

2.5 System Operations

PX-4 is equipped with several convenient functions which are referred to as system operations. This section describes these system operations and procedures for using them. The system operations are as follows.

1. Alarm function Sounds an alarm and displays an alarm screen when a preset time is reached.
2. Wake function Turns the computer on and performs a specific job when a preset time is reached.
3. Auto start Automatically executes a specific job whenever the computer is turned on.
4. Auto power-off Automatically turns off the power when a certain amount of time has passed without anything being input from the keyboard.
5. Screen dump Outputs the contents of the display screen to a printer.

Of these system operations, the alarm, wake, and auto start functions are set from the System Display.

2.5.1 Alarm

The alarm function sounds an alarm at a present time and displays a screen such as the one shown below.

```
<ALARM TIME>    05/05    18:20
" WE HAVE DINNER
                "
                Press ESC key
```

Setting the alarm time

- (1) The alarm time can be set from the System Display by pressing the **[2]** key to select 2=alarm when the screen appears as shown below.

```
* SYSTEM DISPLAY *    05/05 (SAT) 17:08:30
<RAM   DISK> 026    KB    <ALARM> OFF
<USER  BIOS> 000x256 B    <AUTO>  OFF
<MENU  DRIVE> CBA      <MENU>  OFF

-Select or ESC to return.
<ALARM>  1=off  2=alarm  3=wake  4=MSG
```

- (2) When the **[2]** key is pressed, the screen changes as follows.

```
* SYSTEM DISPLAY *    05/05 (SAT) 18:23:56
<RAM   DISK> 026    KB    <ALARM> OFF
<USER  BIOS> 000x256 B    <AUTO>  OFF
<MENU  DRIVE> CBADE     <MENU>  OFF

-Set alarm time, ESC to cancel
MMDDhhmm
```

To set the alarm time, input two digits each for the month, day, hour, and minute (in that order). Input the time using the 24-hour system; e.g., input 2:00 P.M. as 1400.

For example, to input May 5, 6:30 P.M., input 05051830. If any incorrect keys are pressed, make corrections by pressing the **[BS]** key; this deletes the last character entered and moves the cursor one space to the left. To move the cursor to the left without deleting the last character entered, press the **[←]** key. After typing in the date and time, check to make sure that they are correct, then press the **[RETURN]** key.

If you want to return to quit alarm specification without specifying an alarm time, press the **[ESC]** key.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:24:10
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Set alarm time, ESC to cancel
MMDDhhmm 05051830
```

NOTE:
Any wake time which has been set is cancelled when an alarm time is set.

Setting the alarm message

- (1) After selecting 2=alarm from the initial System Display screen, press the **[4]** key to select 4=MSG. The screen then changes as shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 20:03:37
<RAM DISK> 026 KB <ALRM> ON
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Input message/string, ESC to cancel
```

- (2) Type in the message which is to be displayed in the alarm screen when the alarm time is reached. The message may include up to 32 characters. Use the **[BS]**, **[←]**, and **[→]** keys to correct any mistakes. After verifying that the message has been typed correctly, set it by pressing the **[RETURN]** key.

```
* SYSTEM DISPLAY * 05/05 (SAT) 17:09:27
<RAM DISK> 026 KB <ALRM> ON
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBA <MENU> OFF

-Input message/string, ESC to cancel
TEA TIME
```

Alarm operation

When the preset alarm time is reached, operation is as described below. Here we will assume that the alarm has been set for the time indicated above and that the current time is 18:29 on May 5; thus, the alarm time will be reached after waiting for one minute. After reaching the alarm time, the alarm sounds and the following screen appears.

```
<ALARM TIME> 05/05 18:30
" TEA TIME "
Press ESC key
```

Ending alarm screen display

Alarm screen display is ended under any of the following conditions.

- When the **[ESC]** key is pressed. This returns the computer to the state it was in before the alarm time was reached.
- After 50 seconds have passed. This returns the computer to the state it was in before the alarm time was reached.
- When the power switch is turned off (if it is already off, by turning it on momentarily, then back off again). This causes the power to go off in the restart mode.

Cancelling the alarm time and message

To cancel the alarm setting, enter the System Display, select "2=alarm", then select "1=off". This cancels both the alarm time and alarm message and changes the "<ALRM>" status from ON to OFF.

2.5.2 Wake

The wake function sounds an alarm when a preset time is reached, then turns PX-4 on. If the wake time is reached while PX-4's power switch is in the OFF position, operation is the same as when the power switch is turned on. If the wake time is reached while the power is already on, the alarm is sounded and a screen such as the following is displayed.

```
<WAKE TIME>      05/05   18:21
" WAKE STRING
Press ESC key
```

Setting the wake time

- (1) Press **CTRL** + **HELP** to display the System Display, then select "2=alarm". The screen then changes as shown below.

```
* SYSTEM DISPLAY *   05/05 (SAT) 20:34:25
<RAM   DISK> 026   KB   <ALARM> OFF
<USER  BIOS> 000x256 B   <AUTO>  OFF
<MENU  DRIVE> CBADE   <MENU>  OFF
-Select or ESC to return.
<ALARM>  1=off  2=alarm  3=wake  4=MSG
```

- (2) Select "3=wake". The screen changes again as follows.

```
* SYSTEM DISPLAY *   05/05 (SAT) 20:39:00
<RAM   DISK> 026   KB   <ALARM> OFF
<USER  BIOS> 000x256 B   <AUTO>  OFF
<MENU  DRIVE> CBADE   <MENU>  OFF
-Set wake time, ESC to cancel
MMDDhhmm
```

- (3) To set the wake time, input two digits each for the month, day, hour, and minute (in that order). Input the time using the 24-hour system; e.g., input 2:00 P.M. as 1400.

For example, to input May 5, 9:00 P.M., input 05052100.

After typing in the date and time, check to make sure that they are correct. Use the **←** and **→** keys to correct any mistakes, then press the **RETURN** key to set the time.

If you want to quit wake specification without specifying an wake time, press the **ESC** key.

```
* SYSTEM DISPLAY *   05/05 (SAT) 20:39:30
<RAM   DISK> 026   KB   <ALARM> OFF
<USER  BIOS> 000x256 B   <AUTO>  OFF
<MENU  DRIVE> CBADE   <MENU>  OFF
-Set wake time, ESC to cancel
MMDDhhmm 05052100
```

NOTE:

Any alarm time which has been set is cancelled when an wake time is set.

Setting the wake string

The wake string consists of characters which are automatically input (just as if they were typed in from the keyboard) when PX-4's power is turned on by the wake function. When the MENU display function is turned on, the wake string is automatically inserted into the command line starting at the position of the cursor. If the MENU display function is turned off, it is automatically input into the CCP command line.

Procedures for setting a wake string are explained with examples below.

(1) When the MENU display function is turned on

If a return code (**^M** or **^m**) is set for the wake string as shown below, the program which is indicated on the command line of the MENU screen will be automatically executed when the power is turned on by the wake function. In other words, operation is the same as if the power were turned on and the **RETURN** key pressed.

```
* SYSTEM DISPLAY *   05/05 (SAT) 20:39:50
<RAM   DISK> 026   KB   <ALARM> ON(W)
<USER  BIOS> 000x256 B   <AUTO>  OFF
<MENU  DRIVE> CBADE   <MENU>  OFF
-Input message/string, ESC to cancel
^M
```

Using wildcard characters (*) to specify the alarm or wake time

Ordinarily, the alarm or wake time is specified using only numbers. However, it is also possible to specify all or part of the date and time using wildcard characters (i.e., asterisks). When this is done, positions filled with asterisks are always assumed to match the corresponding position in the current time. For example, wake operation will take place at all of the following times if the wake string is specified as 050518*0.

```
05051800    05051830
05051810    05051840
05051820    05051850
```

To see how this works, try setting an alarm time as follows.

Press **CTRL** + **HELP** to display the System Display, then select "2=alarm". Check the time displayed in the top right corner of the screen, type in the date and hour as shown, then type in asterisks for the minute. For example, if the current date/time 18:00, May 5, type in an alarm time as shown below. (Remember to press the **RETURN** key after typing in the time.)

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:00:26
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Set alarm time, ESC to cancel
MMDDhhmm 050518**
```

After setting the alarm time, leave the machine untouched for about 5 minutes and watch what happens. The alarm should sound within one minute, then will sound repeatedly at intervals of one minute. Also, the alarm screen should appear when the alarm sounds. If the **ESC** key is pressed while the alarm screen is displayed, the System Display will appear again. Otherwise, the System Display reappears automatically after 50 seconds have passed.

Some other examples of alarm time settings using the asterisk are shown below.

```
05**0800    Causes the alarm function to operate at 8:00 every day in May.
****1200    Causes the alarm function to operate every day at 12:00 noon.
```

2.5.3 Auto start function

The auto start function causes a predesignated command to be executed automatically each time the power switch is turned on while PX-4's power is off in the restart mode. However, this function does not operate when the power is off in the continue mode.

Setting the auto start string

The auto start string consists of character data which is automatically passed to the CCP when PX-4's power switch is turned on while the power is off in the restart mode. (If the MENU display function is turned on, the contents of the auto start string are automatically input into the parameter area of the MENU screen command line; otherwise, they are automatically input to the CCP screen.)

(1) Press **CTRL** + **HELP** to bring the System Display to the screen.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:13:19
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> ON
<MENU DRIVE> CBADE <MENU> OFF

-Select or ESC to exit. 1=RAM cartridge
2=alarm 3=auto start 4=menu
```

Press the **3** key to select "3=auto start"; the screen changes as shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:12:51
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Select or ESC to return.
<AUTO START> 1=off 2=assign
```

(2) Select 2=assign. Now the screen will appear as follows.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:14:28
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Input auto start string, ESC to cancel
```

Using wildcard characters (*) to specify the alarm or wake time

Ordinarily, the alarm or wake time is specified using only numbers. However, it is also possible to specify all or part of the date and time using wildcard characters (i.e., asterisks). When this is done, positions filled with asterisks are always assumed to match the corresponding position in the current time. For example, wake operation will take place at all of the following times if the wake string is specified as 050518*0.

05051800	05051830
05051810	05051840
05051820	05051850

To see how this works, try setting an alarm time as follows.

Press **CTRL** + **HELP** to display the System Display, then select "2=alarm". Check the time displayed in the top right corner of the screen, type in the date and hour as shown, then type in asterisks for the minute. For example, if the current date/time 18:00, May 5, type in an alarm time as shown below. (Remember to press the **RETURN** key after typing in the time.)

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:00:26
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF
-Set alarm time, ESC to cancel
MMDDhhmm 050518**
```

After setting the alarm time, leave the machine untouched for about 5 minutes and watch what happens. The alarm should sound within one minute, then will sound repeatedly at intervals of one minute. Also, the alarm screen should appear when the alarm sounds. If the **ESC** key is pressed while the alarm screen is displayed, the System Display will appear again. Otherwise, the System Display reappears automatically after 50 seconds have passed.

Some other examples of alarm time settings using the asterisk are shown below.

05**0800	Causes the alarm function to operate at 8:00 every day in May.
****1200	Causes the alarm function to operate every day at 12:00 noon.

2.5.3 Auto start function

The auto start function causes a predesignated command to be executed automatically each time the power switch is turned on while PX-4's power is off in the restart mode. However, this function does not operate when the power is off in the continue mode.

Setting the auto start string

The auto start string consists of character data which is automatically passed to the CCP when PX-4's power switch is turned on while the power is off in the restart mode. (If the MENU display function is turned on, the contents of the auto start string are automatically input into the parameter area of the MENU screen command line; otherwise, they are automatically input to the CCP screen.)

- (1) Press **CTRL** + **HELP** to bring the System Display to the screen.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:13:19
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> ON
<MENU DRIVE> CBADE <MENU> OFF
-Select or ESC to exit. 1=RAM cartridge
2=alarm 3=auto start 4=menu
```

Press the **3** key to select "3=auto start"; the screen changes as shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:12:51
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF
-Select or ESC to return.
<AUTO START> 1=off 2=assign
```

- (2) Select 2=assign. Now the screen will appear as follows.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:14:28
<RAM DISK> 026 KB <ALARM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF
-Input auto start string, ESC to cancel
```

- (3) Now type in the command which is to be set as the auto start string. If you want to include a return code at the end of the string, type ^M ("M" can be typed in either uppercase or lowercase). The auto start string may consist of up to 32 characters (including ^M or other control codes). After typing in the string, verify that it is correct, then set it by pressing the **RETURN** key. An example is shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:13:08
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBADE <MENU> OFF

-Input auto start string. ESC to cancel
B: BASIC^M
```

After the auto start string has been set, the <AUTO> status changes from OFF to ON.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:17:43
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> ON
<MENU DRIVE> CBA <MENU> OFF

-Select or ESC to exit. 1=RAM cartridge
2=alarm 3=auto start 4=menu
```

Start-up by the auto-start string

When the power switch is turned on while an auto start string is set (or if the power is already on, when the power switch is turned on, off, and then on again), the auto start string is handled in the same manner as if it had been input from the keyboard.

However, this only applies when PX-4 is off in the restart mode; when it is off in the continue mode, the auto start string is not input.

As with the wake string, whether the auto start string is input to the CCP screen or the MENU screen differs according to whether the MENU display function is turned on.

(1) When the MENU display function is turned off

When the MENU display function is turned off, the auto start string is input directly to the command line of the CCP screen. For example, when "B: BASIC^M" is specified as the auto start string, BASIC is started.

```
A>B: BASIC
```

(2) When the MENU display function is turned on

When the MENU display function is turned on, the auto start string is input to the MENU screen command line when the power is turned on. In this case, the auto start string would be used to pass parameters to a program file; an example of this is shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 18:28:23
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> ABC <MENU> ON

-Input auto start string. ESC to cancel
/P:3
```

In this example, the auto start string is input to the MENU screen as follows when the name of a COM file is displayed on the MENU screen command line.

```
##.##k CP/M 05/05 (SAT) 18:29:02 1/1
B: BASIC /P:3
B: BASIC COM
```

When the file displayed on the MENU screen command line is not a COM file, the auto start string is input to the command line as follows.

```
##.##k CP/M 05/05 (SAT) 18:29:32 1/1
B: BASIC A: TEST.BAS /P:3
B: BASIC COM
```

Cancelling the auto start string

To cancel the auto start string, display the auto start string specification screen and select "1=OFF".

2.5.4 Auto power-off function

The purpose of the auto power-off function is to automatically turn off the power when the computer has been standing by for input from the keyboard for a certain period of time. This helps conserve battery power when the power is left on accidentally or the computer is left unattended for any reason. However, since power is constantly supplied to PX-4's RAM disk and memory, this does not result in the loss of any information. Further, the auto power-off function turns off the power in the continue mode; this means that operation can be resumed at the point of interruption simply by turning the power switch off, then back on again.

Setting the auto power-off time

Immediately after system initialization, the auto power-off function is set to turn off the computer after five minutes have elapsed since the last key was pressed. However, the setting can be changed to turn off the power after from 1 to 255 minutes have elapsed; this is done using the POWER statement of BASIC or the CONFIG command. See the description of the POWER statement in the BASIC Reference Manual for further details.

2.5.5 Screen dump function

The screen dump function outputs the contents of the display screen to a printer. This is done by pressing the **PF5** key together with **CTRL**. Output to the printer can be interrupted by pressing the **STOP** key together with **CTRL** or by turning off the power switch.

When output to the printer is completed without error, PX-4 returns to the state it was in before the screen dump was started.

NOTES:

1. In order to use the screen dump function, a printer must be connected to the RS-232C interface, the serial interface, or the printer interface and the interface specifications must match those of the printer.
2. The screen dump function cannot be used under the following condition.
 - While the system initialization screen is being displayed

If the contents of the display are not output to the printer when **CTRL** + **PF5** is pressed, terminate operation by pressing **CTRL** + **STOP**, then make sure that the printer is connected properly and that the DIP switch settings are correct (see section 4.3, "Printers").

Method 5 initiates system initialization, followed by a cold start. Accordingly, all previously set system parameters (such as user BIOS size and System Display settings) are cleared. This type of restart is ordinarily used only to restore system operation following execution of a machine language program which contains an error.

```
SYSTEM INITIALIZE  
DATE/TIME (MMDDYYhhmmss) 000000000000
```

See section 2.1, "Introduction to Operation" for the system initialization procedures.

Method 6 resets the 7508 sub-CPU. To do this, press the 7508 reset switch inside the ROM capsule compartment. After doing this, initialize the system (method 5).

Ordinarily, system operation can be restored by one of methods 1 to 4. Therefore, methods 5 and 6 should only be used as a last resort when system operation cannot be restored by one of the first four methods.

<Internal RAM disk check>

The contents of the internal RAM disk are checked whenever the reset switch is pressed or the power switch is turned on. If the contents of the RAM disk are accidentally destroyed during program execution, the following message is displayed.

```
RAM DISK FORMAT (Y/N) ?
```

If you want to reformat the RAM disk, press the **Y** key; otherwise, press the **N** key.

2.5.6 Restarting the system

If the system becomes inoperative for any reason while using PX-4 (as can happen, for example, if a user-written machine language program contains an error), it will be necessary to restart the system. There are six methods of doing this; the method which is used will vary according to the seriousness of the problem.

1. Press the **CTRL** and **C** keys together.
2. Press the **STOP** key.
3. Press the **CTRL** and **STOP** keys together.
4. Press the reset switch.
5. Press and hold the **SHIFT** and **GRPH** keys, then press the reset switch.
6. Press the 7508 reset switch (the switch which resets the 7508 sub-CPU).

Each of these methods is briefly described below.

Methods 1 to 3 all produce the same result. That is, a warm start is made and the screen appears as shown below. (If the MENU display function is turned on, the MENU screen is displayed.)


```
A>
```

When the system is restarted using methods 1 to 3, the contents of the RAM disk and user BIOS areas are preserved.

When method 4 is used, the Z-80 main CPU is reset and a cold start is made. The contents of the RAM disk and user BIOS areas are also preserved when this method is used.

2.5.7 Audible signals generated by the system

PX-4's operating system generates a variety of audible signals to inform the user of the system's status. Types of audible signals generated and the conditions to which they correspond are as shown in the table below.

Condition	Signal
Power switch turned on with PX-4 in the restart mode	Short beep(—)
Power switch turn on with PX-4 in the continue mode	Long beep(—)
Alarm or wake time reached while the power is off	} Warbling sound 
Alarm or wake time reached while the power is on	

Example: When the wake time is reached while the power is off in the restart mode, signals generated are as follows.

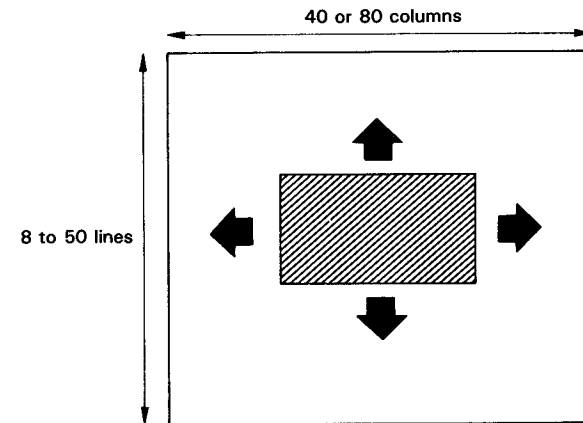


2.6 Virtual Screen and Window

The display screen used with PX-4 is a large (40 characters × 8 lines) LCD panel. However, since some applications require even larger display sizes, a kind of display-screen-in-memory called a "virtual screen" is also used.

In other words, the virtual screen uses a special area in memory which is handled in much the same manner as an actual display screen, and which stores data for output to the LCD panel. This special area in memory is referred to as "video RAM" (VRAM). Although you cannot see the entire contents of the virtual screen at one time, you can use the cursor keys to change the part of the virtual screen which appears on the LCD panel at any given moment; this is referred to as "scrolling through the virtual screen." You can scroll up or down and (depending on the width of the virtual screen) left or right.

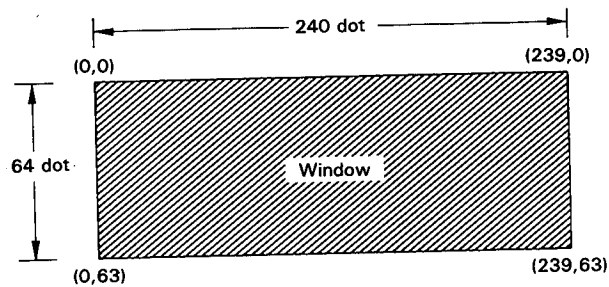
In other words, you can think of the LCD screen as a window which can be moved around above a large sheet of paper; therefore, the LCD screen is also sometimes referred to as the window.



The height and width of the virtual screen can be changed using the WIDTH statement of BASIC. Either 40 or 80 columns can be specified for the width, and the height can be specified as any number of lines in the range from 8 to 50; however, the product of the width \times height must not be greater than 2,000. Therefore, maximum virtual screen dimensions for each screen width are as follows.

- (1) 80 columns \times 25 lines
- (2) 40 columns \times 50 lines

Further, graphic data can be written into the screen using a coordinate system which addresses individual dots. The graphic screen coordinate system is shown in the figure below.



Graphic data can be written into the screen regardless of any characters which happen to be displayed or their positions. However, when any graphics which are scrolled outside of the screen window are erased, and will not be redisplayed when the screen window is scrolled back to that position.

Types of Scrolling Used with the Virtual Screen

When the cursor is moved through the virtual screen, the mode of scrolling selected determines whether the window moves along with the cursor.

With one mode, the window tracks (follows) the cursor as it is moved in any direction; with another, the window stays in the same position regardless of where the cursor is moved; and with the third mode, the window tracks horizontal movement of the cursor, but not vertical movement.

(1) The tracking mode

In the tracking mode, the window follows cursor movement in all directions.

(2) Non-tracking mode

In the non-tracking mode, the window stays in the same place regardless of where the cursor is moved. However, if scrolling is switched from the non-tracking mode to the tracking mode while the cursor is located outside of the window, the window immediately moves to the position of the cursor. The window can also be moved to the position of the cursor without switching modes by pressing the **SCRN INS** key together with **CTRL**.

(3) Horizontal tracking mode

In the horizontal tracking mode, the window follows horizontal movement of the cursor, but does not move vertically. This mode can only be used when the virtual screen width is 80 columns.

Scrolling is switched between these three modes by pressing the **SCRN INS** key together with **SHIFT**.

2.7 CP/M Commands

There are three types of CP/M commands as follows.

- Control key commands
- Built-in commands
- Transient commands

2.7.1 Control key commands

Control key commands are commands which are input by pressing various letter or number keys on the standard keyboard together with the **CTRL** (control) key (control key commands cannot be input when the item keyboard is installed). To input any of the control key commands, press and hold the **CTRL** key, then press the applicable letter or number key. The control key commands and their functions are as listed below.

- CTRL** + **C** : Restarts CP/M by initiating a warm start.
- CTRL** + **E** : Forces the cursor to the next line of the screen for continued command line input.
- CTRL** + **H** : Moves the cursor one space to the left in the same manner as the **BS** key.
- CTRL** + **I** : Inputs a tab code (same as the **TAB** key).
- CTRL** + **P** : Turns on or off the printer echo function. When the printer echo function is turned on, data displayed on the LCD screen is output to the printer (or other device assigned to LST:) each time the **RETURN** key is pressed. The printer echo function is turned on by pressing **CTRL** + **P** once, and is turned off when **CTRL** + **P** is pressed a second time. (Make sure the printer is connected properly before using this command.)
- CTRL** + **R** : Redisplay the contents of the current command line.
- CTRL** + **S** : Momentarily stops processing currently being performed (same as the **PAUSE** key). Processing can be resumed by inputting this command again.
- CTRL** + **U** : Cancels the current command line and moves the cursor to the next line on the screen for input of a different command.
- CTRL** + **X** : Erases the current command line and moves the cursor back to the beginning of the line.
- CTRL** + **Z** : Terminates input from the keyboard (used in combination with certain CP/M transient commands).

Specifying file names when using commands

In this manual, points at which file descriptors are specified in CP/M commands are indicated by the following notation.

<filespec>

The <filespec> is composed of three parts as follows.

d:filename.ext

Here, "d:" indicates a drive name, "filename" indicates the name of the file being handled, and ".ext" indicates the file name extension.

- d: Specify the drive name as a single letter. Drives supported by PX-4 are as follows.
 - A: RAM disk
 - B: ROM capsule 1
 - C: ROM capsule 2
 - D: Floppy disk drive
 - E: Floppy disk drive
 - F: Floppy disk drive
 - G: Floppy disk drive
 - H: Microcassette drive
 - I: RAM cartridge
 - J: ROM cartridge 1
 - K: ROM cartridge 2

If no drive name is specified, the currently logged-on drive is assumed.

filename The file name is specified using up to 8 characters. Only alphanumeric characters and symbols can be used in the file name.

.ext The file extension ordinarily consists of three letters which indicate the file type. Some examples are shown below.

- .COM Indicates an executable program file (transient command).
- .ASM Indicates an assembler source program file.

- .SYS Indicates a CP/M system program file.
- .BAS Indicates a BASIC application program file.
- .LIB Indicates a library file.

Only files with the file name extension “.COM” can be executed as CP/M transient commands.

Special characters used in <filespec>

Two special characters can be used when specifying file names and file name extensions. These are referred to as wildcard characters, and their functions are as follows.

? (question mark): When a question mark is specified in “filename.ext”, it is regarded as matching any character in the corresponding position in all files in the drive being accessed.

Example: A:TEST?.BAS

This file descriptor indicates any file in drive A: which has a five-letter file name beginning with “TEST” and whose extension is “.BAS”.

* (asterisk): Indicates any group of characters in a file name or extension.

Example: A:TEST*.BAS

This file descriptor indicates any file in drive A: whose file name begins with the letters “TEST” and whose extension is “.BAS”.

NOTE:

Wildcard characters (? and *) cannot be used to specify the drive name. A file descriptor specified using wildcard characters is referred to as a “filematch” or “ambiguous file name”.

An example of use of a filematch is shown below.

Assume that files in drive A: are as shown below.

```

##.#k CP/M 05/05 (SAT) 00:04:55 1/1
B:BASIC A:TEST1.BAS
A:TEST0 BAS
A:TESTA BAS A:TEST02 BAS
A:TEST2 BAS A:TES001 BAS
A:TEST3 BAS A:TESTTT BAS
A:PROG1 BAS A:TEST4 BAS
A:PROGAA BAS A:PROG2 BAS
A:PROGG BAS A:PROG3 BAS

```

Note the difference in the directory lists which are displayed when “TEST*.BAS” and “TEST?.BAS” are specified as file descriptors with the DIR command (the command used to display a directory of files stored in disk drives).

```

A>DIR A:TEST*.BAS
A: TEST1 BAS : TEST02 BAS
A: TESTA BAS : TEST2 BAS
A: TESTTT BAS : TEST3 BAS
A: TEST4 BAS
A>
A>DIR A:TEST?.BAS
A: TEST1 BAS : TESTA BAS
A: TEST2 BAS : TEST3 BAS
A: TEST4 BAS
A>

```

All files in drive A: will be displayed if the file descriptor is specified as “*.*”.

```

A>DIR *.*
A: TEST1 BAS : TEST02 BAS
A: TESTA BAS : TES001 BAS
A: TES002 BAA : TEST2 BAS
A: TESTTT BAS : TEST3 BAS
A: TEST4 BAS : PROG1 BAS
A: PROG2 BAS : PROGAA BAS
A: PROGG BAS
A>

```

2.7.2 Built-in commands

Built-in commands are commands which are loaded into memory as part of the CP/M operating system when CP/M is started.

The built-in commands are as follows.

1. DIR (directory) Displays a list of all file names in the specified drive which correspond to <filespec>.
2. ERA (erase) Erases files corresponding to <filespec> from the specified drive.
3. REN (rename) Changes the file name or extension of the specified file.
4. SAVE (save)..... Saves the contents of the specified number of pages of the transient program area as a file. Pages start at address 100H, and each page consists of 256 bytes.
5. TYPE (type)..... Displays the contents of the specified file on the screen.
6. USER (user)..... Used to select a user area in a disk drive.

DIR

Format DIR drivename:filename.ext

Function Displays a list of files stored in the specified drive.

The DIR command can be used in three ways as follows.

(1) DIR d:

Displays a list of all files in the drive specified by d:. If d: is omitted, displays a list of all files in the currently logged in drive. If no files are present on the specified drive, displays the message "NO FILE".

Example

```
A>DIR
A: TEST      BAS : PROG      COM
A>

A>B:
B>DIR A:
A: TEST      BAS : PROG      COM
B> .

A>DIR
NO FILE
A>
```

(2) DIR d:filename.ext

Displays the name of the specified file in the specified drive.

Example

```
A>DIR A:TEST1.BAS
A: TEST1     BAS
A>DIR TEST2.BAS
A: TEST2     BAS
A>
```

(3) DIR d:filematch

Displays the names of all files in drive d: which correspond to filematch.

Example

```
A>DIR TEST*.BAS
A: TEST1    BAS : TEST2    BAS
A>DIR *.BAS
A: TEST1    BAS : TEST2    BAS
A: PROG     BAS : PROG1    BAS
A: PROG2    BAS : SAMP1    BAS
A: SAMP2    BAS
A>DIR TEST1.*
A: TEST1    BAS : TEST1    DAT
A>DIR SAMP?.BAS
A: SAMP1    BAS : SAMP2    BAS
A>
```

ERA

Format ERA d:filename.ext

Function Deletes specified files from the specified drive.

There are two methods of using the ERA command as follows.

(1) ERA d:filename.ext

Deletes the file specified by "filename.ext" from drive specified by "d:".

Example

```
A>DIR
A: TEST1    BAS : TEST2    BAS
A: TEST1    DAT : TEST2    DAT
A: PROG     BAS : PROG1    BAS
A: PROG2    BAS : SAMP1    BAS
A: SAMP2    BAS : SAMPLE    DAT
A: SAMPLE   ASM
A>ERA A:PROG.BAS
A>DIR
A: TEST1    BAS : TEST2    BAS
A: TEST1    DAT : TEST2    DAT
A: PROG1    BAS : PROG2    BAS
A: SAMP1    BAS : SAMP2    BAS
A: SAMPLE   DAT : SAMPLE    ASM
A>
```

In the example above, the DIR command is used to show how the directory changes when a file is deleted by executing the ERA command.

(2) ERA d:filematch

Deletes all files from the specified drive whose file names correspond to "filematch".

Example Deleting all files from the currently logged-in drive whose file names begin with "TEST" and whose extension is ".DAT".

```
A>DIR
A: TEST1      BAS : TEST2      BAS
A: TEST1      DAT : TEST2      DAT
A: PROG1      BAS : PROG2      BAS
A: SAMP1      BAS : SAMP2      BAS
A: SAMPLE     DAT : SAMPLE     ASM
A>ERA TEST*.DAT
A>DIR
A: TEST1      BAS : TEST2      BAS
A: PROG1      BAS : PROG2      BAS
A: SAMP1      BAS : SAMP2      BAS
A: SAMPLE     DAT : SAMPLE     ASM
A>
```

Example ERA *.*

Deletes all files from the logged-in disk. Before files are deleted, a message is displayed to request confirmation that all files are to be deleted. Files are deleted only when the Y key is pressed in response to this message.

```
A>DIR
A: TEST1      BAS : TEST2      BAS
A: PROG1      BAS : PROG2      BAS
A: SAMP1      BAS : SAMP2      BAS
A: SAMPLE     DAT : SAMPLE     ASM
A>ERA *.*
ALL (Y/N)?Y
A>DIR
NO FILE
A>
```

REN

Format REN d:newfilename.ext = oldfilename.ext

Function Changes the name of a disk file from "oldfilename" to "newfilename".

The name which is specified for "newfilename.ext" must not belong to any other file in the drive.

Example The first example below changes the name of file "OLD.OLD" in drive A: to "NEW.NEW". The second example changes just the file name extension.

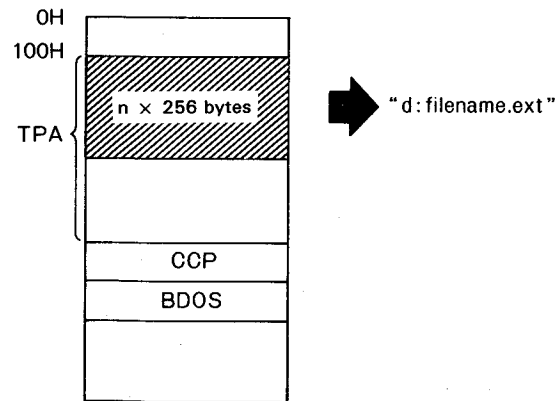
```
A>DIR
A: OLD        OLD
A>REN A:NEW.NEW=OLD.OLD
A>DIR
A: NEW        NEW
A>REN NEW.DAT=NEW.NEW
A>DIR
A: NEW        DAT
A>
```

SAVE

Format SAVE number-pages d:filename.ext

Function Saves the specified number of pages of the transient program area to disk under the specified file name.

The SAVE command saves the specified number of pages (1 page = 256 bytes) of the memory area starting at address 0100H to disk.



Example The following example saves the 4-page (1024-byte) area starting at address 0100H to drive A: under the file name "TEST.DAT".

```
A>DIR
NO FILE
A>SAVE 4 A:TEST.DAT
A>DIR
A: TEST    DAT
A>
```

TYPE

Format TYPE d:filename.ext

Function Displays the contents of ASCII text files on the display screen.

The TYPE command displays the contents of the specified file on the display screen. However, only files which have been saved in ASCII format (as character codes) can be displayed; if any other type of file is specified, display will be meaningless.

Example The following example illustrates use of the TYPE command to display a BASIC program file which has been saved in ASCII format.

(BASIC)

```
LIST
10 PRINT "A"
20 PRINT "B"
30 PRINT "C"
40 PRINT "D"
50 PRINT "E"
60 END
OK
SAVE "A:TEST.BAS",A
OK
```

(CCP)

```
A>TYPE A:TEST.BAS
10 PRINT "A"
20 PRINT "B"
30 PRINT "C"
40 PRINT "D"
50 PRINT "E"
60 END
```

A>

USER

Format **USER n**

Function **Switches to the specified user area in a disk drive.**

A user area is a physical area on a disk which has its own directory and which is managed separately from the rest of the disk. Data cannot be read from or written to any user area other than that in which CP/M is currently operating. A disk can be divided up into a maximum of 16 user areas. The USER command switches CP/M operation from one user area to another.

Example The following example shows that data in one user area (area 0) cannot be read while CP/M is operating in another (area 1).

```
A>USER 0
A>DIR
A: TEST      DAT
A>USER 1
A>DIR
NO FILE
A>
```

2.7.3 Transient commands

A transient command is a program which is loaded into the transient program area (TPA, the area starting at address 0100H) from a disk drive for operation when the command is executed. Representative transient commands of CP/M are PIP and STAT.

2.7.4 Error messages

If any error is encountered during file processing, BDOS (the basic disk operating system) displays one of the following error messages. In these messages, the characters displayed for "d:" indicate the applicable drive name.

BDOS ERR ON d:BAD SECTOR

Indicates that an error occurred during input or output processing; there is something wrong with the disk drive or the floppy disk in the drive. After the cause of the error has been eliminated, processing can be resumed by pressing any key.

BDOS ERR ON d:SELECT

BDOS does not recognize the drive name which was specified in a command. A warm start is made when any key on the keyboard is pressed.

BDOS ERR ON d:READ ONLY

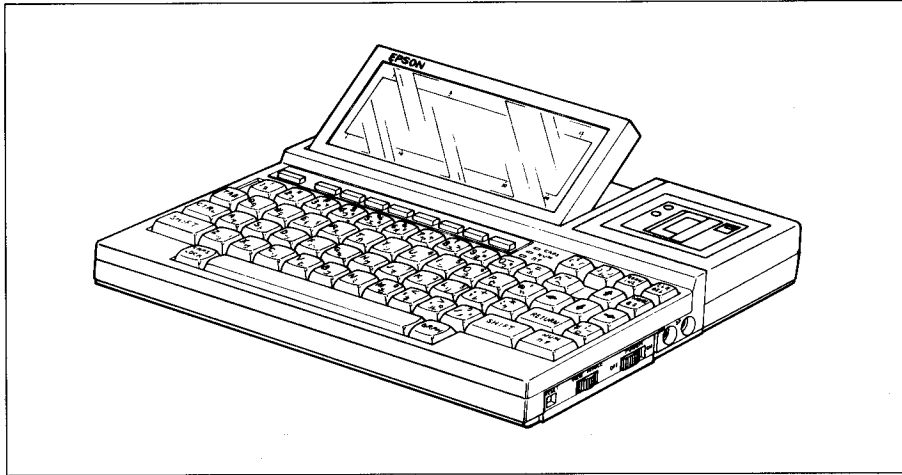
An attempt was made to write data to a read-only drive (a drive for which the read-only attribute has been set with the STAT command). A warm start is made when any key on the keyboard is pressed. This error will also occur if an attempt is made to write data to a disk which was inserted in a drive which previously contained a different disk. In this case, the read-only condition can be cleared by pressing **CTRL** + **C** or **STOP**.

BDOS ERR ON d: FILE READ ONLY

This message appears when you try to erase, rename, or set file attributes of a Read-Only file. The file should first be set to Ready-Write (RW) with the command: "STAT filesystem \$R/W."

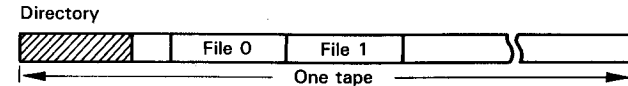
2.8 Microcassette Handling

When PX-4's optional microcassette drive is installed, microcassettes can be used for file storage in much the same manner as with the RAM disk or floppy disk drives. The drive name of the microcassette drive is H:.



As with disk drives, microcassette files are managed using a file directory (a directory containing information regarding files which are present). This directory must be loaded into memory from tape before microcassette files can be read or written. The processing of loading the directory into memory is referred to as "mounting" the tape. Once the tape has been mounted, PX-4 manages files on the tape based on information contained in the directory in memory. If data is written to the tape, the contents of the directory in memory are changed. Therefore, when operation is completed the directory must be written back onto the tape from memory before unloading the tape from the drive. This operation is referred to as "removing" the tape.

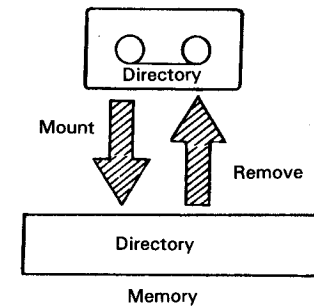
Once the tape has been removed, the FREE lamp (green) on the microcassette drive lights. Before unloading a tape, always verify that the FREE lamp is lit. (Since the FREE lamp will light only if PX-4's power is turned on, always make sure that the power is on and that the FREE lamp is lit before unloading the tape.)



It is very important to remember to do the "remove" operation before unloading a tape.

If the tape is taken out of the microcassette drive without updating the directory by doing the "remove" operation, all data written to the tape will be lost.

Tapes are mounted or removed by pressing **CTRL** + **HELP** to switch to the System Display, then pressing one of function keys. During BASIC operation, tapes can be mounted and removed by executing the MOUNT and REMOVE statements.



If the tape in the drive is not already mounted, it is mounted automatically whenever drive H: is specified in CP/M commands (such as DIR or ERA) or BASIC statements (such as FILES, SAVE, and LOAD).

Therefore, it is not necessary to explicitly mount each tape which is accessed. However, the "remove" operation is not performed automatically, so be sure to remember to do the remove operation before unloading tapes from the drive.

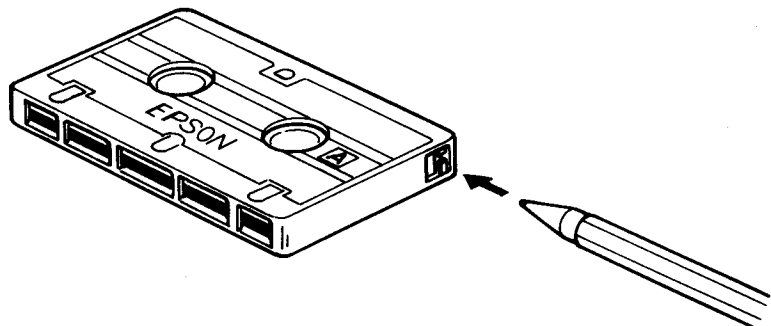
When the remove operation is done (either from the System Display or from BASIC), directory information is written to tape from memory only if data has been recorded to the tape since it was last mounted. (The directory is not updated if nothing has been written to the tape because the directory information remains the same as when the tape was mounted.)

Once a tape has been mounted, it is not possible to execute the "mount" function from the System Display; if the MOUNT statement of BASIC is executed while a tape is already mounted, an "AC Error" will result. An "AC Error" will also result if the REMOVE statement of BASIC is executed when no tape has been mounted. In other words, the "mount" and "remove" functions can only be done in alternation.

When a file is written to tape, the write operation always starts at the point on tape which immediately follows the end of the last file written. This applies whether or not the file is being written to the tape for the first time.

NOTES:

1. Always make sure that the FREE lamp is lit before unloading tape from the microcassette drive. If the power is not on, turn on the power switch and make sure that the FREE lamp is lit.
FREE (green): When lit, indicates that tape may be unloaded from the microcassette drive.
REC (red): When lit, indicates that data is being written to the microcassette tape.
2. Make sure than the microcassette drive is closed before doing the "remove" operation.
3. Before initializing the microcassette directory, verify that the record lock-out tabs on the microcassette are not broken.
4. When drive H: (the microcassette drive) is specified in the STAT command, the value which is returned is meaningless.
5. To prevent accidental erasure of tapes which contain important data, break off the microcassette's record lock-out tabs. Once these tabs have been broken off, the tape cannot be recorded or erased.



Manual microcassette operation

When the microcassette drive is installed, certain microcassette operations can be performed manually from the System Display. The appearance of the System Display changes as follows when the microcassette drive is installed.

```
* SYSTEM DISPLAY * 05/05 (SAT) 17:06:56
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBA <MENU> ON
<MCT COUNT> 00000
-Select or ESC to exit. 1=RAM cartridge
2=alarm 3=auto start 4=menu 5=MCT
<<-/ <-/mou #/dint ->>/era 000/
```

The value following <MCT COUNT> in the screen indicates the present value of the microcassette drive's tape counter. The "5=MCT" option in this screen can be selected to specify items which determine microcassette drive operating mode (the manner in which the drive operates). On the bottom line, <<- indicates that the tape can be manually fast-forwarded by pressing the **PF1** key, "mou" indicates that the tape can be mounted by pressing **SHIFT** + **PF2**, and so forth.

After the directory of a new tape has been initialized or a previously initialized tape has mounted, the screen changes as shown below.

```
* SYSTEM DISPLAY * 05/05 (SAT) 00:05:13
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBA <MENU> ON
<MCT COUNT> 00191
-Select or ESC to exit. 1=RAM cartridge
2=alarm 3=auto start 4=menu 5=MCT
/rem / / / / /
```

With this screen, the only microcassette operation which can be performed is the "remove" operation.

Commands and statements related to microcassette operation are summarized in the table below.

Operation	Function	System Display control	BASIC statements
MOUNT	Reads the tape directory.	SHIFT + PF2 (mou)	MOUNT
REMOVE	Writes the tape directory.	SHIFT + PF1 (rem)	REMOVE
DIRINT	Initializes the tape directory.	SHIFT + PF3 (dint)	-----
REWIND	Rewinds the tape.	PF4 (->>)	WINDn (where n is the tape counter value). Tape is rewound only if n is less than the present counter value.
PLAY	Outputs the contents of the tape to the speaker.	PF2 (<-)	WIND ON
FF	Fast-forwards the tape.	PF1 (<<-)	WINDn (where n is the tape counter value). Tape is fast-forwarded only if n is greater than the present counter value.
ERASE	Erases the tape.	SHIFT + PF4 (era)	-----
STOP	Stops the tape.	PF3 (⊙)	WIND OFF
RESET	Resets the tape counter to 0.	PF5 (000)	TAPCNT = 0

Setting the microcassette mode

The microcassette drive access mode can be set by selecting "5 = MCT" from the System Display. When "5 = MCT" is selected, the screen changes as shown below.

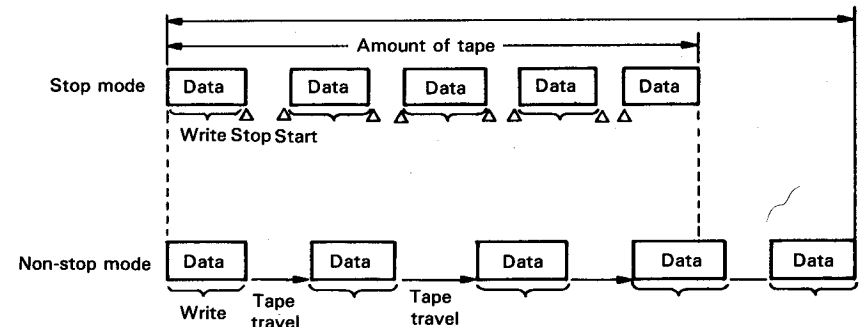
```
* SYSTEM DISPLAY * 05/05 (SAT) 00:06:29
<RAM DISK> 026 KB <ALRM> OFF
<USER BIOS> 000x256 B <AUTO> OFF
<MENU DRIVE> CBA <MENU> ON
<MCT COUNT> 00191
-Select or ESC to return.
<MCT> stop nonverify
1=stop 2=nonstop 3=verify 4=nonverify
```

<Stop mode and non-stop mode>

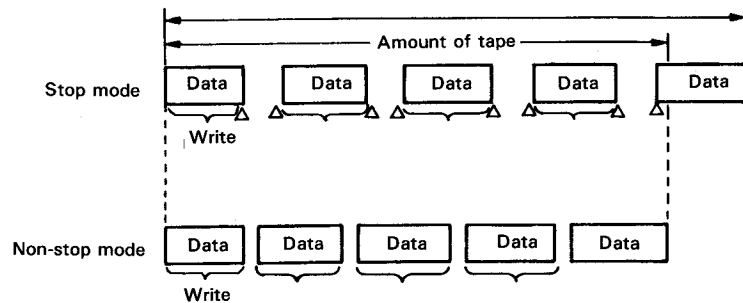
In the stop mode, the microcassette drive stops running after each block of data has been read or written, and does not start running again until read or write operation begins for the next block. In contrast, the microcassette drive runs continuously when it is used in the non-stop mode (that is, it does not stop running from the time a file is opened until the time that file is closed). Ordinarily, the stop mode is used when processing involving arithmetic calculations or the like is done in the interval between access to each block, and the non-stop mode is used when only data transfer (such as with the PIP command of CP/M or the SAVE command of BASIC) is involved. Access takes longer when the stop mode is used because it takes a certain amount of time to start and stop the drive motor.

Microcassette drive operation can be switched to the stop mode selecting "1 = stop", and to the non-stop mode by selecting "2 = nonstop".

Example 1: This example graphically illustrates the difference in the amount of tape which is used to store a file with the stop and non-stop modes when lengthy processing is done between the time each block is written.



Example 2: This example illustrates the difference in the amount of tape which is used to store a long file with the stop and non-stop modes when only data transfer is involved.



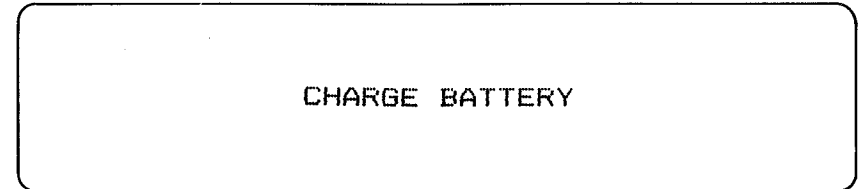
< Verify mode and non-verify mode >

In the verify mode, the tape is automatically rewound after a file has been written, then the file is read to verify that data has been properly recorded; if any data error is detected while the tape is being read, the microcassette drive stops and an error message is displayed. This operation is not performed when data is written to the microcassette drive in the non-verify mode.

Microcassette drive operation can be switched to the verify mode by selecting "3 = verify", and to the non-verify mode by selecting "4 = non-verify".

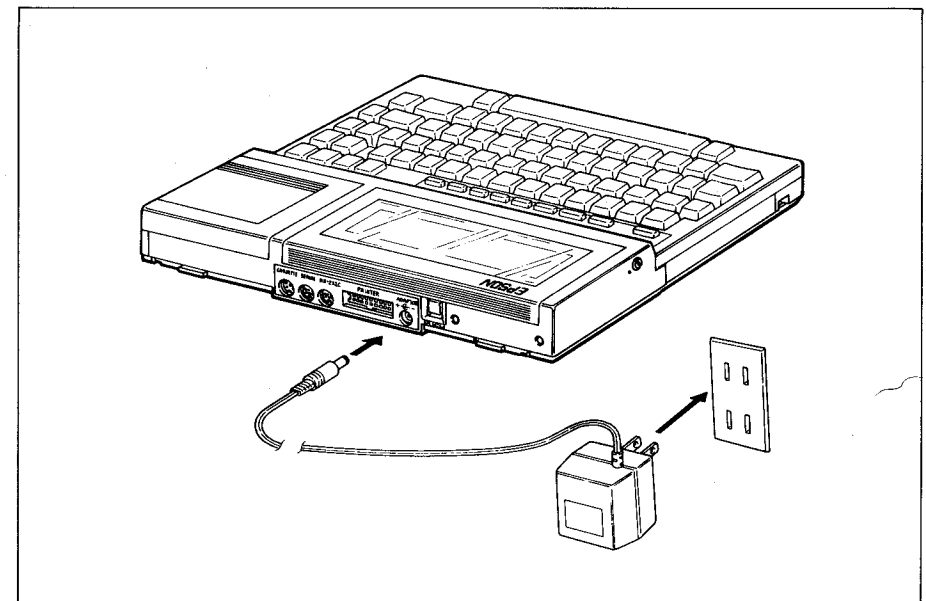
2.9 Charging and Replacing the Main Battery

When the main battery voltage drops below a certain level while PX-4 is being used, the following screen appears, then PX-4 automatically shuts itself off.



When this message appears, the main battery must be recharged or replaced. When using dry cells, replace them as described in section 2.1, "Introduction to Operation." When using the NiCd battery pack, recharge it as follows.

1. Turn off the power switch.
2. Plug the AC adapter cable into the ADAPTER connector, then plug the AC adapter into an AC power outlet.

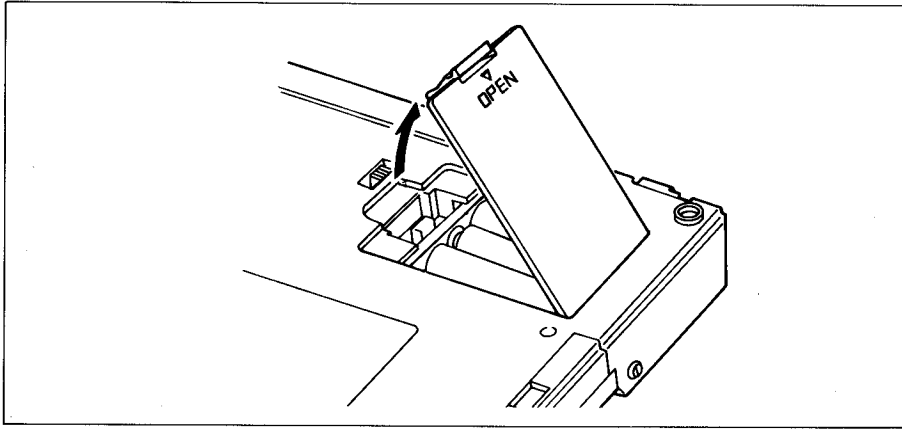


3. Charging takes about 8 hours if PX-4 is not used during charging, and about 11 hours if PX-4 is used (provided no input/output processing is performed). However, the battery may not be fully charged if PX-4 is used during charging.

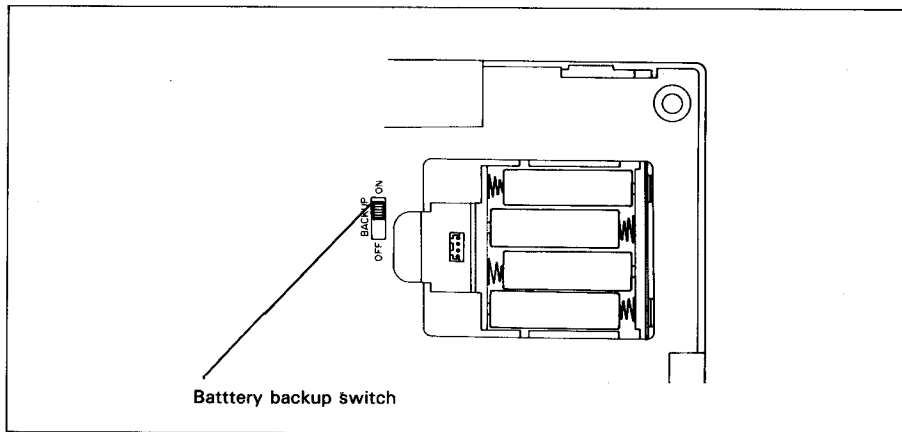
Installing the NiCd battery pack

Procedures for installing the NiCd battery pack are as follows.

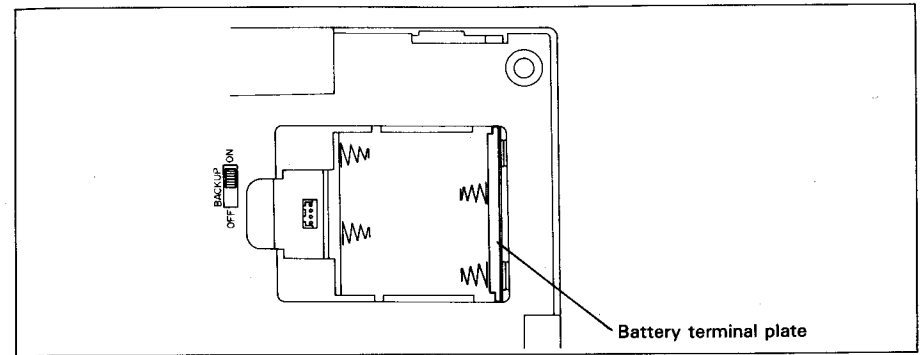
1. Turn off the power switch.
2. Open the battery compartment cover on the bottom of PX-4.



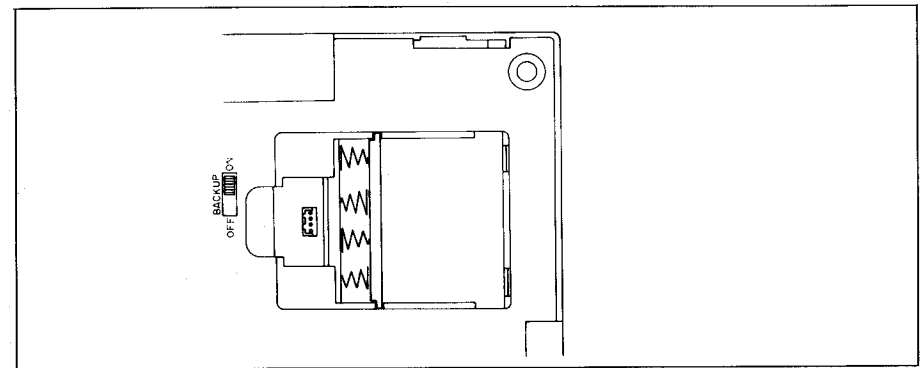
3. Verify that the battery backup switch next to the battery compartment is set to ON.



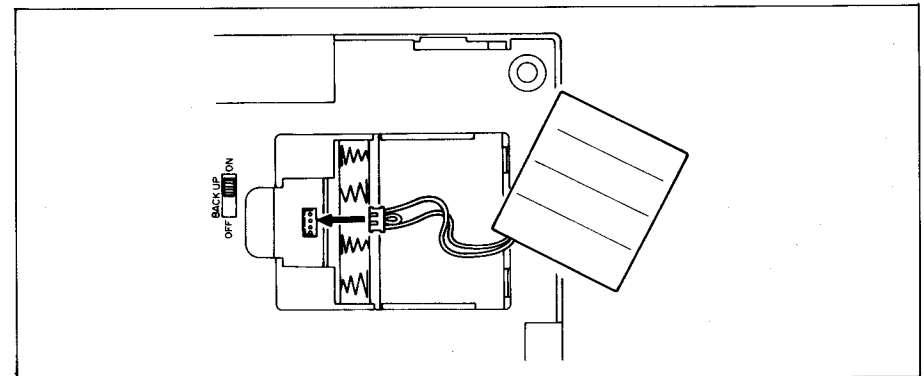
4. Remove dry cells from the battery compartment.



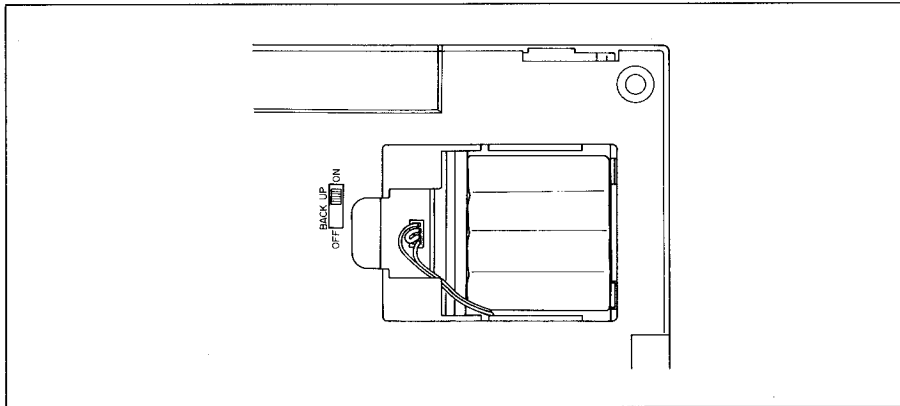
5. Move the battery terminal plate to the position shown in the figure below.



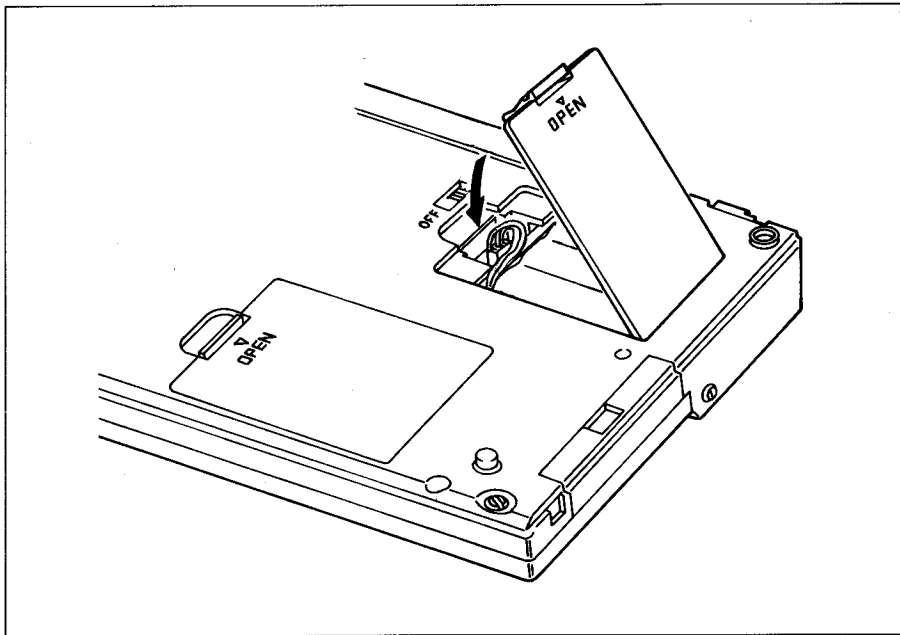
6. Plug the NiCd battery pack connector lead into the connector socket.



7. Push the battery terminal plate all the way to the side and insert the NiCd battery pack.



8. Close the battery compartment cover.

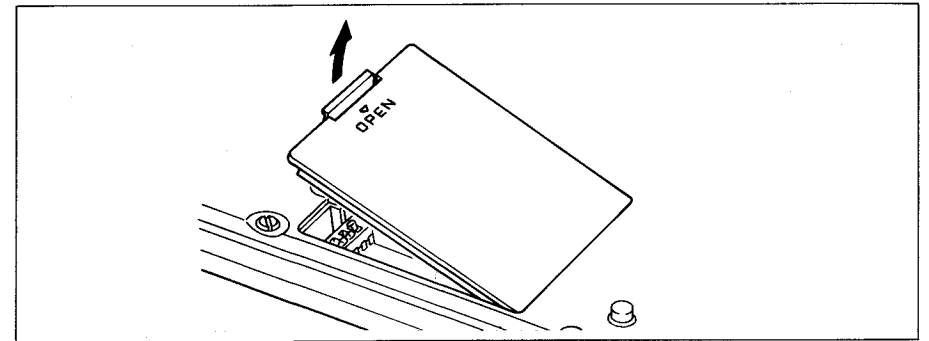


2.10 ROM Capsule Replacement

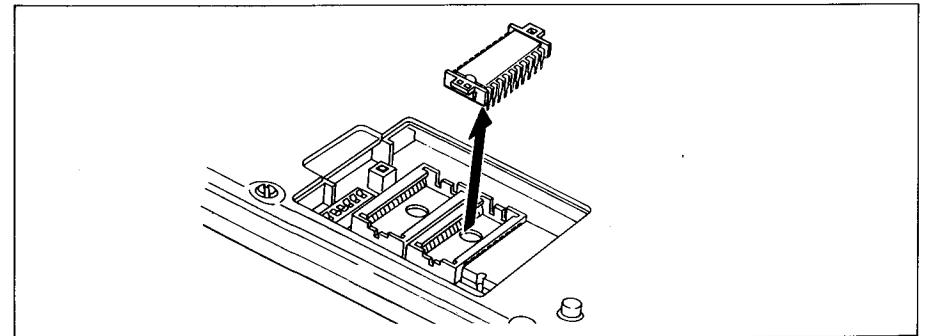
A ROM capsule can be thought of a disk drive which contains prerecorded application programs. When necessary, ROM capsules can be replaced to allow different application programs to be used. Up to two ROM capsules can be installed in PX-4 at the same time, and different device names (B: and C:) are assigned to each ROM capsule. When the optional ROM cartridge is used, two additional ROMs can be installed (device names assigned to ROMs in the ROM cartridge are J: and K:).

Procedures for replacing ROM capsules are as follows. Be sure to turn off the power before replacing the ROM capsules.

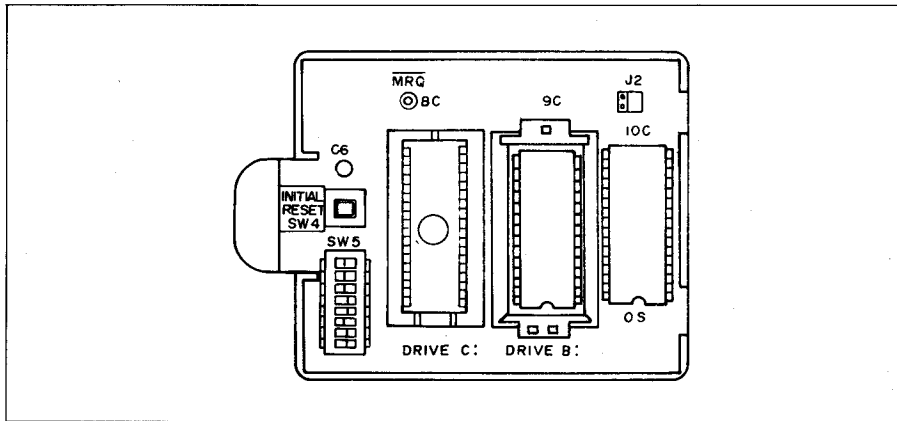
1. Set the power switch to OFF.
2. Open the ROM capsule compartment on the bottom of PX-4.



3. Grip the ROM capsule by the ends with your fingers and slowly work the capsule out of its socket by pulling the ends up slightly in alternation. Do not rock the capsule from side to side.



4. Insert the new ROM capsule. Verify that the pins of the ROM capsule are seated properly in the socket, and make sure that the end with the notch is positioned as shown in the figure below.



5. Replace the ROM capsule compartment cover.
6. Turn on the power switch.

NOTE:

System operation may be disrupted if a ROM capsule is removed or installed without turning off the power.

Chapter 3

STANDARD INPUT/OUTPUT INTERFACES

Input/output interfaces are the part of the hardware system through which PX-4 exchanges data with external devices such as printers or other computers. These signals make it possible for PX-4 to receive data for processing from other external devices, or to output drive/control signals and data to optional devices. All interfaces except the bar code reader are supported by BIOS of CP/M or BASIC (no standard software support is provided for the bar code reader interface).

This chapter describes the functions of PX-4's eight standard input/output interfaces and procedures for using them.

3.1 Speaker Interface

An external speaker can be connected to PX-4's external speaker interface. When an external speaker is connected, speaker output goes to the external speaker instead of to the speaker which is built into PX-4. Speakers (or earphones) which can be connected must have a nominal impedance of at least 100 ohms.

