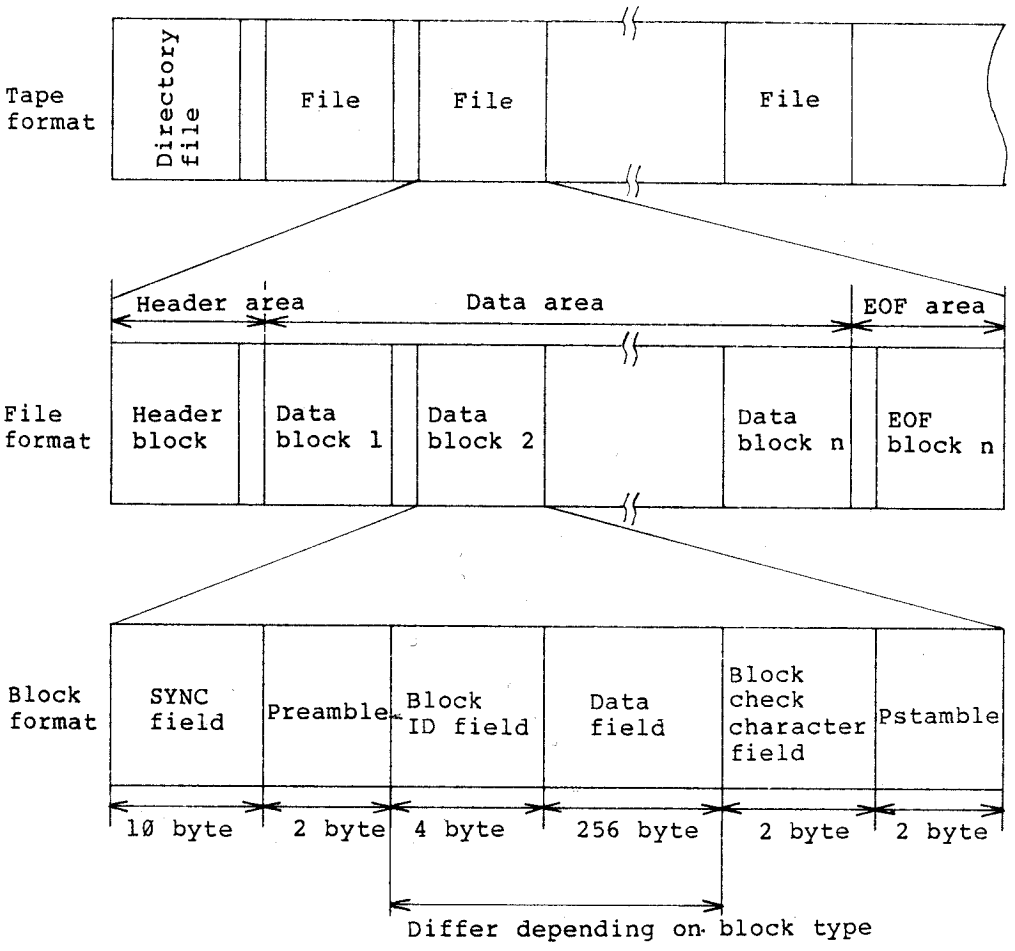
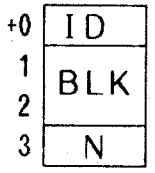


Fig. 3.7.2 Tape Structure

3.7.2.1 Block format

Each block has the format as shown below. The formats of the data fields are described in 3.7.2.2.

Field name	Size (bytes)	Description
SYNC field	10	Used for tape synchronization. Contains 80 0 bits.
Preamble	2	Contains 0FFH and 0AAH.
Block ID field	4	Identifies the block.  Byte 0: Block identifier "H": Header block "D": Data block "E": End of file block Bytes 1 and 2: 2-byte binary number indicating the block number. Byte 3: Block ID number indicating the ordinal number of writes.
Data filed	256	Contains data bytes.
BCC (Block Check character) field	2	BCC characters computed using CRC (Cyclic Redundancy Check). The CCITT CRC method is used. Calculation extends from the first block number to the BCC field itself.
Postamble	2	Contains 0FFH and 0AAH.

3.7.2.2 Data field formats

The data field formats differ among the header, data, and EOF blocks. The following pages describe the format of each field.

(1) Header block data field format

Column from	to	Size	Item	Description
0	3	4	ID field	Identifies an 'HDR1' header (ASCII).
4	11	8	File name	Contains the file name.
12	19	8	File type	Contains the file type.
20		1	Record type	'F': Fixed length 'v': Variable length 'n': Fixed length The same block is written n times.
21		1	Block mode	' ': Specifies that the intergaps are to be long enough to stop the tape successfully. 's': Specifies that the intergaps are not to be long enough to stop the tape successfully.,
22	26	5	Block length	Indicates the length of the block (ASCII number from '00000' to 'FFFFF').
27	28	2	Counter value	Indicates the tape count at which this file starts.
29		1		Free
30		1		File attribute
31		1		Free
32	37	6	Date of creation	Date on which this file is created. The month, day, and year are set in that order in 2-byte ASCII codes, respectively.
38	43	6	Creation time	Time at which this file is created. The hour, minute, second are set in that order in 2-byte codes, respectively.
44	49	6		Free
50	51	2	Volume number	Tape volume number ('01' -)
52	59	8	System name	Name of the system under which the file is created.
60	61	2	System file number	File number by which the file is controlled in the directory. 0000H - 0FFFFH
62	67	8		Reserved for the system.
68	255			Free

(2) Data block data field format
The data field of a data block contains actual data bytes. There is no restriction on the data format except that the data field size is 256 bytes.

(3) EOF block data field

Column from	to	Size	Item	Description
0	3	4	ID field	Contains 'EOF' (ASCII).
4	11	8	File name	Contains the file name.
12	19	8	File type	Contains the file type.
20	21	2	File number	Contains the file number by which the file is controlled in the directory ('0000' to 'FFFF').
22	23	2	Counter value	Contains the last counter value for the preceding block.
24	255			Free

3.7.2.3 Directory File Structure

The directory file comprises the following three blocks:

1) Directory ID (first block)
The directory ID contains the information obtained when the tape directory is created for the first time, the information set up when the MCT is used last, and the information pertaining to the MCT itself such as the current total block count and the total record count.

2) Directory (second and third blocks)
The directory contains the information pertaining to the files on the MCT. One file entry is 32 bytes long and one block of directory contains information for 8 files. Two blocks are reserved for the directory because each MCT contains a maximum of 12 files.

3) RAM directory
The directory file is loaded into RAM by the MOUNT function for controlling subsequent accesses to the MCT. The directory in RAM is called the RAM directory. Its structure is identical to that on the MCT.

(1) Directory ID (first block)

Column from	to	Size	Item	Description
0	7	8	Tape name	Loaded with the tape name and volume number specified when the directory is created.
8	9	2	Volume number	
10	17	8		Reserved for the system.
18	23	6	Creation date	Loaded with the date at which the directory is created. The month, day, and year are set in this order in 2-byte codes, respectively.
24	29	6	Creation time	Loaded with the time at which the directory is created. The hour (ØØ-23), minute, and second are sets in this order in 2-byte codes, respectively.
30	35	6	Remove date	Loaded with the date at which the tape is removed last. The month, day, and year are set in this order in 2-byte codes, respectively.
36	41	6	Remove time	Loaded with the time at which the tape is removed last. The hour (ØØ-23), minute, and second are set in this order in 2-byte codes, respectively.
42	43	2	Total mount count	Loaded with the total number of mounts. This field is initialized to Ø and incremented at each mount operation.
44	45	2	Total block count	Loaded with the total number of blocks on the MCT except those for the directory file.
46	47	2	Total record count	Loaded with the total number of records except those for the directory file.
48		1	Total file count	Loaded with the total number of files on the MCT.
49		1	System flag 1	Tape ID flag (used by the automatic MTOS identification feature.)
50		1	System flag 2	Tape TOS controller (used by the automatic MTOS identification feature.)
51	52	2	Last file number	The file number of the last file on the MCT.
53	255			Free

(2) Directory (second and third blocks)

Column from to	Size	Item	Description
Ø 1	2	File number	Is the number of the file by which MTOS manages the file. MTOS manages a file not by its file name but by the file number assigned to it.
2	1	Presence flag	Indicates the file cataloged in this directory entry is valid or invalid. ØØH: Valid ØFFH: Invalid
3	1	File attribute 1	Indicates the logical characteristics of the file and the mode during read operations. Bit Description 7 Ø: Nonstop mode access 1: Stop mode access 6 - 4 Don't care. 3 - Ø Number of retires during read
4	1	File attribute 2	Reserved by the system.
5 6	2	Number of blocks	Total number of blocks in the file. The header block is counted as ØØØØH.
7 8	2	Number of records	Total number of records in the file. The first 128-byte record in the first block is counted as record ØØØØH.
9 1Ø	2	Starting count	Tape counter value at which the header of this file starts.
11 12	2	Ending count	Tape counter value at the end of an EOF block.
13 14	2	Number of opens	Number of open operations performed.
15	1	User number	User number assigned by the CP/M system.
16 23	8	File name	Loaded with the name of the file.
24 31	8	File type	Loaded with the file type of the file. The highest order three bytes of this field are used.

3.7.3 Tape File Control Block (T-FCB)

3.7.3.1 T-FCB general

When using MTOS services, the application program must use a packet, called the T-FCB, which corresponds to the CP/M FCB. The T-FCB is placed in the same memory location as FCB but their formats are different.

3.7.3.2 T-FCB format

Figure 3.7.3 shows the T-FCB format.

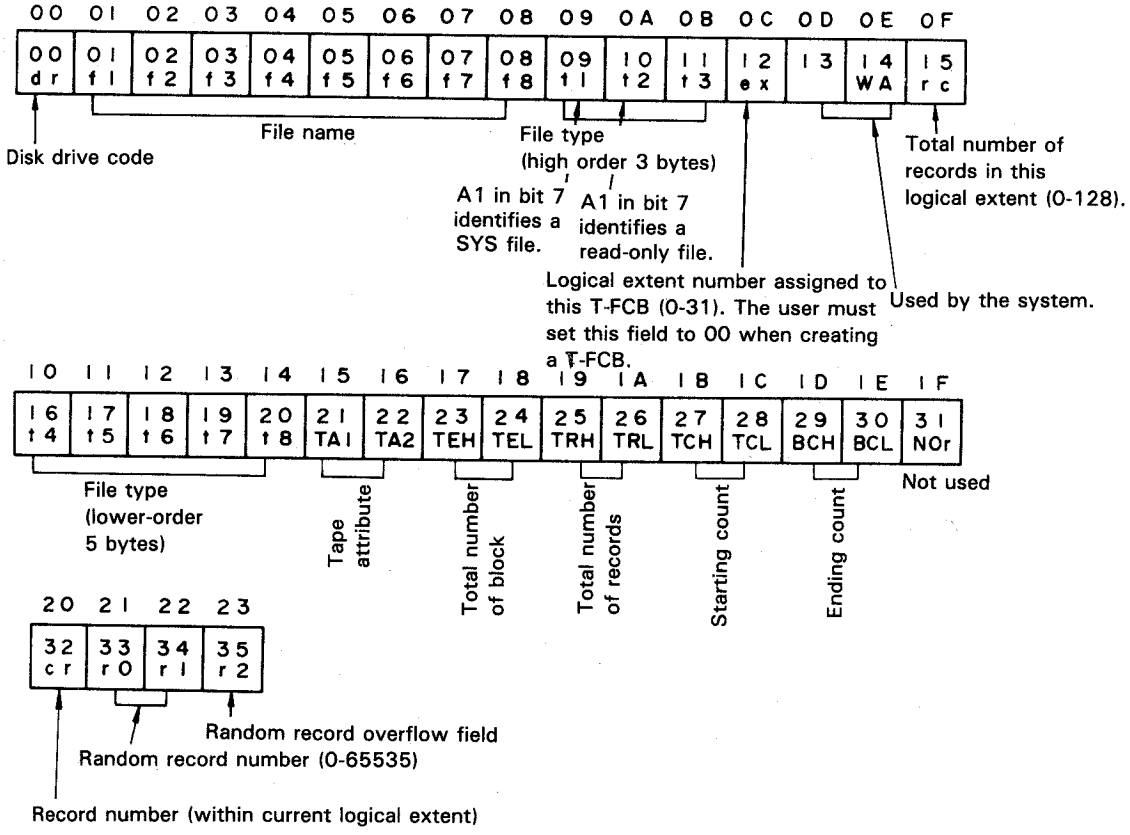


Fig. 3.7.3 T-FCB Format

3.7.3.3 T-FCB description

Column from to	Field name	Description
Ø	dr	Loaded with the disk drive code. Must be set to ØØH when drive H is selected or Ø8H when another drive is selected.
1 8	f1 - f8	Loaded with the file name.
9 11	t1 - t3	Loaded with the file type. A 1 in t1, bit 7 identifies a read-only file. A 1 in t2, bit 7 indicates an SYS file.
12	ex	Logical extent number assigned to this T-FCB. The user must set this field to ØØH when creating a T-FCB.
13 14		Used by the system.
15	rc	Total number of records in this logical extent (ØØH - 8ØH).
16 2Ø	t4 - t8	Loaded with the lower five bytes of the file type.
21 22	TA1, TA2	Loaded by the system with a tape attribute.
23 24	TBH, TBL	Loaded with the total number of blocks reserved for the file. This field is incremented by one each time a block is written onto the file.
25 26	TRH, TRL	Loaded with the total number of records stored in the file. This field is incremented by one each time a record is written onto the file.
27 28	TCH, TCL	Loaded with the starting tape count of the file.
29 3Ø	BCH, BCL	Loaded with the ending tape count of the file. This field is updated each time a record is written onto the file.
31	Ncr	Not used.
32	Cr	Loaded with the record number in the current logical extent. The user must set this field to ØØH when creating a T-FCB for the first time.
33 34	rØ, r1	Loaded with the random record number (ØØØØH - ØFFFFH).
35	r2	A nonzero value in this field indicates that a random record overflow condition has occurred.

3.7.3.4 Notes on the use of T-FCB

The contents of the T-FCB are updated whenever an access is made to the associated file on the MCT.

Incorrect file size values will be returned when a STAT command is executed for the H drive. This is because MTOS uses the file allocation vector field (FCB+16 through FCB+31) for purposes different from the original ones. In CP/M, the file allocation vector field indicates the utilization status of the file space on the disk and the CP/M STAT command examines this field to calculate the size of the file.

3.7.4 Using MTOS

3.7.4.1 Outline

MTOS/MIOS is included into CP/M through an interface. MTOS functions are compatible with BDOS functions. Whether an MTOS function or BDOS function is specified is determined by the following rules:

1. Functions not supported by MTOS are carried out by BDOS.
2. Functions requiring an FCB (T-FCB) as a parameter are identified by the disk drive code at the beginning of the FCB (T-FCB).
3. Other MTOS functions are serviced only when the MCT drive is logged in.

The application program must call BDOS when using MTOS functions. MTOS calls differ from BDOS calls in that drive H must be specified as the drive code at the beginning of the FCB.

Although FCB and T-FCB are located in the same memory location as mentioned in 3.7.3, their format and use are different. In the following sections, only T-FCB is used to represent a file control block.

3.7.4.2 MTOS Programming Considerations

(1) MOUNT and REMOVE
As mentioned in 3.7.2, MTOS loads the directory file at the beginning of the MCT into the RAM directory area in memory when controlling a tape file. Therefore, the following considerations must be taken when handling MCT.

1) Whenever a microcassette tape is inserted into the PINE microcassette slot, it is necessary to performa MOUNT operation. In practice, however, the user need to perform nothing for this purpose because the automatic mount feature is executed when he accesses the H drive via BDOS (not calling MIOS directly).

2) When a write or rename operation is performed on the MCT, however, the associated file information is updated only in the RAM directory. It is therefore necessary to restore the updated file information from the RAM directory onto the MCT at the end of the file processing. This is called a REMOVE operation. The user must perform a REMOVE operation immediately before removing an MCT from the PINE whenever a file is written on the MCT.

3) Whether an MCT is mounted or removed is indicated by the LED identifying the MCT tape MOUNT/REMOVE state. The user can remove the MCT while that LED is on.

(2) File access

MTOS controls the file acessing by examining the directory at the beginning of the MCT.

Each file is blocked and accessed on a block basis. Blocks are identified by sequentially assigned block numbers.

Files are given a file name but controlled by a file number assigned by the system at file open time. The file number counter is set to 0000H when the directory is created and incremented each time a file is created. The maximum file number is 0FFFFH.

The following restrictions on file accessing must be noted:

1) No more than one file can be opened simultaneously.
2) When a file is opened in the write mode, no other files can be opened until that file is closed.
3) A new file may be opened when another file has been opened in the read mode. The currently open file, however, is closed.
4) An attempt to open the already-opened file on to write it will cause an error.

The user must observe the following restrictions on sequential file access:

1) In the write mode:
Once a record is written in a block, no record can be placed in the next block until that block is filled. No data can be written in any locations other than the record areas in the current and next blocks.

2) In the read mode:
No record area can be accessed other than those in the current and next blocks.

3) Read from a file opened in the write mode:
Any record in the current block may be read.

MTOS accesses an MCT in one block (256 bytes) at a time while the system accesses in one record (128 bytes) at a time. This means that MTOS performs blocking/deblocking to make each block.

(3) Note on the creation of an MCT file

A new file created on the H drive (MCT) is placed after the last file on the MCT. Consequently, a disk full condition may occur even when there is only one file on the MCT if that file is stored as shown in Figure 3.7.4.

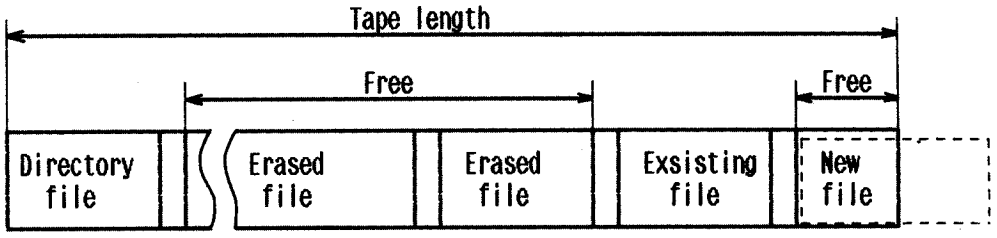


Fig. 3.7.4 Disk Full Condition

3.7.4.3 Miscellaneous Considerations on MTOS

(1) MTOS and MIOS termination and power-off processing

MCT processing may be terminated by stopping the MCT (CTRL/STOP) or turning off MCT power. MTOS and MIOS react as summarized below when one of the above conditions occurs.

The CTRL and STOP keys must be pressed simultaneously a little longer than ordinary keys are because keyboard interrupts are disabled during a write onto the current block.

When MCT is stopped:
- MTOS
  If the current operation is a seek, write, or read, MTOS stops the operation, stops the motor, unloads the read/write head, and returns control to the calling program with the return code ØFFH in the A register.
- MIOS
  MIOS terminates processing as Bad sector error if the current operation is a read or write. The file is closed. MIOS does not store the directory file if the current operation is a write.

When power is turned off:
- MTOS
  If a power off condition occurs during a read or write, MTOS stops the motor and unloads the read/write head after completing the access to the current block. MTOS then returns control to the calling program.
- MIOS
  Power is turned off after MIOS processing is completed. Subsequent MIOS processing when power is restored differs depending on the mode in which power was turned off. When power was turned off in the continue mode, MCT processing continues at the point when power was turned off. In the restart mode, the file that was open when power was turned off is closed. The file that was opened in the write mode is not cataloged in the directory.

(2) Automatic MTOS identification feature

1) Auto mount

MTOS carries out an automatic mount when an MTOS function is called on an MCT which has not been mounted (auto mount feature). This allows the user to operate the MCT without being aware of the need of mount processing.

2) Auto remove check

MTOS does not perform remove processing unconditionally; when performing remove processing, MTOS reads in the directory ID and compares the creation date and time with those in the RAM directory. It carries out the actual remove processing only when a match occurs. The auto remove check function is disabled by default.

(3) MTOS flags for the automatic MTOS identification feature

MTOS uses a flag to control automatic MTOS operations such as auto mount and remove. This flag is referenced by the automatic MTOS identification feature to identify the operation to be performed. The flag is labelled TOSCTL. It is initialized when an MCT is mounted. The contents of TOSCTL are determined as summarized below based on the system flag 2 in the directory ID.

TOSCTL is set to 50H when the system flag 2, bit 7 is 0.
TOSCTL is set to the value of the system flag 1 when the system flag 2, bit 7 is 1.
(The contents of TOSCTL is described later.)

The TOSCTL value for an MCT may be altered using the procedure shown in Figure 3.7.5. After this procedure, MTOS automatically operates on the MCT in the specified control mode when it is mounted.

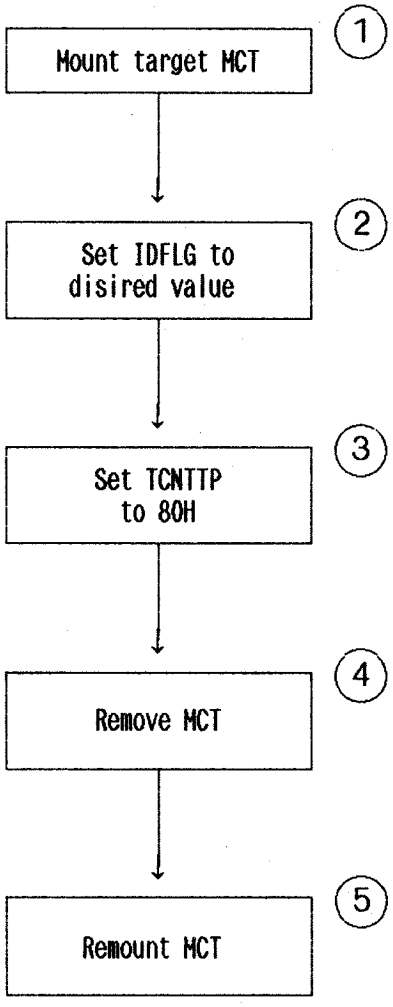


Fig. 3.7.5 Procedure for TOSCTL Alteration

Step	Action	Description
1	Mount the target MCT	Load the tape directory into the RAM directory area.
2	Set the desired value in IDFLG	Specify the desired MTOS control mode in RAM directory area IDFLG (system flag 1).
3	Set 80H in TCNTTP	Load 80H in RAM directory area TCNTTP (system flag 2). This causes the TOSCTL value to be initialized as specified by the user.
4	Remove the MCT	Copy the RAM directory into the tape directory. After this, MTOS operation on this tape is controlled by the mode specified by the user.
5	Remount the MCT	Load the tape directory into the RAM directory area. This causes the IDFLG to be set to the value of TCNTTP specified in step 3. After this, the TOSCTL is set to the value of IDFLG set up in step 2 when this tape is mounted.

```
TOSCTL (ØEFBBH)  1 byte
- MTOS control flag
     Bit 7      Always set to Ø.
         6 = 1: Enables counter adjustment.
           = Ø: Disables counter adjustment.
         5 = 1: Determines access mode based on system status.
           = Ø: Determines access mode based on directory status.
         4 = 1: Enables auto mount.
             Ø: Disables auto mount.
         3 = 1: Enables auto remove check.
           = Ø: Disables auto remove check.
         2     Always set to Ø.
         1     Always set to Ø.
         Ø = 1: Disconnects MTOS from CP/M.
           = Ø: Includes MTOS into CP/M.
     TOSCTL defaults to 50H.

IDFLG (ØFA13H)  1 byte
- System flag 1 in RAM directory
The bit assignments are identical to those of TOSCTL.

TCNTTP (ØFA14H)  1 byte
- System flag 2 in RAM directory.
     Bit 7 = 1: Loads the IDFLG value into TOSCTL at a mount.
           = Ø: Loads 50H into TOSCTL at a mount.
     Bits 6 - Ø: Always set to Ø.
```

(4) Tape access mode

MTOS and MIOS allow accesses to MCTs in two modes, i.e., stop and nonstop modes. These modes can be switched by means of the system display or by changing the value in the associated system area. Accesses are retried several times if the requested block is not accessed successfully. The rest of this subsection describes the stop and nonstop modes.

1) Stop and nonstop mode operations

Functional differences between the stop and nonstop modes are listed below.

i) Stop mode
- Function
  In the stop mode, the motor is stopped each time one block of data has been read or written. The motor is started again when the next block is read or written.
- Advantage
  Since the motor is in the stopped state after a block has been read or written, the next block may be read or written at any given time.
- Disadvantage
  Because the times required for turning the motor on and off are added to the read or write time, read or write operations in the stop mode take longer processing time than in the nonstop mode.

ii) Nonstop mode
- Function
  During a read or write in the nonstop mode, the motor is not stopped after one block of data has been read or written.
- Advantage
  Because no time is required for turning the motor on and off as in the stop mode, read or write operation in the nonstop mode takes shorter processing time.
- Disadvantage
  The subsequent read operation must be started before the next block passes through the read or write head; otherwise, a read error would occur. If this mode is used for single-block writes, the inter-block gap size will be increased. This results in a waste of tape space and an increase in the access time in the read mode.

2) Block read and write

MTOS writes a block of data onto an MCT n times (n defaults to 2) to increase tape reliability. Because of this redundancy, MTOS needs to read only one block out of n blocks successfully in the read mode. If errors occur in all (n) blocks written as a single block, MTOS makes several times of retries.

The user can specify write data to be verified during file close after write. In the verify mode, MTOS only checks whether the written file can be read in normally and does not check the file contents. (The default is nonverify mode.)

3) Changing the tape access mode
The value of TACMOD is established when a new file is created for write or when an existing file is opened for read.

The user can change the value of TACMOD using the procedure shown in Figure 3.7.6. Step 2 in the figure is unnecessary for write because TACMOD is unconditionally set to the value of TACATR during a write operation.

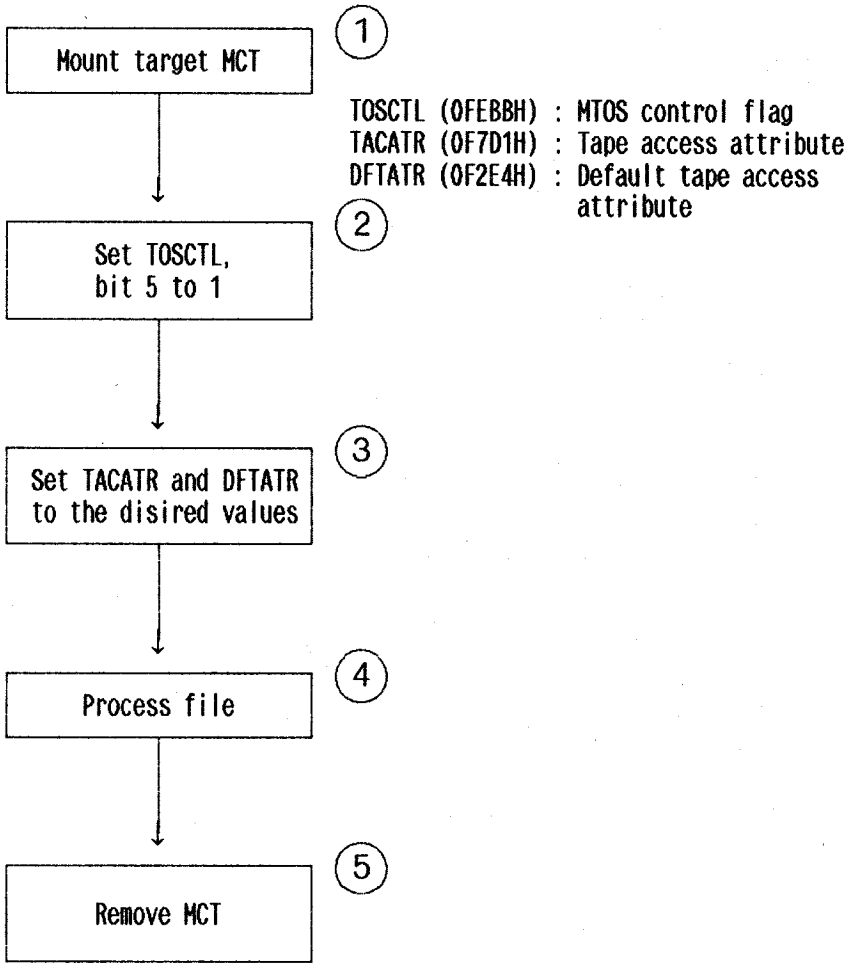


Fig. 3.7.6 Procedure for TACMOD Alteration

Step	Action	Description
1	Mount the target MCT	Load the tape directory into the RAM directory area.
2	Set TOSCTL, bit 5 to 1	Set the TACMOD to the mode specified by the file attribute 1 field in the RAM directory. This operation is unnecessary for write because the TACMOD is always set to the value of TACATR during a write.
3	Set TACATR and DFTATR to the desired values	Change TACATR and DFTATR to the desired values and specify the stop mode and number of retries. Once the value of DFTATR is altered, the new value is held valid until the next reset. This is because DFTATR is copied into TACATR during a warm boot.
4	Process file	For write, create a file and write data into the file. For read, open and read in a file.
5	Remove MCT	Copy the RAM directory into the tape directory.

VERFDFLT (ØEFBEH) 1 byte
- Verify mode flag for write (for default setting)
     = ØØH: Nonverify mode
     = Nonzero: Verify mode
The default setting is the nonverify mode. VERFFG is set to the VERFDFLT value during a warm boot.

VERFFG (ØEFBFH) 1 byte
- Verify mode flag for write
     = ØØH: Nonverify mode
     = Nonzero: Verify mode
VERFFG is initialized to the VERFDFLT value at a warm boot.

DFTATR (ØF2E4H) 1 byte
- Tape access attribute area (for default setting)
     Bit 7   Ø: Nonstop mode   1: Stop mode
     Bits 6 - 4: Always set to 1ØØB.
     Bits 3 - Ø: Number of retries (Ø - 15)
The access mode and the number of retries are initially set to the stop mode and 2, respectively.
This area is set to the TACATR value at a warm boot.

TACATR (ØF7D1H) 1 byte
- Tape access attribute area
The bit assignments are identical to those for DFTATR.
TACATR is set to the value of DFTATR at a warm boot.

TACMOD (Ø7D2H) 1 byte
- Tape access mode
The bit assignments are identical to those for DFTATR. TACMOD is unconditionally initialized to the value of TACATR when a file is created. It is initialized to the value of TOSCTL (ØEFBBH), bit 5 when opening a file. A 1 in this bit specifies that TACMOD is initialized to the value of TACATR. A Ø in the bit indicates that the access mode is to be equal to the value specified in the file attribute 1 field in the RAM directory.

BLKWRTNO (ØF2FDH) 1 byte
- Number of block writes +1 (Ø2H - ØFFH)
MTOS writes the block of data the specified number of times. The initial value is Ø3H (twice).

BMDCNT (ØF357H) 1 byte
- Block mode check counter
Loaded with the number of read retires made during a block read. This counter is checked when a read error occurred. The initial value is Ø2H.

3.7.5 MTOS Functions

3.7.5.1 Outline

This subsection presents a description of the MTOS functions with entry and return information. The return information includes return codes that are returned when CP/M error reporting is not suppressed (referred to as return code 1) and return codes that are returned when CP/M error reporting is suppressed (referred to as return code 2). Error reporting can be suppressed by calling SETERR. See 3.2.4 for more detail.

When the latter information is returned by MIOS, the application program can obtain the error details by referring to BIOSERROR (ØF52BH) and TOSRCD (ØF7CEH).

The PINE assigns drive H (physical device number is Ø8H) to MCT, so before accessing a file, the application program must set up the drive code field of the T-FCB as follows:

When the current drive is H:	ØØH
When the current drive is other than H:	Ø8H

In the descriptions of the MTOS functions that follow, the descriptions of the use and error information of the MTOS functions that are identical to those of the BDOS functions are omitted (except the setting of the drive code at the beginning of the T-FCB).

3.7.5.2 BDOS calls

The following MTOS-related BDOS calls are described in this sub-subsection:

	BDOS call number	Function	Page
1	14	Select disk drive	II-304
2	15	Open file	II-304
3	16	Close file	II-305
4	17	Frist search	II-306
5	19	Delete file	II-306
6	20	Read sequential	II-307
7	21	Write sequential	II-307
8	22	Create file	II-308
9	23	Rename file	II-309
10	30	Set file attribute	II-309
11	33	Read random	II-310
12	34	Write random	II-310
13	251	Verify MCT	II-311
14	252	Remove(close MCT)	II-311
15	253	Mount (open MCT)	II-312
16	254	Read MCT ID number	II-312
17	255	Create directory file	II-313

Name SELDSK BDOS No. 14

Function Selects drive H:.

Entry parameter
C = ØEH
E = Drive No.
Load the E register with 7 when selecting drive H:.

Return parameter
Return code 1
None.
Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø4H	FFH	Ø4H	Mount unsuccessful.
-	FFH	Ø1H	Error in MIOS.

Explanation
This function selects the drive specified in the E register. If no MCT is mounted when drive H is specified, the function automatically performs the MCT mount function.

Name OPEN BDOS No. 15

Function Opens an MCT file.

Entry parameter
C = ØFH
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: File not found
Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
ØØH	FFH	ØØH	No file found.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø8H	FFH	ØØH	File not found.
Ø9H	FFH	Ø5H	File is already open.
11H	FFH	Ø5H	File number associated with the specified file was not found in the MCT directory.
-	FFH	Ø1H	Error in MIOS.

Explanation
The OPEN function searches the RAM directory for the file specified in the T-FCB, and if it is found, reads the header block of that file into the T-FCB for subsequent read or write operations on the file. The function performs an automatic MCT mount function if no MCT is mounted on the MCT.

An error is generated if the file is already open in the write mode. If the file is already open in the read mode, the function closes that file and opens a new file.

Tape access mode (stop or non-stop) is determined by the file attribute in the directory file when the file is opened in the read mode. See 3.7.4 for tape access modes.

Note
Load each of the T-FCB+12, T-FCB+15, T-FCB+32 with ØØH when opening a file.

Name CLOSE BDOS No. 16

Function Closes an MCT file.

Entry parameter
C = 10H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: Normal termination
0FFH: Close error

Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	Normal termination.
00H	FFH	00H	No file found.
02H	FFH	05H	No MCT mounted.
08H	FFH	00H	File not found.
10H	FFH	00H	Verify error.
11H	FFH	05H	File number associated with the specified file was not found in the MCT directory.
-	FFH	01H	Error in MIOS.

Explanation
The directory of a file on which write operations are performed during processing must be updated at the end of the processing. This update is carried out by the CLOSE function.

When this function is called during write file processing, an EOF block is written on the MCT and the directory in memory is updated.

When the verify flag is on, the function automatically verifies the validity of the file contents before closing the file. The file will not be cataloged into the directory file on tape if an error is found.

Note
Once the RAM directory is updated, the directory file on the MCT must also be updated with the REMOVE function before the MCT is demounted from the PINE main unit.

Name FIRST SEARCH BDOS No. 17

Function Searches the file directory on MCT for the first time.

Entry parameter
C = 11H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: File found
0FFH: File not found

Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	File found.
00H	FFH	00H	File not found.
04H	FFH	04H	Mount unsuccessful.
-	FFH	01H	Error in MIOS.

Explanation
The FIRST SEARCH function searches the RAM directory for the file specified in the T-FCB address in the DE register. If the file is found, the function loads the first 32 bytes of the DMA buffer with the file directory information and pads the remaining bytes with 0E5Hs.

Name DELETE BDOS No. 19

Function Deletes the specified file from the MCT directory.

Entry parameter
C = 13H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: Delete successful
0FFH: File not found

Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	Normal termination.
00H	FFH	00H	No file found.
04H	FFH	04H	Mount unsuccessful.
06H	FFH	03H	R/O file.
0FH	FFH	02H	File number associated with the specified file was not found in the MCT directory.
-	FFH	01H	Error in MIOS.

Explanation
The DELETE function deletes the file specified in the T-FCB address in the DE register from the directory on drive H: (MCT). If no MCT is mounted, this function performs the mount function automatically.

Note
A file is actually deleted when the corresponding presence flag in the RAM directory is reset. Therefore, the user must execute a REMOVE function before demounting an MCT from the PINE.

Name SEQUENTIAL READ BDOS No. 20

Function Reads an MCT file sequentially.

Entry parameter
C = 14H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: Normal termination
Nonzero: An EOF was encountered
Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	Normal termination.
04H	FFH	04H	Mount unsuccessful.
09H	FFH	05H	Invalid file specified.
0AH	01H	00H	File not open.
0BH	FFH	05H	Illegal record access.
0CH	01H	00H	EOF detected.
-	FFH	01H	Error in MIOS.

Explanation
The SEQUENTIAL READ function reads a record specified in the cr field (T-FCB+32) from the file specified in the T-FCB and returns that record to the DMA.

Note
The file to be read must be opened before this function is called. Although the function attempts the automatic MCT mount function if no MCT is mounted when it is executed, an error will be signaled by MTOS because the specified file is not open.

Name SEQUENTIAL WRITE BDOS No. 21

Function Writes an MCT file sequentially.

Entry parameter
C = 15H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: Normal termination
Nonzero: An error occurred
Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	Normal termination.
04H	FFH	04H	Mount unsuccessful.
06H	FFH	03H	R/O file.
09H	FFH	05H	Invalid file specified.
0AH	01H	00H	File not open.
0BH	FFH	05H	Illegal record access.
0FH	FFH	02H	R/O disk.
-	FFH	01H	Error in MIOS.

Explanation
The SEQUENTIAL WRITE function writes the record specified in the cr field (T-FCB+32) to the file specified in the T-FCB. Blocking/deblocking is performed during a sequential write since the DMA buffer size is 128 bytes while the data block size is 256 bytes. Two records in the data block can be read immediately.

Note
The requested file must be opened and closed before and after write processing is performed, respectively. A REMOVE function must be executed before any MCT is to be removed from the PINE main unit.

Although this function performs the automatic MCT mount function if no MCT is mounted when it is executed, an error is signaled by MTOS because the specified file is not opened.

Reference
If an EOT (End Of Tape) error occurs during a sequential write, MIOS reports it to the application program by loading the A register and IOSRCD (F7CFH) field with nonzero value and 02H, respectively. If CP/M error reporting is suppressed, however, BDOS only signals a "BAD SECTOR" error.

Name MAKE BDOS No. 22

Function Makes a directory entry for an MCT file.

Entry parameter
C = 16H
DE = T-FCB address

Return parameter
Return code 1
A = 00H: File creation successful
0FFH: Directory full

Return code 2

TOSRCD	A reg.	H reg.	Result
00H	00H	00H	Normal termination.
04H	FFH	04H	Mount unsuccessful.
05H	FFH	00H	MCT directory full.
07H	FFH	05H	The specified name is already assigned to an existing file.
09H	FFH	05H	Another file already open.
0FH	FFH	02H	R/O disk.
-	FFH	01H	Error in MIOS.

Explanation
The MAKE function catalogs the file specified by the T-FCB in the DE registers into the MCT directory in RAM. If no MCT is mounted, this function performs the automatic MOUNT function. Up to 12 files can be managed under the MTOS. A directory full error occurs if an attempt is made to create the 13th file.

Name RENAME BDOS No. 23

Function Renames an MCT file.

Entry parameter
C = 17H
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: File not found

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
ØØH	FFH	ØØH	No file found.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø6H	FFH	Ø3H	R/O file.
Ø8H	FFH	ØØH	File not found.
ØFH	FFH	Ø2H	R/O disk.
-	FFH	Ø1H	Error in MIOS.

Explanation
The RENAME function renames a file on drive H: (MCT). This function must be called with the T-FCB loaded with the old file name (dr to t3 fields) and a new file name (dØ to dl5 fields).

Note
A REMOVE function must be executed before an MCT is removed from the PINE main unit.

Name FILE ATTRIBUTE BDOS No. 3Ø

Function Sets MCT file attributes.

Entry parameter
C = 1EH
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: File not found

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
ØØH	FFH	ØØH	No file found.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø8H	FFH	ØØH	File not found.
-	FFH	Ø1H	Error in MIOS.

Explanation
The FILE ATTRIBUTE function changes the attribute of an MCT file cataloged in the RAM directory. The file attribute is specified by the tl and t2 fields of the T-FCB.
MSB of tl = Ø: R/W file
= 1: R/O file
MSB of t2 = Ø: DIR file
= 1: SYS file

Note
Since the change is actually made in the RAM directory, a REMOVE function must be executed before the MCT is removed form the PINE.

Name RANDOM READ BDOS No. 33

Function Performs a random read of an MCT file.

Entry parameter
C = 21H
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: MTOS error
Ø1H: File error
Ø4H: Random access error

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø9H	FFH	Ø5H	Another file already open.
ØAH	Ø1H	ØØH	File not open.
ØBH	FFH	Ø5H	Illegal record access.
ØCH	Ø1H	ØØH	EOF detected.
ØDH	Ø4H	ØØH	Random access error.
-	FFH	Ø1H	Error in MIOS.

Explanation
The RANDOM READ function reads a record specified in the rØ and rl fields (T-FCB+33, 34) from the file addressed by the T-FCB and places the record in the DMA. This function performs the same function as the SEQUENTIAL READ function except that the read operation takes place at a particular record.

Name RANDOM WRITE BDOS No. 34

Function Performs a random write to an MCT file.

Entry parameter
C = 22H
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: MTOS error
Ø1H: File not open

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø6H	FFH	Ø3H	R/O file.
Ø9H	FFH	Ø5H	Another file already open.
ØAH	Ø1H	ØØH	File not open.
ØBH	FFH	Ø5H	Illegal record access.
ØFH	FFH	Ø2H	R/O disk.
-	FFH	Ø1H	Error in MIOS.

Explanation
The RANDOM WRITE function writes a record to the file addressed by the T-FCB with a record number specified in the rØ and rl fields (T-FCB+33, 34). This function performs the same function as the SEQUENTIAL WRITE function except that it starts a write at a particular record.

Name VERIFY BDOS No. 251

Function Verifies an MCT file.

Entry parameter
C = ØFBH
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: Verify error

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø4H	FFH	Ø4H	Mount unsuccessful.
Ø8H	FFH	ØØH	File not found.
Ø9H	FFH	Ø5H	File already open.
1ØH	FFH	ØØH	Verify error.
11H	FFH	Ø5H	File number corresponding to the specified file was not found in the directory.
-	FFH	Ø1H	Error in MIOS.

Explanation
The VERIFY function reads a file addressed by the T-FCB in the DE registers and checks the file on a block basis to verify that the values of the blocks match the values calculated when the file was stored.

When called, this function performs an automatic MCT mount function and opens it before verifying the specified file.

An error is signaled if the function is specified for a file which is already open.

Name REMOVE BDOS No. 251

Function Writes the RAM directory into MCT directory file.

Entry parameter
C = ØFCH

Return parameter
Return code 1
A = ØØH: Normal termination
= ØFFH: Remove error

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø2H	FFH	Ø5H	MCT not mounted.
Ø3H	FFH	Ø5H	Cannot remove.
12H	FFH	Ø5H	Auto remove check error.
-	FFH	Ø1H	Error in MIOS.

Explanation
The REMOVE function writes the directory data from the RAM directory onto the MCT directory file.

No actual write takes place if no change has been made to the RAM directory (i.e., neither write, delete, nor rename operations have been performed).

Name MOUNT BDOS No. 253

Function Reads the MCT directory file to the RAM directory.

Entry parameter C = ØFDH

Return parameter Return code 1
A = ØØH: Normal termination
ØFFH: Mount error

Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø1H	FFH	Ø5H	Not removed.
Ø4H	FFH	Ø4H	Cannot mount.
-	FFH	Ø1H	Error in MIOS.

Explanation
The MOUNT function reads the MCT directory file and loads file control information into the system RAM directory.

Name READ TAPE ID BDOS NO. 254

Function Reads the ID number of the current MCT.

Entry parameter C = ØFEH

Return parameter Return code 1
A = ØØH: Not mounted
ØFFH: Normal termination

Return code 2

TOSRCD	A reg.	H reg.	Result
-	ØØH	-	MCT not mounted
-	FFH	-	Normal termination

Explanation
The READ TAPE ID function places the ID information pertaining to the currently mounted tape (columns Ø - 53 of the directory file's first block) into the DMA buffer. The function returns nothing when no MCT is mounted.

Name MAKE DIRECTORY BDOS No. 255

Function Creates a directory file on MCT.

Entry parameter
C = ØFFH
DE = T-FCB address

Return parameter
Return code 1
A = ØØH: Normal termination
ØFFH: MCT mounted
Return code 2

TOSRCD	A reg.	H reg.	Result
ØØH	ØØH	ØØH	Normal termination.
Ø1H	FFH	Ø5H	The function was called with the MCT mounted.
-	FFH	Ø1H	Error in MIOS.

Explanation
The MAKE DIRECTORY function rewinds the tape to the beginning to create a directory file.

The first 1Ø bytes of the directory file are copied from the the first 1Ø bytes of the T-FCB.
Bytes Ø - 7: Tape name (ASCII)
Bytes 8 and 9: Volume number (ASCII)

The number of directory entries is set to Ø. A RAM directory is also created by this function.

3.7.5.3 Return Codes from MTOS

Each MTOS or MIOS function returns several return codes. An MTOS function returns control to the calling program with error information loaded in the A and H registers and TOSRCD. The values placed in the A and H registers depends on the error code in the TOSRCD.

Furthermore, an MTOS function reports four types of CP/M error conditions, or returns control to the caller with the corresponding error codes loaded in A and H registers. See Subsection 3.2.4, "BDOS Errors" for the error report modes.

Table 3.7.6 lists the TOSRCD return codes and the meanings of the corresponding return codes that are placed in the A and H registers.

Table 3.7.7 lists the TOSRCD return codes returned by the MTOS functions. The contents of TOSRCD can be determined by referring to ØF7CEH.

Table 3.7.6 Meaning of Error Codes

TOSRCD return value	A reg.	H reg.	Meaning
ØØ	ØØ	ØØ	Normal termination.
Ø1	FF	Ø5	Not removed.
Ø2	FF	Ø5	Not mounted.
Ø3	FF	Ø5	Cannot remove.
*Ø4	FF	Ø5 (4)	Cannot mount.
Ø5	FF	ØØ	Directory full.
*Ø6	FF	ØØ (3)	R/O file.
Ø7	FF	Ø5	File already exists.
Ø8	FF	ØØ	File not found.
Ø9	FF	Ø5	File already open.
ØA	Ø1	ØØ	File not open.
ØB	FF	Ø5	Illegal record access.
ØC	Ø1	ØØ	EOF reached.
ØD	Ø4	ØØ	Random access error.
ØE	-	-	---
*ØF	FF	ØØ (2)	R/O drive.
1Ø	FF	ØØ	Verify error.
11	FF	Ø5	File number corresponding to the specified file not found in the directory.
12	FF	Ø5	Auto remove check error.

*: Numbers enclosed in parentheses identify the values returned when CP/M error reporting is suppressed.

Table 3.7.7 Errors Reported by MTOS Functions

MTOS Call No.	Function name	TOSRCD / Parameter	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12
12 ○	Get version No.																			
13	Reset disk system																			
14	Select disk drive					○														
15	Open file	DE ← T-FCB				○				○	○								○	
16	Close file	DE ← T-FCB		○						○								○ *	○ *	
17	First search	DE ← T-FCB				○														
18	Next search																			
19	Delete file	DE ← T-FCB				○		○									○			
20	Sequential read	DE ← T-FCB				○					○	○	○	○						
21	Sequential write	DE ← T-FCB				○		○			○	○	○				○			
22	Create file	DE ← T-FCB				○	○		○		○						○			
23	Rename file	DE ← T-FCB				○		○		○							○			
24	Get login vector																			
25	Get login disk No.																			
26 ○	Set DMA address																			
27	Get allocation address																			

MTOS Call No.	Function name	TOSRCD / Parameter	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12
28	Set write protect																			
29	Get R/O vector																			
30	Set file attribute					○				○										
31	Disk parameter block address																			
32 ○	Get user code																			
33	Random read	DE ← T-FCB				○					○	○	○	○	○					
34	Random write	DE ← T-FCB				○		○			○	○	○				○			
35	Compute file size	DE ← T-FCB																		
36	Set random record	DE ← T-FCB																		
37	Reset disk drive	DE ← Drive vector																		
38	Undefined																			
39	Undefined																			
40 ○	Random write with zero fill																			

MTOS Call No.	Function name	TOSRCD / Parameter	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12
251	Verify	DE ← T-FCB				○				○	○							○	○	
252	Remove			○	○															○
253	Mount		○			○														
254	Read tape ID																			
255	Create tape directory	DE ← T-FCB	○																	

Notes 1: MTOS functions identified by an o mark are not supported by MTOS.
2: See related pages for details about the functions that return parameters in registers.
3: * denotes that the code is returned when verify if specified.

3.7.6 Using MIOS

3.7.6.1 Outline

MIOS is located between MTOS and MCT firmware and made up of 23 functions.

3.7.6.2 How to use MIOS (MCMTX)

Each MIOS function is described in the same format as a BIOS function.

<Entry address>
WBOOT + 78H or ØEB7BH
<Entry parameter>
B = Function number (ØØH - 18H)
Some other registers are loaded with parameter data depending on the function.
<Return parameter>
Different parameters are returned for different functions.
<Explanation>
26 functions are defined for the PINE OS. They are identified by the value in the B register

Descriptions of the parameters and the use of each MIOS function is given in 3.7.7.

Function number	Name	Function	Page
00H	MIRDST	Read tape status	II-320
01H	MIRDCT	Read tape counter	II-321
02H	MISTCT	Set tape counter	II-321
03H	MISTOP	Stop motor	II-321
04H	MIPLAY	Turn motor in play mode	II-322
05H	MIREC	Turn motor in record mode	II-322
06H	MIFF	Turn motor in fast feed mode	II-322
07H	MISREW	Turn motor in slow rewind mode	II-322
08H	MIREW	Turn motor in rewind mode	II-323
09H	MIFFTE	Fast feed to tape end	II-323
0AH	MIRWTT	Rewind to tape top	II-323
0BH	MIHDON	Turn head on	II-324
0CH	MIHDOF	Turn head off	II-324
0DH	MISKTP	Seek tape	II-324
0EH	MISTMP	Set move protect counter	II-325
0FH	MIRSMP	Reset move protect counter	II-325
10H	MIRDBL	Read one block	II-325
11H	MIWTBL	Write one block	II-327
12H	——	———	
13H	——	———	
14H	MIGTWD	Get write protect pin status	II-327
15H	MILEDON	Turn LED on	II-328
16H	MILEDOF	Turn LED off	II-328
17H	MISDAT	Save data area	II-328
18H	MILDAT	Restore data area	II-329

3.7.7 MIOS Functions

3.7.7.1 Outline

This subsection describes the entry and return parameters and error codes for each MIOS function. A table of error codes is located at the end of this subsection.

3.7.7.2 Programming note on the use of MIOS functions

(1) Reserve the buffer area for the MIOS (pointed to by TOSDMA) in a location between 8000H and 0FFFFH.
(2) The number of data bytes specified for reading or writing MCT blocks must be in the range from 4 to 270.
(3) Each MIOS function makes an MCT mount check before execution. If the MIOS function is called with no MCT mounted, it immediately returns control to the calling program with the A and C registers loaded with 08H respectively.

3.7.7.3 MIOS function details

The following pages describe the use of the MIOS functions.

Error information for each function is returned in the A and C registers as follows:

Areg.	Meaning
00H	Normal termination.
01H	Read error.
02H	Write error.
03H	Write protect error.
04H	Time over error.
05H	Seek error.
06H	Break error (CTRL/STOP pressed).
07H	Power off error (Power turned off).
08H	MCT cartridge not mounted.
FEH	Other errors.

Creg.	Meaning
01H	Head move error (error during a head move).
02H	Motor stop error (Motor stopped).
03H	Write protect error.
04H	Data error (Data bits 0 and 1 unrecognizable).
05H	CRC error
06H	Block mode error (invalid block mode).
07H	Tape error (Tape not found).
08H	MCT cartridge not mounted.

The values in the A and C registers are copied into BIOSERROR (ØF52BH) and IOSRCD (ØF7CFH) respectively. In the following descriptions, only the error information returned to the A register is listed.

Name MIRDST

Function Reads MCT Status.

Entry parameter B = ØØH

Return parameter H = MCT status
A = ØØH: Normal termination
Ø8H: Mount error

Explanation
The MIRDST function reads the current microcassette status and places it in the H register. The bit assignments for the H register are as follows:

Bit	Contents
7	Head position (0 : OFF 1 : On)
6	Motor (0 : Stop 1 : Move)
5	Wind (0 : No 1 : Wind)
4	Fast feed (0 : No 1 : Fast feed)
3	Play (0 : No 1 : Play)
2	Record (0 : No 1 : Record)
1, 0	Reserved for the system.

Name MIRDCT

Function Reads the MCT counter.

Entry parameter B = 01H

Return parameter HL = Counter value
A = 00H: Normal termination
08H: Mount error

Explanation
The MIRDCT function reads the value of the 16-bit MCT counter and places it in the HL register pair. The counter increments when the tape is moved forward and decrements when it is moved backward.

Name MISTCT

Function Sets the MCT counter.

Entry parameter B = 02H
DE = Counter value to be set

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MISTCT function sets the MCT counter to the value specified in the DE register pair. The counter is set to 0000H immediately after an MCT is mounted. If no MCT is mounted, this function returns control to the caller with the A register loaded with 08H.

Name MISTOP

Function Stops MCT.

Entry parameter B = 03H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MISTOP function stops the MCT motor after turning off the loudspeaker. The function turns off the loudspeaker not by issuing a command to the MCT but by switching off the loudspeaker on the PINE main unit.

Name MIPLAY

Function Drives the MCT motor in the play mode.

Entry parameter B = 04H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MIPLAY function turns on the loudspeaker and rotates the MCT motor in the play mode. The read data signal is sent if the read/write head is on. The function turns on the loudspeaker not by issuing a command to the MCT but by switching on the loudspeaker on the PINE main unit.

Name MIREC

Function Drives the MCT motor in the record mode.

Entry parameter B = 05H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MIREC function rotates the MCT motor in the record mode. Tape data is erased if the read/write head is on.

Name MIFF

Function Drives the MCT motor in the fast feed mode.

Entry parameter B = 06H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MIFF function rotates the MCT motor in the fast feed mode.

Name MISREW

Function Drives the MCT motor at a slow speed in the backward direction.

Entry parameter B = 07H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MISREW function rotates the MCT motor in the slow rewind mode. The read/write head is automatically turned off in this mode.

Name MIREW

Function Drives the MCT motor in the reverse direction.

Entry parameter B = 08H

Return parameter A = 00H: Normal termination
08H: Mount error

Explanation
The MIREW function rotates the MCT motor in the rewind mode. The read/write head is automatically turned off in this mode.

Name MIFFTE

Function Moves the MCT rapidly in the forward direction to the end.

Entry parameter B = 09H

Return parameter A = 00H: Normal termination
05H: Seek error
06H: Break error
07H: Power off error
08H: Mount error
0FEH: Other errors

Explanation
The MIFFTE function resets the move protect count and rotates the MCT motor in the fast feed mode until the MCT end is reached.

Name MIRWTT

Function Rewinds the MCT to the start.

Entry parameter B = 0AH

Return parameter A = 00H: Normal termination
05H: Seek error
06H: Break error
07H: Power off error
08H: Mount error
0FEH: Other errors

Explanation
The MIRWTT function resets the move protect count and moves the MCT backward up to the start of tape. The tape counter is set to 0000H when the start of tape is reached.

Name MIHDON

Function Turns on the MCT head.

Entry parameter B = ØBH

Return parameter A = ØØH: Normal termination
ØBH: Mount error
ØFEH: Other errors

Explanation
The MIHDON function turns on the MCT head (i.e., loads the head).

Name MIHDOF

Function Turns off the MCT head.

Entry parameter B = ØCH

Return parameter A = ØØH: Normal termination
ØBH: Mount error
ØFEH: Other errors

Explanation
The MIHDOF function turns off the MCT head (i.e., unloads the head).

Name MISKTP

Function Seeks for the specified MCT position.

Entry parameter B = ØDH
DE = Counter value

Return parameter A = ØØH: Normal termination
Ø6H: Break error
Ø7H: Power off error
Ø8H: Mount error
ØFEH: Other errors

Explanation
The MISKTP function moves tape to the count specified by the DE register pair as follows:

Current count < desired count: Moves tape in the forward direction (fast feed).
Current count = desired count: Does nothing.
Current count < desired count: Moves tape in the reverse direction (rewind).

The MCT motor must be stopped before a seek (MISTOP). After a seek operation is completed, the MCT head is automatically turned on.

Name MISTMP

Function Sets the MCT move protect count.

Entry parameter
B = ØEH
DE = Move protect count

Return parameter
A = ØØH: Normal termination
ØØH: Mount error

Explanation
The MISTMP function sets the MCT move protect count (total count to which MCT can run). After a move protect count is set, the tape automatically stops when an attempt to seek past this count is made.

Example:

Current count 5ØØ
Move protect count 3ØØ

Assume that the tape has been rewound to count 4ØØ and an attempt is made to feed the tape up to count 7ØØ. Because the move protect count is decremented by 1ØØ when the tape is rewound to 4ØØ, the tape can now feed only 2ØØ counts and, therefore, stops at count 6ØØ.

Name MIRSMP

Function Resets the MCT protect count.

Entry parameter
B = ØFH

Return parameter
A = ØØH: Normal termination
ØØH: Mount error

Explanation
The MIRSMP function resets the MCT move protect count (total count to which MCT can run).

Name	MIRDBL
Function	Reads one block of data from an MCT file.
Entry parameter	A = 1ØH B = Block number position offset C = Read mode DE = Bytes of data to be read HL = Block number TOSDMA (ØF351H) = Starting address of the buffer for storing read data
Return parameter	A = ØØH: Normal termination ØlH: Read error Ø6H: Break error Ø8H: Mount error ØFEH: Other errors

Explanation
The bit assignments for the C register are as follows:

Bit	
7	Ø: Nonstop mode, 1: Stop mode
6 - 4	Not use
3 - Ø	Number of retries (ØØH - ØFH)

Load the DE register pair with the number of bytes to be read. The number must be in the range 4 (block identification field requires four bytes at least) to 270. The address of the buffer pointed to by TOSDMA must be between 8ØØØH and ØFFFFH.

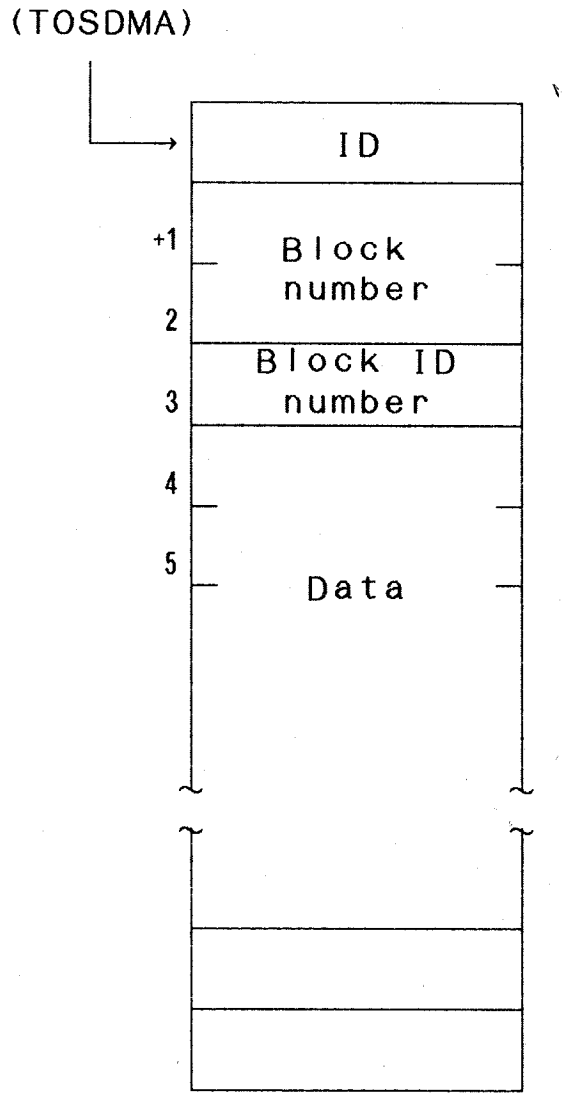
The MIRDBL function reads the number of bytes specified in DE from a block in the mode specified in C into the buffer addressed by TOSDMA. The block must satisfy the following conditions:

(Condition 1)
The value in the read data block ID field matches the ID code loaded at the beginning of the read buffer (addressed by TOSDMA) during execution of this function. Accordingly, the ID code of the block to be read must be loaded as the first read buffer data when executing the MIRDBL function. The ID code "?" matches any ID code (that is, no check is made on this field).

(Condition 2)
The block number of the read data placed in the two bytes starting at the address designated by (buffer address + value in A) matches the block number specified in HL before the execution of this function.

An error is generated if the following conditions occur:
(Block number of read block) + 2 < (Block number specified in HL)
(Block number of read block) > (Block number specified in HL)

Note
The A register (offset value) is normally loaded with Ø1H. This is because 1-block data is read into the buffer as shown below. The data block format is described in 3.7.2.



Name MIWTBL

Function Writes one block of data into an MCT file.

Entry parameter
B = 11H
C = Write mode
DE = Bytes of write data
TOSDMA = Starting address of the buffer storing write data

Return parameter
A = ØØH: Normal termination
ØØ2H: Write error
Ø3H: Write protect error
Ø6H: Break error
Ø8H: Mount error
ØFEH: Other errors

Explanation
Bit 7 of the C register identifies the tape access mode. A Ø in the bit indicates the nonstop mode; a 1 indicates the stop mode.

Load TOSDMA with a buffer address in the range from 8ØØØH to ØFFFFH. Load the DE register pair with the number of bytes to be written. The number must be in the range from 4 (block identification field requires four bytes at least) to 27Ø.

The MIWTBL function writes on MCT the number of bytes specified in DE from the buffer addressed by TOSDMA in the mode specified in C. The write data is written the number of times specified in BLKWRTNO (ØF2FDH). When the data is to be written two or more times, the function refers to the block ID number loaded in the location (Address pointed to by TOSDMA) + 3.

Name MIGTWD

Function Reads the MCT write protect pin status.

Entry parameter
B = 14H

Return parameter
A = ØØH: Not protected
Ø3H: Protected
Ø8H: Mount error

Explanation
The MIGTWD function reads the MCT write protect pin status and places it in the A register.

Name MILEDON

Function Turns on the MCT LED.

Entry parameter B = 15H

Return parameter A = ØØH: Normal termination
Ø8H: Mount error

Explanation
The MILEDON function turns on the LED (labeled FREE) on the MCT. The FREE LED is used by the system to identify the mount or remove state of the MCT and cannot be used by the user.

Name MILEDOF

Function Turns off the MCT LED.

Entry parameter B = 16H

Return parameter A = ØØH: Normal termination
Ø8H: Mount error

Explanation
The MILEDOF function turns off the LED (labeled FREE) on the MCT. The FREE LED is used by the system to identify the mount or remove state of MCT and cannot be used by the user.

Name MISDAT

Function Saves the system data pertaining to the MCT into the data area on the PINE main unit.

Entry parameter B = 17H

Return parameter A = ØØH: Normal termination
Ø8H: Mount error

Explanation
The MISDAT function saves the system data pertaining to the MCT cartridge (MICROCASSETTE DRIVE) into the data area MCTSVDAT (ØF7FCH) on the main unit.

This function is used by the system to keep the MCT cartridge status when the power of the PINE main unit is turned off. The user cannot use this function.

Name MILDAT

Function Restores the system data pertaining to the MCT from the data area on the PINE main unit.

Entry parameter B = 18H

Return parameter A = ØØH: Normal termination
Ø8H: Mount error

Explanation
The MILDAT function restores the system data pertaining to the MCT cartridge from the data area MCTSVDAT (ØF7FCH) on the PINE main unit.

This function is executed by the system, when the PINE main unit is powered on, to restore the MCT cartridge status of immediately before the last power off. The user cannot use this function.

3.7.7.4 Return codes from MIOS

Control returns from MIOS with the A and C registers loaded with return codes. The return codes are also placed in BIOSERROR and IOSRCD.

BIOSERROR is loaded with an error code common to the BIOS while lOSRCD is loaded with error information returned from the firmware.

BIOSERROR (ØF52BH)
- Return information from BIOS
  = ØØH: Normal termination
    ØlH: Read error
    Ø2H: Write error
    Ø3H: Write protect error
    Ø4H: Time out error
    Ø5H: Seek error
    Ø6H: Break error
    Ø7H: Power off error
    Ø8H: Mount error
    ØFE: Other errors

IOSRCD (ØF7CFH)
- Return information from MIOS
  = ØØH: Normal termination
    ØlH: Head move error (error during a head move)
    Ø2H: Motor stop error (motor stopped)
    Ø3H: Write protect error
    Ø4H: Data error (data bits Ø and 1 unrecognizable)
    Ø5H: CRC error
    Ø6H: Block mode error (invalid block mode)
    Ø7H: Tape error (tape not found)

MIOS Function number	Function	BIOSERROR								IOSRCD							
		Code	1	2	3	4	5	6	7	FE	1	2	3	4	5	6	7
00H	MIRDST																
01H	MIRDCT																
02H	MISTCT																
03H	MISTOP																
04H	MIPLAY																
05H	MIREC																
06H	MIFF																
07H	MISREW									○	○						*
08H	MIREW									○	○						
09H	MIFFTE					○	○	○	○		○					○	
0AH	MIRWTT					○	○	○	○		○					○	
0BH	MIHDON									○	○						
0CH	MIHDOF									○	○						
0DH	MISKTP						○	○	○		○		○			○	
0EH	MISTMP																
0FH	MIRSMP																
10H	MIRDBL		○					○			○	○		○	○	○	
11H	MIWTBL			○	○			○			○	○	○				
14H	MIGTWD																
15H	MILEDON																
16H	MILEDOF																
17H	MISDAT																
18H	MILDAT																

*: The error is generated because the head is automatically turned off in the rewind mode.

3.7.8 Work Areas Related to MCT Processing

The work areas used during MCT processing are listed below.

TOSCTL (ØEFBBH) 1 byte
- MTOS control flag
This flag controls the MTOS operation status. See 3.7.4, "Using MTOS."

STOSCTL (ØEFBCH) 1 byte
- MTOS control subflag
Bit 7: Specifies force mount.
1: Force mount Ø: Non-force mount
Bit 6: Specifies force remove.
1: Force remove Ø: Non-force remove
Bits 5 - Ø: Don't care.
This flag is not used by the PINE OS.

TOSSTS (ØEFBDH) 1 byte
- MTOS status flag
Bit 7: MTOS directory search bit
1: MTOS Ø: BDOS
Bit 6: Motor stop bit (used when an error occurs)
1: No Ø: Stop
Bit 5: MTOS error bit
1: MTOS Ø: BDOS
Bit 4: Directory counter correction bit
1: Correct Ø: No
Bit 3: Bad select report bit
1: No Ø: Report
Bits 2- Ø: Don't care.
This flag is used by the system.

VERFDFLT (ØEFBEH) 1 byte
- Verify flag for write (for default setting)
= ØØH: No
= Nonzero: Verify
See 3.7.4, "Using MTOS."

VERFFG (ØEFBFH) 1 byte
- Verify flag for write
= ØØH: No
= Nonzero: Verify
See 3.7.4, "Using MTOS."

MCTDETCH (ØEFCØH) 1 byte
- MCT detach control flag
= ØØH: No
= Nonzero: Detach
When this flag is set to a value other than ØØH, the MCT is forced into the remove state if no MCT cartridge is mounted at power-on time. The flag is initialized to ØFFH.

TAPMOD (ØF2E1H) 1 byte
- MCT status flag
= ØØH: Remove state
= Ø1H: Mount state

MCTDCD (ØF2E2H) 1 byte
- MCT drive code
Used to check whether the drive code in the FCB identifies an MCT. The flag is initialized to Ø7H (drive H:).

ROMCT (ØF2E3H) 1 byte
- Indicates the MCT R/O status.
    = ØØH: R/W
    = Ø1H: R/O

DFTATR (ØF2E4H) 1 byte
- Tape access attribute flag (for default setting)
Loaded with the default data in TACATR. See 3.7.4, "Using MTOS,"

WRTATR (ØF2E5H) 1 byte
- Not used.

SRDATR (ØF2E6H) 1 byte
- The flag controlling the tap access attribute for system read
The bit assignments are identical to those of TACMOD. This flag is referenced when reading the header or EOF area on tape.
The flag is initialized to ØC2H.

DRP (ØF2E7H) 2 bytes
- Directory read start counter
This counter is initialized to ØØ3CH.

DWP (ØEFB9H) 2 bytes
- Directory write start counter
This counter is initialized to ØØ4DH.

DEP (ØF2EBH) 2 bytes
- Directory end counter
This counter is initialized to ØØD9H.

DMR (ØEFBDH) 2 bytes
- The margin between the directory and the file area.
The initial value is ØØ68H.

IFG (ØF2EFH) 2 bytes
- Inter-file gap
The initial value is ØØ68H.

SKG (ØF2F1H) 2 bytes
- Inter-file-seek gap
The initial value is ØØ34H.

ERG (ØF2F3H) 2 bytes
- Erasing gap generated during file creation.
The initial value is ØØ34H.

LERG (ØF2F5H) 2 bytes
- Trailing erasing gap generated during file close.
The initial value is ØØ4EH.

BKG (ØF2F7H) 2 bytes
- Inter-block-number gap (not used)
The initial value is ØØØ2H.

PRIPG (ØF2F9H) 2 bytes
- Inter-block gap (not used)
The initial value is ØØØ4H.

CCDFLT (ØF2FBH) 1 byte
- Default count for tape counter correction
The initial value is Ø5H.

CRCCNT (ØF2FCH) 1 byte
- Tape counter correction counter
The value of this counter is decremented by one each time a file is created. When the counter value reaches ØØH, the machine rewinds the tape to the top. The correction value is indicated by CCDFLT.

BLKWRTNO (ØF2FDH) 1 byte
- Number of times a block plus 1 is to be written.
The initial value is Ø3H (twice). See 3.7.4, "Using MTOS."

LMCTRED (ØF2FEH) 4 bytes
- Error return point entered during a MCT read through BIOS.
Loaded with the following instruction codes:

```
LD   A, ØFFH
JR   LMCTWRT+2
```

LMCTWRT (ØF3Ø2H) 6 bytes
- Error return point entered during MCT write through BIOS.
Loaded with the following instruction codes:

```
LD   A, ØFFH
LD   (BIOSERROR), A
RET
```

TOSDMA (ØF351H) 2 bytes
- MCT DMA buffer starting address
The initial value points to TOSBUF (ØEB97H).

ALCVAD (ØF353H) 2 bytes
- MCT allocation vector starting address

OPNMOD (ØF355H) 1 byte
- Current MCT open status
  = ØØH: Not open
    Ø1H: Read mode open
    Ø2H: Write mode open

MISSTS (ØF356H) 1 byte
- MIOS status flag
  Bit 7: Move protect bit
    1: Move protect Ø: No
  Bits 6 - Ø: Reserved for the system
When the move protect bit is set on, the machine is move-protected, that is, it is automatically stopped after feeding the tape for the tape count specified in TAPMVC (ØF35AH). The initial setting is move protect on.

BMDCNT (ØF357H) 1 byte
- Block mode check retry count
The number of read retires made when a block mode error occurred during a block read. The default value is Ø2H.

RRBKMD (ØF358H) 1 byte
- Random read block mode
This area is not used by the PINE OS.

RNIDPT (ØF359H) 1 byte
- Random access ID pointer
This area is not used by the PINE OS.

TAPMVC (ØF35AH) 2 bytes
- System move protect count
The initial value is ØØC8H.

TOSRCD (ØF7CEH) 1 byte
- MTOS return code area
     = ØØH: Normal termination
       Ø1H: Not removed
       Ø2H: Not mounted
       Ø3H: Cannot remove
       Ø4H: Cannot mount
       Ø5H: Directory full
       Ø6H: R/O file
       Ø7H: File already existed
       Ø8H: File not found
       Ø9H: File already open
       ØAH: File not open
       ØBH: Record number error
       ØCH: EOF reached
       ØDH: Random access error
       ØEH: not use, reserved for the system
       ØFH: R/O drive
       1ØH: Verify error
       11H: File number error
       12H: Auto remove check error
See 3.7.5, "MTOS Functions" for details.

IOSRCD (ØF7CFH) 1 byte
- MIOS return code area
     = ØØH: Normal termination
       Ø1H: Head error
       Ø2H: Motor stop error
       Ø3H: Write protect error
       Ø4H: Data error
       Ø5H: CRC error
       Ø6H: Block mode error
       Ø7H: Tape error
       Ø8H: Mount error
This area is loaded with the return code from the MCT cartridge.
See 3.7.6, "Using MIOS" for details.

CURMCT (ØF7DØH) 1 byte
- Current MCT drive code
Loaded with the MCT drive code when the current drive is the MCT drive.

TACATR (ØF7D1H) 1 byte
- Tape access attribute
Indicates the stop or nonstop mode and the number of retries.
See 3.5.4, "Using MTOS."

TACMOD (ØF7D2H) 1 byte
- Tape access mode
See 3.5.4, "Using MTOS."

BLKNO (ØF7D3H) 2 bytes
- Current block number area

RECNO (ØF7D5H) 2 bytes
- Current record number area

BLKREC (ØF7D7H) 2 bytes
- DMA buffer first record number

```
RECEXT (ØF7D9H)  1 byte
- TOSDMA record presence flag
     = ØØH: No record present
       Ø1H: First record present
       Ø2H: Second record present
       Ø3H: Two records present

ORECEXT (ØF7DAH)  1 byte
- Old TOSDMA record presence flag

DIRPNT (ØF7DBH)  1 byte
- Directory file counter

FILPNT (ØF7DCH)  1 byte
- Current file pointer in the directory

SRCADD (ØF7DDH)  2 bytes
- T-FCB address referenced during file search

MAXBLK (ØF7DFH)  2 bytes
- Current file maximum block number

MAXREC (ØF7E1H)  2 byte
- Current file maximum record number

REMFLG (ØF7E3H)  1 byte
- Remove flag
     = ØØH: Remove not required.
     = Nonzero: Remove required (for directory update).

SKCKCT (ØF7E4H)  1 byte
- Seek check retry counter

LSTCNT (ØF7E5H)  2 bytes
- Tape last counter

USERCNT (ØF7E7H)  2 bytes
- User seek counter
When IDFLG(ØFA13H) bit 6 is 1, the value in this area is used to
find the tape count for the last free area.  The counter value of
the last free area is usually calculated using the data in the
directory.

RWMOD (ØF7E9H)  1 byte
- Read/write mode flag
     Bit 7: Access type bit
            Ø: Sequential access    1: Random access
     Bits 6 - 1: Don't care.
     Bit Ø: Read/write bit
            Ø: Read      1: Write

ALCVEC (ØF7EAH)  8 bytes
- MCT allocation vector

REGBC (ØF7F2H)  2 bytes
- BC register save area

REGDE (ØF7F4H)  2 bytes
- DE register save area
```

BSTCNT (ØF7F6H) 2 bytes
- Block start count during read

RNDNO (ØF7F8H) 2 bytes
- Random record number (not used)

RNDCNT (ØF7FAH) 2 bytes
- Random record tape counter (not used)

MCTSVDAT (ØF7FCH) 32 bytes
- MCT cartridge system data save area

MCTDTSV (ØF9BAH) 4Ø bytes
- Reserved for the system

IDTOP (ØF9E2H) 53 bytes
- Tape ID field area
This area constitutes a part of the RAM directory area or the directory ID field. See 3.7.2, "File Control."

DIRTOP (ØFA17H) 384 bytes
- Tape directory area
This area is the second and third blocks of the RAM directory area and contain control information for 12 files. See 3.7.2, "File Control."

TOSDMA (ØFB97H) 26Ø bytes
- MCT DMA buffer

3.8 Disk Storage

3.8.1 General

The PINE assigns memory-related I/O devices to disk drives to allow the user to handle I/O devices easily.

The I/O device and disk drive assignments are defined as follows:

Drive A: RAM disk (internal, external)
      B: ROM capsule 1
      C: ROM capsule 2
      D: External disk (floppy disk)
      E: External disk
      F: External disk
      G: External disk
      H: Microcassette
      I: RAM cartridge
      J: RAM cartridge 1
      K: RAM cartridge 2

See Chapter 5, "I/O Operations" for details of the interfaces to cartridges, disk units, and external RAM disks.

3.8.2 Logical to Physical Drive Assignment

On the PINE, the user can reassign logical drives to physical drives as needed. The logical to physical drive assignment settings are listed in the previous subsection. Only the association between drive H: and microcassette is fixed and cannot be changed.

3.8.2.1 How to change an assignment

The assignment of logical drives to physical drives are controlled through a table located in the system area DISKTBL. Logical drives can be reassigned by rewriting this table. More specifically, logical drives can be reassigned to physical drives by rewriting physical codes in DISKTBL. The reassignments remain valid until the next reset (BOOT) operation.

Example: To assign drive B: to the floppy disk drive, change the contents of DISKTBL + 1 (ØF1ØØH) from Ø1H to Ø3H.

DISKTBL (ØFØFFH) 11 bytes
- Logical-to-physical drive assignment table

Address	Initial value	Assigned logical drive
ØFØFFH	ØØH	A:
ØF1ØØH	Ø1H	B:
ØF1Ø1H	Ø2H	C:
ØF1Ø2H	Ø3H	D:
ØF1Ø3H	Ø4H	E:
ØF1Ø4H	Ø5H	F:
ØF1Ø5H	Ø6H	G:
ØF1Ø6H	Ø7H	H:
ØF1Ø7H	Ø8H	I:
ØF1Ø8H	Ø9H	J:
ØF1Ø9H	ØAH	K:

Physical drive code
= ØØH: RAM disk
  Ø1H: ROM capsule 1
  Ø2H: ROM capsule 2
  Ø3H: Floppy disk
  Ø4H: Floppy disk
  Ø5H: Floppy disk
  Ø6H: Floppy disk
  Ø7H: Microcassette
  Ø8H: RAM cartridge
  Ø9H: ROM cartridge 1
  ØAH: ROM cartridge 2