

READ ME FIRST

As with any computer-based product we recommend you read the accompanying manual. However, if you are like some of us at FROBCO, you won't. In that case scan through the manual first, paying particular attention to the sections marked with the heading "WARNING:".

**Preliminary Documentation  
Subject to Change**

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PROGRAM PRODUCT:

Title of Software Disk \_\_\_\_\_

Release Version Number \_\_\_\_\_ Disk Serial Number \_\_\_\_\_

FROB BURNER Hardware Serial Number \_\_\_\_\_

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## CHAPTER 1 INTRODUCTION

### 1.1 Purpose Of The FROB BURNER

The FROB BURNER is an Apple II computer peripheral card used to program (or 'burn') the 2732 EPROM. The programmer uses the FROB BURNER to burn into EPROM the program that has been developed on the FROB program development system. Then the EPROM is placed in a FROB cartridge adapter, and the adapter can be plugged into any Atari VCS. The FROB BURNER is also used to program EPROMs for the Atari 5200 system.

This manual covers the use of the hardware registers on the FROB BURNER and provides a tutorial on the FROB BURNER software.

## CHAPTER 2 INSTALLATION

It is assumed that the FROB BURNER user is an experienced Apple user and is therefore familiar with the dos and don'ts of inserting Apple peripheral cards. It is further assumed that the user is familiar with Apple disk software. If these assumptions are not true for you, we strongly advise you to spend some time getting to know your Apple and reading the Apple reference manuals, or enlist help from a friend who knows the Apple.

The FROB BURNER includes the Apple peripheral card, two (2) cartridge adapters, an Apple DOS 3.3 diskette with the software, and this document. You should check to see that all these items have been included with your FROB BURNER.

### 2.1 Hardware

The FROB BURNER peripheral card can be placed in Apple slots 1 through 7. Once you decide which slot to use, **be sure that the Apple is turned OFF before you install the card.** The FROB BURNER software will prompt you for the slot number of the FROB BURNER.

**WARNING:** NEVER REMOVE OR INSTALL THE FROB BURNER OR ANY OTHER APPLE PERIPHERAL CARD UNLESS THE APPLE IS POWERED OFF! IF YOU REMOVE OR INSERT AN APPLE PERIPHERAL CARD WHILE THE APPLE IS POWERED ON, YOU WILL DESTROY THE PERIPHERAL CARD AND CAUSE EXTENSIVE DAMAGE TO THE APPLE COMPUTER. THE FROB BURNER WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER INSTALLATION. BE CAREFUL!

### 2.2 Cartridge Adapters

The FROB BURNER comes with two cartridge adapters that are used for burning the EPROMs. The cartridge adapters are keyed in such a way that they can be inserted into the FROB BURNER edge connector in only one way. When you are ready to burn an EPROM, you should insert a 2732 into the cartridge adapter. **Be sure to insert the 2732 into its socket correctly.** Pin 1 of the 2732 is nearest to capacitor C2 on the cartridge adapter. An incorrectly installed 2732 can destroy both the EPROM and the FROB BURNER.

**WARNING:** The cartridge adapter from earlier versions of the FROB will NOT work in the FROB BURNER. Using an old style cartridge adapter will destroy the FROB BURNER card. The edge connector on the FROB BURNER has been keyed so that it is extremely difficult to insert an old style cartridge adapter into the FROB BURNER. It is easy to identify an old style adapter. There is only

one capacitor on the adapter and there is no notch between the fingers of the edge connector. The new version of the adapter supplied with the FROB BURNER has two capacitors on the board and a notch between two of the fingers on the edge connector.

Once the EPROM is installed into the cartridge adapter, insert the adapter into the edge connector on the FROB BURNER. Before you insert the cartridge adapter into the FROB BURNER, **be sure that the power switch on the FROB BURNER is OFF.** As you look at the board with the components facing you, the power switch is located in the upper left hand corner of the FROB BURNER. When this switch is to the RIGHT, the power to the adapter is OFF. When the switch is to the LEFT, the power to the adapter is ON. When you are sure that the power switch on the FROB BURNER is OFF, you can insert the cartridge adapter into the edge connector. Be sure to line up the notch in the cartridge adapter with the key in the edge connector on the board. It is not necessary to power your Apple OFF to insert or remove the cartridge adapter from the FROB BURNER board. Just be sure that the power switch on the FROB BURNER board is OFF before you insert or remove the cartridge adapter. We recommend that you turn the power switch ON only when prompted by the software, and turn the power switch OFF after you have programmed the EPROM. This will prevent any accidental programming of the EPROM.

After burning the EPROM, you can use either the new style or old style cartridge adapter to run your program in the VCS. If you wish to use the old style adapter, you must transfer the EPROM to the old style adapter. Once the EPROM is burned, you can simply place the cartridge adapter into the VCS and run your program. Place the cartridge adapter into the VCS with the EPROM facing towards the back of the VCS. This is the same orientation for the adapter as that used by the FROB.

### 2.3 Software

The software for the FROB BURNER is supplied on a standard Apple DOS 3.3 floppy diskette. The diskette is not write protected, so the first thing you must do is make two copies of the diskette and set the original and one copy aside in a safe place.

There are two programs supplied with the FROB BURNER. These are written in Applesoft and are called BURNER and FBSAVE. BURNER is used to read a standard Apple Binary file in from the disk and then burn the contents of that file into an EPROM. The BURNER program checks for an erased EPROM and verifies that the burn was done correctly. It is possible to burn all or any part of the EPROM with the BURNER program.

The FBSAVE program is almost identical to the FSAVE program included with the FROB. It is used to move programs from the FROB BURNER's memory into the Apple's memory and then to a Binary file on the diskette. The Binary file saved with FBSAVE can be used directly with the BURNER program.

## CHAPTER 3 FROB BURNER HARDWARE

### 3.1 Introduction

The FROB BURNER hardware is the Apple peripheral card, designed to be inserted into any of the Apple peripheral slots numbered 1 through 7. The FROB BURNER will not work in slot 0. On the FROB BURNER card, you will notice an edge connector (J2). The edge connector accepts one FROB BURNER cartridge adapter. The cartridge adapter holds the 2732 EPROM to be programmed by the FROB BURNER. The FROB BURNER comes with two (2) cartridge adapters.

**WARNING:** The FROB BURNER contains an on-board 25-volt power source used to program the EPROM. Most EPROMs on the market use 25 volts for programming, though a few EPROMs use 21 volts. Most INTEL EPROMs use 21 volts. NEVER TRY TO PROGRAM A 21-VOLT EPROM WITH THE FROB BURNER. THIS WILL DESTROY THE EPROM AND MOST LIKELY DESTROY THE FROB BURNER ALSO.

The FROB BURNER also has an ON-OFF switch in the upper left hand corner of the Apple peripheral card. This switch is used to supply power to the FROB BURNER cartridge adapter. You can insert or remove the cartridge adapter only when the switch is OFF. It is not necessary to turn off power to the Apple to remove or insert the FROB BURNER cartridge adapter. We recommend that you keep the switch in the OFF position except when actually programming the EPROM.

### 3.2 Memory Map

The FROB BURNER resides in the Apple slot memory space and uses both the peripheral card I/O locations (DEVSEL signal) and the peripheral card PROM locations (IOSEL signal).

The peripheral card I/O locations are sixteen addresses that are slot-dependent. The addresses are calculated by this formula (all numbers in hexadecimal):

$$\text{\$C080} + \text{\$N0}$$

In this formula,  $\text{\$N0}$  is the FROB BURNER's slot number multiplied by  $\text{\$10}$ . If you install the FROB BURNER into slot 1, then you have  $\text{\$C080} + \text{\$10} = \text{\$C090}$ . Likewise, slot 4 is address  $\text{\$C0C0}$ . All sixteen locations address the FROB BURNER control register. The control register selects the current EPROM page, controls the CHIP SELECT line and enables programming.

The peripheral card PROM locations are also slot-dependent. There are 256 PROM locations for each slot. The starting address of each area is calculated by this formula:

$$\$C000 + \$N00$$

In this formula,  $\$N00$  is the FROB BURNER's slot number multiplied by  $\$100$ . If you install the FROB BURNER in slot 1, then you have  $\$C000 + \$100 = \$C100$  as the starting address of the peripheral card's PROM space. In this example, that PROM space runs from  $\$C100$  to  $\$C1FF$ . Likewise, slot 4 uses addresses  $\$C400$  through  $\$C4FF$ . The PROM addresses are used to read or write to locations in the current EPROM page.

In the examples used in this manual, we assume that the FROB BURNER is installed in slot 2 of the Apple. Thus the addresses we use will range from  $\$C0A0$  to  $\$C0AF$  for the card I/O, and from  $\$C200$  to  $\$C2FF$  for the card PROM addresses.

The 2732 EPROM holds 4K (4096) bytes that is accessed one page (256 bytes) at a time by the FROB BURNER. There are sixteen pages in total.

### 3.3 FROB BURNER Control Register

The FROB BURNER has one write only control register. The control register can be accessed by writing to ANY of the sixteen addresses in the card I/O address range. Thus if the FROB BURNER is in slot 2, a write to ANY address in the range of  $\$C0A0$  to  $\$C0AF$  writes data into the FROB BURNER control register.

The control register uses ONLY the six (6) least significant bits of the eight-bit data byte. The four least significant bits (bits 0-3) are used to select one of sixteen possible pages of the EPROM address space. This use of page addressing is similar to FROB's page addressing. Each one of the four bits is latched and then presented to the EPROM address lines.

Bit 4 is used to drive the CHIP SELECT pin of the 2732 EPROM. This bit must be cleared to 0 to enable the EPROM for either writing (programming) or reading (verification). Setting this bit to 1 disables the EPROM.

Bit 5 is used both to control the 25-volt programming power supply and to allow data to be sent to the EPROM for programming. When bit 5 is set to 1, the 25-volt power supply is turned ON and data can be sent from the Apple to the EPROM. When bit 5 is cleared to 0, the 25-volt power supply is turned OFF and data cannot be sent from the Apple to the EPROM.

Pressing the RESET key on the Apple clears the control register to all 0s. Here are the bit assignments for the control register:

BIT 7 - MOST SIGNIFICANT BIT - NOT USED  
BIT 6 - NOT USED

BIT 5 - Controls the 25-volt programming power supply and the output of the data latch. When set to 1, the 25-volt supply is ON and the output of the data latch is enabled. When cleared to 0, the 25-volt supply is OFF and the output of the data latch is disabled.

BIT 4 - Controls the CHIP SELECT pin of the 2732 EPROM. When cleared to 0, the EPROM chip is enabled for reading or writing. When set to 1, the EPROM chip is disabled for reading or writing.

BIT 3 - Drives the A11 address line of the 2732 EPROM.  
BIT 2 - Drives the A10 address line of the 2732 EPROM.  
BIT 1 - Drives the A9 address line of the 2732 EPROM.  
BIT 0 - Drives the A8 address line of the 2732 EPROM.

#### 3.4 FROB BURNER Address And Data Latches

The FROB BURNER contains a latch for the eight data bits of the Apple bus that is used when burning an EPROM. The FROB BURNER also contains a latch for the lower eight address bits of the Apple bus that is used for both burning and verifying an EPROM.

The input to the address latch is the low-order eight bits of the Apple address bus. These are bits A0 through A7. Any reference to the peripheral card PROM space (\$CN00 - \$CNFF) causes the latching of the address bits. The output of the address latch is always enabled and is connected to the lowest eight bits of the 2732 EPROM. Thus a read to location \$C255 (with the FROB BURNER in slot 2) causes \$55 to be latched into the address latch. The low-order eight bits of the EPROM address is \$55.

The data latch gets its input from the Apple's data bus. The data latch latches the Apple's data bus ONLY when a WRITE is made to the card's PROM space. Thus a WRITE to location \$C255 causes the value written to be latched into the data latch. The output of the data latch is controlled by bit 5 of the FROB BURNER control register. When the FROB BURNER is enabled to program an EPROM, the data latch output is enabled; otherwise the data latch output is disabled. The output of the data latch is connected to the EPROM's data pins.



### 3.5 Programming An EPROM

The simplest way to program a 2732 EPROM with the FROB BURNER is to use the software supplied with the FROB BURNER. This section describes what needs to be done at the hardware level to program an EPROM. It is assumed that the FROB BURNER is in slot 2 of the Apple.

First of all, prepare a FROB BURNER cartridge adapter by placing a 2732 EPROM into the 24-pin socket on the adapter. Be sure to place pin 1 of the 2732 into pin 1 of the socket. Pin 1 of the EPROM socket is the pin nearest capacitor C2 on the cartridge adapter. Incorrect installation of the EPROM will result in damage to the FROB BURNER and the EPROM! With the EPROM installed in the adapter, be sure the power switch on the FROB BURNER is OFF before you install the cartridge adapter into the edge connector on the FROB BURNER. The power switch is OFF when it is towards the center of the FROB BURNER card, and ON when it is towards the left edge of the card. After you install the cartridge adapter, switch the power ON.

Next, the value \$10 is written to the control register on the FROB BURNER. This causes page 0 to be addressed, CHIP SELECT to be false, and programming to be disabled. The four high-order EPROM address bits (the page number) is written into the four low-order bits of the control register. Those four bits determine which one of sixteen pages appears in the PROM space. Bit 5 is then set to 1 to enable programming. The data to be programmed is written to an address in the PROM space (\$CN00 - \$CNFF) corresponding to the address in the selected page to be programmed in the 2732. After that write, data is latched into the data latch and the low-order eight bits of the address are latched into the address latch. At this point, the EPROM has the data and the address, and the programming voltage is present.

The byte of data is programmed into the EPROM by asserting the CHIP SELECT line of the 2732 for 50 ms. This is done by writing a 0 to bit 4 of the FROB BURNER control register and exactly 50 ms later writing a 1 to bit 4 of the control register. Since this 50 ms timing pulse is critical to the correct programming of the 2732, programming cannot be done by manual use of the Apple monitor. We recommend that you use the software provided for burning the EPROMs.

After programming a location on the EPROM, you can verify the data. Clear bit 5 of the control register to disable the FROB BURNER for programming and enable it for verification. Once the four high-order address bits are written into the control register, clear the CHIP SELECT bit 4 to 0. Then simply READ from the desired address (in PROM space \$CN00 - \$CNFF) within the page selected.

The above information is provided so that you can understand

the hardware operations that go on when the EPROM is being programmed. Because of the critical timing, we recommend that you use the software supplied to program and verify EPROMs.

## CHAPTER 4 FROB BURNER SOFTWARE

### 4.1 Introduction

This chapter first describes the software supplied with the FROB BURNER, and then leads the user through a tutorial on software use.

There are two programs supplied with the FROB BURNER, BURNER and FBSAVE. BURNER is used to program or burn the EPROMs. FBSAVE is used to read data in 2732 EPROMs and store it in Apple binary files.

BURNER prompts the user for the name of the binary file on the disk that is to be burned into the EPROM. After the file has been loaded, the user specifies which part of the EPROM is to be burned. All of the EPROM or any part of it can be burned, but the portion of the EPROM to be burned is always in a contiguous address range. If you want to burn two different portions of the same EPROM, simply run BURNER once for each portion of the EPROM. After the address range has been specified, you are prompted to install an erased EPROM into the cartridge adapter edge connector on the FROB BURNER and switch the power to the ON position. The final prompt asks if you wish to verify only or burn and verify the EPROM. The program then displays a message as it checks to see that the EPROM is erased in the specified address range. Another message is displayed when the burning begins and another message is displayed when verification begins. If the EPROM passes verification, a message indicating a good burn is displayed along with the checksum of the EPROM. All of the prompts in the BURNER program are easy to understand.

**WARNING:** The BURNER program uses software timing loops to generate the 50 ms pulse used to program 2732 EPROMs. Since less than 50 ms will not program the EPROM and greater than 50 ms will destroy the EPROM, we recommend that you use the BURNER program to burn EPROM. You must not run the BURNER program if any device in your Apple is enabled to generate interrupts or DMA cycles. Any interrupts or DMA cycles that occur while you run the BURNER program will change the 50 ms timing pulse. Disable all interrupts and DMA devices before you run the BURNER software.

The FBSAVE program is similar to the FSAVE program included with the FROB. Its purpose is to move programs from the 2732 EPROM plugged into the FROB BURNER into the Apple memory and to save the program in a standard DOS binary file.

## 4.2 BURNER Tutorial

Sit down in front of your Apple and follow along on the keyboard as you read this tutorial. We assume that the FROB BURNER card is installed in the Apple peripheral slot 2, and that you have placed a binary file named FOOBAR on the diskette. It is this file FOOBAR that you will burn into the EPROM. We also assume that you have installed a 2732 EPROM into a cartridge adapter. (See the chapter on Installation for more details.) Place your diskette into the drive and boot the diskette. Now run the BURNER program by typing:

**]RUN BURNER**

Don't forget to type the RETURN key at the end of the line. All responses to the BURNER program are terminated with the RETURN key, so we assume that you will always type the RETURN key at the end of a line. The screen will clear and this message appears at the top of the screen.

**PROGRAM TO OPERATE THE FROB BURNER**

**ENTER THE FILE NAME:**

Assuming that your file is named FOOBAR, you type FOOBAR and a RETURN key. The next prompt appears:

**HIT RETURN WHEN READY TO LOAD FILE.**

If your file is on another diskette, you can remove the first diskette and insert the diskette containing FOOBAR into the same drive. If FOOBAR is on the same diskette as BURNER, simply hit the RETURN key. The BURNER program always tries to load the file from the same drive that BURNER was loaded from. Once you hit the RETURN key, the program loads the FOOBAR file into the Apple's memory. The program then prompts again:

**ENTER THE STARTING ADDRESS RELATIVE  
TO THE START OF THE FILE.  
(AT MOST 3 HEX DIGITS):**

You must enter the starting address in hexadecimal at this point. If you wish to start at the beginning of the file FOOBAR, then type 000 followed by RETURN. This also causes the EPROM burn to start at the EPROM's relative address of 000. If you wish to skip the first 256 bytes of the FOOBAR file, then you type 100 in response to the prompt. This skips the first \$FF bytes in the FOOBAR file and starting with byte \$100, burns data into the EPROM. The burning in the EPROM also starts at the EPROM relative location \$100, thus skipping the first 256 bytes of the EPROM. The starting address is relative to the beginning of the file AND the beginning of the EPROM. For our example, let's burn the

whole EPROM. Type 000 in response to the prompt. If you make a mistake while entering the address, use the Apple's left and right arrow keys to edit your entry. Make sure to enter hexadecimal digits only.

The next prompt appears on the screen:

**ENTER THE ENDING ADDRESS  
RELATIVE TO THE START OF THE FILE.  
(AT MOST 3 HEX DIGITS):**

The relative addresses mentioned here are the same as above for the starting address. If you want to burn the whole EPROM then enter the address FFF in response to this prompt. The next prompt appears:

**WHICH SLOT IS THE FROB BURNER IN?**

Since you have your FROB BURNER in slot 2, type the digit 2 and the RETURN key. Another prompt appears:

**BE SURE THE ADAPTER IS IN POSITION  
AND AN ERASED 2732 EPROM IS INSTALLED  
TURN THE POWER SWITCH ON AND HIT RETURN**

Install the cartridge adapter as described in the chapter on installation. Be sure that the power switch is OFF before you install the adapter into the FROB BURNER. Once installed, switch the power ON. Remember that as you face the Apple the switch is on the edge of the FROB BURNER card nearest the front of the Apple. Move the switch towards the front of the Apple to turn it ON. Then hit RETURN and the next prompt appears:

**VERIFY ONLY? (Y/N)**

Since you want to burn and verify this EPROM, you answer this prompt with an N for NO. If you wish to verify the contents of an EPROM against the file FOOBAR, then you should respond with a Y for YES. If you respond with a Y, then the program will not burn the EPROM; it only performs a verification. Once you have responded to this prompt, the BURNER program begins burning the EPROM.

First the program checks that the address range specified is erased in the EPROM. While checking, this message is displayed:

**CHECKING EPROM...**

You will notice the dots appearing. One dot appears at the start of each 1K block. This is to assure you that the BURNER program is running. If the EPROM is not erased within the specified address range, the next message appears:

**ADDRESS RANGE GIVEN IS NOT ERASED  
DO YOU WISH TO ABORT? (Y/N)**

If you choose to abort, the program simply ends. If you choose not to abort, the program continues with the burning and verification. Once the EPROM has been checked, the burning starts and this message is displayed:

**STARTING BURN...**

Again, the dots appear as the burning progresses. It takes about 12 minutes to burn all 4K of a 2732 EPROM. After the burn is done, the program begins to verify that the file is burned into the EPROM correctly. This message appears:

**STARTING VERIFY...**

If everything has gone well, the next message appears:

**BURN OK, CHECKSUM=204335**

The checksum of course depends on the data burned into the EPROM. It is a decimal number. When you get this message, you know that you have had a good burn of the EPROM. The very next thing you should do is **turn the power switch OFF**. After that, you can remove the cartridge adapter and install it in a VCS and enjoy the fruits of your labour.

Sometimes there is a problem with a burn of the EPROM. If the verification of the EPROM fails, you will see a message similar to this:

**LOC: 0000 SHOULD BE 55 BUT IS 00  
LOC: 0001 SHOULD BE 3E BUT IS 30**

**ERROR -- VERIFY FAILURE**

The messages identify the location(s) in the EPROM where the file and the EPROM don't hold the same data. If you get this message, be sure that your EPROM is good and installed in the socket on the cartridge adapter correctly. It is our experience at FROBCO that EPROMs don't last forever.

### 4.3 FBSAVE Tutorial

The FBSAVE program allows you to move data from a 2732 EPROM plugged into the FROB BURNER into an Apple binary file.

Boot your diskette and then run the FBSAVE program by typing

**]RUN FBSAVE**

The first thing that you see are the title lines:

**PROGRAM TO READ PROM IN FROB BURNER  
AND SAVE CONTENTS IN A BINARY FILE.**

You are then prompted to input the slot number of the FROB BURNER peripheral card.

**WHAT SLOT IS THE FROB BURNER IN?**

Enter a number in the range of 1 to 7. Next you are prompted for a file name.

**ENTER NAME OF FILE?**

This is the name of the file that will be created on the diskette. The next prompt asks you to turn ON the FROB BURNER and press RETURN when you are ready to write to the diskette.

**TURN ON FROB BURNER**

**PRESS RETURN WHEN READY TO WRITE DISK?**

This allows you to write the file onto a different diskette. When the diskette is ready, type the RETURN key and the file is written out to disk. The file created is an Apple binary file with an origin of \$8000 and a length of \$1000 (4K). When the file has been written out, this message appears on the screen:

**SAVE PROCESS COMPLETE**

**TURN OFF FROB BURNER**

At this point you should turn OFF the FROB BURNER.

This ends the software tutorial section of the FROB BURNER manual.

```
1 HIMEM: 32767
10 REM PROGRAM TO OPERATE THE FROB BURNER
12 FOR I = 1 TO 11
14 READ XZ: POKE 767 + I,XZ
16 NEXT I
18 WT = 768
20 DATA 160,30,162,0
22 DATA 202,208,253,136,208
24 DATA 248,96
25 HOME
30 PRINT "PROGRAM TO OPERATE THE FROB BURNER"
40 PRINT : PRINT : PRINT
50 INPUT "ENTER THE FILE NAME: ";A$
52 INPUT "HIT RETURN WHEN READY TO LOAD FILE. ";B$
55 PRINT CHR$(4);"BLOAD ";A$;"A$8000"
60 PRINT
70 PRINT "ENTER THE STARTING ADDRESS RELATIVE"
80 PRINT "TO THE START OF THE FILE."
90 GOSUB 1000:STZ = XZ
100 PRINT
110 PRINT "NOW ENTER THE ENDING ADDRESS"
120 PRINT "RELATIVE TO THE START OF THE FILE."
130 GOSUB 1000:ENZ = XZ
140 IF ENZ < STZ THEN 70
145 PRINT
150 INPUT "WHICH SLOT IS THE FROB BURNER IN? ";SZ
160 IF SZ = 0 OR SZ > 7 THEN 150
170 DEV = 49152 + 16 * (SZ + 8)
180 IO = 49152 + 256 * SZ
190 PRINT
200 PRINT "BE SURE THE ADAPTER IS IN POSITION"
210 PRINT "AND AN ERASED 2732 EPROM IS INSTALLED"
220 INPUT "TURN THE POWER SWITCH ON AND HIT RETURN";B$
225 PRINT : INPUT "VERIFY ONLY? (Y/N)";B$
226 IF B$ = "N" THEN 230
227 IF B$ = "Y" THEN 530
228 GOTO 225
230 PRINT : PRINT
240 PRINT "CHECKING EPROM";
250 CPZ = - 1:OKZ = 1
260 FOR I = STZ TO ENZ
270 HIGHZ = I / 256
280 IF HIGHZ = CPZ THEN 300
290 CPZ = HIGHZ
292 PRINT ".";
295 POKE DEV,CPZ
300 LOWZ = I - HIGHZ * 256
310 IF PEEK (IO + LOW) = 255 THEN 320
315 OKZ = 0:I = ENZ
320 NEXT I
325 PRINT
330 IF OKZ = 1 THEN 400
340 PRINT "ADDRESS RANGE GIVEN IS NOT ERASED"
350 INPUT "DO YOU WISH TO ABORT? (Y/N)";B$
360 IF B$ = "Y" THEN 900
370 IF B$ = "N" THEN 400
380 GOTO 250
```



```
400 PRINT 'STARTING BURN';
401 CPZ = - 1;OKZ = 1
402 POKE DEV,16; POKE DEV,48
405 FOR I = 1 TO 1000: NEXT I
410 FOR I = STZ TO ENZ
420 HIGHZ = I / 256
430 IF HIGHZ = CPZ THEN 480
440 CPZ = HIGHZ
450 POKE DEV,CPZ + 48
460 PRINT ',';
480 LOWZ = I - HIGHZ * 256
490 POKE IO + LOWZ, PEEK (32768 + I)
495 POKE DEV,CPZ + 32
500 CALL WT
505 POKE DEV,CPZ + 48
510 NEXT I
520 PRINT : PRINT :
530 PRINT 'STARTING VERIFY'
540 CPZ = - 1
550 POKE DEV,16
560 FOR I = 1 TO 2000: NEXT I
570 FOR I = STZ TO ENZ
580 HIGHZ = I / 256
590 IF HIGHZ = CPZ THEN 650
600 CPZ = HIGHZ
610 POKE DEV,CPZ
620 PRINT ',';
650 LOWZ = I - HIGHZ * 256
660 XZ = PEEK (32768 + I)
670 IF PEEK (IO + LOWZ) = XZ THEN 680
675 OKZ = 0; GOSUB 2000
680 SUM = SUM + XZ
690 NEXT I
700 IF OKZ = 1 THEN 800
710 PRINT
720 PRINT 'ERROR -- VERIFY FAILURE'
730 GOTO 900
800 PRINT
810 PRINT 'BURN OK, CHECKSUM =';SUM
900 END
```

```
1000 REM ROUTINE TO GET 3 HEX DIGITS
1010 INPUT "(AT MOST 3 HEX DIGITS): ";X$
1020 IF LEN (X$) = 0 OR LEN (X$) > 3 THEN 1010
1025 XZ = 0:OKZ = 1
1030 FOR I = 1 TO LEN (X$)
1035 IF OKZ = 0 THEN 1100
1040 CHZ = ASC ( MID$ (X$,I,1)) - 48
1050 IF (CHZ > = 0 AND CHZ < 10) OR (CHZ > 16 AND CHZ < 23) THEN 1060
1055 OK = 0: GOTO 1100
1060 IF CHZ > 9 THEN CHZ = CHZ - 7
1070 XZ = XZ * 16 + CHZ
1100 NEXT I
1110 IF OKZ = 0 THEN 1010
1120 RETURN
2000 PRINT : PRINT "LOC: ";
2005 KZ = HIGHZ: GOSUB 3000
2010 KZ = LOWZ: GOSUB 3000
2020 PRINT " SHOULD BE ";
2030 KZ = XZ: GOSUB 3000
2040 PRINT " BUT IS ";
2050 KZ = PEEK (IO + LOWZ): GOSUB 3000
2060 PRINT
2070 RETURN
3000 K1Z = KZ / 16:K2Z = KZ - K1Z * 16
3010 IF K1Z > 9 THEN K1Z = K1Z + 7
3020 IF K2Z > 9 THEN K2Z = K2Z + 7
3030 PRINT CHR$ (K1Z + 48); CHR$ (K2Z + 48);
3040 RETURN
```

J

```

0000:      2 * *****
0000:      3 * * COPYRIGHT 1982 *
0000:      4 * * FROBCO ALL RIGHTS RESERVED *
0000:      5 * * *
0000:      6 * *****
0000:      7 *
0000:      8 * AUTHOR: KEN CLEMENTS
0000:      9 * DATE: 10/13/82
0000:     10 * LAST MODIFIED: 10/13/82
0000:     11 * VERSION 1.1
0000:     12 * PAGE MOVE
0000:     13 *

```

----- NEXT OBJECT FILE NAME IS PMOVE.OBJ0

```

0300:      14      ORG  $300
0300:A2 00      15 PMOVE LIX  $0
0302:BD 00 10      16 PM1  LIA  $1000,X
0305:9D 00 10      17 PM2  STA  $1000,X
0308:E8          18      INX
0309:D0 F7          19      BNE  PM1
0304:          20 PFROM EQU  PM1+2
0307:          21 PTO  EQU  PM2+2
030B:8E 03 03      22      STX  PFROM-1
030E:8E 06 03      23      STX  PTO-1
0311:60          24      RTS
0312:          25 *
0312:          26 *
0312:          27 * HERE IS A ROUTINE TO LOAD OR
0312:          28 * UNLOAD THE FROB
0312:          29 *
0312:00          30 FSLOT DFB  0      ; SLOT NUMBER FOR THE FROB
0313:00          31 LFROM DFB  0      ; WHERE IN MEMORY TO LOAD TO/FROM
0314:00          32 LNPGS DFB  0      ; HOW MANY PAGES TO TRANSFER
0315:00          33 STPAGE DFB  0      ; WHAT FROB PAGE TO START WITH
0316:          34 *
0316:A9 03          35 INLOAD LDA  #<PTO    ; PICKUP HIGH ORDER ADDRESS PART
0318:8D 65 03          36      STA  TX+2 ; SETUP FOR DOWNLOAD
031B:A9 07          37      LDA  #>PTO ; PICKUP LOW ORDER ADDRESS PART
031D:8D 64 03          38      STA  TX+1
0320:A9 03          39      LDA  #<PFROM
0322:8D 77 03          40      STA  TX1+2
0325:8D 89 03          41      STA  TX2+2
0328:A9 04          42      LDA  #>PFROM
032A:8D 76 03          43      STA  TX1+1
032D:8D 88 03          44      STA  TX2+1
0330:4C 4D 03          45      JMP   FXFER
0333:          46 *
0333:A9 03          47 UPLOAD LDA  #<PFROM
0335:8D 65 03          48      STA  TX+2
0338:A9 04          49      LDA  #>PFROM
033A:8D 64 03          50      STA  TX+1
033D:A9 03          51      LDA  #<PTO
033F:8D 77 03          52      STA  TX1+2
0342:8D 89 03          53      STA  TX2+2
0345:A9 07          54      LDA  #>PTO
0347:8D 76 03          55      STA  TX1+1
034A:8D 88 03          56      STA  TX2+1
034D:          57 *
034D:AD 14 03          58 FXFER LDA  LNPGS

```

```
0350:F0 34 59 BEQ EXIT ; DON'T DO FOR 0 PAGES
0352:A9 00 60 LDA #0
0354:8D 06 03 61 STA PTO-1
0357:8D 03 03 62 STA PFROM-1
035A:A9 C0 63 LDA ##C0
035C:8D 7D 03 64 STA PPOINT+2
035F:18 65 CLC
0360:6D 12 03 66 ADC FSLOT
0363:8D 07 03 67 TX STA PTO
0366:29 07 68 AND #7 ; GET SLOT NUMBER BACK
0368:18 69 CLC ; ADD IN DEV SELECT OFFSET
0369:69 08 70 ADC #8
036B:0A 71 ASL A ; SHIFT IT OVER TO
036C:0A 72 ASL A ; FORM LOWER BYTE OF
036D:0A 73 ASL A ; DEVSEL ADDRESS FOR SLOT
036E:0A 74 ASL A
036F:8D 7C 03 75 STA PPOINT+1
0372:AD 13 03 76 LDA LFROM ; MEM PAGE ADDRESS
0375:8D 04 03 77 TX1 STA PFROM
0378: 78 *
0378:AD 15 03 79 LDLOOP LDA STPAGE ; FROB START PG
037B:8D EB 03 80 PPOINT STA 1000 ; FROB PAGE SELECT
037E:20 00 03 81 JSR PMOVE
0381:CE 14 03 82 DEC LNPGS
0384:D0 01 83 BNE TX2 ; KEEP GOING UNTIL 0
0386:60 84 EXIT RTS
0387:EE 04 03 85 TX2 INC PFROM
038A:EE 15 03 86 INC STPAGE
038D:4C 78 03 87 JMP LDLOOP
```

\*\*\* SUCCESSFUL ASSEMBLY: NO ERRORS

LIST

```
1 HIMEM: 32767
2 HOME : REM VERSION 1.2
5 D$ = ""
10 REM PROGRAM TO READ FROM IN FROB BURNER
15 PRINT D$;"BLOAD PMOVE.OBJ"
17 PM = 768: REM START OF PMOVE
20 PRINT "PROGRAM TO READ FROM IN FROB BURNER"
21 PRINT "AND SAVE CONTENTS IN A BINARY FILE"
22 PRINT
23 PRINT
24 GOSUB 3000
25 PRINT "ENTER NAME OF FILE";
30 INPUT FILE$
95 STPAGE = 0
96 LNPGS = 16
97 LFROM = 128
100 PRINT
165 PRINT "TURN ON FROB BURNER"
167 PRINT
170 PRINT "PRESS RETURN WHEN READY TO WRITE DISK";
180 INPUT A$
185 GOSUB 1000
190 PRINT D$;"BSAVE",FILE$,"A$8000,L$1000"
195 PRINT
200 PRINT "SAVE PROCESS COMPLETE"
205 PRINT
210 PRINT "TURN OFF FROB BURNER"
500 END

1000 REM FROB UPLOAD ROUTINE
1010 POKE PM + 18,FSLOT
1020 POKE PM + 19,LFROM
1030 POKE PM + 20,LNPGS
1040 POKE PM + 21,STPAGE
1050 CALL PM + 51
1060 RETURN

3000 REM COMPUTE ADDRESSES OF CARD IO STUFF
3001 PRINT "WHAT SLOT IS THE FROB IN";
3005 INPUT FSLOT
3010 IF FSLOT < 1 THEN 3100
3020 IF FSLOT > 7 THEN 3100
3030 RETURN
3100 PRINT "THE FROB MUST BE IN A SLOT NUMBER 1-7"
3110 GOTO 3001
```

J

SOURCE FILE: PMOVE