Part II SOFTWARE

CONTENTS (SOFTWARE)

CHAPTER 1 GENERAL SYSTEM INFORMATION

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1.1 Introduction

1.1.1 Extended CP/M V2.2

The PINE uses an extension of CP/M V2.2 as its operating system.

PINE main memory is 64K bytes in size, part of which can be used as a RAM disk. A RAM disk allows for fast file access, and can be used in the same way as a floppy disk. A RAM disk, ROM capsule, microcassette, and ROM and RAM cartridges are available in place of floppy disks. The PINE is furnished with RAM disk and BASIC ROM capsule as standard. The other devices are optional.

In PINE CP/M, application programs on a ROM capsule can be executed in main memory, as in the standard CP/M. In PINE CP/M, however, they can also be executed directly in the ROM capsule, thus improving mamory efficiency and economizing on power requirements.

1.1.2 Item Keyboard

The PINE OS supports an optional item keyboard, as standard, which allows the system to be used exclusively for specific applications. Since the item keys on the item keybaord are arranged in a matrix and can be redefined, the user can use the keyboard for his or her special purposes. The user can replace the item keyboard with the standard keyboard at any time.

1.1.3 PINE Devices

The PINE supports a variety of devices as shown below:

(1) LCD
A virtual screen of 80 columns by 25 lines, a system screen, and user-defined character definitions are supported.

(2) Keyboard
The keyboard shift status is indicated by one of the LEDs. The keyboard supports auto repeat, N-key rollover, and function key (five) features. The user can define cursor key codes and the keys with a key code from 40H to 5EH and 60H to 7EH. The PINE also supports the item keyboard, whose item keys can be redefined.

(3) Disk drives
The PINE is designed so that part of external memory can be used in the same way as disk drives.

1) ROM capsule
Programs in a ROM capule can be executed either in RAM or ROM.

2) Microcassette
The PINE supports MTOS (file management on BDOS level) as standard and provides MTOS function calls in addition to ordinary BDOS function calls. Multiple write, retry, and verify features are also supported for microcassette processing.

3) ROM cartridges, RAM cartridges, and RAM disks can be used in the same way as floppy disks. ROM cartridges store read-only files. RAM cartridges and disks permit fast file access.

(4) Other devices and interfaces
In addition to above, the PINE supports devices such as floppy disks, clock, buzzer, printer, RS-232C interface, SIO (serial interface), and so on.

1.2 System Configuration

The PINE comprises power supply unit, keyboard, LCD, and interfaces. Figure 1.2.1 illustrates the PINE system configuration.

The PINE employs two CPUs: Z-80 as the main CPU and 7508 as the slave CPU. It has a four-bank memory configuration. The PINE's memory consists of 64KB of RAM, 32KB of OS ROM, and up to two 32KB ROM capsules.

The 4-bit slave CPU (7508) controls the keyboard, clock, and power supply. The main CPU (Z-80) controls the RS-232C, SIO, cartridge and Printer interfaces. It also controls optional cartridges such as microcassette, ROM and RAM cartridges, and cartridge printer.

The PINE also supports an external RAM disk unit connected to the sytem bus.

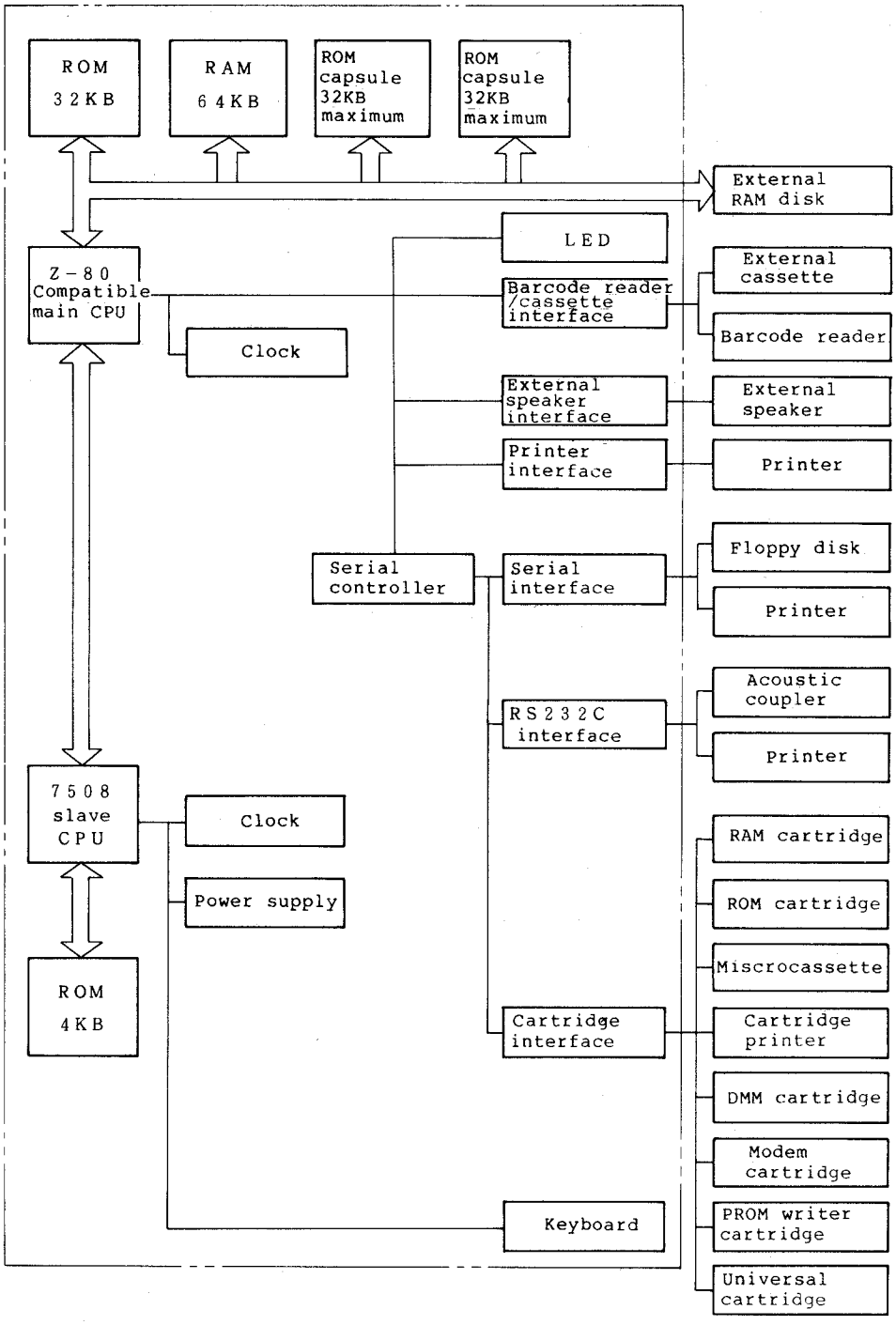


Fig. 1.2.1 System Configuration

1.3 Software Organization

The PINE software is physically stored in two places: OS ROM (32KB) and 7508 internal ROM (4KB). See Chapter 2, "7508 General" in PART I, hardware for information about the 7508.

The PINE OS consists of the function modules below. Section numbers enclosed in parentheses indicate the sections of this manual in which the corresponding modules are described.

(1) Starter (2.2 - 2.8)
Performs system activation, initialization, reset, or power-on processing.

(2) Interrupt handler (4.7)
Handles 7508 (keyboard, 1 sec, alarm, power-related), serial reception, ICF, OVF, and EXT interrupts.

(3) Menu (2.10)
Displays executable program files or user-specified files on the menu screen. The user can start a desired program by selecting it from the menu.

(4) System display (2.11)
Permits checking or setting up of a PINE status condition or manual handling of a microcassette.

(5) Clock (2.9)
Performs alram or wake processing.

(6) CCP
Is the CP/M command processor containing six buit-in commands (DIR, ERA, REN, TYPE, SAVE, and USER).

(7) BDOS (3.2)
Controls CP/M disk files. BDOS handles ROM capsules, RAM disks, and ROM and RAM cartridges exactly the same way as it handles disks.

(8) MTOS (3.7)
Controls microcassette files. MTOS corresponds to CP/M BDOS.

(9) BIOS (3.3 - 3.6)
Is an I/O interface between CP/M and hardware.

(10) MIOS (3.7)
Is an I/O interface between CP/M and microcassette.

(11) Relocator
Relocates resident programs in RAM.

(12) Resident processor
Performs part of interrupt and bank switching processing.

CHAPTER 2 SYSTEM FUNCTIONS

CHAPTER 2 SYSTEM FUNCTIONS

2.1 Relationship of System Functions to OS

2.1.1 General

The PINE OS has the following unique functions:
(1) System initialize
(2) Reset
(3) Alarm, wake
(4) Menu
(5) System display

This section describes the reletionship of these functions to the operating system. See the following sections for details of individual functions.

2.1.2 System Flow

This subsection discusses the operation flow from the activation of the system to the return of control to CP/M.

The system is started when one of the following is performed:
(1) System initialization
(2) Reset
(3) Power-on
(4) BOOT
(5) WBOOT
(6) Alarm/wake

The operation flow after the system is started is shown in Figure 2.1.1.

When system is activated by the system initialize, reset, power-on, or alarm/wake functions, the address 0 start processing routine in OS ROM reads the 7508 status and invokes the corresponding processing routine.

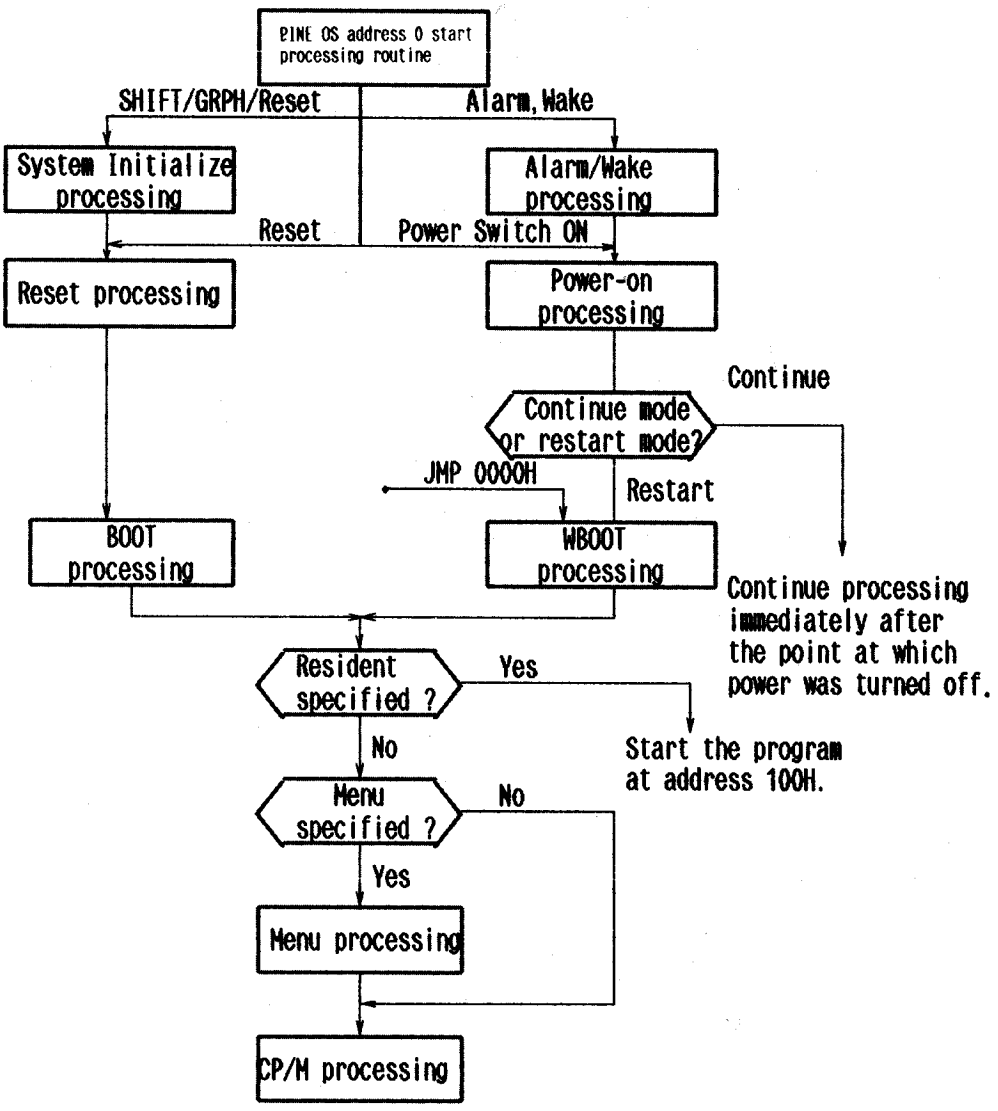


Fig. 2.1.1 System Operation Flow

2.1.3 State Transition

Figure 2.1.2 illustrates the state transition of the PINE.

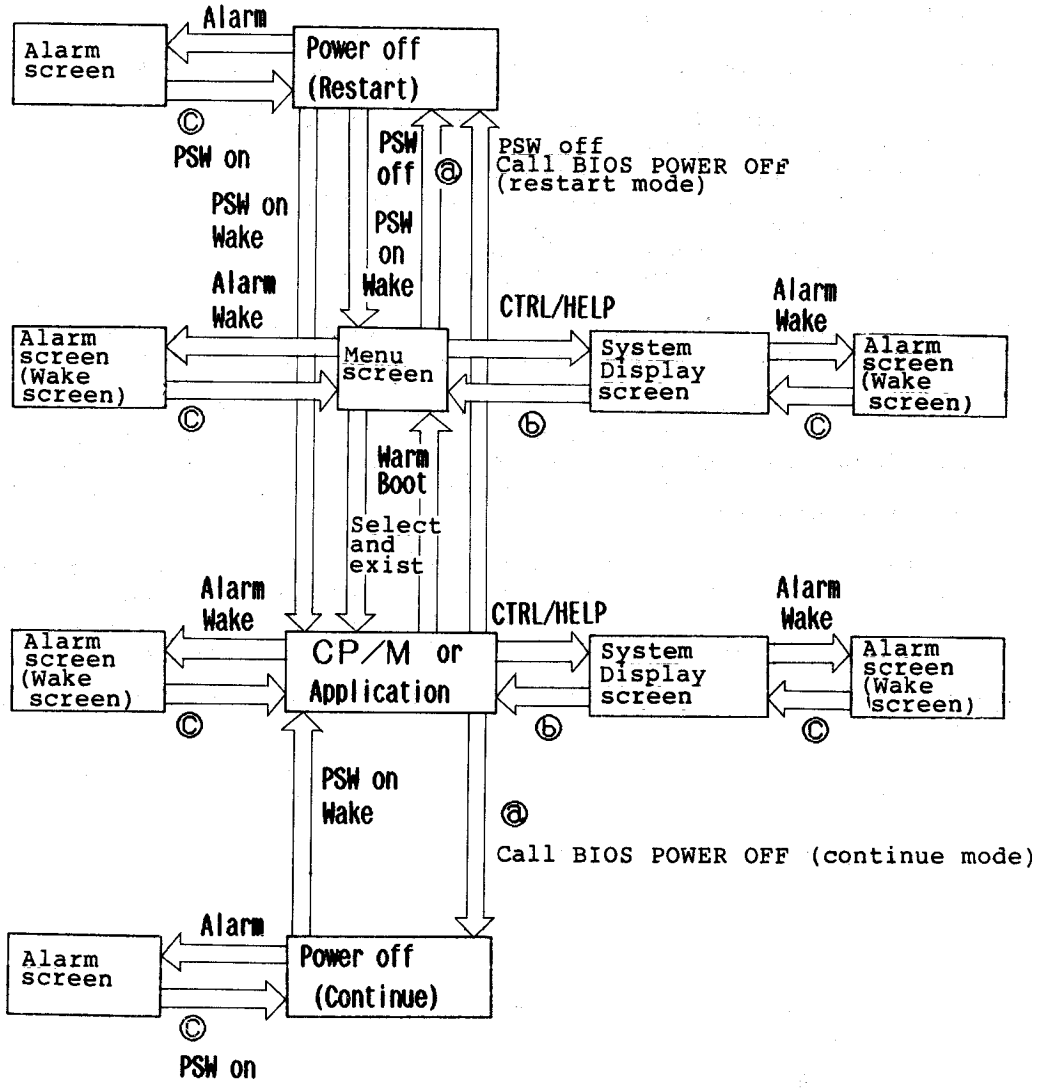
The PINE is always in one of the following six states:
(1) Power is off (restart mode).
(2) Power is off (continue mode).
(3) CP/M (or an application) is in execution.
(4) Menu screen is displayed.
(5) Alarm (wake) screen is displayed.
(6) System display screen is displayed.

The power-off state is either in the restart or continue mode depending on the conditions in which power was turned off.

When power is turned on from the restart mode power-off state, processing starts with the menu screen displayed or in the CP/M state. When power is turned on from the continue mode power-off state, processing resumes in the CP/M state that was established when power was turned off.

If power is turned off during a state transition from CP/M to the system display or alarm/wake screen, control is once again returend to CP/M. CP/M determines the power-off mode by checking the cause of power-off, and turns off power accordingly.

See Section 2.5 for power-off, Section 2.10 for menu, and Section 2.11 for system display.



ⓐ CTRL/PSW off, Auto power off, Power failure

ⓑ CTRL/PSW off, Auto power off, Power failure, ESC, PSW off

© CTRL/PSW off, 50 seconds elapsed, Power failure, ESC, PSW off

Fig. 2.1.2 State Transition Diagram

2.1.4 Replacing the Keyboard

In PINE, the user can easily replace the stnadard keyboard with the item keyboard.

The PINE OS checks the keyboard state during power on to determine whether or not the keyboard has been replaced (automatic keyboard identification).

If the standard keyboard has been replaced, the OS performs keyboard initialization and starts reset processing.

Figure 2.1.3 shows the operation flow of automatic keyboard identification. Table 2.1.4 lists the differences between the standard and item keyboards. See Section 3.5, "Keyboard" for hardware restrictions for individual keyboards.

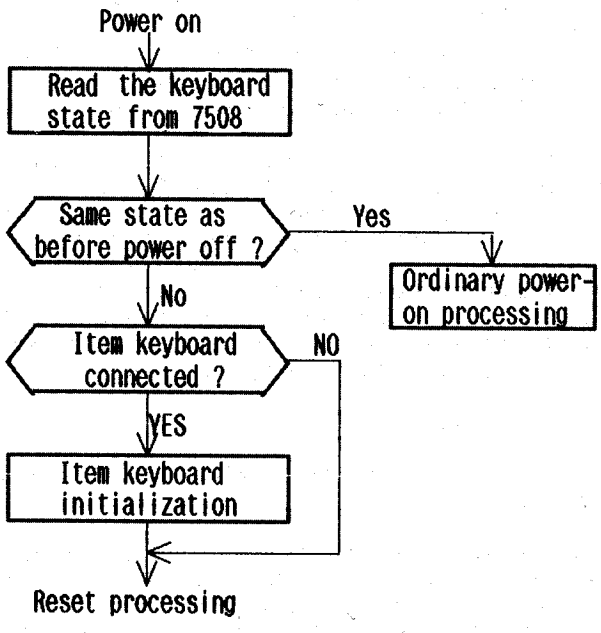


Fig. 2.1.3 Automatic Keyboard Identification

Item \ Keyboard type	Standard keyboard	Item keyboard
Menu screen display drive	C, B, A	A, B, C, D, H, I, J, K
Auto repeat function	Provided	Not provided
Power-off mode	Restart mode	Continue mode

Table 2.1.4 Differences Between the Standard and Item Keyboards

2.2 System Initialize

2.2.1 General

The PINE executes the system intialize routine to reset the execution environment when the system is started, program execution hangs up, or the RAM contents is destroyed by battery failure. The entire system resident area is initialized when the system initialize routine is executed.

2.2.2 Invoking the System Initalize Routine

The system initialize routine is invoked when:

(1) The RESET button is pressed and released while the right SHIFT and GRPH keys are held down. (Standard keyboard)
(2) The RESET button is pressed and released while the INIT and STOP keys are held down. (Item keyboard)
(3) The slave CPU RESET button on the main unit rear panel is pressed.
(4) Power is turned on for the first time after the external RAM disk is connected or disconnected.
(5) Power is turned off during system intialization and turned on again.
(6) An error is detected during error checking at power-on or reset time. Errors include the following:
    1) The checksum obtained at the last power-off does not match the checksum obtained at current power-on.
    2) The sum of the internal RAM disk size and the user BIOS area size exceeds 35.5K bytes. (Reset time)
    3) The address calculated from the CCP, RBDOS1, and RBIOS1 load addresses and their sizes does not match the starting address of the internal RAM disk. (Reset time)

2.2.3 Internal Processing

The system carries out the following during system initilaization:

(1) Sends a Keyboard Reset command to the 7508 and initalizes the keyboard-related values stored in the 7508.
(2) Initializes system work area RSYSAR1.
(3) Cold boots the system devices. The cold boot procedure consists of the following steps:
    1) Initialize the data in the system resident area (loading of data).
    2) Warm boot the sytem devices. (Check for a RAM disk, ROM capsule, and ROM and RAM cartridges and establish the sytem environment accordingly.)
    3) Enable 1-second interrupts.
    4) Disable alarm interrupts.
    5) Read in DIP switch data and initialize the keyboard-related parameters according to the keyboard type and language setting.
    6) Turn on LCD screen display and enables cursor blinking.
(4) Displays the system initialize screen to permit the user to set up the following:
    1) Year, month, day, hour, minute, and second
    2) Day of the week
    3) Internal RAM disk size
    4) User BIOS size
(5) Clears the auto start string or alarm message.
(6) Passes control to the reset processing routine (see Section 2.3, "Reset" for reset processing).

2.2.4 System Initialize Screen

The system initalize screen shown below appears when the system initalize routine is invoked:

```
SYSTEM INITIALIZE

(1) DATE/TIME (MMDDYYhhmmss) 053084153740
(2) WEEK (0 to 6)  3
(3) RAM DISK SIZE (×1  kB)  26
(4) USERBIOS SIZE (×256 B)  000
```

Repond to the system prompt as follows:

(1) Specify each of the year, month, day, hour, minute, and second with a two-digit number. Enter the last two digits of the year. Time must be specified in the 24-hour system.
(2) Specify the day of the week with a number Ø to 6.
Ø: Sunday, 1: Monday, ... , 6: Saturday
(3) Specify the internal RAM disk size with a two-digit number. The internal RAM disk size must be speicified in 1 KB increments and must be ØØ or Ø2 to 35. 26 (on the screen) is the system default. The system will ask for reentry if Ø1 or a value larger than 35 is entered.
(4) Specify the user BIOS size with a three-digit number in 256 byte units. ØØØ (on the screen) is the system default.

Note the following when entering the above data:

(1) Specify items (1) through (4) in that order.
(2) When the external RAM disk is connected, the internal RAM disk is made invalid (i.e., its size is automatically set to Ø byte) and no request for RAM disk size is displayed.
(3) The total size of the internal RAM disk and the user BIOS must be smaller than 35.5K bytes. If the sum exceeds 35.5K bytes, the system asks for reentry.
(4) Be careful when entering data because no check is made for invalid data (specifying 13 for month or 7 for day of the week).
(5) Data other than numbers or entries from other than cursor movement keys are not accepted.

The system initailize routine transfers control to the reset processing routine when items (1) through (4) are specified.

2.3 Reset

2.3.1 General

The system executes the reset processing routine when the RESET button on the side panel of the PINE main unit is pressed or when the keyboard is repladed. The reset processing routine initailizes the entire system resident area except for RSYSAR1 (the area initialized during system initialization).

2.3.2 Invoking the Reset Processing Routine

The reset processing routine is invoked when:
(1) The RESET button is pressed and released in power-on state.
(2) The power switch is turned on or the alarm/wake time is reached after a power failure occurred in power-off state.
(3) The power switch is turned on after the keyboard was replaced in power-off state.

Control is transferred to system initialize processing when the RESET button is pressed while the following keys are held down: Right SHIFT and GRAPH (when the standard keyboard is installed) or INIT and STOP (when the item keyboard is installed.)

2.3.3 Internal Processing

The system carries out the following during reset:

(1) Checks the shift state of the currently pressed key and passes control to the system initailize processing routine when only the right SHIFT and GRPH keys (standard keyboard) or the INIT and STOP keys (item keyboard) are pressed.
(2) Sends a Keyboard Reset command to the 75Ø8 and initalizes the keyboard-related values stored in the 75Ø8.
(3) Cold boots the system devices. The cold boot procedure consists of the following steps:
    1) Initialize the data in the system resident area (loading of data).
    2) Warm boot the sytem devices. (Check for installation of the RAM disk, ROM capsule, and ROM and RAM cartridges and establish the sytem environment accordingly.)
    3) Enable 1-second interrupts.
    4) Enable or disable alarm interrupts according to the current alarm/wake settings.
    5) Read in DIP switch data and initialize the keyboard-related parameters according to the keyboard type and language setting.
    6) Turn on LCD screen display and enable cursor blinking.
(4) Checks the sizes of the internal RAM disk and user BIOS area and passes control to the system initialize routine if their sum exceeds 35.3K bytes.
(5) Passes control to the reset processing routine if the address calculated from the CCP, RBDOS1, and RBIOS1 load addresses and their sizes does not match the starting address of the internal RAM disk.
(6) Updates the data in the disk parameter block for each of the currently installed devices (RAM disk, ROM capsule, ROM cartrige or RAM cartridge).
(7) Performs a sum check on the internal RAM disk. If a checksum mismatch occurs, the sytem displays a message asking for RAM disk formatting.

The system transfers control to BIOS BOOT when the above procedure is completed.

Figure 2.3.1 shows the operation flow of reset processing.

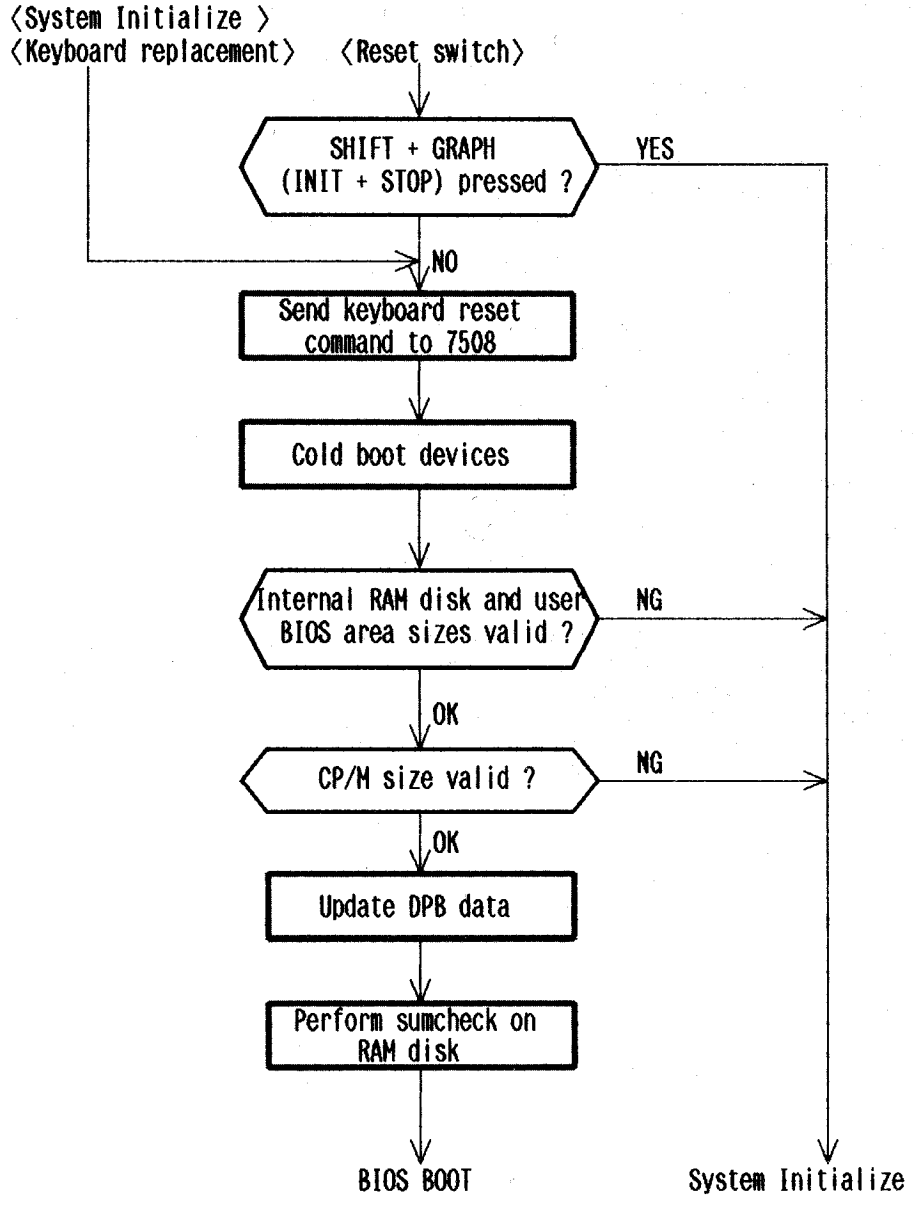


Fig. 2.3.1 Reset Processing Flow

2.3.4 Miscellaneous

2.3.4.1 RAM disk checking

(1) General
Since the RAM disk uses part of internal RAM, its contents can be unexpectedly destroyed by an application program that is being executed in internal RAM. Therefore, a sum check must be made during each read. The entire RAM disk must be checked at warm boot time. The system prompts the user to format the disk if a checksum error is detected.

(2) RAM disk formatting
The RAM disk is formatted in the following cases:
1) The system is initialized (when an external RAM disk is installed).
2) The RESET button is pressed, or power is turned on (power switch is set to ON or the wake time is reached) when:
- The internal RAM disk size is not zero and an internal RAM disk checksum error is detected (when no external RAM disk is connected); or
- The RESET button is pressed during external RAM disk read/write processing (when an external RAM disk is connected).

(3) Formatting procedure
1) The system prompts "RAM DISK FORMAT (Y/N) ?."
2) If the user response is Y, the system formats the RAM disk (file). If the user response is N, the system does nothing.

(4) Note
The contents of the RAM disk are not guaranteed if the user enters N. That is, a Bad Sector error may occur when the RAM disk is accessed. In such a case, the user must initialize the system and format the RAM disk. When an internal RAM disk is insatlled, no message is displayed during system initialization because the internal RAM disk is formatted automatically.

2.3.4.2 Initializing the sytem areas

Figure 2.3.2 shows when the system areas are initialized.

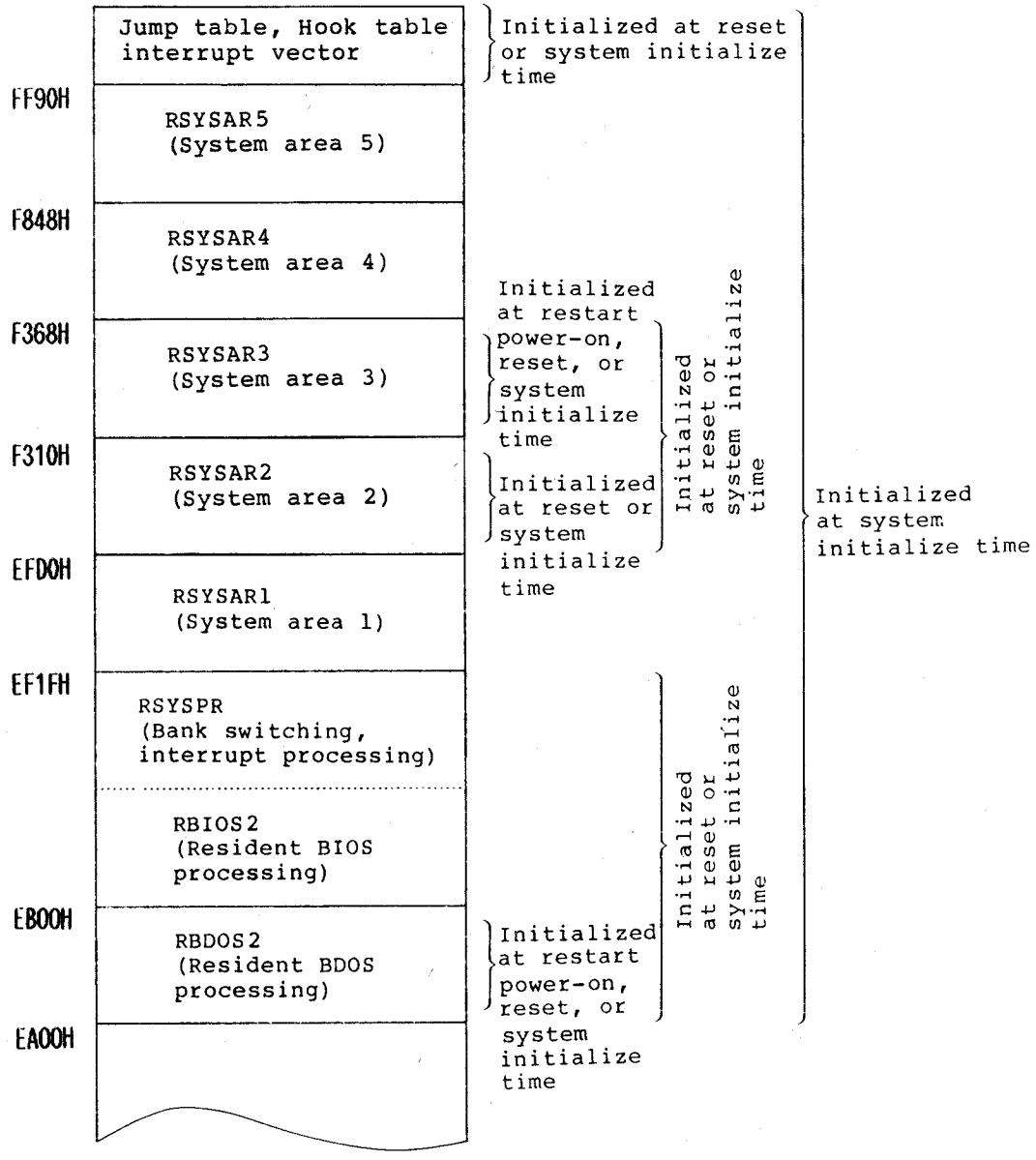


Fig. 2.3.2 System Areas and Their Initialization Times

2.4 Power-on

2.4.1 General

The power-on sequence is initiated when the power switch is turned on from the PINE power-off state. Power-on processing takes place in two modes: restart and continue. The power-on processing mode is determined by the method in which power was turned off.

2.4.2 Starting Power-on Processing

Power-on processing starts when:
(1) The power switch is turned on from the power-off state.
(2) The alarm time is reached in the power-off state and the power switch is turned on while the alarm screen is dispalyed.
(3) The wake time is reached in the power-off state. In this case, the wake string is used in place of the auto start string.

2.4.3 Internal Processing

The operations that the system performs during power-on include the following:
(1) Warm boots the system devices. Warm boot processing consists of the steps below.
    1) Restore the I/O port status to its original status at power-off.
    2) Check for cartridge installation.
    3) Check for ROM capsules installation.
    4) Check for ROM cartridge installation.
    5) Check for RAM cartridge installation.
    6) Check for RAM disk installation.
    7) Update the disk parameter blocks based on the results of steps 3) to 6).
(2) Transfers control to the sytem intialize processing routine if the RAM disk capacity does not match that calculated before power-off.
(3) Setting to check the type of keyboard installed, and transfers control to the reset processing routine if it does not match the keyboard type defined before power-off (automatic keyboard identification).
(4) Switches the screen to the user mode and displayes accordingly.
(5) Makes a sum check on the internal RAM disk. If a checksum mismatch is found, the system requests that the RAM disk be formatted.

(6) Checks the power-off mode and transfers control to the continue power-on processing routine if power was turned off in the continue mode, and to the restart power-on processing routine if power was turned off in the restart mode.

(7) The restart power-on processing routine generates a power-on sound, initializes the screen size and cursor type, and passes control to BIOS WBOOT.

(8) The continue power-on processing routine restores the system to the alarm state at power-off and generates a continue sound. It then restores the interrupt-related areas and registers to their state at power-off, and returns control to the point at which power was turend off.

Figure 2.4.1 shows the power-on processing flow.

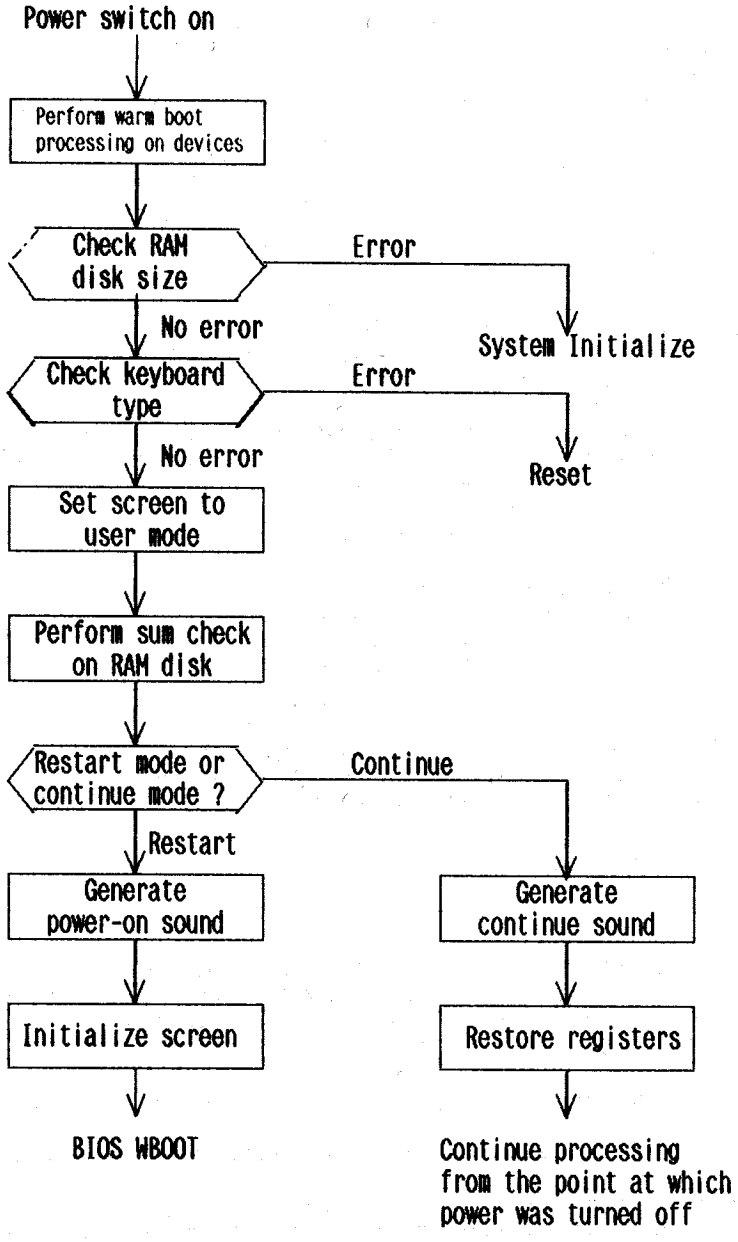


Fig. 2.4.1 Power-on Processing Flow

2.4.4 Restart Mode

2.4.4.1 Outline

The PINE turns off in the restart mode when the power switch is turned off while it is running CP/M or an application program. If the item keyboard is used, however, the power-off state defaults to continue mode when the power switch is turned off.

The PINE unconditionally turns off in the restart mode is power is turned off while a menu is displayed on the screen (even if the item keyboard is used). It starts in the restart mode whenever power is turned on from the restart mode power-off state.

2.4.4.2 Activation from restart mode power-off state

The PINE performs the following operations when started from the restart mode power-off state:

(1) When the power switch is turned on:
Passes control to 100H of bank 0 when Resident is specified. If an auto string is specified, the PINE passes it as a starting parameter (by loading it into the key buffer, as PF key pressing).
When Resident is not specified, the PINE transfers control to the specified menu or CCP state, and the auto start string is executed or passed as a starting parameter.
See Section 4.5, "Resident Processing" for Resident and Section 2.7, "Auto Start" for the auto start string.

(2) When alarm time is reached:
Generates an alram and displays the alarm screen. If the power switch is turned on in this state, the PINE performs the operations descrived above.

(3) When wake time is reached:
The PINE operates in the same way as it does when the power switch is turned on, except that it passes the wake string instead of the auto start string.

2.4.5 Continue Mode

2.4.5.1 Outline

If the power switch is turned off in the continue mode during execution of an application program, the next time the power is turned on the PINE can continue execution in the state established before power-off.

2.4.5.2 Activation from continue mode power-off state

The PINE performs the following when started from the continue mode power-off state:

(1) When the power switch is turned on:
Continues program execution at the point where power was turned off. Ignores the auto start string.

(2) When alarm time is reached:
Generates an alram and displays the alarm screen. If the power switch is turned on in this state, the PINE performs the operations descrived above.

(3) When wake time is reached:
Operates in the same way as it does when the power switch is turned on except that it ignores the wake string.

2.4.6 Miscellaneous

2.4.6.1 System operation flow from power-off to power-on

Figure 2.4.2 shows the system operation flow from power-off to power-on.

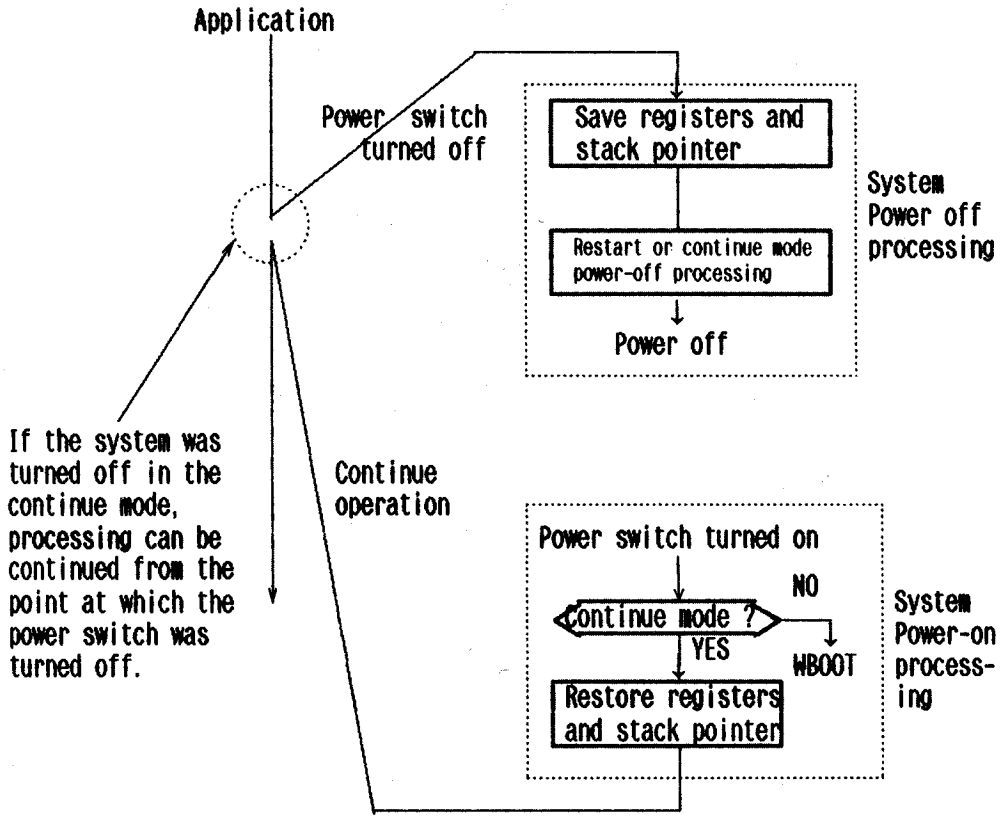


Fig. 2.4.2 Operation Flow from Power-off to Power-on

2.5 Power-off

2.5.1 General

The PINE turns off when 1) the power switch is turned off, 2) a power failure occurrs, 3) the auto power-off time is reached, or 4) BIOS POWEROFF is called.

Before performing power-off processing, the system saves information that will be required the next time that power is turned on. This section gives an outline of power-off processing.

For further information, see Section 2.6, "Power Fail," Section 2.8, "Auto Power-off," Section 3.4, "BIOS Details," and Section 4.7, "Interrupts."

2.5.2 Causes of Power-off

The causes of power-off and the actions performed by the system are as follows:

(1) The power switch is turned off.
Performs power-off processing according to a power off interrupt received from the 75Ø8.

(2) A power failure occurrs.
Performs power-off processing according to a power fail interrupt received from the 75Ø8 if the battery voltage drops below a specified value.

(3) The auto power-off time is reached.
Performs continue-mode power-off processing if a specific period of time (default is five minutes) elapses while BIOS CONIN is waiting for key entry.

(4) BIOS POWEROFF (WBOOT + 7BH) is called.

2.5.3 Internal Processing

Power-off is processed in three modes: continue, restart, and power-cut only modes.

2.5.3.1 Continue mode power-off

(1) Processing
The system saves parameters that are necessary to continue processing when power is turned on again, and carries out power-off processing. In the continue mode, execution can resume from the point at which power was turned off.

(2) Conditions
Power is turned off in the continue mode if one of the following conditions is met.

1) FRCECNTN (ØF311H) is not ØØH (when using the standard keyboard) or IFRCECNT (ØF312H) is not ØØH (when using the item keyboard).
2) FRCECNTN or IFRCECNT is ØØH and:
   - BIOS POWEROFF is called in the continue mode.
   - Auto power-off time is reached.
   - The power switch is turned off with the CTRL key held down.
   - A power failure occurrs.

If, however, power is turned off during menu processing, the system turns off in the restart mode, even if condition 1) or 2) is satisfied.

2.5.3.2 Restart mode power-off

(1) Processing
The system carries out power-off processing so that a warm boot can be performed the next time power is turned on. Fundamental operations in continue power-off and restart power-off processing are the same, although system parameters are initilaized differently.

(2) Conditions
Power is turned off in the restart mode if one of the following conditions is met.

1) Menu processing flag is set to ON.
2) FRCECNTN (ØF311H) for the standard keyboard or IFRCECNT (ØF312H) for the item keyboard is ØØH and:
   - BIOS POWEROFF is called in the restart mode.
   - The power switch is turned off without the CTRL key held down.

2.5.3.3 Power-cut only mode

(1) Processing
The power-cut only mode is used exclusively by the system. In this mode, power is turned off in the mode established at the last power-off time (continue or restart).

(2) Conditions
Power is turned off in the power-cut only mode when one of the following conditions is met.

1) The alarm time is reached while power is off and then a power-off condition occurs while the alram screen is being displayed (i.e., control is transferred from the alarm screen through a cause other than power switch-on).
2) A power-off condition occurs during execution of address Ø start processing. Address Ø start processing includes system initialize, reset, and power-on processing.

2.5.3.4 Power-off processing

The system performs the following operations when power is turned off:

1) Writes buffer data onto the floppy disk.
2) Skips steps 3) thorugh 5) if Power-cut only is specified.
3) Saves registers.
4) If the sytem is processing a menu, initializes screen-related areas and performs restart power-off processing. If the system is not processing a menu, it checks whether power was turned off in the continue mode or restart mode.
5) Clears parameters if it is determined in the above step that power was turned off in the restart mode.
6) Performs power-off processing on cartridges.
   - Saves MCT farmware data in RAM if a microcassette is installed.
   - Turns cartridge power off if a ROM cartridge is insatlled.
7) Performs power-off processing on the keyboard.
   - Clears the key buffer.
   - Saves the current shift status.
8) Creates a power fail screen using the sytem screen if power fail processing is specified.
9) Makes a sum check on the sytem areas.

10) Displays the power fail screen and performs power fail processing if power fail processing is specified.
11) Sends a power-off command to the 7508 and turns off the main power.

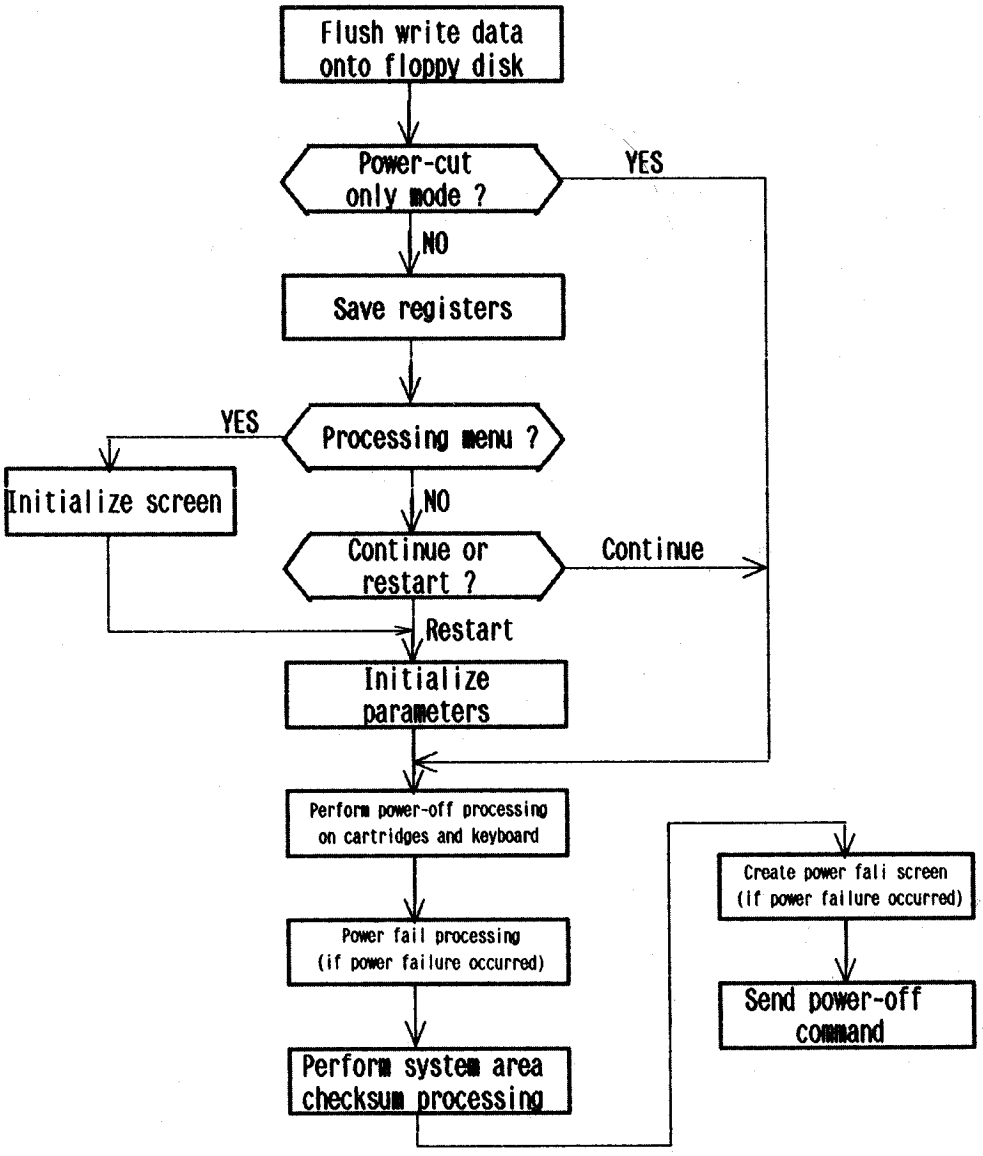


Fig. 2.5.1 Power-off Processing Flow

The power-off processing routine references the following system areas:

FRCECNTN (ØF311H) 1 byte
- Standard keyboard continue flag
  = ØØH: Specifies restart power-off
  = Nonzero: Specifies continue power-off
- Initial value is ØØH.

IFRCECTN (ØF312H) 1 byte
- Item keyboard continue flag
  = ØØH: Specifies restart power-off
  = Nonzero: Specifies continue power-off
- Initial value is ØFFH. That means that, the default power-off state is the continue mode, if an item keyboard is installed.

BTRYFG (ØEFEEH) 1 byte
- Power fail flag
  = ØØH: No power fail occurred
  = Nonzero: Power fail occurred
- This flag is set by the power fail interrupt processing routine.

2.5.4 Miscellaneous

The user can control power-off in an application program using the power-off disable flag YPOFDS (OEFEFH). See Section 4.7, "Interrupts" for controlling power-off.

2.6 Power Fail

2.6.1 General

A power fail condition occurs when the main battery voltage falls below a specified value (4.8 V for a NiCd battery and 4.Ø V for an Mn dry sell battery).

The system informs the user that a power fail has occurred by displaying the power fail screen.

2.6.2 Starting Power Fail Processing

Power fail processing starts when the 75Ø8 slave CPU sends a power fail interrupt to the main CPU.

2.6.2.1 Slave CPU operations

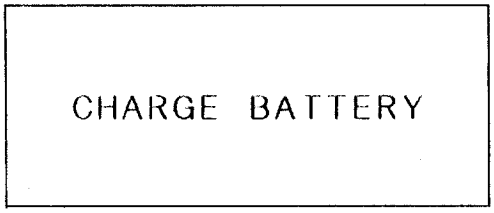
When the main battery voltage falls below approximately 4 V (dry cell battery) or 4.8 V (NiCd), the 75Ø8 sends a power fail interrupt to the main CPU to switch it to the back-up battery. The 75Ø8 then generates a power fail interrupt every second, and cuts off the power supply in 5Ø seconds if the main CPU does not perform power-off processing.

2.6.2.2 Main CPU operations

The main CPU, on receiving a power fail interrupt, performs power-off processing after completing the current I/O operation. See Section 4.7, "Interrupts" for power fail interrupts.

2.6.3 Internal Processing

When a power fail occurs, the system informs the user by displaying the following power fail screen after having completed continue-mode power-off processing (except for actually turning off power).



The system flashes the power fail screen on and off every second, and turns off power when any of the following conditions are met:

(1) 3Ø seconds pass after the initial display of the power fail screen.
(2) The user turns off the power switch after display of the power fail screen.
(3) 5Ø seconds pass after a power fail is detected.

The power fail screen is displayed via the system screen; the user screen is not affected. See Section 2.5, "Power-off" for power-off processing flow.

2.6.4 Miscellaneous

2.6.4.1 Power fail and alarm/wake functions

The PINE disables the alarm/wake funciton when a power fail occurrs and restores the previous alarm/wake state when the power switch is turned on again. That is, any alarm/wake conditions are ignored between a power fail and the next power-on.

2.6.4.2 Restoring the system after power-off

The user can restore the system by turning the power switch on after 1) connecting an AC adapter to the system, or 2) replacing the main battery.

2.6.4.3 Continue mode processing after a power fail

Processing terminated by a power fail can be continued by the system restoration procedure mentioned above if any of the following conditions is met:

(1) Power is automatically turned off 30 seconds after the initial display of the power fail screen.
(2) The user sets the power switch to OFF while the power fail screen is displayed.
(3) The slave CPU cuts off power while the power fail screen is displayed.

If the current I/O operation is not completed within 50 seconds after a power fail, the slave CPU cuts off power even before the power fail screen is displayed. In this case, the system performs reset processing (identical to that performed when the reset button is pressed) instead of continue processing, even if the above restoration procedure is followed.

2.6.4.4 Power fail in the power-off state

Backing up the 7508 and RAM consumes power, even if the PINE is in the power-off state. If the system is held in the power-off state for a long time, the main battery voltage may fall below the specified level, and the back-up battery may replace the main battery. When this occurs, power will not turn on when the power switch is set to ON; power can be turned on by the restoration procedure described in 2.6.4.2. In this case, reset processing is performed.

A sum check is always made on the system area at power-on time. If the checksum does not match the value calculated at power-off time, it is assumed that the memory was destroyed while power was off, and the system is initilaized.

2.7 Auto Start

2.7.1 General

When a warm boot is invoked by a power switch-on, the system loads the key buffer with a predefined auto start string and carries out subsequent processing as if it were entered from the keyboard. The auto start function is convenient for users who wish to run a specific program every time they start their system, or those who want to use the PINE as a turnkey system.

2.7.2 Defining/cancelling an Auto Start String

An auto start string can be defined or cancelled by 1) using the system display, 2) calling BIOS AUTOST (WBOOT + 81H), or 3) rewriting the corresponding system area.

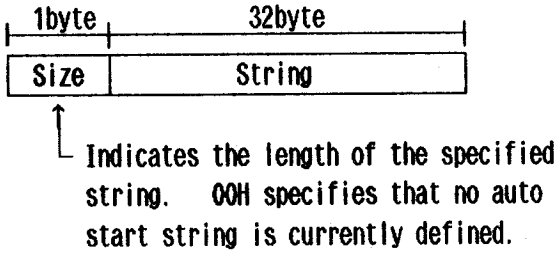
An auto start string may consist of up to 32 characters, including control codes. Control codes can be entered as in the example below:
Example: Entering a Carriage Return (CR) code
Type ^M (or ^m) when using the system display.
Type ØDH when using BIOS AUTOST.
In either case, code ØDH is stored in memory.

As in the above example, any control code entered via the system display must be a combination of ^ and an alphabetic character.

See Section 2.11, "System Display" for details of the system display and Section 3.4, "BIOS Details" for BIOS AUTOST.

The auto start string area AUTOSTRT (ØF3BDH) is the system area for containing an auto start string. An auto start string can be defined or cancelled by directly rewriting this area.

AUTOSTRT (ØF3BDH) 34 bytes
- Auto start string area



This area is initialized during system initialization.
34th byte do not use.

2.7.3 Auto Start Processing

2.7.3.1 Invoking the auto start function

The auto start function is invoked when the power switch is turned on either in the restart-mode power-off state or while the alarm screen is being displayed.

2.7.3.2 Auto start function operations

When the auto start function is invoked, the auto start stirng is loaded into the key buffer in the same way as a PF key definition, and power-on processing is performed. This sequence is illustrated in Figure 2.7.1.

2.7.3.3 Termination of the auto start function

Since the auto start string is handled in the same way as PF key definitions, the auto start function does not terminate if a STOP code (Ø3H) is received. The STOP code is passed to the application program.

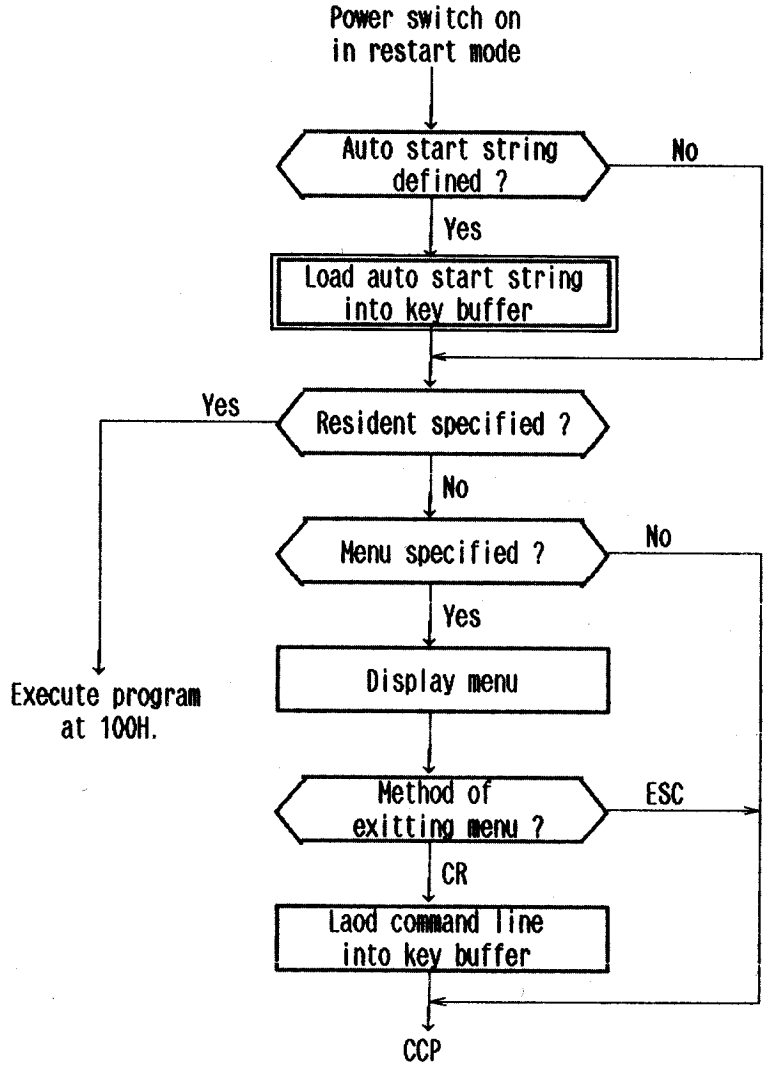


Fig. 2.7.1 Auto Start Function Processing Flow

2.7.4 Miscellaneous

2.7.4.1 Passing the auto start string

When Resident is specified:
The auto start function causes the application program to be directly executed regardless of whether or not Menu is specified. The function loads a predefined auto start string into the key buffer in the same way as a PF key definition.

When Resident is not specified:
If Menu is specified, the auto start string is treated as if it were entered from the keyboard to a menu command line. If CCP is specified, the auto start string is treated as if it were entered from the keyboard (that is, it is loaded into the CCP command buffer).

2.7.4.2 Menu function and auto start string

The menu function loads the current command line data into the key buffer when a CR is entered. Therefore, if a CR (ØDH) code is contained in an auto start string, the function takes only the part of the string ending with the CR, and ignores any data following the CR. (This is also true of a wake string.)

2.8 Auto Power-off

2.8.1 General

To save power, the PINE accepts keyboard input in the sleep mode. In addition to that, it automatically turns its own power off if it receives no data from the keyboard within a predetermined waiting period. This feature is called the auto power-off function.

This section describes how to define, operate, and disable the power-off function.

2.8.2 Defining the Auto Power-off Function

The interval between the time the PINE starts waiting for keyed-in data and the time it automatically turns off its power is set to five minutes by default. It can be redefined by rewriting the work areas ATSHUTOFF (ØEF40H) and ATSOTIME (ØEF41H).

ATSHUTOFF (ØEF40H) 1 byte
- Contains the auto power-off time in minutes.
- A ØØH in this area disables the auto power-off function.
- The initial (default) value is Ø5H (5 minutes).
- The system references this area only when determining whether or not the auto power-off function is disabled.

ATSOTIME (ØEF41H) 2 bytes
- Contains the auto powr-off time in seconds.
- ATSOTIME has the following relationship to ATSHUTOFF:
  ATSOTIME = ATSHUTOFF x 6Ø
  However, it can also be defined independently of ATSHUTOFF.
- The initial value (default) is Ø12CH (3ØØ seconds).

2.8.3 Operation

When the auto power-off function is activated, the PINE automatically turns off its power in the continue mode if it receives no data from the keyboard whithin the time specified in ATSOTIME (ØEF41H) while waiting for key input with the BIOS CONIN function. When the power switch is turned off and on again, or the wake time is reached, the PINE is restored to the previous state (key input wait state).

The following key input routine determines whether or not the auto power-off time has been reached. It uses the 16-bit counter TIMERØ (ØEF8FH) for 1-second interrupt:

(1) Set an auto power-off time.
The sum of ATSOTIME (ØEF41H) and TIMERØ (ØEF8FH) is loaded into TIMEEND (ØF77CH) as the time at which the auto power-off function is to be executed.

(2) Check for keyed-in data.
The PINE determines whether any data has been entered by checking the key buffer. If keyed-in data is present, auto power-off checking processing terminates.

(3) HALT
The CPU enters into the sleep state via a HALT instruction. It exits from that state when it receives an OVF or 75Ø8 1-second interrupt.

(4) Check auto power-off time.
If the value of ATSHUTOFF (ØEF4ØH) is nonzero and the M-flag set or reset depending on the result of (TIMEEND - TIMERØ) is 1, The PINE determines that the auto power-off time has been reached.

(5) Power off.
The PINE turns off power in the continue mode if the auto power-off time has been reached. If not, it loops back to step (2).

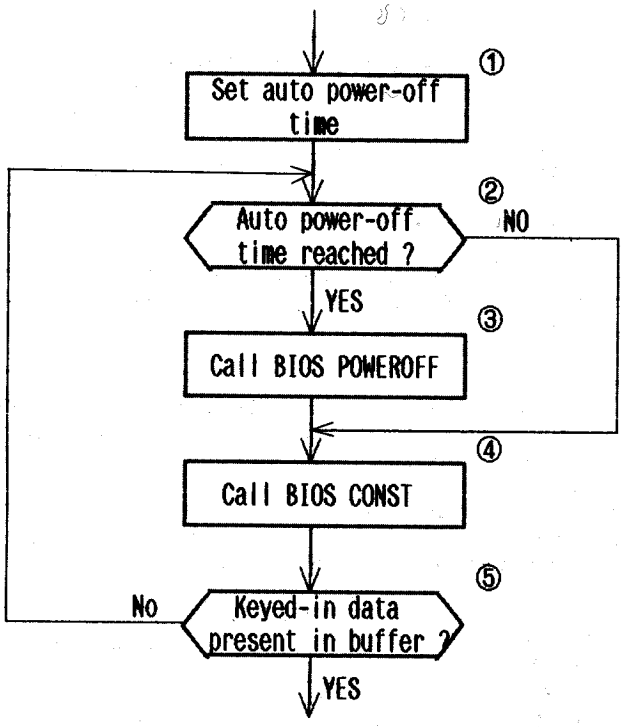
An auto power-off time is set at the entry or exit point of the sytem display or alarm/wake screen, or at the time of a continue-mode power-on.

The PINE turns on in the restart mode if the auto power-off time is reached during display of the menu screen.

2.8.4 Miscellaneous

2.8.4.1 Executing the auto powr-off function in an application

The auto power-off function may not be available for application programs which do not use CONIN for receiving console input, but rather receive console input by polling the keyboard port with CONST. To make the auto power-off function available for such programs, add the routine shown below to the application programs and so that they can execute the auto power-off function independently.



Note: Power can be conserved adding a HALT instruction before step ②.

Fig. 2.8.1 Auto Power-off Processing Flow

Step	Action	Description
1	Set auto power-off time	The sum (2 bytes) of ATSOTIME (ØEF41H) and TIMERØ (ØEF8FH) is loaded into TIMEEND (ØF77CH) as the auto power-off time.
2	Check auto power-off time	It is determined that the auto power-off time has not been reached if the value of ATSHUTOFF (ØEF40H) is ØØH. If it is nonzero, the difference of TIMEEND and TIMERØ is calculated. If the M-flag is found to be 1 as the result of this calculation, it is determined that the auto power-off time has been reached.
3	Call BIOS POWEROFF	If the auto power-off time has been reached, BIOS POWEROFF is called to turn off power.
4	Call BIOS CONST	BIOS CONST is called to check for keyed-in data.
5	Check for keyed-in data	The application program checks the parameters returned in step (4) to determine whether any entry has been made.

2.9 Alarm/Wake

2.9.1 General

The PINE is provided with alarm and wake functions. The alarm function sounds an alarm and displays the alarm screen at the preset time. The wake function powers on the PINE at the preset time from the power-off state and performs predefined operations.

This section explains how to set or reset the alarm or wake function. Their operations are also descirbed here.

The alarm/wake function is provided with several hooks through which the user can extend the function (see Section 4.3, "Hooks"). Display of the alarm/wake screen can be temporarily disabled (see Section 4.7, "Interrupts").

2.9.2 Setting or Resetting the Alarm/Wake Function

The PINE is furnished with a 75Ø8 4-bit CPU which controls the software timer (clock) and generates interrupts to the Z8Ø CPU at specified times. Even in the power-off state, the 75Ø8 is activated at every 1Ø seconds to check whether a preset alarm/wake time has been reached. When the time is reached, the 75Ø8 automatically powers on the PINE.

The alarm/wake function can be set or reset using the system display or by calling the BIOS TIMDAT (WBOOT+4BH) function. Setitng of the alarm/wake function via the sytem display can be disabled by rewriting ALRMSTDS (ØEF43H).

The following items must be specified for the alarm/wake function:

(1) Alarm/wake time (in month/day/hour/minute/second/day of the week format. The second must be set in 1Ø-second increments.)
(2) Alarm/wake string (up to 32 characters)
(3) Alarm/wake type (specify alarm or wake)

See Section 2.11, "System Display" for system display and Section 3.4, "BIOS Details" for BIOS TIMDAT.

The system uses the following areas to control alarm/wake data:

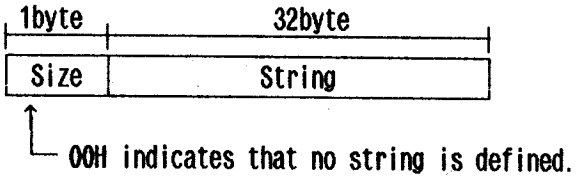
ALRMSTDS (ØEF43H) 1 byte
- Flag for enabling or disabling setting of the alram/wake function via the system display.
  = ØØH: Setting or cancelling via system display is enabled.
  = Nonzero: Setting or cancelling via system display is disabled.
- The initial value is ØØH.

ALRMTP (ØEF8AH) 1 byte
- Alarm/wake type
  = ØØH: Not specified (default)
  = Ø1H: Alarm specified
  = Ø2H: Wake specified

ALRMAD (ØEF8BH) 2 bytes
- Alarm/wake string starting address
- Always points to ALRMMSG (ØF3DFH).

ALRMST (ØEF8DH) 1 byte
- Indicates whether or not the alarm/wake time has been reached.
  = ØØH: Not reached (default)
  = Ø1H: Reached

ALRMMSG (ØF3DFH) 34 bytes
- Alarm/wake string area
- The first byte is loaded with the string size.



2.9.3 Operation

2.9.3.1 General

The alarm/wake function executes in different ways depending on whether PINE power is off or on. How alarm/wake processing proceeds in both power-off and power-on states is summarized below.

Type	PINE power state		
	Restart-mode power-off state	Continue-mode power-off state	Power-on state
Alarm	* Displays the alarm screen and turns power off in the restart mode. *Turns power on in the restart mode when the power switch is turned on while the alarm screen is displayed.	*Displays the alarm screen and turns power off in the continue mode. *Turns power on in the continue mode when the power switch is turned on while the alarm screen is displayed.	* Displays the alarm screen. (The display timing is checked in actual oepration.)
Wake	* Sounds an alarm and performs restart mode power-on processing. If a wake string is defined, performs processing accordingly.	* Sounds an alarm and performs continue mode power-on processing. Ignores any wake string.	*Displays the wake screen (The display timing is checked in actual oepration.)

2.9.3.2 Alarm/wake screen

The alarm/wake screen is displayed whenever the alarm time is reached, or when the wake time is reached in the power-on state.

(1) Displaying the alarm/wake screen
The alarm/wake display routine generates an alarm and displays the following alarm/wake screen:

```
<ALARM TIME> MM/DD  hh:mm
"Alarm/Wake string(32 characters)"
Press ESC Key
```

In the wake screen, <WAKE TIME> appears in place of <ALARM TIME>.

(2) Terminating display of the alarm/wake screen
When the alram/wake screen is displayed, any of the following conditions causes the screen to be restored to its original state before the alarm/wake function was invoked:

1) 50 seconds pass after the screen was displayed.
2) The ESC key is pressed.
3) The power switch is turned off when it is turned on.
4) A power fail is detected.

When the alarm function is invoked in the power-off state the following condition also brings about the same result:

5) The power switch is turned on.

(3) Notes

(a) Keyboard shift state
Once the alarm/wake screen is displayed in the power-on state, the keyboard shift state is determined by the state in which control leaves the alarm screen. Key data that had been loaded into the key buffer before the screen was displayed is processed in the shift state established before the initial display of the screen.

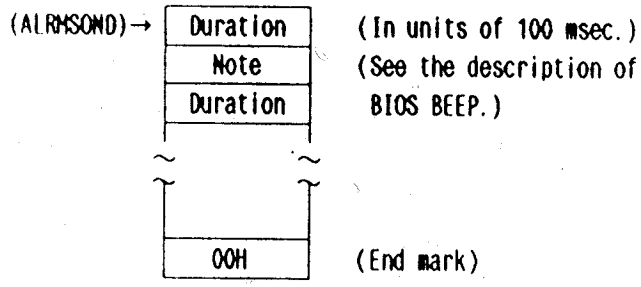
(b) Screen mode
The alarm/wake screen is displayed via the system screen. The screen mode reverts to its original state (user screen) when the display of the alarm/wake screen is terminated.

(c) Alarm/wake screen display time
The alarm/wake screen display time (50 seconds) is measured using the 16-bit 1-second interrupt timer TIMER0 (0EF8FH). The display time can be changed by rewriting ALRMTIME (0F308H)

(d) Alarm sound
The pattern of the alarm sound generated when the alarm/wake time is reached can be changed by rewriting ALRMSOND (0EF3EH). ALRMSOND is loaded with the address at which the the pattern of the alarm sound is stored. When rewriting ALRMSOND in an application program, the new address must be 8000H or up.

ALRMTIME (ØF3Ø8H) 1 byte
- Contains the time interval for which the alarm/wake screen is to be displayed.
- The time must be specified in seconds. Initial value is 32H (5Ø seconds).

ALRMSOND (ØEF3EH) 2 bytes
- Alarm sound pattern starting address



- An alarm consists of three occurrences of the above sound pattern.
- ALRMSOND initially points to an OS ROM address where sound pattern data Ø1H, 25H, Ø1H, 29H, ØØH is stored.

2.9.3.3 Alarm processing

The operation of the alarm processing routine differs when an alarm condition occurs in the power-off state and power-on state.

(1) When an alarm condition occurs in the power-off state
If an alarm condition occurs in the power-off state, the alarm processing routine turns on the main power, sounds an alarm, and displays the alarm screen.

When control leaves the alram screen, the alram processing routine turns off power again in the mode in which power was turned off the last time (restart or continue mode). If, however, the alarm screen is terminated by turning on the power switch, the routine performs power-on processing instead.

Two hooks, ALMHKØ and ALMHK1, are used during processing of an alarm condition that occurs in the power-off state. See Section 4.3, "Hooks" for details.

(2) When an alarm condition occurs in the power-on state
If an alarm condition occurs in the power-on state, the 750Ø sends an alarm interrupt to the system, and the system calls the alarm interrupt handling routine.

The alarm interrupt handling routine sounds an alarm and displays the alram screen if alarm screen display is enabled.

After leaving the alarm screen, the system returns to the state in which the alarm occurred.

The ALMHK2 and ALMHK3 hooks are used during procssing of an alarm condition that occurs in the power-on state. The ALMHK4 is provided for alarm display processing. See Section 4.3, "Hooks" for more information.

2.9.3.4 Wake processing

The operation of the wake processing routine differs when an wake condition occurs in the power-off and power-on state.

(1) When a wake condition occurs in the power-off state
If a wake condition occurs in the power-off state, the wake processing routine turns on the main power, sounds an alarm, and calls the power-on processing routine.

The power-on processing routine performs restart mode power-on processing if power was turned off in the restart mode. If a wake string is defined, the routine passes control to CCP or the Menu. If power was turned off in the continue mode, the routine performs continue mode power-on processing. Any wake string is ignored.

(2) When a wake condition occurs in the power-on state
If a wake condition occurs in the power-on state, the 750Ø sends an alarm interrupt to the system, and the system calls the wake interrupt handling routine.

The operation of the wake interrupt handling routine is the same as that of the alarm interrupt handling routine described in 2.9.3.3. (2)

2.9.4 Miscellaneous

2.9.4.1 Alarm/wake functions and power fail

The alarm/wake function is disabled when a power fail occurs. The alarm/wake state before the power fail occurred is resotred when the power switch is turned on the next time. Note that no alarm/wake processing occurs during power-off due to a power fail.

2.9.4.2 Menu function and wake string

The menu function loads the current command line data into the key buffer when a CR is entered. Therefore, if a CR (ØDH) code is contianed in a wake string, the function takes only the part of the string ending with the CR, and ignores any data following the CR.

2.9.4.3 Inhibiting alarm/wake screen display from application programs

Display of the alarm/wake screen can be controlled from application programs using the alarm/wake display disable flag YALMDS (ØEFFlH). See Section 4.7, "Interrupts" for control methods.

2.9.4.4 Alarm/wake hooks

The alarm/wake funtion has five hooks. These hooks allow the function to be extended with user-supplied routines such as an alarm/wake automatic update routine. See Section 4.3, "Hooks" for the location and use of the hooks.

2.10 Menu

2.10.1 General

The menu function displays a directory of files with specified extensions in specified drives. It allows the user to select and start a desired program easily.

2.10.2 Operation

2.10.2.1 Activation and termination

(1) Activation
Menu processing starts when menu display is specified and one of the following conditions is met:
(a) The power switch is turned on in the restart mode or power is turned on by the wake function. (The menu function is not started if Resident processing is specified or SUBMIT processing is being performed.)
(b) A warm boot is performed in an application program (even if it is invoked through CCP). Warm boots performed during SUBMIT processing are excluded.

The menu function can be specified using menu flag MENUFG (ØEF44H). Whether or not SUBMIT is being executed can be determined using the BDOS Reset disk system function (ØDH).

(2) Interruption
Menu processing is interrupted when:
(a) Alarm or wake time is reached.
(b) System display is invoked.
(c) Screen dump is invoked.

Neither (b) nor (c) can occur if the item keyboard is installed.

(3) Continuation
When the PINE is released from the interrupt state, menu processing resumes from the point at which it was interrupted. If the specified drive or file name was changed while operating in the system display mode, menu processing starts from the beginning.

(4) Termination
Menu processing terminates when:
(a) The ESC key is pressed and the system enters the CP/M command mode.
(b) The return key is pressed after an application program is selected from the menu.
(c) Auto power-off time is reached.
(d) A power fail is detected.
(e) The power switch is turned off.

Menu processing is always terminated in the restart mode if it is terminated by power-off. This is because file names to be displayed are changed if the ROM capsule or cartridge is replaced while power if off.

2.10.3 Menu Specifications

2.10.3.1 Menu-related parameters

The following parameters can be specified for menu display:
1) Whether or not a menu is to be displayed.
2) The drives whose directories are to be displayed in the menu.
3) The file name extensions, COM file names, and drive names of the files that are to be displayed in the menu.

These parameters can be redefined by using the system display function or rewriting the corresponding system area. See Section 2.11, "System Display" for details.

(1) Menu display
Whether or not a menu is to be displayed can be specified using MENUFG (0EF44H).

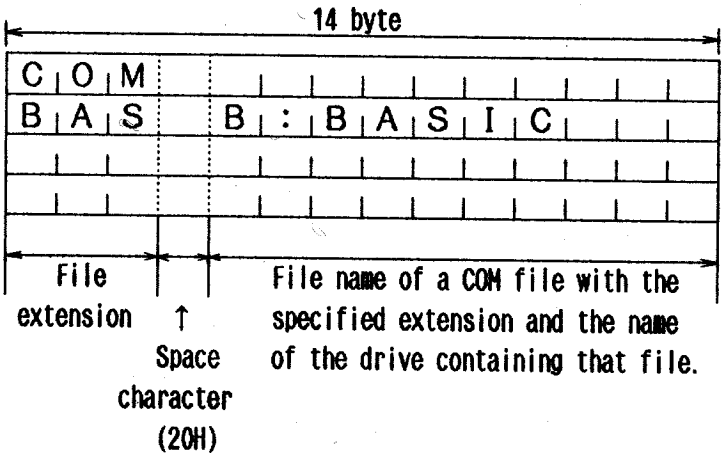
(2) Menu drives
The menu function displays the directories of the drives specified in MENUDRV(0EF45H). The directories are displayed in the same order in which the drive names are specified in MENUDRV. If the same drive name is specified two or more times, its directory is displayed the specified number of times.

Up to 11 drives can be specified. Remaining byte positions in the drive input field must be padded with spaces (20H).

(3) Menu files
The menu function displays the names of files having the extensions specified in the file table FTYPETBL (0EF50H).

File specifications must include a file extension. A file specification may consist of a maximum of 14 bytes. Up to four files may be specified at one time.

The structure of FTYPETBL is as follows:



Unused table entries or any extra byte positions left over after a file name is specified must be padded with spaces (20H).

The file and drive names (bytes 5 - 14) which follow a COM specification (bytes 1 - 3) are ignored.

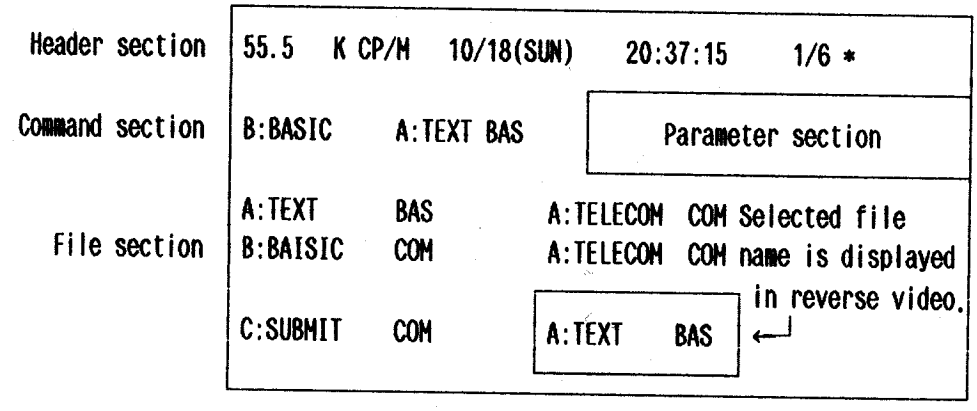
MENUFG (ØEF44H) 1 byte
- Menu display flag
    = ØØH: Menu displayed (default).
    = Nonzero: No menu displayed.
- Control goes directly to CCP if MENUFG is nonzero.

MENUDRV (OEF45H) 11 bytes
- Table containing the drive names of the drives whose directories are to be displayed in the menu.
- Specify drive names A through K in ASCII code.
- This area defaults to CBA if the standard keyboard is installed, and to ABCDHIJK if the item keyboard is installed.

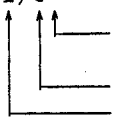
FTYPETBL (ØEF5ØH) 56 bytes
- Table containing the file types and the file names (including the drive name) of the files that are to be displayed in the menu.
- A file specification, which must include an extension, may be up to 14 bytes in length. Up to four files can be specified.
- Files must be specified in ASCII code.
- This area is initially loaded with 'COM' and 'BAS B:BASIC'.
- The structure of FTYPETBL is described above.

2.1Ø.3.2 Menu screen

The following figure shows an example of the menu display:



(1) Contents of header section
- CP/M sign-on message
- Month, day, day of the week, time (24-hour system)
- Number of menu pages



(2) Contents of command section
- The command section displays the selected files. When a file with a COM extension is selected, only its drive and file names are displayed.
- When an extension other than COM is specified, file names with that extension are displayed, preceded by the COM files associated with the extension (if any are specified in FTYPETBL).
- Parameter section

Entry of 14 to 40 characters is allowed. The allowable number of characters differs depending on the selected file type. If entry parameters do not fit in the command section, enter them via CCP.

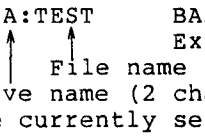
(3) Contents of file section
- Up to 12 file names can be displayed in a menu page. The user can select a desired file using arrow keys.

2.10.3.3 File specifications

(1) Menu display conditions
- Names of files whose drive names (A - K) are cataloged via the system display ca be displayed in the menu.
- If specified files are not present, the system displays no menu and goes to CCP.
- If an error (not ready, Bad sector, etc.) is detected in specified drives, names of files in those drives are not displayed.
- When the item keyboard is installed, names of files in drives A through D and H through K can be displayed.

(2) Number of files to be displayed
- 2 files per line
  12 files per page
  Maximum number of pages: 6 pages
  Maximum number of displayable files: 72 files
- If more than 72 files are specified, the extra files are not displayed. In this case, an asterisk is appended to the end of the header section.

(3) File display
- File names are displayed in the format below.



- The currently selected file is displayed in reverse video.

(4) File selection key

- A file can be selected using the following keys:
  ↑: Selects a file in an higher row of the screen. Does nothing if the cursor is positioned on a file in the top row.
  ↓: Selects a file in a lower row. Does nothing if the cursor is positioned on a file in the bottom row.
  →: Selects a file on the right. If the cursor is positioned on the right file, moves it to the left file in the row below. If the cursor is on the right file in the bottom row, moves it to the left file in the top row.
  ←: Selects a file on the left. If the cursor is positioned on the left file, moves it to the right file on the row above. If the cursor is on the left file in the top row, moves it to the right file in the bottom row.
- The menu screen can be switched using the following keys:
  SHIFT/↓: Moves the menu screen to the next page. Does nothing if the last page is currently displayed. When the item keyboard is used, the function of this key sequence differs depending on the SHIFT key state.
  SHIFT/↑: Moves the menu screen to the previous page. Does nothing if the first page is currently displayed. When the item keyboard is used, the function of this key sequence differs depending on the SHIFT key state.
  CTRL/↑: Moves the menu screen to the first page. Does nothing if the first page is currently displayed. (This key sequence is invalid when the item keyboard is installed.)
- When the menu page is switched, the file in the upper left corner of the new page is always selected.
- All parameters on the command lines are cleared when file selection is changed or the display page is moved.

2.10.3.4 File activation

When the user presses the return key after selecting a desired application program with the arrow keys, the PINE transfers control to CCP with the contents of the command section loaded in the key buffer.

The application program is started if the parameters entered for it are valid.

2.10.4 Miscellaneous

(1) A menu is displayed via the 25-row by 80-column user screen. The underline cursor is used in the menu screen. When menu processing is terminated, the screen size and cursor type must be initialized using ESC sequence data stored in CONSCRN1 (0EFF3H).

(2) A menu is always displayed on the LCD irrespective of the I/O byte setting for the CON: device.

2.11 System Display

2.11.1 General

The system display refers to the screen through which the user can set or reference the system status. The system display function is called from a BIOS key routine as a subroutine when the CTRL/HELP keys are pressed.

The user can set or reference items pertaining to the following using the system display:
(1) RAM cartridge
(2) Alarm/wake
(3) Auto start string
(4) Menu
(5) Microcassette drive

If the item keyboard is installed, the system display function cannot be activated by pressing the CTRL/HELP keys.

2.11.2 Operation

2.11.2.1 Activation and termination

(1) Activation
The system display function is called from a BIOS key routine when the CTRL/HELP keys are pressed while the PINE is in operation. This means that pressing of the CTRL/HELP keys does not activate the system display function unless a BDOS or BIOS key routine (CONST or CONIN) is being executed in an application program.
See Section 3.5, "Keyboard" for subroutine calls.

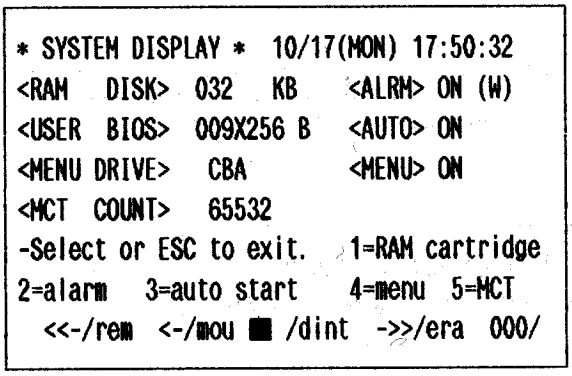
If the item keyboard is installed, system display cannot be invoked by pressing of the CTRL/HELP keys. This is because the CTRL key on the item keyboard, unlike that on the standard keyboard, does not affect the keyboard status.

(2) Interruption and restart
When an alarm or wake condition occurs or the screen dump function is invoked while the system is in the system display mode, the system terminates display processing and performs alarm, wake, or screen dump processing. System display processing resumes when the pertinent processing ends.

(3) Termination
System display processing ends when:
  (a) The ESC key is pressed while the initial screen is displayed.
  (b) The preset auto power-off time is reached.
  (c) The power switch is turned off.
  (d) A power fail is detected.
After termination of processing, the system restores the state which was operative before the system display function was called.

2.11.2.2 Operation

(1) Initial screen



(a) The date (month, day, day of the week) and time are automatically updated.
(b) The RAM DISK and USER BIOS fields display the corresponding capacities and cannot be redefined by the user.
(c) The MENU DRIVE and MENU fields can be redefined.
(d) The MCT (microcassette) COUNT field, "5=MCT" on the seventh line and the message on the eighth line are not displayed if no MCT is connected.
(e) MCT manual operations that the user can perform are displayed on the eighth line.
- The items on the eighth line are valid only when a microcassette cartridge is connected.
- The MCT COUNT field indicates the MCT counter value.
- Function keys are used for MCT operation. Currently active function keys are displayed on the eighth line (rem and mou are not displayed at the same time).
- Manual operation is disabled while a cassette file is open.
- In the remove state, operations other than remove are enabled. In the mount state, only remove operation is enabled.

  <<- (PF1): Fast forward
  <- (PF2): Wind tape
  ■ (PF3): Stop tape
  ->> (PF4): Rewind tape
  ooo (PF5): Clear tape counter
  rem (PF6): Remove processing (write tape directory)
  mou (PF7): Mount processing (read tape directory)
  dint (PF8): Initialize tape directory
  era (PF9): Erase tape

(f) Input keys
- 1 - 5: Perform corresponding processing.
- ESC: Exit from system display.
- PF1 - PF9: Perform MCT-related processing.
- Other keys: Ignored.

(g) When setting data (1 - 5 selected)
- The current state is displayed.
- BS, ←, →, and CTRL/E (erase end of line) are available as edit keys.
- All keys are enabled for entry.

(h) The ALARM field indicates whether or not the alarm/wake function is enabled. When the wake function is enabled, ON (W) is displayed in this field.
(i) The AUTO field indicates whether or not the auto start string is enabled.

(2) RAM cartridge
When 1 is selected in the initial screen, the messages on the lowest three lines change as shown below. If no RAM cartridge is connected, the system does nothing and returns control to the initial screen.

```
 - Select or ESC to return.
< RAM FORMAT >  1 = no  2 = Yes
```

(a) Selecting 1 immediately returns control to the initial screen.
(b) Selecting 2 initiates formatting of the RAM cartridge.
(c) The ESC key returns control to the initial screen.
(d) Any other keys are ignored.

(3) Alarm/wake
When 2 is selected in the initial screen, the messages on the lowest three lines change as shown below.

Initial alarm screen

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

(a) Selecting 1 through 4 initiates processing (b) through (e). The ESC key returns control to the initial screen. Any other keys are ignored.
(b) When 1 is selected, both the alarm and wake functions are disabled and control returns to the initial screen.
(c) When 2 is selected, the screen changes as follows:

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

- If the alarm or wake function is already specified, the defined time is displayed in month/day/hour/minute format (each item is set with a two-digit number). If neither alarm nor wake function is specified, no time is displayed.
- Set each of the month, day, hour, and minute with a two-digit number. Items specified with an asterisk (*) are not referenced; the alarm or wake function is invoked repeatedly with these items ignored. Pressing the return key saves the display data and returns control to the initial alarm screen.
- The ESC key returns control to the initial screen.

(d) When 3 is selected, the screen changes as follows:

```
- Set Wake time, ESC to cancel.
  MMDDhhmm
```

- The only difference between the messages in (c) and (d) is that "alarm" is replaced with "wake." The time setting method is the same.
- If a time is specified for a function (alarm or wake) other than the one defined currently, the message defined for the current function is cleared.
Example: Any alarm time and message cataloged currently are cleared when a wake time is specified.

(e) When 4 is selected, the screen changes as follows:

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

- If an alarm message or wake string is already specified, its contents are also displayed below the above message. If neither is specified, only the above message is displayed.
- Both an alarm message and wake string may consist of up to 32 characters. A wake string may contain any characters, including control codes. A control code is specified as a combination of ^ and an alphanumeric character, and counts as two characters.
- Pressing the return key terminates processing, saves the specified message or string, and returns control to the initial auto start screen.
- The ESC key returns control to the initial screen.

(4) Auto start
When 3 is selected in the initial screen, the messages on the lowest three lines change as shown below.

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

(a) Selecting 1 disables the auto start function and returns control to the initial screen.
(b) Any keys other than 1, 2, and ESC are ignored.
(c) The ESC key returns control to the initial screen.
(d) When 2 is selected, the screen changes as shown below.

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

- An auto start string is displayed if one is already defined.
If a string has not been defined, a blank screen is displayed.
- An auto start string may consist of up to 32 characters. It may contain any characters including control codes. A control code is specified as a combination of ^ and an alphabetic character, and counted as two characters.
- Pressing the return key terminates processing, saves the specified message or string, and returns control to the initial auto start screen.
- The ESC key returns control to the initial screen.

(5) Menu
When 4 is selected in the initial screen, the messages on the lowest three lines change as shown below.

Initial menu screen

```
- Select or ESC to return.
< MENU >  1 = off  2 = on  3 = drive
          4 = ext1  5 = ext2  6 = ext3  7 = ext4
```

(a) Selecting 1 through 7 initiates processing (b) through (f). The ESC key returns control to the initial screen. Any other keys are ignored.
(b) When 1 is selected, control returns to the initial screen. The MENU field is set to OFF and menu display is disabled.
(c) When 2 is selected, control returns to the initial menu screen. The MENU field is set to ON and menu display is enabled at the next warm boot.
(b) When 3 is selected, the screen changes as follows:

```
- Input drive names, ESC to cancel.
  CBA
```

- The currently specified drive name is displayed.
- Enter the drive name of the drive whose directories are to be displayed (A - K). Pressing the return key returns control to the initial menu screen and the MENU DRIVE field displays the new drive name. This specification becomes valid the next time the menu function is activated.
- The ESC key returns control to the initial screen.

(e) When 4 is selected, the following message appears on the screen:

```
- Input extension name 1, ESC to cancel.
  COM
```

- The ESC key returns control to the initial screen.
- Enter data in the following format:

BAS␣B:BASIC

- BAS: Extension (3 char.)
- ␣: 1 space
- B: : File name of a COM file having the specified extension and the drive name of the drive containing the file.
- BASIC

The drive and file names may be omitted when specifying the COM extension.

- The return key saves the input data and returns control to the initial menu screen.

(f) The user can specify three more extensions for menu display by selecting 5 through 7.

(6) MCT (Microcassette drive)

When 5 is selected in the initial screen, the messages on the lowest three lines change as shown below.

```
- Select or ESC to return.
 < MCT >  stop   verify
  1 = stop  2 = nonstop  3 = verify  4 = nonverify
```

(a) The ESC key returns control to the initial screen.
(b) When 1 is selected, "stop" is displayed on the seventh line and the MCT operates in the stop mode.
(c) When 2 is selected, "nonstop" is displayed on the seventh line and the MCT operates in the nonstop mode.
(d) When 3 is selected, "verify" is displayed on the seventh line and the MCT operates in the verify mode.
(e) When 4 is selected, "nonverify" is displayed on the seventh line and the MCT operates in the nonverify mode.

2.11.3 Internal Processing

This subsection describes the system areas used by the system display function and system processing associated with system display.

2.11.3.1 Display operations

The system display function displays the following information:
(1) RAM disk size
Reads YSIZERAM (ØF77AH) (binary value in 1-KB units) and displays the RAM disk size.
(2) User BIOS area size
Reads USERBIOS (ØEF2DH) (binary value in 256-byte units) and displays the user BIOS area size.
(3) Alarm type
Reads ALRMTP (ØEF8AH) and displays the alarm type.

```
ALRMTP = ØØH: Alarm off
       = Ø1H: Alarm on
       = Ø2H: Wake on
```

(4) Auto start string
Reads AUTOSTRT (ØF3BDH) and indicates the presence or absence of an auto start string. AUTOSTRT is loaded with the length of the auto start string.

```
AUTOSTRT = ØØH: No auto start string defined.
         ≠ Nonzero: Auto start string defined.
```

(5) Menu ON/OFF
Reads MENUFG (ØEF44H) and indicates whether menu display is on or off.

```
MENUFG = ØØH: Menu display ON
       = ØFFH: Menu display OFF
```

(6) Microcassette drive mount state
Reads CRGDEV (ØF53FH) and indicates whether or not an MCT cartridge is mounted.

```
CRGDEV = 48H: MCT cartridge mounted
       ≠ Other than 48H: No MCT cartridge mounted, or another
         type of cartridge mounted
```

2.11.3.2 Setting operations

The system display function performs the following setting operations:
(1) RAM cartridge
Identifies the presence or absence of the RAM cartridge by examining the value of CRGDEV (ØF53FH). The function formats the RAM cartridge using RAMCRFMT (ØØ24H). See Section 4.2, "Jump Tables" for the contents of RAMCRFMT.

(2) Alarm/wake
Sets or resets the alarm/wake function or displays the current alarm/wake settings using the BIOS TIMDAT routine. The system display function can be inhibited from setting or resetting the alarm/wake function by manipulating the value of ALRMSTDS (ØEF43H).

```
ALRMSTDS = ØØH: The alarm/wake function can be set/reset via
                the system display.
         ≠ Nonzero: The alram/wake function cannot be
                set/reset via the system display.
```

(3) Auto start
Sets or resets the auto start function by directly accessing AUTOSTRT (ØF3BDH).

(4) Menu
Wets or resets the menu function by directly accessing MENUFG (ØEF44H), MENUDRV (ØEF45H), and FTYPETBL (ØEF50H). See Section 2.10, "Menu" for these areas.

(5) Microcassette drive
Identifies the MCT stop/nonstop mode setting by examining DFTATR (ØF2E4H), bit 7.

DFTATR, bit 7 = 1: Stop mode
= Ø: Nonstop mode

The stop/nonstop mode can be selected by setting or resetting bit 7 of DFTATR (ØF2E4H) and TACATR (ØF7D1H).

The system display function identifies the MCT verify/non-verify mode by examining VERFDFLT (ØEFBEH).

VERFDFLT = ØØH: Non-verify mode
= ØFFH: Verify mode

MCT manual operations are assigned to the following PF keys:

PF1: Initiates MIOS function Ø6H (Fast feed).
PF2: Initiates MIOS functions ØBH (Head on) and then Ø4H (Play).
PF3: Initiates MIOS functions Ø3H (Stop) and then ØCH (Head off).
PF4: Initiates MIOS function Ø8H (Rewind).
PF5: Initiates MIOS function Ø2H (Set tape counter).
PF6: Initiates MIOS function 252 (Remove).
PF7: Initiates MIOS function 253 (Mount).
PF8: Initiates MIOS function 255 (Make directory).
PF9: Initiates MIOS function 15H (Erase).

The following restrictions are placed on MCT manual operations.

- No manual operation can be performed when an MCT file is open. OPNMOD (ØF355H) is examined to check for the presence or absence of an open MCT file.

OPNMOD = ØØH: No open file.
= Ø1H: File open in read mode.
= Ø2H: File open in write mode.

- In the MCT mount state, only the remove operation can be performed. In the MCT remove state, any operations except for remove can be performed. Whether the MCT is in the mount or remove state is determined by the value of TAPMOD (ØF2E1H).

TAPMOD = ØØH: Remove state
= Ø1H: Mount state

See Section 3.7, "MTOS/MIOS Operations" for Microcassette drive

2.11.4 Miscellaneous

2.11.4.1 System display processing when the item keyboard is installed

When the item keybaord is installed, no system display screen is displayed even when the CTRL/HELP keys are pressed. This is because the CTRL key on the item keyboard is used only in combination with the STOP key; it has different functions from the CTRL key on the standard keyboard.

Even when the item keyboard is installed, the system display screen can be displayed from an application program, following the steps described below. However, MCT manual operation cannot be performed since the item keyboard has no PF keys.

(1) Calculate the starting address of the system display processing routine based on the CTRL/HELP address (ØFØDlH) in YSUBRTN.
(2) Call the address obtained in the above step using BIOS CALLX.
(3) The system display screen is displayed via the above two steps. When system display processing is completed, application program processing resumes at the point at which the system display routine starting address was called.

```
                                ;       TITLE   SYSTEM DISPLAY
                                ;       PAGE    45
                                ;       ************************************************
                                ;               SYSTEM DISPLAY BY USER CALL
                                ;       ************************************************
                                ;
                                ;       NOTE :
                                ;       <> assemble condition <>
                                ;
                                        .Z80
                                ;
                                ;       <> loading address <>
                                ;
                                        .PHASE  100H
                                ;
                                ;       <> constant values <>
                                ;
F0D1                            CTRLHELP        EQU     0F0D1H          ; CTRL/HELP function.
F52E                            DISBNK          EQU     0F52EH          ; Destination bank.
                                ;
EB03                            WBOOT           EQU     0EB03H          ; WBOOT entry address
EB69                            CALLX           EQU     0EB69H          ; CALLX entry address
                                ;
1000                            MAINSP          EQU     01000H          ; Stack pointer.
                                ;
0100                            START:
0100    31 1000                         LD      SP,MAINSP       ; Set stack pointer.
                                ;
0103    DD 2A F0D1                      LD      IX,(CTRLHELP)
0107    3E FF                           LD      A,0FFH          ; Select system bank.
0109    32 F52E                         LD      (DISBNK),A      ;
010C    CD EB69                         CALL    CALLX           ; Call SETERR.
010F    C3 EB03                         JP      WBOOT
                                ;
                                        END
```