Rainbow™ 100

Memory Board Option and Adapter Installation Guide

with Testing Procedures

digital™

EK-PCMXA-IN-001

Rainbow™ 100

Memory Board Option and Adapter Installation Guide

with Testing Procedures

digital equipment corporation

First Edition, June 1984

Contents

Preface

This guide contains the information you need to install additional memory in your Rainbow™ 100 computer (PC100A). It also contains information on testing your new memory and updating your operating systems. Included with this guide is the adapter board that enables you to install the additional memory.

Additional memory includes one of the following memory board options:

- 128K byte memory board (part number PC1XX-AC)
- 256K byte memory board (part number PC1XX-AD)

The memory board option is not packaged in this box. It must be ordered separately.

You may further increase the memory capacity of your Rainbow 100 computer with a memory upgrade kit, also available separately. The memory upgrade kit contains nine memory chips that you can install on your memory board.

A summary of the procedure for adding memory follows.

1. Install the memory chips (if you have ordered them) on your memory board.
2. Assemble your memory board and adapter boards.
3. Install this memory/adapter assembly in your Rainbow 100 computer.
4. Test the memory.
5. Correct any faults that may occur.
6. Update your operating system(s).

To install additional memory correctly, follow the steps in order. If you find you need help, do not hesitate to call the Help Line number:

800-DEC-8000

Be sure to tell the Help Line that you have a memory adapter board.

Before you install additional memory, you will need a successfully installed and tested Rainbow 100 computer. You should also be familiar with using the Rainbow computer. If not, you will need to refer to the *Rainbow™ 100 Installation Guide* to learn how to perform some procedures such as connecting cables, opening the diskette drive doors, and so on.

Checklist

Make sure you understand the following before you begin the installation procedure.

☐ You must use **one** of the following memory board options for this procedure. Make sure you have ordered one.

- 128K byte memory board (part number PC1XX-AC)
- 256K byte memory board (part number PC1XX-AD)

☐ Do **not** use the following memory boards for this procedure.

- 64K byte memory board (part number PC1XX-AA)
- 192K byte memory board (part number PC1XX-AB).

☐ You may choose to install extra memory chips on your memory board. These chips come in a memory upgrade kit. You may order (or already have ordered) the following upgrade kits. (See Appendix F, Bits and Bytes, for more information.)

- 64K byte upgrade kit (part number PC1XX-AY)
- 256K byte upgrade kit (part number PC1XX-AZ).

☐ Disregard the following books.

- *Rainbow™ Memory Board Option Installation Guide.* The part number for this book is EK-RBMXE-IN. This book is packaged with the memory board that you order.
- *Rainbow™ Memory Upgrade Kit Installation Guide.* The part number for this book is EK-RBMEC-IN. This book is packaged with the memory upgrade kit that you may order.
- *Rainbow™ Memory Test Procedures.* The part number for this book is EK-RBMXE-IN-CN1.

☐ If you use any of the following operating systems, you must have both a working copy and a backup copy of each **before** you continue. Refer to the books listed for instructions on making copies of the diskettes.

Operating System	**Book**
MS™-DOS, version 2.01	Rainbow™ 100 MS™-DOS Getting Started
MS™-DOS, version 2.05	Rainbow™ MS™-DOS Getting Started
CP/M®-86/80, version 1.0	Rainbow™ 100 CP/M®-86/80 Getting Started
CP/M®-86/80, version 2.0	Rainbow™ CP/M®-86-80 Getting Started

MS™-DOS is a trademark of Microsoft Corporation.
CP/M®-86/80 is a registered trademark of Digital Research Inc.

Unpacking

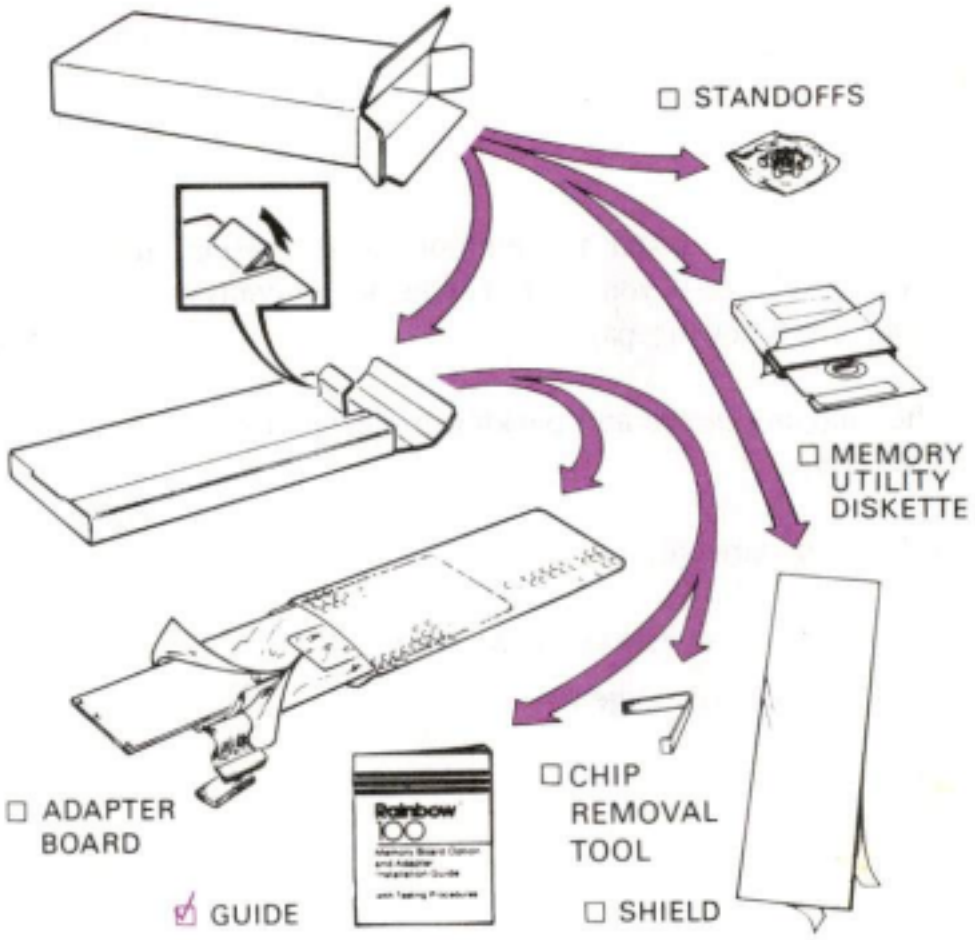
Unpack the adapter board, the memory board option, and the memory upgrade kit if you have it. Check the contents with the figures on the following pages.

Save the shipping boxes and packing materials in case you need to return an item.

If you discover damage:

- Call your sales representative or
- Call your delivery agent

Check the contents of the adapter board shipping box.

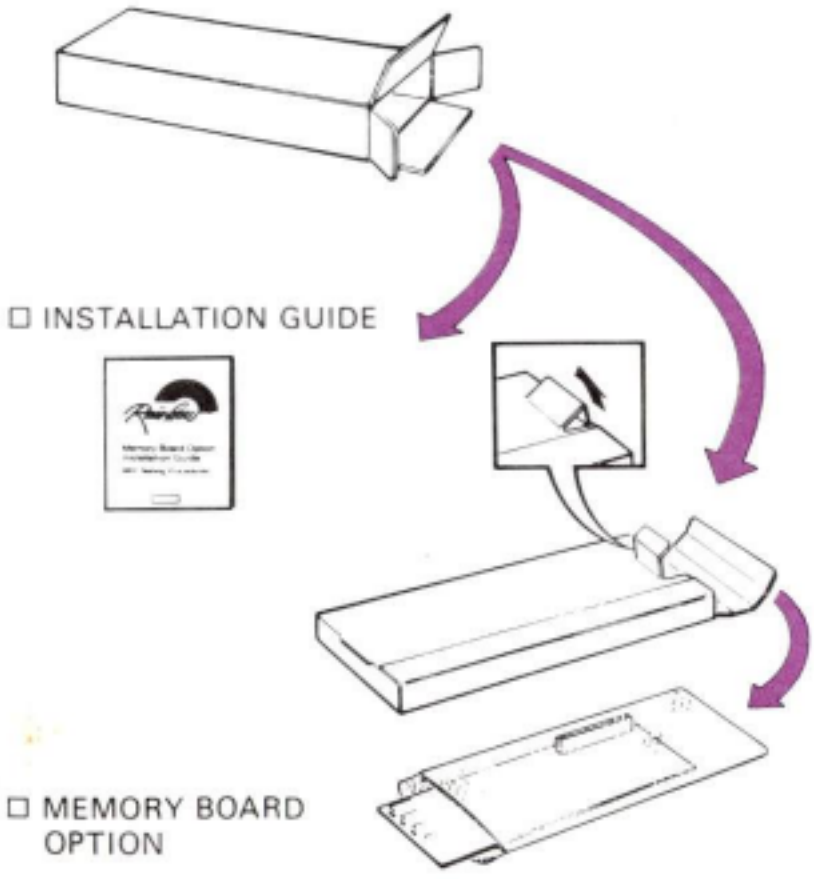


CAUTION

To prevent possible damage from static electricity, keep the adapter board in its protective wrapping and minimize handling until you are ready to assemble it.

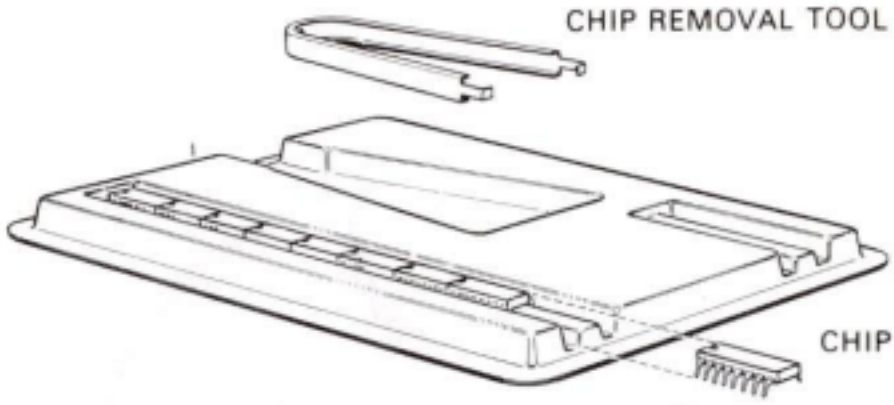
Check the contents of the memory board shipping box.

The memory board is sent to you separately. You will not need to use the installation guide that comes with it.



If you have ordered the memory upgrade kit(s), check the contents.

You will not need to use the *Rainbow™ Memory Upgrade Kit Installation Guide.*

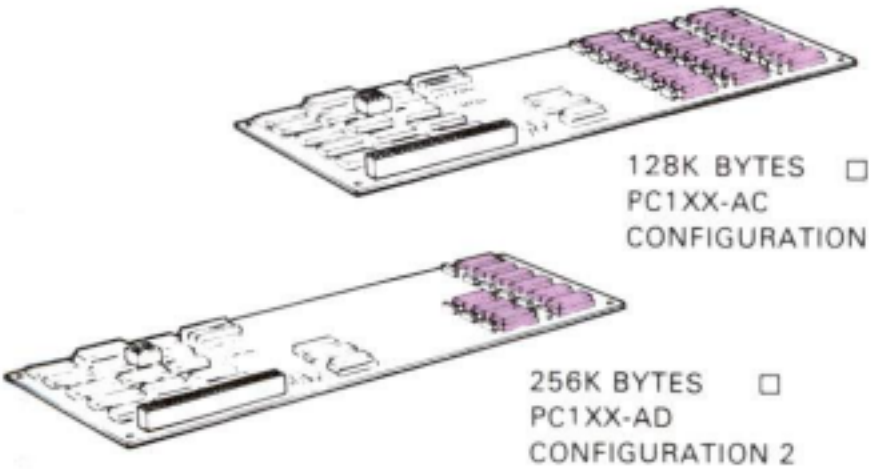


Preparation

Determine the configuration number.

There are two standard factory configurations of the memory board. Check which configuration you have. You will need this information later.

MEMORY BOARD OPTIONS

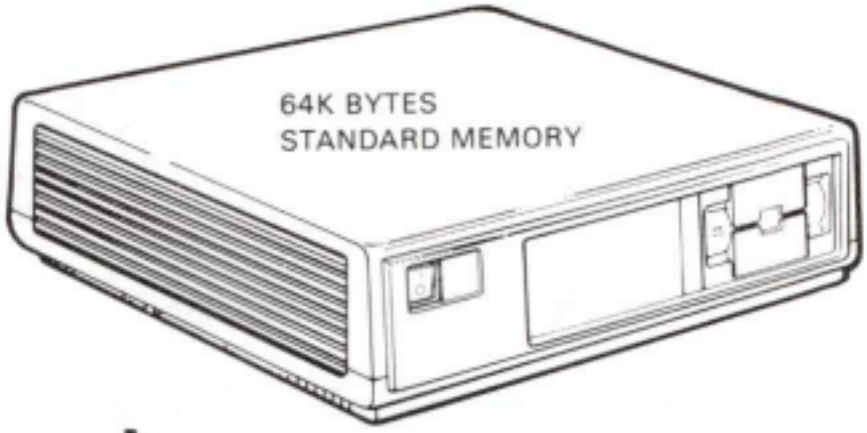


128K BYTES ☐
PC1XX-AC
CONFIGURATION 1

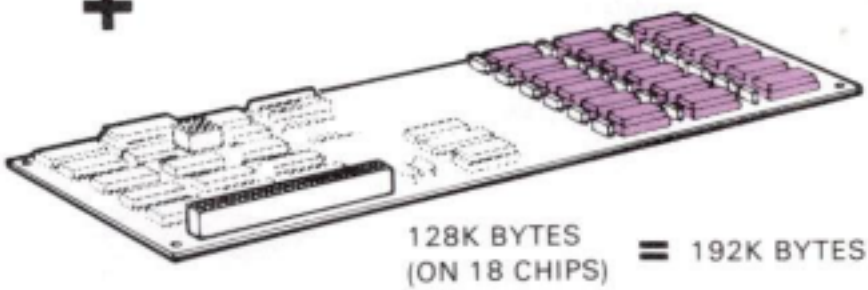
256K BYTES ☐
PC1XX-AD
CONFIGURATION 2

NOTE
If you have a Memory Upgrade Kit, add the memory chips at this time. See Appendix A, Installing Memory Chips, for directions.

Determine the new memory size.

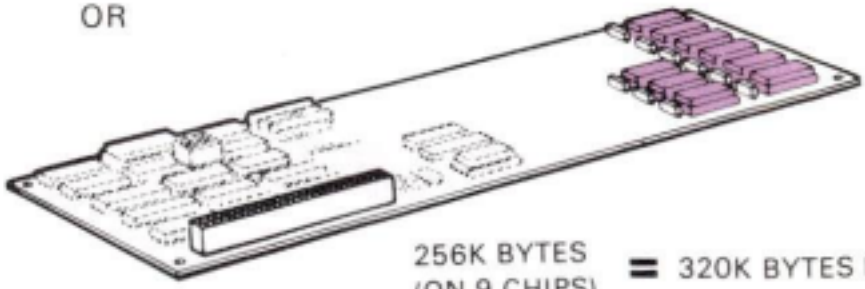


+



128K BYTES
(ON 18 CHIPS) = 192K BYTES □

OR

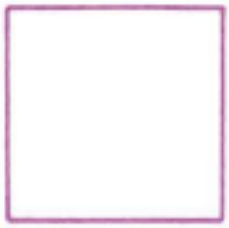


256K BYTES
(ON 9 CHIPS) = 320K BYTES □

+

OPTIONAL MEMORY CHIPS = _____ BYTES □

Record the new memory size here; you will need this information later.

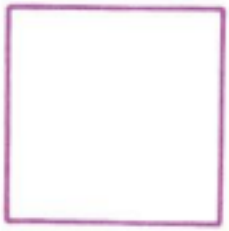


SIZE

If you are adding a new memory board but no memory chips, your configuration number is either 1 or 2.

If you added more memory chips, your configuration number may change. Find your new configuration number in Appendix B, Configurations.

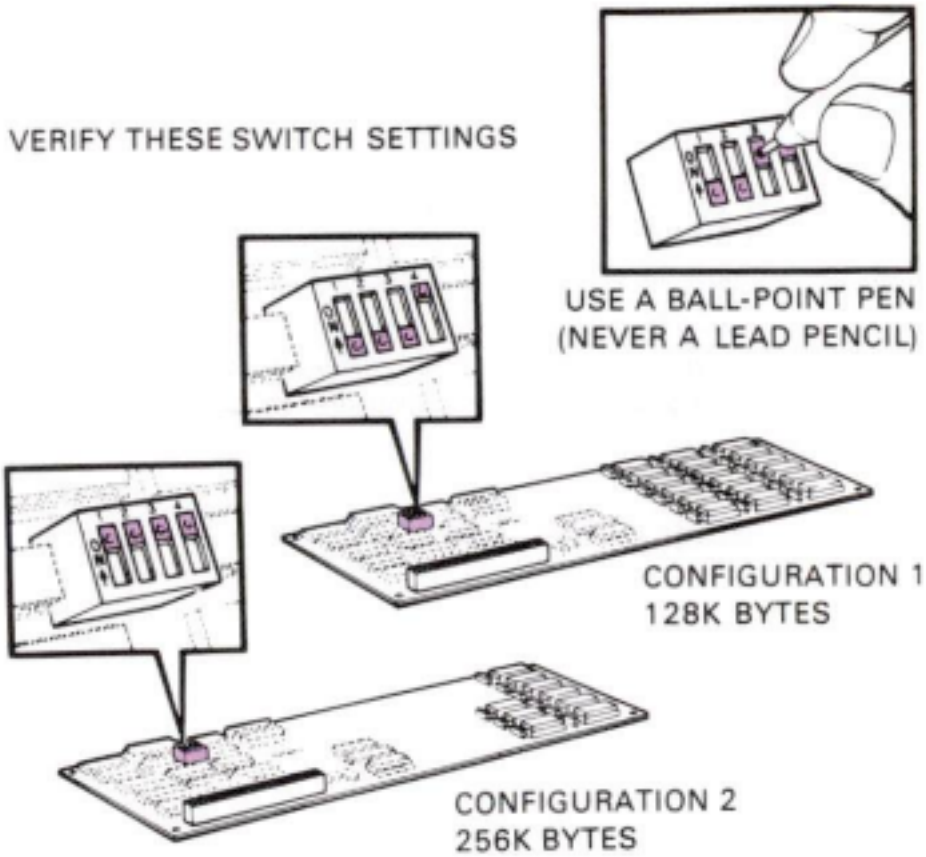
Record the configuration number here; you will need this number later.



NUMBER

Check the memory switch settings for correct positions.

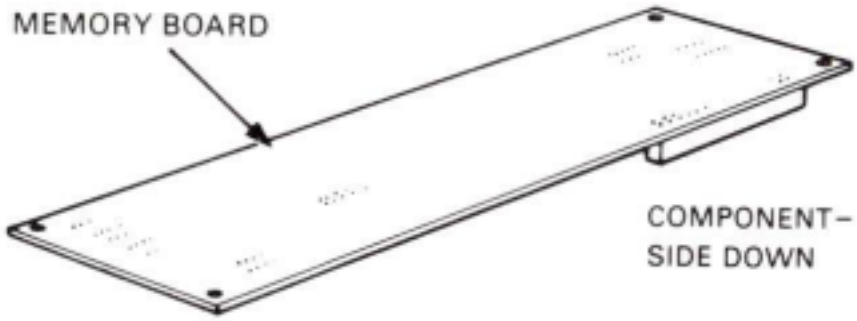
Switch position 4 must *always* remain ON. If you have added memory chips, see Appendix B, Configurations, for the correct switch settings.



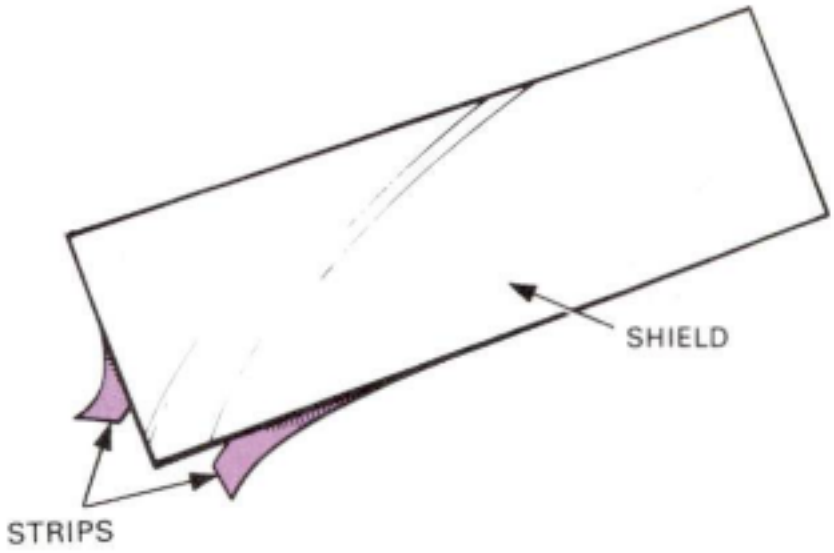
Board Assembly

Place the memory board component-side down on a hard, flat surface.

If you have saved the silver-colored bag that the memory board was wrapped in, place it under the board.

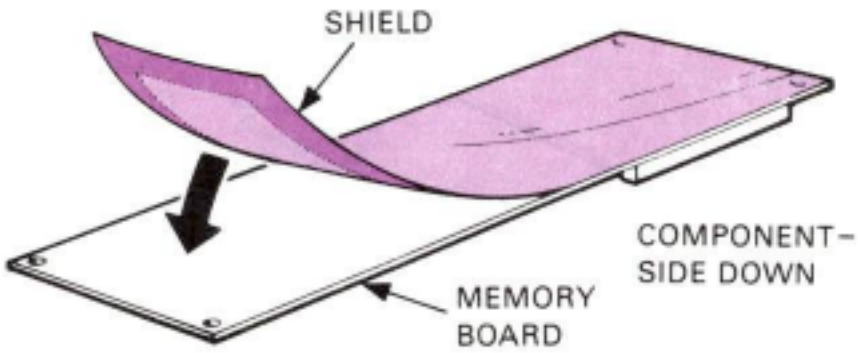


Peel away the strips on the shield to expose the adhesive surface.

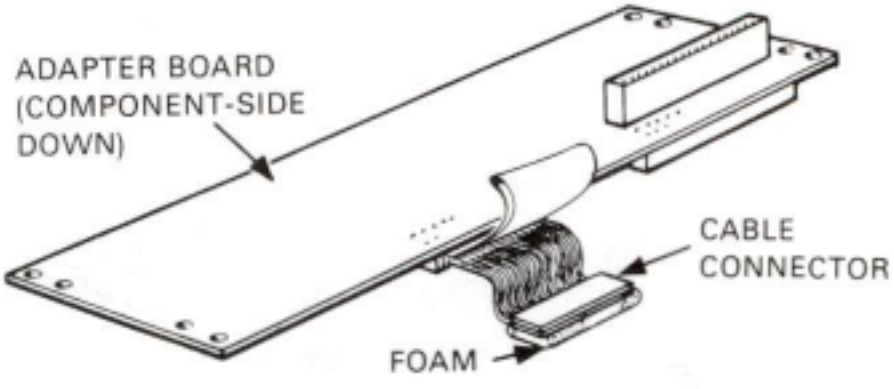


Attach the shield to the back of the memory board.

- Make sure all four corners of the shield are aligned with the corners of the memory board.
- Smooth the shield over the memory board so the edges of the shield stick to the board.



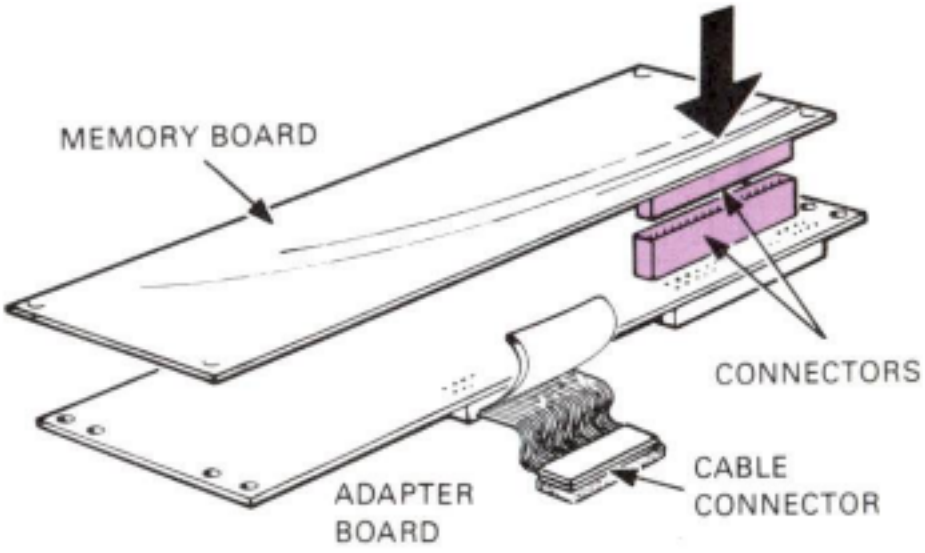
Remove the adapter board from its protective wrapping. Place it component-side down on a flat surface.



NOTE
Do not remove the foam from the end of the cable connector yet. This will be described later in the book.

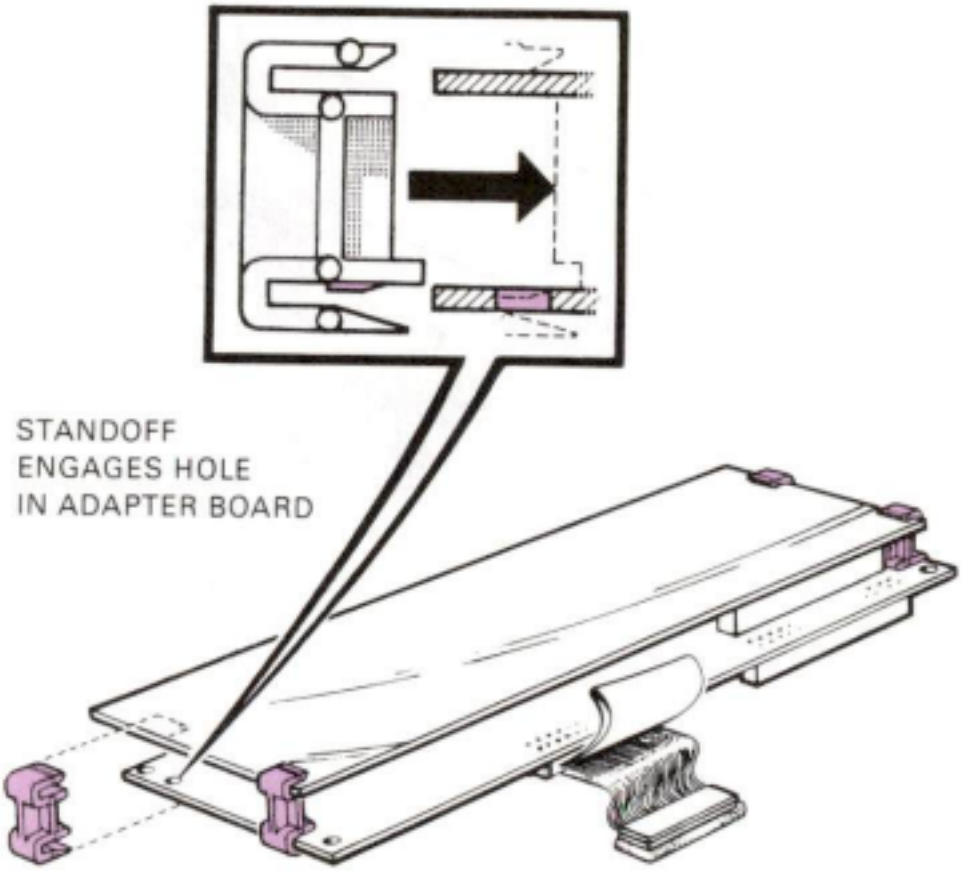
Position the memory board over the adapter board and press down firmly at the connectors so that they fit together.

The boards do not align directly over each other; they are slightly offset.



Attach the four standoffs.

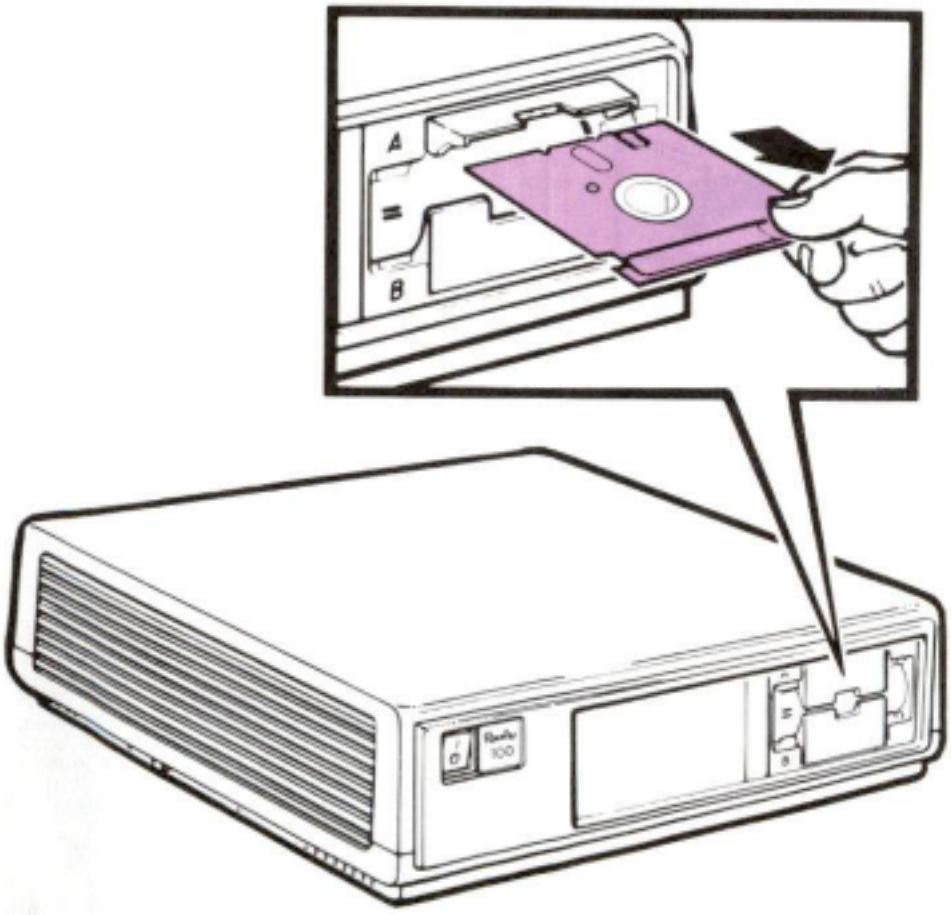
- Align the standoffs with the sets of holes next to the corner holes on the adapter board.
- Push the standoffs in until they click into the holes. If a standoff does not click, check to see if it is upside down.



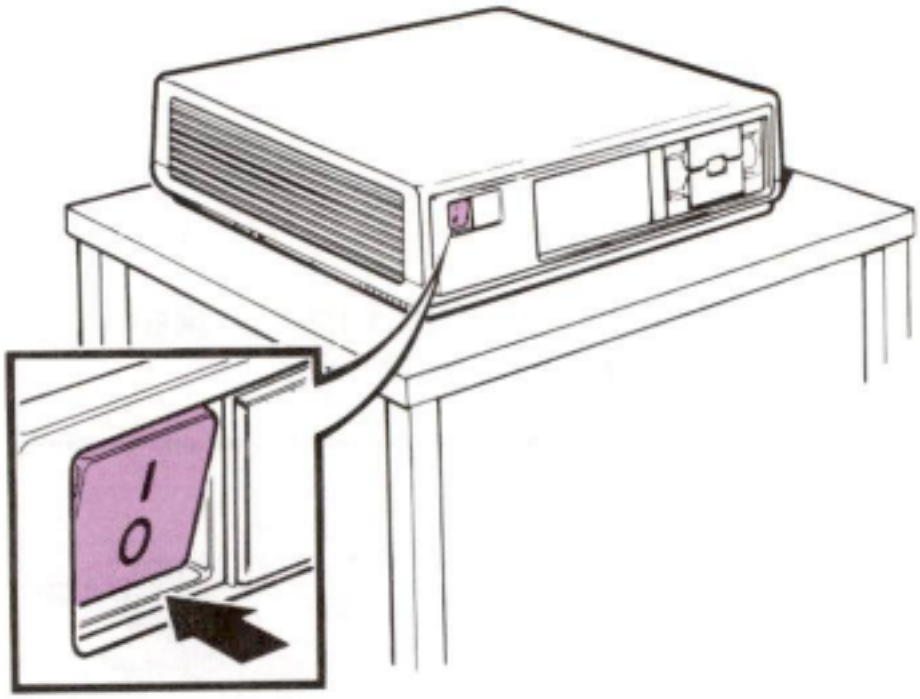
Place the memory/adapter assembly on the protective wrapping. You will install the assembly later.

System Module Removal

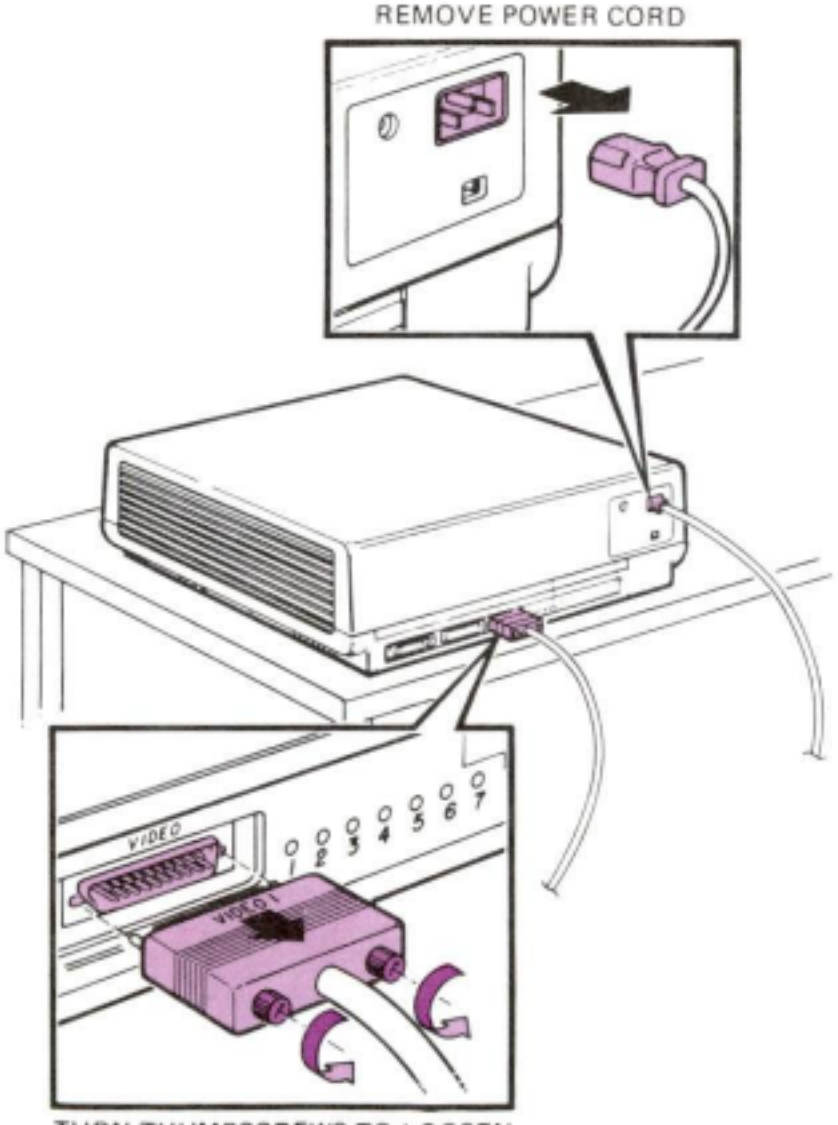
Remove any diskettes from the diskette drives. Close the diskette drive doors.



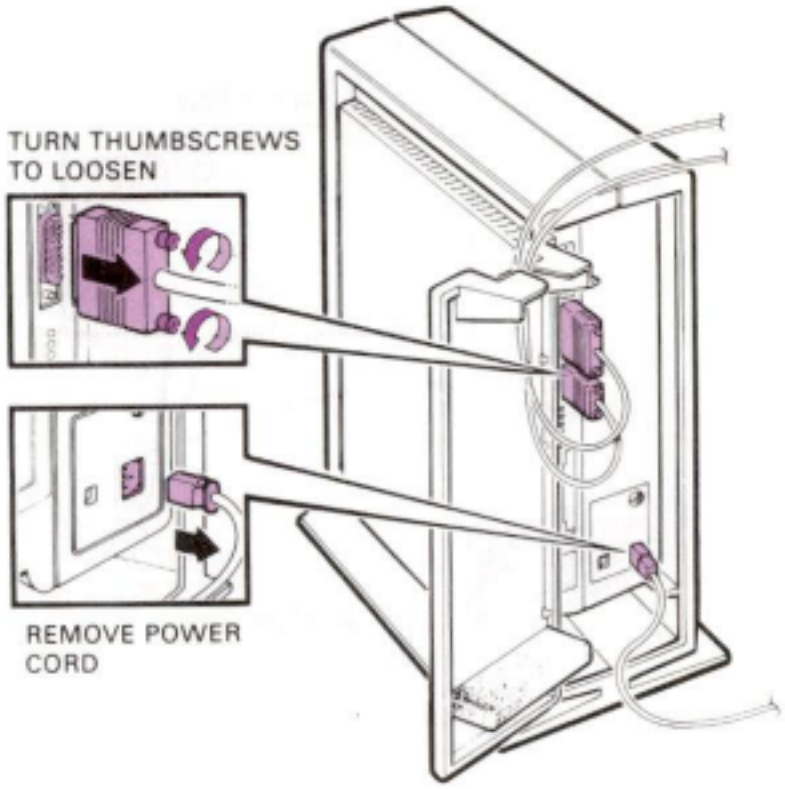
Turn your computer off (0).



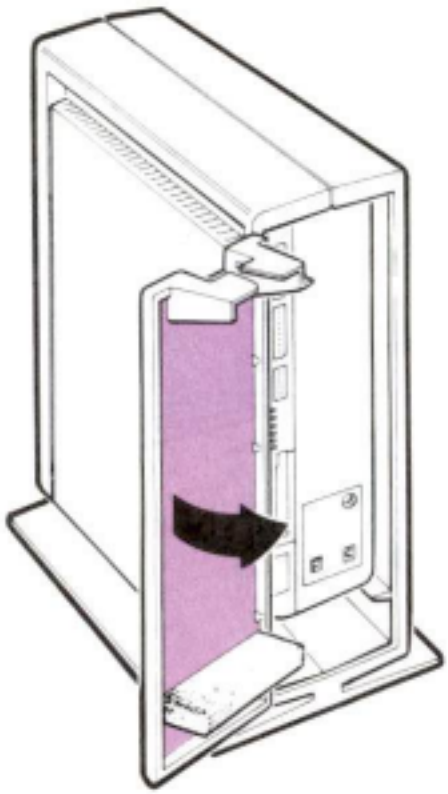
If you do not have a floor stand, remove the power cord and all cables from the system unit; then go to page 23.



If you have a floor stand, open the rear door and remove the power cord and all cables from the system unit.

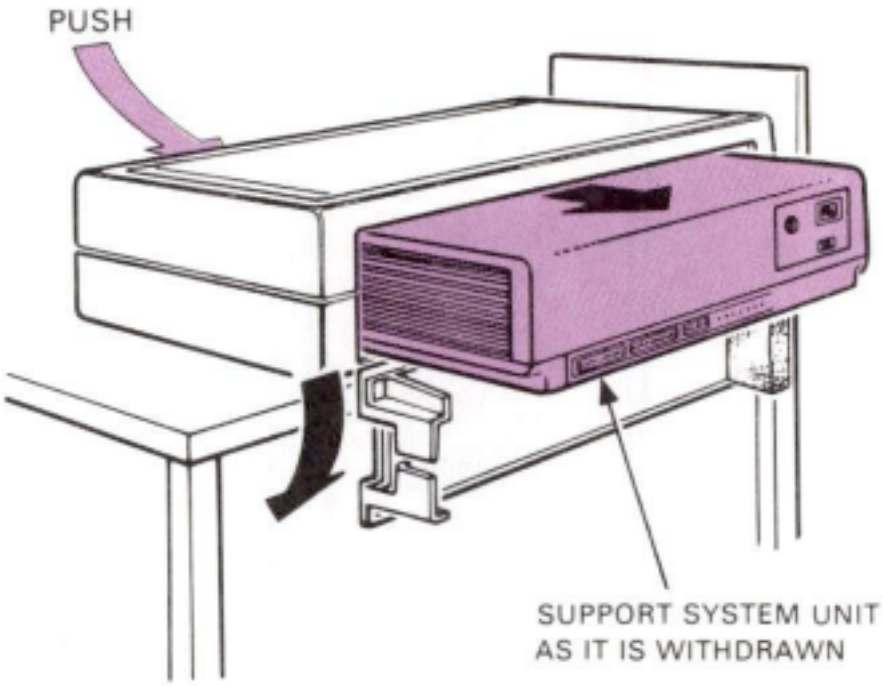


Close the rear door of the floor stand. Place the floor stand on a desk so that its door opens downward.



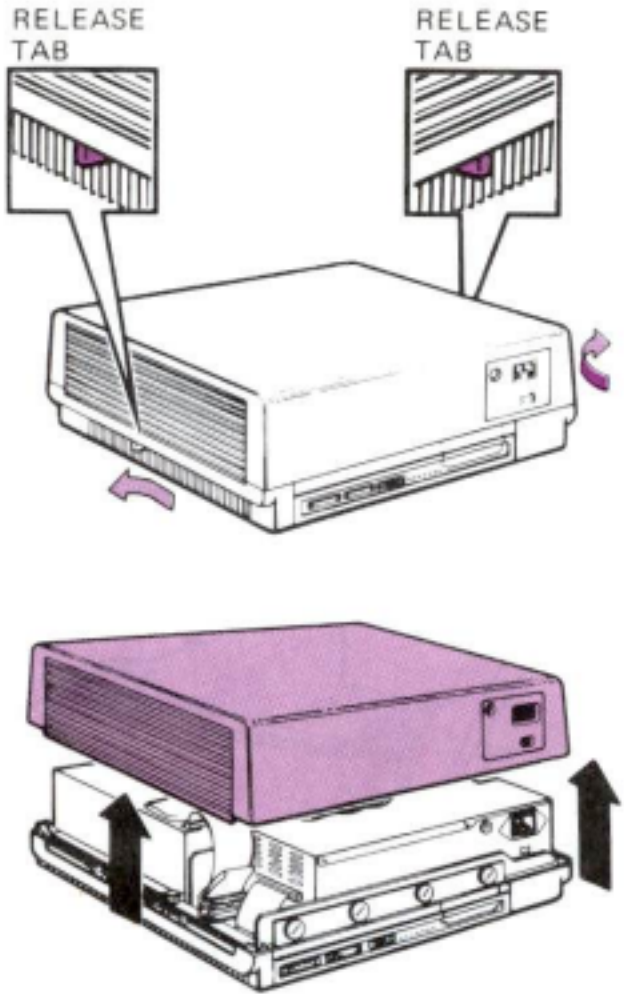
Open the rear door of the floor stand and remove the system unit.

- Lift and slide the system unit out of the floor stand.

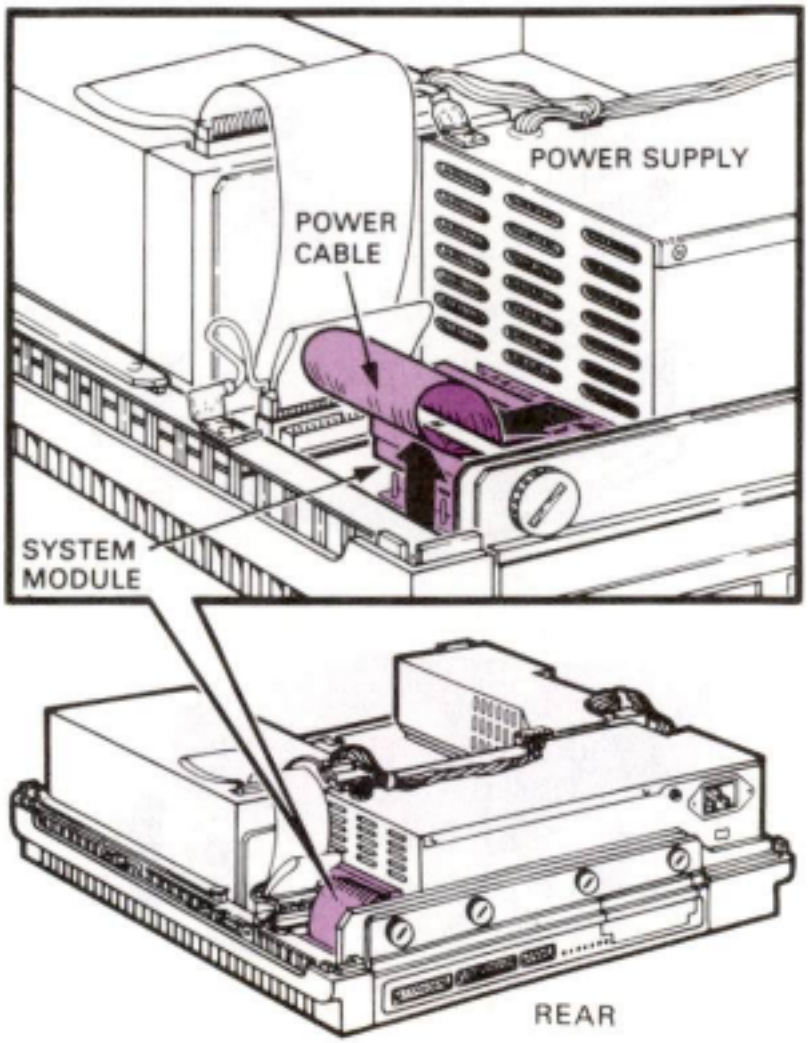


Remove the cover from the system unit.

- Locate the two cover release tabs. Slide the tabs away from you and out.
- Lift the cover straight up and put it aside.

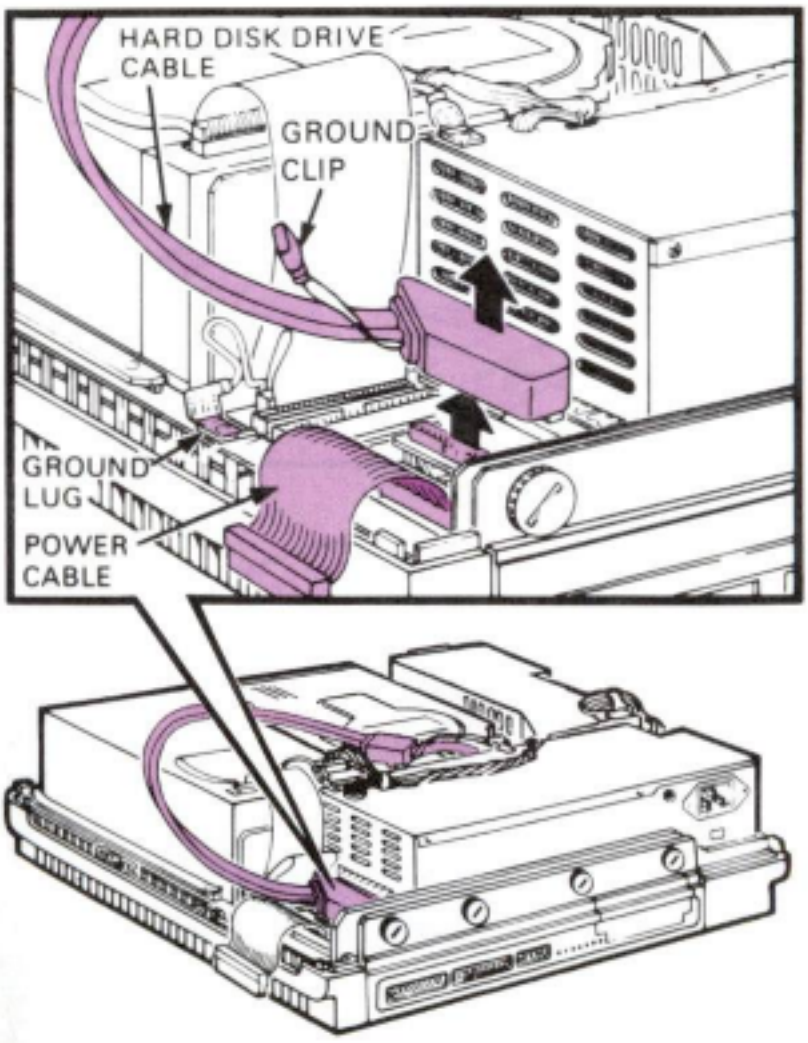


If you do not have a hard disk drive (Winchester), remove the power cable from the power supply and from the system module. Go to page 26.



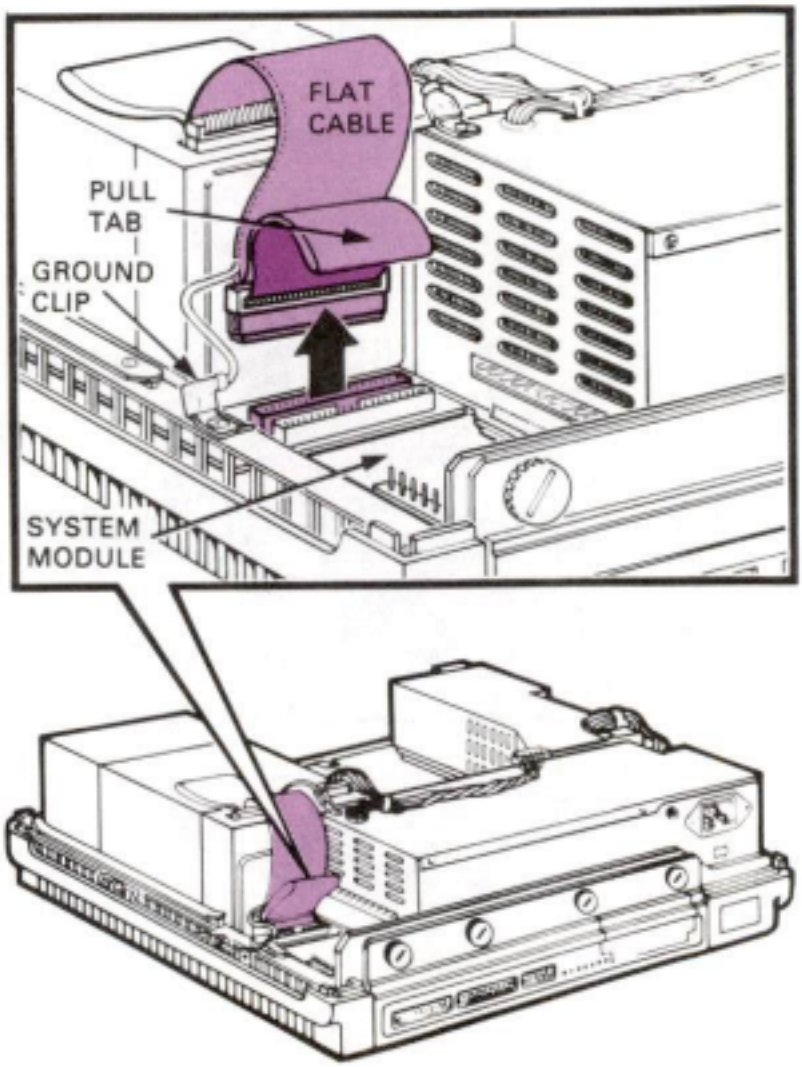
If you have a hard disk drive (Winchester):

- Remove the power cable from the power supply.
- Remove the hard disk drive cable and detach its ground clip from the lug. (This connector may be very tight. Pull hard.)
- Remove the power cable from the system module.



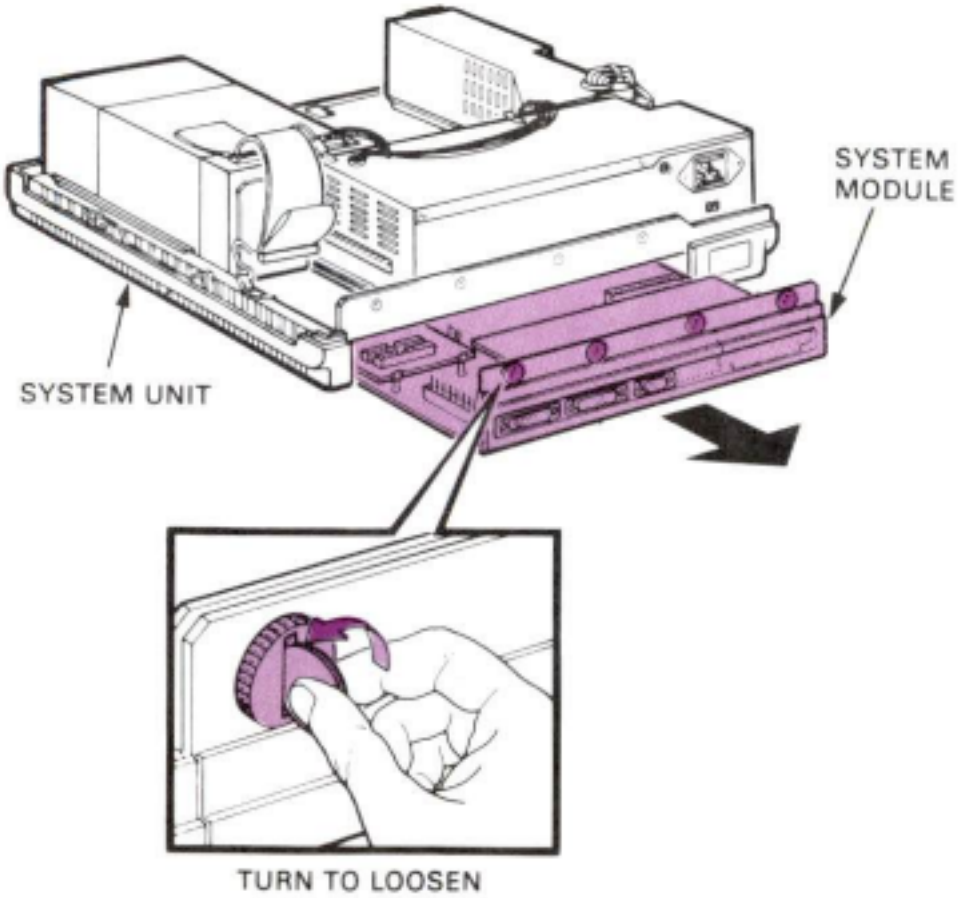
Disconnect the diskette drive flat cable.

If you have two diskette drives, remove both flat cables. You may leave the ground clip attached to the ground lug.



Remove the system module.

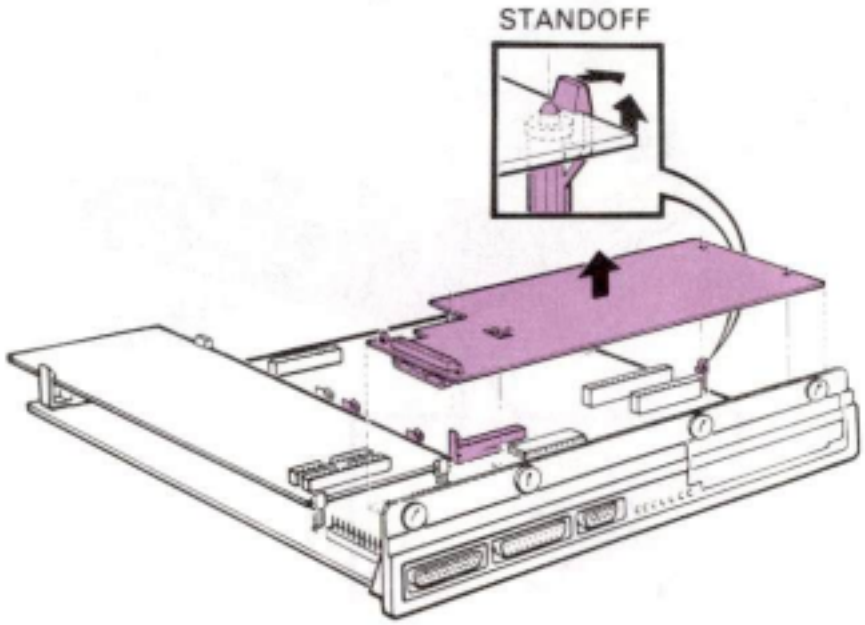
- On the rear panel, use a coin to slightly loosen each screw.
- Repeat until all the screws are loose and you can slide the system module out of the system unit.



Remove any option board as shown.

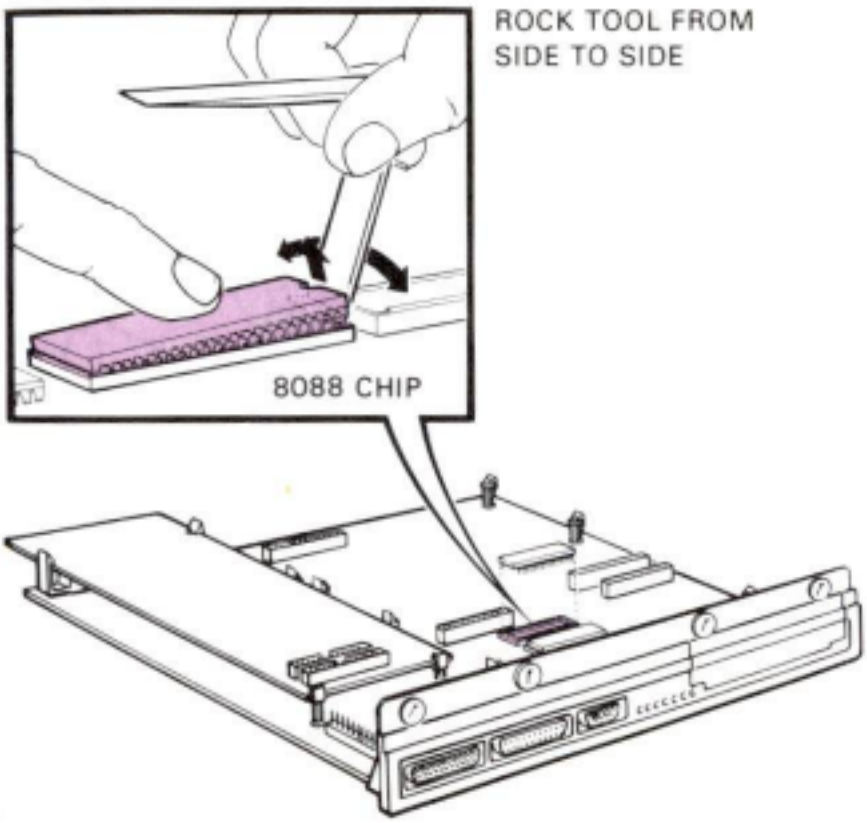
The option board can be either the hard disk controller board or the extended communications board.

- Press the top of each standoff outward and lift each corner of the option board.
- Lift the option board from the connectors.



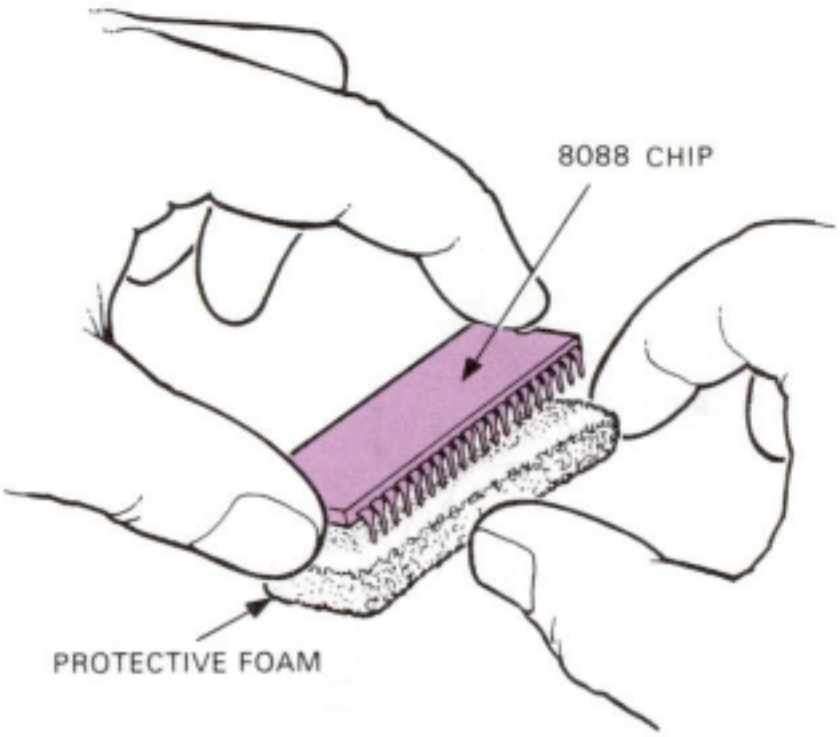
Remove the 8088 chip from the system module.

- Lightly hold the chip with one finger while rocking the chip removal tool back and forth until one end of the chip is out of the socket. Avoid prying the chip.
- Repeat this procedure at the other end of the chip.



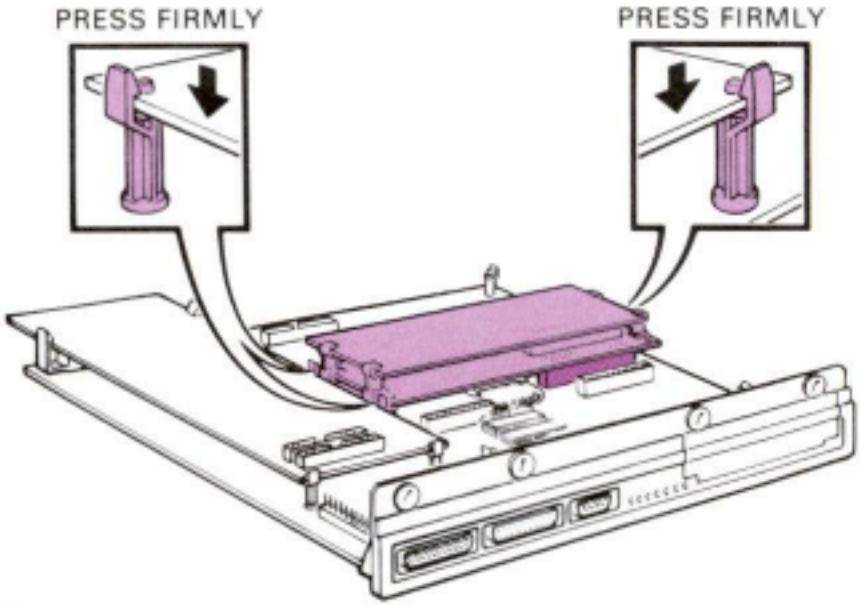
Remove the foam from the cable connector of the adapter board (the adapter board is now part of the memory/adapter assembly).

Store the 8088 chip, which you just removed from the system module, on the foam.

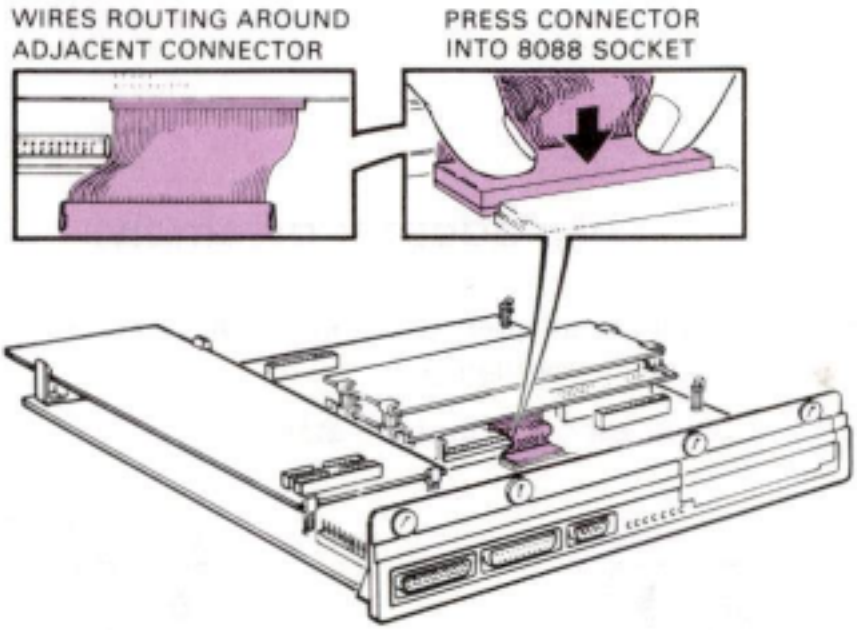


Install the memory/adapter assembly.

- Place the memory/adapter assembly on the system module so the connectors are aligned.
- Press firmly at each of the three standoffs.



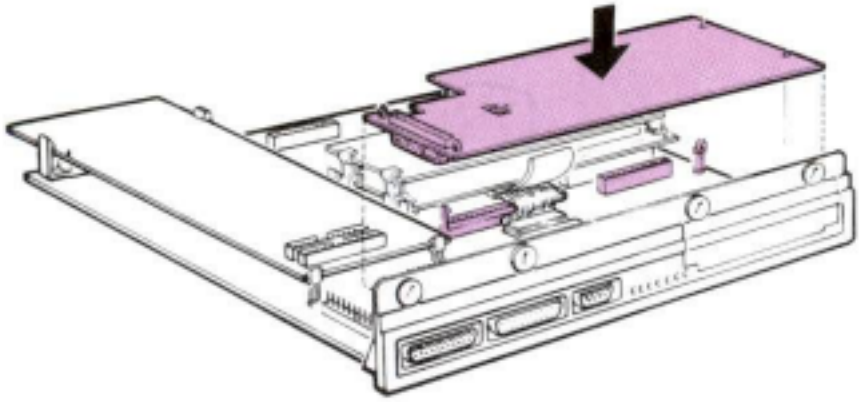
- Align all 40 pins of the cable connector with the 8088 socket holes. Make sure the cable connector wires route around the adjacent connector.



- Press the cable connector into the 8088 socket.

Reinstall the option board that you previously removed.

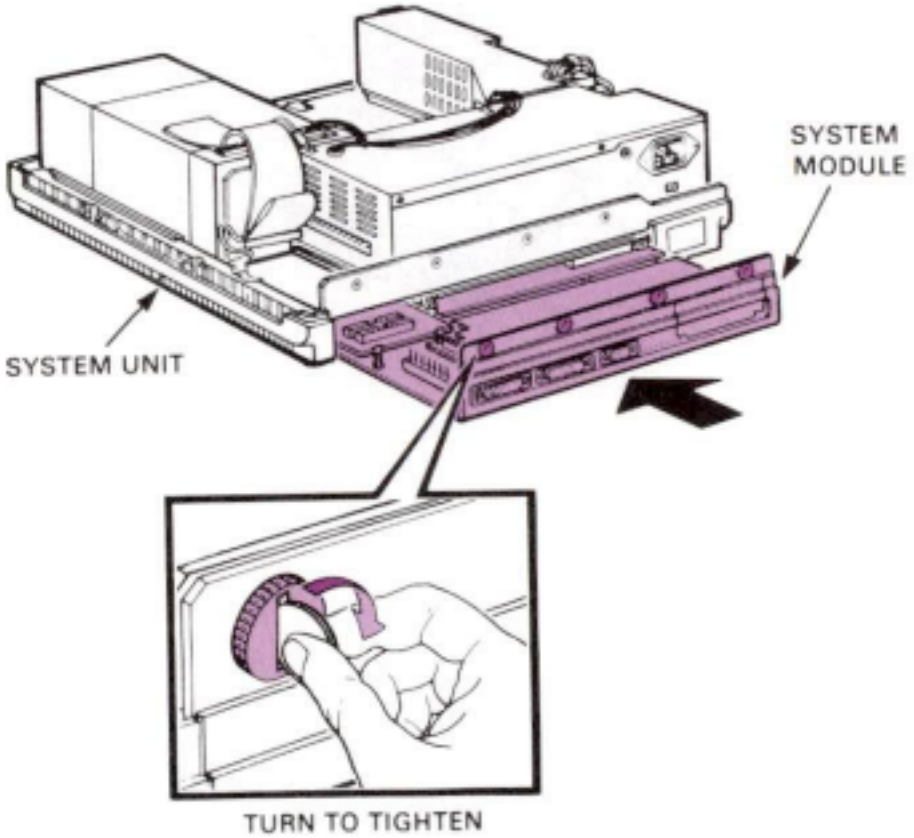
Press the option board down at each standoff and at the connectors.



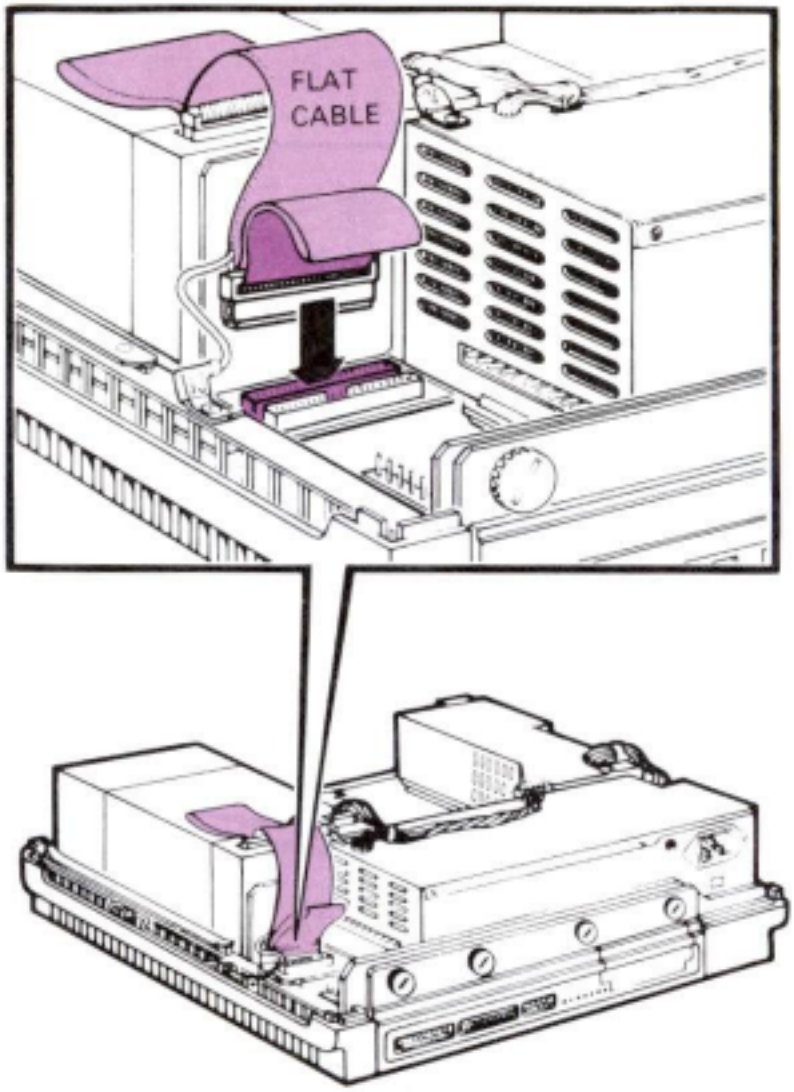
Replace the system module.

Place the system module in the guides and slide it in.

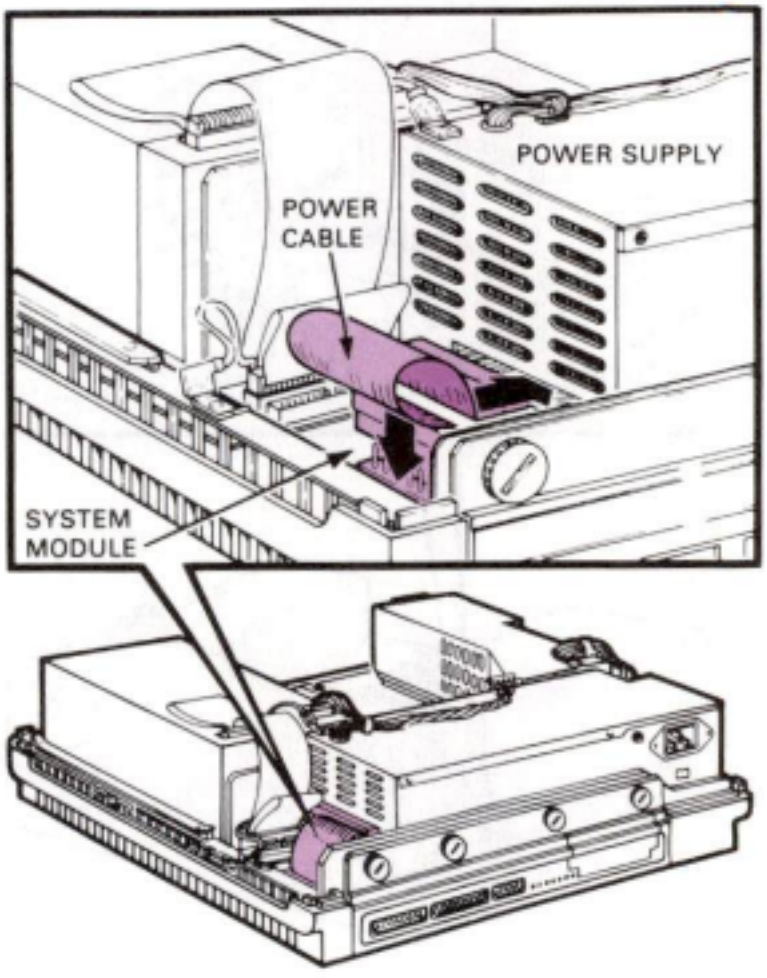
- Turn each screw about half a turn.
- Use a coin to tighten all of the screws *firmly*.



Reconnect the diskette drive flat cable. If you have two drives, reconnect both cables.

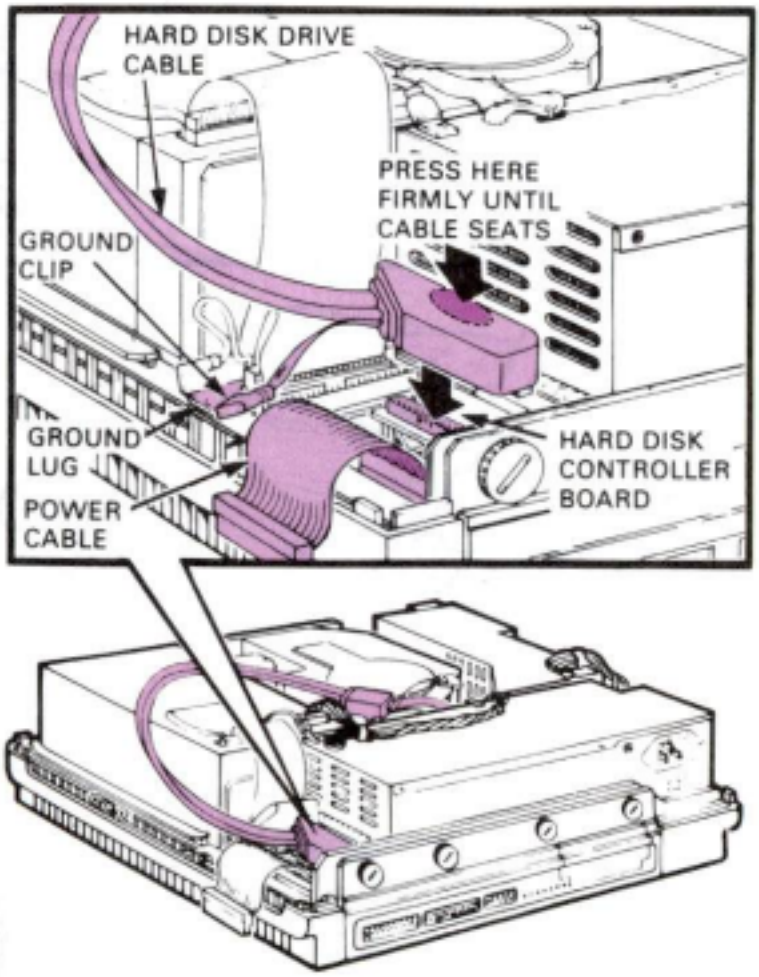


If you do not have a hard disk drive, reconnect the power cable to the system module and to the power supply. Go to page 39.

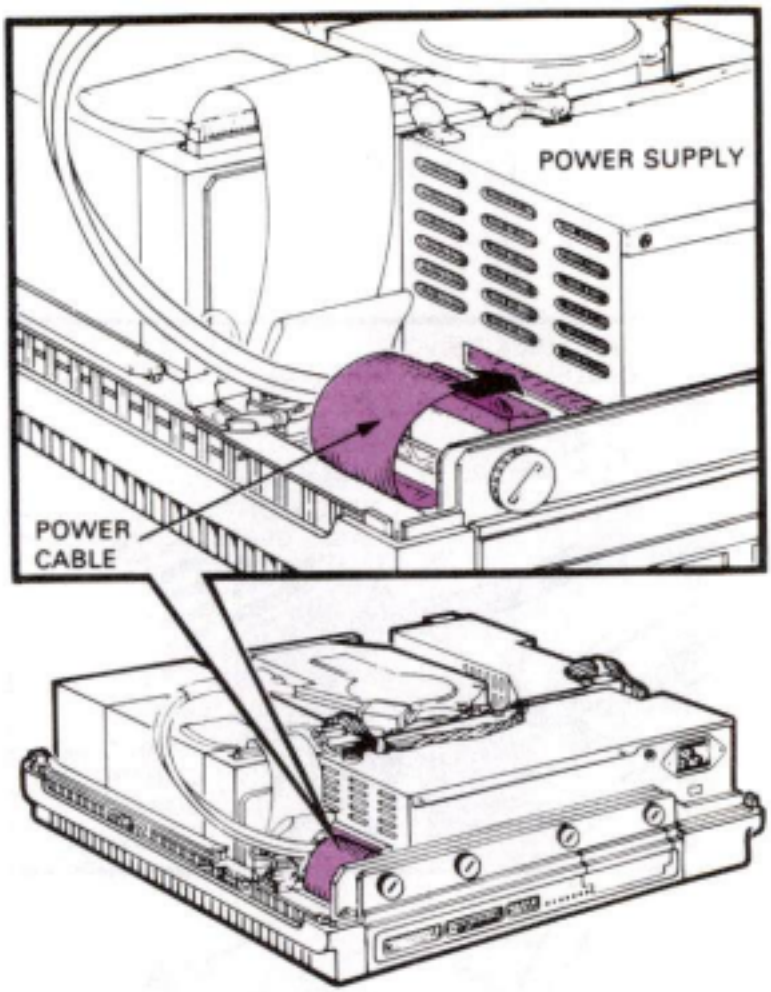


If you have a hard disk drive:

- Connect the power cable to the system module.
- Plug the hard disk drive cable into the connector on the hard disk controller board.
- Connect the ground clip to the ground lug. You must push very hard.



Plug the power cable into the power supply.



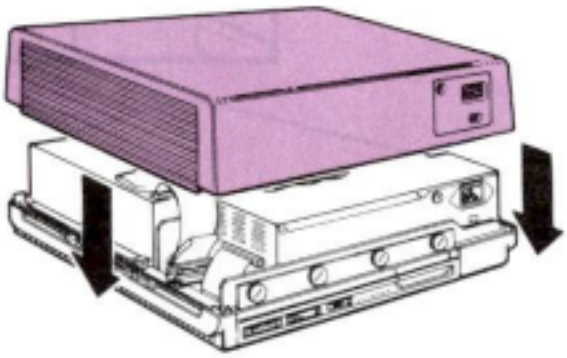
Replace the cover on the system unit.

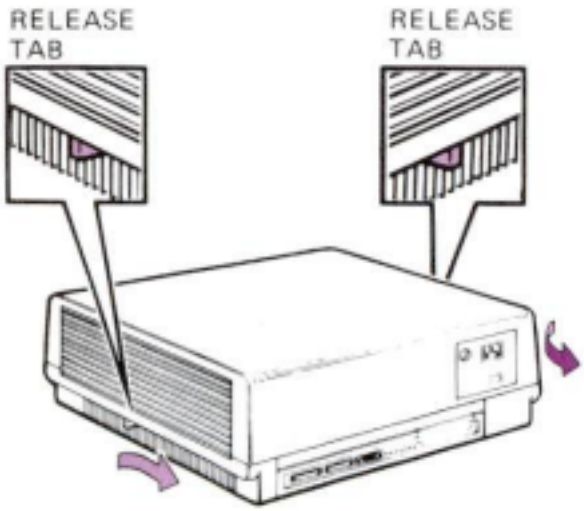
If the cover does not seat properly:

- Make sure the screws on the system module are tight.
- Check that the cover release tabs are pushed in and locked.

To make sure the cover is on securely, test it by lifting it.

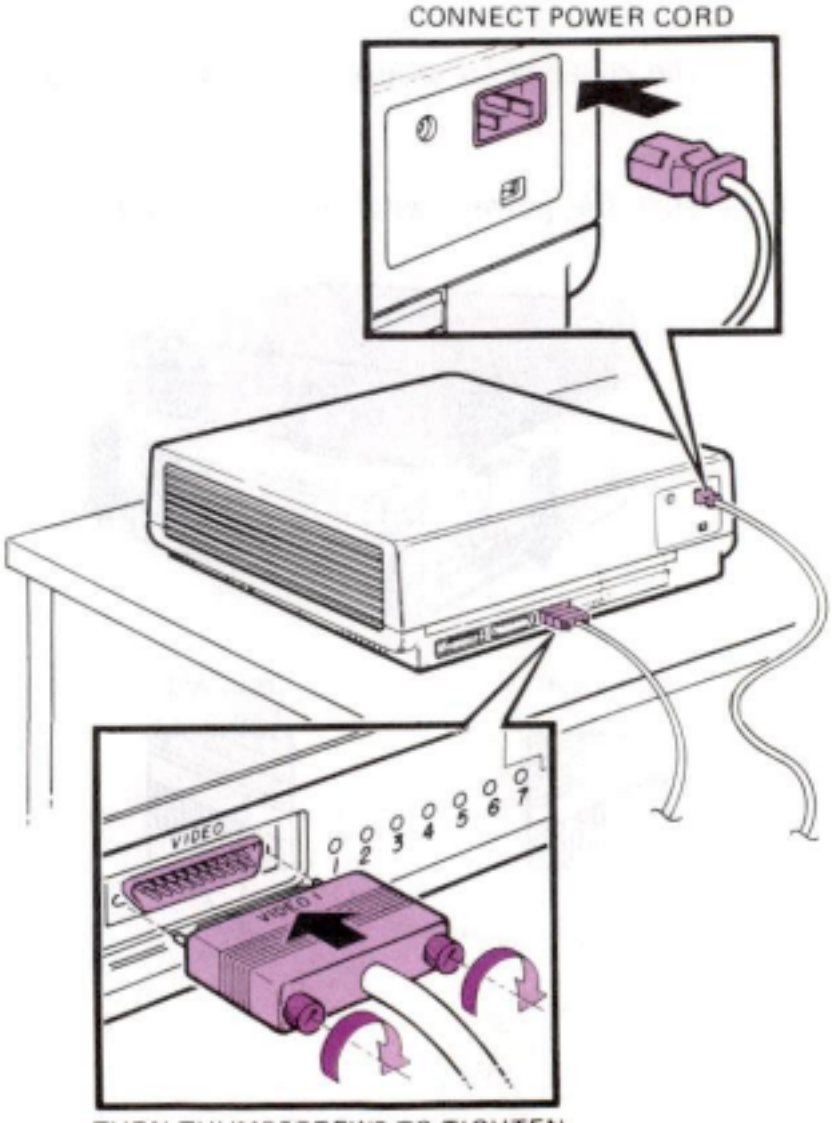
NOTE
Make sure the power switch is set to 0 (off).



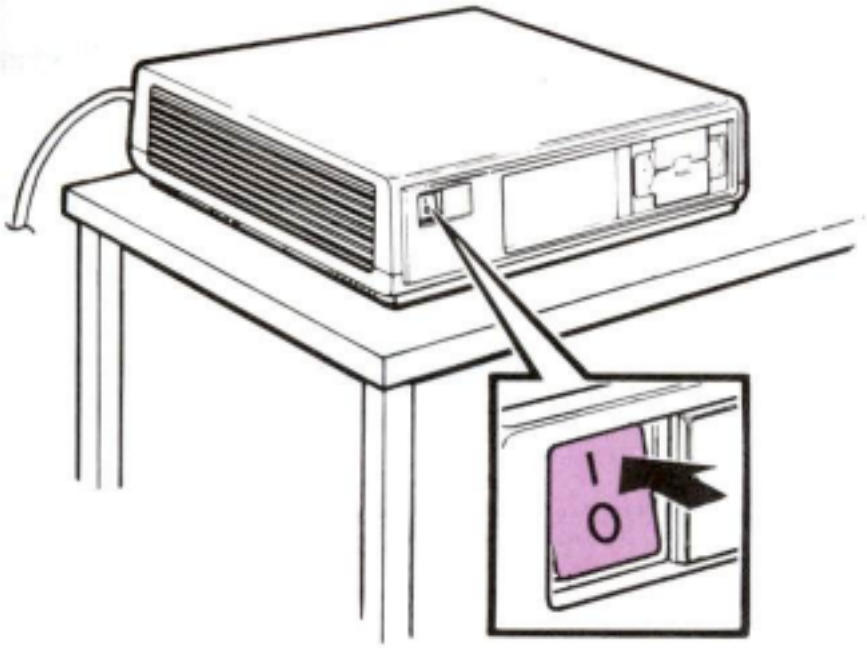


Connect all cables and the power cord to the system unit.

Do not reinstall the system unit into the floor stand yet.



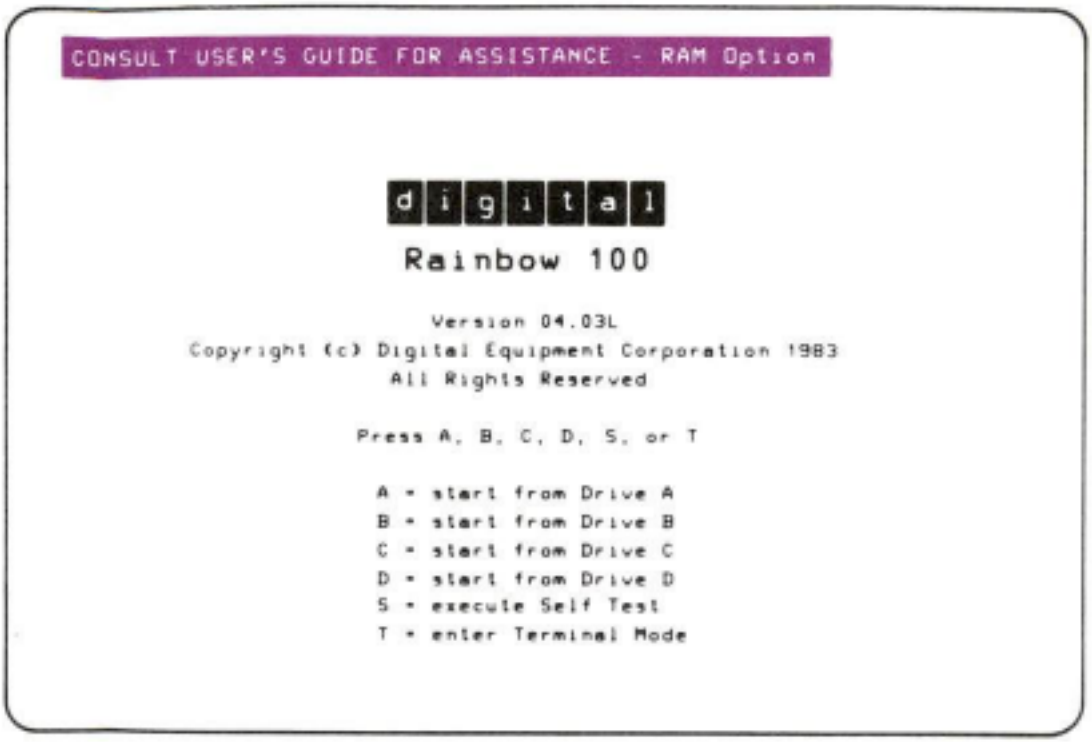
Turn the computer on (1).



You will hear a whir and a beep; then, you will see the Main System Menu.

The version number displayed on your screen may be different than the one shown here.

If you see a message at the top of the screen or no display at all, turn to Appendix D, Messages.



Changing Memory Set-Up

Access the Memory Set-Up feature.

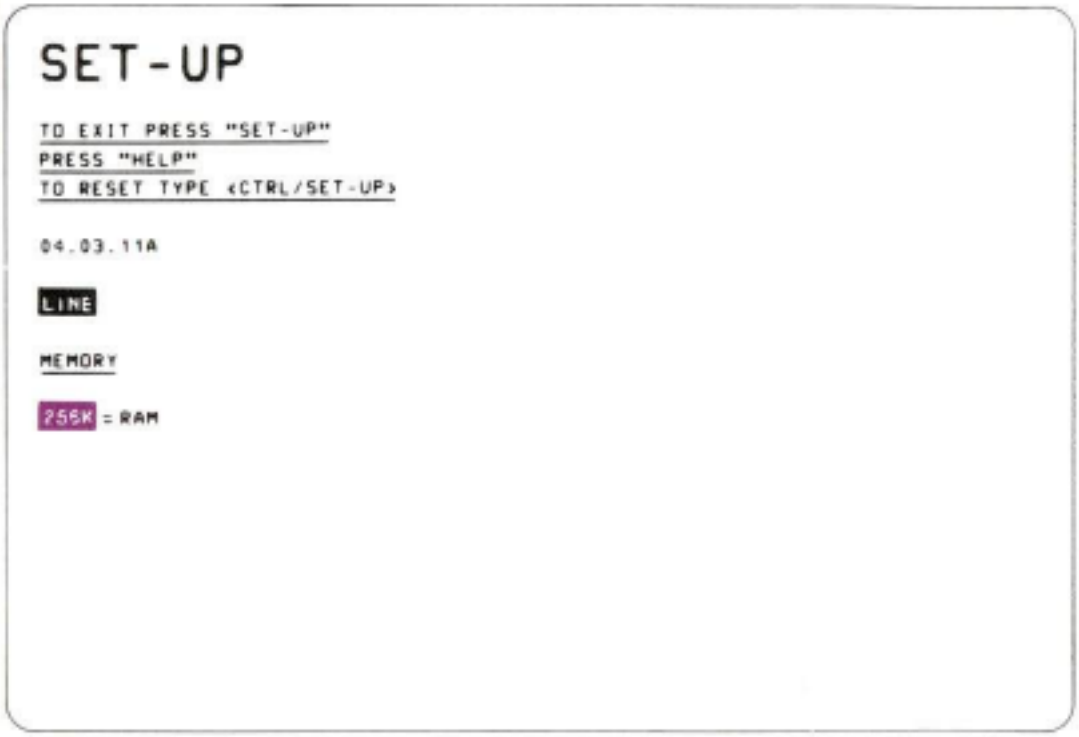
To tell the computer you have changed the size of its memory, you must change the Memory Set-Up feature.

- Press the **Set-Up** key.
- Then, press the **Prev Screen** key.

Set the new memory size.

You previously determined the new memory size. (See page 9).

Set the new memory size to 256K bytes. Press the ⬟ key until 256 is displayed under the MEMORY heading.



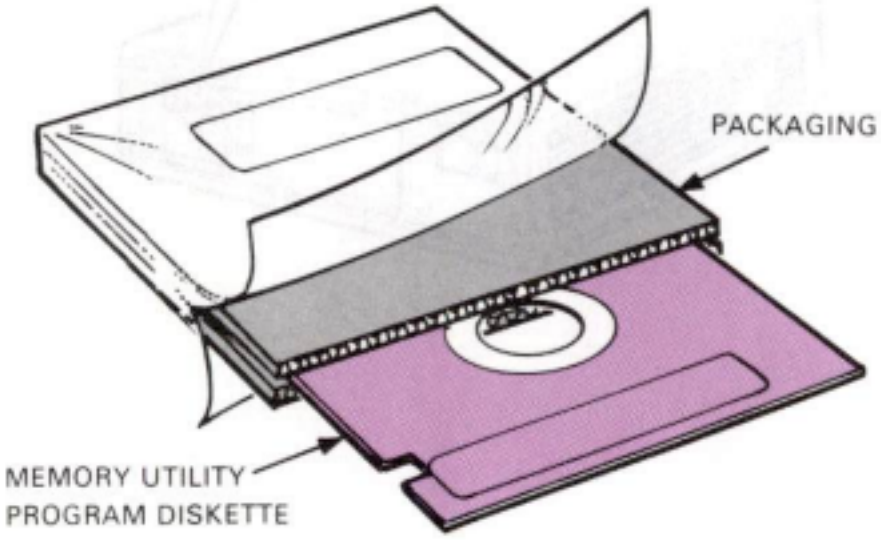
NOTE
Your computer offers three choices in Set-Up for the memory size: 64K, 128K, and 256K. If your new memory size is 192K bytes or greater, you must set the memory to 256K bytes.

Save the new memory size.

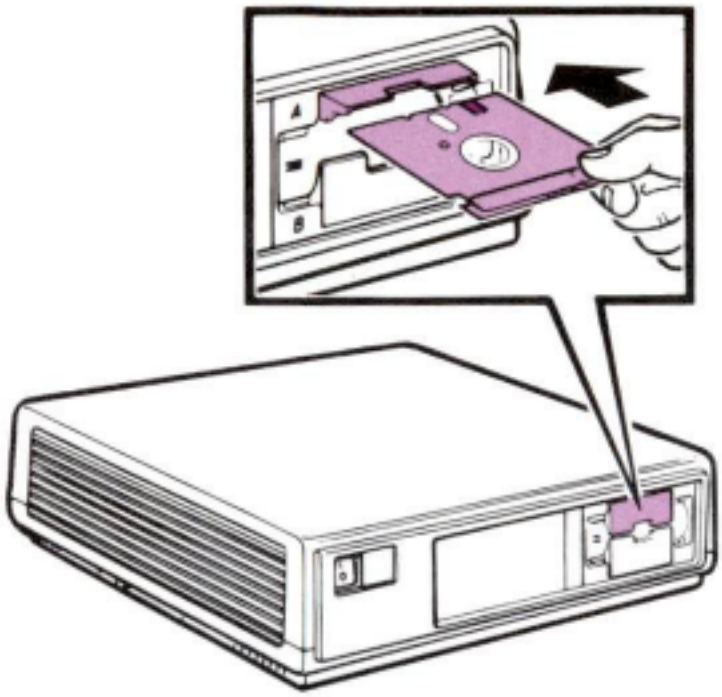
- Hold down the **Shift** key and type **S** to save the new total memory size.
- Press the **Set-Up** key to exit to the Main System Menu.

Testing Memory

Remove the Memory Utility Program diskette from its box and envelope.



Insert the diskette in drive A and close the diskette drive door.



Type A. The computer displays the Memory Adapter Utility Program menu, also called the Main Screen.

(You may have a different version number.)

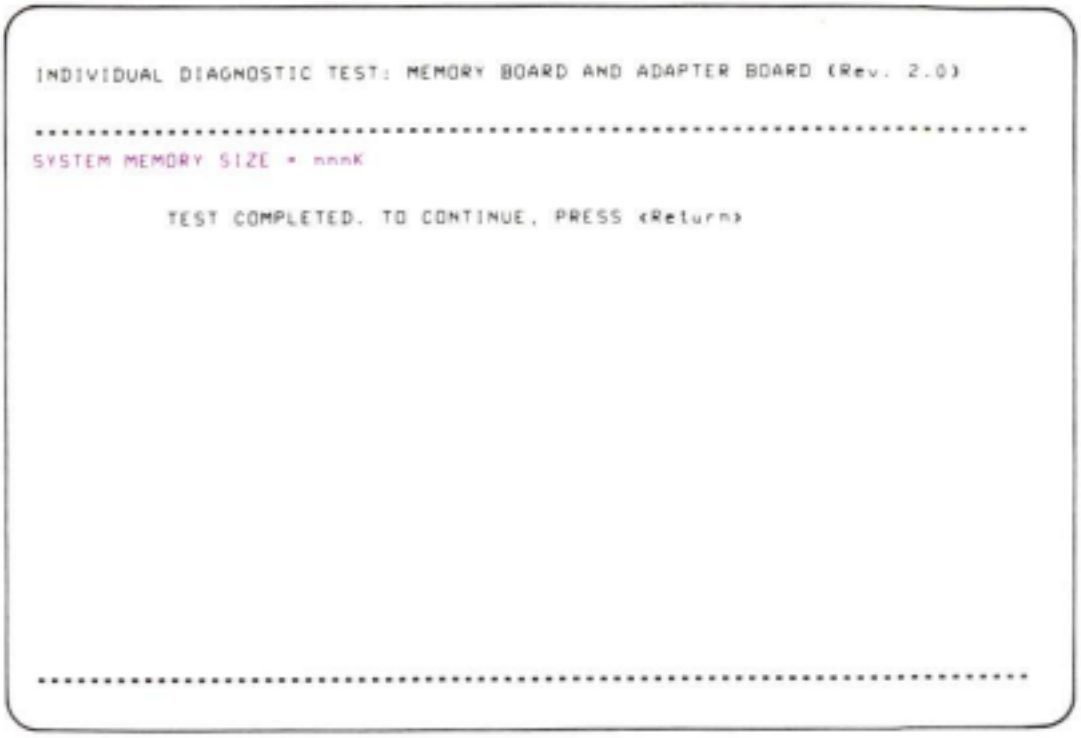
```
          Rainbow Memory Adapter Utility Program (Version 1.5)

------------------------------------------------------------------------------
                              Main Screen


--->
     1.  Test the memory board and adapter board

     2.  Update the following operating system disks
         (Required only for Rainbow 100 not Rainbow 100+)

         o  MS-DOS Version 2.01
         o  MS-DOS Version 2.05
         o  CP/M 86/80 Version 1.0
         o  CP/M 86/80 Version 2.0

To point to a selection, press the up arrow key, down arrow key
   or a number key.
To begin the selected action, press <Do>.
When finished with this program, insert a system diskette into Drive A
    and press <Set-Up> followed by <Ctrl/Set-Up>.
```

NOTE

You must use the Memory Utility Program diskette to test your memory board. Do not use your Rainbow Diagnostic diskette.

Type 1 and press the Do key to test the memory board.

The new memory size is displayed on the screen after approximately one minute depending on the size of the memory.



NOTE
If the SYSTEM MEMORY SIZE message is not displayed or does not equal the amount of new memory the computer has, refer to Appendix C, An Unsuccessful Test.

Press the **Return** key to continue.

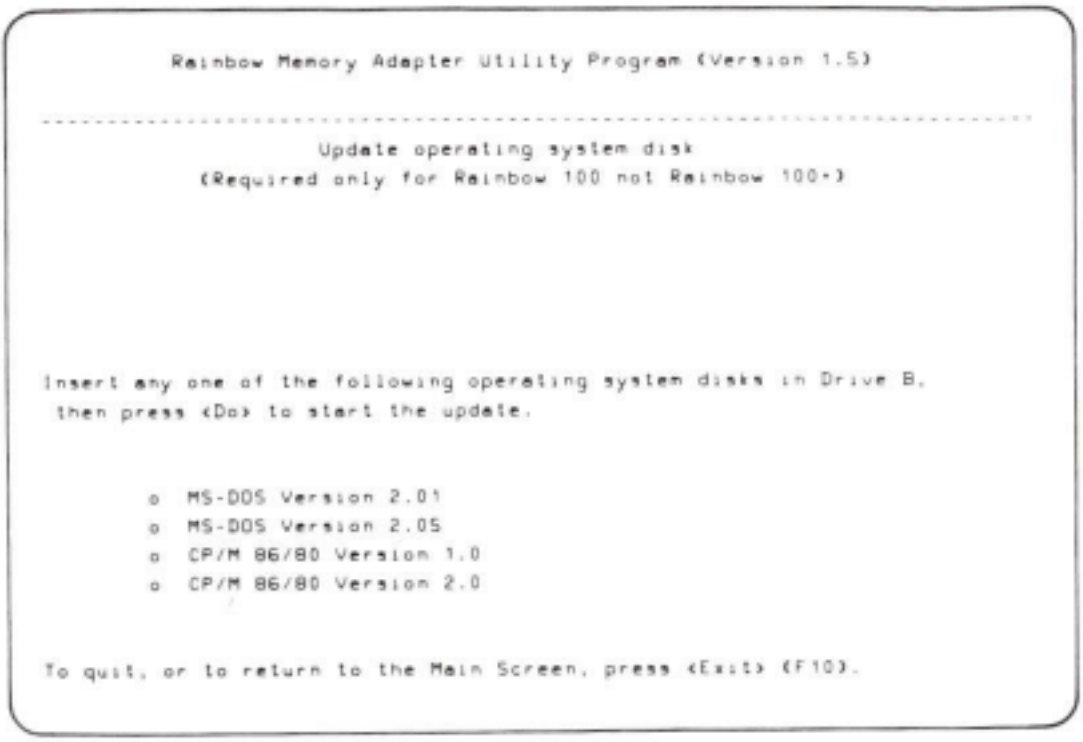
Updating Operating Systems

These operating systems must be updated.

- MS™-DOS, version 2.01
- MS™-DOS, version 2.05
- CP/M®-86/80, version 1.0
- CP/M®-86/80, version 2.0

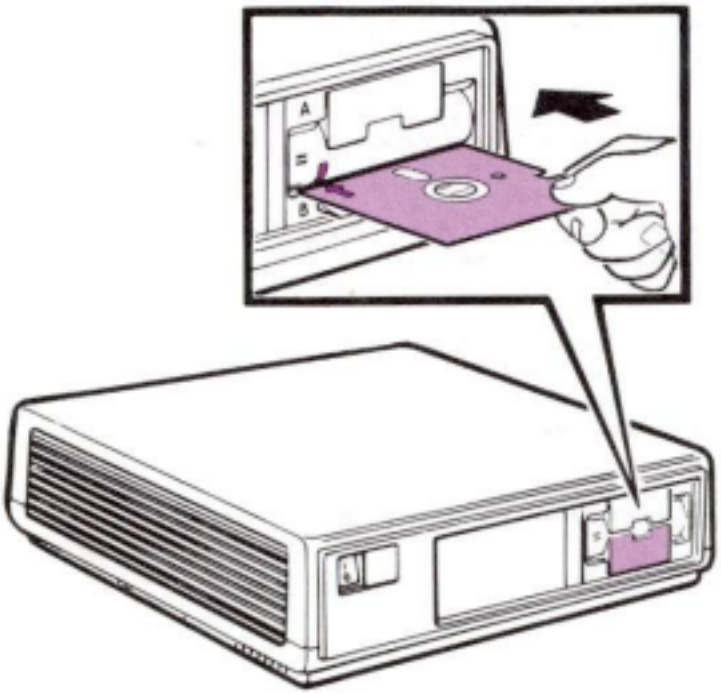
Use the following procedure to update your working and backup copies of these operating systems.

Type 2 and press the Do key to display the following screen.



Insert the working copy of the operating system diskette in drive B.

- Make sure the write-protect notch is not covered.



Press the Do key.

When the update is complete, the following screen is displayed.

```
          Rainbow Memory Adapter Utility Program (Version 1.5)

--------------------------------------------------------------------------------
                      Update operating system disk
              (Required only for Rainbow 100 not Rainbow 100+)


Insert any one of the following operating system disks in Drive B,
 then press <Do> to start the update.


        o  MS-DOS Version 2.01
        o  MS-DOS Version 2.05
        o  CP/M 86/80 Version 1.0
        o  CP/M 86/80 Version 2.0


To quit, or to return to the Main Screen, press <Exit> (F10).



Update completed.
```

- Remove the updated diskette from drive B and apply the write-protect tab.
- Repeat the procedure for each operating system.

You may receive one of the following messages:

```
Disk error.

The disk in drive B is not a system disk.

The disk in drive B is a newer operating system disk
or it is not a Rainbow system disk - no update needed.
```

If you receive the disk error message, remove the diskette and make sure it does not have the write-protect tab on it. Insert the diskette and repeat the update procedure.

CONGRATULATIONS

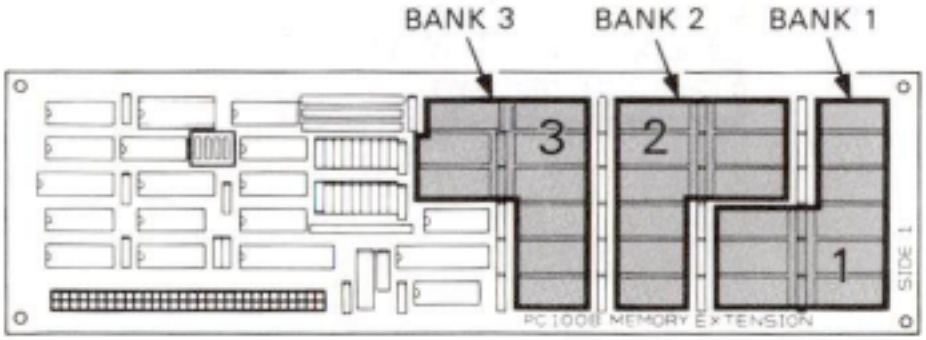
You have successfully installed and tested the memory board and adapter. Reinstall the system unit in the floor stand if you have one.

A

Installing Memory Chips

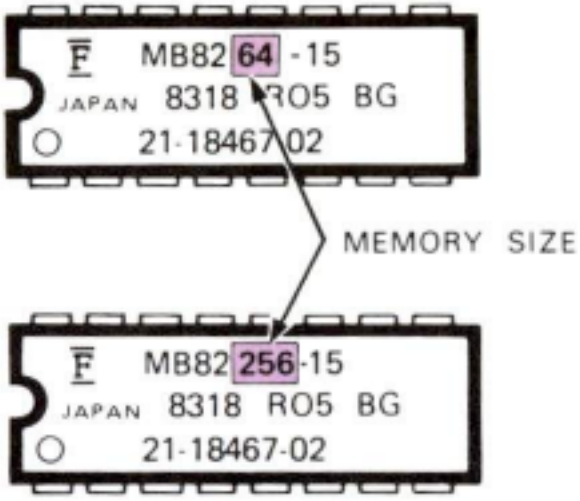
Place the memory board in front of you.

The numbered areas in the illustration are called banks. Bank 1 is already filled on your memory board and bank 2 may also be filled.



Find the memory size printed on the chips.

The memory size may be in a different location on your chips. Each bank of memory MUST have the same size chips in that bank, for example, all 64 numbers or all 256 numbers.



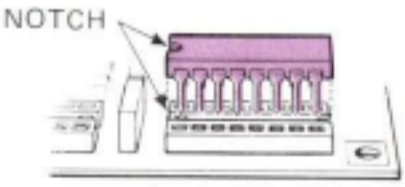
If the legs on any of your memory chips are not straight, lay the chip on its side and press the legs inward against a flat surface to straighten them.

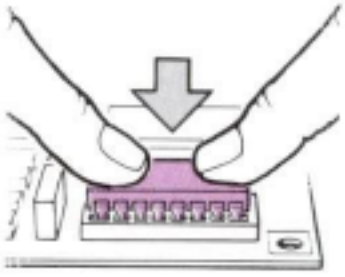
Position the chip over the socket slots, one side at a time, before pressing the chip down into the socket.

Insert the chip in bank 2 or the next unoccupied bank.

Press the chip down into the socket.

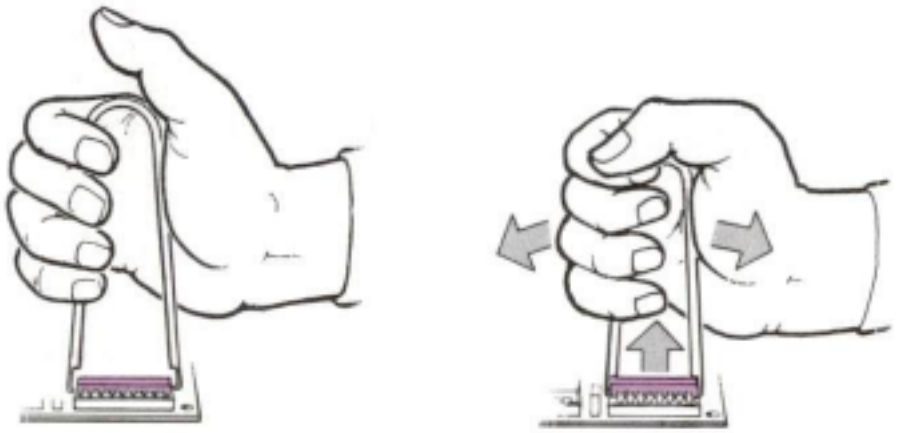
Repeat for each chip. The entire bank of 9 sockets must be filled.





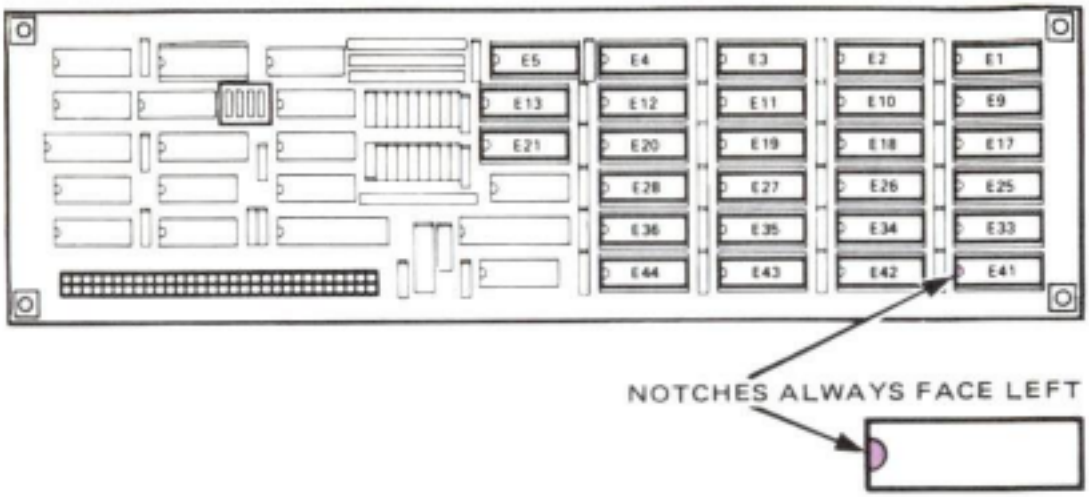
If you want to remove a bank of 64K chips and replace them with 256K chips to increase the memory size, use the chip removal tool provided in the upgrade kit.

Grasp the chip with the tool and rock it from side to side until the chip is raised. Then lift straight up.



If you notice a chip inserted incorrectly, installed backward, or with a bent leg, remove it from its socket.

After correcting the fault, install the memory chip correctly.

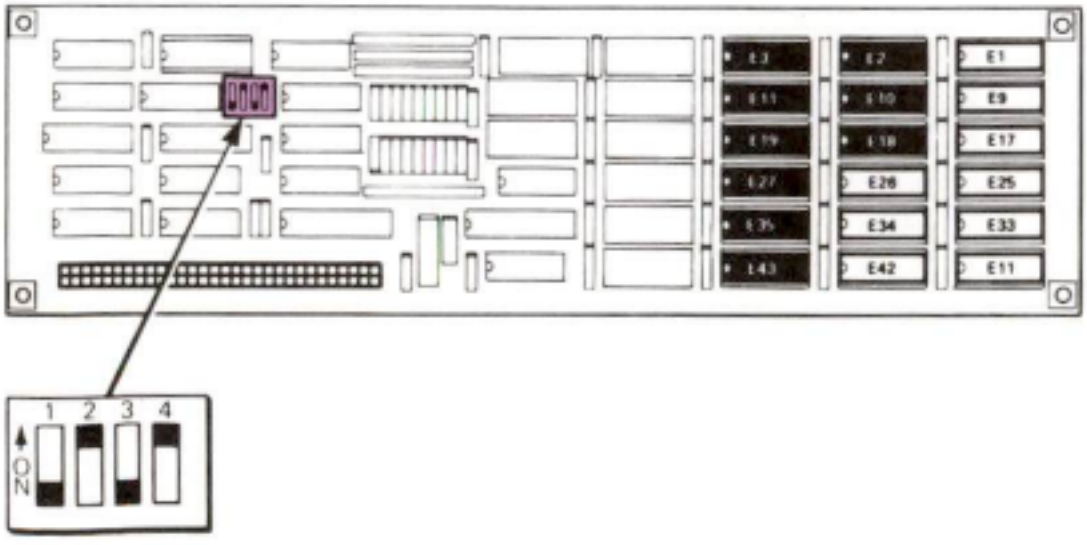


Check the memory switch settings for correct positions.

See Appendix B, Configurations. Record the size of the chips (64K or 256K) and the number of chips you added to the memory board. You will need this information later.

Find your new configuration number in Appendix B, Configurations.

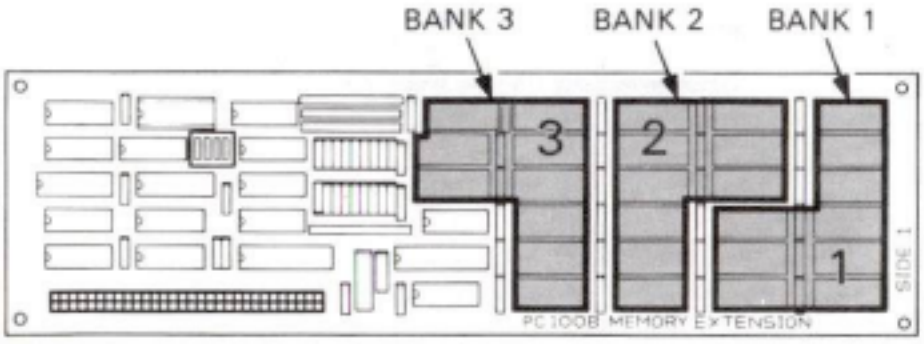
Record the configuration number on page 9, then go to page 8 to continue.



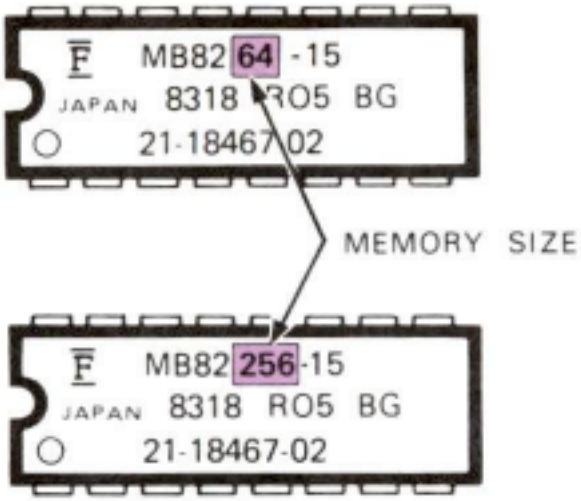
B

Configurations

To determine the configuration of your memory board, place the memory board in front of you as shown.



Determine the size of the memory chips in each bank by comparing them to the following figure.

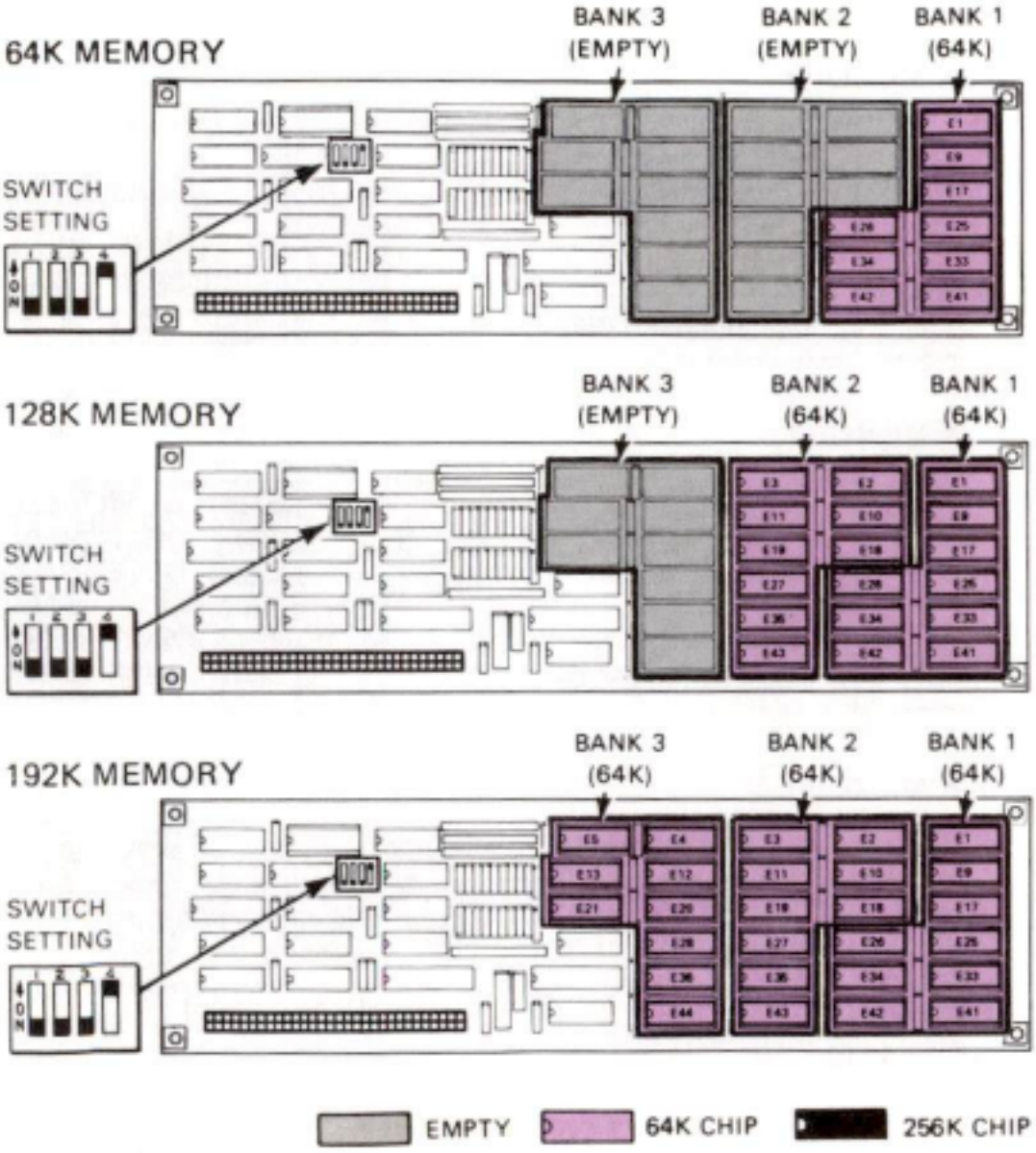


NOTE
The exact letters and numbers on the chips and their locations may be different on your memory board.

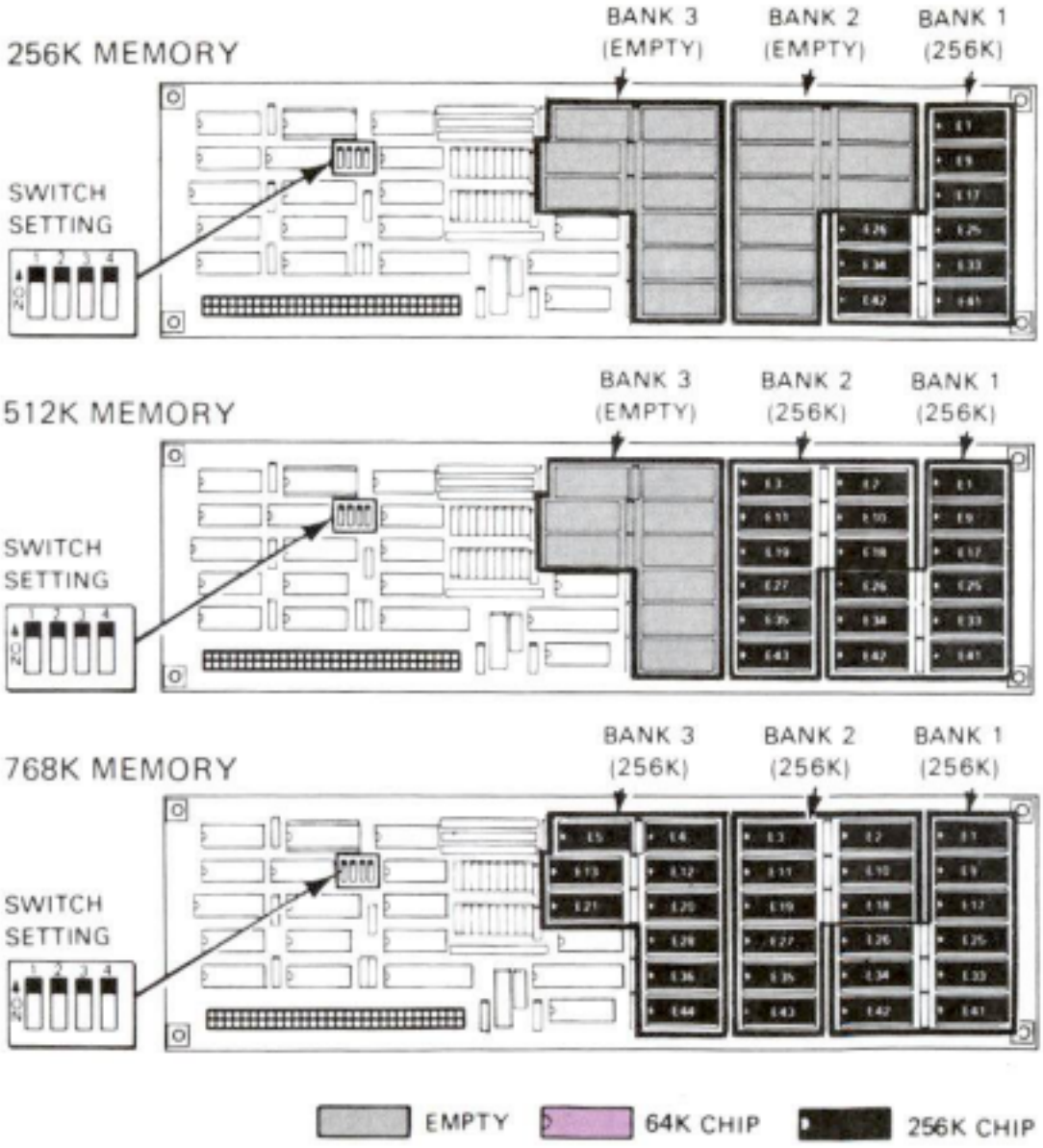
Compare your memory board chip sizes and locations to the eight configurations shown on the following pages.

Once you find your configuration number, write it down on page 9 for future reference.

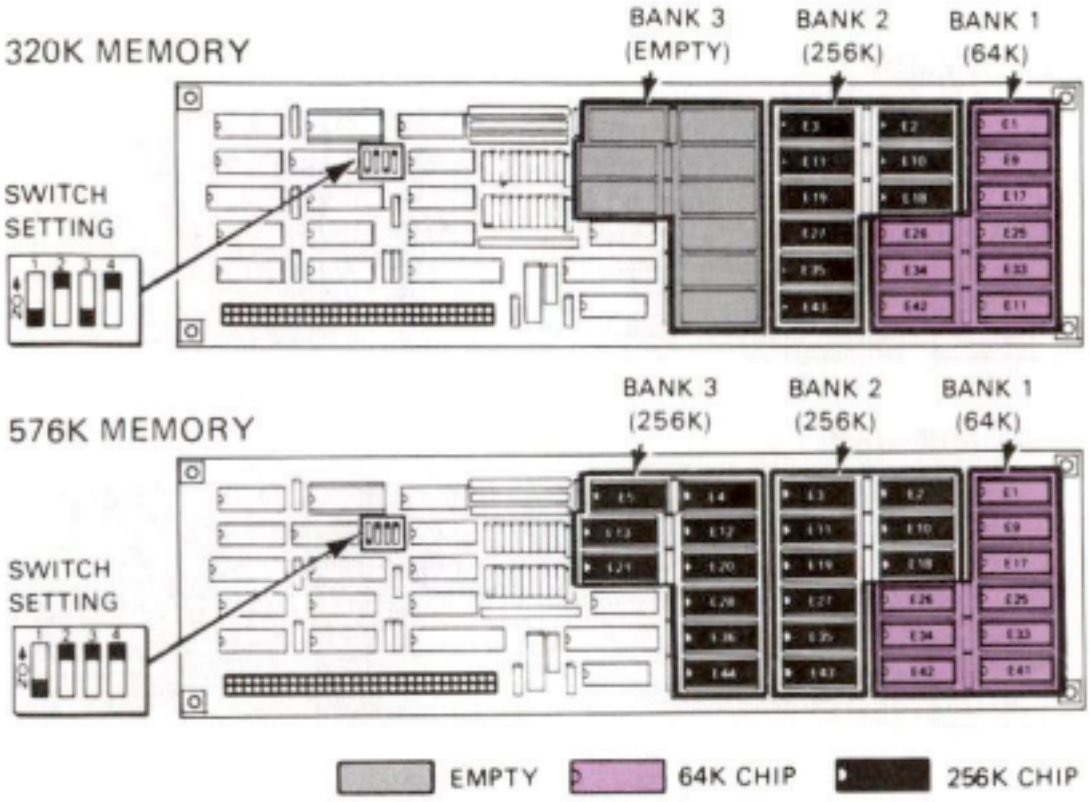
CONFIGURATION 1



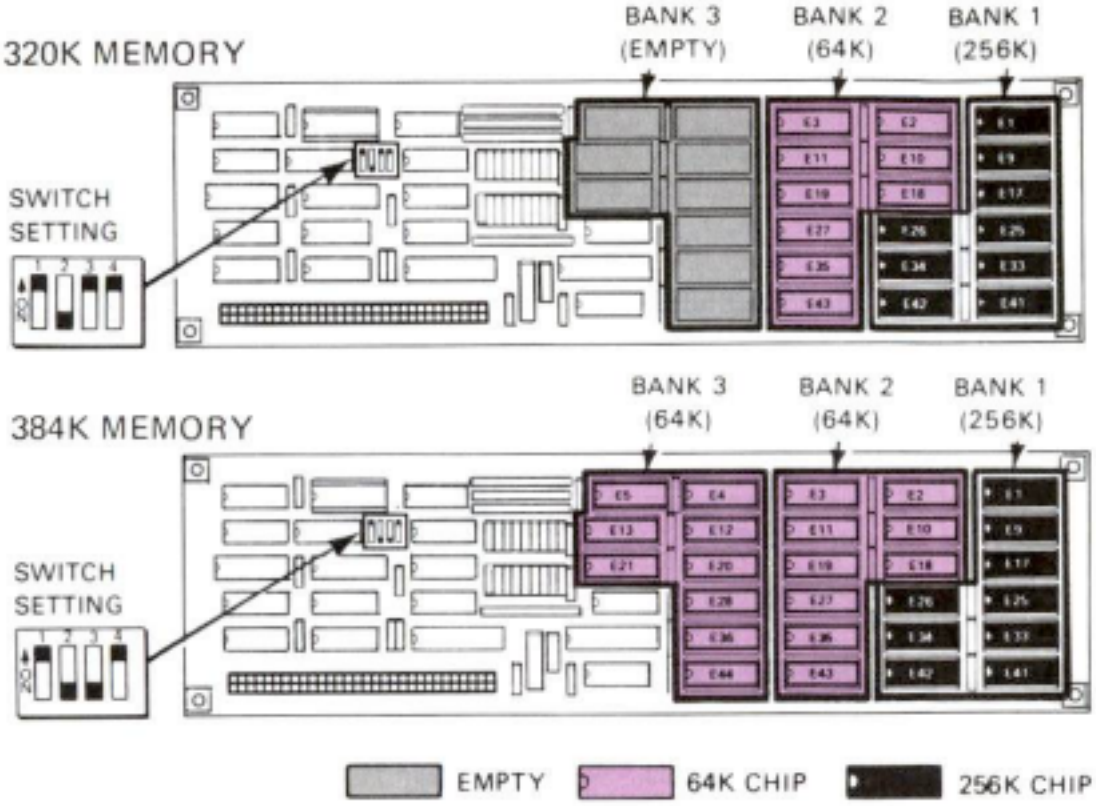
CONFIGURATION 2



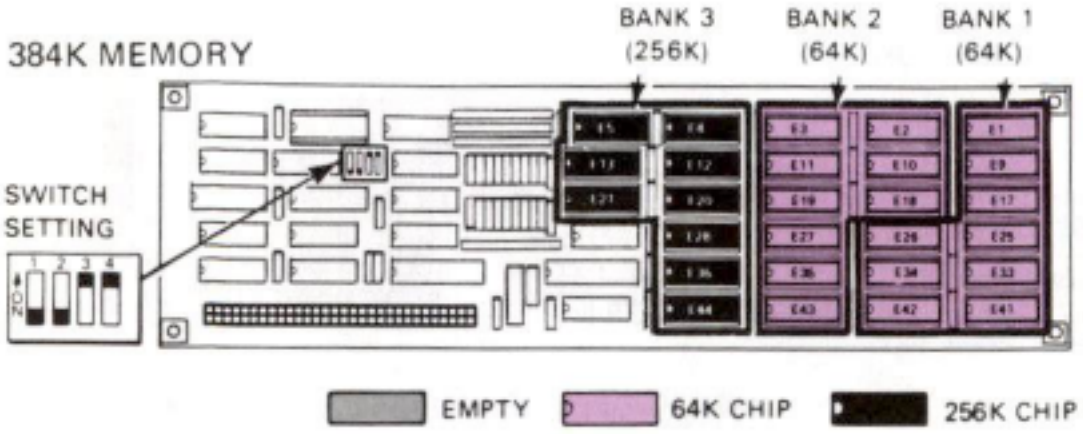
CONFIGURATION 3



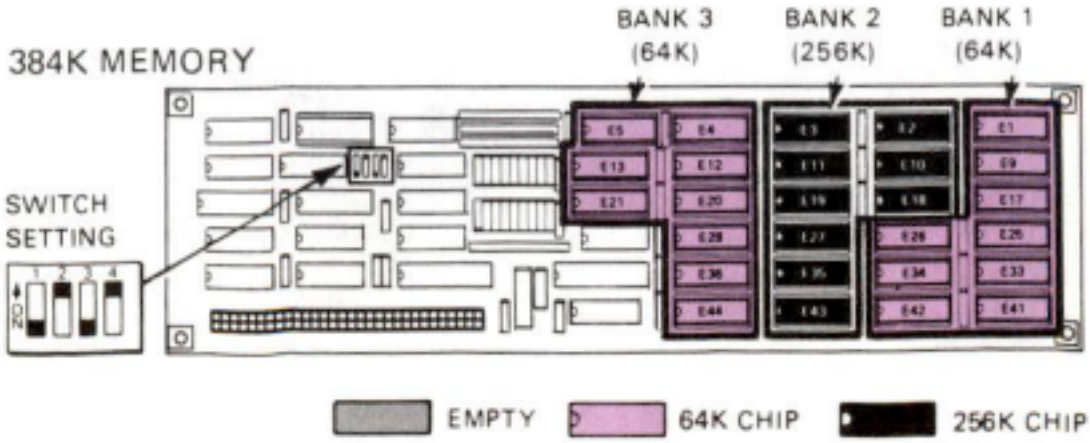
CONFIGURATION 4



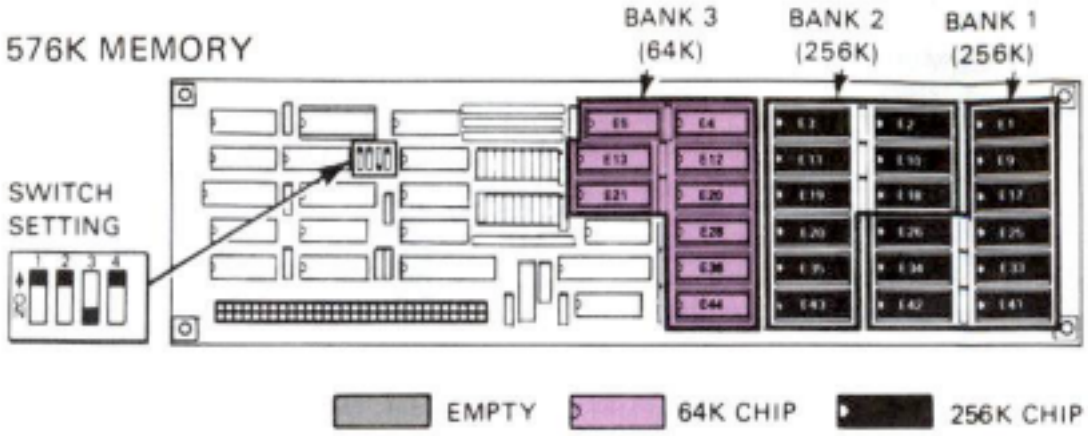
CONFIGURATION 5



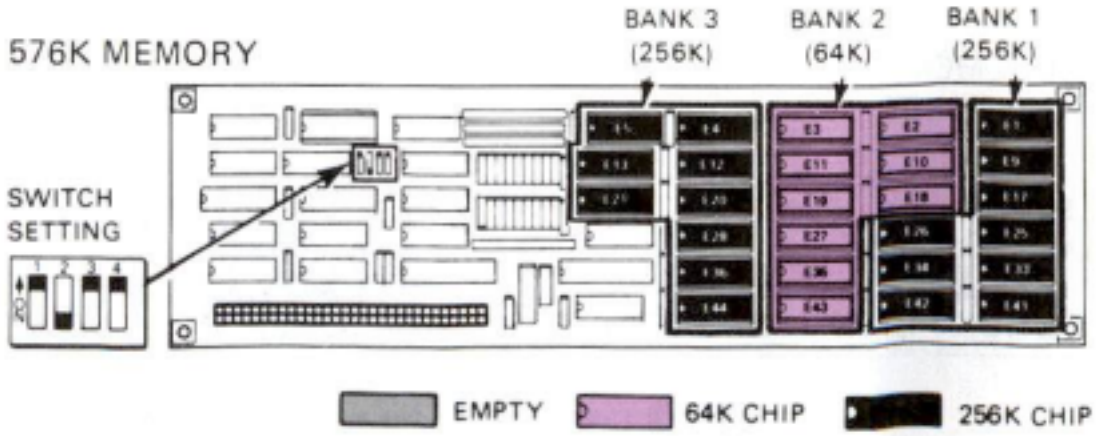
CONFIGURATION 6



CONFIGURATION 7



CONFIGURATION 8



C

An Unsuccessful Test

A message is displayed:

- if a memory chip
  - is inserted backward
  - has a bent leg
  - is the wrong size
  - is faulty
- if the memory board has the wrong switch settings.

If you see the message:

```
FAILURE: OPTION MEMORY BOARD:
  MEMORY SIZING INCORRECT
```

type **P** to proceed, as many times as requested, until you receive a failure code.

If FAILURE CODE = nn is displayed, record the number below, then go to the next page.

nn = ____

Determine the failing chip

Type your configuration number and press the **Return** key.

(Refer to page 9 for the configuration number you recorded.)

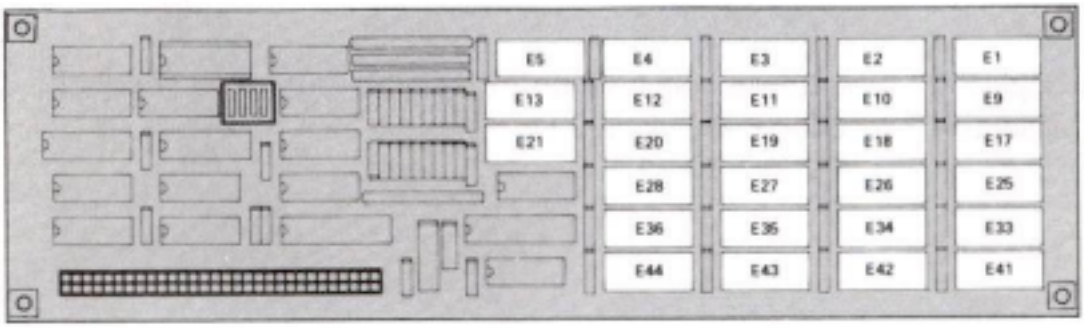
Example:

If your memory board is configuration 2, type **2** and press the **Return** key. The following screen shows an example of a faulty chip in location E26.

```
SYSTEM MEMORY SIZE = nnnk




  CHECK OPTION MEMORY BOARD COMPONENT CHIP NUMBER E26
*FAILURE CODE = (number)   TYPE CONFIGURATION NUMBER OR
*TYPE P TO PROCEED OR L TO LOOP ON ERROR, THEN PRESS <RETURN>
*PRESS <HELP> FOR MORE INFORMATION.
```

Identify the chip location.

Find the E number displayed on your screen and mark it in the figure below.



Remove the memory board.

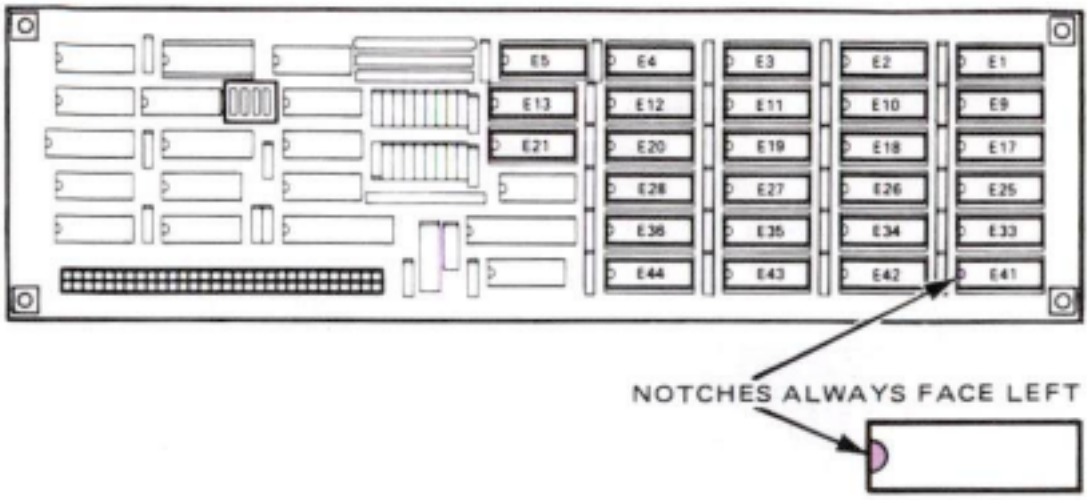
Set the power switch to 0 (off), unplug the power cord, and remove the system module, as described starting on page 17.

Remove the memory/adapter assembly from the system module.

Separate the memory board from the adapter board. Reverse the assembly procedure (see page 11).

If the chip is in backward:

Place the memory board in front of you as shown below. Locate the notch on the end of the chip. If the notch is facing right, use your chip removal tool to remove the chip; then, reinsert it correctly. Check the other chips on the board.

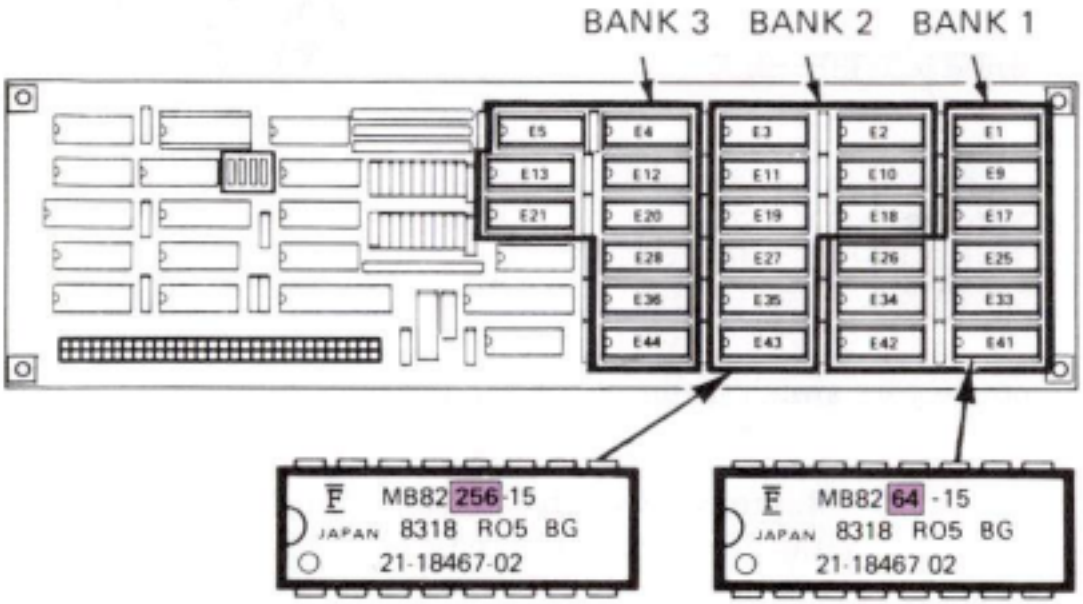


If the chip has a bent leg:

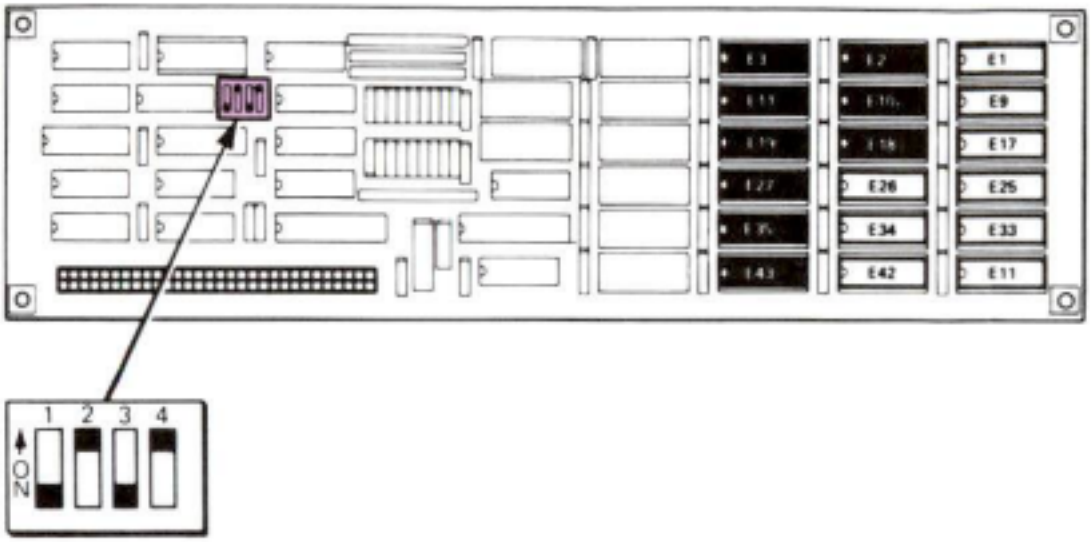
Use the chip removal tool to remove the chip. Straighten each leg of the chip, then reinsert the chip, taking care not to bend the legs.

Check that all nine chips in each bank are the same size.

Check the memory size number (either 64 or 256) on the chips in each bank. They must be the same size within the bank, but can differ from another bank. For example, 64K chips can be in bank 1, and 256K chips can be in bank 2.



Check the memory board switch for the correct setting.



Compare your switch settings with the following table.

Memory Bank	Switch Position	64K Chips	256K Chips
1	1	OFF	ON
2	2	OFF	ON
3	3	OFF	ON
	4*	ON	ON

*Factory set. Must always remain ON.

If no visible problem is found:

If you cannot find any visible problem with the failing chip, return the chip and memory board to your dealer. Remember to ship the memory board in its original protective packing material and shipping box.

> **NOTE**
> This test reveals only one failure at a time. Therefore, you must correct each chip that causes the test to fail, then run the test again. Run the test until it is successful.

D

Messages

If your computer displays one of the following messages, follow the instructions given after each message.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - Drive A - not ready
```

Be sure the orange arrow on the diskette aligns with the orange stripe on drive A.

Diskette drive flat cable is not connected firmly at either end.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - DRIVE A - read
```

The Rainbow 100 computer cannot read the diskette, try another.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - MAIN BOARD
- unsolicited interrupt
```

Press **Set-Up**. Then, hold down the **Ctrl** key and press **Set-Up** to obtain the Main System Menu. Turn to page 42 to continue.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - KEYBOARD
```

The keyboard may be unplugged, or you may have pressed a key during the power-up test. Turn the power switch off, then on again.

```
CONSULT USER'S GUIDE FOR ASSISTANCE - RAM OPTION
```

Press **Set-Up**. Then, hold down the **Ctrl** key and press **Set-Up** to obtain the Main System Menu. Turn to page 42 to continue.

```
NO DISPLAY
```

The power cable or video cable is not connected firmly at either end.

If a different message is displayed, refer to the error message section of the *Rainbow™ 100 Owner's Manual*. If you need help, call the Help Line number:

800-DEC-8000

E

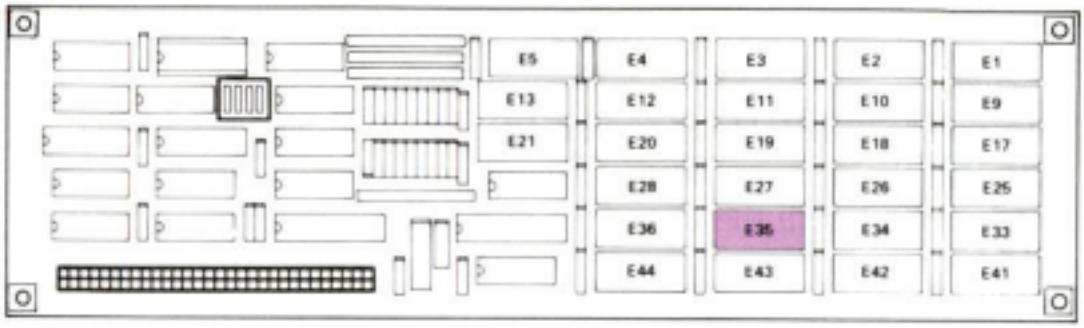
Failure Code Table

The failure code table is provided for the user who has just removed the memory board to determine its configuration. You do not have to install the memory board and run the memory test again. If you know:

1. Your configuration number, and
2. Your failure code number (the E number that you recorded on page 75).

you can isolate the failing chip by following the instructions on the next page.

To use the table, look for your configuration number at the top of the table. Below that number, find your failure code. Then go to the far right of the failure code table and locate the failing E number. The location of the chip with that E number is shown below.



Example:

- If you have configuration 3, look for the column head 3.
- Look down this column for your failure code, which in this example is 70.
- Go to the far right column from this number. This E number shows the chip that failed on the memory board.
- Examine chip E36 to see if it is in backward, has a bent leg, or is the wrong size.

TABLE 1

FAILURE CODE NUMBERS	CONFIGURATION NUMBERS								E NUM
	#1	#2	#3	#4	#5	#6	#7	#8	
20	20	20 30 40 50	20	20 30 40 50	20	20	20 30 40 50	20 30 40 50	34
21	21	21 31 41 51	21	21 31 41 51	21	21	21 31 41 51	21 31 41 51	26
22	22	22 32 42 52	22	22 32 42 52	22	22	22 32 42 52	22 32 42 52	41
23	23	23 33 43 53	23	23 33 43 53	23	23	23 33 43 53	23 33 43 53	33
24	24	24 34 44 54	24	24 34 44 54	24	24	24 34 44 54	24 34 44 54	25
25	25	25 35 45 55	25	25 35 45 55	25	25	25 35 45 55	25 35 45 55	17
26	26	26 36 46 56	26	26 36 46 56	26	26	26 36 46 56	26 36 46 56	9
27	27	27 37 47 57	27	27 37 47 57	27	27	27 37 47 57	27 37 47 57	1
28	28	28 38 48 58	28	28 38 48 58	28	28	28 38 48 58	28 38 48 58	42
30	60	60 70 80 90	30 40 50 60	60	30	30 40 50 60	60 70 80 90	60	35
31	60	60 70 80 90	31 41 51 61	61	31	31 41 51 61	61 71 81 91	61	27
32	62	62 72 82 92	32 42 52 62	62	32	32 42 52 62	62 72 82 92	62	19
33	63	63 73 83 93	33 43 53 63	63	33	33 43 53 63	63 73 83 93	63	11
34	64	64 74 84 94	34 44 54 64	64	34	34 44 54 64	64 74 84 94	64	3
35	65	65 75 85 95	35 45 55 65	65	35	35 45 55 65	65 75 85 95	65	18
36	66	66 76 86 96	36 46 56 66	66	36	36 46 56 66	66 76 86 96	66	10
37	67	67 77 87 97	37 47 57 67	67	37	37 47 57 67	67 77 87 97	67	2
38	68	68 78 88 98	38 48 58 68	68	38	38 48 58 68	68 78 88 98	68	13
40	A0	A0 B0 C0 D0	70 80 90 A0	70	40 50 60 70	70	A0	70 80 90 A0	36
41	A1	A1 B1 C1 D1	71 81 91 A1	71	41 51 61 71	71	A1	71 81 91 A1	28
42	A2	A2 B2 C2 D2	72 82 92 A2	72	42 52 62 72	72	A2	72 82 92 A2	20
43	A3	A3 B3 C3 D3	73 83 93 A3	73	43 53 63 73	73	A3	73 83 93 A3	12
44	A4	A4 B4 C4 D4	74 84 94 A4	74	44 54 64 74	74	A4	74 84 94 A4	4
45	A5	A5 B5 C5 D5	75 85 95 A5	75	45 55 65 75	75	A5	75 85 95 A5	21
46	A6	A6 B6 C6 D6	76 86 96 A6	76	46 56 66 76	76	A6	76 86 96 A6	13
47	A7	A7 B7 C7 D7	77 87 97 A7	77	47 57 67 77	77	A7	77 87 97 A7	5
48	A8	A8 B8 C8 D8	78 88 98 A8	78	48 58 68 78	78	A8	78 88 98 A8	44

Once you have corrected the failing chip, install your memory board and run this memory test procedure again. Repeat the substitution of chips until the memory test runs successfully.

F

Bits and Bytes

Codes using 1s and 0s have been developed to represent all of the information that the Rainbow computer uses. Each 1 and 0 in the code is known as a bit. A bit stands for binary digit. The following terms and values have been assigned.

Term	Value
Bit	1 or 0
Byte	8 bits
K bytes	1,024 bytes (or 8,192 bits)

It takes one byte (8 bits of disk space or system memory) to store one character symbol.

A typewritten page holds about 250 words (average) or about 1,500 characters and spaces. It takes 1,500 bytes of computer memory to store that many characters. Therefore, it takes approximately

- 1,500 bytes of Rainbow memory to hold an average typewritten page.
- 64,000 bytes of Rainbow memory to hold 43 average typewritten pages.

Adding Memory

Rainbow memory upgrade kits are available to increase the memory capacity of your Rainbow memory board. Each memory upgrade kit contains the following items:

- Upgrade instructions
- 9 memory chips
- 1 chip removal tool

Additional Memory Size	Number of Chips	Upgrade Kit Order Number
64K bytes	9	PC1XX-AY
256K bytes	9	PC1XX-AZ

Maximum memory size:

64K bytes resident

\+ 768K bytes upgraded memory board (maximum)

832K bytes of maximum total memory

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