

ISO/IEC 14776-322:2007-02 (E)

Information technology – Small computer system interface (SCSI) – Part 322: Block commands-2 (SBC-2)

CONTENTS

- FOREWORD..... 10
- INTRODUCTION..... 11
- 1 Scope..... 13
- 2 Normative references 14
 - 2.1 Approved references 14
 - 2.2 References under development 14
- 3 Definitions, symbols, abbreviations, keywords, and conventions 15
 - 3.1 Definitions..... 15
 - 3.2 Symbols and abbreviations 18
 - 3.3 Keywords..... 18
 - 3.4 Conventions..... 19
- 4 Direct-access block device type model..... 21
 - 4.1 Direct-access block device type model overview 21
 - 4.2 Media examples 21
 - 4.2.1 Media examples overview..... 21
 - 4.2.2 Rotating media..... 21
 - 4.2.3 Memory media 22
 - 4.3 Removable medium..... 22
 - 4.3.1 Removable medium overview..... 22
 - 4.3.2 Removable medium with an attached media changer 22
 - 4.4 Logical blocks 23
 - 4.5 Ready state 23
 - 4.6 Initialization..... 24
 - 4.7 Write protection 24
 - 4.8 Medium defects 25
 - 4.9 Write failures..... 25
 - 4.10 Caches 26
 - 4.11 Implicit HEAD OF QUEUE command processing 27
 - 4.12 Reservations..... 27
 - 4.13 Error reporting 29
 - 4.13.1 Error reporting overview..... 29
 - 4.13.2 Block commands sense data descriptor 30
 - 4.14 Model for XOR commands..... 30
 - 4.14.1 Model for XOR commands overview 30
 - 4.14.2 Storage array controller supervised XOR operations 31
 - 4.14.2.1 Storage array controller supervised XOR operations overview..... 31
 - 4.14.2.2 Update write operation 31
 - 4.14.2.3 Regenerate operation..... 31
 - 4.14.2.4 Rebuild operation 32
 - 4.14.3 Array subsystem considerations..... 32
 - 4.14.3.1 Array subsystem considerations overview 32
 - 4.14.3.2 Buffer full status handling 32
 - 4.14.3.3 Access to an inconsistent stripe..... 32
 - 4.14.4 XOR data retention requirements 33
 - 4.15 START STOP UNIT and power conditions..... 33
 - 4.15.1 START STOP UNIT and power conditions overview..... 33
 - 4.15.2 START STOP UNIT and power conditions state machine..... 34
 - 4.15.2.1 START STOP UNIT and power conditions state machine overview..... 34
 - 4.15.2.2 SSU_PC0:Powered_on state..... 35
 - 4.15.2.2.1 SSU_PC0:Powered_on state description 35
 - 4.15.2.2.2 Transition SSU_PC0:Powered_on to SSU_PC1:Active 35

4.15.2.2.3 Transition SSU_PC0:Powered_on to SSU_PC4:Stopped	35
4.15.2.3 SSU_PC1:Active state	35
4.15.2.3.1 SSU_PC1:Active state description	35
4.15.2.3.2 Transition SSU_PC1:Active to SSU_PC2:Idle	35
4.15.2.3.3 Transition SSU_PC1:Active to SSU_PC3:Standby	35
4.15.2.3.4 Transition SSU_PC1:Active to SSU_PC4:Stopped	35
4.15.2.4 SSU_PC2:Idle state	35
4.15.2.4.1 SSU_PC2:Idle state description	35
4.15.2.4.2 Transition SSU_PC2:Idle to SSU_PC1:Active	36
4.15.2.4.3 Transition SSU_PC2:Idle to SSU_PC3:Standby	36
4.15.2.4.4 Transition SSU_PC2:Idle to SSU_PC4:Stopped	36
4.15.2.5 SSU_PC3:Standby state	36
4.15.2.5.1 SSU_PC3:Standby state description	36
4.15.2.5.2 Transition SSU_PC3:Standby to SSU_PC1:Active	36
4.15.2.5.3 Transition SSU_PC3:Standby to SSU_PC2:Idle	36
4.15.2.5.4 Transition SSU_PC3:Standby to SSU_PC4:Stopped	36
4.15.2.6 SSU_PC4:Stopped state	37
4.15.2.6.1 SSU_PC4:Stopped state description	37
4.15.2.6.2 Transition SSU_PC4:Stopped to SSU_PC1:Active	37
4.15.2.6.3 Transition SSU_PC4:Stopped to SSU_PC2:Idle	37
4.15.2.6.4 Transition SSU_PC4:Stopped to SSU_PC3:Standby	37
4.16 Protection information model	37
4.16.1 Protection information overview	37
4.16.2 Protection information format	38
4.16.3 Logical block guard	38
4.16.3.1 Logical block guard overview	38
4.16.3.2 CRC generation	39
4.16.3.3 CRC checking	40
4.16.3.4 CRC test cases	40
4.16.4 Application of protection information	40
4.16.5 Protection information and commands	40
4.17 Grouping function	41
5 Commands for direct-access block devices	42
5.1 Commands for direct-access block devices overview	42
5.2 FORMAT UNIT command	45
5.2.1 FORMAT UNIT command overview	45
5.2.2 FORMAT UNIT parameter list	49
5.2.2.1 FORMAT UNIT parameter list overview	49
5.2.2.2 Parameter list header	49
5.2.2.3 Initialization pattern descriptor	51
5.2.2.4 Address descriptor formats	52
5.2.2.4.1 Address descriptor formats overview	52
5.2.2.4.2 Short block format address descriptor	53
5.2.2.4.3 Long block format address descriptor	53
5.2.2.4.4 Bytes from index format address descriptor	53
5.2.2.4.5 Physical sector format address descriptor	54
5.3 PRE-FETCH (10) command	54
5.4 PRE-FETCH (16) command	56
5.5 READ (6) command	56
5.6 READ (10) command	58
5.7 READ (12) command	62
5.8 READ (16) command	63
5.9 READ (32) command	63
5.10 READ CAPACITY (10) command	65
5.10.1 READ CAPACITY (10) overview	65
5.10.2 READ CAPACITY (10) parameter data	65
5.11 READ CAPACITY (16) command	66

5.11.1 READ CAPACITY (16) command overview.....	66
5.11.2 READ CAPACITY (16) parameter data	67
5.12 READ DEFECT DATA (10) command	67
5.12.1 READ DEFECT DATA (10) command overview.....	67
5.12.2 READ DEFECT DATA (10) parameter data	68
5.13 READ DEFECT DATA (12) command	69
5.13.1 READ DEFECT DATA (12) command overview.....	69
5.13.2 READ DEFECT DATA (12) parameter data	70
5.14 READ LONG (10) command	70
5.15 READ LONG (16) command	71
5.16 REASSIGN BLOCKS command.....	72
5.16.1 REASSIGN BLOCKS command overview.....	72
5.16.2 REASSIGN BLOCKS parameter list.....	72
5.17 START STOP UNIT command.....	73
5.18 SYNCHRONIZE CACHE (10) command.....	75
5.19 SYNCHRONIZE CACHE (16) command.....	76
5.20 VERIFY (10) command	77
5.21 VERIFY (12) command	86
5.22 VERIFY (16) command	87
5.23 VERIFY (32) command	87
5.24 WRITE (6) command.....	89
5.25 WRITE (10) command.....	89
5.26 WRITE (12) command.....	93
5.27 WRITE (16) command.....	94
5.28 WRITE (32) command.....	94
5.29 WRITE AND VERIFY (10) command	96
5.30 WRITE AND VERIFY (12) command	96
5.31 WRITE AND VERIFY (16) command	97
5.32 WRITE AND VERIFY (32) command	97
5.33 WRITE LONG (10) command.....	99
5.34 WRITE LONG (16) command.....	99
5.35 WRITE SAME (10) command.....	100
5.36 WRITE SAME (16) command.....	101
5.37 WRITE SAME (32) command.....	102
5.38 XDREAD (10) command	104
5.39 XDREAD (32) command	105
5.40 XDWRITE (10) command.....	105
5.41 XDWRITE (32) command.....	106
5.42 XDWRITEREAD (10) command.....	107
5.43 XDWRITEREAD (32) command.....	108
5.44 XPWRITE (10) command	109
5.45 XPWRITE (32) command	110
6 Parameters for direct-access block devices.....	112
6.1 Diagnostic parameters.....	112
6.1.1 Diagnostic parameters overview.....	112
6.1.2 Translate Address Output diagnostic page.....	112
6.1.3 Translate Address Input diagnostic page.....	113
6.2 Log parameters	115
6.2.1 Log parameters overview.....	115
6.2.2 Format Status log page.....	115
6.2.3 Non-volatile Cache log page.....	117
6.3 Mode parameters	118
6.3.1 Mode parameters overview.....	118
6.3.2 Mode parameter block descriptors.....	120
6.3.2.1 Mode parameter block descriptors overview.....	120
6.3.2.2 Short LBA mode parameter block descriptor	120
6.3.2.3 Long LBA mode parameter block descriptor.....	122

6.3.3 Caching mode page.....	123
6.3.4 Read-Write Error Recovery mode page.....	126
6.3.5 Verify Error Recovery mode page.....	131
6.3.6 XOR Control mode page.....	132
6.4 Vital product data (VPD) parameters.....	132
6.4.1 VPD parameters overview	132
6.4.2 Block Limits VPD page	133
Annex A (informative) Numeric order codes	135
A.1 Variable length CDBs.....	135
A.2 Service action CDBs	135
Annex B (informative) XOR command examples.....	137
B.1 XOR command examples overview	137
B.2 Update write operation	137
B.3 Regenerate operation	138
B.4 Rebuild operation	139
Annex C (informative) CRC example in C.....	141
Bibliography	143

Table 1 - ISO and American numbering convention examples	20
Table 2 - SBC-2 commands that are allowed in the presence of various reservations	28
Table 3 - Example error conditions	29
Table 4 - Sense data field usage for direct-access block devices	29
Table 5 - Block commands sense data descriptor format	30
Table 6 - User data and protection information format	38
Table 7 - CRC polynomials	39
Table 8 - CRC test cases	40
Table 9 - Commands for direct-access block devices	42
Table 10 - FORMAT UNIT command	46
Table 11 - FORMAT UNIT command address descriptor usage	48
Table 12 - FORMAT UNIT parameter list	49
Table 13 - Short parameter list header	49
Table 14 - Long parameter list header	50
Table 15 - Initialization pattern descriptor	51
Table 16 - Initialization pattern modifier (IP MODIFIER) field	51
Table 17 - INITIALIZATION PATTERN TYPE field	52
Table 18 - Address descriptor formats	53
Table 19 - Short block format address descriptor (000b)	53
Table 20 - Long block format address descriptor (011b)	53
Table 21 - Bytes from index format address descriptor (100b)	54
Table 22 - Physical sector format address descriptor (101b)	54
Table 23 - PRE-FETCH (10) command	55
Table 24 - PRE-FETCH (16) command	56
Table 25 - READ (6) command	56
Table 26 - Protection information checking for READ (6)	58
Table 27 - READ (10) command	59
Table 28 - RDPROTECT field	59
Table 29 - Force unit access for read operations	62
Table 30 - READ (12) command	63
Table 31 - READ (16) command	63
Table 32 - READ (32) command	64
Table 33 - READ CAPACITY (10) command	65
Table 34 - READ CAPACITY (10) parameter data	65
Table 35 - READ CAPACITY (16) command	66
Table 36 - READ CAPACITY (16) parameter data	67
Table 37 - READ DEFECT DATA (10) command	67
Table 38 - READ DEFECT DATA (10) parameter data	68
Table 39 - READ DEFECT DATA (12) command	69
Table 40 - READ DEFECT DATA (12) parameter data	70
Table 41 - READ LONG (10) command	70
Table 42 - READ LONG (16) command	71
Table 43 - REASSIGN BLOCKS command	72
Table 44 - REASSIGN BLOCKS parameter list	72
Table 45 - REASSIGN BLOCKS short parameter list header	73
Table 46 - REASSIGN BLOCKS long parameter list header	73
Table 47 - START STOP UNIT command	74
Table 48 - POWER CONDITION field	74
Table 49 - SYNCHRONIZE CACHE (10) command	75
Table 50 - SYNC_NV bit	76
Table 51 - SYNCHRONIZE CACHE (16) command	76
Table 52 - VERIFY (10) command	77
Table 53 - VRPROTECT field with BYTCHK set to zero - checking protection information read from the medium	78
Table 54 - VRPROTECT field with BYTCHK set to one - checking protection information read from the medium	81

Table 55 - VRPROTECT field with BYTCHK set to one - checking protection information transferred from the data-out buffer	82
Table 56 - VRPROTECT field with BYTCHK set to one - byte-by-byte comparison requirements	85
Table 57 - VERIFY (12) command	87
Table 58 - VERIFY (16) command	87
Table 59 - VERIFY (32) command	88
Table 60 - WRITE (6) command	89
Table 61 - WRITE (10) command	90
Table 62 - WRPROTECT field	90
Table 63 - Force unit access for write operations	93
Table 64 - WRITE (12) command	93
Table 65 - WRITE (16) command	94
Table 66 - WRITE (32) command	95
Table 67 - WRITE AND VERIFY (10) command	96
Table 68 - WRITE AND VERIFY (12) command	97
Table 69 - WRITE AND VERIFY (16) command	97
Table 70 - WRITE AND VERIFY (32) command	98
Table 71 - WRITE LONG (10) command	99
Table 72 - WRITE LONG (16) command	100
Table 73 - WRITE SAME (10) command	100
Table 74 - LBDATA bit and PBDATA bit	101
Table 75 - WRITE SAME (16) command	102
Table 76 - WRITE SAME (32) command	103
Table 77 - XDREAD (10) command	104
Table 78 - XDREAD (32) command	105
Table 79 - XDWRITE (10) command	106
Table 80 - XDWRITE (32) command	107
Table 81 - XDWRITEREAD (10) command	108
Table 82 - XDWRITEREAD (32) command	109
Table 83 - XPWRITE (10) command	110
Table 84 - XPWRITE (32) command	111
Table 85 - Diagnostic page codes	112
Table 86 - Translate Address Output diagnostic page	112
Table 87 - Translate Address Input diagnostic page	113
Table 88 - Log page codes	115
Table 89 - Format Status log page parameter codes	116
Table 90 - Non-volatile Cache log page	117
Table 91 - Non-volatile Cache log parameters	117
Table 92 - Remaining Non-volatile Time parameter data	117
Table 93 - REMAINING NON-VOLATILE TIME field	117
Table 94 - Maximum Non-volatile Time parameter data	118
Table 95 - MAXIMUM NON-VOLATILE TIME field	118
Table 96 - DEVICE-SPECIFIC PARAMETER field for direct-access block devices	118
Table 97 - Mode page codes for direct-access block devices	119
Table 98 - Short LBA mode parameter block descriptor	120
Table 99 - Long LBA mode parameter block descriptor	122
Table 100 - Caching mode page	123
Table 101 - DEMAND READ RETENTION PRIORITY field	124
Table 102 - WRITE RETENTION PRIORITY field	125
Table 103 - Read-Write Error Recovery mode page	126
Table 104 - Combined error recovery bit descriptions	128
Table 105 - Verify Error Recovery mode page	131
Table 106 - XOR Control mode page	132
Table 107 - Direct-access block device VPD page codes	133
Table 108 - Block Limits VPD page	133
Table A.1 - Variable length command service action code assignments	135
Table A.2 - SERVICE ACTION IN (16) service actions	135
Table A.3 - SERVICE ACTION OUT (16) service actions	136

Figure 1 - SCSI document relationships	12
Figure 2 - Power condition state machine for logical units implementing the START STOP UNIT command	34
Figure B.1 - Update write operation (storage array controller supervised)	138
Figure B.2 - Regenerate operation (storage array controller supervised)	139
Figure B.3 - Rebuild operation (storage array controller supervised)	140