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To: T10 Committee (SCSI)
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Subject: Changing Logical Block Sizes

1 Overview

It is common knowledge that the method used in SCSI to change the number of bytes in a logical block on a block device is to first issue a Mode Select command with the desired block size placed into the BLOCK LENGTH field of the mode parameter block descriptor, then issue a FORMAT command. The block device will then format the logical blocks on the media to the size that was specified in the BLOCK LENGTH field.

Unfortunately this common knowledge is not specified in either the SPC-3 nor the SBC-2 standards. Actually it has never been specified in any standard starting with SCSI-2.

This proposal defines this behavior.

2 SPC-3 changes

2.0.0.1 General block descriptor format

When the LONGLBA bit is set to zero (see 7.4.3), the mode parameter block descriptor format for all device types except direct-access is shown in table 1.

Table 1 — General mode parameter block descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	DENSITY CODE							
1	(MSB)							
2	NUMBER OF BLOCKS							
3								(LSB)
4	Reserved							
5	(MSB)							
6	BLOCK LENGTH							
7								(LSB)

Block descriptors specify some of the medium characteristics for all or part of a logical unit. Support for block descriptors is optional. Each block descriptor contains a DENSITY CODE field, a NUMBER OF BLOCKS field, and a BLOCK LENGTH field. Block descriptor values are always current (i.e., saving is not supported). A unit attention condition (see 6.7 and SAM-2) shall be generated when any block descriptor values are changed. [No change shall be made to the medium until a format operation \(e.g., a FORMAT UNIT command as specified in SBC-2\) is initiated by an application client.](#)

The DENSITY CODE field is unique for each device type. Refer to the mode parameters subclause of the specific device type command standard (see 3.1.17) for definition of this field. Some device types reserve all or part of this field.

The NUMBER OF BLOCKS field specifies the number of logical blocks on the medium to which the DENSITY CODE and BLOCK LENGTH FIELDS apply. A value of zero indicates that all of the remaining logical blocks of the logical unit shall have the medium characteristics specified.

If the number of logical blocks on the medium exceeds the maximum value that may be specified in the NUMBER OF BLOCKS field a value of FF FF FFh indicates that all of the remaining logical blocks of the logical unit shall have the medium characteristics specified.

NOTES

- 1 There may be implicit association between parameters defined in the mode pages and block descriptors. In this case, the target may change parameters not explicitly sent with the MODE SELECT command. A subsequent MODE SENSE command may be used to detect these changes.
- 2 The number of remaining logical blocks may be unknown for some device types.

The BLOCK LENGTH field specifies the length in bytes of each logical block described by the block descriptor. For sequential-access devices, a block length of zero indicates that the logical block size written to the medium is specified by the transfer length field in the CDB (see SSC).

2.0.0.2 Direct-access device block descriptor format for LONGLBA=0

When the LONGLBA bit is set to zero (see 7.4.3), the mode parameter block descriptor format for the direct-access device type is shown in table 2.

Table 2 — Direct-access device mode parameter block descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1								
2	NUMBER OF BLOCKS							
3								(LSB)
4	DENSITY CODE							
5	(MSB)							
6	BLOCK LENGTH							
7								(LSB)

This block descriptor format shall apply only to direct-access devices. When the LONGLBA bit is set to zero (see 7.4.3), all other device types shall use the block descriptor format described in 2.0.0.1.

Block descriptors specify some of the medium characteristics for a logical unit. Support for block descriptors is optional. Each block descriptor contains a DENSITY CODE field, a NUMBER OF BLOCKS field, and a BLOCK LENGTH field. A unit attention condition (see 6.7 and SAM-2) shall be generated when any block descriptor values are changed. [No change shall be made to the medium until a format operation \(e.g., a FORMAT UNIT command as specified in SBC-2\) is initiated by an application client.](#)

The NUMBER OF BLOCKS field specifies the number of logical blocks on the medium to which the DENSITY CODE and BLOCK LENGTH fields apply. A value of zero indicates that all of the remaining logical blocks of the logical unit shall have the medium characteristics specified.

If the number of logical blocks on the medium exceeds the maximum value that may be specified in the NUMBER OF BLOCKS field a value of FFFF FFFFh indicates that all of the remaining logical blocks of the logical unit shall have the medium characteristics specified.

If the SCSI device doesn't support changing its capacity by changing the NUMBER OF BLOCKS field using the MODE SELECT command, the value in the NUMBER OF BLOCKS field is ignored. If the device supports

changing its capacity by changing the NUMBER OF BLOCKS field, then the NUMBER OF BLOCKS field is interpreted as follows:

- a) If the number of blocks is set to zero, the device shall retain its current capacity if the block size has not changed. If the number of blocks is set to zero and the block size has changed, the device shall be set to its maximum capacity when the new block size takes effect;
- b) If the number of blocks is greater than zero and less than or equal to its maximum capacity, the device shall be set to that number of blocks. If the block size has not changed, the device shall not become format corrupted. This capacity setting shall be retained through power cycles, hard resets, logical unit resets, and I_T nexus losses;
- c) If the number of blocks field is set to a value greater than the maximum capacity of the device and less than FFFF FFFFh, then the command is terminated with a CHECK CONDITION status. The sense key is set to ILLEGAL REQUEST. The device shall retain its previous block descriptor settings; or
- d) If the number of blocks is set to FFFF FFFFh, the device shall be set to its maximum capacity. If the block size has not changed, the device shall not become format corrupted. This capacity setting shall be retained through power cycles, hard resets, logical unit resets, and I_T nexus losses.

NOTE 3 - There may be implicit association between parameters defined in the mode pages and block descriptor. For direct-access devices, the block length affects the optimum values (i.e., the values that achieves the best performance) for the sectors per track, bytes per physical sector, track skew factor, and cylinder skew factor fields in the format parameters mode page. In this case, the target may change parameters not explicitly sent with the MODE SELECT command. A subsequent MODE SENSE command may be used to detect these changes.

The DENSITY CODE field is unique for each device type. Refer to the mode parameters subclause of the specific device type command standard (see 3.1.17) for the definition of this field. Some device types reserve all or part of this field.

The BLOCK LENGTH field specifies the length in bytes of each logical block described by the block descriptor.

2.0.0.3 Long LBA block descriptor format

When the LONGLBA bit is set to one (see 7.4.3), the mode parameter block descriptor format for all device types is shown in table 3.

Table 3 — Long LBA mode parameter block descriptor

Bit Byte	7	6	5	4	3	2	1	0
0	(MSB) _____							
7	NUMBER OF BLOCKS						_____ (LSB)	
8	DENSITY CODE							
9	Reserved							
10	Reserved							
11	Reserved							
12	(MSB) _____							
15	BLOCK LENGTH						_____ (LSB)	

Block descriptors specify some of the medium characteristics for all or part of a logical unit. Support for block descriptors is optional. Each block descriptor contains a DENSITY CODE field, a NUMBER OF BLOCKS field, and a BLOCK LENGTH field. Block descriptor values are always current (i.e., saving is not supported). A unit attention condition (see 6.7 and SAM-2) shall be generated when any block descriptor values are changed. [No change shall be made to the medium until a format operation \(e.g., a FORMAT UNIT command as specified in SBC-2\) is initiated by an application client.](#)

The NUMBER OF BLOCKS field specifies the number of logical blocks on the medium to which the DENSITY CODE and BLOCK LENGTH fields apply. A value of zero indicates that all of the remaining logical blocks of the logical unit shall have the medium characteristics specified.

If the SCSI device doesn't support changing its capacity by changing the NUMBER OF BLOCKS field using the MODE SELECT command, the value in the NUMBER OF BLOCKS field is ignored. If the device supports changing its capacity by changing the NUMBER OF BLOCKS field, then the NUMBER OF BLOCKS field is interpreted as follows:

- a) If the number of blocks is set to zero, the device shall retain its current capacity if the block size has not changed. If the number of blocks is set to zero and the block size has changed, the device shall be set to its maximum capacity when the new block size takes effect;
- b) If the number of blocks is greater than zero and less than or equal to its maximum capacity, the device shall be set to that number of blocks. If the block size has not changed, the device shall not become format corrupted. This capacity setting shall be retained through power cycles, hard resets, logical unit resets, and I_T nexus losses;
- c) If the number of blocks field is set to a value greater than the maximum capacity of the device and less than FFFF FFFF FFFF FFFFh, then the command is terminated with a CHECK CONDITION status. The sense key is set to ILLEGAL REQUEST. The device shall retain its previous block descriptor settings; or
- d) If the number of blocks is set to FFFF FFFF FFFF FFFFh, the device shall be set to its maximum capacity. If the block size has not changed, the device shall not become format corrupted. This capacity setting shall be retained through power cycles, hard resets, logical unit resets, and I_T nexus losses.

NOTE 4 - There may be implicit association between parameters defined in the mode pages and block descriptor. For direct-access devices, the block length affects the optimum values (i.e., the values that achieves the best performance) for the sectors per track, bytes per physical sector, track skew factor, and cylinder skew factor fields in the format parameters mode page. In this case, the target may change parameters not explicitly sent with the MODE SELECT command. A subsequent MODE SENSE command may be used to detect these changes.

The DENSITY CODE field is unique for each device type. Refer to the mode parameters subclause of the specific device type command standard (see 3.1.17) for the definition of this field. Some device types reserve all or part of this field.

The BLOCK LENGTH field specifies the length in bytes of each logical block described by the block descriptor.

3 SBC-2 changes

3.0.1 FORMAT UNIT command

3.0.1.1 FORMAT UNIT command overview

The FORMAT UNIT command (see table 13) formats the medium into application client addressable logical blocks ~~per~~ as indicated in the number of blocks and the block length values received in the last MODE SELECT commands mode header block descriptor (see SPC-3). ~~application-client-defined-options~~. In addition, the medium may be certified and control structures may be created for the management of the medium and defects. The degree that the medium is altered by this command is vendor-specific.

If a device server receives a FORMAT UNIT command before receiving a MODE SELECT command the device server shall use the number of blocks and block length that the logical unit is currently formatted at (i.e., no change is made to the number of blocks and the block length of the logical unit during the format operation).