

ISO/IEC 14776-333:2013-10 (E)

Information technology - Small Computer System Interface (SCSI) - Part 333: SCSI Stream Commands - 3 (SSC-3)

Contents	Page
FOREWORD	9
INTRODUCTION	11
1 Scope	12
2 Normative references	13
3 Terms, definitions, acronyms, keywords and conventions	14
3.1 Terms and definitions.....	14
3.2 Acronyms.....	22
3.3 Keywords	22
3.4 Editorial conventions.....	23
3.5 Notation conventions – State diagrams	24
4 General concepts	26
4.1 Overview	26
4.2 Sequential-access device model	26
4.2.1 Sequential-access device model overview	26
4.2.2 Physical elements.....	26
4.2.3 Removable volumes	29
4.2.4 Device entity	29
4.2.5 Early-warning.....	32
4.2.6 Programmable early warning.....	32
4.2.7 Partitions within a volume	33
4.2.8 Logical objects	34
4.2.9 Logical files	35
4.2.10 Object buffering	35
4.2.11 Synchronize operation behavior	36
4.2.12 Direction and position definitions	36
4.2.13 Error reporting.....	37
4.2.14 Write protection.....	39
4.2.15 Progress indication	41
4.2.16 Tagged command queuing	42
4.2.17 Block address mode	43
4.2.18 TapeAlert application client interface.....	52
4.2.19 READ ATTRIBUTE and WRITE ATTRIBUTE command support	58
4.2.20 Reservations.....	59
4.2.21 WORM volume and WORM mode.....	61
4.2.22 Logical block encryption	61
4.2.23 External data encryption control	72
4.2.24 Logical block encryption key protection	78
4.2.25 Appending data to a volume containing encrypted logical blocks	78
4.2.26 Self-test operations.....	79
4.2.27 Capability-based command (CbCS) security	79
5 Explicit address command descriptions for sequential-access devices	81
5.1 Summary of commands for explicit address mode.....	81
5.2 ERASE(16) command.....	84
5.3 READ(16) command.....	85
5.4 READ REVERSE(16) command.....	89
5.5 VERIFY(16) command.....	90
5.6 WRITE(16) command	92
5.7 WRITE FILEMARKS(16) command.....	94

6	Implicit address command descriptions for sequential-access devices	96
6.1	Summary of commands for implicit address mode	96
6.2	ERASE(6) command.....	99
6.3	LOCATE(10) command	100
6.4	READ(6) command.....	101
6.5	READ REVERSE(6) command.....	103
6.6	SPACE(6) command.....	103
6.7	VERIFY(6) command.....	106
6.8	WRITE(6) command	107
6.9	WRITE FILEMARKS(6) command.....	108
7	Common command descriptions for sequential-access devices	110
7.1	FORMAT MEDIUM command	110
7.2	LOAD UNLOAD command	111
7.3	LOCATE(16) command	113
7.4	PREVENT ALLOW MEDIUM REMOVAL command	114
7.5	READ BLOCK LIMITS command	115
7.6	READ POSITION command.....	117
7.6.1	READ POSITION command description	117
7.6.2	READ POSITION DATA format, short form.....	118
7.6.3	READ POSITION data format, long form	120
7.6.4	READ POSITION data format, extended form	122
7.7	RECOVER BUFFERED DATA command	123
7.8	REPORT DENSITY SUPPORT command	124
7.8.1	REPORT DENSITY SUPPORT command description.....	124
7.8.2	REPORT DENSITY SUPPORT header.....	124
7.8.3	Density support report	125
7.8.4	Medium type support report.....	127
7.9	REWIND command.....	129
7.10	SET CAPACITY command	130
7.11	SPACE(16) command.....	130
8	Parameters for sequential-access devices	134
8.1	Diagnostic parameters.....	134
8.2	Log parameters.....	134
8.2.1	Log parameters overview	134
8.2.2	Sequential-Access Device log page	135
8.2.3	TapeAlert log page	137
8.2.4	Device Statistics log page.....	138
8.2.5	Tape Diagnostic Data log page	140
8.2.6	Current Service Information log page	144
8.2.7	Requested Recovery log page	149
8.3	Mode parameters.....	152
8.3.1	Mode parameters overview	152
8.3.2	Data Compression mode page	155
8.3.3	Device Configuration mode page	159
8.3.4	Medium Partition mode page.....	163
8.3.5	Read-Write Error Recovery mode page	166
8.3.6	Informational Exceptions Control mode page.....	168
8.3.7	Medium Configuration mode page.....	169
8.3.8	Device Configuration Extension mode page.....	170

8.4	Vital product data (VPD) parameters	172
8.4.1	VPD parameters overview and page codes	172
8.4.2	Sequential-access Device Capabilities VPD page	173
8.4.3	Manufacturer-assigned Serial Number VPD page.....	173
8.4.4	TapeAlert Supported Flags VPD page	174
8.4.5	Automation Device Serial Number VPD page	174
8.5	Security protocol parameters	175
8.5.1	Security protocol overview.....	175
8.5.2	SECURITY PROTOCOL IN command specifying Tape Data Encryption security protocol.....	175
8.5.3	SECURITY PROTOCOL OUT command specifying Tape Data Encryption security protocol.....	190
8.5.4	SECURITY PROTOCOL IN and SECURITY PROTOCOL OUT descriptors	201
Annex A	(informative) Application client recommendations for using TapeAlert	205
Annex B	(informative) Security environment	211
Annex C	(informative) Example keyless copy operation flowchart	213
Annex D	(informative) Sense logical block information for error conditions	215
BIBLIOGRAPHY	220

Figure 1	— SCSI document relationships	12
Figure 2	— Example state diagram	25
Figure 3	— Typical volume layout	27
Figure 4	— Typical medium track layout	27
Figure 5	— Serpentine recording example	28
Figure 6	— Parallel recording example	28
Figure 7	— Helical scan recording example	28
Figure 8	— UML example of SCSI target device and device entity	30
Figure 9	— Early-warning example	32
Figure 10	— Programmable early warning example	32
Figure 11	— Partitioning example - one partition per track group	33
Figure 12	— Partitioning example - one partition per two track groups	34
Figure 13	— Partitioning example - two partitions per track group	34
Figure 14	— Block address mode state diagram, overview	45
Figure 15	— Block address mode state diagram, Idle state	46
Figure 16	— Block address mode state diagram, Explicit Address Mode - Neutral	48
Figure 17	— Block address mode state diagram, Explicit Address Mode - Write Capable	50
Figure 18	— Block address mode state diagram, Implicit Address Mode	51
Figure B.1	— Simple security deployment environment	211
Figure C.1	— Example keyless copy operation flowchart	214

Table 1 —	Numbering conventions examples	24
Table 2 —	Device entity attributes	30
Table 3 —	Stream commands sense data descriptor	37
Table 4 —	Information sense data descriptor	38
Table 5 —	Error conditions and sense keys	38
Table 6 —	Write protect additional sense code combinations	40
Table 7 —	Commands providing progress indication without changing ready state.....	41
Table 8 —	Commands changing ready state and providing progress indication	42
Table 9 —	TapeAlert flags severity	52
Table 10 —	TapeAlert flags	53
Table 11 —	TapeAlert flag activation conditions.....	57
Table 12 —	Device common attributes	58
Table 13 —	Medium common attributes	59
Table 14 —	SSC-3 commands that are allowed in the presence of various reservations	60
Table 15 —	Default I_T_L nexus logical block encryption information	69
Table 16 —	Logical block encryption parameters for encryption request policies	74
Table 17 —	Logical block encryption parameters for decryption request policies	75
Table 18 —	Logical block encryption parameters for encryption request indicator settings	76
Table 19 —	Logical block encryption parameters for decryption request indicator settings	76
Table 20 —	Logical block encryption period timer expired indicator.....	77
Table 21 —	Association between commands and CbCS permissions	79
Table 22 —	Explicit address command set for sequential-access devices.....	81
Table 23 —	ERASE(16) command	84
Table 24 —	METHOD field	85
Table 25 —	READ(16) command	86
Table 26 —	READ REVERSE(16) command	89
Table 27 —	VERIFY(16) command	90
Table 28 —	WRITE(16) command.....	92
Table 29 —	WRITE FILEMARKS(16) command	94
Table 30 —	Implicit address command set for sequential-access devices.....	96
Table 31 —	ERASE(6) command	99
Table 32 —	LOCATE(10) command.....	100
Table 33 —	READ(6) command	101
Table 34 —	READ REVERSE(6) command	103
Table 35 —	SPACE(6) command	104
Table 36 —	CODE field.....	104
Table 37 —	VERIFY(6) command	106
Table 38 —	WRITE(6) command.....	107
Table 39 —	WRITE FILEMARKS(6) command	108
Table 40 —	FORMAT MEDIUM command	110
Table 41 —	FORMAT field	111
Table 42 —	LOAD UNLOAD command.....	112
Table 43 —	LOCATE(16) command.....	113
Table 44 —	DEST_TYPE field.....	114
Table 45 —	PREVENT ALLOW MEDIUM REMOVAL command	114
Table 46 —	PREVENT field	115
Table 47 —	READ BLOCK LIMITS command.....	115
Table 48 —	READ BLOCK LIMITS data.....	116
Table 49 —	READ POSITION command.....	117
Table 50 —	READ POSITION service action codes.....	117
Table 51 —	READ POSITION data format, short form.....	118
Table 52 —	READ POSITION data format, long form	120
Table 53 —	READ POSITION data format, extended form	122
Table 54 —	RECOVER BUFFERED data command.....	123
Table 55 —	REPORT DENSITY SUPPORT command.....	124
Table 56 —	REPORT DENSITY SUPPORT header	124
Table 57 —	Density support data block descriptor	125
Table 58 —	Medium type descriptor	128
Table 59 —	REWIND command	129
Table 60 —	SET CAPACITY command.....	130

Table 61 — SPACE(16) command	131
Table 62 — Space positioning information	132
Table 63 — Diagnostic page codes	134
Table 64 — Log page codes	134
Table 65 — Parameter codes for Sequential-Access Device log page	135
Table 66 — TapeAlert log page	137
Table 67 — TapeAlert parameter format	137
Table 68 — Device Statistics log page	138
Table 69 — Device Statistics log parameter codes	138
Table 70 — Device statistics data counter log parameter format	139
Table 71 — Medium type log parameter format.....	140
Table 72 — Medium type parameter format	140
Table 73 — Tape Diagnostic Data log page	141
Table 74 — Tape diagnostic data log parameter format.....	142
Table 75 — Current Service Information log page.....	144
Table 76 — Service information log parameter format	144
Table 77 — Service information descriptor	145
Table 78 — SERVICE INFORMATION DESCRIPTOR TYPE field.....	145
Table 79 — Vendor-specific service information descriptor.....	145
Table 80 — Device information descriptor.....	146
Table 81 — DEC field.....	146
Table 82 — DEVICE REQUESTED RECOVERY field	147
Table 83 — Volume information descriptor.....	147
Table 84 — VIC field	147
Table 85 — VICQ field.....	148
Table 86 — TapeAlert flag specific information descriptor.....	149
Table 87 — Requested Recovery log page	150
Table 88 — REQUESTED RECOVERY LOG PARAMETER CODES.....	150
Table 89 — Requested recovery log parameter format.....	150
Table 90 — RECOVERY PROCEDURES.....	151
Table 91 — Device-specific parameter	152
Table 92 — Buffered modes	152
Table 93 — SPEED field	153
Table 94 — Sequential-access density codes	153
Table 95 — Mode page codes and subpage codes.....	154
Table 96 — Data Compression mode page.....	155
Table 97 — Possible boundaries and resulting sense keys due to data compression	156
Table 98 — Compression algorithm identifiers	158
Table 99 — Device Configuration mode page	159
Table 100 — EOD DEFINED field	160
Table 101 — WTRE field	161
Table 102 — REWIND ON RESET field	162
Table 103 — Medium Partition mode page.....	163
Table 104 — PSUM field.....	164
Table 105 — MEDIUM FORMAT RECOGNITION field.....	165
Table 106 — Read-Write Error Recovery mode page	166
Table 107 — Informational Exceptions Control mode page.....	168
Table 108 — TEST bit and TEST FLAG NUMBER field	168
Table 109 — Medium Configuration mode page	169
Table 110 — WORM MODE LABEL RESTRICTIONS field	170
Table 111 — WORM MODE FILEMARKS RESTRICTIONS field	170
Table 112 — Device Configuration Extension mode page	170
Table 113 — SHORT ERASE MODE field	172
Table 114 — Sequential-access device VPD page codes.....	172
Table 115 — Sequential-access Device Capabilities VPD page	173
Table 116 — Manufacturer-assigned Serial Number VPD page	173
Table 117 — TapeAlert Supported Flags VPD page.....	174
Table 118 — Automation Device Serial Number VPD page	174
Table 119 — SECURITY PROTOCOL SPECIFIC field.....	175
Table 120 — Tape Data Encryption In Support page	176

Table 121 — Tape Data Encryption Out Support page	176
Table 122 — Data Encryption Capabilities page	177
Table 123 — EXTDECC field	177
Table 124 — CFG_P field	178
Table 125 — Logical block encryption algorithm descriptor.....	178
Table 126 — DECRYPT_C field	179
Table 127 — ENCRYPT_C field	179
Table 128 — AVFCLP field.....	180
Table 129 — NONCE_C field	180
Table 130 — DKAD_C field.....	181
Table 131 — EEMC_C field.....	181
Table 132 — RDMC_C field	182
Table 133 — Supported Key Formats page.....	182
Table 134 — Data Encryption Management Capabilities page	183
Table 135 — Data Encryption Status page.....	184
Table 136 — PARAMETERS CONTROL field	185
Table 137 — Next Block Encryption Status page	186
Table 138 — COMPRESSION STATUS field	187
Table 139 — ENCRYPTION STATUS field.....	187
Table 140 — Random Number page	189
Table 141 — Device Service Key Wrapping Public Key page	189
Table 142 — PUBLIC KEY TYPE field	190
Table 143 — SECURITY PROTOCOL SPECIFIC field	190
Table 144 — Set Data Encryption page.....	191
Table 145 — SCOPE field.....	192
Table 146 — CEEM field.....	192
Table 147 — RDMC field	193
Table 148 — ENCRYPTION MODE field	194
Table 149 — DECRYPTION MODE field	195
Table 150 — LOGICAL BLOCK ENCRYPTION KEY FORMAT field.....	196
Table 151 — KEY field format with KEY FORMAT field set to 00h	197
Table 152 — KEY field format with KEY FORMAT field set to 01h	198
Table 153 — KEY field format with KEY FORMAT field set to 02h	198
Table 154 — PARAMETER SET field	198
Table 155 — ECIES-HC REQUIREMENTS AND PARAMETERS FOR ECIES-KEM	200
Table 156 — ECIES-HC REQUIREMENTS AND PARAMETERS FOR ECIES-DEM	200
Table 157 — SA Encapsulation page	201
Table 158 — Tape Data Encryption descriptor format.....	201
Table 159 — KEY DESCRIPTOR TYPE field.....	202
Table 160 — AUTHENTICATED field.....	202
Table 161 — Wrapped Key descriptor format.....	203
Table 162 — WRAPPED KEY DESCRIPTOR TYPE field	203
Table A.1 — TapeAlert log page parameter codes	205
Table B.1 — Security environment threats	212
Table D.1 — Sense logical block error indications for read and write operations	215
Table D.2 — INFORMATION field and position for read and write operations	217
Table D.3 — Summary of length error conditions on read type commands	219