EPSON

PX-4 OPTION

PROM Writer Cartridge

OPERATING MANUAL

Y20699101300

ERRATA SHEET

(Page 6)

1. Program execution
   (1) PROM write mode (the mode varies depending on the size of the PROM in use).

PROM Size	Size of Internal RAM Disk + User BIOS (CP/M Size)
64 Kbit	33.5 Kbytes or less (22 K)
128 Kbit	25.5 Kbytes or less (30 K)
256 Kbit	9.5 Kbytes or less (46 K)

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(2) EPSON ROM Capsule mode

All ROMs	14 Kbytes or less (41.5 K)

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2.1 Program Execution

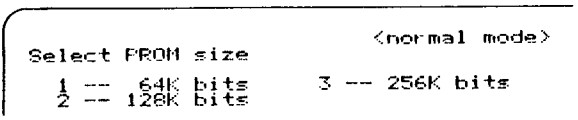
1. After program execution: (See subsection 1.5, 'Program Execution' in Chapter I.)

```
  PROM WRITER CARTRIDGE  version 2.0
< Press ESC to restart, STOP to exit.>
 Select mode
   1 -- Normal PROM writer mode
   2 -- EPSON format PROM writer mode
```

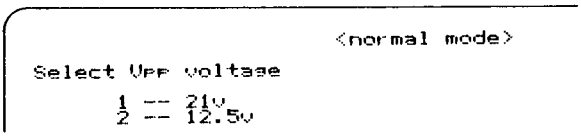
Select 1.

Y20699100100

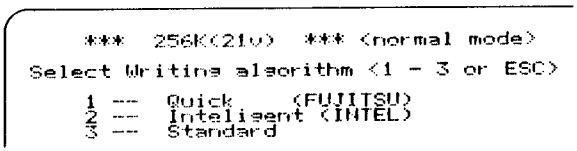
2. (1) The screen below will be displayed, so select the PROM size using the numeric keys.



(2) Select the writing voltage using the numeric keys (see APPENDIX).



3. Next select the writing program:



- Quick (FUJITSU):
  This is the high-speed Writing program of FUJITSU.
- Intelligent (INTEL):
  This is the high-speed Writing program of INTEL.
- Standard:
  This standard Writing program is comparatively slower than the above two Writing programs.

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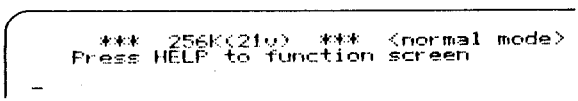
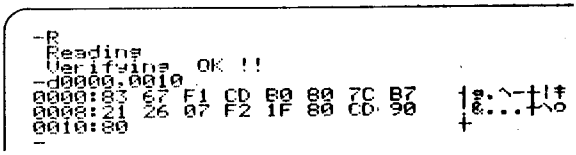
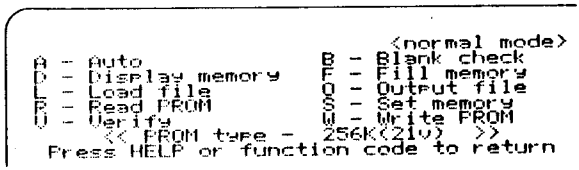
4. The Command Input screen is displayed:



(1) Input a command after the '-' prompt:

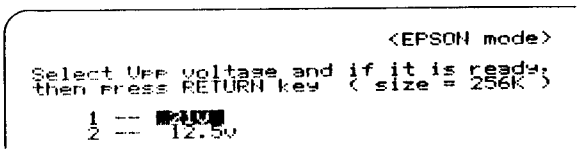


(2) During the status where the prompt is displayed (requesting command input), pressing the [HELP] key will display the Command List:



(Page 24)

8. Select the writing voltage using the numeric keys (see APPENDIX).



Select the writing voltage of 21V or 12.5V in accordance to the PROM type. The selected writing voltage will be indicated in reverse display.
After selection, press the [RETURN] key.

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EXCHANGE THE WHOLE SENTENCES AND THE CHART.

Writing program and writing voltage for each type of PROM are as follows.

For PROM types not listed below, make sure to use the appropriate writing voltage and Writing program by referring to the OPERATING MANUAL or other related materials.

Maker	PROM Model No.		Writing Program		Vpp
FUJITSU	MBM	2764	Ⓢ	Ⓠ	21V
		27C64	Ⓢ	Ⓠ	21V
		27128	Ⓢ	Ⓠ	21V
		27C256	Ⓠ		21V
		27256	Ⓘ		12.5V
NEC	μPD	2764D	Ⓢ	Ⓘ	21V
		27C64D	Ⓢ	Ⓘ	21V
		27128D	Ⓢ	Ⓘ	21V
HITACHI	HN	482764G	Ⓘ	Ⓢ	21V
		27C64G	Ⓘ	Ⓢ	21V
		4827128G	Ⓘ	Ⓢ	21V
		27C256G	Ⓘ		12.5V
INTEL		2764	Ⓢ	Ⓘ	21V
		2764A	Ⓘ		12.5V
		27128	Ⓢ	Ⓘ	21V
		27128A	Ⓘ		12.5V
		27256	Ⓘ		12.5V
TOSHIBA	TMM	2764DI	Ⓢ	Ⓘ	21V
		27128D	Ⓢ	Ⓘ	21V
		27256D	Ⓠ		21V
	TC	57256D	Ⓠ		21V
MITUSBISHI	M5L	2764K	Ⓢ	Ⓘ	21V
		27128K	Ⓢ	Ⓘ	21V

Ⓠ Quick Ⓘ Inteligent Ⓢ Standard

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Introduction

In addition to being able to use your new PROM Writer Cartridge just like any other regular PROM writer, it also possesses the ability to write files using the file formats unique to EPSON hand-held computers.
We are sure you will be able to make abundant use of, and gain plenty of pleasure from, the compact, low-priced PROM Writer system realized through the combination of the EPSON PX-4 Hand-held Computer and this PROM Writer Cartridge.

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- The above notwithstanding, EPSON can assume no responsibility for any errors in this manual or their consequences.

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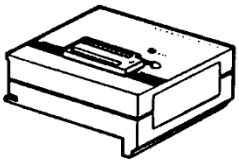
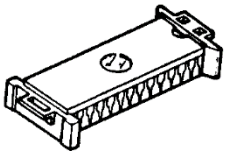
Nagano, Japan

Take everything out of the box your new PROM Cartridge comes in and check to be sure all of the following are included:

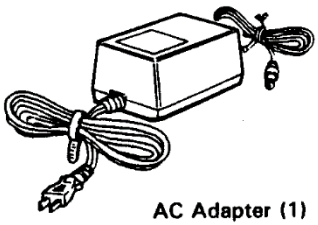
Instruction Manual (1)



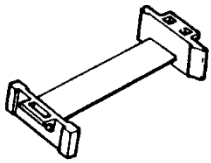
PROM Writer Cartridge (1)



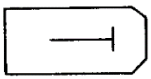
Program ROM (1)



AC Adapter (1)



ROM Carrier (3)

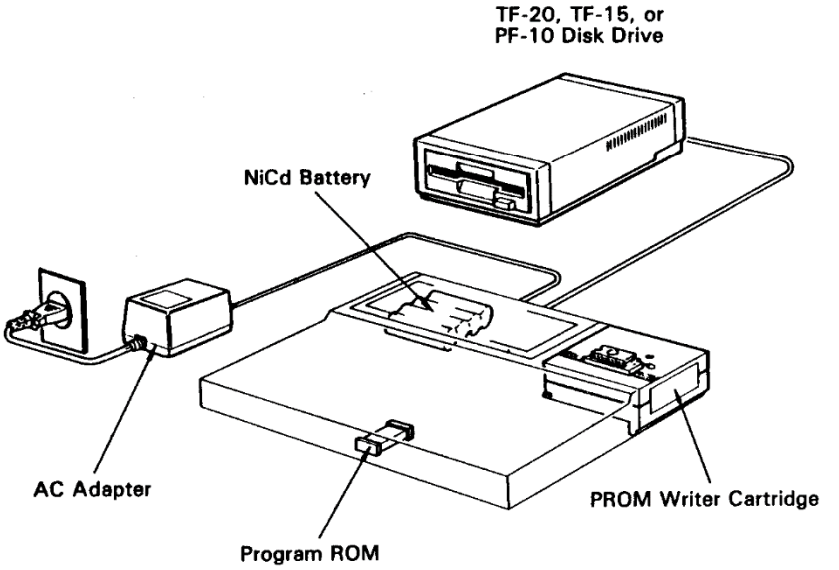


Guarantee Papers

Chapter I. System Configuration

1.1 System Outline

In other to get your PROM Writer System in operation, the component units illustrated below are necessary:



* Disk Drives are necessary when data written into the PROM is to be stored on disk; an external RAM disk can also be used.

Mounting and/or installation of the above component units will be subsequently explained in the following order:

1) how to mount the PROM Writer Cartridge;

2) how to install the Program Cartridge;

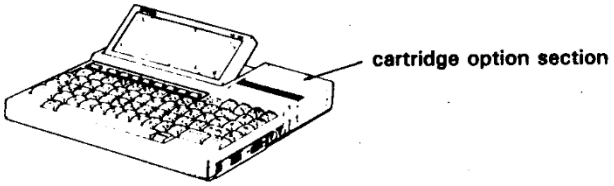
3) how to connect the AC Adapter;

4) how to setup for program execution.

1.2 How to Mount the PROM Writer Cartridge

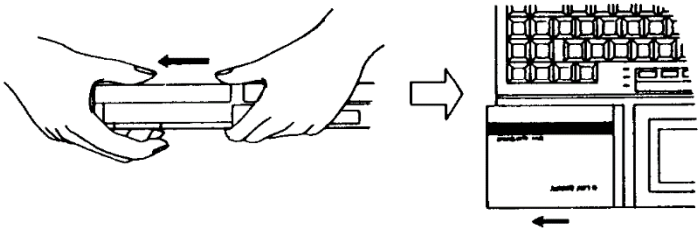
1. Switch your PX-4's power switch OFF.

2. Carefully observing the steps explained below, remove the dummy cartridge (or any optional cartridge which may otherwise be installed) from the cartridge option section of your PX-4.

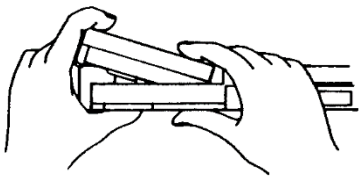


(1) There is a cartridge lock button ("LOCK/FREE") located on the underside of your PX-4; push it in the direction of the arrow to free the installed cartridge.

(2) Holding the cartridge as shown in the illustration below, slide it in the direction of the arrow. Removal can be made easier by placing a finger on the round knob to get better hold of the cartridge, and pushing against it with the thumb of the other hand.

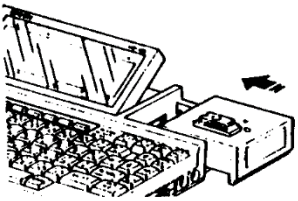


(3) Then push up on the cartridge through the hole provided in the button of the host unit to remove it.

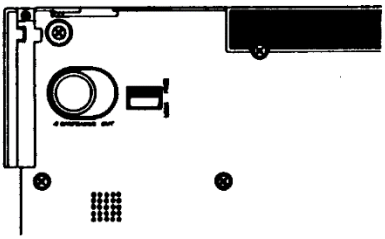


3. To mount your new PROM Writer Cartridge, carefully observe the following steps:

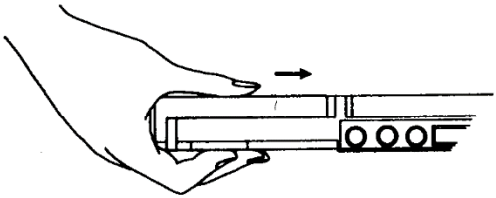
(1) First, place the PROM Writer Cartridge into the cartridge option section as shown in the illustration below.



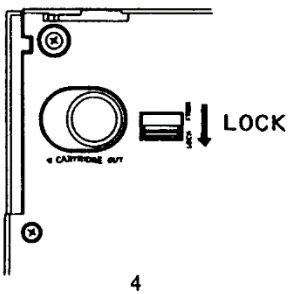
Before proceeding any further, turn the PX-4 over and look at the back to be sure that the knob on the bottom of the cartridge fits into the hole on the underside of the host unit in the manner illustrated below.



(2) Next, place the palm of your hand against the cartridge and, with uniform speed and strength, slowly slide it in the direction of the arrow shown in the illustration below. At the same time making sure the connector plug fits properly into its socket.



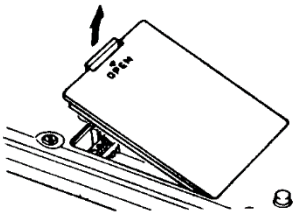
(3) After making sure there are no gaps between the cartridge and the host unit, put the cartridge lock bottom ("LOCK/FREE") in the LOCK position.



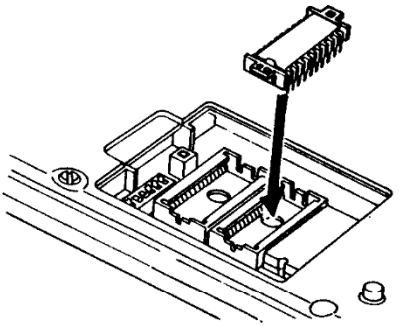
1.3 How to Install the Program ROM

The following steps explain how to install the Program ROM into the PX-4.

1. First, open the ROM capsule box located on the underside of the PX-4.



2. As shown in the illustration below, plug the ROM into either one of the sockets (which one doesn't matter; it is however advisable to remember which socket, B or C, for later reference), making sure to insert it with it facing in the proper direction.



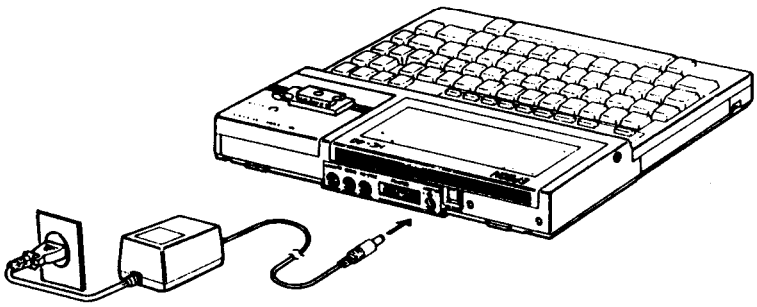
3. Replace the cover to the ROM capsule box and close it.

The Program ROM contains the following four program files:

ROMWRITE.COM
ROMWRT1.OVR
ROMWRT2.OVR
ROMWRT3.OVR

1.4 How to Connect the AC Adapter

The included AC Adapter must be connected to your PX-4 and used for supplying power when the PROM Writer Cartridge is in use; the PROM Writer Cartridge may not operate properly if only dry batteries or the NiCd battery are used.



The NiCd battery should nevertheless be in place when operating the PX-4 with the PROM Writer Cartridge.
Also please note that AC adapters other than the one included with the PROM Writer Cartridge cannot be used in combination with it.

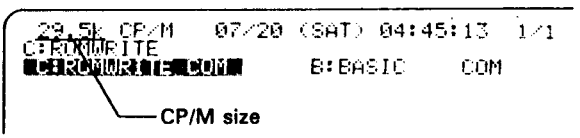
1.5 Program Execution

1. Reserving Program Area
   Before operating your PROM Writer Cartridge, you must first reserve enough work area by adjusting the sizes of the RAM disk and User BIOS areas. When using an external RAM disk, internal RAM disk size is set at 0.

   (1) PROM Writer Modes (Mode varies according to size of PROM to be used.)

PROM Size	Internal RAM Disk + User BIOS Size (CP/M Size)
64k bit	34k byte or less (21.5k)
128k bit	26k byte or less (29.5k)
256k bit	10k byte or less (45.5k)

NOTE: The numerical value displayed in the left corner of the menu screen represents the CP/M size. If the value displayed is greater than the one specified above, you will not be able to execute a program.



(2) EPSON ROM Capsule Mode

All ROMs	21k byte or less (34.5k)

2. Program Execution

(1) Turn the PX-4's power switch ON.

(2) Call up the ROMWRITE.COM program by indicating the appropriate drive (B: or C:, depending on which socket you plugged the Program ROM into) and:

* Menu Screen

```
 29.5k CP/M   07/20 (SAT) 04:45:13  1/1
C:ROMWRITE
C:ROMWRITE.COM      B:BASIC    COM
```

moving the cursor to ROMWRITE and pressing the RETURN key.

* CP/M Screen

```
A>C:ROMWRITE
```

(3) The Initialization Screen will be displayed:

```
  PROM WRITER CARTRIDGE  version 2.0
< Press ESC to restart, STOP to exit.>

 Select mode
   1 -- Normal PROM writer mode
   2 -- EPSON format PROM writer mode
```

here, you select either 1 or 2.

* Selecting "1" will put you into the normal PROM Writer mode; for details, see Chapter II.
* Selecting "2" will put you into the EPSON format PROM Writer mode for generating PROM programs on the EPSON PX-8 or PX-4. For further details, see Chapter III.

Errors which can occur when starting up:

Error Message	Cause	Corrective Measures
Incompatible computer press any key	Attempt was made to execute on computer other than PX-4.	See Section 1.2
Interface unit not mount press any key	PROM Writer Cartridge has not been installed.	
Too small user area size press any key	Program area is too small; program cannot be loaded completely.	See Section 1.5

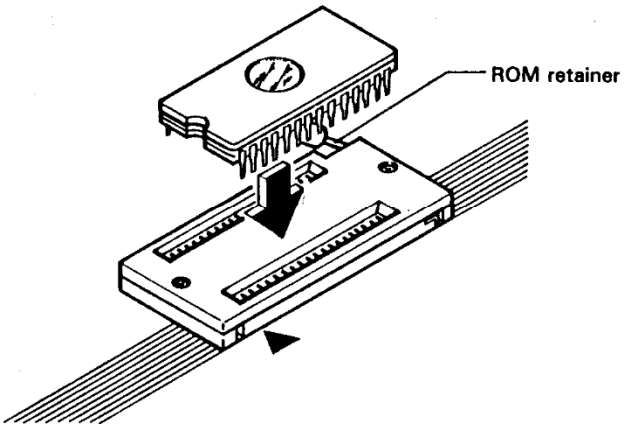
If any of the above errors should occur, press any key to abandon program and warm boot. After correcting the cause, re-attempt to start up ROMWRITE.COM

How to set the Program ROM

Position the ROM so that the round indent faces the direction of the arrow and set it.

After setting the ROM into place, close the ROM retainer.

Stand the ROM retainer upright before setting the ROM.



The red LED on top of the PROM Write Cartridge lights up to let you know when the cartridge is ON. To avoid serious damage to the ROM and/or your PROM Write Cartridge, never attempt to take out the ROM or remove the cartridge when the LED is glowing.

Chapter II. Normal PROM Writer Mode

In the PROM Writer Mode, the PX-4 can support normal PROM writer functions. By entering the appropriate commands, you can perform such operations as writing data onto ("L"), and reading data from ("R"), the PROM, as well as conducting PROM ~ RAM data comparisons ("V").

2.1 Program Execution

1. After activating the ROMWRITE.COM (see Chapter I, section 1.5 "Program Execution"),

```
 PROM WRITER CARTRIDGE  version 2.0
< Press ESC to restart, STOP to exit.>

Select mode
  1 -- Normal PROM writer mode
  2 -- EPSON format PROM writer mode
```

   select the normal PROM Writer Mode by typing "1".

2. Six PROM types will appear on the display; press the number key corresponding to the PROM type you wish to slect (see APPENDIX for details).

```
                                <normal mode>
Select PROM type

  1 -- 2764          4 -- 27128A
  2 -- 2764A         5 -- 27C256
  3 -- 27128         6 -- 27256
```

3. Next, select one of the following write program algorithms by pressing the pertinent number key.

```
        ***  2764   *** <normal mode>
Select Writing algorythm <1 - 3 or ESC>

    1 --  Quick     (FUJITSU)
    2 --  Inteligent (INTEL)
    3 --  Standard
```

   The PROM type selected in 1 is displayed at the upper most line.

   (a) Quick (FUJITSU)
   FUJITSU high-speed write method

   (b) Inteligent (INTEL)
   INTEL high-speed write method

   (c) Standard
   Standard write method. Every PROM can be written using this method, although substantially longer write time will be required compared to method (a) or (b).

4. ROMWRITE displays the command entry screen.

```
          ***  27C256 *** <normal mode>
   Press HELP to function screen
-
```

(1) Enter a command after the prompt "—".

```
-R
 Reading
 Verifying  OK !!
-D0000,0010
0000:24 44 45 53 54 49 4E 41    $DESTINA
0008:54 49 4F 4E 20 49 53 20    TION IS
0010:52                         R
-
```

(2) A directory of commands will be displayed on the screen if you press the [HELP] key in response to the prompt that ask for a command.

```
                                  <normal mode>
A - Auto                  B - Blank check
D - Display memory        F - Fill memory
L - Load file             O - Output file
R - Read PROM             S - Set memory
V - Verify                W - Write PROM
      << PROM type - 27C256 >>
 Press HELP or function code to return.
```

Pressing the [HELP] key once again or typing a function code will return you to the previous (prompt) screen.

2.2 PROM Writer Commands

1. The following table is a brief summary of the PROM Writer commands (used in the normal mode.)

A	Executes the blank check, write, and verify functions sequentially.
B	Executes blank check.
D	Displays contents of buffer RAM.
F	Fills addresses in the buffer RAM with data dd.
L	Loads file into buffer RAM from floppy disk, RAM disk, etc.)
O	Stores buffer RAM contents in specified file.
S	Rewrites buffer RAM.
V	Compares contents of buffer RAM and ROM.
W	Writes buffer RAM contents into ROM.

2. Normal Command Summary

Command	Format	Function
A	A [addr1, addr2]* where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The A command executes the blank check, write, and verify functions sequentially from address addr1 to addr2. When addresses are omitted, this command checks the entire buffer RAM. During execution, the A command displays the following messages in the order of (1), (2), and (3) on the screen: (1) Blank check OK!! (2) ADDRS RAM Writing XXXX XX (3) Verifying OK!! (1) If an error is found during the blank check, ROMWRITE displays the ROM address in error and the contents of the ROM address in that order. ADDRS ROM XXXX XX ROMWRITE resume the blank check at the next address if the [RETURN] key is pressed. If the [ESC] key is pressed, ROMWRITE returns to the command entry screen. (2) ROMWRITE displays an address and data that is currently being written into that address. (3) ROMWRITE compares the contents of the buffer RAM and ROM and, if a mismatch occurs, displays the address at which the mismatch occurred, the contents of the ROM and RAM addresses in the following format: ADDRS RAM ROM XXXX XX XX ROMWRITE starts verifying at the next address if the [RETURN] key is pressed. If the [ESC] key is pressed, ROMWRITE returns to the command entry screen.

* Descriptions within brackets [ ] can be omitted.
There is no need to input "[,]" into the command line.

Command	Format	Function
B	B [addr1, addr2] where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The B command performs a blank check from address addr1 to addr2. During execution, ROMWRITE displays the following message: Blank check (1) When the command is terminated normally, ROMWRITE displays "OK!!" after the "Blank check" message. (2) When the command is terminated abnormally, ROMWRITE displays the ROM address in error and the contents of the ROM address. ADDRS ROM XXXX XX ROMWRITE resumes the blank check at the next address if the [RETURN] key is pressed. If the [ESC] key is pressed, ROMWRITE returns to the command entry screen.
D	D [addr1 [, addr2]] where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The D command displays the contents of the buffer RAM in PX-4's from addr1 to addr2 both in hexadecimal and ASCII format. When addr1 and addr2 are omitted, this command displays 32 bytes of data starting at the address immediately following the last address displayed with the preceding D command. When only addr2 is omitted, 32 bytes of data starting at addr1 will be displayed. ASCII format data between &H00 to &H1F and &HE0 to &HFF will be shown as period " . ". Display format is shown below. Address (XXXX:) 8 data bytes (XX...XX) ASCII format (XX...X) XXXX: XX...XX XX...X XXXX: XX...XX XX...X Display can be suspended temporarily by pressing the [CTRL]+[S] keys, pressing [CTRL]+[S] again will reactivate display.

Command	Format	Function
F	F addr1, addr2, dd where: addr1 is a hexadecimal number. addr2 is a hexadecimal number. dd is a hexadecimal number.	The F command fills addresses from addr1 to addr2 in the buffer RAM with data dd.
L	L filename [,offset] where: offset is a hexadecimal number	The L command loads the file identified by filename into the buffer RAM at address offset, then write the contents of the file into ROM. Files with a file type of HEX are converted into binary format. When the loading is completed, ROMWRITE displays the range of addresses that have been written into ROM in the following format, then wait for the next command: Write address is xxxx-xxxx, Written address range File not end. Displayed when file has not been completely written into the ROM. (1) If the user press the [RETURN] key after the above message is displayed, ROMWRITE starts and then verifies the written data. (See "W Command" for the format of the message displayed after the verify processing.) (2) If the user presses the [ESC] key, ROMWRITE returns to the command entry screen. (3) ROMWRITE proceeds as follows if the [N] key is pressed: (a) If not all file bytes have been loaded (i.e., the file size is larger than the buffer RAM size), ROMWRITE loads again the file data starting at the address in file immediately following the last address loaded. (b) If the entire file has been loaded, ROMWRITE returns to the command entry screen.

Command	Format	Function
O	O filename, addr1, addr2 where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The O command stores the contents of the buffer RAM between addr1 and addr2 in the filename, in the Intel Hex format if HEX is specified as the file type and in the binary format if a file type other than HEX is specified. When the loading is completed, ROMWRITE displays the range of the specified addresses in the following format: File out address is xxxx-xxxx, Address range (1) If the user presses the [RETURN] key, ROMWRITE stores the RAM data on the disk. (2) If the user presses the [ESC] key, ROMWRITE returns to the command entry screen.
R	R [addr1, addr2] where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The R command reads the ROM data between addr1 and addr2 into the buffer RAM and verifies it. When addresses are omitted, this command reads the entire ROM area. During execution, ROMWRITE displays the following message: Reading
S	S addr1 where: addr1 is a hexadecimal number.	The S command rewrites the buffer RAM at address addr1 with new data. When this command is entered, ROMWRITE displays the specified address and its data in that order. XXXX=XX Cursor Data byte Address (1) If the user enters the new data and type either of the [RETURN], [↓], [↑], and [^] keys, ROMWRITE rewrites the indicated address with the new data. If the user presses either [RETURN] or [↓] key, ROMWRITE displays the next address and its contents. If the user presses either [↑] or [^] key, ROMWRITE displays the preceding address and its contents.

Command	Format	Function
S		(2) If the user presses only the [RETURN] or [↓] key without entering data, ROMWRITE does not rewrite the current address and displays the next address and its contents. (3) If the user presses only the [↑] or [^] key without entering data, ROMWRITE does not rewrite the current address and displays the preceding address and its contents. (4) If the [ESC] key is pressed or if the [.] key is pressed followed by the [RETURN] key, ROMWRITE returns to the command entry screen.
V	V [addr1, addr2] where: addr1 is a hexadecimal number addr2 is a hexadecimal number.	The V command compares the contents of the buffer RAM and ROM between addresses addr1 and addr2. When addresses are omitted, this command verifies the entire buffer RAM addresses. During execution, ROMWRITE displays the message: Verifying (1) If matches occur in all addresses, ROMWRITE displays "OK!!" after the message "Verifying". (2) If a mismatch is found, ROMWRITE displays the address where the mismatch occurred, and the contents of the address in both RAM and ROM in the following format: ADDRS RAM ROM XXXX XX XX (a) If the user presses the [RETURN] key, ROMWRITE resumes the verify processing at the next address. (b) If the user presses the [ESC] key, ROMWRITE returns to the command entry screen.

Command	Format	Function
W	W [addr1, addr2] where: addr1 is a hexadecimal number. addr2 is a hexadecimal number.	The W command writes the contents of the buffer RAM between address addr1 and addr2 into the target PROM. The command verifies the contents of the ROM after the programming. When addresses are omitted, this command writes the entire buffer RAM addresses. During execution, ROMWRITE displays the address value and contents of the current address in the format: ADDRS RAM Writing XXXX XX See "V Command" for verification.

2.3 Error Messages

Argument error	An invalid argument was found in the command line.
Check sum error	An error was found while checking the check sum of an Intel Hex format file.
Command error	An invalid command code was entered.
Disk full	The disk became full while writing a file during the execution of an O command.
Disk Read/Write error	An I/O error occurred while reading or writing a disk.
File name error	An invalid file name was specified.
File not found	The file specified in the L command does not exist on the disk.
File head address over buffer	The address exceeded the ending address of the buffer while reading a HEX file with an L command.
Nothing Directory Space	An attempt was made to load a file with an O command but the directory area was full.

Chapter III. EPSON Format PROM Writer Mode

The PX-4 and the PX-8 use their ROM capsule ROM's and ROM cartridge ROM's as disk image auxiliary memory. It is therefore necessary to add special data to composed programs which are to be written into the PROM's in order to convert them into disk image.
In the EPSON Format PROM Writer Mode, image conversion is conducted simply and writing into the PROM can be conducted with a single series of operations.

3.1 The M & P Formats

There are two ROM formats which can be used in the EPSON PX-8 and PX-4:

(1) The M Format
With this format, programs can be read (into ROM's) with both the PX-8 and the PX-4. Programs composed in the M format can be loaded into the TPA and executed in the same manner as normal CP/M programs (load-and-go programs).
It can be used in the PX-8 and PX-4 ROM Capsule and PX-4 ROM Cartridges.

(2) The P Format
This format allows loading within a PX-4 ROM Capsule. Programs written in this format can be directly executed in a ROM (ROM-based programs) or loaded into the RAM for execution (load-and-go programs).

3.2 Usable PROM's

While both formats can support single-ROM devices, they can also support certain two-ROM devices, handling them as disk image. The following table shows which combinations of PROM's can be used with which format:

Size of first ROM (Kbits)	Size of second ROM (Kbits)	Usable format (Kbits)
64	—	M, P
64	64	M, P
128	—	M, P
128	64	M
128	128	M, P
256	—	M, P
256	64	M
256	128	M
256	256	M, P
512	—	M
1024	—	M

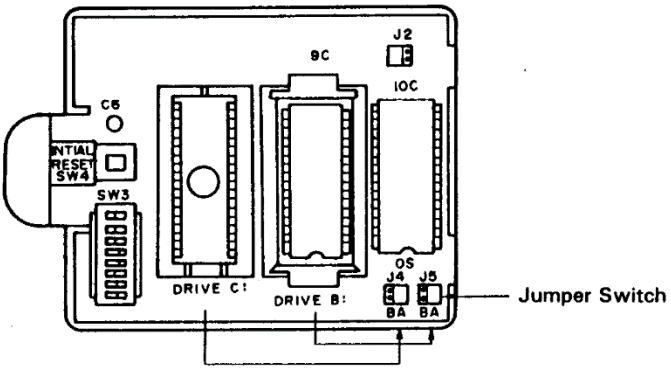
M: M Format
P: P format

The usable ROM's are also limited to the following tyeps:

PX-8 ROM Capsule PX-4 ROM Cartridge	NMOS & CMOS ROM's
PX-4 ROM Capsule	CMOS ROM

NMOS ROM's can be used with the PX-4 ROM Capsule, however their use results in a considerable increase in current consumption; we therefore strongly recommend the use of CMOS ROM's instead.

CAUTION: When using the PX-4 ROM Capsule, be sure to appropriately set the Jumper Switches, located in the ROM compartment, as described below.



Set (by inserting the jumper plug in the proper position) the Jumper Switches according to the ROM type(s) which you are going to use; the settings for the different sizes are shown in the table below. Switch J4 corresponds to Drive C, while Switch J5 corresponds to Drive B.

Jumper Plug Position (Switch Position)	PROM Type
A	128 Kbit
B	64 Kbit, 256 Kbit

3.3 Program Execution

1. After activating the ROMWRITE.COM (see Chapter I, section 1.5 "Program Execution"), select the EPSON Format PROM Writer Mode by typing "2".

```
 PROM WRITER CARTRIDGE  version 2.0
< Press ESC to restart, STOP to exit.>

 Select mode
   1 -- Normal PROM writer mode
   2 -- EPSON format PROM writer mode
```

2. Select either the M or the P format by pressing the number key corresponding to the format you wish to use.

```
                              <EPSON mode>

Select format

  1 -- M format
  2 -- P format
```

3. The next step is to select the size of the PROM or PROM's you wish to use; this has to be done according to the format chosen in the previous step.

   (a) When using the M format:

   - Select the size of the first PROM, again, by pressing the number key corresponding to the desired size shown on the display;

```
                                  <EPSON mode>

Select 1st PROM size ( M format )

  1 --  64K bit        3 -- 256K bit
  2 -- 128K bit
```

Now, in the same manner, select the size of the second PROM. When using only one PROM, press the [RETURN] key without selecting a second PROM size.
When the first PROM size selected is 64 Kbits, the following Second PROM Size Select Menu will appear on the display:

```
                                  <EPSON mode>

Select 2nd PROM size ( M format )

  1  --  64K bits   RETURN -- Nothing
```

- **When the first PROM size selected was 128 Kbits, the following Second PROM Size Select Menu will appear:**

```
                                    <EPSON mode>
Select 2nd PROM size ( M format )

  1 --  64K bits     RETURN -- Nothing
  2 -- 128K bits
```

- **When the first PROM size selected was 256 Kbits, the following Second PROM Size Select Menu will appear:**

```
                                    <EPSON mode>
Select 2nd PROM size ( M format )

  1 --  64K bits     RETURN -- Nothing
  2 -- 128K bits
  3 -- 256K bits
```

(b) When using the P format:
Select one of the PROM combinations form the P format PROM Size Select Menu, illustrated below.

```
                                    <EPSON mode>
Select PROM size ( P format )

  1 --  64K x 1        4 -- 128K x 2
  2 --  64K x 2        5 -- 256K x 1
  3 -- 128K x 1        6 -- 256K x 2
```

4. **Select the desired Programming Algorithm (for details, please refer back to Chapter II, section 2.1.3).**

5. **Next, enter the PROM Header data (see APPENDIX C for details); input data can be any pertinent data which the user wishes to employ.**

```
                                    <EPSON mode>
Enter system name (3 characters max.)
   H40
Enter ROM name (14 characters max.)
   HANBAIKANRIUTI
Enter version number (nn)
   10
Enter date (mmddyy)
   061985
```

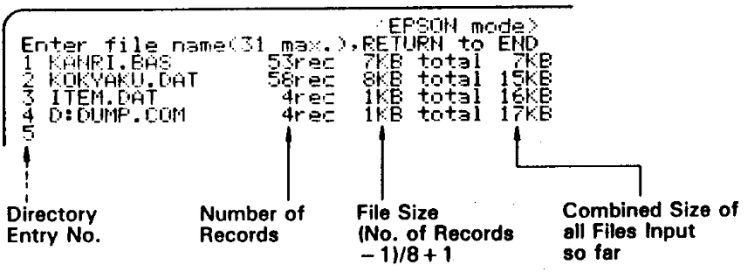
Three characters

Fourteen characters

Two digits

Six digits

6. Enter file name(s).
Sequentially designate the names of the files to be written into the PROM (only alphanumeric characters can be used).



Once you have completed entering the names of the files you wish to write into the PROM, press the RETURN key.

NOTE: Files which have HEX file name extensions will be automatically considered as files written in the INTEL HEX FORMAT and therefore be converted in COM files upon being loaded (file name extensions will also be altered to COM). Files with any other types of file name extension will be processed as they are.

(a) ROMWRITE will issue the following error message if the specified file is not found:

```
*** file not found ***
```

(b) ROMWRITE will issue the following error message if the specified HEX file is not in the Intel HEX format:

```
*** file not INTEL HEX FORMAT ***
```

(c) ROMWRITE will issue the following error message if the specified HEX file is not arranged such that data can be allocated in contiguous addresses.

```
*** address data not sequential ***
```

(d) ROMWRITE will issue the following error message if the PROM capacity is exceeded:

```
                                    <EPSON mode>
Enter file name(31 max.),RETURN to END
1 KANRI.BAS          53rec  7KB total  7KB
2 KOKYAKU.DAT     *** out of memory ***
 Select next key
  A:Abort  D:Delete last file  I:Ignore
```

A ..... Type A to terminate ROMWRITE and perform WBOOT.

D ..... Type D to reenter the correct name (ignoring the current specification).

I ..... Type I to accept the file data up to the file capacity and update the directory entries accordingly.

7. Push the [RETURN] key without entering a file name first and the operation for entering file name first and the operation for entering file names will be completed. The Header Directory will then appear on the display.

```
                                    <EPSON mode>
Header information
 System name    : H40
 ROM name       : HANBAIKANRIUTI
 Version NO.    : 10
 Date           : 06/19/85

   Press any key
```

Press any key to proceed to the next frame.

```
Directory information
 KANRI.BAS          KOKYAKU.DAT
 ITEM.DAT           D:DUMP.COM

Directory size :  4 entries  ,   160  B
Files size     :  4 files   ,    17 KB

   Press any key
```

To scroll up or down when all of the file names do not fit onto the display at once, simultaneously press the [SHIFT] key and either the [↑] or the [↓] key.

8. Select the type of PROM you wish to use. (see "APPENDIX".)

```
                                    <EPSON mode>

Select PROM type and if it is ready,
then press RETURN key

   1 -- 27C256
   2 --  27256
```

Only the PROM types appropriate to the PROM size selected at step 3 will be displayed, therefore all you need to do here is enter either "1" or "2". The selected PROM will be displayed inverted. Please note that the write voltage (Vpp) of either 21V or 12.5V will also be automatically selected, together with the PROM type, at this stage. Press the [RETURN] key when you have finished making your selection.

9. Write processing

(a) PROM blank check.
If the blank check proves OK, ROMWRITE displays the following message and proceeds to the next step:

```
Blank check  OK !!
```

If an error occurs, ROMWRITE displays the message:

```
Blank check  NG !!

Press STOP to exit, ESC to restart
or RETURN to retry
```

— Press [STOP] to terminate ROMWRITE and warm boot the system.
— Press [ESC] to restart ROMWRITE form the beginning.
— Press [RETURN], and ROMWRITE will display the message shown in 8 and start the write processing again. Replace with a blank PROM.

(b) Writing the header and file data
ROMWRITE writes the header and file into the PROM in 128-byte units with verification. As ROMWRITE writes the header and file data, it displays the address value and contents of the current address. On normal termination, ROMWRITE displays the following:

```
Header write      ADDRS  RAM
                  60FF   00
KANRI.BAS         ADDRS  RAM
                  787F   00
KOKYAKU.DAT       ADDRS  RAM
                  09FF   1F
```

```
ITEM.DAT          ADDRS  RAM
                  1EFF   00
D:DUMP.COM        ADDRS  RAM
                  22FF   00

Done
Press ESC to restart ROMWRITE
STOP to exit from ROMWRITE
```

— Press [STOP] to terminate ROMWRITE and warm boot the system.
— Press [ESC] to restart ROMWRITE from the beginning.

If a verify error is found, ROMWRITE displays the address in error and the contents of the address as shown below.

```
Verify NG  !!    ADRS  RAM   ROM
                   9   62    FF
```

By pressing any of the following keys, the corresponding operations can be initiated:

[RETURN] ..... Sequential display of data in RAM and ROM.
[ESC] ..... Restart ROMWRITE from the very beginning.
[STOP] ..... Exit from ROMWRITE and warm boot the system.

When writing into two ROM's, the message shown below will appear on the display; to proceed, press any key, then return to "8." and write into the second ROM.

```
Change PROM and press any key
```

Please note that pressing the [ESC] key or the [STOP] key at any time during ROMWRITE execution will initiate following operations.

[ESC] ..... Restart ROMWRITE from the very biginning.
[STOP] ..... Exit from ROMWRITE and warm boot the system.

APPENDIX A Load-and-go Programs

Load-and-go programs are executed by loading them into the TPA and executing them in the same manner as regular CP/M programs.
Programs written in BASIC or Machine Language can be executed as they are by converting them into disk image with PROFORM and loading them into the TPA.
In the M Format, all converted files, and in the P Format, files which do not have the special data (described in APPENDIX B) added to them are considered Load-and-go Programs.

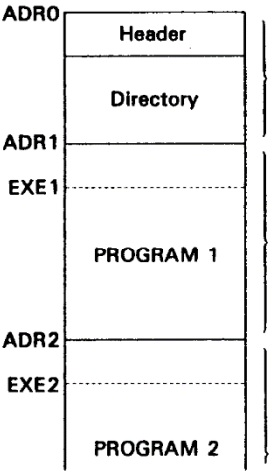
APPENDIX B ROM-based Programs

The P Format can handle both Load-and-go and ROM-based programs. When executing ROM-based programs, it is necessary to pay attention to a few more items, listed below, than when executing Load-and-go programs.

1. Program Addresses

Since ROM-based programs execute programs directly within the ROM capsule, it is necessary to carefully determine their starting addresses while taking the header and directory areas into account.
The starting addresses for such programs vary depending on program size and in which PROM (format) a program is to be composed. The size of the directory also varies according to the size and number of program files, although the header area in fixed at 32 bytes, so that the size of the area to be allocated for the directory must be calculated ahead of time.
Special 5 byte or 90 byte data must be supplementally added to the beginnings of such ROM-based programs so the system will recognize them sa being ROM-based.

<Concept of Addresses Being Added to Beginning of Programs>



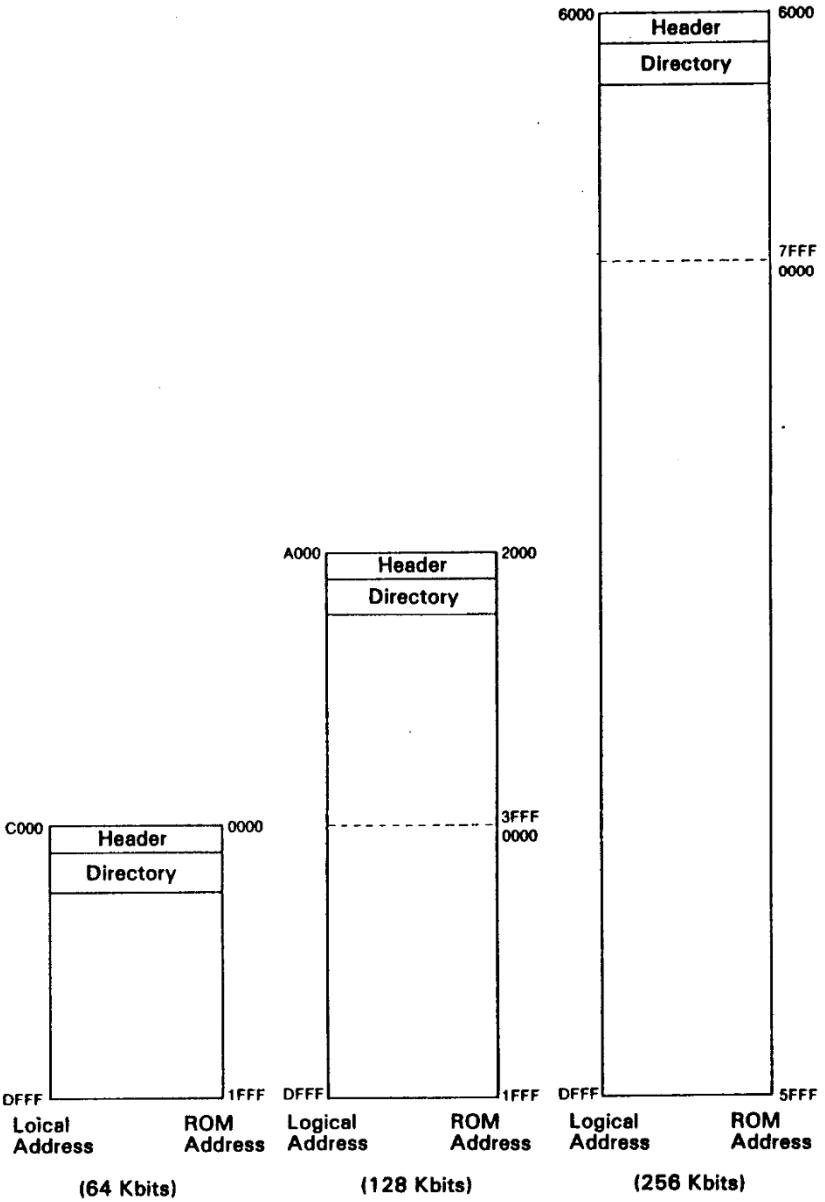
Minimum 128 bytes; increases in units of 128 bytes (see appendix for details).

Start address must be again altered to allow addition of supplemental 5 (non-resident) or 90 (resident) byte data to beginning of program file.

EXAMPLE: Starting addresses:
EXE1 = ADR1 + 5 (non-resident)
EXE1 = ADR1 + 90 (resident)

EXEMPLE: If PROGRAM 1 is 8 Kbytes, the beginning of PROGRAM 2 is:
ADR2 = ADR1 + 2000H (8 Kbytes)

Logical Addresses: Actually allocated addresses when PROM is set in the PX-4.



— Comparison of Logical Addresses and ROM Addresses in the P Format—

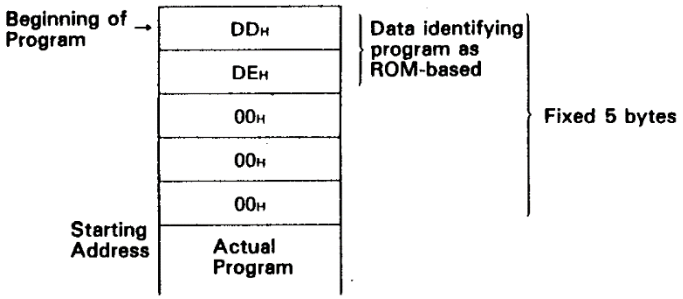
(1) Setting ROM-based Programs

When the data at the beginning of a program is DDHDEH, that program will be interpreted by the system as being a ROM-based program; when not so, the program will be considered a Load-and-go program. In addition, there are two types of ROM-based programs [, resident and nonresident], as subsequently described.

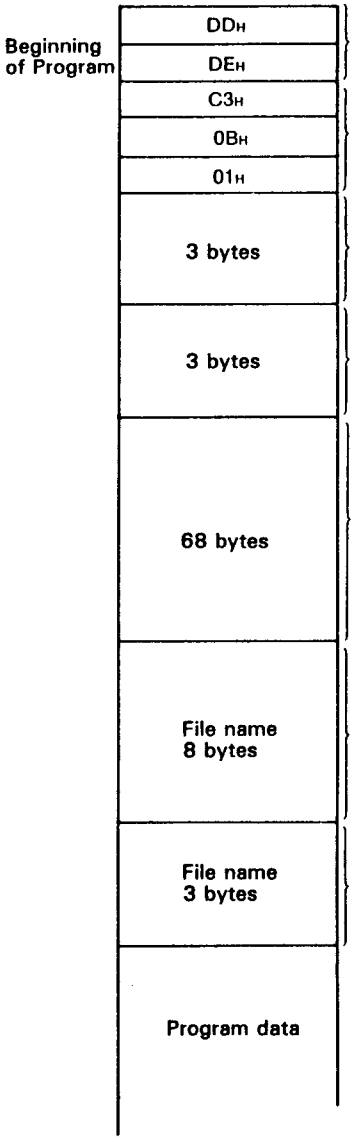
If you merely switch the power OFF, the program currently being executed will be terminated: if you turn the power back on, the CP/M or the Menu screen will be displayed. In contast, there are progams like the BASIC in the PX-4 which will return, albeit from the initialization screen, even after the power has been turned off and then on again. Programs like this are called 'resident programs.' In the items below, we will explain how to set the 'residency status' of a program.

(a) To set a non-resident program:

Add the fixed 5 byte data illustrated below to the beginning of the program (this data is not automatically added by the present software).



(b) To set a resident program:
Add the fixed 90 byte data depicted below to the beginning of the program (this data is not automatically added by the present software).



Sets ROM-based program.

Jump command(s) for processing as resident program.

Jump command(s) for cold start entry (execution address for when program is to be executed before any other).

Jump command(s) for warm start entry (execution address for resident program when power source has been cut off and then turned on again)

0E	1A	11	3A	F9	CD	05	00	21	5C	00	11
5D	00	01	23	00	AF	77	ED	B0	21	59	01
11	67	00	0E	0B	ED	B8	CD	99	FF	0E	09
11	3E	01	CD	05	00	AF	32	28	EF	0E	00
CD	05	00	52	4F	4D	20	41	43	43	49	44
45	4E	54	20	21	21	07	24				

*hexadecimal notation

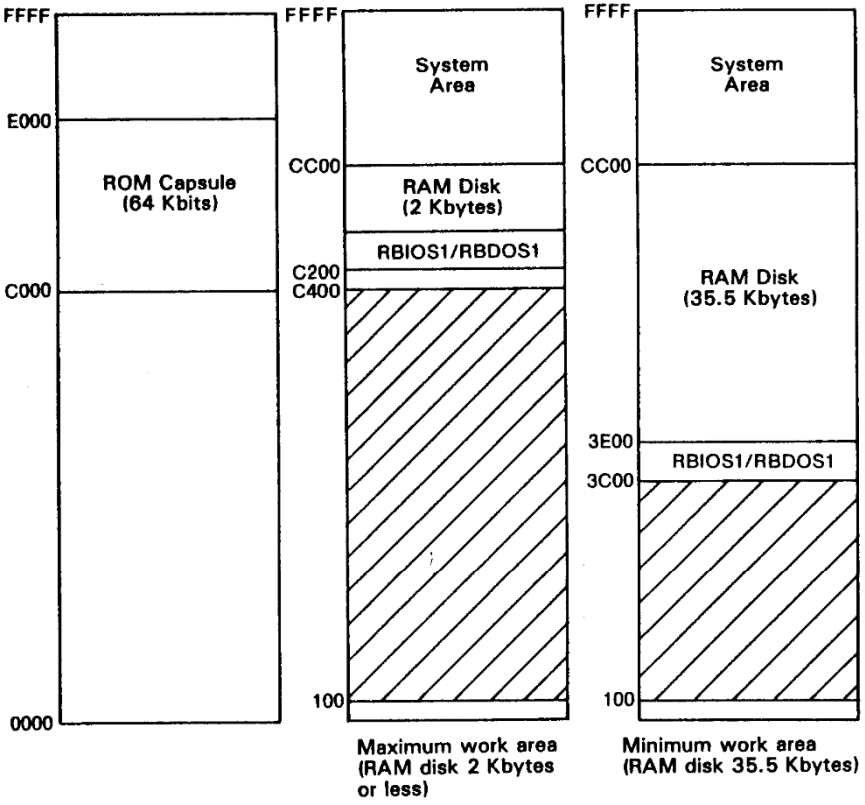
File name of ROM-based program (must be identical to name in ROM directory)

File name extension of ROM-based program (must be idnetical to extension listed in ROM directory).

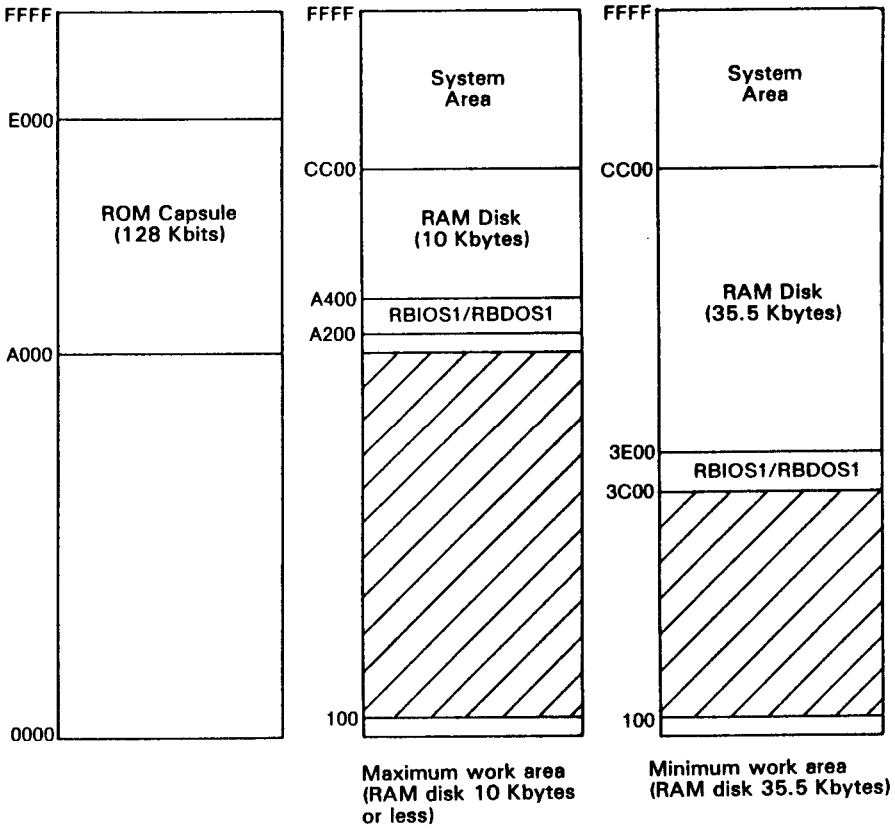
(1) Work Areas

ROM-based programs require a different work area than that used by load-and-go programs. While load-and-go programs can use the area following their program area as a work area, ROM-based programs must use the area at or after the address 100H (015AH when resident program) as their work area. The upper limit of the work area must be either the PROM starting address or the RBDOS1 starting address, whichever of the two is smaller. The hatched areas in the illustrations below represent the work areas.

(a) When using 64 Kbit ROM's:



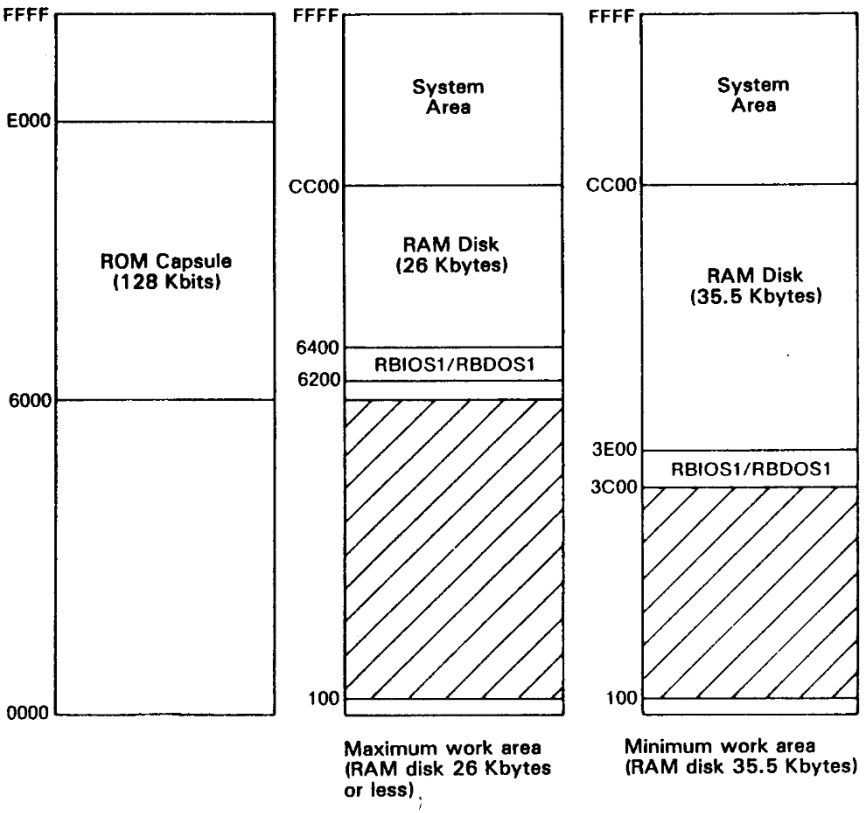
(b) When using 128 Kbit ROM's:



(3) BDOS/BIOS Calls

Load-and-go programs usually call on addresses 005H ~ 007H when making BDOS calls and addresses 0000H ~ 0002H when making BIOS calls. However, with ROM-based programs BDOS/BIOS addresses may be located in the back of the ROM capsule due to fluctuations in their positioning (RBDOS1/RBIOS1 sections) due to variations in RAM disk size.

(c) When using a 256 Kbit ROM:



Therefore, when using the BDOS/BIOS addresses in ROM-based programs, the BDOS/BIOS (RBDOS2/RBIOS2) within the system area must be utilized:

Entry address of RBDOS2:	FF90H	Call BDOS	→	Call FF90H
Boot address of RBIOS2:	EB00H	Call WBOOT − 3	→	Call EB00H
WBOOT address:	EB03H	Call WBOOT	→	Call EB03H
CONST address:	EB06H	Call WBOOT + 3	→	Call EB06H
⋮	⋮	⋮		⋮
CONTINUE address:	EB8AH	Call WBOOT + 87	→	Call EB8AH

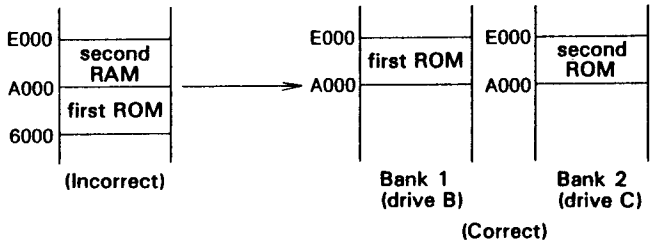
The following table shows the entry addresses and the names of BIOS subroutines.

Address	Subroutine name	Address	Subroutine name
FB00H	BOOT	FB48	(RSIN)
03H	WBOOT	4B	(RSOUT)
06H	CONST	4E	TIMDAT
09H	CONIN	51	MEMORY
0CH	CONOUT	54	RSIOX
0EH	LIST	57	(LIGHTPEN)
12H	PUNCH	5A	MASKI
15H	READER	5D	LOADX
18H	HOME	60	STORX
1BH	SELDSK	63	LDIRX
1EH	SETTRK	66	JUMPX
21H	SETSEC	69	CALLX
24H	SETDMA	6C	GETPFK
27H	READ	6F	PUTPFK
2AH	WRITE	72	READSW
2DH	LISTST	75	(SLAVE)
30H	SECTRN	78	RDVRAM
33H	PSET	7B	MCMTX
36H	SCRNDUMP	7E	POWEROFF
39H	BEEP	81	(USERBIOS)
3CH	(RSOPEN)	84	AUTOST
3FH	(RSCLOSE)	87	RESIDENT
42H	(RSINST)	8A	CONTINUE
45H	(RSOUTST)		

NOTE: Subroutines listed in parenthesis are limited to entry (addresses).

CAUTION:
ROM-based programs written on two ROM's require rather complicated handling, such as bank switching. This is because the ROM address is always fixed depending upon the size of the ROM, the ROM address for the first ROM being allocated to bank one, and that for the second ROM, to bank 2. The use of two ROM's eliminates the possibility of sequential addresses.

Example: 128 Kbits, two-ROM:



APPENDIX C PROM Format

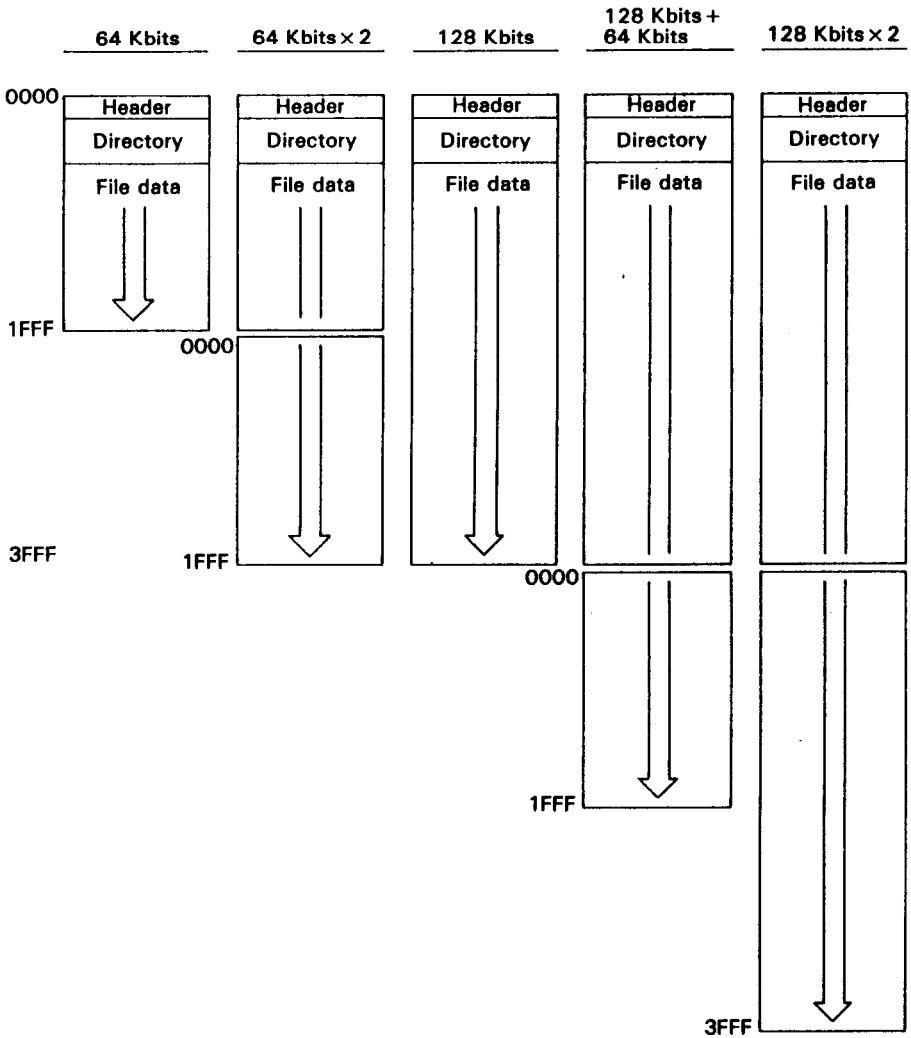
1. PROM Format

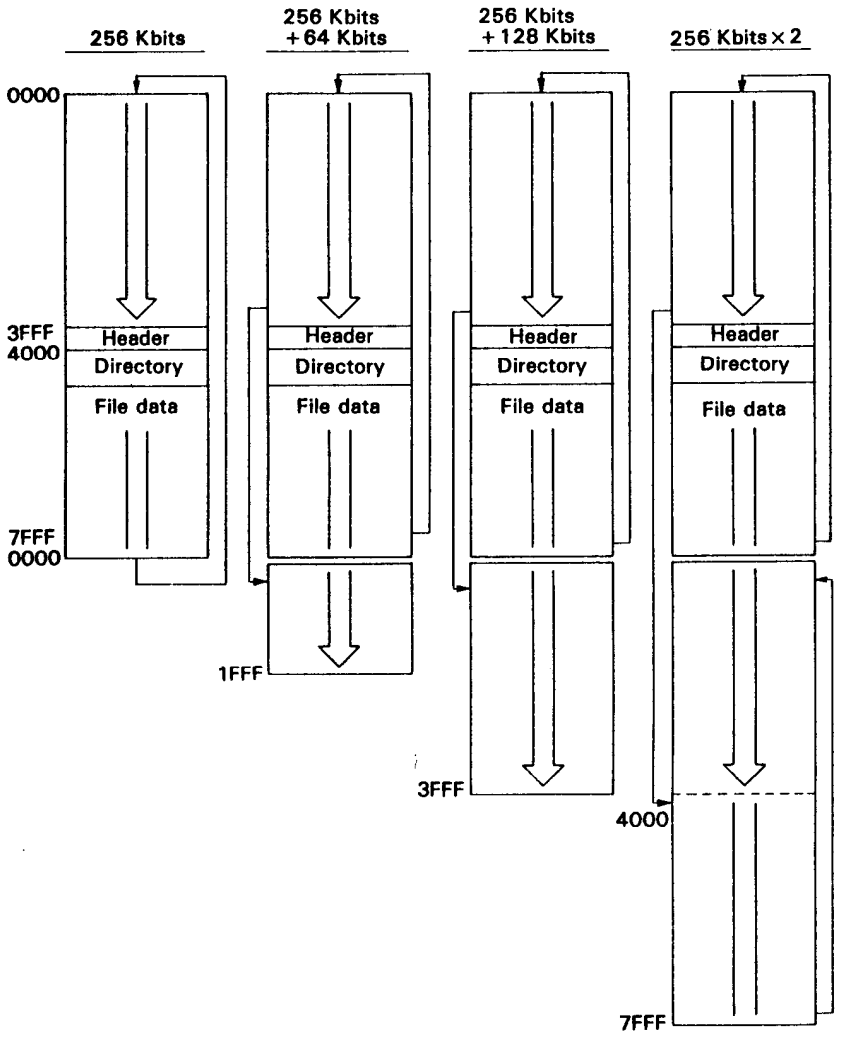
Header and directory data are added to files converted with PROMFORM. This data contains the following information:

HEADER: format and size of PROM being used;
DIRECTORY: just like a CP/M directory, it contains information such as file names, allocation map, etc.

Header and directory location may vary, as described below, according to PROM size and arrangement.

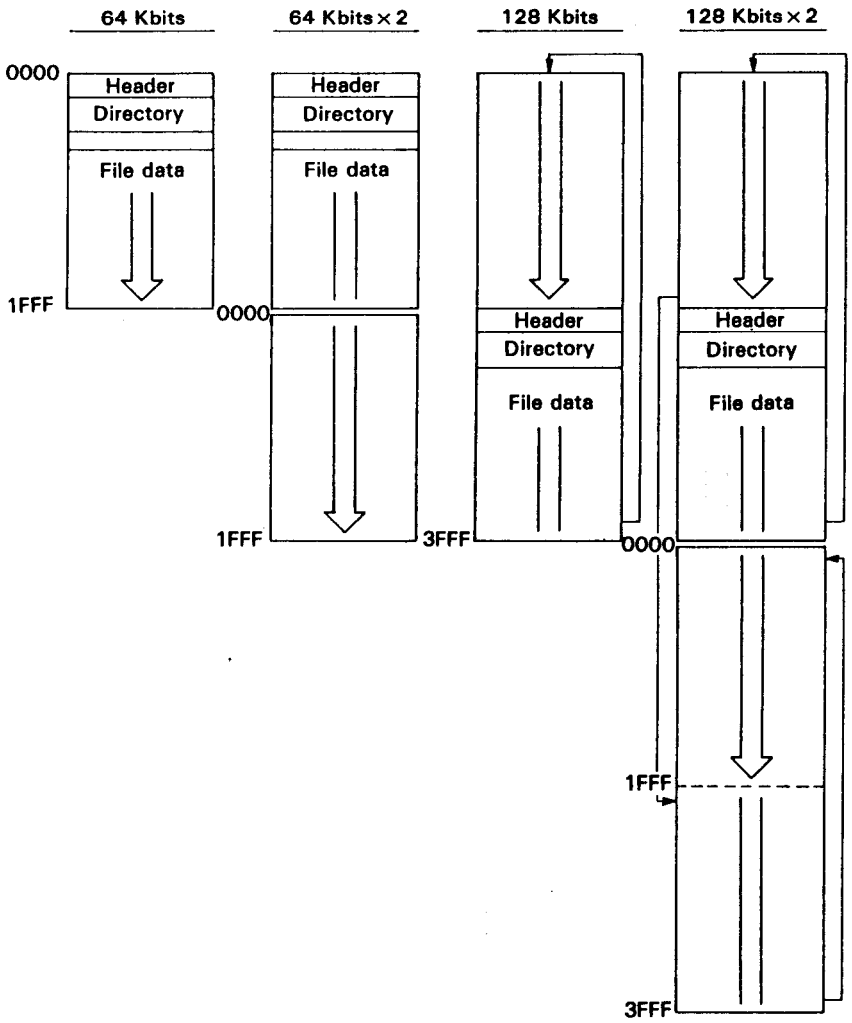
(1) M Format Structure

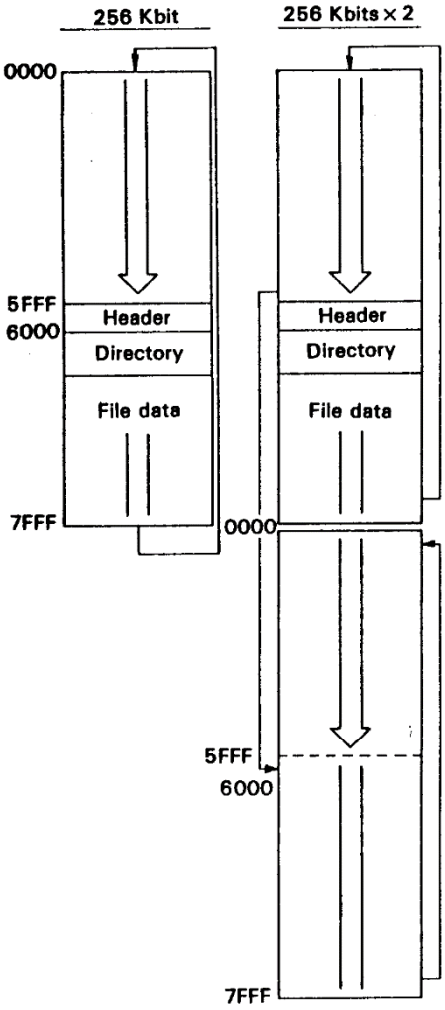



256 Kbits
256 Kbits
+64 Kbits
256 Kbits
+128 Kbits
256 Kbits×2
0000
3FFF
4000
7FFF
0000
1FFF
3FFF
4000
7FFF
Header
Directory
File data
Header
Directory
File data
Header
Directory
File data
Header
Directory
File data

(2) P Format Structure

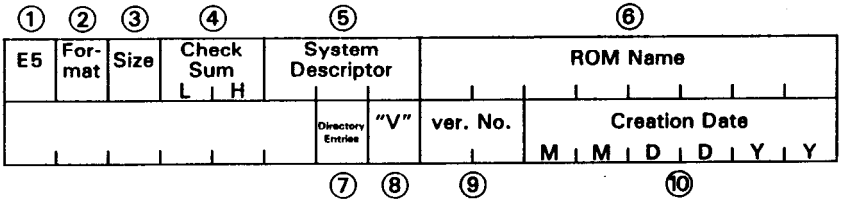
The location of the directory for P format PROMs differs depending on their type.




256 Kbit
256 Kbits × 2
0000
5FFF
6000
7FFF
Header
Directory
File data
Header
Directory
File data
0000
5FFF
6000
7FFF

2. Header Structure

The size of the header for a PROM file is fixed at 32 bytes. The structure of the PROM header is shown below.

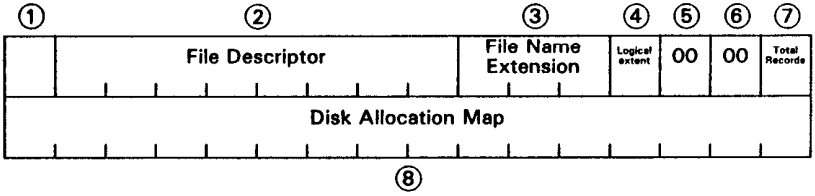


No.	Size	Description
1	1	Set to 0E5H.
2	1	Identifies the format. 37H: M format 50H: P format
3	1	Indicates the capacity of the ROM in 1 Kbytes (binary format). The MSB is set to 1 for a dual-part PROM. 08H: 64 Kbits, single-part PROM 88H: 64 Kbits, 2-part PROM 10H: 128 Kbits, single-part PROM 90H: 2-part PROM with one part consisting of 128 Kbits 20H: 256 Kbits, single-part PROM A0H: 2-part PROM with one part consisting of 256 Kbits
4	2	2-byte field containing the check sum of the data calculated by adding together the values of the data bytes from beginning to end of the data area and taking the lowest order two bytes. The lower order byte is placed in the first byte position of the field.
5	3	User-supplied system name.
6	14	User-supplied ROM name.
7	1	Indicates the size of the directory area in the number of directory entries. The header area is counted as one directory entry. The number or directory entries is rounded up to the multiple of 4 and stored in binary form. This field can take values of 04H, 08H, 0CH, 10H, 14H, 18H, 1CH, and 20H. *The value of this field is calculated using the following formula: (((Directory Entries)/4) + 1) * 4

No.	Size	Description
8	1	Set to "V".
9	2	User-defined ROM version number.
10	8	User-supplied date of ROM production.

3. Directory Structure

PX-4's System can manage a file of up to 16 Kbytes with each directory entry. For files larger than 16 Kbytes, it uses two or more entries. The format of the directory entry is identical to the entry of standard CP/M and is depicted in the figure below.



No.	Size	Description
1	1	00H: Valid directory entry E5H: Invalid directory entry The directory area is divided into 128-byte segments and processed, one segment at a time. If, for example, five valid directory entries are created, counting the header as a single entry, two odd entries (64 bytes) will result. Such entries are referred to as invalid directory entries (see the example below).

Header	128 bytes
Directory entry 1	
Directory entry 2	
Directory entry 3	
Directory entry 4	128 bytes
Directory entry 5	
Invalid directory entry	
Invalid directory entry	
File data area	

No.	Size	Description
2	8	Contains a file name of up to 8 characters.
3	3	Contains a file type of 3 characters.
4	1	Contains the logical extent number (00H to 1FH) of this directory entry. As explained previously, one directory entry can handle a file area of up to 16 Kbytes. Two or more entries are used for a file larger than 16 Kbytes. These entries are identified by numbers, called logical extent numbers, assigned to them sequentially starting at 00. The logical extent number can take a value from 00H to 1FH.
5	1	Set to 00H.
6	1	Set to 00H.
7	1	Contains the total number of records (00H to 80H) managed in this directory entry. A record is the unit of data accessed by CP/M. Its size is 128 bytes. Since a single directory entry can handle a maximum of 16 Kbytes of file data, the greatest total number value for a single entry is 128 (80H).
8	16	Contains the disk allocation map. The disk allocation map is made up of block numbers which identify the blocks allocated for the file (files are managed in 1K-byte units). The block number begins with 1 which identifies the first 1 Kbyte of the file. Since the disk allocation map is 16 bytes long, it can manage a maximum of 16 blocks (16 Kbytes) of file data.

PROM directory size must be calculated in units of 128 bytes; directory area can be expanded to a maximum of 1 Kbyte, thus limiting the number possible of directory entries to no more than 31. File area is contiguous to the directory area and is managed in units of 1 Kbyte.

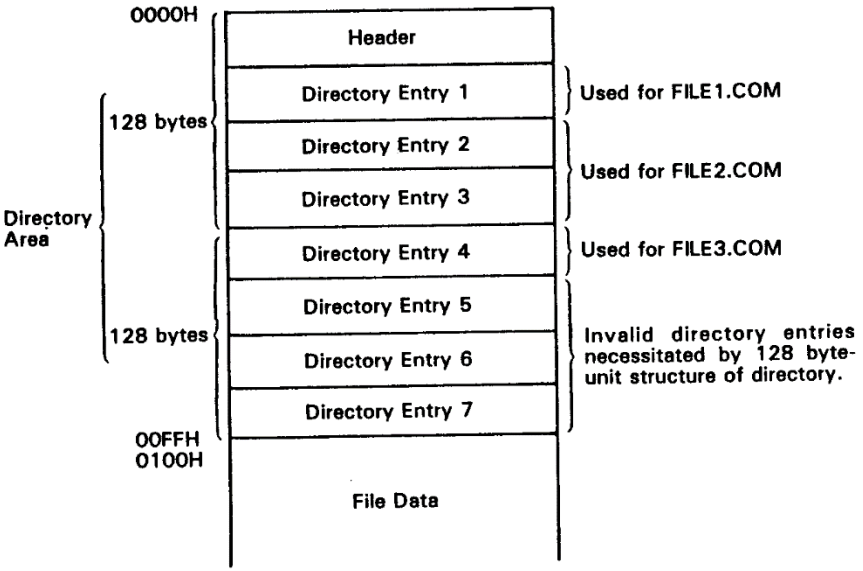
Example:
Here we will use an example to describe how to calculate the header and directory areas for the three files, shown in the table below, using PROMFORM.

PROM used: 128 Kbit, single ROM

File descriptor	No. of Records	File Size	No. of Necessary Directory Entries
FILE1.COM	30	4 Kbytes	1
FILE2.COM	150	19 Kbytes	2
FILE3.COM	50	7 Kbytes	1

Number of Records:
Number of records display when a CP/M STAT command is given.
File size:
Actual space needed for file in ROM; calculate thus: file size = ((no. of recs. − 1) ÷ 8) + 1
Number of necessary directory entries:
This number of directory entries necessary for any individual file. Each directory entry can handle a file of up to 16 Kbytes in size; files larger than that require more than one entry. Calculate the number of entries needed thus: No. of entries = ((file size − 1) ÷ 16) + 1

Since the directory area is divided into units consisting of 128 bytes each, the arrangement of the directory for the three fiels mentioned above is as shown below.



APPENDIX Correct Write Voltage (Vpp) Selection

When indicating the type of PROM you are going to use with the ROMWRITE program, the write voltage for each type is correspondingly predetermined as shown below:

(1) 2764: 21V
(2) 2764A: 12.5V
(3) 27128: 21V
(4) 27128A: 12.5V
(5) 27C256: 21V
(6) 27256: 12.5V

It is absolutely necessary that you select the correct write voltage for the PROM you are going to use: using an INCORRECT write voltage will DESTROY the PROM.
Therefore, please bear the following precautionary points in mind when indicating write voltage (PROM type):

(1) If a write voltage is specified on the PROM (or its label), use that write voltage.

(2) The Vpp for the subsequently listed NMOS (27256) PROM's is 12.5V. Please select the following PROM types:
In the normal PROM Writer Mode: 5 ... 27C256
In the EPSON Format PROM Writer Mode: 1 ... 27C56
Toshiba TMM27256D
NEC μPD27256D

(3) The Vpp for the CMOS (27C256) PROM listed below is 12.5V. Please select the following PROM types:
In the normal PROM Writer Mode: 6 ... 27256
In the EPSON Format PROM Writer Mode: 2 ... 27256
Hitachi HH27C256G

(4) Please carefully read the usage instructions accompanying any PROM's which are put on the market after this manual was published in order to avoid using the incorrect write voltage. Remember, using the incorrect write voltage will irrevocably damage your programmable ROM.

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