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**HP 64000
Logic Development
System**

**Model 64500A
Prom Programmer
Reference Manual**



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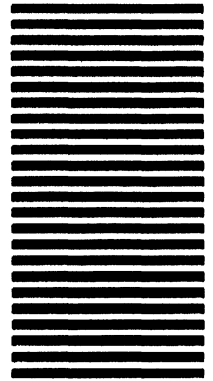
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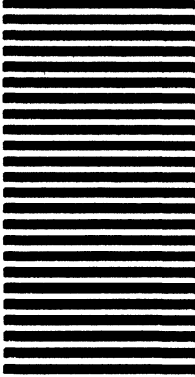
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GROUND THE INSTRUMENT.

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

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Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

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Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

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SAFETY SYMBOLS

General Definitions of Safety Symbols Used on Equipment or in Manuals.



Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



OR



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



OR



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

WARNING

The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed, could result in injury or death to personnel.

CAUTION

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NOTE :

The **NOTE** sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.



OPERATING MANUAL

**MODEL 64500S
PROM PROGRAMMER
REFERENCE MANUAL**

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Chapter 1

PROM PROGRAMMER

INTRODUCTION

This manual provides instructions for installing and operating the Model 64500S PROM Programmer option. The first part of the manual describes the Model 64500S PROM Programmer option and shows you how to install it in a Model 64100 terminal. The PROM Programmer is not compatible with the Model 64110A terminal. All of the error messages that can be displayed by the PROM Programmer are listed and described at the end of this manual.

DESCRIPTION

The Model 64500S PROM Programmer option provides the capability to program, verify, and read popular bipolar and MOS PROM's. A PROM Programmer consists of a 64502A PROM Interface Module, A 64501A Control Card, a special cable (HP Part No. 8120-4336), and a choice of unique personality PROM modules. The PROM Programmer includes circuitry for the operator self test and for the service self test.

Table 1 lists power supply requirements of the PROM Programmer option. This information will help you determine how many circuit cards can be loaded into the card cage of your terminal.

Table 1. PROM Programmer Power Requirements

Power Supply	+40V	+12V	+5V	-5.2V	-12V
Typical Current	0.38A	.03A	1.07A	.01A	.01A



Before turning on or turning off system power, make sure there are no PROM's or other devices installed in any of the module sockets. Otherwise, the device may be damaged or its program altered.

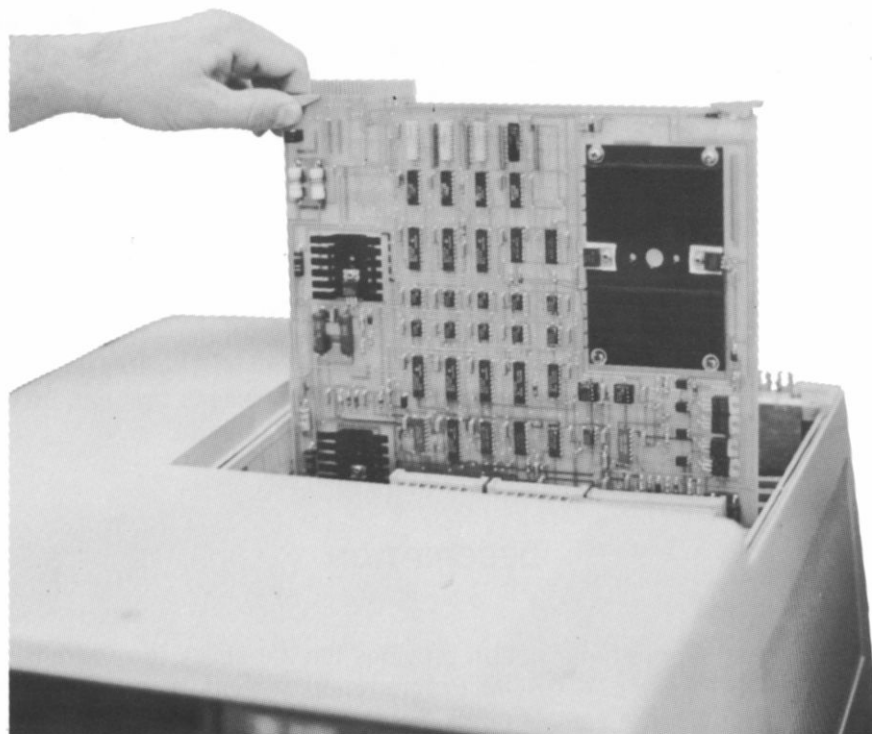
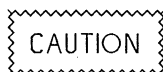


Figure 1. Control Board Installation

INSTALLATION



Turn off station power before installing PC card or connecting personality module.

Control Board Installation

Remove the card cage top lid by loosening the two screws, lifting the back of the lid, and pulling to the rear. Install the Model 64501A driver card in the card cage (component side toward front of instrument) in the card slot closest to the front of the 64100A terminal to minimize cable length problems. This will normally be slot 0 to slot 1 if a 64941A Floppy Disc system is installed.

Connect the single-keyed connector of the PROM cable (HP Part No. 8120-4336) to the top, left-hand connector of the circuit board.

Run the cable across the top of the card cage and down behind the right side of the front panel. Both connectors on the end of the cable should be visible in the well on the right-hand side of the keyboard.

Personality Module Installation

Personality modules come with one or two connectors (see figure 2). The cable can be used with either type. If the module has only one connector, connect it to the end cable connector. This allows the module to seat fully into the well. If the module has two connectors, use both cable connectors.

NOTE

The cable and module connectors are keyed so there is only one way to connect them.

After the cable is connected, place the module in the well and adjust it until it is flush. Turn the hold-down screw clockwise until it is tight.

PROM Installation

To use the PROM Programmer Module, proceed as follows:

1. Before installing PROM in personality module, press the *prom_prog* softkey at the monitor level. This evokes the PROM Programmer Software module, ensuring no unwanted voltages will be present at pins of the personality module.
2. Install PROM into personality module. Pin 1 is identified on each personality module.

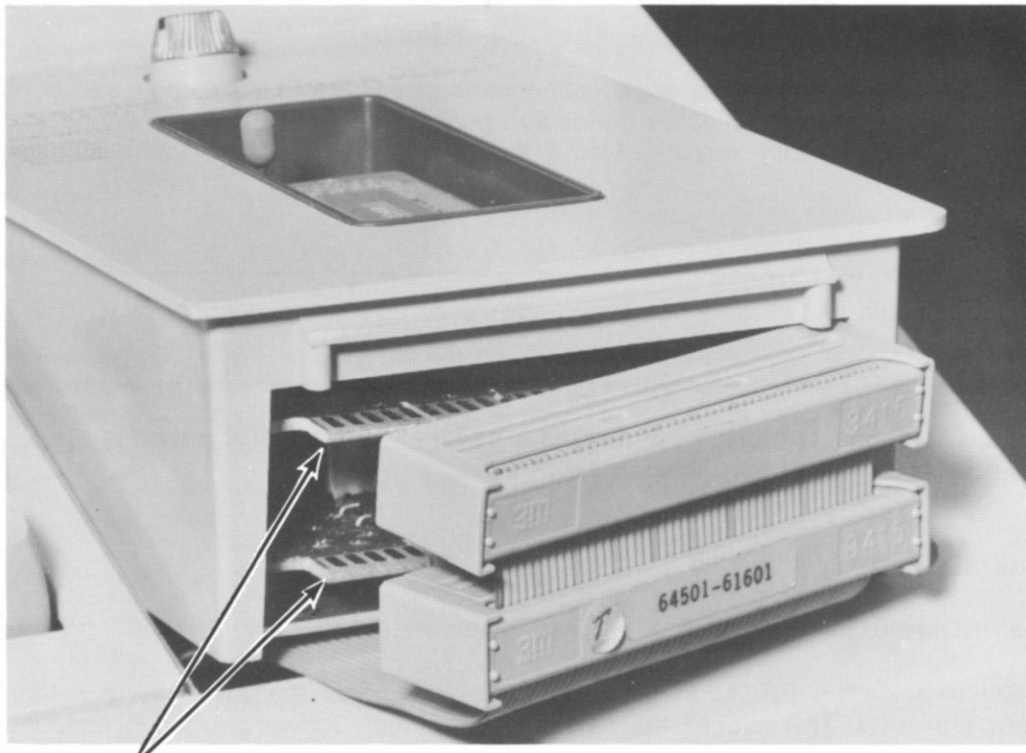


Certain PROM's can be damaged by static electricity. Observe the manufacturer's handling procedures to prevent damage. Verify the correct PROM programmer personality module is installed in the Model 64100.

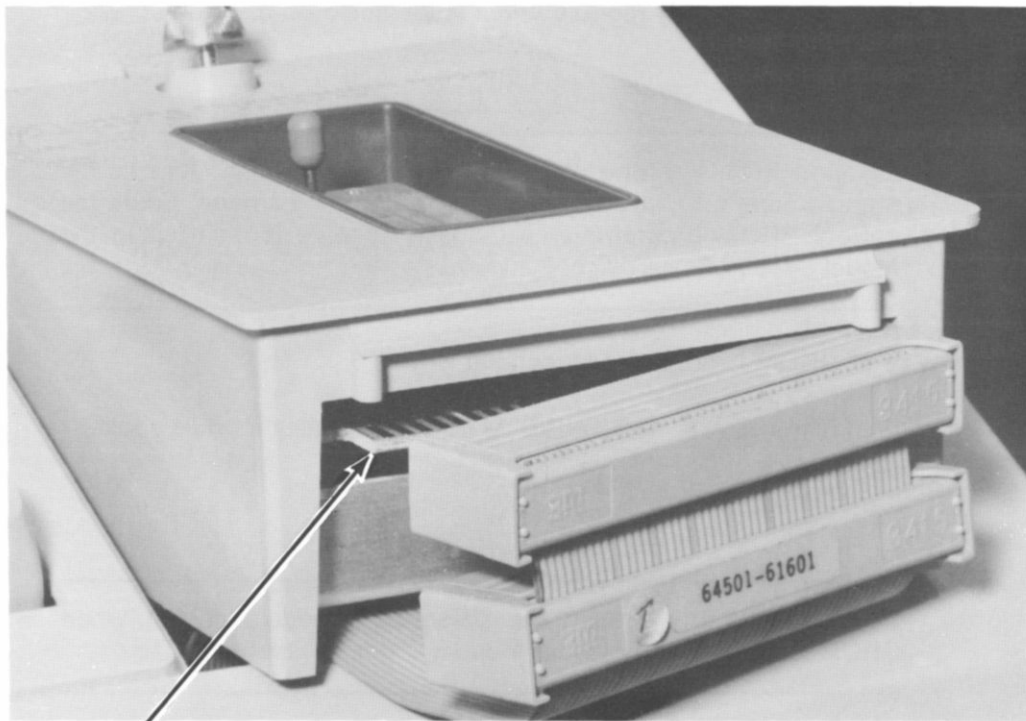
3. Use any or all PROM Programmer functions.
4. After programming session, remove PROM from personality module socket.
5. Exit PROM Programmer Software Module.

NOTE

Do not leave PROM's in the personality module socket when PROM Programmer Software Module is not in use.



CABLE CONNECTOR



SINGLE CONNECTOR

Figure 2. Personality Module Installation

OPERATING THE PROM PROGRAMMER

The following paragraphs describe how to operate the PROM Programmer. First, all of the parameters common to the PROM Programmer softkeys are listed and described. Then the kinds of files used by the PROM Programmer are described. The formula used by the PROM Programmer to calculate addresses and data segments during programming is discussed. Finally, each of the softkeys is described in detail.

Parameters

The following parameters are used by many of the softkeys that appear during PROM Programmer operation.

<ADDRESS>

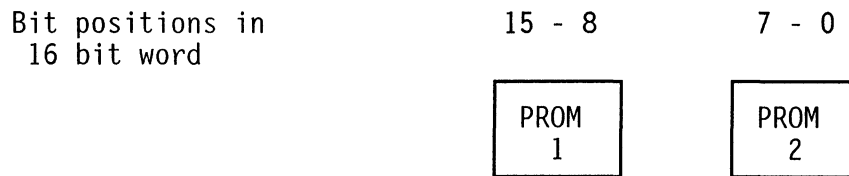
The <ADDRESS> parameter prompts you to specify where the terminal should begin its read or write of PROM data or of the content of the absolute file or the listing file, as applicable. If you make no entry in this field, the terminal will begin with address 0H.

START <ADDRESS>

The start parameter specifies the lowest address in the absolute or listing file, or in the PROM, where programming or reading should begin. The default is 0.

BIT <VALUE>

The bit parameter identifies a single logical unit. You can use this to extract bytes and nibbles from a file whose word size is greater than the PROM size. The bit number identifies the least significant bit of the byte or nibble. For example, if a processor word is 16 bits wide and memory is contained on two 8-bit PROM's, the bit number allows programming these PROM's from the same file as follows:



program_from FILE bit 8 PROM 1, bits 15 - 8

program_from FILE bit 0 PROM 2, bits 7 - 0

The "bit 0" entry was unnecessary in the second line. The default bit value is 0.

ROM_ADDR

The PROM address function permits programming or reading a sub range of the PROM. Normally, programming or reading will affect the entire address range of the PROM, but there are occasions when you may want to affect only a portion of the PROM range. The rom_addr can specify a starting and ending address range in the PROM for programming or reading. In the case of

"rom_addr 5 thru 8", for example, programming or reading will occur in PROM addresses 5 thru 8 inclusive.

NEG_DATA

If the system hardware is constructed using negative logic, it will expect the data to be complemented. In such cases, the neg_data option will perform a ones complement of the data before it is programmed into the PROM and will complement data read from the PROM.

NEG_ADDR

If the hardware expects an address to be negative logic, the programmer can store data at the ones complement of the address given. For example, if data would normally be programmed at PROM address 0, the programmer would store it at the ones complement of the address (in this case, the maximum PROM address).

No_Blank_Check

The PROM Programmer normally performs a blank check of the PROM before programming begins. It places an error message on screen if it finds the PROM is not blank. If your PROM is not blank, but you still want to program it, you can override the blank check feature by using the no_blank_check instruction.

Files Used by PROM Programmer

The PROM Programmer can use two types of files for programming or verifying PROM contents: absolute files and listing files. These two file types are described below.

Absolute files are created by the system linker. They contain information about the processor, the addresses where data is located in memory, and who generated the file. All of this information will be transparent to the user. The programmer is compatible with any microprocessor, regardless of word size.

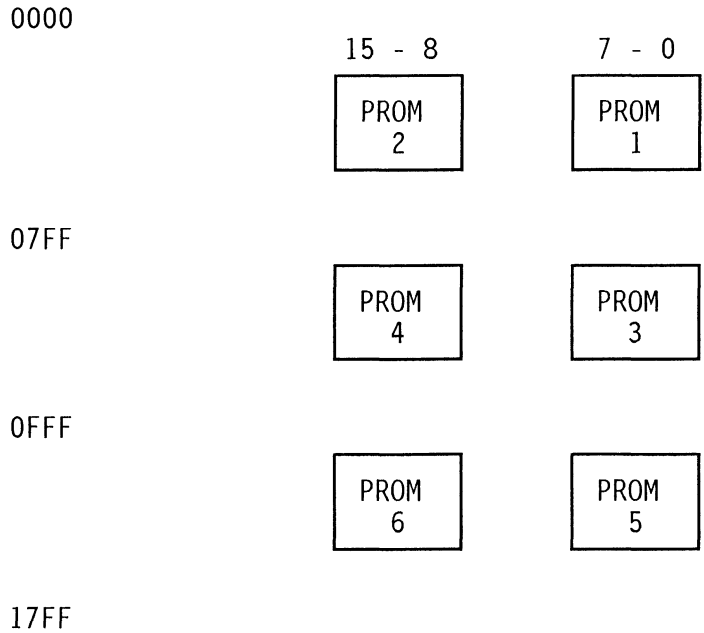
Listing files provide several features within the programmer. For example, they allow the user to see what is in a PROM. By listing a PROM program to a file, it can be reviewed for changes or corrections via the system editor and returned to the programmer for downloading onto a PROM.



Syntax of the listing file is very important to the PROM Programmer. Be careful, therefore, not to change the basic structure of the file. This structure is described in Appendix A of this manual.

The list function has another important feature. It allows the user to generate a memory map which may consist of more that one ROM and cover a 32-bit address space. A list file containing bit widths up to 128 bits wide can be constructed using the bit number function. Also, by specifying the starting address, PROM data can be placed anywhere in the list file, and the existing list data will automatically be updated. For example, if we had a memory which was 6K long by 16 bits wide and we wanted to construct a file reflecting the memory shown below, we would issue the following commands to construct the list file:

```
list_rom_to LIST start 0000H bit 0   for PROM 1
list_rom_to LIST start 0000H bit 8   for PROM 2
list_rom_to LIST start 0800H bit 0   for PROM 3
list_rom_to LIST start 0800H bit 8   for PROM 4
list_rom_to LIST start 1000H bit 0   for PROM 5
list_rom_to LIST start 1000H bit 8   for PROM 6
```



Relationship of the File Address and PROM Address

There are three basic formats for programming a PROM with the PROM Programmer. The three formats are shown in figures 3 through 5 and discussed in the following paragraphs. All of the programming functions discussed are transparent to the user, but some explanation of how the PROM Programmer handles each of these formats will be helpful.

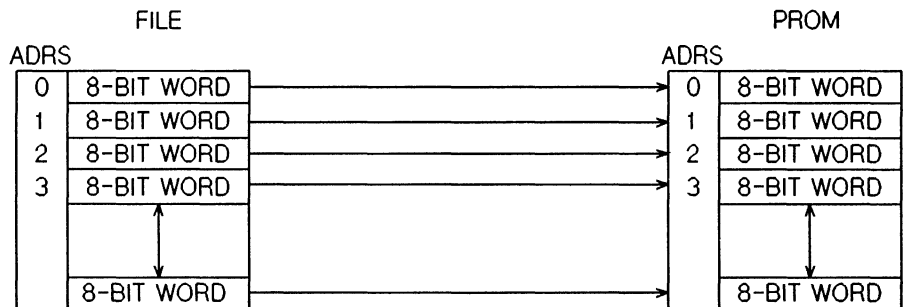


Figure 3. Programming a Single PROM where the File Addresses are the same as the PROM Addresses

Figure 3 shows the programming of a PROM where the word size in the file is the same as the word size of the PROM. In this case, you insert the PROM in the Personality Module, press the *program* softkey, and type in the name of your file. When you press **(RETURN)**, the terminal will automatically take the data word from file address 0 (bit-by-bit) and program it into PROM address

0. Then it will take the word from file address 1 and program it into PROM address 1. It will continue this process until it reaches the end of the file.

Parameters are available in the PROM Programmer to help you overcome special programming problems. The parameters can be used as follows:

- a. In the case where your file is too large to be contained in one PROM, you will have to distribute blocks of your file over two or more PROM's. You can program your first PROM from the file address 0, but subsequent PROM's will have to be programmed from addresses located further into the file. The *start* <ADDRESS> parameter is provided to help you accomplish this task. When you include a *start* <ADDRESS> in your command, the first word taken from the file will not come from address 0. Instead, it will come from the file address you specify. The next word will be taken from <ADDRESS>+1, and the word after that from <ADDRESS>+2, etc.
- b. There is also a parameter that lets you program a portion of the available space in the PROM without programming the entire PROM. You can specify the address where programming will start in the PROM. You can also format the command as <value> thru <value> if you want to program a limited portion of the center of the PROM without affecting the content of either end of the PROM. The parameter to use for this requirement is the *rom_addr* <value> in your command, the first word taken from your file will be programmed into the PROM at PROM address <value>. The next word taken from your file will be programmed into PROM address <value>+1, etc.
- c. You can use the *start* and *rom_addr* parameters together to program activity starting at any file address and any PROM address.

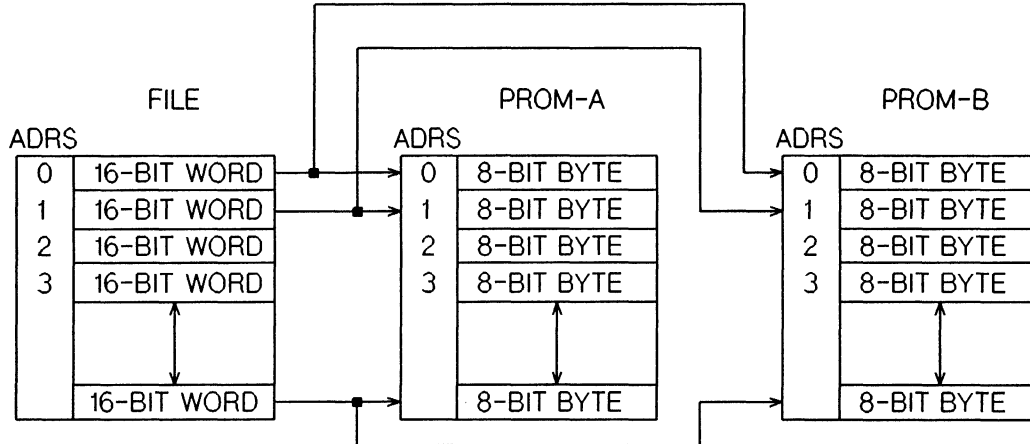


Figure 4. Programming Multiple PROM's where the File Address is the same as the PROM Address

When you are programming a set of PROM's like those shown in figure 4, you can only program one of the PROM's at a time (you might program PROM-A first and then program PROM-B next). To accomplish this programming, you will need to use the *bit* <value> parameter. To program PROM-A, you can simply specify a command of *program* <the name of your file> **(RETURN)**. The PROM Programmer will program bits 0 through 7 of each word into the PROM and send bits 8 through 15 of each word to a location unrecognized by the Programmer Module.

Then you will need to add the *bit* <value> parameter to your command before you can program the next PROM. This time your command line will read *program* <the name of your file> *bit* <8>

RETURN. This command will cause the PROM Programmer to send bits 0-7 of each word to a location unrecognized by the Programmer Module and begin programming into the PROM with bit 8 of each word. The PROM Programmer reads every bit each time it goes through your file but it only enters the specified bits into the PROM.

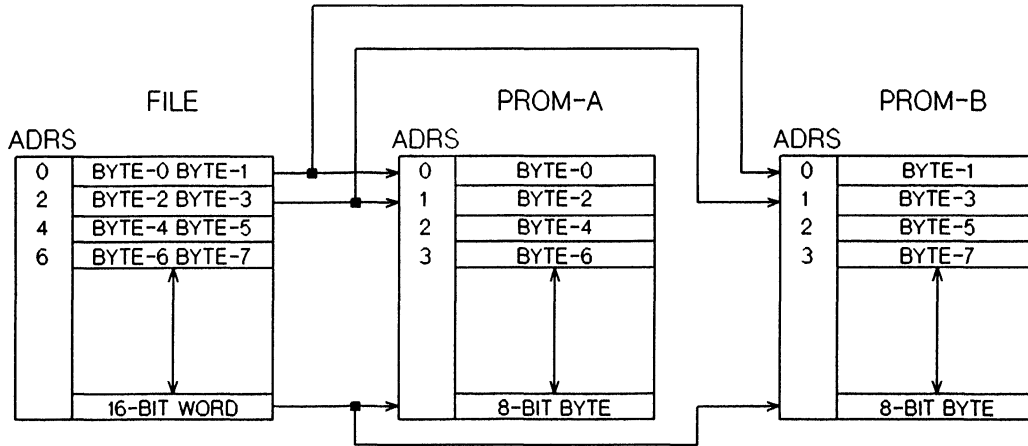


Figure 5. Programming Multiple PROM's where the File Address is different from the PROM Address

When you are programming PROM's in a situation like figure 5, you may find that the data is programmed into PROM addresses which are different from the addresses you expect to see. As shown above, you would find the first byte of the word at file address 200H programmed into PROM address 100H.

In figure 5, the PROM Programmer divides each word in your file into bytes and programs the bytes into consecutive PROM locations. The PROM Programmer accomplishes this task by making multiple passes through the file. On the first pass, the PROM Programmer will take all of the even numbered bytes and program them into PROM-A. It will send the odd-numbered bytes of each word to addresses which are not recognized by the Programmer Module. You must insert the other PROM into the Programmer Module before you start the next pass. Then the PROM Programmer will program PROM-B.

When it finishes programming a PROM address, the PROM Programmer will calculate the next PROM address to be programmed by using the formula shown in figure 6. The formula that was chosen to calculate the next address is universal. It will calculate correct PROM addresses for any programming arrangement, regardless of the size of the file word or the size of the PROM bytes. At the end of each pass through the file, the rom_addr parameter is incremented by 1 to begin the next pass through the file at the proper byte address in the file.

$$\text{PROM address} = (\text{file address} - \text{file start}) \times (\text{address base}/\text{word size}) + \text{rom_addr}$$

Where:

PROM address = next address to be programmed in PROM.

file address = address in file where next data unit will be obtained.

file start = first file address where data was taken for PROM programming during present run.

address base = smallest unit of data the processor can address.

word size = number of bits addressing a data word for the processor.

rom_addr = PROM address offset where first byte was programmed during the present run.

Figure 6. Formula PROM Programmer uses to calculate Next Addresses during programming.

To format your commands when programming PROM's that correspond to figure 5, use the following procedure:

1. Insert the first PROM to be programmed into the Programmer Module.
2. Enter *program* <the name of your file> *bit* 0, and press **(RETURN)**.
3. PROM_A will be programmed automatically with the correct set of bytes from your file.
4. Remove PROM-A.
5. Insert PROM_B.
6. Enter *program* <the name of your file> *bit* 8, and press **(RETURN)**. PROM_B will be programmed with the corresponding set of bytes from your file.

NOTE

You can program a set of PROM's with more that two PROM's in the set by using the PROM Programmer. Simply repeat steps 2 through 6 of this procedure, and select the correct bit numbers until all of your PROM's are programmed.

Softkeys Used by the PROM Programmer

Table 2 lists each of the softkeys that is used in the operation of the PROM Programmer, and describes their functions. On the pages following table 2, each of these softkeys is discussed in detail.

Table 2. PROM Programmer Softkeys

Softkey Name	Function Selected
program	Causes the terminal to program and verify your PROM from the absolute file or listing file you specify.
verify	Causes the terminal to compare the data in your PROM with the data in the absolute file or listing file you specify.
list_rom	Causes the terminal to create a list of the content of your PROM either on the printer or in a listing file.
display	Causes the CRT to display the data at any PROM location you specify. Press display again to exit this selection.
check_sum	Causes the terminal to display a 32-bit total of all data stored either in your PROM or in the file you specify.
prog_loc	Causes the terminal to program only the PROM address you specify.
read_loc	Causes the terminal to read only the PROM address you specify.

program

Syntax

```
program_from <FILE> [parameters]
```

Parameters

:absolute	identifies the program source as the absolute file.
:listing	identifies the program source as a listing file.
bit <value>	least significant bit of data unit (default 0).
rom_addr <value> thru <value>	PROM sub range (default entire range of PROM).
neg_data	negative logic for data (default positive logic).
neg_addr	negative logic for address (default positive logic).
no_blank	turns off the automatic blank_check feature.

Function

This function programs a PROM from either an absolute or a listing file. Each time a location is programmed, the location is read and compared to the file data. If the comparison does not match, the location is reprogrammed and compared again in an attempt to match the file data. This will occur five times. After the fifth try, the programmer will stop and display a message on the status line stating that the programming function has failed, and programming will stop. If no programming errors occur, the PROM will be programmed and an automatic verification of the PROM will be performed to make sure that programming one location did not affect any others.

verify

Syntax

```
verify_from <FILE> [parameters]
```

Parameters

:absolute	identifies the file as the absolute file.
:listing	identifies the file as a listing file.
start <ADDRESS>	starting file address (default 0).
bit <value>	least significant bit of data unit (default bit 0).
rom_addr <value> thru <value>	PROM sub range (default entire range of PROM).
neg_data	negative logic for data (default positive logic).
neg_addr	negative logic for address (default positive logic).
listfile	list locations which fail verify.

Function

The verify command will compare file data with data in the PROM and report the number of failures on the status line. If the PROM verifies, the status will read:

Verify complete, no errors

If the PROM does not verify, the number of failures will be displayed on the status line. If you specify a list file, a summary of the failures will be listed with PROM address, PROM data, and file data. If the verify does not find any data in the range specified, and warning message will be displayed stating that no locations were verified.

list_rom

Syntax

```
list_rom_to <FILE> [parameters]
```

Parameters

- start <ADDRESS> starting file address (default 0).
- bit <value> least significant bit of data unit (default 0).
- rom_addr <value> PROM sub range (default entire range of PROM).
thru <value>
- neg_data negative logic for data (default positive logic).
- neg_addr negative logic for address (default positive logic).

Function

The list instruction allows the user to obtain a list of PROM contents by listing them to a file or to the printer directly. The list file can then be edited and used to construct memory maps of several PROM's. (Refer to paragraph entitled "File Data".)

display

Syntax

```
display <ADDRESS>
```

Parameters

<ADDRESS> starting address of data display, default 0.

Function

The display command will show the hex value of data stored at each location in the PROM. Press display again to exit this mode.

check_sum

Syntax

```
check_sum rom [parameters]
```

Parameters

rom_addr <value> PROM sub range (default entire range of PROM)
thru <value>

neg_data negative logic for data (default positive logic)

neg_addr negative logic for address (default positive logic)

Syntax

```
check_sum <FILE> [parameters]
```

Parameters

:absolute identifies the file as the absolute file.

:listing identifies the file as a listing file.

start <ADDRESS> starting file address (default 0).

bit <value> least significant bit of data unit (default bit 0).

rom_addr <value> PROM sub range (default entire range of PROM).
thru <value>

neg_data negative logic for data (default positive logic).

neg_addr negative logic for address (default positive logic).

Function

The check sum is a 32-bit sum of all data in the specified range in the PROM or from the file.

prog_loc

Syntax

```
program_location <address> to <value> [parameters]
```

Parameters

neg_data negative logic for data (default positive logic).

neg_addr negative logic for address (default positive logic).

Function

This function permits the programming of one location at a time and is useful when dealing with check sums. The address specified must be in the PROM address range, and the lower 4 or 8 bits of the value must be used. The programmer will try to program the location without checking to see if it is a blank or not; then it will read the location back and compare data. The status line will tell if the location programmed or not.

NOTE

This function should not be used on any PROM which requires several passes through the address range to program it (such as the 2708).

read_loc

Syntax

```
read_location <ADDRESS>
```

Parameters

- neg_data negative logic for data (default positive logic).
- neg_addr negative logic for address (default positive logic).

Function

This function will read the content at the specified address, and display the data on the status line.

PROM PROGRAMMER SELF-CHECK

NOTE

Model 64502A Personality Module must be connected to run this test.

To evoke the PROM programmer self-check, proceed as follows:

1. At the system monitor level, press the *opt_test* softkey and press **(RETURN)**. The display will show a list of modules that offer Option Performance Verification, and identify the slots where each is located.
2. Press the number key on the keyboard corresponding with the Slot # of the Prom Programmer, and press **(RETURN)**. The top of the display will show "Prom Programmer Performance Verification". The bottom of the display will show "STATUS: Awaiting option_test command."
3. Press the *cycle* softkey. The system will perform each of the tests in sequence. It will count the number of tests performed, and count the number of test failures (if any).
4. You can perform any of the tests singly, if desired. Press *next_test* as required to move the bright bar to the desired test on screen. Then press *disp_test* to get the single-test mode.
5. Press the *start* key to run the test. Press it again to stop the test.
6. Press the *exit_test* key to return to the full list of prom programmer performance verification tests.
7. Press the *print* key anytime you want to obtain a copy of the present display on an associated printer, if available.
8. Press *end*. This completes the operator's self-check. For a detailed description of the performance verification tests, refer to the PROM Programmer Service Manual.

Table 3. PROM Programmer Error Messages

<p>Bit number too large</p> <p>Bit number specified is too large</p>
<p>Blank check failed</p> <p>PROM is not blank.</p>
<p>Ending rom address too large</p> <p>Specified end address is greater than maximum address.</p>
<p>Error found while reading listing file</p> <p>This message indicates that an error was found in the list file. The error was probably made while editing the list file.</p>
<p>File prom:HP not present</p> <p>This message indicates that the prom programmer software is not present on the system disc.</p>
<p>Mapping error</p> <p>During programming, data was sent to an address specified as illegal in your memory map.</p>
<p>More than one prom card in cage</p> <p>Two or more cards in cage. There must be only one.</p>
<p>No control card in card cage. Power down and insert card.</p> <p>Control card not plugged in. Turn off station power and start again.</p>
<p>Programming error: prom address=XXXXH, data=XXH, file data=XXH</p> <p>The indicated location failed to program. Contents of the PROM are displayed along with data from the file which should have been programmed in that location.</p>

Table 3. PROM Programmer Error Messages

Prom module not recognized

The socket is not recognized by the software. This message indicates that there is either a hardware error, or that the software does not recognize a new socket. In the latter case, a software update will be necessary.

Socket module not connected

Socket is not connected to PROM Control Card. Check cables.

Starting rom address too large

PROM address is greater than maximum address.

Test voltage overload, check prom or socket

When programmer is initialized, the socket is checked to see if it is drawing too much current. If this error message occurs, it indicates there is either a hardware problem, or the PROM is plugged in upsidedown.

User memory

During programming, data was sent to an address specified as user memory in your memory map.

Verify failed XXXX times

This message indicates the file data and PROM data did not match during the verify command.

Warning. No file data found in address range.

When verifying a file, if none of the file data is mapped into the PROM space, this message will be displayed.

64502A prom module ID not detected - only ID test may be run.

This message is displayed when the PROM Programmer self test detects any PROM socket other than a 64502A Programmer Module installed. Only the 64502A Programmer Module is capable of handling the voltage produced during performance verification. See service manual.

NOTES

Appendix A

PROM LISTFILE FORMAT

The list option of the PROM Programmer can be used to list the contents of a PROM to the printer or to a listfile. The PROM Programmer can also program PROM's from listfiles, if the listfiles have been created in a particular format. The format that the PROM Programmer uses to create listfiles and/or to program PROM's is as follows:

```
<ADDRESS> data data data data data, etc
```

The listfile <ADDRESS> is similar to an address in an absolute file. It indicates that the next piece of data will reside at the address specified:

Example:

```
<0000> 00 01 02 03 04 05 06 07 08 09 0A 0B 0D 0E 0F
```

Here, the file address is <0000> and the data in that location is 01, etc.

Listfiles, like their absolute file counterparts, can range in width from 8 to 128 bits. In cases where more than one PROM is required to create the word width for a processor, the PROM Programmer can still create a single listfile to store the program, as described above. The number of characters in the data field of your command tells the PROM Programmer the size of the data word. For example, if you are using two 8-bit ROM's to store 16-bit words, you might issue the following command:

```
list_rom_to<FILE>start 0 bit 0
```

You might get the following listfile:

```
<0000> 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F  
<0010> 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
```

This listing would contain the lower 8 bits of each data word. Then by inserting the high order PROM and issuing the following list command:

```
list_rom_to<FILE>start 0 bit 8
```

The listfile might appear as follows:

```
<0000> 0000 0101 0202 0303 0404 0505 0606 0707 0808 0909 0A0A 0B0B 0C0C  
<000D> 0D0D 0E0E 0F0F 1010 1111 1212 1313 1414 1515 1616 1717 1818 1919
```

In this example, the data stored in the upper 8 bits of each location is the same as the data stored in the lower 8 bits. Note that there are four characters in each data word. This indicates that the data width is 16 bits, each character represents 4 bits. The starting addresses are automatically adjusted in the listing because fewer data words can be shown on one line.

NOTES

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25026 **BESANCON** Cedex
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Schmidt & Co. (Hong Kong) Ltd.
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Telex: 0155645
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Telex: 46748 BERSAL IA
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BERCA Indonesia P.T.
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Telex: 31146 BERSAL SB
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Telex: 30439
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Kilmore Road
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Telex: 30439
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P.O.Box 1270

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JERUSALEM 94467
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Computation and Measurement
Systems (CMS) Ltd.
11 Masad Street
67060

TEL-AVIV
Tel: 388 388
Telex: 33569 Motil IL
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Hewlett-Packard Italiana S.p.A.
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Via C. Colombo 49
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Telex: 322116
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3-1 Hon Chiba-Cho
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