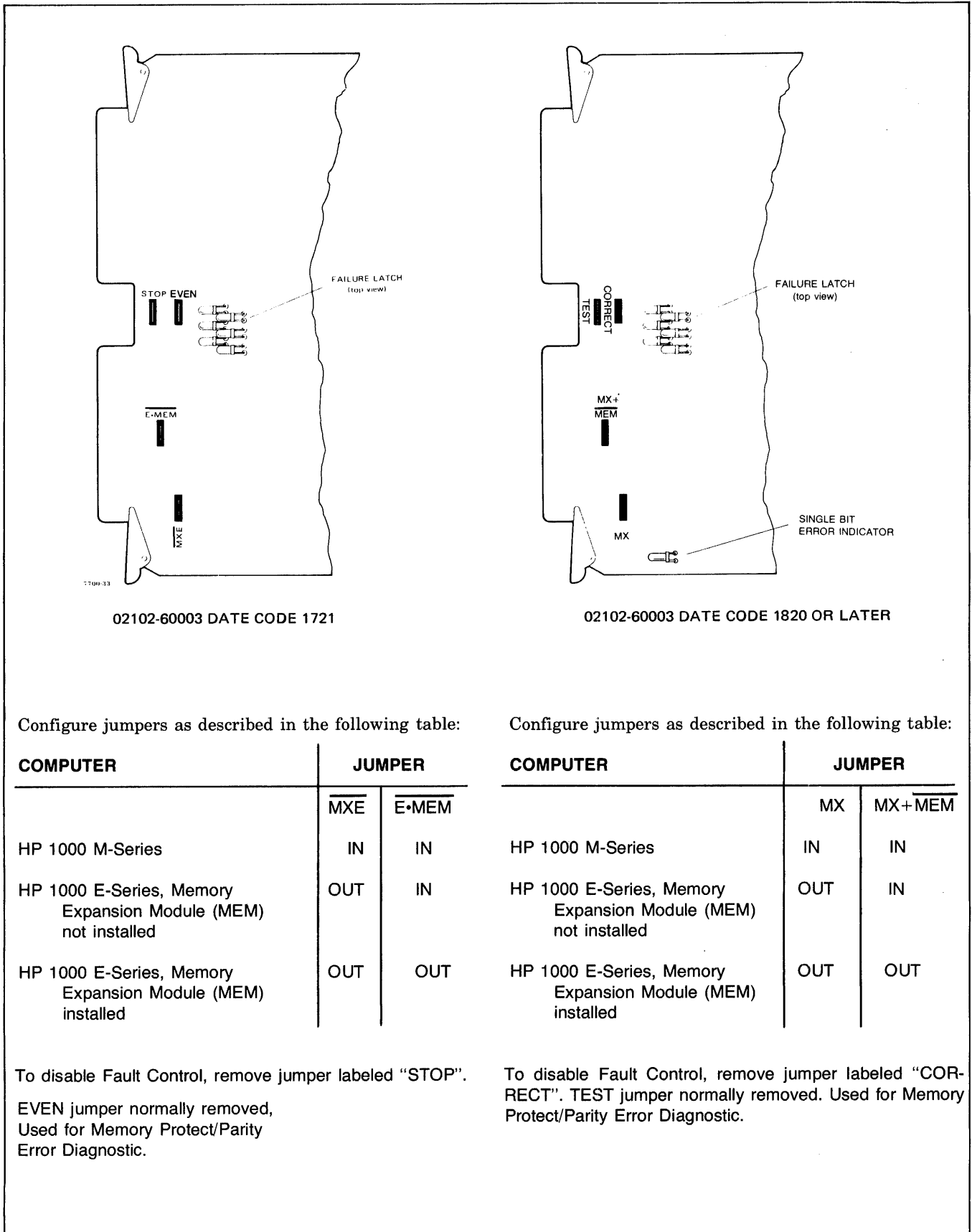


Figure 4-2. 2102C Memory Controller Jumpers

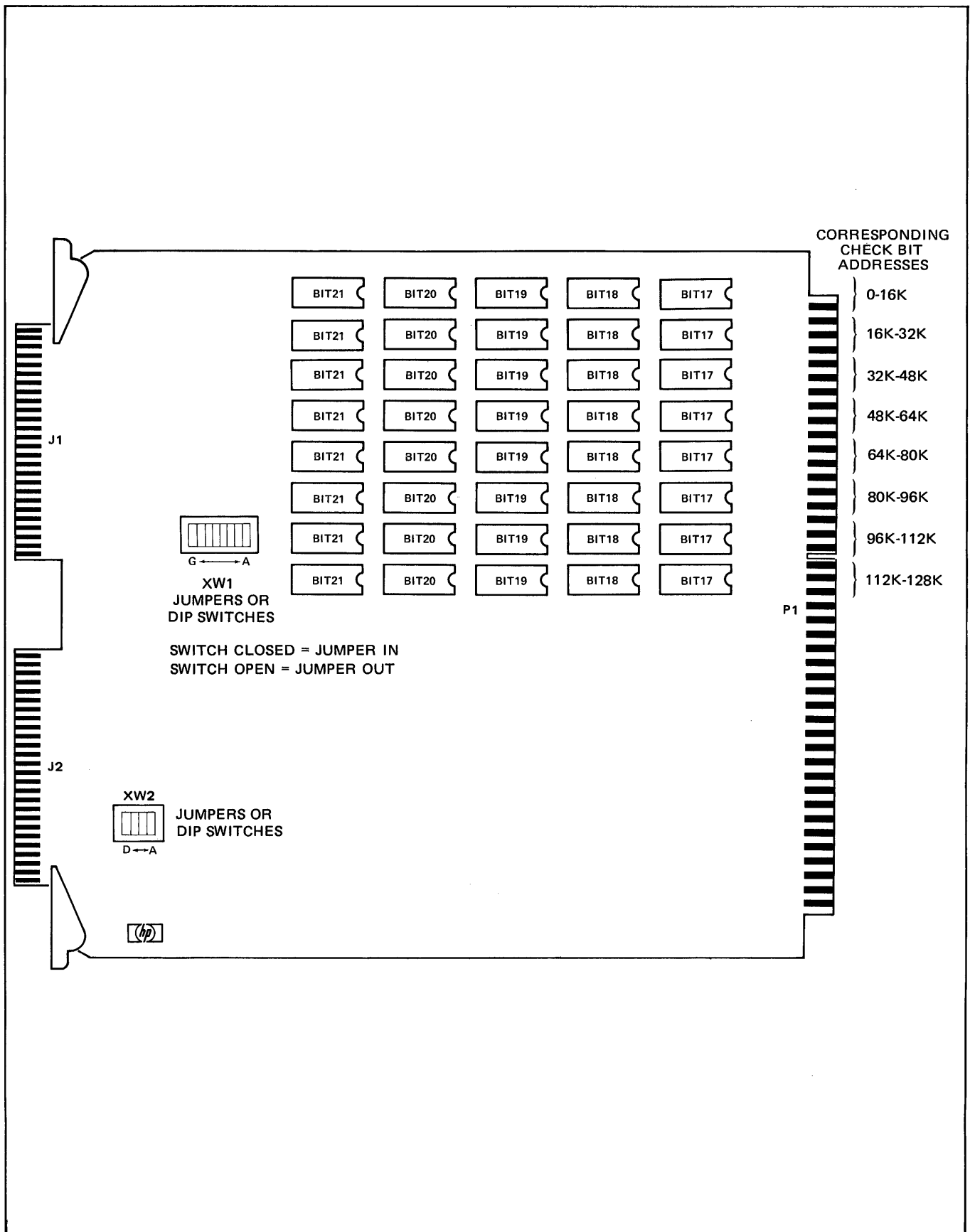


Figure 4-3. 12779A Jumper or DIP Switch Locations

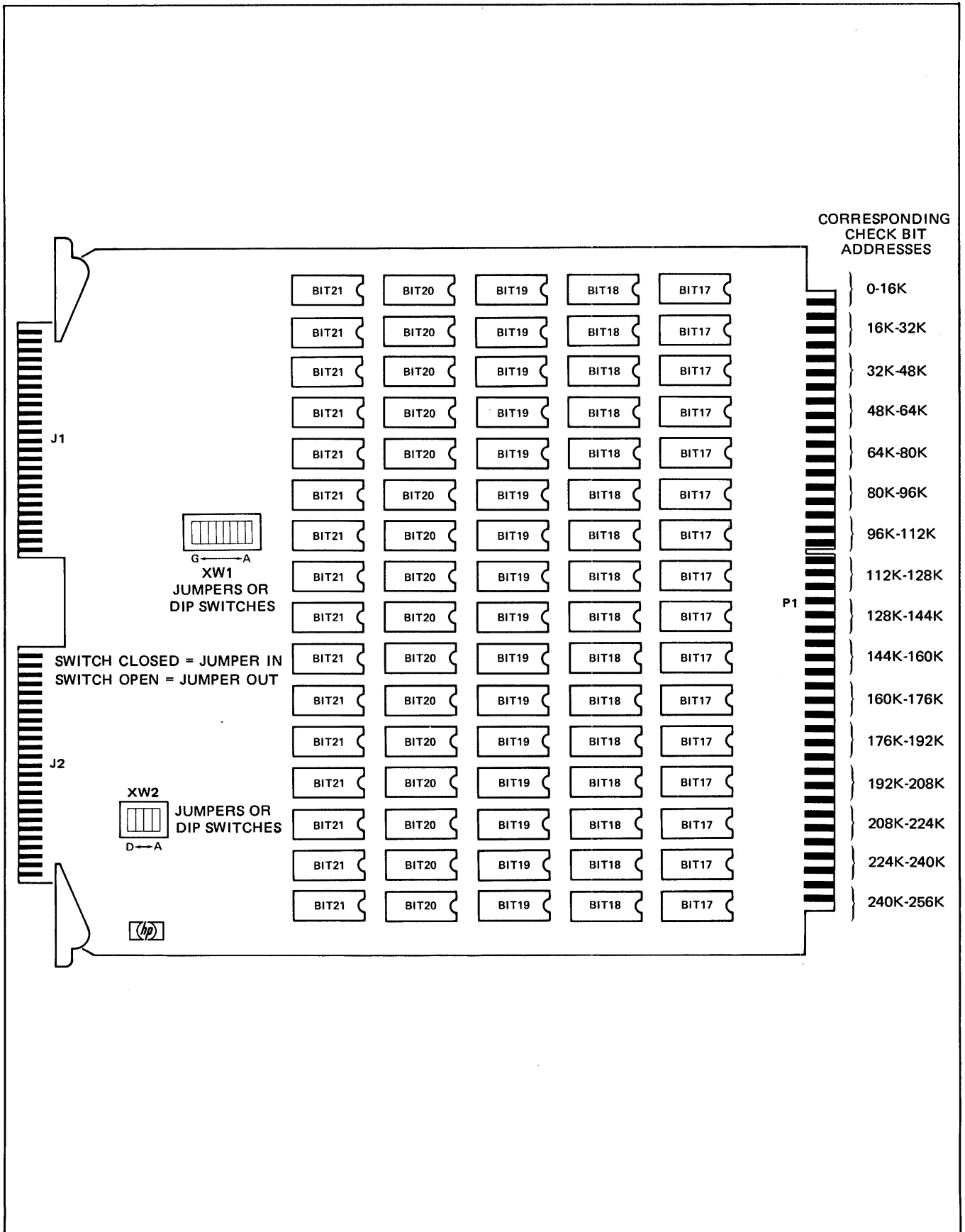


Figure 4-4. 12780A Jumper or DIP Switch Locations

MAINTENANCE (FAULT CONTROL MEMORY SYSTEMS)

SECTION

V

5-1. 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.

5-2. 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.

5-3. TROUBLESHOOTING

Troubleshooting is divided into three separate procedures, depending on the computer, (M- or E-Series) and the version of 2102C controller ("STOP" or "CORRECT" jumper). These are presented separately in the manual, one procedure for the M-Series Computer and two for the E-Series Computer.

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

- a. Self Test — Available on E-Series computers only. Executed from computer front panel.

DIAGNOSTIC	MANUAL PART NO.	ABSOLUTE BINARY PROGRAM NO.
Software 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 tape, disc, and magnetic tape). The binaries also exist on single as well as multiple files. For current date code(s) associated with these media, refer to Appendix A in the Diagnostic Configurator Reference Manual, part no. 02100-90157, dated Jan. 1977 or later.

5-4. TROUBLESHOOTING E-SERIES COMPUTER, 2102C CONTROLLER WITH "CORRECT" JUMPER

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 Fault Control Self Test, 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.

5-5. TEST PROCEDURE

- If power is off, power up the system and proceed to step c. If the system power is on proceed to step 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.
- 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.
- 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 2102C Memory Controller 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.)
- 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 repair procedure of paragraph 5-6.
- i. Repeat the procedure until all memory problems are corrected.

5-6. REPAIR PROCEDURE

a. Self Test Passes

The computer memory system is operating properly. Reinstall the "CORRECT" jumper in the 2102C Memory Controller and reinstall the controller. Verify the memory system proper operation by executing Self Test with Fault control enabled.

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 Module(s) 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 figure 6-1 through 6-6).

Table 5-1. Analysis of Fault Control Memory System Self Test (PCAs with "CORRECT" Jumper)

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

If no misconfigured module is found, then the defective module may be isolated by observing the 32K segment count. The faulty module(s) reside on the skipped segment(s).

e. Data Bit Failure(s)

This problem can be corrected by swapping modules. Refer to Appendix B to isolate the faulty module and bit(s).

f. CPU Failure

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

NOTE

The state of the failure latch is random upon power up and will remain in a random state until a parity error occurs.

When the Fault Control Feature is not enabled, ("STOP" jumper out), a parity error indication will occur for single bit errors. Perform the Self Test and compare the results with table 5-2, 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.

5-7. TROUBLESHOOTING E-SERIES COMPUTER, 2102C CONTROLLER WITH "STOP" JUMPER

If an uncorrectable memory failure is detected, the parity indicator on the front panel will be lighted and the failure latch on the front panel will light and the failure latch on the memory controller, which consists of six light emitting diodes (LEDs) will indicate the bit in memory that has failed. Refer to Appendix D for interpretation of the failure. Memory failures that are corrected do not affect the state of the status latch. By performing the procedures below and comparing the results with table 5-2, Analysis of Self Test Results, these bit errors can be traced and the defective module replaced.

5-8. TEST PROCEDURE

- Turn off the ac and battery power to the computer.
- Remove the "STOP" jumper from the 2102C Memory Controller, disabling the fault control feature.
- Load and execute the Self Test from the front panel according to Appendix A.
- Refer to table 5-2 for analysis of the results of the Self Test.
- Refer to the repair procedure of paragraph 5-9.

Table 5-2. Analysis of Fault Control Memory System Self Test (PCAs With "STOP" Jumper)

DISPLAY INDICATOR LAMPS	DISPLAY REGISTER LAMPS	PARITY LAMP	OVERFLOW LAMP	32K SEGMENT COUNT (DISPLAY REGISTER)	FAULT LATCH LED'S	INDICATION
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Smooth and Consecutive		Self test passes, memory system OK
T-Register Lamp ON all others OFF	100000 (octal)	ON	ON	Smooth and Consecutive		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)	OFF	ON	Not Consecutive		Misconfigured or faulty memory module
ALL Lamps ON	177777 (octal)	ON	OFF		Latches on octal #'s does not flash	Data bit failure(s)
ALL Lamps ON	177777 (octal)		ON			CPU failure

5-9. REPAIR PROCEDURE

a. Self Test Passes

The computer memory system is operating properly. Reinstall the "STOP" jumper in the 2102C controller, and verify the memory system's proper operation by executing Self Test using the fault control feature.

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 Module(s) 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. 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 Section VI). If no misconfigured module is found, then the defective module may be isolated by observing the 32K segment count. The faulty module(s) reside on the skipped segment(s). Finally exchange memory modules.

d. Data Bit Failure(s)

This problem can be corrected by swapping modules. Refer to Appendix B to isolate the faulty module and bit(s).

e. CPU Failure

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

5-10. TROUBLESHOOTING M-SERIES COMPUTERS

If an uncorrectable memory fault is detected, the parity indicator on the front panel will light. If the fault control feature is enabled ("CORRECT" or "STOP" jumper in), the status latch LEDs on the controller (see Appendix C or D) 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. When the Fault Control Feature is not enabled, (jumper out), a parity error indication will occur for single bit errors.

To find memory problems in an M-Series Computer it is necessary to execute the Semiconductor Memory Diagnostic. Some form of input device is needed to load the diagnostic. The part numbers associated with the different media on which the diagnostic are available can be found in Appendix A of the Diagnostic Configurator Reference Manual, part no. 02100-90157, dated January 1977 or later.

5-11. TEST PROCEDURE

- a. Turn off the ac and battery power to the computer.
- b. Remove the "STOP" or "CORRECT" jumper from the 2102C Memory Controller, disabling the fault control feature.
- c. Load and execute the Semiconductor Memory Diagnostic. Refer to the Semiconductor Diagnostic Reference Manual, part no. 24395-90001 for failure indications of the diagnostic. Appendix C or D of this manual should be used to isolate faulty bit(s).

MEMORY MODULE CONFIGURATION

SECTION

VI

6-1. DESCRIPTION

This section provides configuration and compatibility information for Hewlett-Packard Standard Performance Memory Modules used in HP 1000 M- and E-Series Computers. Note that all references are to 16-bit words, not 8-bit bytes.

6-2. MEMORY MODULES

6-3. 12994A — 4K WORD MEMORY MODULE

This module can be configured for 4K addresses with a lower boundary of any multiple of 8K. Only one 12994A Module is allowed per system, and it must be assigned the highest used memory addresses regardless of memory configuration. The 12994A is compatible with the 2102A and the 2102B Memory Controller, it is not compatible with the 2102C Fault Control Memory Controller. (See Figure 6-1.)

6-4. 12998A — 8K WORD MEMORY MODULE

The 12998A can be configured for 8K addresses with a lower boundary of any multiple of 8K. The 12998A is compatible with 2102A, 2102B, and 2102C Memory Controllers. (See Figure 6-2.)

6-5. 13187A/B — 16K WORD MEMORY MODULE

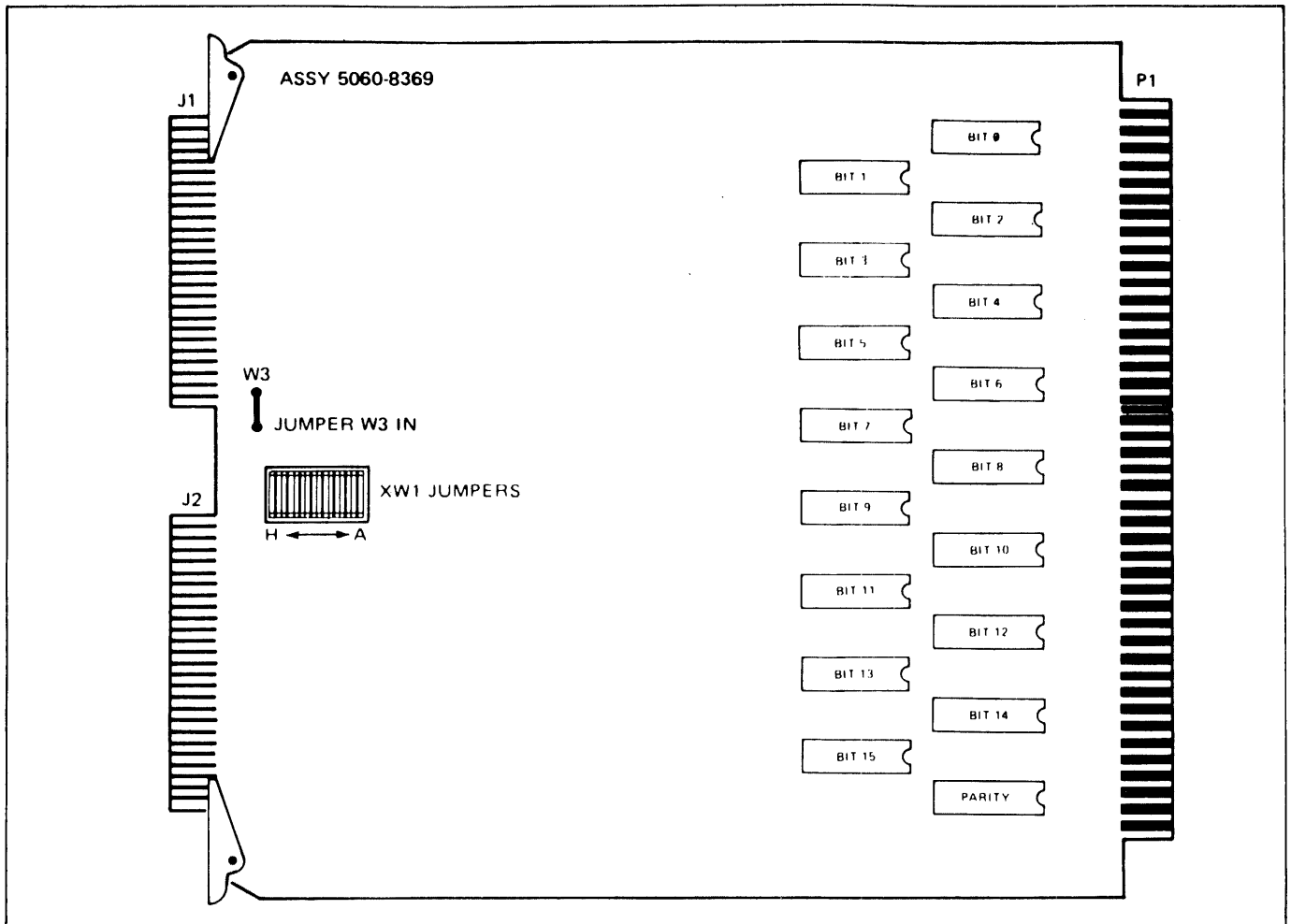
The 13187A and 13187B are electrically identical. The 13187A/B can be configured for 16K addresses with a lower boundary of any multiple of 16K. The 13187A/B are compatible with the 2102B and the 2102C Memory Controllers. (See Figures 6-3 and 6-4.)

6-6. 12746A — 32K WORD MEMORY MODULE

The 12746A can be configured for 32K addresses, with a lower boundary of any multiple of 32K. The 12746A is compatible with the 2102B Memory Controller if the controller has a date code of 1801 or later. The 12746A is also compatible with the 2102C Fault Control Memory Controller. (See Figure 6-6.)

6-7. 12747A — 64K WORD MEMORY MODULE

The 12747A can be configured for 64K addresses, with a lower boundary of any multiple of 64K. The 12747A is compatible with the 2102B Memory Controller, if the controller has a date code of 1801 or later. The 12747A is also compatible with the 2102C Fault Control Memory Controller. (See Figure 6-5.)



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	W3	XW1 JUMPERS							
		A	B	C	D	E	F	G	H
0-4K	ALWAYS IN		IN	IN	IN	IN	IN	IN	IN
8K-12K		OUT	IN	IN	IN	IN	IN	IN	IN
16K-20K		IN	OUT	IN	IN	IN	IN	IN	IN
24K-28K		OUT	OUT	IN	IN	IN	IN	IN	IN
32K-36K		IN	IN	OUT	IN	IN	IN	IN	IN
40K-44K		OUT	IN	OUT	IN	IN	IN	IN	IN
48K-52K		IN	OUT	OUT	IN	IN	IN	IN	IN
56K-60K		OUT	OUT	OUT	IN	IN	IN	IN	IN
64K-68K		IN	IN	IN	OUT	IN	IN	IN	IN
72K-76K		OUT	IN	IN	OUT	IN	IN	IN	IN
80K-84K		IN	OUT	IN	OUT	IN	IN	IN	IN
88K-92K		OUT	OUT	IN	OUT	IN	IN	IN	IN
96K-100K		IN	IN	OUT	OUT	IN	IN	IN	IN
104K-108K		OUT	IN	OUT	OUT	IN	IN	IN	IN
112K-116K		IN	OUT	OUT	OUT	IN	IN	IN	IN
120K-124K		OUT	OUT	OUT	OUT	IN	IN	IN	IN
128K-132K	IN	IN	IN	IN	IN	OUT	IN	IN	

Note: This 4K module must be assigned the highest used memory addresses regardless of the memory configuration. Only one 4K module allowed per configuration.

Figure 6-1. 12994A 4K Word Memory Address Configuration

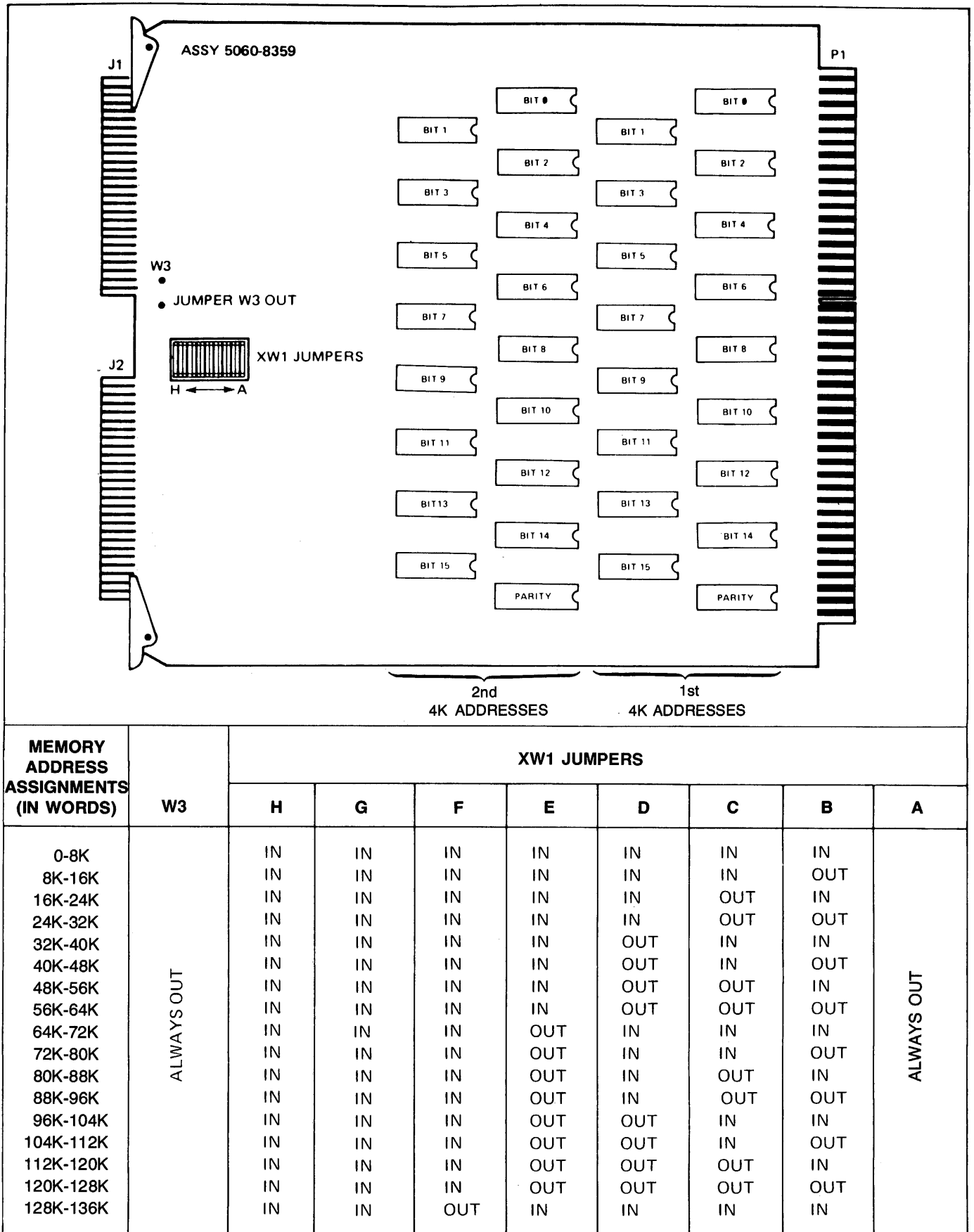
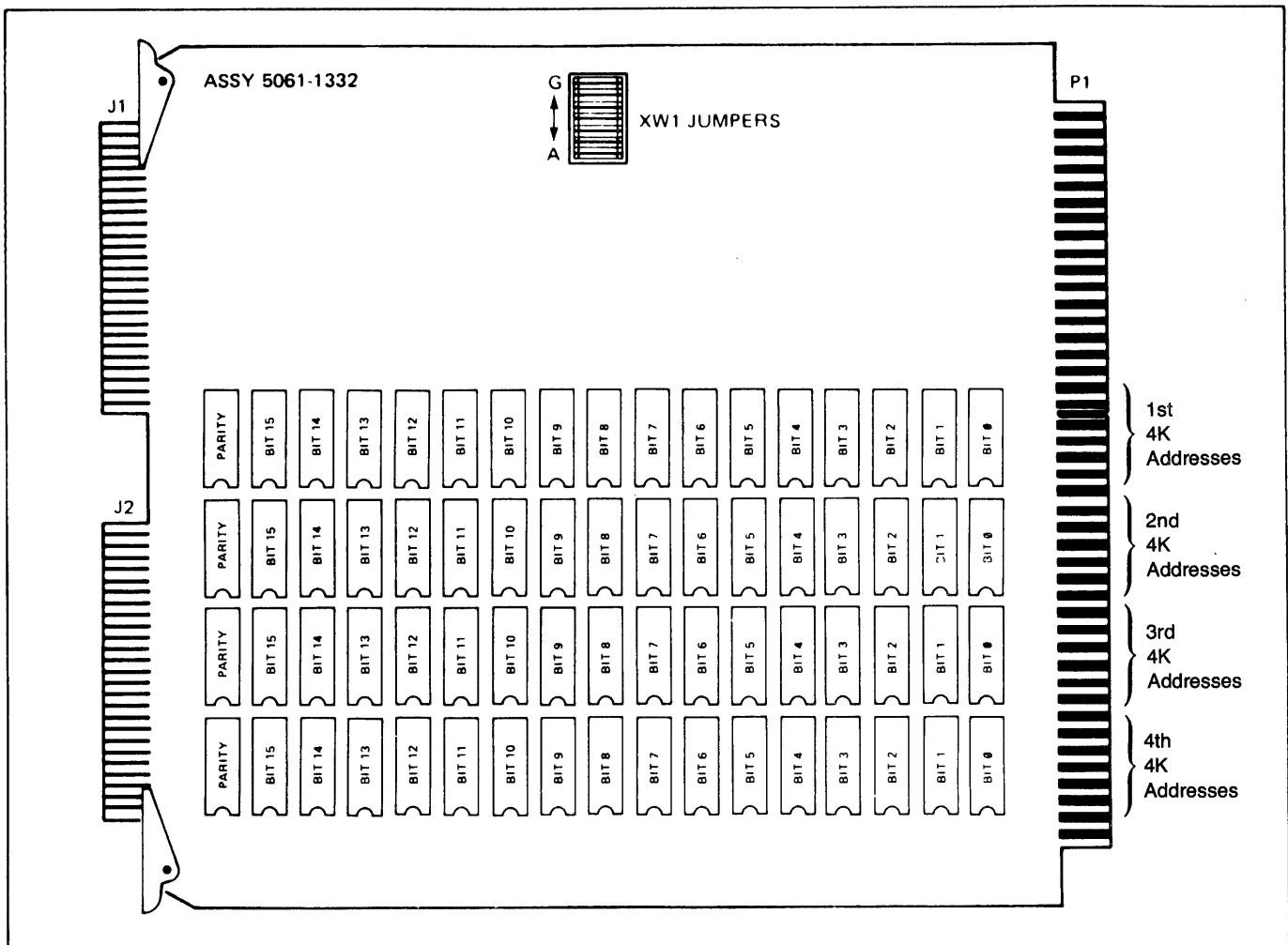
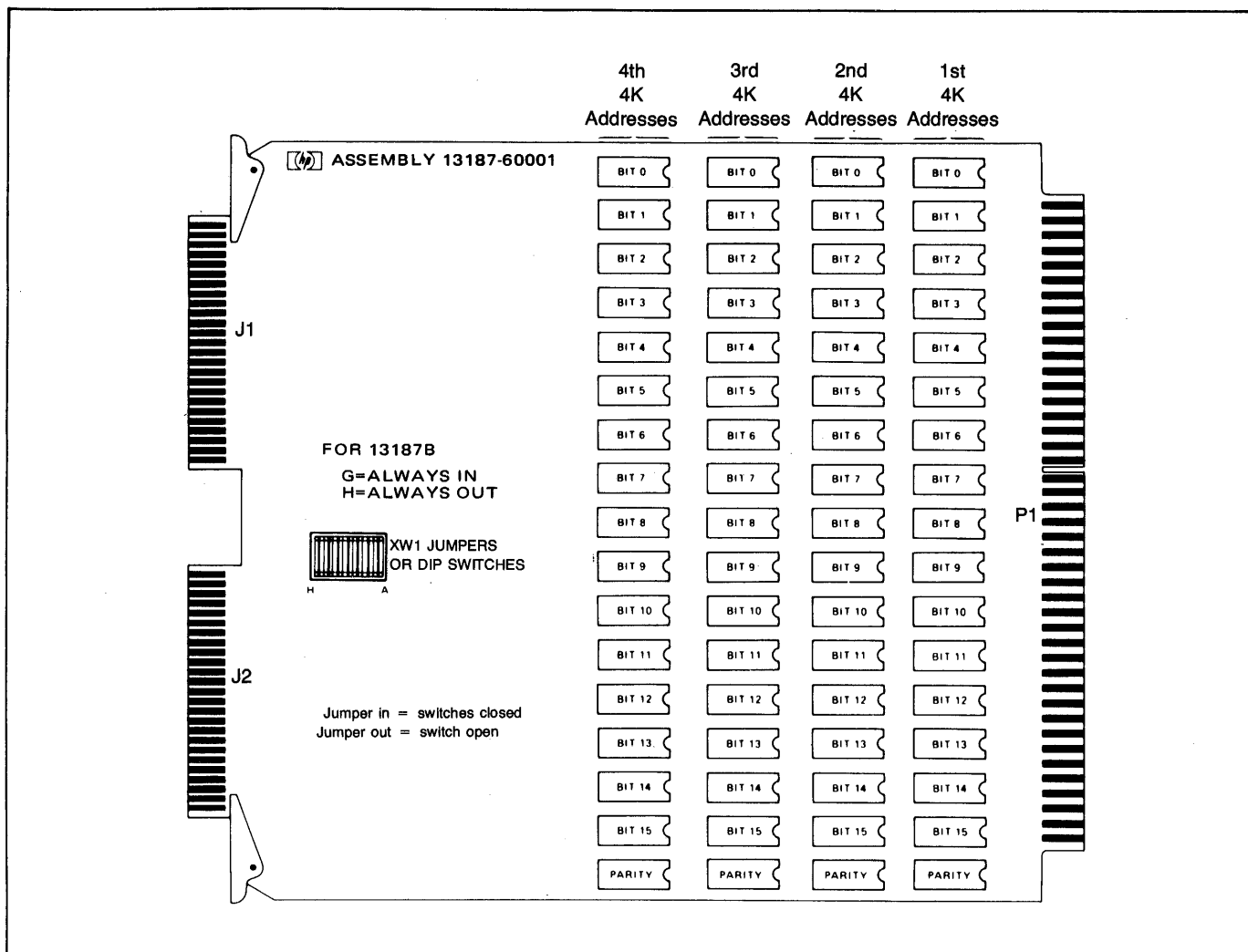


Figure 6-2. 12998A 8K Word Memory Address Configuration



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS						
	A	B	C	D	E	F	G
0-16K	IN	IN	IN	IN	IN	IN	ALWAYS OUT
16K-32K	OUT	IN	IN	IN	IN	IN	
32K-48K	IN	OUT	IN	IN	IN	IN	
48K-64K	OUT	OUT	IN	IN	IN	IN	
64K-80K	IN	IN	OUT	IN	IN	IN	
80K-96K	OUT	IN	OUT	IN	IN	IN	
96K-112K	IN	OUT	OUT	IN	IN	IN	
112K-128K	OUT	OUT	OUT	IN	IN	IN	
128K-144K	IN	IN	IN	OUT	IN	IN	
144K-160K	OUT	IN	IN	OUT	IN	IN	
160K-176K	IN	OUT	IN	OUT	IN	IN	
176K-192K	OUT	OUT	IN	OUT	IN	IN	
192K-208K	IN	IN	OUT	OUT	IN	IN	
208K-224K	OUT	IN	OUT	OUT	IN	IN	
224K-240K	IN	OUT	OUT	OUT	IN	IN	
240K-256K	OUT	OUT	OUT	OUT	IN	IN	
256K-272K	IN	IN	IN	IN	OUT	IN	

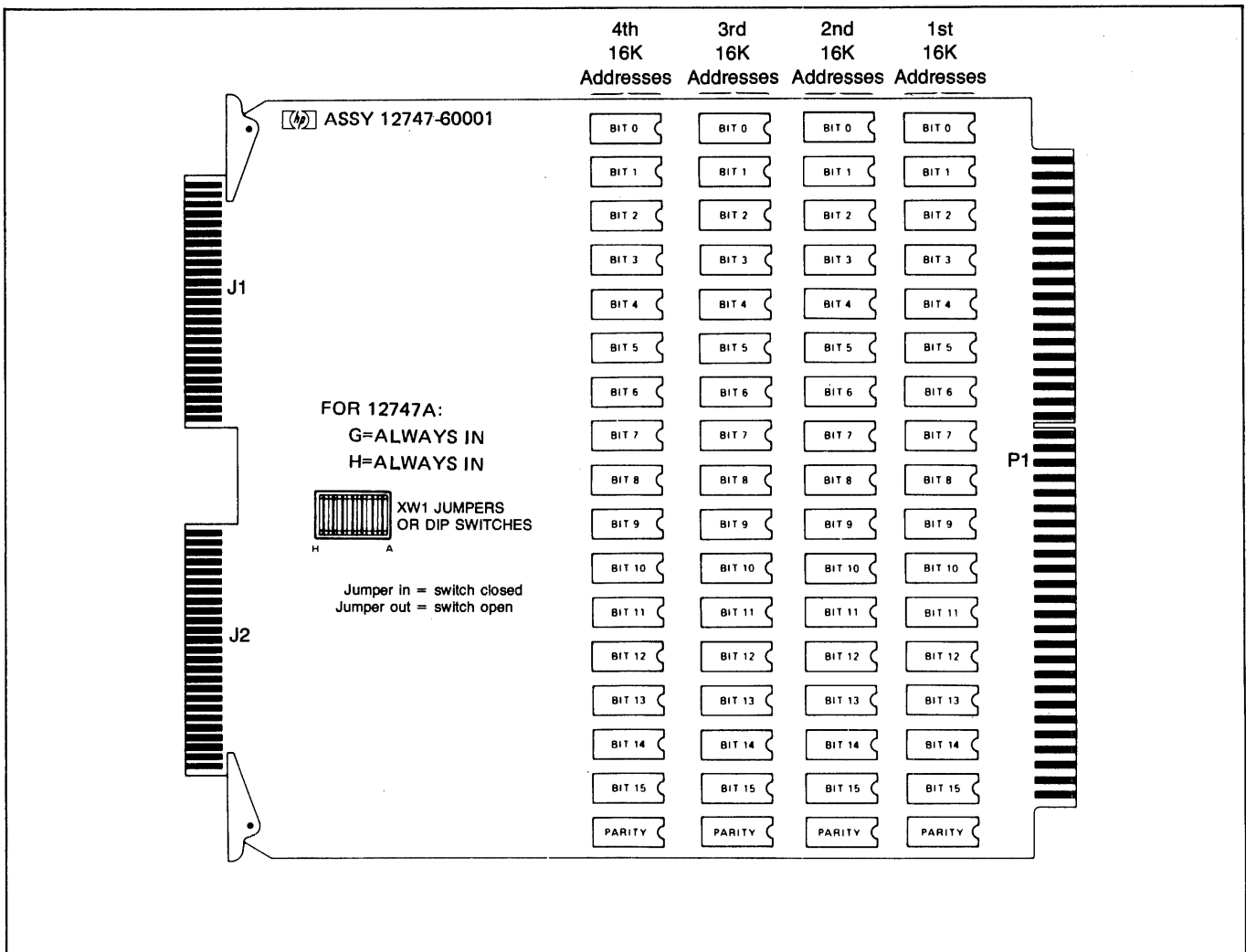
Figure 6-3. 13187A 16K Word Memory Address Configuration



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES								
	H	G	F	E	D	C	B	A	
0-16K	ALWAYS OUT	ALWAYS IN	IN	IN	IN	IN	IN	IN	
16K-32K			IN	IN	IN	IN	IN	IN	OUT
32K-48K			IN	IN	IN	IN	IN	IN	OUT
48K-64K			IN	IN	IN	IN	IN	IN	OUT
64K-80K			IN	IN	IN	IN	IN	OUT	IN
80K-96K			IN	IN	IN	IN	IN	OUT	IN
96K-112K			IN	IN	IN	IN	IN	OUT	OUT
112K-128K			IN	IN	IN	IN	IN	OUT	OUT
128K-144K			IN	IN	IN	IN	OUT	IN	IN
144K-160K			IN	IN	IN	IN	OUT	IN	IN
160K-176K			IN	IN	IN	IN	OUT	IN	OUT
176K-192K			IN	IN	IN	IN	OUT	IN	OUT
192K-208K			IN	IN	IN	IN	OUT	OUT	IN
208K-224K			IN	IN	IN	IN	OUT	OUT	IN
224K-240K			IN	IN	IN	IN	OUT	OUT	OUT
240K-256K			IN	IN	IN	IN	OUT	OUT	OUT
256K-272K	IN	IN	IN	OUT	IN	IN	IN		

2102-2A

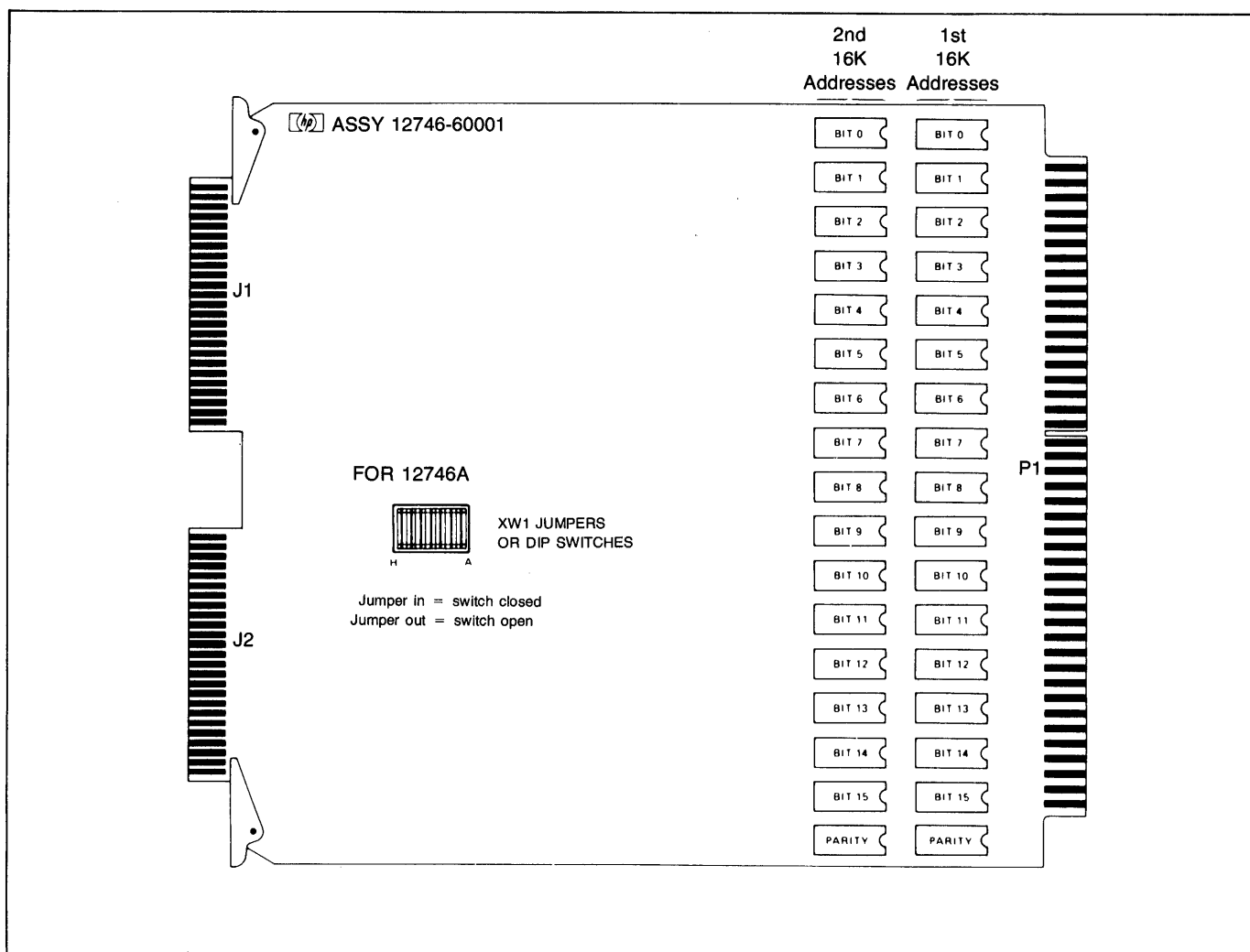
Figure 6-4. 13187B 16K Word Memory Address Configuration



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-64K	ALWAYS IN	ALWAYS IN	IN	IN	IN	IN	ALWAYS OUT	ALWAYS 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		

2102-2A

Figure 6-5. 12747A 64K Word 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 IN	IN	IN	IN	IN	IN	ALWAYS OUT	
32K-64K			IN	IN	IN	IN	IN		OUT
64K-96K			IN	IN	IN	IN	OUT		IN
96K-128K			IN	IN	IN	IN	OUT		OUT
128K-160K			IN	IN	IN	OUT	IN		IN
160K-192K			IN	IN	IN	OUT	IN		OUT
192K-224K			IN	IN	IN	OUT	OUT		IN
224K-256K			IN	IN	IN	OUT	OUT		OUT
256K-288K			IN	IN	OUT	IN	IN		IN
288K-320K			IN	IN	OUT	IN	IN		OUT
320K-352K			IN	IN	OUT	IN	OUT		IN
352K-384K			IN	IN	OUT	IN	OUT		OUT
384K-416K			IN	IN	OUT	OUT	IN		IN
416K-448K			IN	IN	OUT	OUT	IN		OUT
448K-480K			IN	IN	OUT	OUT	OUT		IN
480K-512K			IN	IN	OUT	OUT	OUT		OUT

Figure 6-6. 12746A Memory Address Configuration

MEMORY SYSTEM SELF TEST (E-SERIES COMPUTERS)

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 consecutively count 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. This is for systems with a memory size larger than 32K words. 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 or 5-2 for analysis of test indications for a fault control memory system.

LOCATING FAULTY BITS ON MEMORY MODULES IN E-SERIES COMPUTERS

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 bit(s) (9:0) from t-register (in octal).
- e. The page to module association is determined by the particular configuration of 8K word, 16K word, or 64K word modules within a system. Refer to table B-1, B-2, B-3, or B-4 to determine which row of RAM's contains the failing page.
- f. To determine the faulty bits in a 2102C fault control memory system refer to Appendix C or D and the fault control latch on the controller.

To determine the faulty bits in a 2102B 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 figure in Section VI to locate the faulty bit(s) on the memory module.

Table B-1. 8K Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 8K MEMORY ARRAY ASSEMBLY		MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 8K MEMORY ARRAY ASSEMBLY	
			ROW 0	ROW 1				ROW 0	ROW 1
8K	0-7	0	0-3	4-7	504K	760-767	76	760-763	764-767
16K	10-17	1	10-13	14-17	512K	770-777	77	770-773	774-777
24K	20-27	2	20-23	24-27	520K	1000-1007	100	1000-1003	1004-1007
32K	30-37	3	30-33	34-37	528K	1010-1017	101	1010-1013	1014-1017
40K	40-47	4	40-43	44-47	536K	1020-1027	102	1020-1023	1024-1027
48K	50-57	5	50-53	54-57	544K	1030-1037	103	1030-1033	1034-1037
56K	60-67	6	60-63	64-67	552K	1040-1047	104	1040-1043	1044-1047
64K	70-77	7	70-73	74-77	560K	1050-1057	105	1050-1053	1054-1057
72K	100-107	10	100-103	104-107	568K	1060-1067	106	1060-1063	1064-1067
80K	110-117	11	110-113	114-117	576K	1070-1077	107	1070-1073	1074-1077
88K	120-127	12	120-123	124-127	584K	1100-1107	110	1100-1103	1104-1107
96K	130-137	13	130-133	134-137	592K	1110-1117	111	1110-1113	1114-1117
104K	140-147	14	140-143	144-147	600K	1120-1127	112	1120-1123	1124-1127
112K	150-157	15	150-153	154-157	608K	1130-1137	113	1130-1133	1134-1137
120K	160-167	16	160-163	164-167	616K	1140-1147	114	1140-1143	1144-1147
128K	170-177	17	170-173	174-177	624K	1150-1157	115	1150-1153	1154-1157
136K	200-207	20	200-203	204-207	632K	1160-1167	116	1160-1163	1164-1167
144K	210-217	21	210-213	214-217	640K	1170-1177	117	1170-1173	1174-1177
152K	220-227	22	220-223	224-227	648K	1200-1207	120	1200-1203	1204-1207
160K	230-237	23	230-233	234-237	656K	1210-1217	121	1210-1213	1214-1217
168K	240-247	24	240-243	244-247	664K	1220-1227	122	1220-1223	1224-1227
176K	250-257	25	250-253	254-257	672K	1230-1237	123	1230-1233	1234-1237
184K	260-267	26	260-263	264-267	680K	1240-1247	124	1240-1243	1244-1247
192K	270-277	27	270-273	274-277	688K	1250-1257	125	1250-1253	1254-1257
200K	300-307	30	300-303	304-307	696K	1260-1267	126	1260-1263	1264-1267
208K	310-317	31	310-313	314-317	704K	1270-1277	127	1270-1273	1274-1277
216K	320-327	32	320-323	324-327	712K	1300-1307	130	1300-1303	1304-1307
224K	330-337	33	330-333	334-337	720K	1310-1317	131	1310-1313	1314-1317
232K	340-347	34	340-343	344-347	728K	1320-1327	132	1320-1323	1324-1327
240K	350-357	35	350-353	354-357	736K	1330-1337	133	1330-1333	1334-1337
248K	360-367	36	360-363	364-367	744K	1340-1347	134	1340-1343	1344-1347
256K	370-377	37	370-373	374-377	752K	1350-1357	135	1350-1353	1354-1357
264K	400-407	40	400-403	404-407	760K	1360-1367	136	1360-1363	1364-1367
272K	410-417	41	410-413	414-417	768K	1370-1377	137	1370-1373	1374-1377
280K	420-427	42	420-423	424-427	776K	1400-1407	140	1400-1403	1404-1407
288K	430-437	43	430-433	434-437	784K	1410-1417	141	1410-1413	1414-1417
296K	440-447	44	440-443	444-447	792K	1420-1427	142	1420-1423	1424-1427
304K	450-457	45	450-453	454-457	800K	1430-1437	143	1430-1433	1434-1437
312K	460-467	46	460-463	464-467	808K	1440-1447	144	1440-1443	1444-1447
320K	470-477	47	470-473	474-477	816K	1450-1457	145	1450-1453	1454-1457
328K	500-507	50	500-503	504-507	824K	1460-1467	146	1460-1463	1464-1467
336K	510-517	51	510-513	514-517	832K	1470-1477	147	1470-1473	1474-1477
344K	520-527	52	520-523	524-527	840K	1500-1507	150	1500-1503	1504-1507
352K	530-537	53	530-533	534-537	848K	1510-1517	151	1510-1513	1514-1517
360K	540-547	54	540-543	544-547	856K	1520-1527	152	1520-1523	1524-1527
368K	550-557	55	550-553	554-557	864K	1530-1537	153	1530-1533	1534-1537
376K	560-567	56	560-563	564-567	872K	1540-1547	154	1540-1543	1544-1547
384K	570-577	57	570-573	574-577	880K	1550-1557	155	1550-1553	1554-1557
392K	600-607	60	600-603	604-607	888K	1560-1567	156	1560-1563	1564-1567
400K	610-617	61	610-613	614-617	896K	1570-1577	157	1570-1573	1574-1577
408K	620-627	62	620-623	624-627	904K	1600-1607	160	1600-1603	1604-1607
416K	630-637	63	630-633	634-637	912K	1610-1617	161	1610-1613	1614-1617
424K	640-647	64	640-643	644-647	920K	1620-1627	162	1620-1623	1624-1627
432K	650-657	65	650-653	654-657	928K	1630-1637	163	1630-1633	1634-1637
440K	660-667	66	660-663	664-667	936K	1640-1647	164	1640-1643	1644-1647
448K	670-677	67	670-673	674-677	944K	1650-1657	165	1650-1653	1654-1657
456K	700-707	70	700-703	704-707	952K	1660-1667	166	1660-1663	1664-1667
464K	710-717	71	710-713	714-717	960K	1670-1677	167	1670-1673	1674-1677
472K	720-727	72	720-723	724-727	968K	1700-1707	170	1700-1703	1704-1707
480K	730-737	73	730-733	734-737	976K	1710-1717	171	1710-1713	1714-1717
488K	740-747	74	740-743	744-747	984K	1720-1727	172	1720-1723	1724-1727
496K	750-757	75	750-753	754-757	992K	1730-1737	173	1730-1733	1734-1737
					1000K	1740-1747	174	1740-1743	1744-1747
					1008K	1750-1757	175	1750-1753	1754-1757
					1016K	1760-1767	176	1760-1763	1764-1767
					1024K	1770-1777	177	1770-1773	1774-1777

Table B-2. 16K Word Memory Module Page Table

MEMORY SIZE	PAGE NO.	MODULE NO.	ROW ON 16K MEMORY ARRAY ASSEMBLY			
			ROW 0	ROW 1	ROW 2	ROW 3
16K	0-17	0	0-3	4-7	10-13	14-17
32K	20-37	1	20-23	24-27	30-33	34-37
48K	40-57	2	40-43	44-47	50-53	54-57
64K	60-77	3	60-63	64-67	70-73	74-77
80K	100-117	4	100-103	104-107	110-113	114-117
96K	120-137	5	120-123	124-127	130-133	134-137
112K	140-157	6	140-143	144-147	150-153	154-157
128K	160-177	7	160-163	164-167	170-173	174-177
144K	200-217	10	200-203	204-207	210-213	214-217
160K	220-237	11	220-223	224-227	230-233	234-237
176K	240-257	12	240-243	244-247	250-253	254-257
192K	260-277	13	260-263	264-267	270-273	274-277
208K	300-317	14	300-303	304-307	310-313	314-317
224K	320-337	15	320-323	324-327	330-333	334-337
240K	340-357	16	340-343	344-347	350-353	354-357
256K	360-377	17	360-363	364-367	370-373	374-377
272K	400-417	20	400-403	404-407	410-413	414-417
288K	420-437	21	420-423	424-427	430-433	434-437
304K	440-457	22	440-443	444-447	450-453	454-457
320K	460-477	23	460-463	464-467	470-473	474-477
336K	500-517	24	500-503	504-507	510-513	514-517
352K	520-537	25	520-523	524-527	530-533	534-537
368K	540-557	26	540-543	544-547	550-553	554-557
384K	560-577	27	560-563	564-567	570-573	574-577
400K	600-617	30	600-603	604-607	610-613	614-617
416K	620-637	31	620-623	624-627	630-633	634-637
432K	640-657	32	640-643	644-647	650-653	654-657
448K	660-677	33	660-663	664-667	670-673	674-677
464K	700-717	34	700-703	704-707	710-713	714-717
480K	720-737	35	720-723	724-727	730-733	734-737
496K	740-757	36	740-743	744-747	750-753	754-757
512K	760-777	37	760-763	764-767	770-773	774-777
528K	1000-1017	40	1000-1003	1004-1007	1010-1013	1014-1017
544K	1020-1037	41	1020-1023	1024-1027	1030-1033	1034-1037
560K	1040-1057	42	1040-1043	1044-1047	1050-1053	1054-1057
576K	1060-1077	43	1060-1063	1064-1067	1070-1073	1074-1077
592K	1100-1117	44	1100-1103	1104-1107	1110-1113	1114-1117
608K	1120-1137	45	1120-1123	1124-1127	1130-1133	1134-1137
624K	1140-1157	46	1140-1143	1144-1147	1150-1153	1154-1157
640K	1160-1177	47	1160-1163	1164-1167	1170-1173	1174-1177
656K	1200-1217	50	1200-1203	1204-1207	1210-1213	1214-1217
672K	1220-1237	51	1220-1223	1224-1227	1230-1233	1234-1237
688K	1240-1257	52	1240-1243	1244-1247	1250-1253	1254-1257
704K	1260-1277	53	1260-1263	1264-1267	1270-1273	1274-1277
720K	1300-1317	54	1300-1303	1304-1307	1310-1313	1314-1317
736K	1320-1337	55	1320-1323	1324-1327	1330-1333	1334-1337
752K	1340-1357	56	1340-1343	1344-1347	1350-1353	1354-1357
768K	1360-1377	57	1360-1363	1364-1367	1370-1373	1374-1377
784K	1400-1417	60	1400-1403	1404-1407	1410-1413	1414-1417
800K	1420-1437	61	1420-1423	1424-1427	1430-1433	1434-1437
816K	1440-1457	62	1440-1443	1444-1447	1450-1453	1454-1457
832K	1460-1477	63	1460-1463	1464-1467	1470-1473	1474-1477
848K	1500-1517	64	1500-1503	1504-1507	1510-1513	1514-1517
864K	1520-1537	65	1520-1523	1524-1527	1530-1533	1534-1537
880K	1540-1557	66	1540-1543	1544-1547	1550-1553	1554-1557
896K	1560-1577	67	1560-1563	1564-1567	1570-1573	1574-1577
912K	1600-1617	70	1600-1603	1604-1607	1610-1613	1614-1617
928K	1620-1637	71	1620-1623	1624-1627	1630-1633	1634-1637
944K	1640-1657	72	1640-1643	1644-1647	1650-1653	1654-1657
960K	1660-1677	73	1660-1663	1664-1667	1670-1673	1674-1677
976K	1700-1717	74	1700-1703	1704-1707	1710-1713	1714-1717
992K	1720-1737	75	1720-1723	1724-1727	1730-1733	1734-1737
1008K	1740-1757	76	1740-1743	1744-1747	1750-1753	1754-1757
1024K	1760-1777	77	1760-1763	1764-1767	1770-1773	1774-1777

Table B-3. 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-4. 12746A 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

FAILURE LATCH INDICATIONS (2102C CONTROLLER WITH "CORRECT" JUMPER)

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 error 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 front panel will light.

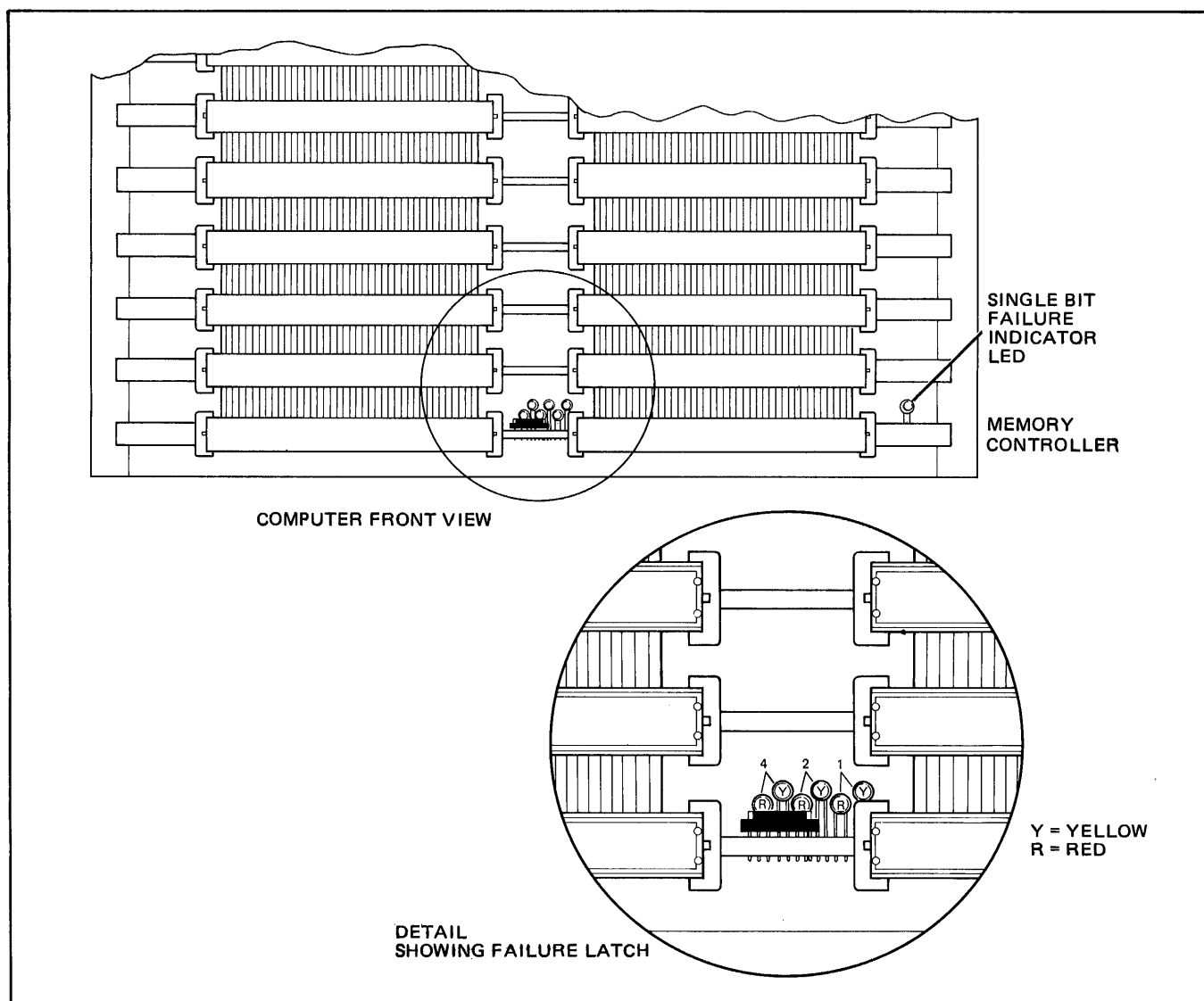


Figure C-1. Failure Latch Indicators (2102C Date Code 1820 or Higher)

Table C-1. Failure Latch Indications ("CORRECT" Jumper)

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
0	0	Bit 0	5	4	Triple (or greater) error
1	0	Triple (or greater) error	6	4	Triple (or greater) error
2	0	Triple (or greater) error	7	4	Bit 19
3	0	Bit 1	0	6	Bit 13
4	0	Triple (or greater) error	1	6	Bit 14
5	0	Bit 2	2	6	Triple (or greater) error
6	0	Bit 3	3	6	Bit 18
7	0	Bit 4	4	6	Bit 15
0	2	Triple (or greater) error	5	6	Bit 17
1	2	Bit 5	6	6	Bit 16
2	2	Bit 6	7	6	Bit 21
3	2	Triple (or greater) error	0	7	Double (or greater) error
4	2	Bit 7	1	7	Double (or greater) error
5	2	Triple (or greater) error	2	7	Double (or greater) error
6	2	Bit 8	3	7	Double (or greater) error
7	2	Bit 20	4	7	Double (or greater) error
0	4	Triple (or greater) error	5	7	Double (or greater) error
1	4	Bit 9	6	7	Double (or greater) error
			7	7	Normal state and result of PRESET

Six LED's on the 2102C 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 bit failure are listed in table C-1.

Double, Triple, or greater bit errors rarely occur. If the failure latch indicates one of the above, 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.

FAILURE LATCH INDICATIONS (2102C CONTROLLER WITH "STOP" JUMPER)

APPENDIX

D

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 front panel will light.

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

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

- (1) Check Bit Arrays or Memory Modules are not configured correctly.
- (2) The memory system cables are not properly connected.
- (3) A gross failure of memory controller, memory module, or check bit array has occurred.

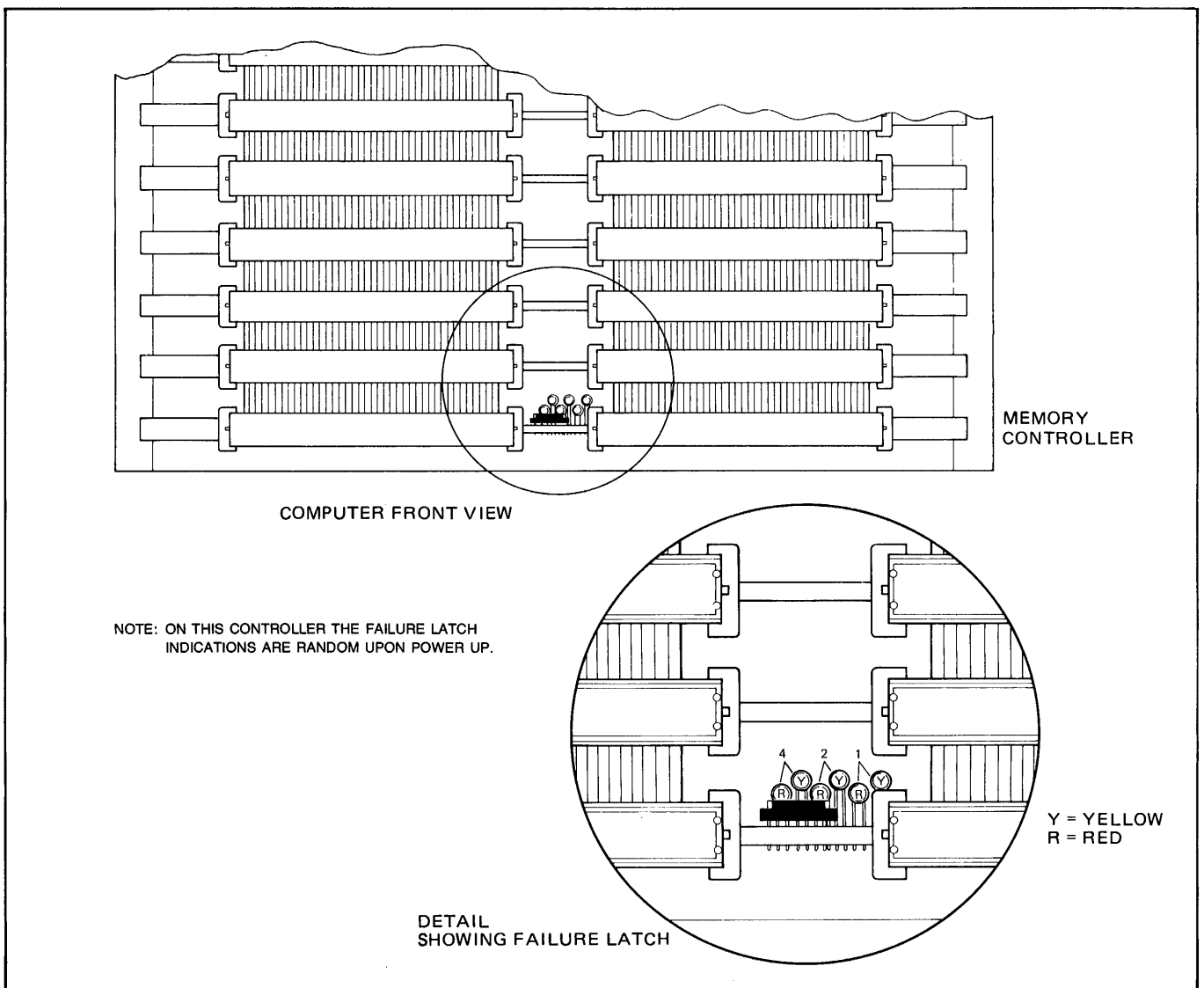


Figure D-1. Failure Latch Indications (2102C Date Code 1721)

Table D-1. Failure Latch Indications ("STOP" Jumper)

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			