

9.1 Sequential-Access Device Model9.1.3 Logical Elements within a Partition

Filemarks, or Tape Marks, are special recorded elements containing no user data written and are used by an initiator to set off sections of recorded data from one another. These sections of recorded data are usually called files or data sets. The filemark format is defined in some American National Standards. The device writes filemarks and detects filemarks. Initiators traditionally use filemarks to separate user data from labels, logical groupings of data from each other, and provide an end of data indication. At least one American National Standard specifically defines filemark use for this purpose. Note: Most current standards do not define an explicit end of data indication so initiator/host software has used conventions with filemarks to substitute for an explicit end of data indication.

Save Set Marks are special recorded elements which provide a segmentation system which is separate and hierarchically superior to filemarks. For Sequential Access Devices of extremely high capacity this segmentation is required to provide clear, concise addressability and fast positioning.

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Table 7-44: Error Codes 70h and 71h Sense Data Format

Bit	7	6	5	4	3	2	1	0
Byte								
0	Valid							Error Code (70h or 71h)
1								Segment Number
2	Mark	EDM	ILI	Reserved				Sense Key
3	(MSB)							
6								Information Bytes (LSB)
7								Additional Sense Length (n-7)
8	(MSB)							
11								Command-Specific Information (LSB)
12								Additional Sense Code
13								Additional Sense Code Qualifier
14								Field Replaceable Unit Code
15 to	SKSV							
17								Sense-Key Specific
18 to								
n								Additional Sense Bytes

A valid bit of zero indicates that the information bytes are not as defined in this standard. A valid bit of one indicates the information bytes contain valid information as defined in this standard.

Error code values of 00h to 6Fh are not defined by this standard and their use is not recommended. The sense data format for error codes 70h (current errors) and 71h (deferred errors) are defined in Table 7-21. Error code values of 72h to 7Eh are reserved. Error code 7Fh is for a vendor specific sense data format.

The segment number field contains the number of the current segment descriptor if the REQUEST SENSE command is in response to a COPY, COMPARE, or COPY AND VERIFY command. Up to 256 segments are supported beginning with segment zero.

The Mark bit indicates that the current command has read a filemark or a save set mark.

Additional Sense Codes for Sequential Access Devices

S Key	Bytes		Description
	12	13	
OH	00	01	File Mark Detected
	00	02	EOM Detected
	00	04	BOM Detected
	00	08	<u>Save Set Mark Detected</u>

9.2.12. SPACE Command

Peripheral Device Type: Sequential Access
Operation Code Type: Mandatory

Table 9-15: SPACE Command

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation (11h)							
1	Logical Unit Number			Reserved		<u>Code</u>		
2	(MSB)							
3	Count							
4	(LSB)							
5	Control Byte							

The SPACE command (Table 9-39) provides a variety of positioning functions that are determined by the code and count. Both forward and reverse positioning are provided, although some targets may only support a subset of this command. Such targets shall return CHECK CONDITION status and set the sense key to ILLEGAL REQUEST in response to any attempt to invoke a function that is not supported.

The code is defined as follows:

DB(2)	DB(1)	DB(0)	Description	Support
0	0	0	Blocks	Mandatory
0	0	1	Filemarks	Mandatory
0	1	0	Sequential Filemarks	Optional
0	1	1	End-of-Data	Optional
1	0	1	Save Set Marks	Optional
1	1	0	Sequential Save Set Marks	Optional

When spacing over blocks or marks, the count field specifies the number of blocks or marks to be spaced over. A positive value N in the count field shall cause forward medium movement over N blocks or marks ending on the end-of-partition side of the last block or mark. A zero value in the count field shall cause no medium movement. A negative value -N (two's complement notation) in the count field shall cause reverse medium movement over N blocks or marks ending on the beginning-of-partition side of the last block or mark. Support of spacing in the reverse direction is optional.

If a mark is encountered while spacing over blocks, or a save set mark is encountered while spacing over filemarks, the command shall be terminated. The logical position shall be on the end-of-partition side of the mark if movement was in the forward direction and on the beginning-of-partition side of the mark if movement was in the reverse direction. CHECK CONDITION status shall be returned to the initiator, the sense key shall be set to NO SENSE, and the mark and valid bits shall be set to one in sense data. The information bytes shall be set to the difference (residue) of the requested count minus the actual number of blocks spaced over (not including the mark).

If the early-warning point is encountered during a SPACE command, and the REW bit is set to one in the MODE SENSE Device Configuration Parameters page (see 9.3.3), CHECK CONDITION status shall be returned, the sense key shall be set to NO SENSE, and the EOM and valid bits shall be set to one in sense data. The information bytes shall be set to the difference (residue) of the requested count minus the actual number of blocks spaced over (not including the mark). If the REW bit is zero or the option is not supported by the target, the target shall not report CHECK CONDITION status at the early-warning point.

IMPLEMENTORS NOTE: It is usually desirable for the target to not report the early-warning condition during a SPACE command because data may be present after the early-warning point.

If end-of-data is encountered while spacing over blocks or marks, CHECK CONDITION status shall be returned, the sense key shall be set to BLANK CHECK, and the valid bit shall be set to one. Additionally, the EOM bit shall be set to one if end-of-data is encountered at or after early-warning. The information bytes shall be set to the difference (residue) of the requested count minus the actual number of blocks or marks spaced over.

If the end-of-partition is encountered while spacing forward over blocks or marks, CHECK CONDITION status shall be returned, the sense key shall be set to MEDIUM ERROR, and the valid bit shall be set to one. The information bytes shall be set to the difference (residue) of the requested count minus the actual number of blocks or marks spaced over.

If beginning-of-medium is encountered while spacing over blocks or marks in the reverse direction, the target shall return CHECK CONDITION status and shall set the sense key to NO SENSE. The EOM and valid bits shall be set to one, and set the information bytes to the difference (residue) of the requested count minus the actual number of blocks or marks spaced over.

When spacing over sequential marks, the count field is interpreted as follows:

- (1) A positive value N shall cause forward movement to the first occurrence of N or more consecutive marks being logically positioned after the Nth mark.
- (2) A zero value shall cause no change in the logical position.
- (3) A negative value -N (2's complement notation) shall cause reverse movement to the first occurrence of N or more consecutive marks being logically positioned on the beginning-of-partition side of the Nth mark.

If end-of-partition is encountered while spacing to sequential marks, CHECK CONDITION status shall be returned, the sense key shall be set to MEDIUM ERROR, the EOM shall be set to one, and the valid bit shall be set to zero.

If end-of-data is encountered while spacing to sequential marks, CHECK CONDITION status shall be returned, the sense key shall be set to BLANK CHECK, the EOM bit shall be set to one, and the valid bit shall be set to zero.

When spacing to end-of-data (see 9.5), the count field is ignored. Upon successful completion, the medium shall be positioned such that a subsequent WRITE command would append data to the last logically recorded information.

If end-of-partition is encountered while spacing to end-of-data, CHECK CONDITION status shall be returned, the sense key shall be set to MEDIUM ERROR, the EOM shall be set to one, and the valid bit shall be set to zero.

9.2.15. WRITE MARKS Command

Peripheral Device Type: Sequential Access
Operation Code Type: Mandatory

Table 9-18: WRITE MARKS Command

Bit	7	6	5	4	3	2	1	0
Byte								
0	Operation Code (10h)							
1	Logical Unit Number			Reserved		SSM		Immed
2	(MSB)							
3	Number of <u>Marks</u>							
4	(LSB)							
5	Control Byte							

The WRITE MARKS command (Table 9-43) requests that the target write the specified number of marks to the medium beginning at the current position on the logical unit. The only mandatory implementation of this command is with the immediate bit set to zero.

An immediate (Immed) bit of one indicates that the target shall return status as soon as the command descriptor block has been validated. If buffered mode is reported in the MODE SENSE header (see 9.3), the specified number of marks shall be written. If unbuffered mode is reported, the command shall be rejected.

A save set mark (SSM) bit set to zero indicates that filemarks will be written to the media. An (SSM) bit set to one indicates that save set marks will be written to the media.

An Immed bit of zero indicates that the target shall not return status until the operation has completed. Any buffered data and marks shall be written to the medium prior to completing the command.

IMPLEMENTORS NOTE: Upon completion of a buffered write operation, an initiator can issue a WRITE MARKS command with the Immed bit set to zero and the number of marks field set to zero to ensure that all buffered data and marks are successfully written to the medium.

If the logical unit encounters early-warning during a WRITE MARKS command, an attempt to finish writing any buffered data or marks may be made, as determined by the current settings of the REW and SEW bits in the MODE SENSE Device Configuration Parameters page (see 9.3.3). The command shall terminate with CHECK CONDITION status and the EOM and valid bits shall be set to one in the sense data. If all buffered data and marks are successfully transferred to the medium, the information bytes shall be set to zero. If any buffered data or marks to be written are not transferred to the medium, the sense key shall be set to VOLUME OVERFLOW and the information bytes shall be defined as follows:

(1) If unbuffered mode is reported in the MODE SENSE header (see 9.3), the information bytes shall be set to the difference (residue) of the requested transfer length minus the actual number of marks written.

(2) If buffered mode is reported in the MODE SENSE header (see 9.3), and the buffered data was written in variable block mode (see 9.2.15), the information bytes shall be set to the total number of bytes and marks not written (the number of marks not transferred from the initiator plus the number of bytes and marks remaining in the target's buffer). Note that it is possible for the value in the information bytes to exceed the transfer length.

(3) If buffered mode is reported and the buffered data was written in fixed block mode (see 9.2.15), the information bytes shall be set to the total number of blocks and marks not written (the number marks not transferred from the initiator plus the number of blocks and marks remaining in the target's buffer). Note that it is possible for the value in the information bytes to exceed the transfer length.

IMPLEMENTORS NOTE: The target should ensure that some additional data can be written to the medium (e.g., labels or marks) after the first early-warning indication has been returned to the initiator.

If a WRITE MARKS command is received while the logical unit is positioned between early-warning and end-of-partition (see 9.5), the target shall return CHECK CONDITION status after attempting to perform the command. The EOM and valid bits shall be set to one in the sense data. If all marks to be written are successfully transferred to the medium, the information bytes shall be set to zero. If any marks to be written are not transferred to the medium prior to encountering end-of-partition, the sense key shall be set to VOLUME OVERFLOW and the information bytes shall be set to the difference (residue) of the requested transfer length minus the actual number of marks written to the medium.

IMPLEMENTORS NOTE: Any WRITE MARKS command received between early-warning and end-of-partition is executed in unbuffered mode, regardless of the buffered mode reported in the MODE SENSE header (see 9.3).

If any of the following conditions occur, the target shall return CHECK CONDITION status and shall set the sense key as indicated in the following table. This table does not provide an exhaustive enumeration of all conditions that may cause the CHECK CONDITION status.

Condition	Sense Key
Immed bit is one and buffered <u>mark</u> mode is not supported	ILLEGAL REQUEST
Immed bit is one and unbuffered mode is reported in MODE SENSE header	ILLEGAL REQUEST
Immed bit is one and number of <u>marks</u> field is set to zero	ILLEGAL REQUEST
Write <u>mark</u> attempted on write protected medium	DATA PROTECT

Table 9-26: Device Configuration Parameters

Bit	7	6	5	4	3	2	1	0
Byte								
0	Reserved		Reserved		Page Code (10h)			
1	Additional Page Length (0Eh)							
2	Reserved	CAP	CAF	Active Format				
3	Active Partition							
4	Write Buffer Full Ratio							
5	Read Buffer Empty Ratio							
6	(MSB)							
7	Write Delay Time							
	(LSB)							
8	DBR	BIS	Reserved	AVC	SOCM	RBO	REW	
9	Gap Size							
10	EOD Defined		EEG	SEW	RSS	SSM	Reserved	
11	(MSB)							
12	Buffer Size at Early Warning							
13	(LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Report Save Set Marks (RSS) bit, set to one, indicates that save set marks will be reported on space and read operations. An RSS bit set to zero indicates that save set marks will be ignored.

Stop on consecutive marks field (SOCM) when 00b indicates that the device shall pre-read data from the medium in buffered mode to the limits of the buffer capacity without regard for marks. This implies that the device can differentiate between data blocks and marks in the buffer. Values 01b, 10b, and 11b specify that the device shall terminate the pre-read operation if 1, 2 or 3 consecutive marks are detected, respectively.

The save set mark bit (SSM) when set to one defines the SOCM field as stop on consecutive save set marks. The SSM bit when set to one defines the SOCM field as stop on consecutive file marks.

End-of-data (EOD) defined field indicates which format type the logical unit shall use to detect and generate the EOD area. The types of EOD formats are specified below:

Value	Description
-----	-----
000b	Logical unit's default EOD definition
001b	Format defined erased area of medium
010b	Number of marks as specified in the SOCM field
011b	EOD recognition and generation is not supported
100b - 111b	Reserved

In the remaining sections of the standard including sequential access Read, Verify, Recovered Buffered Data etc. all references to "filemark" should be changed to "mark".