

19 Optical memory card devices

19.1 Model for optical memory card devices

An optical memory card device is a device that supports an ID-1 card size removable optical recording medium. In several respect, an optical memory card device is similar to a direct-access device and an optical memory device.

The sector is the minimum data recording/reproduction unit for optical memory card devices. Optical memory card devices use variable size sectors to optimize storage performance on the medium.

19.1.1 Peripheral device type

The peripheral device type code value for optical memory card devices returned in response to a INQUIRY command to be decided (will be assigned by NCITS T10).

19.1.2 Address type

There are two address types for optical memory card devices. Address type specifies the value in the logical block address field of the medium access commands and the sense data information field for optical memory card devices.

If the device supports both address types, address types can be selected using the MODE SELECT command by setting an address type (AT) bit of optical memory card device mode parameter header (see 19.3.3). If the device supports only one address type, the AT bit is a read-only bit and cannot be changed by the MODE SELECT command. In this case, the device specific default address type will be used. The current operating address type of the device can be obtained using the MODE SENSE command.

If the AT bit of mode parameter header is set to zero, the value in the logical block address field of the medium access commands and the sense data information field consist of the partition number and the logical block address in the partition as shown in table 364.

Table 364 - Logical block address field and information field (AT = 0)

Byte	Bit	7	6	5	4	3	2	1	0	
0		Partition number								
1	(MSB)	Logical block address in the partition							—	—
2		—	—	—	—	—	—	—	—	
3		—	—	—	—	—	—	—	(LSB)	

If the AT bit is set to one, the value in the logical block address field of the medium access commands and the sense data information field consist of the type of sector, the track address and the sector address as shown in table 365.

Table 365 - Logical block address field and information field (AT = 1)

Byte	Bit	7	6	5	4	3	2	1	0	
0		Type of sector								
1	(MSB)	Track number							—	—
2		—	—	—	—	—	—	—	(LSB)	
3		Sector number								

Note 210 The commands using the logical block address field for optical memory card devices are the following commands: e.g. READ(10), SEEK(10), WRITE(10), WRITE AND VERIFY, or READ CARD CAPACITY command.

19.1.3 Additional sense code

The additional sense codes and additional sense code qualifiers for optical memory card devices are as same as those for direct-access device (see Table 71).

In addition, two additional codes shown in table 366 may be returned to signal error condition specific to optical memory card devices.

Table 366 – Additional ASC and ASCQ for optical memory card devices

ASC	ASCQ	DESCRIPTION
09h	01h	TRACING SERVO FAILURE
09h	02h	FOCUS SERVO FAILURE

19.1.4 Ready state

The conditions to determine logical unit ready is a vender specific. However, ready state means that the logical unit would accept an appropriate medium access command without returning CHECK CONDITION status, and at least both of following two conditions shall be satisfied;

- 1) a medium in accordance with a logical unit shall be loaded in a logical unit.
- 2) basic information (e.g. specific track) in a medium shall be sensed.

19.1.5 Initialization

The command for medium initialization is not defined for optical memory card devices.

19.1.6 Medium defects

The raw defect rate is typically higher for optical medium than magnetic medium. Data is usually recovered though the use of sophisticated error correction algorithms. The level of error correction used for data recovery can be selected. Control of the error correction algorithms and level of correction is defined by respective logical data structures.

19.1.7 Error reporting

If any of the following conditions occur during the execution of a command the target shall return CHECK CONDITION status. The appropriate sense key and additional sense code should be set. The following list illustrates some error conditions and the applicable sense keys. The list does not provide an exhaustive enumeration of all conditions that may cause the CHECK CONDITION status.

<u>Condition</u>	<u>Sense key</u>
Invalid address	ILLEGAL REQUEST
Unsupported option requested	ILLEGAL REQUEST
Target reset or medium change since last command from this initiator	UNIT ATTENTION
Self diagnostic failed	HARDWARE ERROR
Unrecovered read error	MEDIUM ERROR or HARDWARE ERROR
Recovered read error	RECOVERED ERROR
Overrun or other error that might be resolved by repeating the command	ABORTED COMMAND
Attempt to read a blank or previously unwritten block	BLANK CHECK
Attempt to write a previously written block and blank block checking is enabled	BLANK CHECK
Attempt to write on write protected medium	DATA PROTECT

In the case of an invalid address, the sense data information field shall be set to the first invalid address.

In the case of an attempt to read a blank or previously unwritten block, the sense data information field shall be set to the address of the first blank encountered. At least the data read up to that block shall be transferred.

In the case of an attempt to write a previously written block and blank block checking is enabled, the sense data information field shall be set to the address of the first non-blank encountered.

19.2 Commands for optical memory card devices

The commands for optical memory card devices shall be as shown in table 367.

Table 367 - Commands for optical memory card devices

Command name	Operation code	Type	Subclause
CHANGE DEFINITION	40h	O	8.2.1
COMPARE	39h	O	8.2.2
COPY	18h	O	8.2.3
COPY AND VERIFY	3Ah	O	8.2.4
INQUIRY	12h	M	8.2.5
LOCK UNLOCK CACHE	36h	O	9.2.2
LOG SELECT	4Ch	O	8.2.6
LOG SENSE	4Dh	O	8.2.7
MEDIUM SCAN	38h	O	16.2.3
MODE SELECT(06)	15h	O	8.2.8
MODE SELECT(10)	55h	O	8.2.9
MODE SENSE(06)	1Ah	O	8.2.10
MODE SENSE(10)	5Ah	O	8.2.11
PRE-FETCH	34h	O	9.2.3
PREVENT ALLOW MEDIUM REMOVAL	1Eh	O	9.2.4
READ(10)	28h	M	9.2.6
READ BUFFER	3Ch	O	8.2.12
READ CARD CAPACITY	25h	M	19.2.1
RECEIVE DIAGNOSTIC RESULTS	1Ch	O	8.2.13
RELEASE UNIT	17h	O	10.2.9
REQUEST SENSE	03h	M	8.2.14
RESERVE UNIT	16h	O	10.2.10
REZERO UNIT	01h	O	9.2.13
SEEK(10)	2Bh	O	9.2.15
SEND DIAGNOSTIC	1Dh	M	8.2.15
START STOP UNIT	1Bh	O	9.2.17
SYNCHRONIZE CACHE	35h	O	9.2.18
TEST UNIT READY	00h	M	8.2.16
WRITE(10)	2Ah	O	9.2.21
WRITE AND VERIFY	2Eh	O	9.2.22
WRITE BUFFER	3Bh	O	8.2.17

Key: M = command implementation is mandatory.
O = command implementation is optional.

The following command codes are vendor-specific: 20h, 21h, 22h, 23h, and C0h through FFh.

All remaining command codes for optical memory card devices are reserved for future standardization.

19.2.1 READ CARD CAPACITY command

The READ CARD CAPACITY command (see table 368) provides a means for the initiator to request information regarding the capacity of the logical unit.

Note 211 This command has the same operation code (25h) as the READ CAPACITY command (see 9.2.7). The general function is same but definitions of the logical block address field in the command descriptor block and a READ CARD CAPACITY data are defined depend on setting of an address type (AT) bit of mode parameter header.

Table 368 - READ CARD CAPACITY command

Byte	Bit	7	6	5	4	3	2	1	0
0		Operation code (25h)							
1		Logical unit number			Reserved				RelAdr
2	(MSB)	Logical block address field							
3									
4									
5									
6		Reserved							
7		Reserved							
8		Reserved							PMI
9		Control							

See 9.2.2 for a definition of the RelAdr bit.

If the address type (AT) bit of mode parameter header (see 19.3.3) is set to zero, all bytes of the logical block address field except partition number byte (Byte 2) shall be zero if the partial medium indicator (PMI) bit is zero. If the PMI bit is zero and the all bytes of the logical block address field except partition number byte is not zero, the target shall return a CHECK CONDITION status, the sense key shall be set to ILLEGAL REQUEST and the additional sense code set to ILLEGAL FIELD IN CDB.

A PMI bit of zero indicates that the returned logical block address and the block length in bytes are those of last logical block of specified partition.

A PMI bit of one indicates that returned logical block address and the block length in bytes are those of last logical block of a track which includes the logical block address specified by the RelAdr and logical block address field in the command descriptor block.

If the AT bit is set to one, All bytes of four-byte logical block address field and the PMI bit shall be zero. If not the target shall return a CHECK CONDITION status, the sense key shall be set to ILLEGAL REQUEST and the additional sense code set to ILLEGAL FIELD IN CDB.

The READ CARD CAPACITY data shall be sent during DATA IN phase of the command.

If the AT bit of mode parameter header is set to zero, the READ CARD CAPACITY data is defined in table 369.

Table 369 - READ CARD CAPACITY data (AT = 0)

Byte	bit	7	6	5	4	3	2	1	0
0	(MSB)	Returned logical block address							
3									
4	(MSB)								
7		Block length in bytes							
		(LSB)							

If the AT bit is set to one, the READ CARD CAPACITY data is defined in table 370.

Table 370 - READ CARD CAPACITY data (AT = 1)

Byte	bit	7	6	5	4	3	2	1	0
0	(MSB)	Maximum track address							
3									
4	(MSB)	Reserved							
7		(LSB)							

The maximum track address is the address of the highest track accessible by the device on the media currently loaded in the drive.

19.3 Parameters for optical memory card devices

19.3.1 Diagnostic parameters

This subclause defines the descriptors and pages for diagnostic parameters used with optical memory card devices.

The diagnostic page codes for optical memory card devices are defined in table 371.

Table 371 - Diagnostic page codes

Page code	Description	Subclause
00h	Supported diagnostics pages	8.3.1.1
01h - 3Fh	Reserved (for all device type pages)	
40h - 7Fh	Reserved	
80h - FFh	Vendor-specific pages	

19.3.2 Log parameters

This subclause defines the descriptors and pages for log parameters used with optical memory card devices.

The log page codes for optical memory card devices are defined in table 372.

Table 372 - Log page codes

Page code	Description	Subclause
01h	Buffer over-run/under-run pages	8.3.2.1
03h	Error counter (read) page	8.3.2.2
05h	Error counter (verify) page	8.3.2.2
02h	Error counter (write) page	8.3.2.2
07h	Last n error event page	8.3.2.3
06h	Non-medium error page	8.3.2.4
00h	Supported log pages	8.3.2.5
04h	Reserved	
08h - 2Fh	Reserved	
3Fh	Reserved	
30h - 3Eh	Vendor-specific pages	

19.3.3 Mode parameters

This subclause defines the descriptors and pages for mode parameters used with optical memory card devices.

The mode parameter list, including the mode parameter header and mode parameter block descriptor, are defined in 8.3.3.

The mode parameter sent by the MODE SELECT command shall be valid until the UNIT ATTENTION condition is generated by the RESET condition occurred or the mode parameters changed.

The medium-type code field is contained in the mode parameter header (see 8.3.3). Table 373 defines the medium-type code values used for optical memory card devices.

Table 373 - Optical memory card medium-type codes

Code	Description
00h	Default (only one medium type supported)
01h	Read-only medium
02h	Write-once medium
03h - 7Fh	Reserved
80h - FFh	Vendor-specific

The device specific parameter field is contained in the mode parameter header (see 8.3.3). Table 374 defines the device specific parameter values used for optical memory card devices.

Table 374 - Optical memory card device specific parameter

Bit	7	6	5	4	3	2	1	0
	WP	Reserved		DPOFUA	Reserved		AT	EBC

When used with the MODE SELECT command the WP bit is not defined.

When used with the MODE SENSE command, a write protected (WP) bit of zero indicates that the medium is write enabled. A WP bit of one indicates that the medium is write protected. For read-only media the WP bit is reserved.

When used with MODE SELECT command the DPOFUA bit is reserved.

When used with the MODE SENSE command, a DPOFUA bit of one indicates that the target supports the DPO and FUA bits (see 9.2.6).

For the MODE SELECT command, an address type (AT) bit of zero indicates the value in the logical block address field of the medium access commands and the sense data information field shall be interpreted as defined in table 364 (see 19.1.2). The logical block address within a partition begins with block zero and be contiguous up to the last logical block within that partition. The optical memory card devices supports up to 128 partitions by the MODE SELECT command. Each partition can be set the type of sector as a density code (see Table 375) and the number of logical blocks.

Definition of the partitions by the MODE SELECT command is valid with/without card is in a logical unit. The definition for a partition requires eight bytes of a mode parameter block descriptor. When user wants to define multiple partition on a card, he has to set up partitions without blank. The partition number shall be assigned automatically by setting field in the mode parameter block descriptor. The partition zero is defined by from byte 0 to 7, partition one is defined by from byte 8 to 15 in the mode parameter block descriptor.

An AT bit of one indicates the value in the logical block address field of the medium access commands and the sense data information field shall be interpreted as defined in table 365 (see 19.1.2). All sectors must be of the same type within a track. All track addresses are expressed relative to the whole card. The sector address is expressed relative to the beginning of each track.

For the MODE SENSE command, an AT bit reflects the current operating address type of the device.

For the MODE SELECT command, an enable blank check (EBC) bit of zero advises the target to disable the blank checking operation of the medium during write operations. An EBC bit of one enables blank checking. If a non-

blank block is found during a write operations, the command shall be terminated with a CHECK CONDITION status and the sense key shall be set to BLANK CHECK. For read-only media, the EBC bit is reserved.

For the MODE SENSE command, an EBC bit of zero indicates that blank checking of the medium during write operations is disabled. An EBC bit of one indicates that blank checking during write operations is enabled. For read-only media, the EBC bit is reserved.

The density code field is contained in the mode parameter block descriptor (see 8.3.3). Table 375 defines the density code values used for optical memory devices.

Table 375 - Optical memory card density codes

Density code	Optical card media	
00h	Default density	
	Logical format	Reference International standard
01h – 0Fh	Reserved	
10h – 1Fh	Vendor-specific	
20h – 2Fh	Reserved	
30h – 3Fh	PWM recording method, 8-10 NRZI modulation	11694-4 annex A : 1996
40h – 4Fh	PPM recording method, MFM/NRZI-RZ modulation	11694-4 annex B : 1996
Code 80h – FFh are vendor-specific, all other codes are reserved.		
NOTES		
The least significant nibble of the density code (bit 0 to 3) corresponds to the sector type code defined in International Standard.		

For the MODE SELECT command, the density code field of optical memory card device block descriptor indicates the sector type code selected by the initiator for use in subsequent read and write operations.

For the MODE SENSE command, the density code field reflects the current operating sector type of the device.

The MODE SENSE command shall report the most recent mode parameter block descriptor (Current values). The mode parameter block descriptor respond to the MODE SENSE command shall be as described below. The UNIT ATTENTION condition should be cleared.

- a) Following a UNIT ATTENTION condition for a power on or hard reset condition, while not ready, the target shall report the initial default value.
- b) When a logical unit becomes ready state after medium loading, the default value described in a) shall be reported, however the number of blocks field shall be set to total logical block number (track number) of the loaded medium. If a logical unit is not ready state after medium loading, the most recent mode parameter block descriptor (initial default value described item a) above when first card was loaded) shall be reported.
- c) Following a successful MODE SELECT command execution, the target shall report the mode parameter block descriptor specified by MODE SELECT command.
- d) Following a successful card eject operation, the target shall report the most recent mode parameter block descriptor defined by items a) through c) above.

The mode page codes for optical memory card devices are defined in table 376.

Table 376 - Mode page codes

Page code	Description	Subclause
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08h	Caching page	9.3.3.1
0Ah	Control mode page	8.3.3.1
02h	Disconnect-reconnect page	8.3.3.2
0Bh	Medium type supported page	8.3.3.4
09h	Peripheral device page	8.3.3.3
01h	Read-write error recovery page	9.3.3.6
07h	Verify error recovery page	9.3.3.8
03h - 06h	Reserved	
0Ch - 1Fh	Reserved	
00h	Vendor-specific (does not require page format)	
20h - 3Eh	Vendor-specific (page format required)	
3Fh	Return all pages (Valid only for the MODE SENSE command)	