

MOSAICTM 64K RAM SELECT

OWNER'S MANUAL

ABOUT MOSAIC In March 1983, Mosaic Electronics entered its fourth year. We were the first to introduce Atari memory add-ons. A national survey performed in late 1982 varified what we already knew: That Mosaic consistently has the highest quality, and more Atari owners buy Mosaic memory than any other. The Mosaic 64K Select is the most powerful and versatile Atari add-on released to date.

THE MOSAIC 64K SELECT Your new Select memory board is so extremely versatile that we may never find all of its applications.

Most new owners will find immediate uses for the board with disk-based software such as Visicalc, Wordprocessing, OSS Basic A+, and many others. With no ROM cartridge inserted, the computer will recognize 52K of continuous memory. Atari Basic programmers will find immediate uses for the extra memory to hold displays, character sets, player missile graphics and more. Even if you fill up all 16K of "extra" memory with your data, you will still have 40K of RAM space left for your programs. Machine language programmers will find this "extra" memory to be useful for holding up to 16K of utilities and data while keeping the lower 48K for application programs.

Of course, Atari 800 owners may plug-in up to three 64K boards for a total of 144K of "extra" space and 48K of "normal" space. That's 196,608 bytes of RAM! WOW!

THE SELECT MEMBERS CLUB Do you want more applications? Those who join the Mosaic Select Members Club will receive a monthly newsletter spelling out new applications found by Mosaic users around the country. Also, Select members will have access to a growing library of application software.

If you've ever had to wait for your program to reload after typing "DOS," you will be pleased to hear of the program named "Handyman." This software package allows you to get disk Directories, Lock and Unlock, Rename, Format, save blocks of memory, convert DEC and HEX, and much more.

Another software package (SuperDrive) allows you to use bank select memory like a disk drive. Loads and saves go twenty times faster. Atari 800 owners may use up to 144K to hold their program files.

THE MOSAIC 64K RAM SELECT FEATURES

1. No solder installation
2. Powerful; most memory available.
3. No chip sockets for better reliability.
4. Versatile; multiple memory configurations.
5. Compatible with 8K and 16K ROM cartridges.
6. Low power design. Less power and heat than Atari 16K RAM.
7. Can run Atari 1200 software.
8. Test cycled 24 hours to insure reliability.
9. Larger work space for disc software (i.e., Visicalc, Word Processor, etc.)
10. Four year warranty.
11. Allows 400 owners to run disc drives more effectively.
12. Very low cost per byte.
13. Allows more powerful graphic manipulations.
14. Complete users guide.
15. Membership in the "Select" club available.
16. Disc emulation software available for super fast loads and saves.
17. Tool kit software available; never type DOS again (format, directory, and much more).
18. All Mosaic 64K utilities maintain 48K RAM for program space.
19. Allows for up to 192K RAM in Atari 800.
20. Compatible with Mosaic 32K and Atari 16K RAMS.

TABLE OF CONTENTS

About Mosaic Electronics	i
The Mosaic 64K Select	ii
Introduction.	4
400 Installation.	4
800 Installation.	12
Memory Maps.	12
Memory Configurations	14
Board Straps.	16
Peripheral Board	26
Test of Operation	29
What is Bank Select Memory?	31
How to Select Banks	32
Simulating the Atari 1200.	35
Applications for Bank Select Memory	35
Select Members Club	36
Trouble Shooting Guide	37
Guarantee	38

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Atari, 400, 800, 1200 are trademarks of Atari, Inc.

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Visicalc is a trademark of Visicorp, Inc.

Microsoft is a trademark of Microsoft, Inc.

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INTRODUCTION

For normal operations, the 64K Select installs without soldering in both the Atari 400 and 800.

Atari 800 owners may need to solder two wires, depending on the application. The first wire must be soldered if you will be using a Slot 3 peripheral board, such as an 80-column board. The second wire is required if you plan to simulate the Atari 1200. Everything else just plugs in.

When you buy your first 64K Select, be sure to get the 64K Cable Kit #1 (H311). Atari 800 owners who get additional 64K boards must get a 64K Cable Kit #2 (H312) for each additional board.

Atari 800 owners who have three 16K boards will be interested in getting the Mosaic Adapter. This allows you to condense the memory from two Atari 16K boards into one 32K board. Using the Adapter together with the 64K Select and a 16K Atari board will give you 112K total! The adapter is identical to the Mosaic 32K RAM when upgraded.

For more information on this and other Mosaic products, see your Mosaic dealer or call (800) 547-2807.

Also note that details of Select Club membership begin on page 36.

400 Installation - Introduction

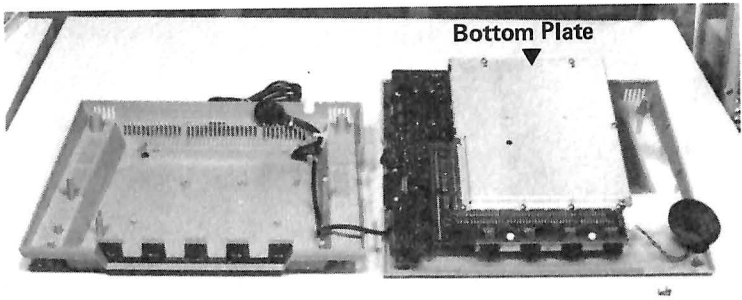
Installation of the 64K Select into the Atari 400 is accomplished in five basic steps:

1. Disassemble.
2. Set straps (configure)
3. Plug in cables
4. Plug in board
5. Reassemble.

The detailed instructions for each of the above steps follows:

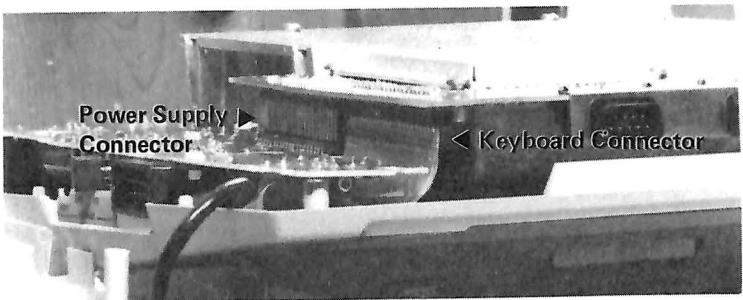
400 Disassembly

1. Unplug all cables and any ROM cartridges from the computer. Close the cartridge door and flip the computer upside down.
2. Remove the four corner screws.
3. Gently lift the bottom case and open to the left as shown in Fig. 1.



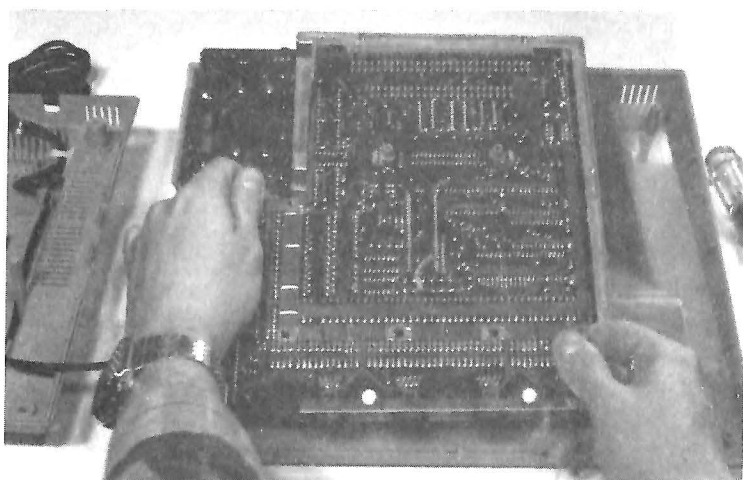
(Fig. 1)

4. Note the placement of the black TV cable for reassembly.
5. Note the placement of the keyboard speaker. Unplug and remove at this time.
6. Remove eight screws that hold the bottom plate on.
7. Remove plate and black paper. Note orientation for reassembly.
8. Note the keyboard connector and the power board connector.



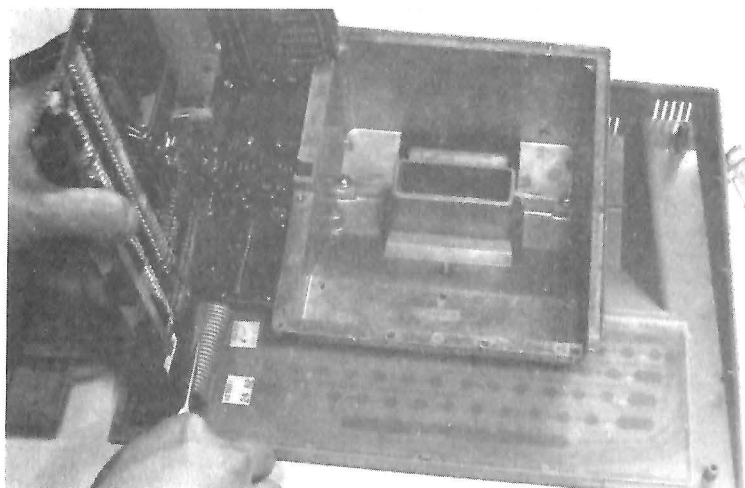
(Fig. 2)

9. Lift the mother board as shown. Apply pressure so as to unplug the power board connector simultaneously.



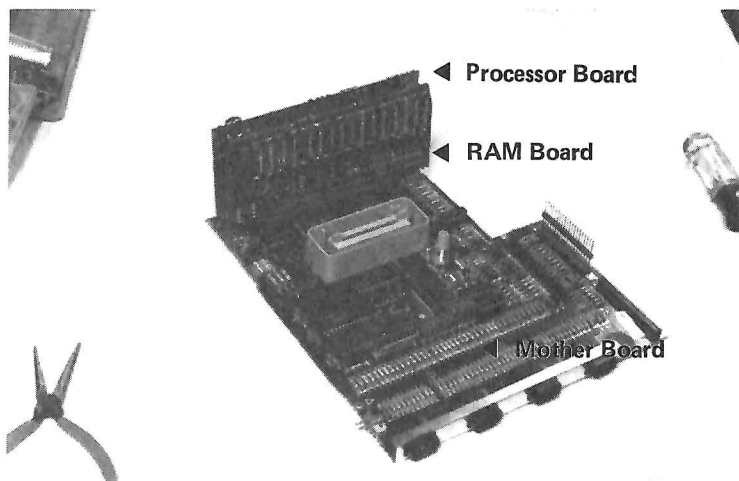
(Fig. 3)

10. Unplug keyboard cable. All pins should unseat simultaneously.



(Fig. 4)

11. Set the mother board down. Note the placement of the processor board and the RAM board.



(Fig. 5)




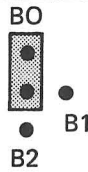
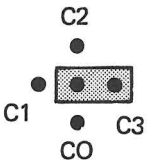
12. Remove both boards. The disassembly is now complete!

NOTE: Your old 16K board may be used in an Atari 800. Also the chips may be used in the Mosaic Expander™ and Adapter™ products which may be of interest to Atari 800 owners.

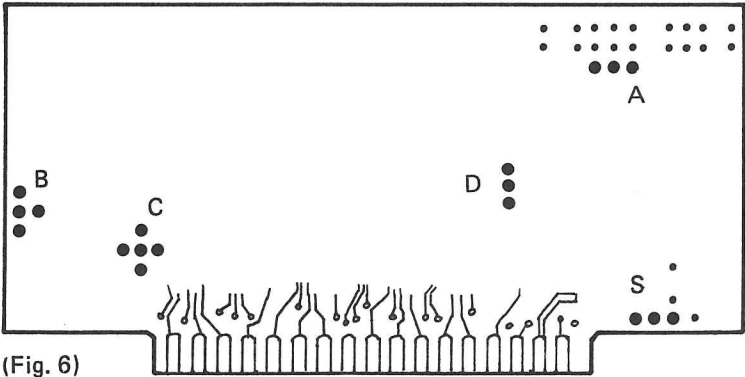
400 Set Straps

Strap is a shortened form of the words "jumper strap." Straps are the little black squares on the board that connect the proper square pin posts.

See page 16 for detailed strap explanations.

STRAP SETTING LOCATION		STRAP NAME	EXPLANATION
	A	STRAP 1	ATARI 400/800 MEMORY MAP
	D	STRAP 2	
	S	S- STRAP	SLOT 1
	B	B-STRAP	BOARD O
	C	C-STRAP	48K + 4 CONFIGURATION

64K RAM SELECT

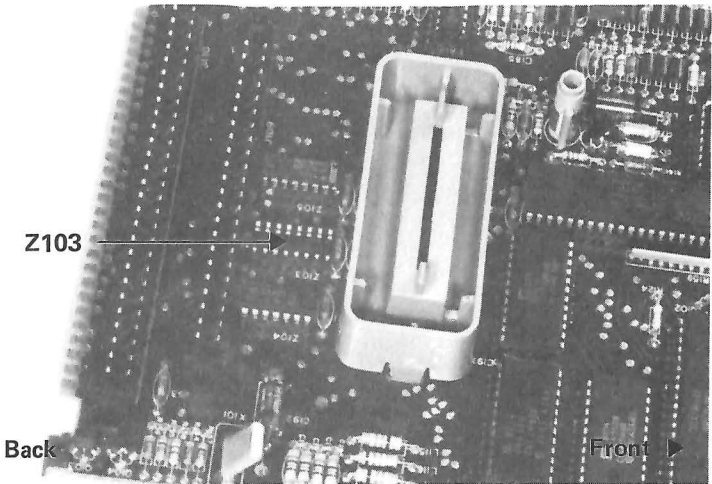


(Fig. 6)

400 Cables

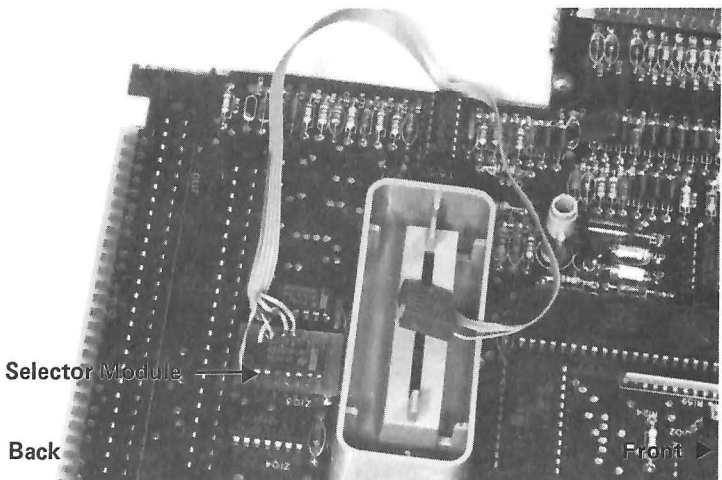
Install Selector Cable

1. Locate IC Z103 and remove as shown. Note that the black IC socket should remain in place.



(Fig. 7)

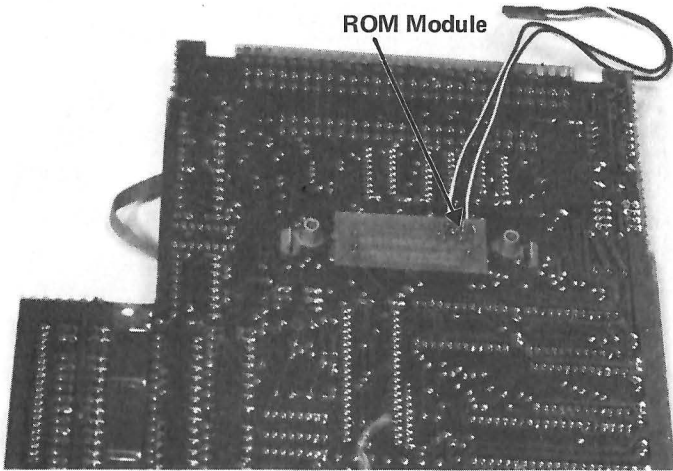
2. Install Selector module so that the red dot points towards the Joystick ports. Be sure all pins line up properly; then gently apply pressure until pins are fully seated.



(Fig. 8)

Install ROM Cable

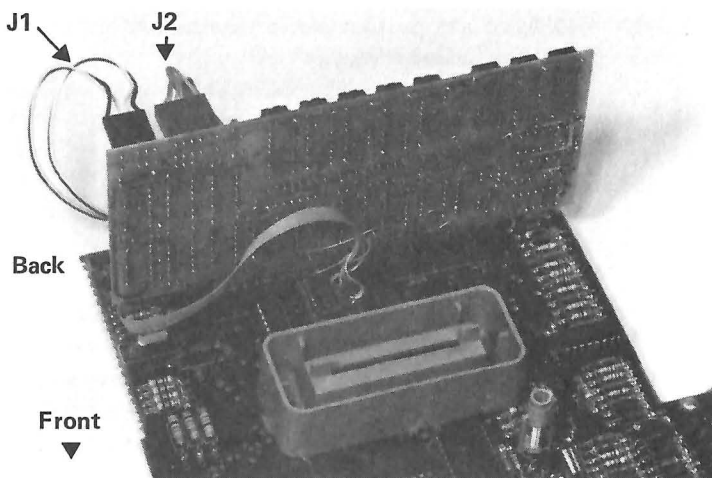
1. Turn mother board upside down.
2. Place ROM cable module so that the wires point to the back of the computer and the 30 holes line up with the ROM cartridge slot.
3. Press until fully seated.



(Fig. 9)

Insert RAM Board

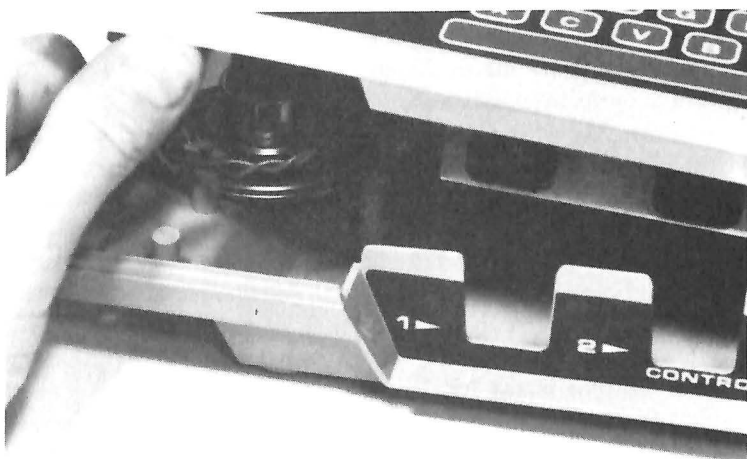
1. Turn mother board upright.
2. Install processor board. Component side must point towards back of computer.
3. Install 64K Select where old RAM board was, component side towards back.
4. Connect ROM cable to J1 on RAM board. Either row of pins will work.
5. Connect Selector cable to J2, either row of pins.



(Fig. 10)

Reassemble

1. Connect keyboard cable. (See Fig. 4)
2. Gently place mother board back into top housing.
3. (See Fig. 2) Be sure power board pins line up properly. Press until fully seated.
4. Replace black paper and bottom plate.
5. Replace eight screws.
6. Replace bottom cover. Watch black TV cable.
7. Gently turn computer upright. Position speaker between pins as shown. Plug in speaker cable.



(Fig. 11)

8. Hold top and bottom pieces together. Adjust anything that may be out of place.
9. Turn computer upside down and replace 4 corner screws. Your computer is ready to test!

Turn to page 29.

800 Installation

Introduction As you probably already know, the Mosaic 64K Select is extremely versatile. Read the following pages concerning the Atari memory maps and the valid memory configurations. As you read, consider the things you plan to do with your software. This should be done before you actually install the board.

Memory Maps

The Mosaic 64K Select may be configured to simulate the Atari 1200. Figures 20A - 20E tell the story. An Atari 800 with 48K RAM has a memory map that looks like Figure 20A. The 10K OS is at the top, 48K RAM is at the bottom, and 4K of unused space is in the middle.

When power is turned on the Atari 1200, its memory looks like Figure 20B. The only difference is that the previous 4K unused space is now filled with 4K ROM.

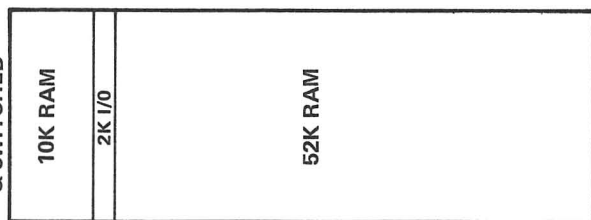
Figure 20C describes the memory map of the Mosaic 64K Select. When the 1200/800 straps are set to 800, the 4K of unused space is filled with 4K RAM banks. Up to 144K of RAM is put in this area when three 64Ks are used together. If the 1200/800 straps are set to 1200, the unused space is filled with only one 4K RAM bank. It is not possible to switch this bank. The extra 4K of OS needed to perfectly simulate the 1200 may be loaded into this area.

When you write to a special memory location, the Atari 1200 effectively erases the OS space and fills it with RAM (see Fig. 20D). When the 1200/800 straps are set to 1200 the Mosaic 64K Select will copy this same function exactly.

Please note that the OS is totally unusable in this configuration. All normal functions will stop. All interrupt handlers will disappear, even the keyboard will not function. Also note that only one 64K board may be used when simulating the Atari 1200. The only conceivable reason for simulating the Atari 1200 is to run Atari 1200 software that will not run on the Atari 800 normally. It is very doubtful whether or not any useful Atari 1200 software will be released. On the other hand, it is nice to know that you will be ready for such software if it is ever made available.

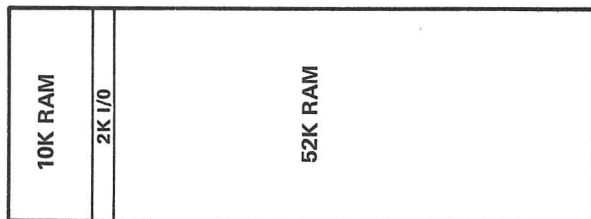
MEMORY MAPS

ATARI 800 W/64K
1200 STRAPPED
& SWITCHED



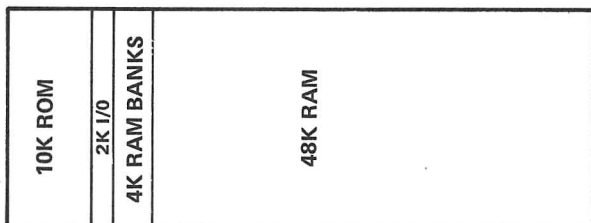
62K
FIG. 20E

ATARI 1200
SWITCHED



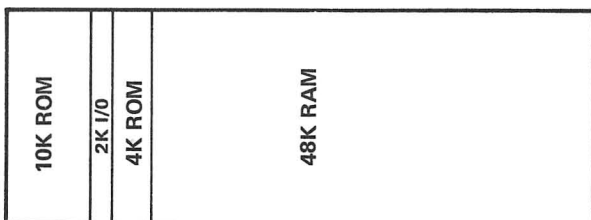
62K
FIG. 20D

ATARI 400/800
W/ 64K SELECT



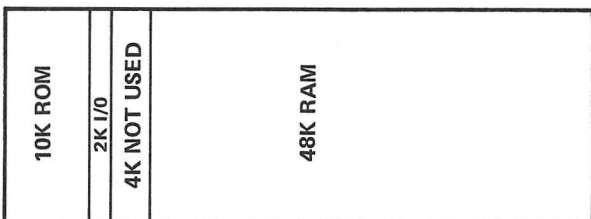
64K
FIG. 20C

ATARI 1200
NON-SWITCHED



48K
FIG. 20B

ATARI 800
W/ 48K



48K
FIG. 20A

Memory Configurations

The internal data bus drivers inside the Atari 800 automatically turn on whenever an address above \$BFFF (49151) is used. A signal line called "Exsel" may be used to turn off the bus drivers. This is how the Mosaic 64K Select makes the OS disappear while simulating the Atari 1200. The Exsel line must also be used to put the extra 4K RAM in the unused space. The Exsel line is only available to RAM Slot 3. It is important to keep this in mind as you read about the valid memory configurations.

800 INSTALLATION MEMORY CONFIGURATIONS

TOTAL RAM	MEMORY CONFIGURATION	LEGAL BANK #S	TOTAL 4K BANKS	B-STRAP	C-STRAP	800/1200 STRAPS	S-STRAP
1 64K	PERIPHERAL	0 - 3	4			ALL 800/1200 STRAPS SET TO '800' ON ALL MEMORY CONFIGURATIONS	
	EMPTY						
	64K			B0	C3		S1,2
2 64K	64K	0 - 3	4	B0	C3		S3
	EMPTY						
	EMPTY						
3 96K	PERIPHERAL	\$0 - \$B (0 - 11)	12				
	32K						
	64K			B0	C1		S1,2
4 96K	64K	\$0 - \$B (0 - 11)	12	B0	C2		S3
	COMPANION						
	32K						
5 96K	64K	\$0 - \$B (0 - 11)	12	B0	C2		S3
	16K						
	16K						
6 112K	64K	\$0 - \$F (0 - 15)	16	B0	C0		S3
	16K						
	32K						
7 128K	PERIPHERAL	\$0 - \$13 (0 - 19)	20				
	64K			B0	C0		S1,2
	64K			B1	C3		S1,2
8 128K	64K	\$0 - \$13 (0 - 19)	20	B0	C0		S3
	EMPTY						
	64K			B1	C3		S1,2
9 160K	64K	\$0 - \$1B (0 - 27)	28	B0	C0		S3
	32K						
	64K			B1	C1		S1,2
10 192K	64K	\$0 - \$23 (0 - 35)	36	B0	C0		S3
	64K			B1	C0		S1,2
	64K			B2	C3		

Memory Configurations

Before determining which memory configurations you want to use, take an inventory of the available circuit boards you have at hand. A peripheral board is any non-memory board that may be plugged into the Atari 800. Most peripheral boards must be plugged into RAM Slot 3. Therefore, if you will be using a peripheral board, plan on using configurations 1, 3, or 7.

If you plan to simulate the Atari 1200, use configuration 2. If you have a Mosaic 32K RAM, plan on using configurations 3, 4, 6, or 9. Since other 32K boards are not totally bus compatible, **you must not use non-Mosaic 32K boards with the 64K Select.** Damage may result.

If you have a 16K RAM, use configuration 6. If you have two 16K RAMs, use configuration 5.

If you are fortunate enough to get three Mosaic 64Ks, use configuration 10.

To the right of each memory configuration is a chart showing the valid bank numbers, the total number of 4K banks, and the strap options to be set.

Strap Options

There are five straps on the board. See page 7 for a physical description of the straps. To change a strap, pull it straight up off of its pins, orient it over top the appropriate pins and press it straight on.

Two straps are labeled 1200/800. Unless you will be simulating the Atari 1200, set these to the 800 position.

The B-strap specifies how many 64K boards are plugged into the computer. The 64K board nearest the back of the computer should be set at B0. The 64K board 2nd nearest the back should be set at B1. When three 64Ks are used, the one nearest the front should be set at B2.

The C-strap specifies how the board itself will be configured and how it will fit into the memory map.

Be sure the C-strap is set according to the memory configuration chart.

Select C3 when simulating the Atari 1200.

The S-strap specifies which memory slot the 64K will be plugged into. Use S1,2 for slots 1 and 2. Use S3 for slot 3. This strap enables the Exsel signal.

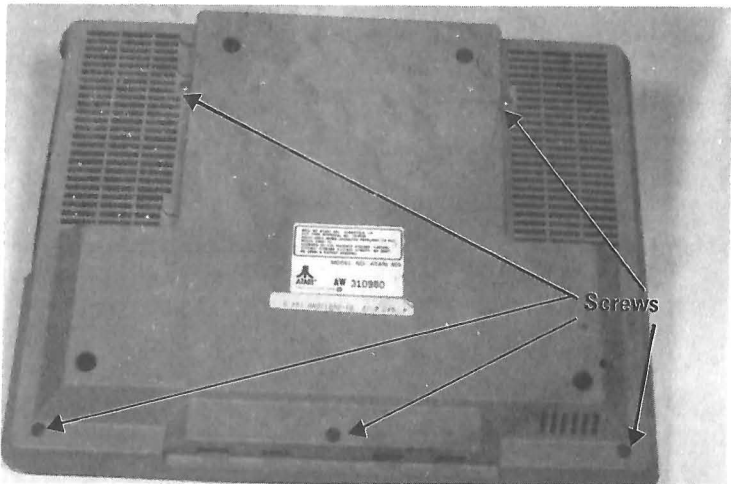
Pre-Disassembly

There are two cables that must be installed in order to gain

access to Atari's entire memory map. Please carefully follow the instructions to come. One wire may require soldering if you plan to simulate the Atari 1200.

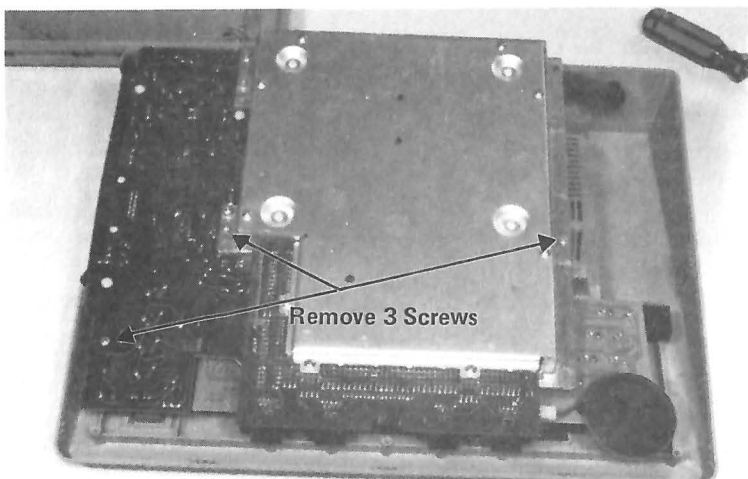
800 Disassembly

1. Unplug all cables and ROM cartridges.
2. Remove cartridge door assembly.
3. Remove 10K OS cartridge and all RAM boards.
4. Turn upside down and remove 5 screws.



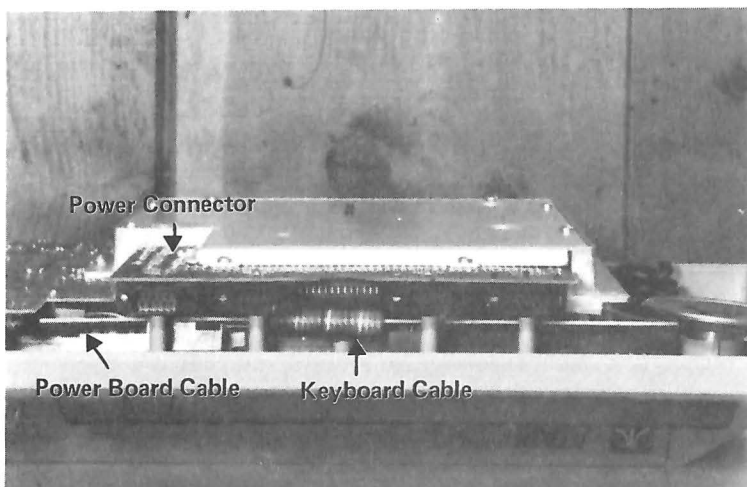
(Fig. 31)

5. Lift back end up; then lift entire bottom cover toward you. Use the bottom cover to hold screws.
6. Remove 3 screws.

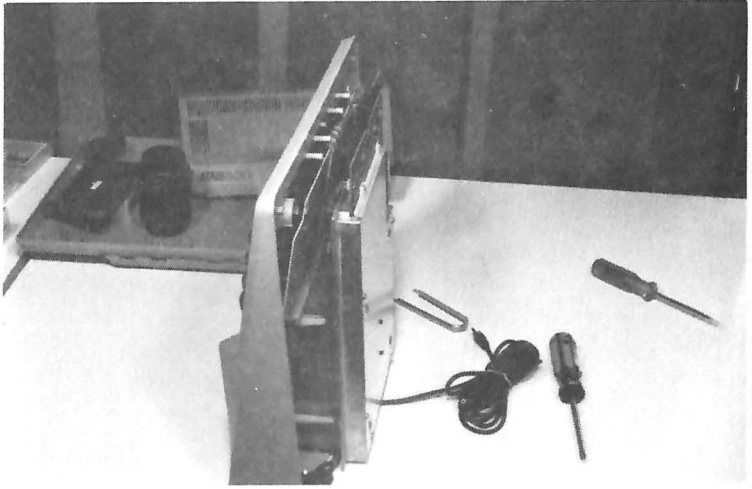


(Fig. 32)

7. Lift front edge of module assembly one inch, unplug speaker, keyboard, and power supply cable. This can best be accomplished by setting the computer on its back end.

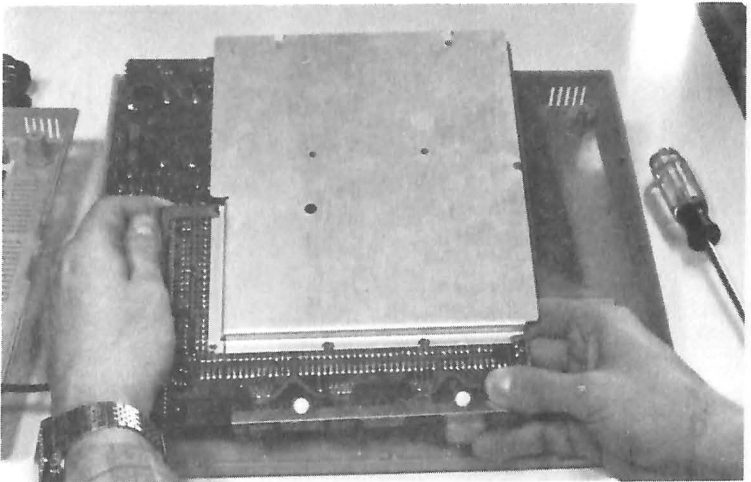


(Fig. 33A)



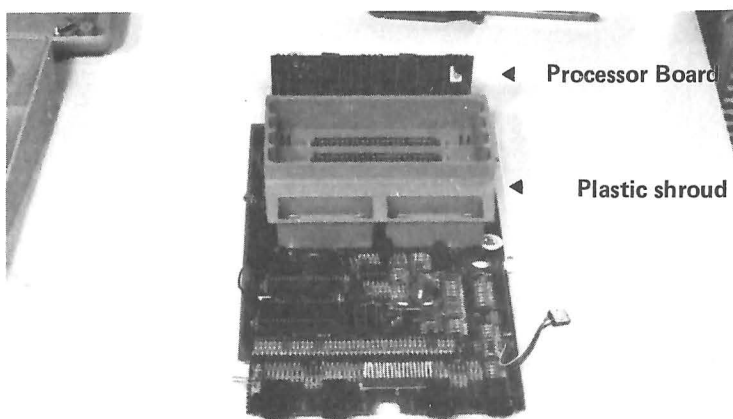
(Fig. 33B)

8. Remove 9 screws from metal shield.
9. Lift mother board assembly while unplugging power board connector.



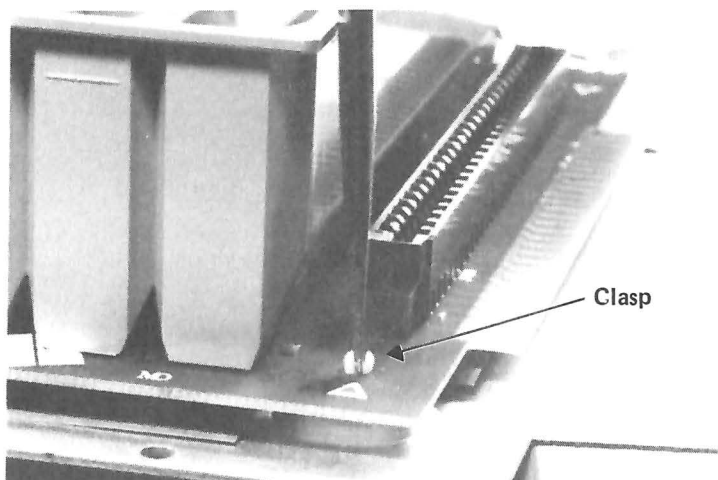
(Fig. 34)

10. Turn mother board assembly upright.



(Fig. 35)

11. Remove processor board. Be sure to note its orientation for reassembly.
12. Use flat blade screwdriver to remove four white clasps that hold together metal shield and mother board.



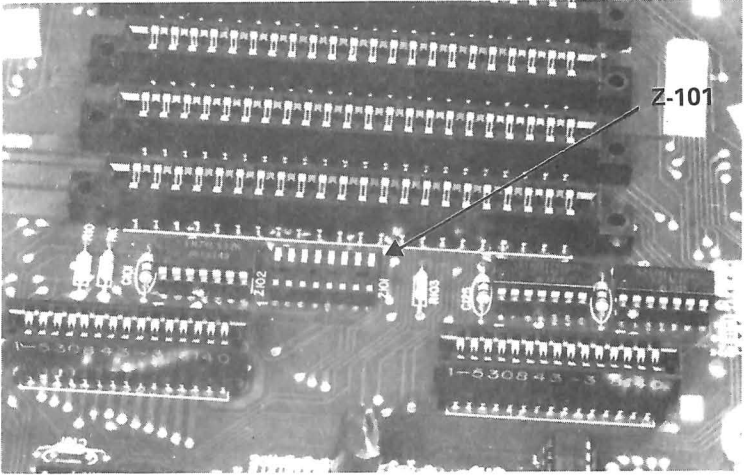
(Fig. 36)

13. Remove metal shield.
14. Carefully unhook plastic cartridge shroud from mother board.

800 Cables

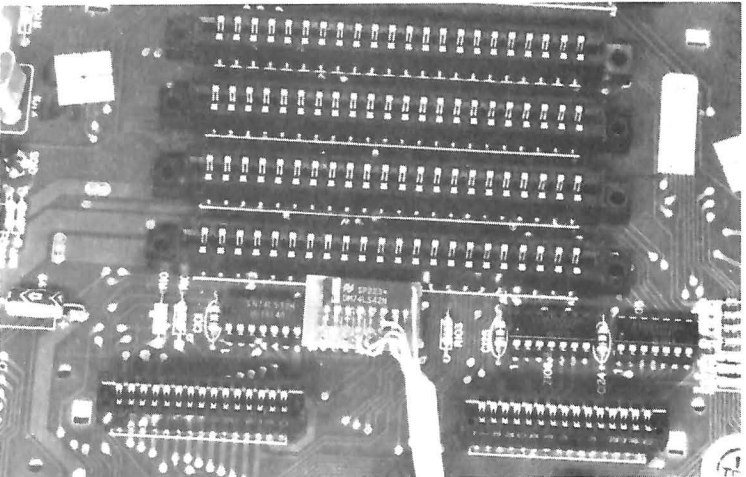
Install Selector Module

1. Locate IC Z101 and remove as shown. Note that the black IC socket should remain in place.



(Fig. 37)

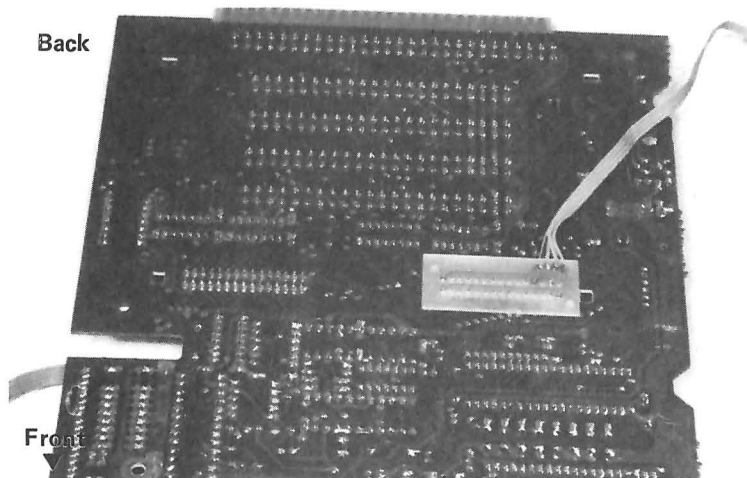
2. Install selector module in its place so that the red dot points toward the left. Take care not to bend any pins.



(Fig. 38)

Install ROM module

1. Turn mother board upside down.
2. Orient the ROM module over top the pins of the left ROM cartridge slot. (On the right as seem from the bottom).



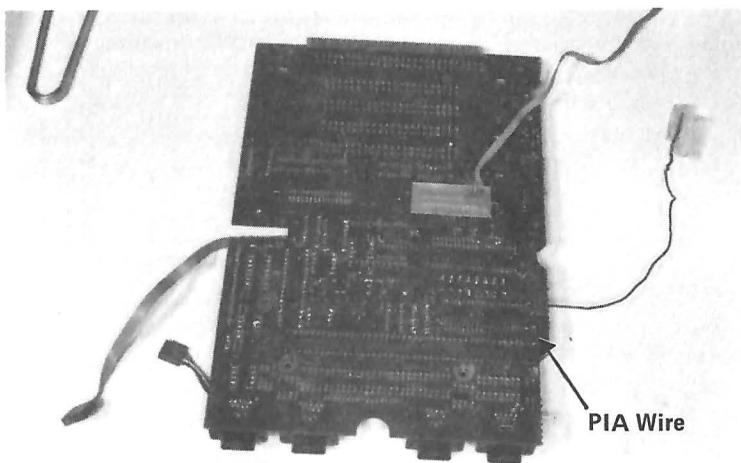
(Fig. 39)

3. Be sure all 30 holes line up and cables point to rear of computer.
4. Firmly press module into place until completely seated.

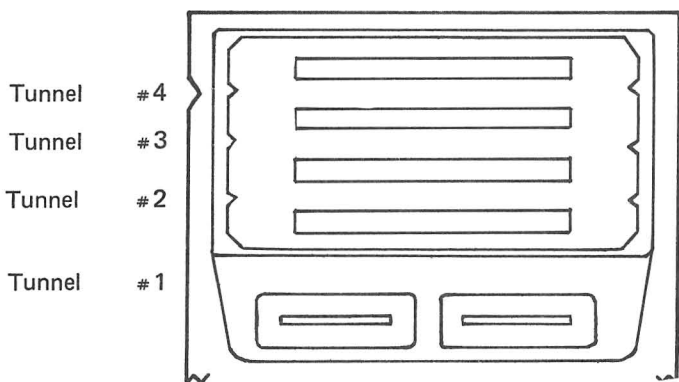
C. Install PIA Wire (Optional)

If you ever plan to simulate the Atari 1200, you should install the PIA wire at this time.

1. Locate Pin 10 of A102 (6520 PIA)
2. Solder stripped end of PIA wire to Pin 10.



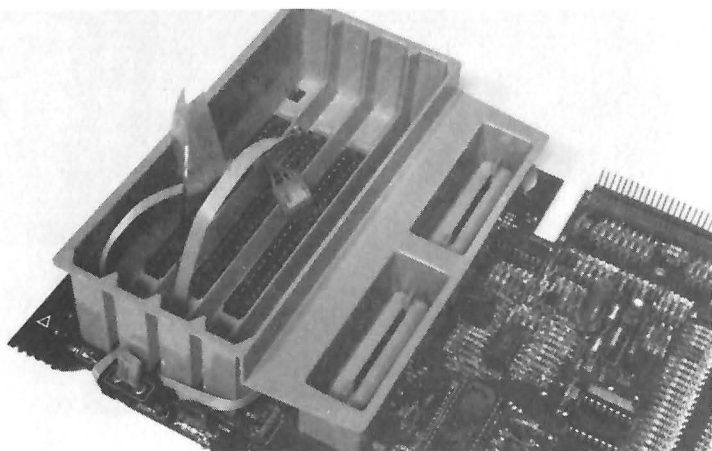
(Fig. 40 A & B)



Route Wires through Plastic Shroud

The cables must be fed through tunnels formed by the plastic shroud against the mother board.

1. Lightly fit plastic shroud on mother board to inspect the tunnels.
2. Feed ROM cable through Tunnel #4.



(Fig. 42)

3. Also feed PIA wire through Tunnel #4.
4. Feed selector cable back through Tunnel #1 and into Tunnel #3.
5. Carefully snap shroud into place. Be sure that no cables are pinched against mother board.
6. Tape the ends of the wires to the inside of the plastic shroud so that no wires will be pinched during re-assembly.

Reassembly of 800

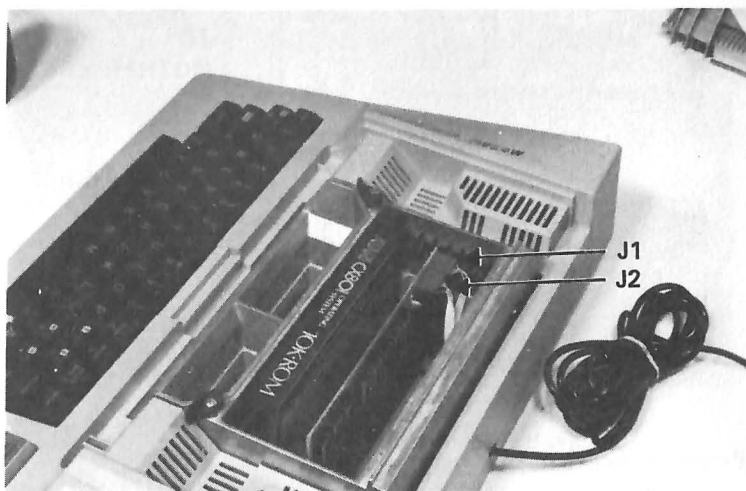
To reassemble, first remember to replace the processor board. Be sure the component side faces the rear of the computer. The blank side must face the joystick ports! Then follow the disassembly instructions in reverse order until you reach the ROM cartridge door assembly. Do it now.

After Reassembly

First plug in the 10K OS cartridge. Then plug in your RAM boards according to the memory configuration you have selected from the chart on page 15. Set the straps accordingly. **BE SURE THAT THE COMPONENT SIDE FACES THE BACK OF THE COMPUTER!!**

Hook up Cables to First 64K Board

1. Connect the 4-wire ROM cable to either row of straight pins of J1 on the 64K board nearest the rear of the computer. Note that the connector only plugs on one way.



(Fig. 45)

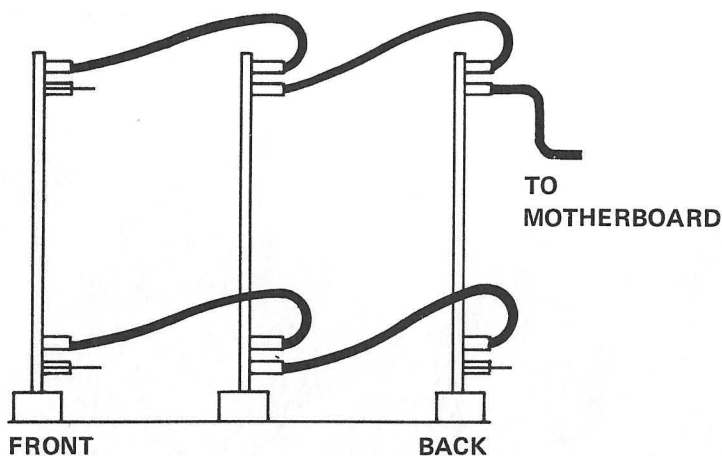
2. Connect the 5-wire selector cable to either row of pins of J2 on the same 64K board. Note connector orientation again.

3. If you have soldered in the PIA wire, connect it to the PIA pin. When the 1200/800 straps are set to 800, the 64K board will automatically ignore the PIA signal.

Hook up Cables to Next 64K Board

1. For each additional 64K board, you need one 64K cable kit #2 (H312). With the cables enclosed in Kit H312, connect the 64K boards together in daisy chain fashion. The 4-wire cables connect to J1. The 5-wire cables connect to J2. The Exsel wire connects to one of the pins marked "Exsel." Use the Exsel wire that does not have a stripped end.

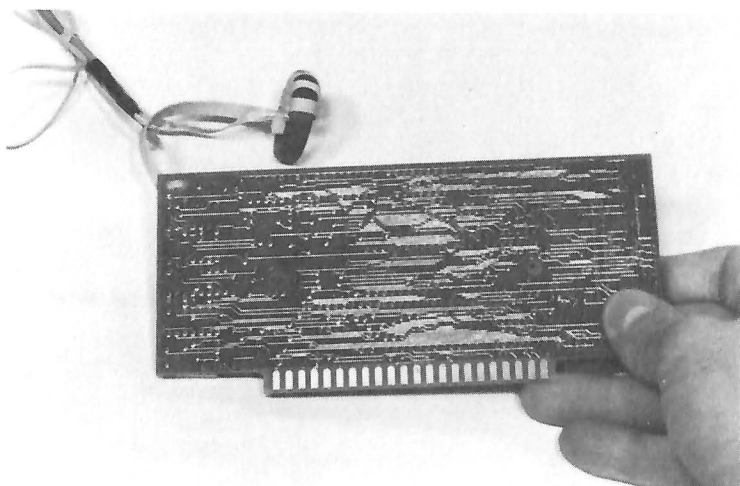
DAISY CHAIN CABLES ON 64K BOARDS



Peripheral Board

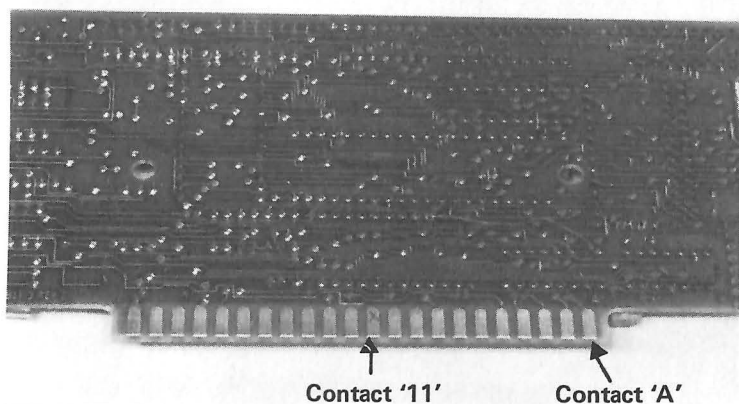
If you will be using a slot 3 peripheral board, there is one more wire to connect. Since the peripheral board will be sitting in Slot 3, it must provide access to the "Exsel" signal line.

Pick up your peripheral board. Hold it so that the component side is pointing away from you. You should be looking at the blank side with the edge connector pointed down.



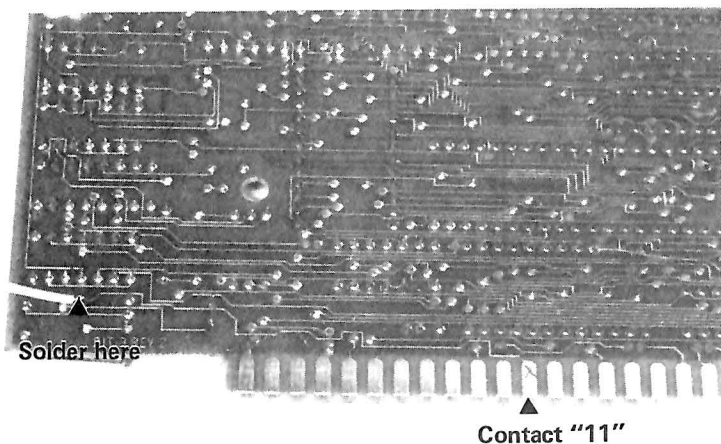
(Fig. 50)

Find the edge connector contact on the farthest right. It may be labeled "A". Starting with the "A" contact, count to the left to the 11th contact. Mark it with a pencil, not an ink pen.



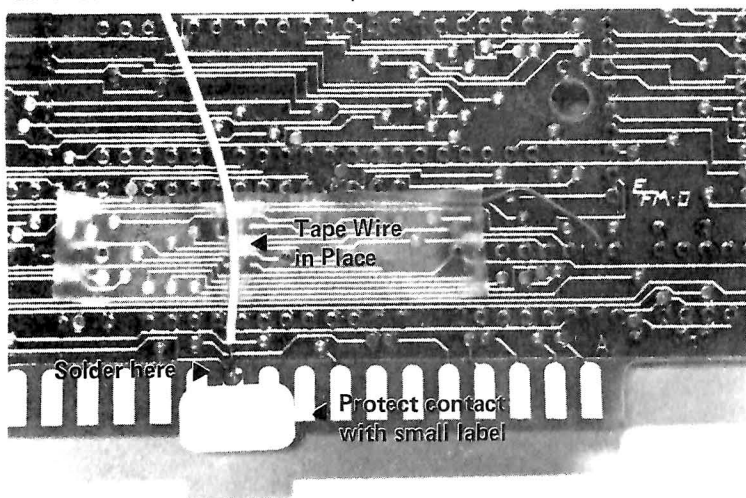
(Fig. 51)

If there is a signal trace connected to this contact, you are in luck. Follow the trace until you find a drilled-through hole. It may be filled with solder and it may have a component lead in it. Solder the stripped end of the Exsel wire into this drilled-through hole.



(Fig. 52)

If no signal trace exists, solder the wire directly to the contact. Cover as little of the contact as possible.



(Fig. 53)

Plug the other end of the Exsel wire to the nearest 64K board on one of the pins marked Exsel.

Finish

When all cables are hooked up and all boards are in place (with the blank sides towards keyboard), put the ROM cartridge door assembly back in place.

Test of Operation

When initially testing the Mosaic 64K Select, it is important to unhook the Atari Daisy Chain cable. Disk drives and other peripherals may use memory and return invalid results.

After inserting the Atari BASIC cartridge and turning the power on, watch for the BASIC "ready" prompt. If the Ready prompt does not appear within two seconds, or if the screen is black, **immediately** turn off the computer and refer to the trouble-shooting guide. Refer to the trouble-shooting guide in the event of any unusual occurrences now or in the future.

1. Turn the power on.
2. When "ready" prompt appears, type: PRINT FRE(0)
(hit return)
3. The computer should respond with: 37902

This indicates proper operation of the bottom 40K of memory and the disable circuitry. When BASIC is inserted, the Atari computer automatically disables 8K of RAM starting at the 40K boundry. Since the Operating System uses about 2K, the computer can only see about 38K available for program space.

To test the 4K of RAM above the BASIC cartridge, type

POKE 106,208 (Hit return)

GR. 0 (Return)

PRINT FRE(0) (Return)

The computer should respond with: 50190

This test modifies a special location called RAMTOP in the computer which tells the computer where the top of memory is. The result of typing these statements is that the display list that generates the screen display has been moved to the 4K bank switched RAM area above the BASIC cartridge. The display list is constantly being read by the computer and is very sensitive to any RAM errors. Thus, the RAM area above the BASIC cartridge is now being checked continuously. If any garbage appears on the screen, or the display does not look normal, refer to the trouble-shooting guide.

Since BASIC occupies 8K of this space, 50190 is not a true indication of the amount of program space available. If you will be writing large 40K programs, you must type the following statements to find the true free program space.

POKE 742,159

POKE 741,255

PRINT FRE(0)

The computer should respond with: 38754

38894

Test

This is the biggest program space that is possible with the Atari BASIC cartridge. The above poke statements need only be typed once. As long as you don't press reset, you can find free memory by simply typing "PRINT FRE(0)."

There are other tricks that can be used to maintain maximum program space. These can be learned by ordering some of the excellent technical manuals at Atari.

To check the bank switching circuitry, first press "reset." Then type the following program:

MOSAIC 64K SELECT DEMO

```
10 POKE 106,208:REM .      SET RAMTOP
20 BNKBAS=65472
98 REM
99 REM .                  STEP THRU BANKS
100 FOR BANK=0 TO 3
110 POKE BNKBAS+BANK,0
120 GOSUB 1000
130 NEXT BANK
198 REM
199 REM .                  FLIP BANKS
200 FOR BANK=0 TO 3
210 POKE BNKBAS+BANK,0
220 FOR DELAY=1 TO 20:NEXT DELAY
230 NEXT BANK
240 GOTO 200
998 REM
999 REM .                  SET-UP DISPLAYS
1000 GRAPHICS 0
1010 FOR LINE=BANK TO 22 STEP 4
1020 POSITION 2,LINE
1030 PRINT "This is Bank ";BANK
1040 NEXT LINE
1050 RETURN
```

If your board is strapped for Atari 1200 simulation, this program will not work. Program Description (64K Select Demo)

- Line 10: Changes RAMTOP pointer to 52K (208-¼K pages). When you perform any Graphics command, the computer will use RAMTOP to determine the last location of memory.
- Line 20: Locations 65472 to 65535 are used to select which bank of memory is to be accessed.

Lines 100-130: This program subroutine is used to select each bank sequentially so that four separate displays can be set up. Line 110 actually does the bank selection.

Lines 200-240: This program subroutine is used to switch from one display to the next, so that an impression of one constantly changing display is given.

Lines 1000-1050: This program subroutine sets up the displays.

Type "list" and verify that you typed the program exactly right. Then type "RUN" (Return). The program will instantly flash four separate displays on the screen. Then it will appear as if text information is scrolling downward. This is just an illusion.

A separate display has been set up on four separate banks of memory. The computer is actually flipping from one bank to the next very quickly. Nothing is moving at all.

To slow down the simulated animation, first press "BREAK" to stop the program, then type:

220 FOR DELAY=1 to 200:NEXT DELAY (return). Type "RUN" (return). The bank numbers can now easily be read.

Animation is just one of the many applications for bank select memory.

WHAT IS BANK SELECT MEMORY

NOTE: Refer to Fig. 20A and 20 C.

A bank select memory system allows the use of more memory than can be directly addressed by the computer system. In the Atari computer, 16K of the directly addressable memory space is reserved for the Operating System ROM and hardware registers. This leaves 48K available for ROM cartridges and user RAM. However, all Atari 400/800 computers to date have only USED 12K of this reserved space. By installing RAM in this extra 4K of unused space, 52K of addressable space is available to the user. The 64K Select memory board uses this extra 4K area as one of many possible RAM banks. Since one of these banks is always active, the user always has 52K of contiguous, directly addressable, RAM available. By selection of the other banks from a program, the entire 64K memory space of the 64K RAM chips is available and can be utilized.

The following is a simple example of how the bank select memory works: The Mosaic 64K RAM Select uses separate banks of memory. You can picture each bank as a separate post office in a separate city; for example, a post office in New York, a post office in Los Angeles, a post office in Portland, and a post office in Chicago. Each post office has a set of post office boxes that use the

same numbers. If each post office had 500 boxes, each of the boxes would be numbered from one to five hundred. For any given box there are three others that use the same box number.

Bank select memory works the same way. Each bank shares the same memory addresses with any other memory bank. To access any one of the post office boxes in the four cities, you must know more than the box number. You must also know the ZIP code of the post office. Bank select memory works exactly the same way. In order to access any one of the memory cells, in addition to the address (box number) of that location, you must also give the bank number (ZIP code).

Once you have reached the city of the post office that has the boxes that you are interested in, it is no longer necessary to use the ZIP code. You can just walk around the post office, going from box to box. Bank select memory works exactly the same way. As long as you are accessing memory locations in the same bank, you only have to give that bank number once. After you have given the bank number, you can address the memory just like normal memory. Only when you switch from one bank to the next is it necessary to give a new bank number.

Bank numbers can be given with a simple "POKE" statement. You must only be concerned with understanding bank selection and memory addressing if you are writing your own software. Most programs available through either the Mosaic Select Members Club or other sources, will perform the memory addressing for you.

When using protected software, the Mosaic 64K Select can be used as a 52K RAM board. This will give you up to 30% more workspace with Word Processors.

To perform bank selection in your own program, use the following techniques.

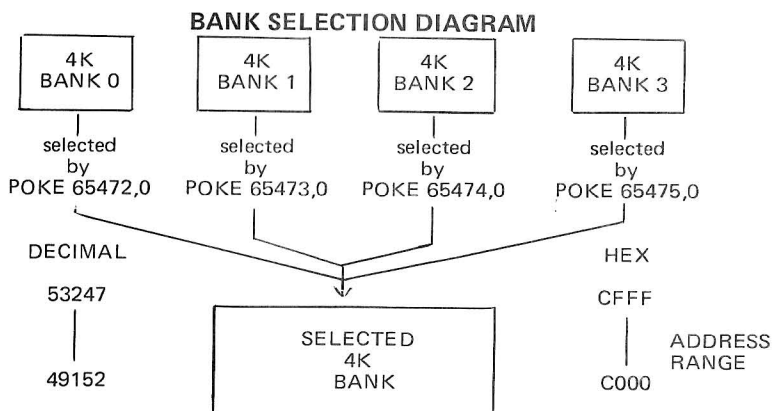
How to Select Banks

The 4K RAM banks are denoted as BANK0, BANK1, BANK2, ...etc. The selection of which bank of RAM is active is accomplished by writing to location BNKBAS+BANK# (BNKBAS=65472, \$FFCO). Note that the least significant bits of your address determine which bank you will access. Therefore, it does not matter "what" data is written, but "where" the data is written.

For example, the following statements will select each of the RAM banks:

BASIC	ASSEMBLY	BANK SELECTED
POKE 65472,0	LDX #0 STA BNKBAS,X	BANK 0
POKE 65473,0	LDX #1 STA BNKBAS,X	BANK 1
POKE 65474,0	LDX #2 STA BNKBAS,X	BANK 2
POKE 65475,0	LDX #3 STA BNKBAS,X	BANK 3

Since locations above 55296 are guaranteed to be OS ROM, no software can possibly interfere with your bank selection addresses. Also note that PEEKing at these locations will not return your bank number, but the original value from ROM.



Simulating the Atari 1200

Atari 800 owners can use the Mosaic 64K Select to simulate the Atari 1200. To simulate the Atari 1200, use memory configuration #2 on Page 15. Strap the board to the following specifications.

1200/800 Straps	in 1200 position
S-Strap	in S3 position
B-Strap	doesn't matter (no bank selection is possible)
C-Strap	in C3 position

On power-up, your memory map will appear as Figure 20C on Page 13. The extra 4K of OS must be loaded from disk or cassette. Select Club members will have access to this software as soon as it is available. When? Who knows. In the meantime, you will have to develop it yourself.

Limitations

The most obvious difference between the 1200 and 800 is the keyboard. 800 owners will not have access to help key functions. Since some 1200 ROM cartridges may not allow you to boot from disk, some 1200 cartridges may not work. However, any software that takes advantage of the memory map shown in Figure 20 D & E, will run exactly the same on the Atari 1200 & 800 (subject to limitations of the keyboard).

At the time of this writing no Atari 1200 Software has been announced. It is doubtful whether more than a few business packages will ever be released.

Simulating the 1200

Switching out the operating system to access 62K of RAM is very easy, use the following technique.

```
LDA PBCTL ($D303)      ; Select data direction register
AND #$FD
STA PBCTL
```

```
LDX #01                ; Set PBO for output
STX PORTB ($D301)
```

```
ORA #$02               ; Select I/O register
STA PBCTL
```

```
LDX #$00               ; Erase OS by
STX PORTB              ; Setting PBO low
```

Recall the operating system with:

```
LDA PBCTL              ; Select I/O Register
ORA #$02
STA PBCTL
```

```
LDX #$01               ; Enable OS by
STX PORTB              ; Setting PBO HI
```

It is possible to switch out the OS through BASIC instead of machine language. However, when the operating system disappears, BASIC will crash and your computer will be totally useless until power is turned off & then back on again.

Simulating the 1200

It is important to understand that when the Operating System disappears all normal functions will stop. Even the keyboard will be useless. When using the 62K configuration (in the Atari 1200 or 800) you must supply your own OS. Period.

APPLICATIONS

Canned Software

With commercial software, your Mosaic 64K Select will be seen as 52K of continuous memory. Now you will have more work space than ever previously available.

Visicalc will give you 17% bigger spreadsheets.

WordProcessors will give up to 30% bigger letters.

Microsoft (the memory tiger) will allow bigger, more powerful programs than previously thought possible.

If you join the Mosaic Select members club, a growing library of software will be made available to you. The monthly newsletter will keep you posted on the latest applications and software for your extra memory.

Your own software

When writing your own programs, you will find an unlimited world of uses for the 64K Select. The first use you will probably discover for the board is a protected space for your displays. With a single 64K board, you can put up to 16 Graphic 0 displays in the bank select area.

As you learn about character sets, player/missile graphics, and other Antic capabilities, you will find your extra memory invaluable for holding all this new data. And without using one byte of program space.

A very powerful use of this 4K bank select memory space is to load each bank with a series of useful assembly language utilities. This will give you at least **64 PAGES** of memory (256 bytes/ page) for all those nifty assembler routines that could never fit into the page 6 RAM area. Advanced programmers will realize that an AUTORUN.SYS file can be produced to automatically load these utility routines when DOS is booted.

Considering that DOS and many other programs have been discovered to alter Page 6, your new "extra" memory may be the only totally safe memory for your uses.

Now the OS, BASIC, and DOS can never violate your precious data.

THE MOSAIC SELECT MEMBERS CLUB

Select members will receive a monthly newsletter spelling out the hows and whys of applications found by other select members. For example, the Portland Atari Club is using the 64K Select in their bulletin board system. Why? Now they only need one disk drive (cutting down on initial costs), the messages are kept in bank memory (increasing response speed 20 times), and disk access is almost eliminated (decreasing disk wear & long-term costs). This and many other applications will be brought to you monthly.

Select members will gain access to a developing library of software. A package named "Handyman" by Holiday Software will almost eliminate any need to type DOS. With Handyman you can type commands like "DIR" for disk directly and "FORMAT" to format disks. Since DOS is never loaded, there is no need for MEM.SAV files and you will never have to wait for your program to reload. Programmers will find additional commands to be invaluable when developing and debugging BASIC and Assembler programs. Like most Select library programs, Handyman resides in bank select memory so that 99% of your normal program space is retained for your uses.

A program named "SuperDrive" allows you to use bank select memory like a superfast disk drive. Saves and loads go twenty times faster. The Memory Manager program allows advanced and beginning programmers to forget about the intricacies of bank selection and memory addressing. The Memory Manager allows high level access to all kinds of data.

With the help of Select members like yourself, the library will grow to meet most every need.

Symptom	Possible Cause	Action
Computer does not turn on (no Power light)	<p>(1) Power pack is not plugged in.</p> <p>(2) Atari power board socket is not seated properly.</p> <p>(3) Power interlock connecting rod not installed properly.</p>	<p>Check AC power plug and power cable to the computer.</p> <p>Check to make sure that none of the square pins that connect the power board are bent or misaligned.</p> <p>Open cartridge door and check that connecting rod is present and operates freely. Adjust the power board position for unobstructed operation.</p>
No Display	<p>(1) RAM board not seated properly or inserted backwards</p> <p>(2) Processor board not seated properly or inserted backwards.</p> <p>(3) Cable connectors not seated properly or pins bent.</p> <p>(4) Solder bridge or conductive debris where cable was added.</p> <p>(5) Atari power board socket is not seated properly.</p>	<p>Check seating and orientation of RAM board by comparing to photos.</p> <p>Check seating and orientation of Processor board by comparing to photos. Make sure ROM cable does not obstruct edge connector.</p> <p>Check cable and connectors. Inspect connector pins.</p> <p>Check connections. Brush or blow any loose solder from between pins. Desolder if necessary.</p> <p>Check to make sure that none of the square pins that connect the power board are bent or misaligned.</p>
Computer comes in "Memo Pad" mode with BASIC cartridge inserted.	ROM module missing or connected wrong.	Check ROM module. Make sure module is completely seated.
PRINT FRE(0) did not return with value of 37902	<p>(1) Peripherals connected and turned on.</p> <p>(2) Bad RAM chip.</p>	<p>Remove all peripheral devices from computer for initial testing.</p> <p>Return board.</p>
Computer turns on OK, but does not respond to keyboard or responds incorrectly.	Keyboard connector not properly inserted or pins bent.	Check keyboard connector closely for bent pins, broken wires, or misalignment.
Keyboard speaker does not work.	Speaker not plugged into mother board.	Check that speaker connector is plugged into mother board.

Symptom	Possible Cause	Action
Apparent interference with TV	Coax cable not connected properly to power board.	Check that black TV cable is plugged in properly and completely seated in RCA phono connector.
Everything worked fine for a few days and then failed.	Component failure on RAM board.	Return board.
48K programs won't work or respond with "insufficient memory."	Program uses defective logic to test for sufficient memory	Return program for repair. If you absolutely must keep program, remove all but one 64K board. Set B-strap to B1. This will disable select memory until a proper bank # is selected.

If no cause for improper operation can be found, reinstall the original memory board and check for proper operation of the computer. If the computer still works properly with the original memory installed, chances are that a memory chip may be bad. Call our toll free service line for further help. (800) 547-2807

GUARANTEE

If the Mosaic 64K RAM SELECT MEMORY ever fails to operate properly within four years from the date of purchase, ship it to the factory and Mosaic will either repair or replace it free.

WARRANTY

Return enclosed Guarantee Card to Mosaic within 10 days from date of purchase to qualify for Mosaic's four-year free repair/replacement coverage.

DISCOUNT MEMBERSHIP WHEN YOU ORDER HANDYMAN

Order Handyman program and receive \$10 off normal membership dues.

Holiday Software presents: the HANDYMAN

The HANDYMAN is a software utility package designed especially for the Mosaic 64K SELECT RAM memory board.

The HANDYMAN routines reside in the bank select RAM area. Most of the commands are useable with both Basic and the Assembler cartridges.

The following HANDYMAN commands may be entered from the keyboard:

DIR or DIR Dn:	Gives directory of disk drive #1 or of named drive in double column form.
LOCK Dn: Filename,ext UNLOCK Dn: Filename,ext. RENAME Dn: oldname,newname DELETE Dn: filename,ext	These are the same functions that are available from DOS. Now you can have high level control over your program files without erasing your software to load DOS.
FORMAT Dn:	Never worry about error '162' again.
ECHO P: ECHO (device):	The characters going to the screen will also go to the printer or other device. A must for anyone attempting to trace software bugs.
PUSH Dn:filename Memory=bytes or PUSH Memory Dn:filename=bytes	Transfers the specified number of bytes between the selected device/ filename and the specified memo- ry location. The memory address may be given in Decimal or HEX format. The number of bytes may be Decimal, Hex, or ALL (useful for input from a disk file when the exact size is unknown). The device/filename may be any al- lowed device. Anyone working with custom characters or P/M graphics knows the value of this function.
BLOAD Dn:filename	Loads Binary files. If the file is "Load and Go" it will execute the program just loaded. Load any binary file while any language cartridge is in place.
CONVERT ### or CONVERT \$###	Converts between Decimal and Hex number.
SLIST or SLIST ##	SLOW LISTER, for use with the Basic cartridge only. SLIST pro- vides an easy, controlled way of paging through a Basic program. All of the editor functions are available, and any line on the screen may be changed or deleted, or lines may be inserted. SLIST can start from any line number. Listings can be stopped & started with the start button.

HANDYMAN

Handyman comes on disk with complete instructions including examples for use. Handyman automatically loads and can be erased as simply as typing "KILL."

APPLICATION FOR SELECT CLUB MEMBERSHIP

_____ I want membership in the Select Members Club. I warrant that I am an owner of the Mosaic 64K Select, and that I am sending or have sent my warranty card. I understand that I will receive 12 issues of the monthly newsletters for one full year, and that I will have access to the complete library of software as it develops.

_____ I want the Handyman package from Holiday Software.
Enclosed is \$30.00 for Handyman
and \$5.00 for discount membership.

_____ Just accept me as a member.
Enclosed is \$15.00 for membership.

Enclosed please find my money order for \$ _____
to Mosaic Electronics, Inc.

Charge \$ _____ to my:

_____ VISA # _____ EXPIRES _____

_____ Mastercard # _____ EXPIRES _____

I own _____ Atari 400, _____ Atari 800 with the following memory boards: _____

Signature: _____

Please print or type:

Name: _____

Address: _____

Phone: _____

Mail to: Select Members Club, Mosaic Electronics, Inc.
P.O. Box 708, Oregon City, OR 97045

PLEASE MAKE NOTE OF THESE CHANGES AS YOU READ YOUR MANUAL.

Cable Kits have been renamed to Cable Connectors. When the manual refers to Cable Kits, substitute "Cable Connectors."

PAGE 16:

Replace the following section.

MEMORY CONFIGURATIONS

There are ten different memory configurations that you may use depending on which boards you have in your computer. The table on page 15 shows how to set the straps for your particular installation.

NOTE

You cannot use Atari 8k or non-Mosaic 32k memory boards with the Mosaic 64k Select board.

Only the configurations shown on page 15 will work. Any other configurations could produce unpredictable results and may damage your computer.

To determine which configuration to use, first take an inventory of the available memory boards you have already. Look up the appropriate configuration to use on page 15, and set the straps on your 64k Select board according to the ones listed for that configuration. Figure 6 on page 8 shows the locations of the configuration straps on the 64k Select board.

If you are using a peripheral board, such as an 80 column display board, you can only use configurations 1, 3, or 7, and for proper operation you must also do the procedure starting on page 26.

If you plan to simulate the Atari 1200, you must use configuration 2. See page 12 for more information on the Atari 1200 configuration.

NOTE

When using the 64k Select board in the Atari 1200 configuration, you cannot use a joystick in port 3 or use any product that uses port 3 to communicate to an external device such as some printer adaptors or keyboard expanders which plug into the joystick 3 plug.

If you are using the 64k Select board alone, use configuration 2.

You cannot use a single 16k board along with the 64k Select. Either obtain an additional 16k or Mosaic 32k board, or use configuration 2.

If you have a 16k board and a Mosaic 32k board, use configuration 6.

If you have a Mosaic 32k board, use configuration 4. You will also need a Mosaic "Companion" board which is available for \$5.00 directly from Mosaic.

If you are adding a second 64k Select board, use configuration 8.

If you are adding a second 64k Select board and also have a Mosaic 32k board, use configuration 9.

If you are sending a third 64k Select board, use configuration 10.

To the right of each memory configuration is a chart showing the valid bank numbers, the total number of 4k banks, and the strap options to set.

PAGE 21:

Replace paragraph 2 & Figure 38

Install the selector module in the blank IC socket from step 1 so that the red dot points toward the left, and the cable point toward the back of the computer. Take care not to bend any pins and be sure that the module is seated firmly into the socket.

The selector module pictured in figure 38 is an old style and should not be used for reference.

PAGE 29:

Add

If, after you type:

PRINT FRE(Ø) (return)

you get 29710 instead of 37902, the ROM module is probably not firmly seated. (For proper installation, see page 10 if you have an Atari 400, or page 22 if you have an Atari 800).

If, after you type:

POKE 1Ø6,2Ø8 (return)

GR Ø (return)

you get garbage on the screen, double check the settings of all the straps.

Bottom line

Replace "The computer should respond with: 38754"

With "The computer should respond with: 38894"

PAGE 34:

Replace the following section:

SIMULATING THE ATARI 1200

The following machine language program will switch out the operating system and give you access to 62k of RAM. (See fig. 20B on page 13 for a memory map of the Atari 1200)

```
LDA    $D303    ;Select data direction register
AND    #$FD
STA    $D303
```

```
LDA    #$FF      ;Set PIA port B for output
STA    $D301
LDA    #$3C      ;Reset control register
STA    $D303
```

```
LDA    #$00      ;Set PIA outputs low
STA    $D301
```

Use the following routine to switch the operating system back in.

```
LDA    $D303    ;Select data direction register
AND    #$FD
STA    $D303
```

```
LDA    #$FF      ;Set PIA port B for output
STA    $D301
```

```
LDA    #$3C      ;Reset control register
STA    $D303
```

```
LDA    #$FF      Set PIA outputs high
STA    $D301
```

NOTE

It is possible to switch out the operating system through BASIC instead of machine language. However, when the operating system disappears, BASIC will crash and your computer will be totally useless until power is turned off and back on again.

PAGE 38:

If you need to return your 64k Select board for service, please also return the cables so that we can test everything together.

Please include \$3.00 postage and handling when ordering the Handyman software package.

ADDITIONAL INSTALLATION TIPS

The metal used in Atari computers is soft. When replacing screws, do not overtighten as you may either strip out the screw hole or break the screw.

Not all of the screws that you take out are the same. Make note of which size screws go where so you can get your computer back together again properly.

On some Atari main boards, the pins for the ROM cartridge sockets have been sheared off too close to the board for the ROM module to seat properly. If this is the case on your machine, you will have to cut the cable on the ROM module and hand solder the individual wires to the proper pins on the ROM socket. Pay close attention to which wire on the cable goes to which pin on the socket.

On some of the newer Atari 400 computers, the plastic card holder that supports the processor and memory cards in the metal shield has been changed. Before you install your 64k Select board, test fit it inside the metal shield. If the card holder prevents the board from seating properly, the plastic tabs must be broken off the board holder or the memory board may be damaged.

IMPORTANT

It is impossible to install your new 64k Select board without first reading the instructions.

Before attempting to install your new board, read the introduction on page 4 and all applicable instructions. If you do not feel competent to do this installation yourself, seek qualified help.

In addition to the board itself, you will also need 64k Cable Connectors #1 (H311) if this is the first 64k Select board you are installing, or 64k Cable Connectors #2 (H312) if you are installing a second or third 64k Select board.

48k BOOT FIX

Some programs check the memory size to see if you have a 48k Atari and may not work with the 64k Select board installed since instead of 48k you have 52k. The following program should solve this problem.

Use this procedure to create a special DOS disk which will enable you to use programs that will not boot normally with the 64 k Select board.

1. Bring up your computer with DOS and the BASIC cartridge installed.

2. Type in the following program:

```
10 FOR A = 0 TO 12
20 READ B
30 POKE 1536 + A,B
40 NEXT A
50 DATA 141,228,255,173,31,208
60 DATA 201,5,208,249,32,119,228
70 DOS
```

3. Save the program to your DOS disk with:

SAVE "D:KBOOT.SAV"

4. Type:

RUN

5. When DOS loads, select menu option "K"

6. When prompted, type the following:

KBOOT,600,610,,600

To run problem 48k programs use this procedure.

1. Remove all cartridges.
2. Insert the DOS disk that you used above.
3. Turn on your computer.
4. After DOS loads, select menu option "L".
5. When prompted, type:

KBOOT

6. The computer will appear to "lock up."
7. Insert your problem 48k program disk and press the SELECT key.
8. Your program should now run properly.