Magneto Optical Disk Drive

SMO-D501

Specification
and Operating Instructions

version 1.0

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Owner's Record

The model and serial numbers are located at the rear of the drive unit. Record these numbers in the spaces provided below. Refer to them whenever you call upon your Sony dealer regarding this product.

Model No._____ Serial No._____

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

DANGER Invisible laser radiation when open. Avoid direct exposure to beam.	**DANGER** Radiations invisibles du laser en cas d'ouverture. Eviter toute exposition directe au faisceau. 4-614-487-02

This label is affixed both on the top cover and front left corner of the inside cartridge tray.

1. Overview

The Sony SMO-D501 is an erasable optical disk drive using a 5.25 inch (130mm) magneto-optical (MO) disk. It can store approximately 650 megabytes (1024 bytes per sector) or 594 megabytes (512 bytes per sector) of data. The SMO-D501 complies with the Continuous-Composite Format of 130mm Optical Disk standard which has been completed at the October 1987 ISO committee meeting. The MO disk is pregrooved and formatted with 1024 bytes per sector and 17 sectors per track, or 512 bytes per sector and 31 sectors per track, using a spiral track configuration.

The SMO-D501 achieves a data transfer rate of 7.40 megabits per second using a 2400 rpm rotational speed. The seek time is improved by a newly developed servo system.

The SMO-D501 is connected to the SMO-C501 MO Disk Controller with an M-ESDI (Modified Enhanced Small Device Interface) which follows the Preliminary ANSI Working Document X3T9.3/87-005 Revision 2.0.

The SMO-D501 contains the mechanical and optical components, the analog circuitry for the data separation, servo systems, and the digital circuitry for drive control, formatting and interfacing with the disk controller. The use of new digital LSI's has resulted in a compact drive with a high degree of reliability.

2. Specifications

The following specifications are defined for the 130 mm magneto optical disk drive SMO-D501. The recorded format is the Continuous- Composite Format of ISO 130mm Optical Disk Standards.

2.1 Drive Specifications

The specifications of the SMO-D501 are shown in Table 2.1 and Table 2.2.

Table 2.1 : SMO-D501 SPECIFICATIONS (1/2)

Item	Specification	Remarks
Disk	130mm (5.25 inch) double sided MO Disk with a cartridge	Formatted Address : Track 0 Sector 0 to Track 18750 Sector 16 or 30
Capacity		$1M = 10^6$
Formatted (per disk)	650 Mbytes	(1024 bytes/sector)
	594 Mbytes	(512 bytes/sector)
(per side)	325 Mbytes	(1024 bytes/sector)
	294 Mbytes	(512 bytes/sector)
Unformatted (per side)	433.5 Mbytes	(1024 bytes/sector)
	433.6 Mbytes	(512 bytes/sector)
Disk Format	Continuous/Composite	ISO standard type A
Rotational Mode	CAV	CAV: Constant Angular Velocity
Write/Read Side	2	Double Sided
Bytes per Sector	1024 or 512	
Sectors per Track	17 or 31	
Total Tracks per Side	18751	
Rotational Speed	2400 rpm	CAV
Avarage Latency	12.5 msec	
Seek Time		
1 Track	1 msec	Only jumping time
	(5 msec)	(Including overhead time)
Short Stroke (±64 Tracks)	30 msec	Including overhead time
Average	120 msec	
Full Stroke	200 msec	
Transfer Rate		
Data Transfer Rate	7.40 Mbps	bps = bits per second
User Data Transfer Rate	680 Kbytes/sec	(1024 bytes/sector)
	620 Kbytes/sec	(512 bytes/sector)
Loading Time	5 sec	Including spin-up time
Unloading Time	3 sec	Including spin-down time
Bias Magnet		Including
Rotation Time	20 msec	setting/overhead time
Drive Interface	Modified ESDI	ESDI: Enhanced Small Device Interface

Table 2.2 : SMO-D501 SPECIFICATIONS (2/2)

Item	Specification	Remarks
Mechanical Dimension	82.5(H)x146.0(W)x203.2(D)	Not include the connector
Weight	3 Kg	
Power Requirements		
DC Voltage	+5 V ± 5%	Ripple voltage < 50 mVpp
	+12 V ± 5%	Ripple voltage < 100 mVpp
DC Current		
+5 V	1 A (max.)	
+12 V	1 A (typ.)	
	2.5 A (max.)	at spinning-up and seeking
Operating Mount	Horizontal or Vertical	
Mounting Tilt	±5°	
Environmental		
Operating		
Temperature	5 - 40 °C	Recommend to use a cooling fan
Relative Humidity	10 - 80 %	Not condensing
Max. Wet-bulb Temp.	29 °C	
Temperature Gradient	10 °C / Hour	
Non-operating		No disk
Temperature	-20 - 60 °C	
Relative Humidity	5 - 90 %	
Laser Diode		
Type	Semiconductor Laser	
	(GaAlAs)	
Wave Length	790 nm, Continuous	
Output Power	30 mW max	
Beam Divergence	60° ±1.5°	
Vibration		
Operating	0.25 G	5 to 500 Hz Sine Sweep
Non-operating	0.5 G	5 to 500 Hz Sine Sweep
Shock		
Operating	35 G	3 msec Half Sine Pulse.
Non-operating	89G	3 msec Half Sine Pulse
	30G	23 msec Trapezoidal Pulse

Laser Product Classification : Class 1 (IEC 825)

2.2 Format Specifications

The Sony SMO-D501 complies with the Continuous-Composite Format of 130mm Optical Disk Standard which has been completed at the October 1987 ISO committee meeting. Refer to the standard specifications for details.

R29.0 - 30.0 mm	Head-in Area (Formatted with negative addresses)
R30.0 - 60.0 mm	Data Area (Formatted with the addresses from Track 0 Sector 0 to Track 18750 Sector 16)
R60.0 - 61.0 mm	Head-out Area (Formatted with the addresses more than Track 18751)

User data and defect management information are written in the Data Area.

2.2.1 Modulation Code

The SMO-D501 implements (2,7)RLL as the modulation code. The recording method adopts pit-position recording of the (2,7)RLL and the code is decoded by detecting the peak levels in a read mode.

The (2,7)RLL code is translated as shown in Table 2.5.

Table 2.5 : (2,7)RLL Modulation Code

Input Data	(2.7)RLL
10	0100
11	1000
000	000100
010	100100
011	001000
0010	00100100
0011	00001000

2.2.2 Sector Format

The Sector Format is defined in Fig.2.1. and Fig.2.2 The ID field contains the preformatted triple ID's and the Data field contains 1024 bytes or 512 bytesof user data.

Each signal in the format is defined as follows:

SM (Sector Mark): 5 byte length to identify a sector header.

[pattern] 5 3 3 7 3 3 3 3 5 0 0 1 0 0 1 0 0 1 0

mark bit length channel coding bit

VFO (Variable Frequency Oscillator Signals): 12 or 8 byte length to synchronize the PLO (Phase locked oscillator) with the read out signal.

[pattern]

VFO 1: 0 1 0 0 1 0 0 1 0 0 1 0 0 1 ----- 0 1 0 0 1 0

VFO 2: 1 0 0 1 0 0 1 0 0 1 0 0 1 0 ----- 0 1 0 0 1 0

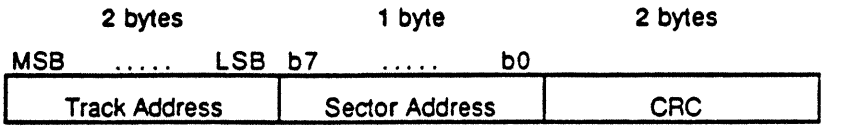
0 0 0 1 0 0 1 0 0 1 0 0 1 0 ----- 0 1 0 0 1 0

VFO 3: 0 1 0 0 1 0 0 1 0 0 1 0 0 1 ----- 0 1 0 0 1 0

AM (Address Mark): 1 byte length to detect ID fields.

[pattern] 0 1 0 0 1 0 0 0 0 0 0 0 1 0 0

ID (Identification) + CRC (Cyclic Redundancy Check Code): The ID consists of 2 bytes of a track address and 1 byte of a sector address as follows. The MSB (most significant bit) of the track address is output first.



b0-b4:	Sector Address (0-16, 31)
b5:	0 (Reserved)
b6, b7:	ID number (ID0-ID2)

2 byte CRC codes are for detecting ID failure. The codes are generated using the CCITT polynominal $x^{16}+x^{12}+x^{5}+1$ with the registers seeded to all 1's.

PA (Post Amble): 1 byte to allow the last byte of CRC to achieve closure of a few uncertain bits in the (2,7)RLL encoding scheme.

ODF (Offset Detection Flag): 1 byte of mirror area with no groove or no preformatted data.

FLAG: 5 bytes of the flag area to prevent inadvertent write operations over previously written data. The SMO-D501 does not used this area because of rewritable operation.

ALPC (Automatic Laser Power Control): This area is designated as a test area for calibration of the laser power levels.

GAP: 3 bytes length to absorb the timing shift when writing a FLAG.

SYNC (Synchronization): 12 bytes length to give the data separation timing for the succeeding DATA field.

[pattern]

0100001001000010001000100100010010000010010010000

DATA FIELD: For 1024 bytes/sector format, the data field consists of 1024 bytes of user data, and 164 bytes of CRC/ECC data, plus 12 bytes of control information.

For 512 bytes/sector format, the data field consists of 512 bytes of user data, 84 bytes of CRC/ECC data, and 2 bytes of reserved data, plus 12 bytes of control information.

RESYNC (Resynchronization Mark): The purpose of the RESYNC marks is to prevent the loss of byte synchronization when the VFO must ride through defects within a data field and to limit the propagation of errors. The RESYNC consists of 1 byte pattern (16 channel code bits) of irregular (2,7)RLL modulation code.

[pattern] 0010000000100100

BUFFER: The BUFFER consists of a total of 20 bytes of reserved space for motor speed tolerances and other electrical/mechanical tolerances.

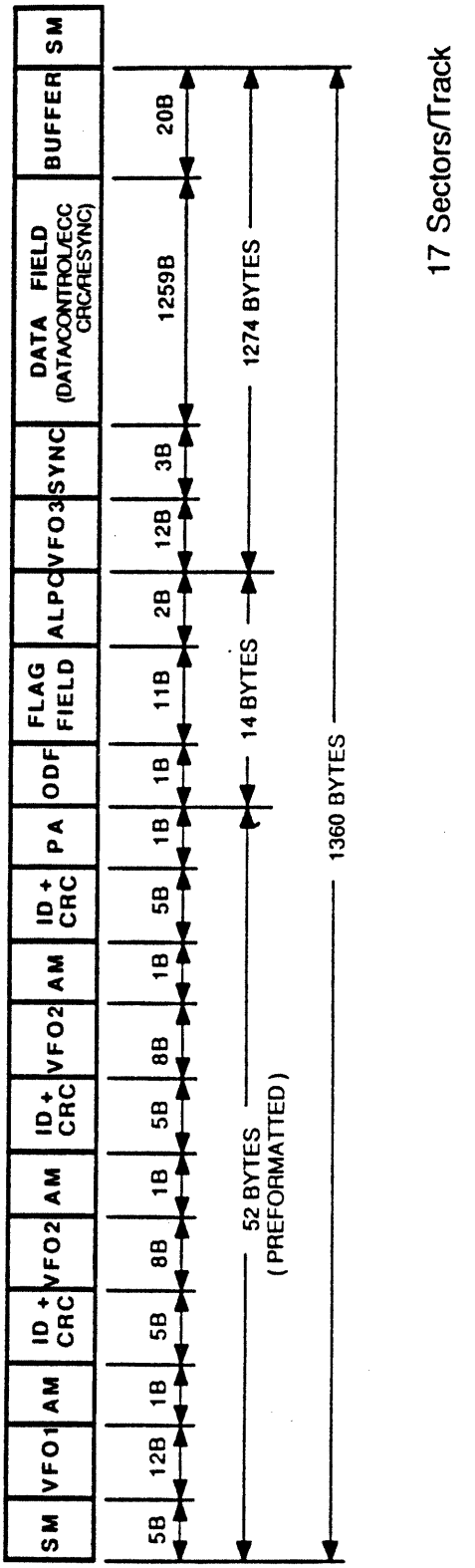


Fig.2.1 Sector Format of 1024 Bytes/Sector

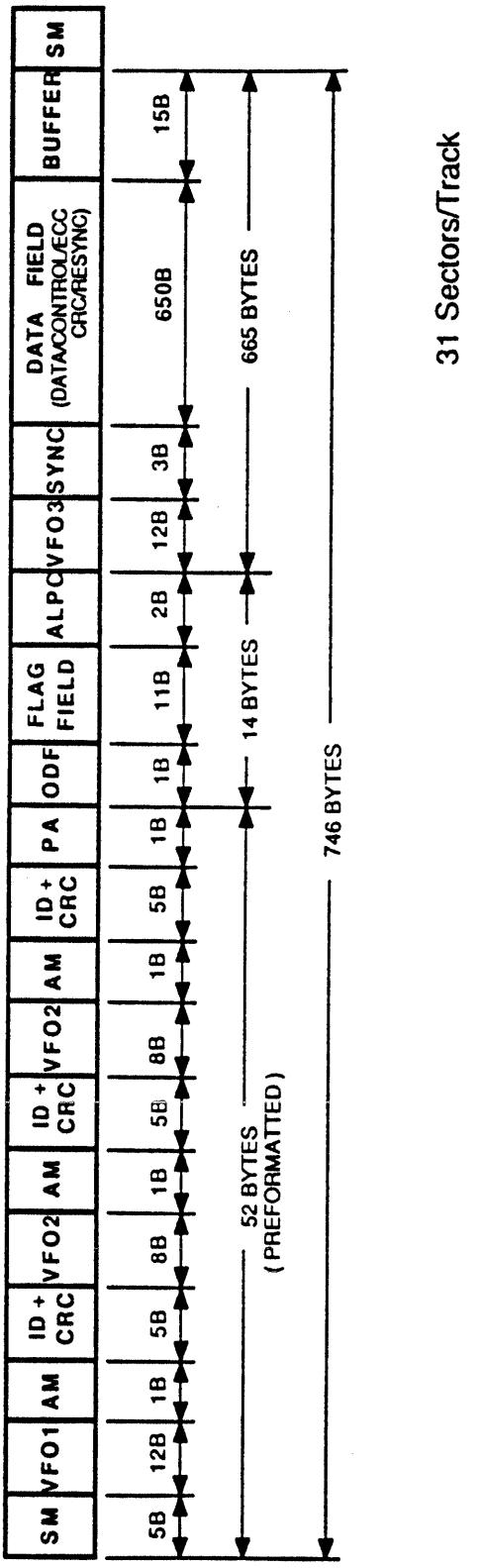


Fig.2.2 Sector Format of 512 Bytes/Sector

2.2.3 Data Field Format

For 1024 bytes/sector format, the data field consists of 1024 bytes of user data, 12 bytes of control information, 4 bytes of CRC data, 160 bytes of EDAC (Error Detection and Correction) data and 59 bytes of RESYNC pattern. The data configuration is shown in Fig.2.3. The 10 way interleave is adopted in the configuration for increasing the error correction capability.

For 512 bytes/sector format, the data field consists of 512 bytes of user data, 12 bytes of control information, 4 bytes of CRC data, 80 bytes of EDAC (Error Detection and Correction) data, 2 bytes of reserved data and 40 bytes of RESYNC pattern. The data configuration is shown in Fig.2.4. The 5 way interleave is adopted in the configuration for increasing the error correction capability.

The EDAC method is the Reed-Solomon code known as Long Distance Code (LDC), with a degree of redundancy of 16. The ECC (Error Correction Code) polynomial expression is as follows.

Primitive Polynomial: $Gp(X) = x^8+x^5+x^3+x^2+1$

Element: $Alpha^i = (Beta^i)^{88}$

Bata: the root of Gp(x)

Generator Polynomial: $G(x) = (x+Alpha^{120})(x+Alpha^{121}) \cdots (x+Alpha^{135})$

Initial set value is all 1's. ECC data output to the media is inverted from that calculated.

The 4 byte CRC is calculated over the data field including the control data. The same primitive polynomial as the ECC is used. The CRC generator polynomial is as follows.

$G(X) = (x+Alpha^{136})(x+Alpha^{137}) \cdots (x+Alpha^{139})$

Initial set value is all 0's. Input sequence is MSB to LSB. Output value to the media is not inverted from that calculated.

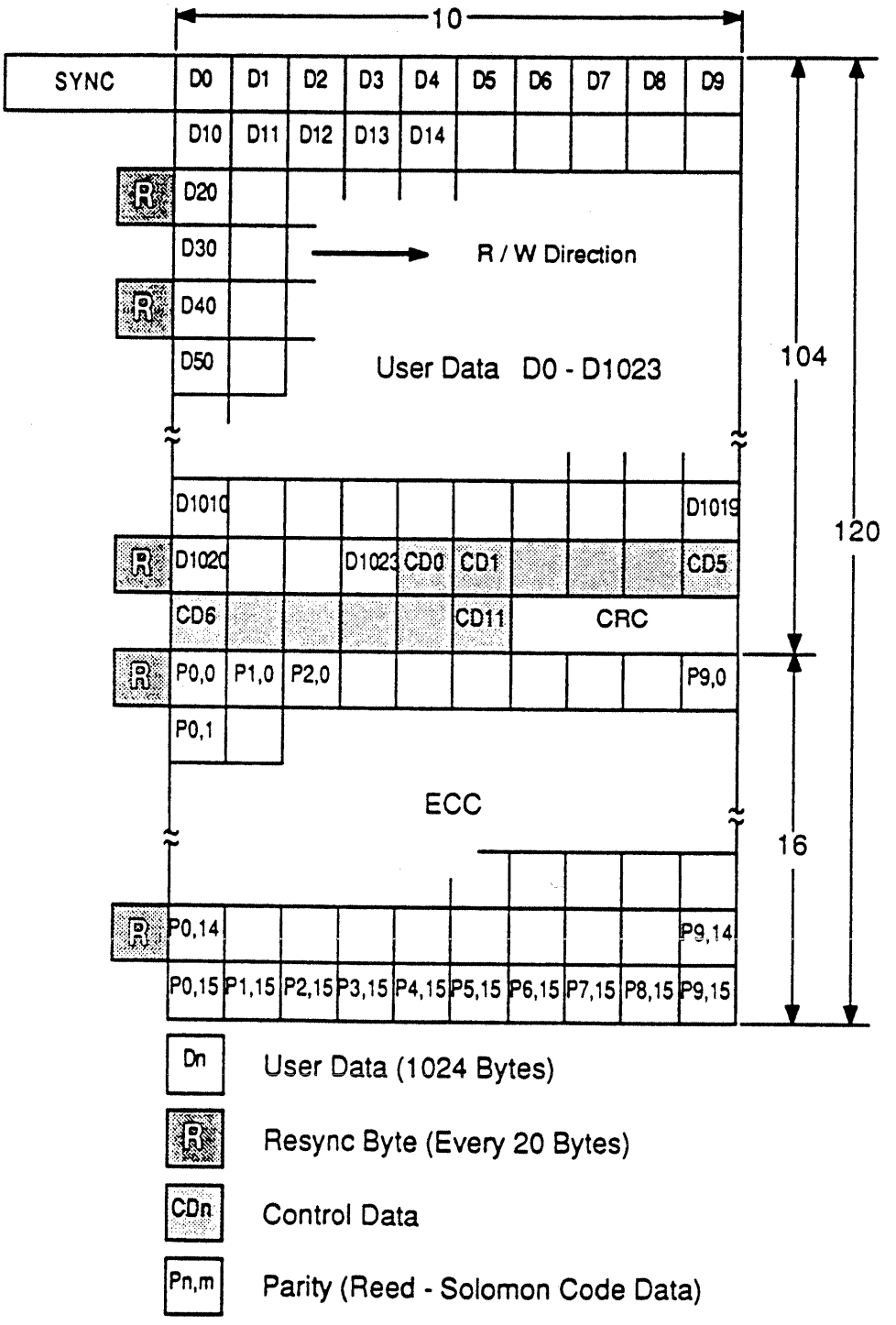


Fig.2.3 1024 Bytes/Sector Data Block Configuration

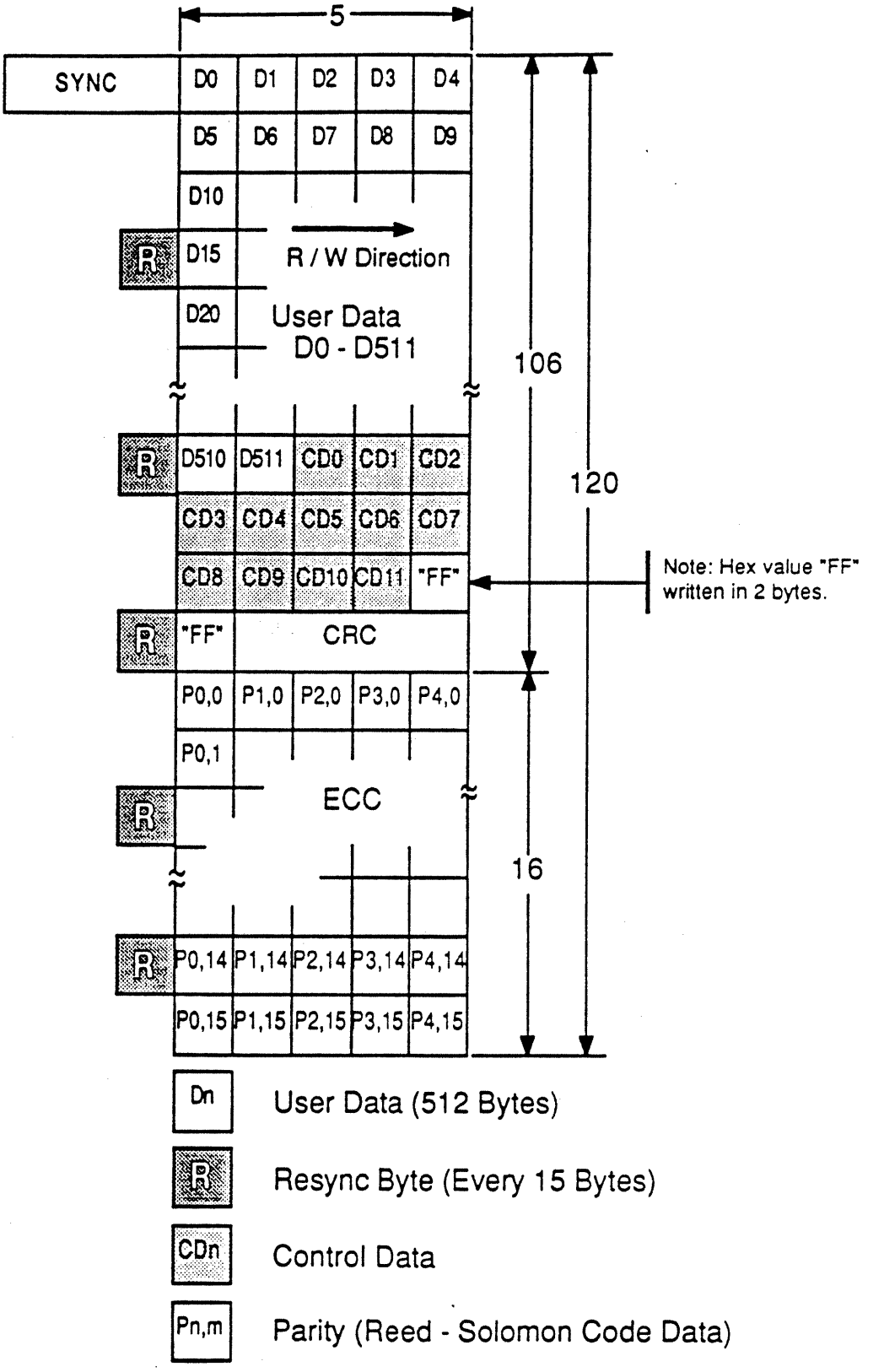


Fig 2.4 512 Bytes/Sector Data Block Configuration

3. System Configuration

The SMO-D501 MO Disk Drive consists of several mechanical blocks, an optical block, and electrical blocks. The electrical blocks contain all of the an analog and digital circuitry for the drive functions. The analog circuitry includes laser diode drive, RF block and the servo systems for focusing and tracking. The digital circuitry includes analog/mechanism control logic, modulator/demodulator and drive interface (modified ESDI) logic. The block diagram of the SMO-D501 drive is shown in Fig.3.1.

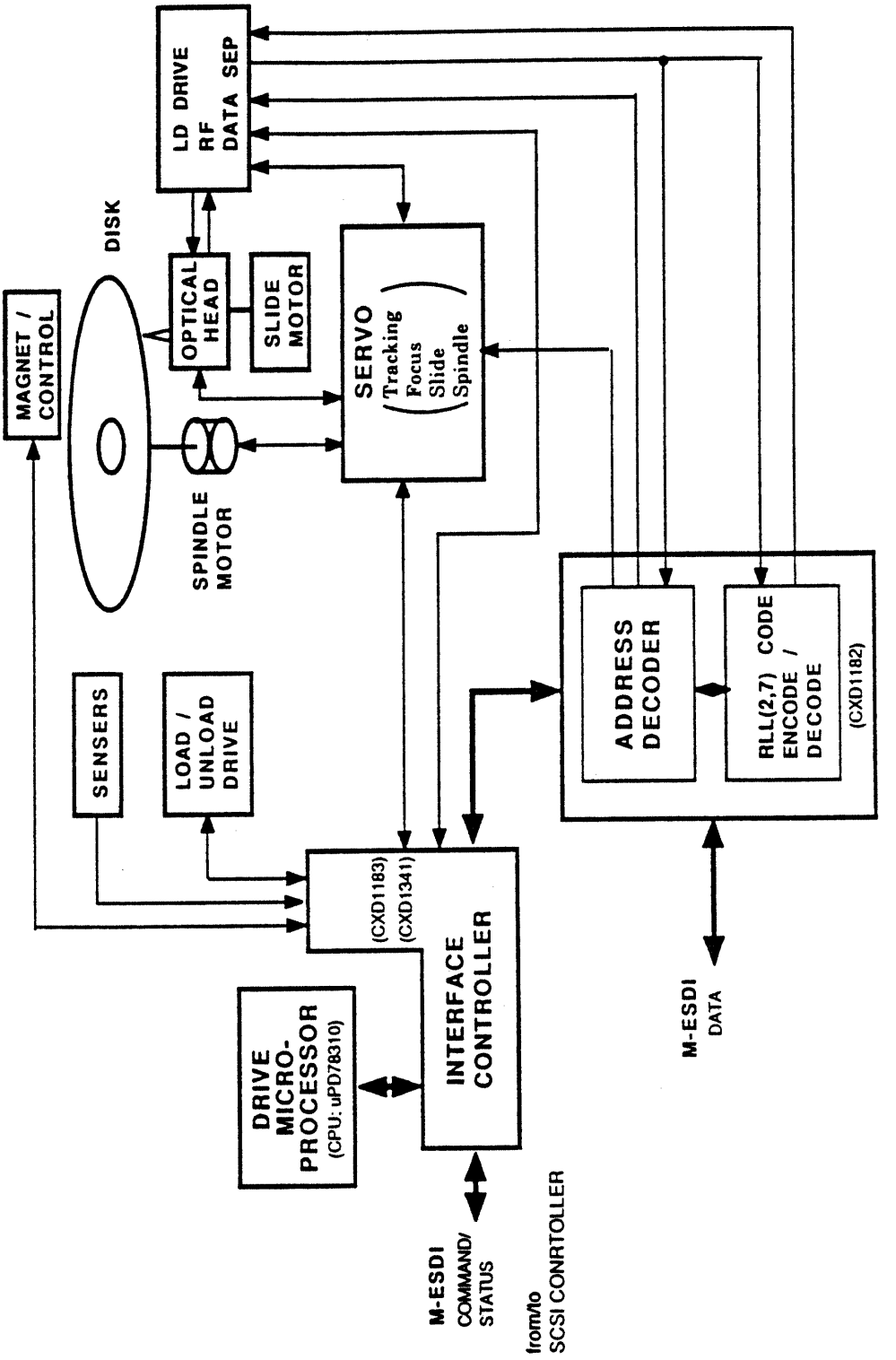


Fig.3.1 : Block diagram of the SMO-D501 MO Disk Drive

3.1 Optical Head

Erasing, writing and reading are performed by a laser diode and photo detectors in the optical head. The laser diode driver and RF/servo pre-amplifiers are built in this optical head.

3.2 Laser Diode Drive Block

This block drives the laser diode at the correct power in each mode for reading, writing and erasing using an Automatic Power Control (APC) circuit. The APC is performed by measuring the writing and erasing power at the ALPC area in the recording format and holding the level.

3.3 Data Separation Block

The read-out signal from the photo-detectors is divided into two different band-width signals for data separation and servo systems. The RF signal is amplified, equalized and differentiated for peak detection of data. The PLO (Phase-Locked Oscillator) generates the phase-locked clock in order to separate the data correctly. The demodulator decodes the (2,7)RLL in accordance with this PLO clock.

3.4 Servo Blocks

The SMO-D501 contains the following four servo blocks.

(1) Spindle Servo
(2) Focus Servo
(3) Tracking Servo
(4) Slide Servo

The Spindle Servo block rotates the MO disk at a constant 2400rpm by a digital frequency-lock servo method using the Frequency Generator (FG) signal.

The Focus Servo block controls a two-axis actuator to focus the laser diode beam on the disk writing surface by an astigmatism focus servo method.

The Tracking Servo block controls a two-axis actuator to follow the track by a DPP (Differential Push-Pull) servo method.

The Slide Servo block drives a slide motor (flat linear motor) to access the designated track when seeking.

3.5 Bias Magnet Control Block

This block flips a bias magnet and senses its polarity to provide an erasing bias magnetic field with opposite polarity to that of writing bias.

3.6 Loading Block

The Loading block consists of a loading motor the switches to load and eject a cartridge.

3.7 MPU Block

The MPU block consists of an MPU (uPD78310), 16K bytes P-ROM and 2K bytes RAM. This block supervises the drive and controls the analog blocks, mechanical blocks and the ESDI. Most of the control lines are transferred via the IOP block. However, part of the servo control signal is connected directly to the MPU. A real time monitor program manages each task of the control.

3.8 IOP Block

The IOP (Input / Output Processor) block provides the control lines to the analog blocks, mechanical blocks and so on. The IOP block also handles the ESDI control handshakes.

3.9 MDA Block

The MDA (Modulator, Demodulator & Address decoder) block performs encoding and decoding the (2,7)RLL and detecting the read address in the ID's of the disk. The encoded channel clock rate is 14.797 MHz at 2400 rpm. The SYNC and RESYNC in the format are encoded in this block. The MDA block provides the laser drive block with the control signals for laser power modes, and provides the RF block with a switch signal for the equalizer.

4. Setting Up

4.1 Locating the Disk Drive

Use the following guideline for selecting a suitable place for the SMO-D501 Magneto-Optical Disk Drive and the Magneto-Optical Disk.

1. Place the SMO-D501 in a well air-conditioned room. The recommended environmental conditions are about 25°C (77°F) temperature and 60% relative humidity. A cooling fan is recommended.

2. Place the SMO-D501 drive horizontally or vertically on a flat plane.

3. Do not place the SMO-D501 and the Magneto Optical Disk where it is dirty or dusty, or where vibration and shock may occur.

4. Do not use the SMO-D501 and the Magneto Optical Disk where there is a strong magnetic field.

5. Do not place the SMO-D501 and the Magneto Optical Disk where it will be exposed to direct sunlight or sudden changes in temperature and humidity from heaters or coolers.

6. Eject the cartridge before the SMO-D501 is moved.

4.2 System Cabling

Connect the ESDI cables to the SMO-C501 MO Disk Controller, and the power cable and the frame ground cable to a power supply unit as shown in the following figure. The SMO-C501 can be connected to one or two SMO-D501 drives.

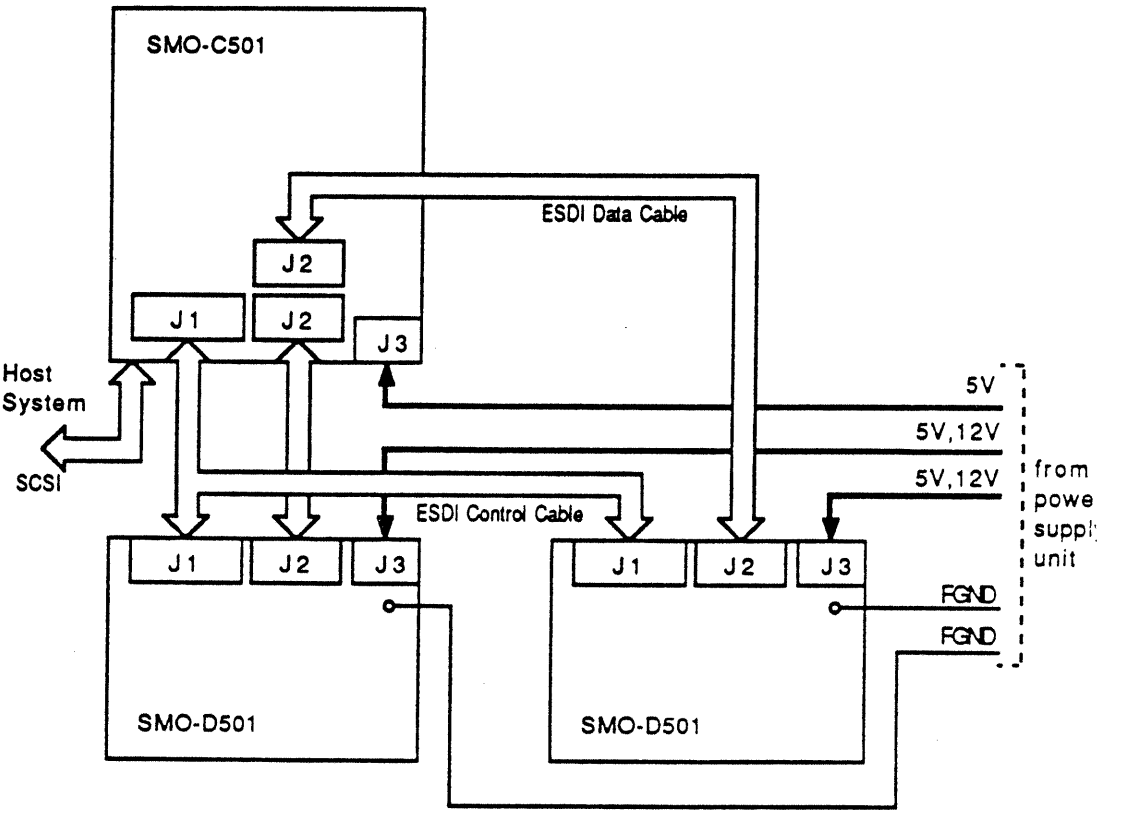


Fig.4.1 : Two Drive System Cabling

Note

- Connect a frame ground cable tightly from a power supply unit to the SMO-D501.

- If you compose the multiple drive system, make sure that the drive number of each SMO-D501 is different from another drive and termination resistor array in the drive which is connected halfway of the cable is removed. See *Chapter 6: Hardware Guide*.

5. Drive Interface Explanation

The drive interface of the SMO-D501 follows the Preliminary ANSI Working Document X3T9.3/87-005 Revision 2.0. But the Sony ESDI specifications has some modifications and vendor unique items to adapt the magneto- optical disk drive to original ESDI specifications. In this chapter, a summary of Sony ESDI specifications is described.

5.1 Physical Interface

5.1.1 Electrical Interface

The Sony ESDI can be divided into the physically separated categories of:

1. Control signals lines
2. Data signals lines
3. DC power lines

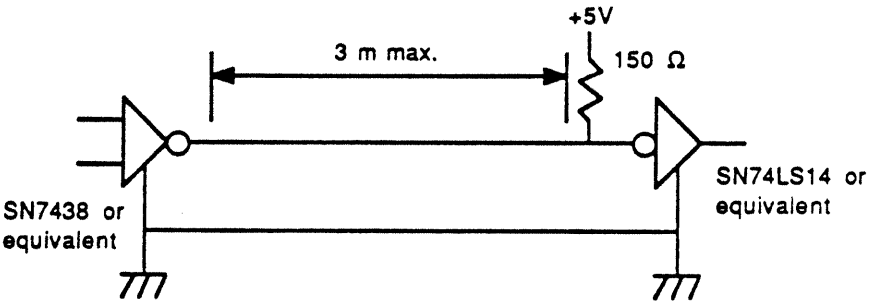
All control lines are digital in nature (open collector TTL) and either provide signals to the drive (input) or signals to the controller (output). The data transfer signals are differential in nature and provide data either to (write) or from (read) the drive.

5.1.2 Control Signal Drivers and Receivers

The drivers and receivers have the following electrical specifications. The recommended circuit is shown in Fig.5.1.

< Open Collector >

Output:	Asserted:	0.0 V-DC to 0.5 V-DC @ I = -48mA
	Negated:	2.5 V-DC to 5.25 V-DC @ I = +250uA
Input:	Asserted:	0.0 V-DC to 0.8 V-DC
	Negated:	2.0 V-DC to 5.25 V-DC



Note : Termination registers for lines originating at the controller are located in the last device. Lines originating at the device are terminated at the controller.

Fig.5.1 : Control Signals Driver/Receiver Combination

5.1.3 Data Line Drivers and Receivers

The data drivers and receivers are differential type. The recommended circuit is shown in Fig.5.2.

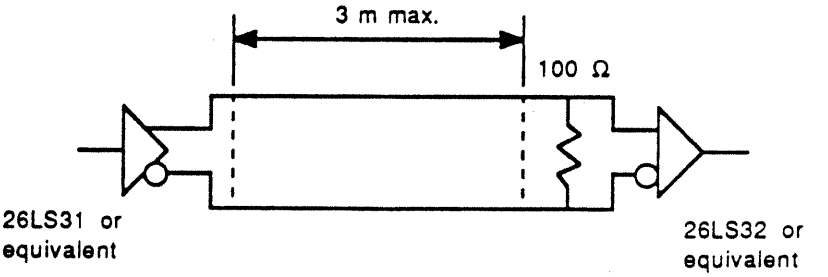


Fig.5.2 : Data Line Driver/Receiver Combination

5.1.4 Connectors

The electrical interface between the SMO-D501 disk drive and the SMO-C501 disk controller is via four connectors:

J1/P1 : Control signals (multiplexed)
J2/P2 : Data signals (radial)
J3/P3 : DC power input
J4/P4 : Frame ground

Specifications of each connector is shown in *Section 6.*

5.2 Signal Lines

5.2.1 Pin Assignments

Pin assignments for the control and data cable are shown in Table 5.1 and Table 5.2. The direction → is Output to the drive and ← is Input to the controller.

Direction	Signal Name	Signal Pin	Ground Pin
→	SPIRAL	2	1
	Reserved	4	3
→	WRITE GATE	6	5
←	CONFIG/STATUS DATA	8	7
←	TRANSFER ACKNOWLEDGE	10	9
←	ATTENTION	12	11
	Reserved	14	13
←	SECTOR	16	15
	Reserved	18	17
←	INDEX	20	19
←	READY	22	21
→	TRANSFER REQUEST	24	23
→	DRIVE SELECT 2(0)	26	25
→	DRIVE SELECT 2(1)	28	27
→	DRIVE SELECT 2(2)	30	29
→	READ GATE	32	31
→	COMMAND DATA	34	33

Cable is Flat Ribbon (3 meters maximum).

Table 5.1 : Control Cable (J1/P1) Pin Assignments

Direction	Signal Name	Signal Pin	Ground Pin
←	DRIVE SELECTED	1	
←	SECTOR	2	
←	COMMAND COMPLETE	3	
	Reserved	4	
	GROUND	5	6
→	+/-WRITE CLOCK	7/8	
	Reserved	9	
←	+/-READ REFERENCE CLOCK	10/11	12
→	+/-NRZ WRITE DATA	13/14	15/16
←	+/-NRZ READ DATA	17/18	19
←	INDEX	20	

Cable is Flat Robbon (3 meters maximum).

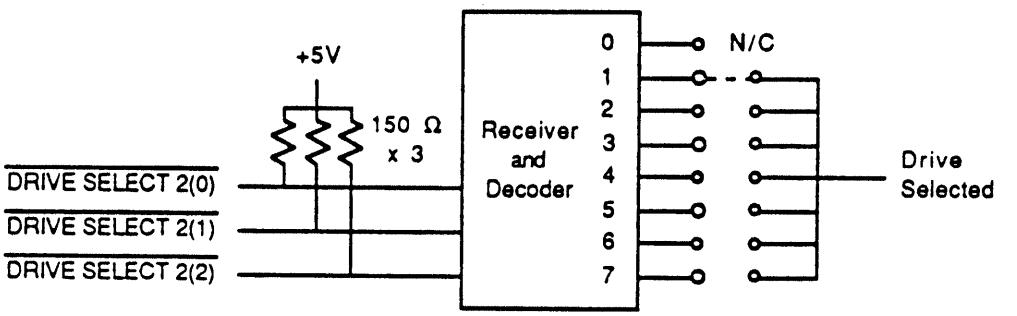
Table 5.2 : Data Cable (J2/P2) Pin Assignments

5.2.2 Control Out Lines

The control out signals are of two types: those to be multiplexed in a multiple drive system and those intended to do the multiplexing. The control signals to be multiplexed are WRITE GATE, READ GATE, SPIRAL, TRANSFER REQ and COMMAND DATA. The signals to do the multiplexing are DRIVE SELECT 2(0), DRIVE SELECT 2(1), DRIVE SELECT 2(2).

5.2.2.1 DRIVE SELECT 2(0),2(1),2(2)

The three DRIVE SELECT lines are to be decoded for drive select. Decode 000 is a no select. See Fig.5.3 and Table 5.3.



Note: Termination resistors are located in last drive only.

Fig.5.3 : Drive Select Termination

Drive Selected	None	1	2	3	4	5	6	7
Drive Select 2(2)	0	0	0	0	1	1	1	1
Drive Select 2(1)	0	0	1	1	0	0	1	1
Drive Select 2(0)	0	1	0	1	0	1	0	1

Table 5.3 : Drive Selection Matrix

5.2.2.2 WRITE GATE

This signal allows data to be recorded on the disk. During the first few bytes at the assertion of this signal, the SMO-D501 adjusts laser power for erase or write operation by using the ALPC area. This line is protected from terminator power loss in the SMO-D501.

5.2.2.3 READ GATE

This signal allows data to be read from the disk. READ GATE should be asserted when passing over a PLO sync field at least the number of bytes defined by the drive prior to the ID or Data Sync Byte. The PLO sync field length is determined by the response to the Request PLO Sync Field Length command. READ GATE is negated when passing over a write splice area.

5.2.2.4 COMMAND DATA

When presenting a command, 16 information bits of serial data plus parity, will be presented on this line. This data is to be controlled by the handshake protocol with signals TRANSFER REQ and TRANSFER ACK. Upon receipt of this serial data, the drive shall perform the required function as specified by the bit configuration. Data is transmitted MSB first. The parity utilized in all commands is odd. No communication should be attempted unless the COMMAND COMPLETE line is asserted just prior to the start of the transfer.

5.2.2.5 TRANSFER REQ

The Transfer Request line functions as a handshake signal in conjunction with TRANSFER ACK during command and configuration/status transfers.

5.2.2.6 SPIRAL

The assertion of this line causes the drive to start spiral operation. This line and the "Spiral On" command is OR-ed in the drive.

This line is a vendor unique control line.

5.2.3 Control In Lines

All control cable input lines are enabled by their respective DRIVE SELECT decodes. All data cable input lines are always enabled.

5.2.3.1 DRIVE SELECTED

A status line is provided at the data cable connector to inform the controller of the selection status of the drive. This signal is asserted only when the drive is selected. See *Section 5.2.2.1*.

5.2.3.2 READY

This signal indicates that the spindle is up to speed. This interface signal when asserted, together with COMMAND COMPLETE indicates that the drive is ready to read, write, erase or seek. When the line is negated, all reading, writing, erasing and seeking is inhibited.

5.2.3.3 CONFIG/STATUS DATA

The drive presents 16 information bits of serial data plus parity on the Configuration/Status Data line upon request from the controller. This config/status serial data is presented to the interface and transferred using the handshake protocol with signals TRANSFER REQ and TRANSFER ACK. Data is transmitted MSB first. The parity utilized is odd.

5.2.3.4 TRANSFER ACK

The Transfer Acknowledge signal functions as a handshake signal along with TRANSFER REQ during COMMAND and CONFIGURATION/STATUS transfer.

5.2.3.5 ATTENTION

ATTENTION is asserted when the drive wants the controller to request its standard status. Generally, this is a result of a fault condition or a change of status. If a selected drive encounters an unexpected condition which cause it to become busy and unable to respond to the controller it shall assert ATTENTION in conjunction with the negation of COMMAND COMPLETE. Writing is inhibited when ATTENTION is asserted. ATTENTION is negated by the Control Command with the Reset Interface Attention modifier set only if the condition which caused it to occur no longer exists.

5.2.3.6 INDEX

This pulse is provided by the drive once each revolution to indicate the beginning of a track. This signal is asserted to indicate INDEX. Only the transition at the leading edge of the asserted pulse is accurately controlled. This signal is available on the control cable (gated) and on the radial data cable (ungated).

5.2.3.7 SECTOR

This signal is provided to indicate the start of a sector. Only the leading edge of the asserted pulse is accurately controlled. This signal is available on the control cable (gated) and on the radial data cable (ungated). The index pulse indicates sector zero.

5.2.3.8 COMMAND COMPLETE

A status line provided at the radial data cable connector. This ungated input to the controller allows the drive's COMMAND COMPLETE status to be monitored during overlapped commands without selecting the drive. This signal is negated in following cases:

During a power up sequence
During entire command sequence from receipt of the 1st Command Data bit
During recovery from internally detected error conditions

5.2.4 DATA TRANSFER LINES

All lines associated with the transfer of data between the drive and the controller are differential in nature and may not be multiplexed. These lines are provided at the radial data cables of each drive. Four pairs of balanced signals are used for the transfer of data and clock: NRZ WRITE DATA, NRZ READ DATA, WRITE CLOCK, and READ/REFERENCE CLOCK.

5.2.4.1 NRZ WRITE DATA

This is a differential pair that defines the data to be written on the disk. This data is clocked by the WRITE CLOCK signal.

5.2.4.2 NRZ READ DATA

The data recovered by reading previously written information is transmitted to the controller via the differential pair of NRZ READ DATA lines. This data is clocked by the READ CLOCK signal. NRZ READ DATA is held at a zero level until PLO sync has been obtained and data is valid.

5.2.4.3 READ/REFERENCE CLOCK

The READ CLOCK signal is provided to clock NRZ READ DATA and is valid when READ GATE is active and PLO Synchronization has been established. The REFERENCE CLOCK signal shall determine the data transfer rate and is valid when READY is asserted and READ GATE is inactive. All transitions between REFERENCE CLOCK and READ CLOCK is performed without glitches.

5.2.4.4 WRITE CLOCK

WRITE CLOCK is provided by the controller and is at the bit data rate. This clock frequency is dictated by the READ/REFERENCE CLOCK during the write operation. WRITE CLOCK should be supplied before beginning a write operation and should last for the duration of the write operation.

5.3. COMMANDS AND RESPONSES

5.3.1 COMMAND STRUCTURE

Each command consists of 17 bits (16 command data + 1 parity) transferred serially. The structure of the command word is defined in Fig.5.4.

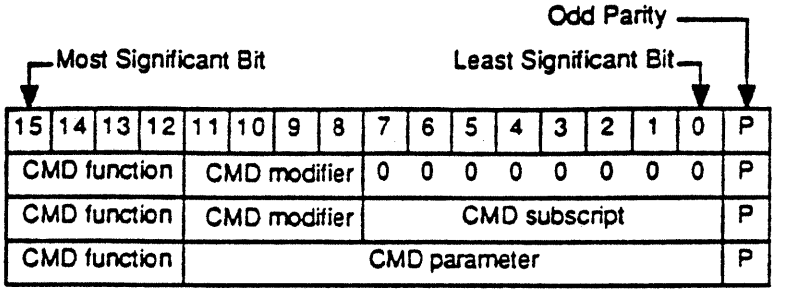


Fig.5.4 : Command Data Word Structure

5.3.2 COMMANDS

Within the commands, all unused or Not Applicable bits are set to zero and any "Reserved" Command Function received is treated as invalid.

Within this document, references to commands and modifiers are by bit e.g. 0011. References to subscripts are made as a value in the range of 0-255 since they are typically encoded e.g., 3.

5.3.2.1 Command Summary

Table 5.4 summarizes the commands supported by SMO-D501.

Optical Disk
Seek
Recalibrate
Request Status
Request Configuration
Reserved
Control
Not Implemented
Not Implemented
Initiate Diagnostics
Reserved
Set High Order Value
Not Implemented
Reserved
Reserved
Set Configuration
Reserved for Linking

Table 5.4 : Summary of Supported Commands of SMO-D501

5.3.2.3 Optical Disk Commands

Table 5.5 summarizes the optical disk commands of SMO-D501.

CMD Fctn Bit 15-12	CMD Function Definition	CMD Modifier Applicable Bits 11-8	CMD Subscript Applicable Bits 7-0	CMD Parameter Applicable Bits 11-0	Status/ Config Data to Ctlr
0000	Seek	No	No	Yes	No
0001	Recalibrate	No	No	No	No
0010	Request Status	Yes	Yes	No	Yes
0011	Request Configuration	Yes	Yes	No	Yes
0100	Reserved	-	-	-	-
0101	Control	Yes	No	No	No
0110	Not Implemented	-	-	-	-
0111	Not Implemented	-	-	-	-
1000	Initiate Diagnostics	No	No	Yes	No
1001	Reserved	-	-	-	-
1010	Set High Order Value	Yes	No	Yes	No
1011	Not Implemented	-	-	-	-
1100	Reserved	-	-	-	-
1101	Reserved	-	-	-	-
1110	Set Configuration	Yes	Yes	No	No
1111	Reserved for Linking	-	-	-	-

Table 5.5 : Optical Disk Command (CMD) Data Definition

5.3.3 RESPONSES AND STATUS

When response or status information is requested by the controller via the proper commands 17 bits (16 data + 1 parity) of information are returned to the controller.

The specific information requested is specified by the command modifier (bits 11-8). The format of the response or status information returned is defined in Fig. 5.5.

All reserved fields returned by the drive are set to zero.

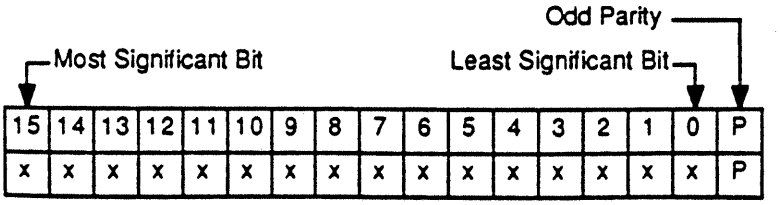


Fig.5.5 : Word Structure of Configuration/Status Data

5.3.4 Seek (0000)

There are two alternative methods to initiate a Seek operation in the drive. Sony SMO-D501 supports both seek operation mode.

5.3.4.1 Seek Absolute

This Seek command causes the drive to begin a seek to the track value contained in bits 11-0 plus the value set by the High Order 4 bits of the High Order Value command (1010).

5.3.4.2 Seek Distance/Direction

This Seek command causes the drive to begin a seek of the distance specified in bits 11-0; plus the high order Value command (1010). See Table 5.19.

5.3.5 RECALIBRATE (0001)

When the drive is in the Seek Absolute mode, the Recalibrate command causes the actuator to return to track zero.

When the drive is in the Seek Distance/Direction mode, this command causes no physical movement.

5.3.6 REQUEST STATUS (0010)

This command causes the drive to send 16 bits of standard or vendor unique status information to the controller as determined by the command modifier bits. The parity utilized in all status responses is odd.

Bits 15-12 does not cause ATTENTION to be asserted. Bits 11-0 are fault or change of status bits that may cause ATTENTION to be asserted each time one is set (see Table 5.6 through Table 5.13).

Command Modifier Bits 11-8	Subs-cript 7-0	Function
0 0 0 0	0	Request Standard Status
	1	Request Extended Standard Status
0 0 0 1		Request Vendor Unique Status
0 0 1 0		Request Vendor Unique Drive Condition #1
0 0 1 1		Request Vendor Unique Drive Condition #2
0 1 0 0		Request Diagnostics Result Status
0 1 0 1 to 0 1 1 1		Reserved
1 0 0 0		Reserved
1 0 0 1		Request Optical Device Status
1 0 1 0		Request Current Track Position
1 0 1 1 to 1 1 0 1		Not Implemented
1 1 1 x		Reserved

Table 5.6 : Request Status Modifier Bit

NOTE: The controller should respond with a Request Status command for any command transfer protocol timeout. Some drives (not Sony SMO-D501) have been built which implement Additional Vendor Unique Status in 8-15. The controller can manage this by requesting as many Vendor Unique status words as reported in the drive's Configuration response.

Δ Request Standard Status: When the command modifier of the Request Status command is 0000, the drive responds with 16 bits of Standard Status. Settings in this status may or may not be fault or change of status bits that cause ATTENTION to be asserted each time one is set.

Δ Request Extended Standard Status: When the command modifier of the Request Status command is 0000 and the subscript is 1, the drive responds with 16 bits of Extended Standard Status. Settings in this status may or may not be fault or change of status conditions that cause ATTENTION to be asserted each time a bit is set.

Δ Request Vendor Unique Status: When the command modifier bits 11-8 of the Request Status command is 0001-0111, the drive responds with Vendor Unique Status (defined in Table 5.9 through Table 5.11). The number of words available is requested using a different command modifier configuration. The command modifier for the first word is 0001 and subsequent words are requested by incrementing the command modifier. Request Diagnostics Result Status is not available in current version.

Δ Request Optical Device Status: When the command modifier of the Request Status command is 1001, the drive responds in accordance with Table 5.12.

Δ Request Current Track Position: When the command modifier of the Request Status command is 1010, the optical drive responds in accordance with Table 5.13.

Δ Request Media Format RO (Read Only): Not supported.

Δ Request Media Format WORM (Write Once Read Multiple): Not supported.

Δ Request Media Format Erasable: Not supported.

If the controller requests a reserved status word by incrementing through the various command modifiers, or if a reserved function is randomly requested, the drive responds with Invalid Command. The number of Vendor Unique Status words available is specified by Configuration Data. Each word of Additional Vendor Unique Status is requested using a different command modifier.

5.3.6.2 Optical Status Response

5.3.6.2.1 Optical Standard Status

There are 16 bits of status information returned to the controller in response to the Request Standard Status command.

Table 5.7 lists the conditions under which the Status Response bits are set and if ATTENTION is asserted.

A Status Response complying with Table 5.7 is returned when the Command Modifier is 0000 and the subscript is 0.

Bit	Status Response	Att
15	Reserved	0
14	1 = Removable Media Not Present	0
13	1 = Write Protected, Removable Media	0
12	1 = Write Protected, Fixed Media	0
11	1 = Spindle is Synchronized (See 7.6.1.1.1)	0
10	1 = Media Type Changed (RO, WORM or Eraseable) *1	1
9	1 = Spindle Motor Stopped by Stop Command	0
	1 = Spindle Motor Stopped For Other (e.g. Power On, Reset)	1
8	1 = Power On Condition (See 7.6.1.1.2)	1
7	1 = Command Data Parity Fault	1
6	1 = Interface Fault	1
5	1 = Invalid or Unimplemented Command Fault	1
4	1 = Seek Fault	1
3	1 = Write Gate with Track Offset Fault	0
2	1 = Vendor Unique Status Not Associated with Error Condition	0
	1 = Vendor Unique Status Available for Error Condition	1
1	1 = Write Fault *2	1
0	1 = Removable Media Changed (has been changed since last status request)	1

*1 The type of media loaded in the drive has changed, as well as the cartridge itself e.g., RO to WORM or differently formatted WORM.

*2 Condition that can cause Write Fault are drive specific error conditions. Sony SMO-D501 supports the following error conditions:

a) Simultaneous assertion of READ GATE and WRITE GATE.

b) WRITE GATE asserted to a write protected media.

c) WRITE GATE asserted while READY is negated.

d) Tracking Fault occurred while WRITE GATE is asserted

Table 5.7 : Optical Disk Standard Status Response Bits

5.3.6.2.2 Optical Extended Status Response

There are 16 bits of status information returned to the controller in response to the Request Standard Status command with a subscript of 1.

Table 5.8 lists the conditions under which the Status Response bits are set and if ATTENTION is asserted.

Bit	Status Response	Att
15	1 = Media Type Not Supported*	1
14	1 = No Active Medium Present	1
13		
	Reserved = 0	0
0		

* The type of media loaded is not supported by the dB

Table 5.8 : Optical Disk Extended Status Response Bits

5.3.6.2.3 Vendor Unique Status

There are four words of Vendor Unique Status information returned to the controller in response to the Request Vendor Unique Status command.

Table 5.9 is returned when the Command Modifier bits are 0001 and lists the condition under which the Status Response bits are set and if ATTENTION is asserted.

Bit	Status Response	Att
15	1 = PEP CRC Error	1
14	1 = PEP Decoded Byte Count Error	1
13	1 = PEP Unexpected GAP / EOD Error	1
12	1 = PEP Syncing Data Error	1
11	1 = PEP Data Capturing Time-out Error	1
10	1 = PEP Searching GAP Time-out Error	1
9	1 = PEP Focus Failure	1
8	1 = PEP Optical Pickup Positioning Error	1
7	1 = Spindle Motor Stopping Failure	1
6	1 = LD Driver IL Failure (AGC Overcurrent)	1
5	1 = LD Read Power Failure (FAPC Underpower)	1
4	1 = LD Erase Power Failure (FAPC Underpower)	1
3	1 = Tracking Overcurrent Failure	1
2	1 = Focus Overcurrent Failure	1
1	1 = Temperature Alarm	1
0	1 = Bias Magnet Failure	1

Table 5.9 : Vendor Unique Status Response Bits

Table 5.10 is returned when the Command Modifier bits are 0010.

Bit	Status Response	Att
15	1 = Seek Condition	0
14	1 = During Read / Write / Erase Condition (Spiral On)	0
13	1 = Spiral Off Condition	0
12	1 = Disk Present Condition	0
11	1 = No Disk Present Condition	0
10	1 = Spiral On Condition	0
9	1 = PEP Reading Condition	0
8	1 = Disk Cartridge is Locked	0
7	1 = Spindle FG Ok	0
6	1 = Focus Servo Ok	0
5	1 = Tracking Servo Ok	0
4	1 = Slide Servo Ok	0
3	1 = Sector Mark Found	0
2	1 = OP Power Supply Relay On	0
1	1 = Still Jump Skip Flag	0
0	1 = Laser Diode is On	0

Table 5.10 : Vendor Unique Drive Status #1 Response Bits

Table 5.11 is returned when the Command Modifier bits are 0011.

Bit	Status Response	Att
15	Cartridge ID Sensor #3	0
14	Cartridge ID Sensor #2	0
13	Cartridge ID Sensor #1	0
12	Cartridge ID Sensor #0	0
11	Reserved = 0	0
10	Reserved = 0	0
9	Reserved = 0	0
8	Write Protected Notch Sensor	0
7	Eject Switch Status	0
6	Focus OK Signal Status	0
5	Reserved = 0	0
4	Reserved = 0	0
3	LD Power Monitor #1	0
2	LD Power Monitor #0	0
1	Tray Position Sensor	0
0	Cartridge In/Out Sensor	0

Table 5.11 : Vendor Unique Drive Status #2 Response Bits

5.3.6.2.3 Optical Device Status

There are two additional status response words (Optical Device Status and Current Track Position) returned to the controller in response to the Request Device Status command.

A Status Response complying with Table 5.12 is returned when the Command Modifier is 1001. Table 5.12 lists the conditions under which the Status Response bits are set and if ATTENTION is asserted.

Bit	Status Response	Att
15	1 = Drive Initialization Failure	1
14	1 = Sensor Failure	1
13	1 = Cartridge Load / Unload Failure	1
12	1 = Spindle Not At Speed Failure	1
11	1 = Focus Failure	1
10	1 = Phase Lock / Tracking Failure	1
9	1 = Tracking Failure	1
8	1 = PLO Failure due to Laser Dying	1
7	1 = Not Track Following	1
6	1 = Not on Correct Track	1
5	1 = Coarse Seek Failure	1
4	1 = Write was Terminated	1
3	1= Eject Request	1
2	MO (MagnetoOptic) - Erase Encoded: 10 = Erase 11 = Transition	x
1	- Write 01 = Write 00 = Off	x
0	Reserved = 0	0

NOTE: The encoded responses are shown with bit 2 first and bit 1 second.

Table 5.12 : Optical Disk Device Status Response Bits

A Status Response complying with Table 5.13 is returned when the Command Modifier bits are 1010. Bits 15-8 define the current Track High order byte and bits 7-0 define the current Track Low order byte. NOTE: A drive which implements the Distance/Direction type of Seek only responds to this status request with an Invalid Command Fault.

Bit	Status Response	Att
15	Current Track High Order Byte - MSB	0
14		0
13		0
12		0
11		0
10		0
9		0
8	Current Track High Order Byte - LSB	0
7	Current Track Low Order Byte -MSB	0
6		0
5		0
4		0
3		0
2		0
1		0
0	Current Track Low Order Byte - LSB	0

Table 5.13 : Optical Disk Current Track Status Response

5.3.7 REQUEST CONFIGURATION (0011)

5.3.7.2 Optical

The specific configuration requested is specified by command modifier bits 11-8 and possibly the subscript.

5.3.7.2.1 General Configuration Response Bits

If the command modifier bits 11-8 are set to 0000 the general configuration status information shown in Table 5.14 is returned as shown for the subscript used.

Command Modifier Bits 11-8	Subs-cript 7-0	Configuration Response	
0 0 0 0	0	General Configuration of Drive and Format	Bit
		1 = Not Magnetic Disk	15
		1 = Optical Disk that can accept Eraseable Media	14
		1 = Optical Disk that can accept WORM Media	13
		1 = Optical Disk that can accept Read Only Media	12
		Reserved = 0	11-8
		1 = Removable Cartridge Drive	7
		Reserved =0	6
		1 = Spindle Motor Option Implemented	5
		1 = Head Switch Time	4
		1 = Not NRZ	3
		Reserved = 0	2
		1 = Hard Sectored	1
		1 = Subscripting Supported	0
0 0 0 0	1	General Configuration of Drive and Format	Bit
		1 = Synchronized Spindles supported	15
		1 = High Speed Data Port	14
		1 = Notched Drive with Equal Zones *	13
		1 = Notched Drive with Unequal Zone Sizes	12
		1 = Notched Drive Capable of Non-notched operation	11
		Seek Alternative Encode 1 '00' = Absolute Seek	10
		Seek Alternative Encode 0 '01' = Distance / Direction	9
		'10' = Absolute and D / D	
		'11' = Reserved	
		1 = Erasure Pointers Supported	8
		Reserved = 0	7
		1 = Defective Sector Identification Supported	6
		Reserved = 0	5
		1 = World Wide ID Implemented	4
		Reserved = 0	3
		1 = Post Field Option Available	2
		Reserved = 0	1
		1 = DRDW (Direct Read During Write)	0
0 0 0 0	x	Values for Configuration of Drive and Format	
	8	Transfer Rate in Kilohertz (rounded)	
	9	Rotational Speed (RPM)	
	10-13	Reserved	
	14-16	Not supporeted	

* The first and last zones may not be the same value as all the others

Table 5.14 : Optical Disk General Configuration Response Bits

5.3.7.2.2 Specific Configuration Response

If command modifier bits 0001-1111 are used, the specific configuration information shown in Table 5.15 is returned for each Request Configuration command with those modifiers.

Command Modifier Bits 11-8	Configuration Response
0 0 0 1	Number of Cylinders on Fixed Media
0 0 1 0	Number of Tracks per Surface
0 0 1 1	Number of Heads Bits15 - 8 Removable Drive Heads Bits 7 - 0 Fixed Heads
0 1 0 0	Number of Recording Bytes per track
0 1 0 1	Number of Recording Bytes per Sector
0 1 1 0	Number of Sectors per Track Bits 15 - 8 Reserved =0 Bits 7 - 0 Sectors per Track
0 1 1 1	Minimum Bytes in ISG Field Bits 15 - 8 Reserved =0 Bits 7 - 0 Bytes per ISG
1 0 0 0	Minimum Bytes per PLO Sync Field Bits 15 - 8 Reserved =0 Bits 7 - 0 Bytes per PLO Sync Field required when READ GATE is asserted
1 0 0 1	Number of Words Available Bits 15 - 8 Number of Extended Status Word Bits 7 - 0 Number of Vendor Unique Status Words
1 0 1 0	Header Address Information Bits 15 - 8 Format Type (x'01' = ESDI Synthesized Header) (x'02' = ESDI Raw Header) Bits 7 - 0 Size of Header Address Field
1 0 1 1	Pre-Recorded Data Pointer Bits 15 - 8 MSB of Track Address *1 Bits 7 - 0 LSB of Track Address *1
1 1 0 0	Sync Pattern Bits 15 - 8 Number of Bytes in Pattern Bits 7 - 0 Least Significant or only Byte of Pattern
1 1 0 1	Recording Pattern Bits 15 - 8 Number of Bytes in Pattern Bits 7 - 0 Least Significant or only Byte of Pattern
1 1 1 0	Number of Sectors per Track in Concentric Operation *2
1 1 1 1	Vendor Identification Vendor Id - Extended Information (See 7.7.4.2)

*1 Sony SMO-D501 doesn't support Erasure Pointer, so both bytes are set to x'FFFF'

*2 If not equal to value in 0110 then media has spiral tracks

Table 5.15 : Optical Disk Specific Configuration Response Bits

5.3.7.4 Vendor Identification Response

5.3.7.4.1 Standard Vendor Information

If a subscript of 0 was issued in the command, bits 15-8 return a binary value which identifies the vendor and bits 7-0 identify the vendor model, revision and any other information the vendor wishes to provide. In current version, x'0000' is returned.

5.3.7.4.2 Extended Vendor Information

If command modifier bits 0001-1111 are used, the extended vendor unique information shown in Table 5.16 is returned for each Request Configuration command with those subscripts.

Command Modifier Bits 11-8	Subs-cript 7-0	Extended Vendor Information
1 1 1 1	0	Vendor Identification (See Table 7-17A)
	1	Product Name (ASCII)
	2	Drive Control Program Revision (trunk)
	3	Drive Control Program Revision (branch)
	4	Drive DIP SW Configuration
	5	Software SW Configuration

* This command returns 2-byte ASCII codes in each time. The delimiter is '\0'.

** The upper byte is major and the lower is minor version number.

Table 5.16 Extended Vendor Information

5.3.9 CONTROL (0101)

5.3.9.2 Optical

This command causes the control operations specified by the command modifier to be performed as shown in Table 5.17

Command Modifier Bits 11-8	Subs-cript 7-0	Function
0 0 0 0	0	Reset Interface Attention, Standard Status and Standard Optical Status (Bits 0 - 11)
0 0 0 1	0	Reserved
0 0 1 0	0	Stop Spindle Motor
0 0 1 1	0	Start Spindle Motor
0 1 0 0	0	Lock Cartridge
0 1 0 1	0	Unlock Cartridge
0 1 1 0	0	Eject Cartridge
0 1 1 1	0	Not Implemented
1 0 0 0	0	Not Implemented
	1	Magnet Control (MO) - Write & Read
	2	- Erase
1 0 0 1	0	
to		Reserved
1 0 1 0	0	
1 0 1 1	0	Select PLL - MO mode
	1	- ROM mode
1 1 0 0	0	Spiral Operation Off
1 1 0 1	0	Spiral Operation On
1 1 1 x	0	Reserved

Table 5.17 : Optical Disk Control Modifier Bits

5.3.12 INITIATE DIAGNOSTICS (1000)

This command causes the drive to perform internal diagnostics. COMMAND COMPLETE indicates the completion of the diagnostics. ATTENTION with COMMAND COMPLETE indicates that a fault was encountered and status should be requested to determine the proper course of action.

The command modifier bits are set to zero to perform the standard diagnostics. Alternatively, these bits are used by the device to invoke alternate vendor diagnostics. See Table 5.18.

The alternative diagnostic routines are numbered in order beginning with x'01', and command reject issued when any unimplemented routines are requested. If the alternate diagnostics are not supported by the device then the command modifier bits are ignored.

The diagnostic parameter bits are used to modify the routine per vendor specifications, but all routines execute when a default value of zero is present.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	P
CMD function				Diagnostic No.				Diagnostic Parameter								x

Table 5.18 : Diagnostic Parameter Bits

5.3.14 SET HIGH ORDER VALUE (1010)

This command is issued to set the high order 4 bits of command which is limited the 12 bit address that can be defined in a single command.

5.3.14.1 Unformatted Bytes/Sector

Not supported.

5.3.14.2 Seek Absolute Address

If the high order value in the seek address has changed since the previous seek was executed and the command modifier is set to 0000 this command defines the value of the upper four bits of the seek distance in bits 3-0. This command is issued prior to the Seek command (0000), which is used to set the low order 12 bits, and the characteristics of that command apply to this also.

COMMAND COMPLETE is asserted when the high order seek address is valid, has been accepted, and the drive is ready to execute the next command. If the address is invalid e.g., out of range, ATTENTION is asserted in conjunction with COMMAND COMPLETE.

5.3.14.3 Seek Distance/Direction

If the command modifier is set to 0001 or 0010 this command defines the value of the upper four bits of the seek distance in bits 3-0. This command is issued prior to the Seek command (0000) if the high order distance value has changed, or if the direction has changed, since the previous seek was executed.

COMMAND COMPLETE is asserted when the high order seek distance is valid, has been accepted, and the drive is ready to execute the next command. If the seek distance is invalid e.g., out of range, ATTENTION is asserted in conjunction with COMMAND COMPLETE.

Command Modifier Bits 11-8	Function
0 0 0 0	Absolute Seek Address
0 0 0 1	Direction towards Track Minimum
0 0 1 0	Direction towards Track Maximum
0 0 1 1	Reserved
0 1 0 0	Not Implemented
0 1 0 1 to 1 1 1 1	Reserved

Table 5.19 : Set High Order Value Modifiers

5.3.18 SET CONFIGURATION (1110)

The Soft Switch Number provides up to 16 identification values and the Soft Switch Parameter is a modifier. See Table 5.20.

5.3.18.1 Synchronized Drives

Not supported.

5.3.18.2 Notched Drives

Not supported.

5.3.18.3 Soft Switches

Soft Switch modifiers are available for the vendor to use as a method of defining configuration information. The implementation of this feature provides users the advantage of reduced installation effort and vendors the advantage of being able to set up automatic testing procedures for different drive configurations.

As an example of the way in which this command is used by a vendor, the dip switches are numbered and parameter used to identify how the switches are to be set (1=On, 0=Off). This command then overrides any physical position to which the switches are set.

It is recommended that the device be capable of retaining the switch configuration information between power cycles.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	P
CMD function				Switch No.				Switch Parameter								x
1	1	1	0	0	0	0	0	Drive Configuration DIP SW								
				0	0	0	1	Software SW Configuration								
				0	0	1	0									
				to				Vendor Unique (Reserved)								
				0	1	1	1									
				1	0	0	0									
				to				Reserved								
				1	0	1	1									
				1	1	0	0	Not Implemented								
				1	1	0	1	Not Implemented								
				1	1	1	0	Reserved								
				1	1	1	1	Reserved								

Table 5.20 : Set Configuration Parameter Value

5.3.18.3 1 Drive Configuration DIP Switch

This command overrides the Drive DIP SW (on the DCN board) settings. Drive Configuration SW is as follows.

5.3.18.3.2 Software Switch

This switch has no physical setting. In Power On Condition, it is set to all 0 (Off). In current version, this switch should be set to zero.

5.3.19 Reserved for LINKING (1111)

In the event that any expansion of the command set is required in future revisions of the ESDI standard, this command is reserved for LINKING. The LINKING command would cause the drive to accept 17 additional bits of information before performing a designated function.

6. Hardware Guide

6.1 Front Panel

The SMO-D501 has a BUSY indicator, EJECT button and emergency eject hole. They are located on the front panel of the disk drive as shown in Fig.6.1.

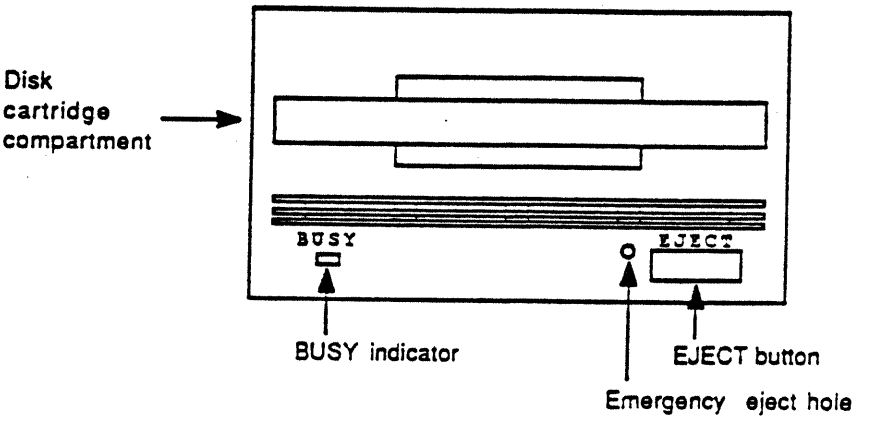


Fig.6.1 : Front View of SMO-D501

6.1.1 BUSY Indicator

Lights up when read, write, erase or seek operation is performed.

6.1.2 EJECT button

Press to eject the disk cartridge inserted in the disk drive. But the disk cartridge will be not ejected by pressing this button if "Lock Cartridge" command had been issued from the disk controller.

6.1.3 Emergency Eject Hole

In an emergency such as when a fault has occurred in the disk drive, insert a straightened paper clip or similar small object and push. This ejects the disk cartridge if all else fails.

6.2 Rear Panel

The SMO-D501 has two PCB edge connectors for the drive interface signals, a header connector for the power supply and a DIP switch. They are located on the rear panel of the disk drive as shown in Fig.6.2.

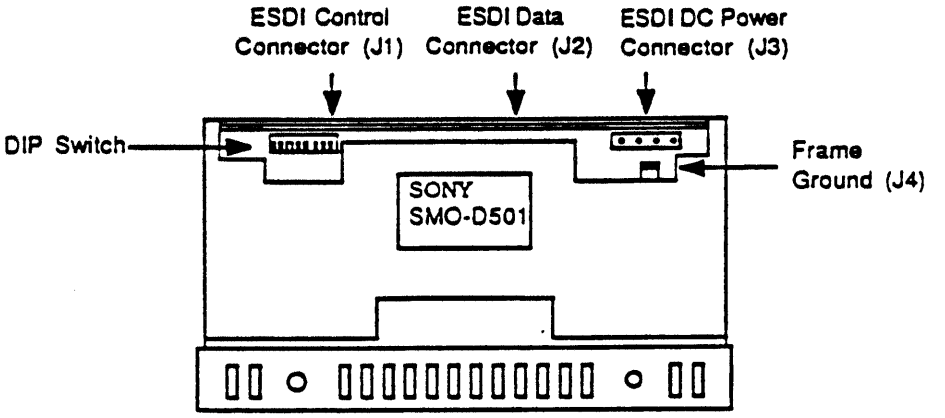


Fig.6.2 : Rear View of SMO-D501

6.2.1 Drive Number Switch

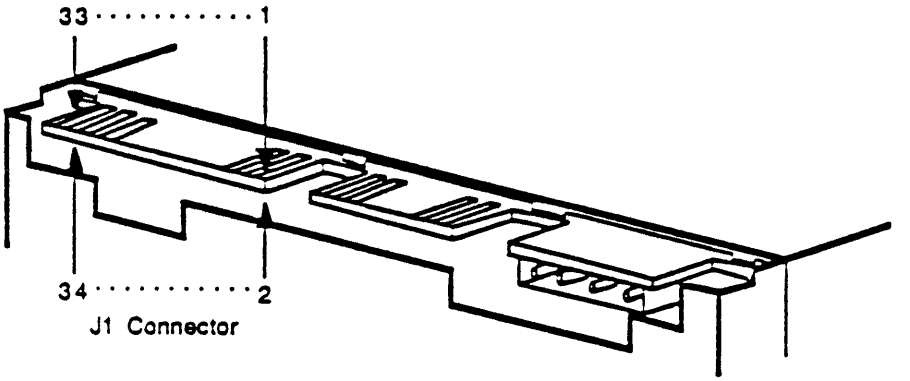
The DIP switch located under the upper circuit board is for setting the ESDI drive number and changing the operational configuration of the drive unit. The settings and corresponding configurations are shown in Table 6.1.

Switch Number	Function	Description	Factory Setting
1	Loading Control Mode	OFF: Loading Mecha. ON: No Loading Mecha.	OFF
2	Eject Mode	OFF: by EJECT BUTTON ON by Controller	OFF
3	Temporary Mode (1024/512 Mode)	OFF: 1024 bytes/sector disk ON: 512 bytes/sector disk	OFF
4	Terminator On/Off (Last Drive or Not)	OFF: Not Terminated ON: Terminated	ON
5	Auto Spin Up Mode	OFF: by Drive Unit ON: by Controller	ON
6	Drive Number (MSB)	OFF: 0 ON: 4 (2^2)	OFF
7	Drive Number	OFF: 0 ON: 2 (2^1)	OFF
8	Drive Number (LSB)	OFF: 0 ON: 1 (2^0)	ON

Table 6.1 : Settings of the DIP switch

6.2.3 ESDI Control Connector (J1)

The 34 pin PCB edge connector is for connecting the multiplexed ESDI control signal lines with the controller. The pins are numbered 1 through 34 with the odd pins located on the upper side of the PCB. The pin assignments of the connector are shown in Fig.6.3.

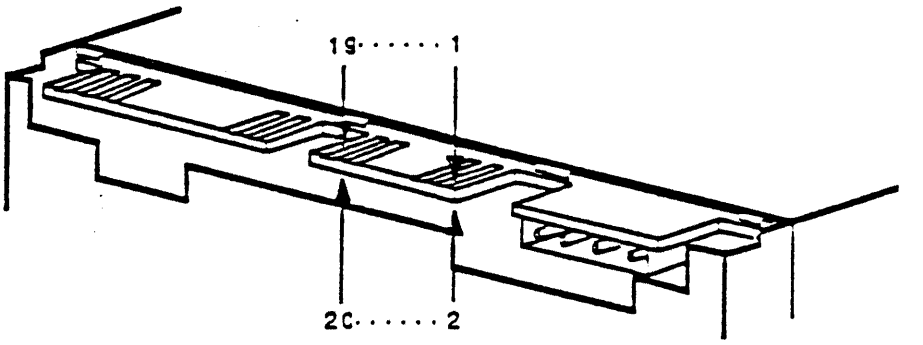


Signal Name	Pin No.		Signal Name
GND	1	2	$\overline{\text{SPIRAL}}$
GND	3	4	Reserved
GND	5	6	$\overline{\text{WRITE GATE}}$
GND	7	8	$\overline{\text{CONFIG/STATUS}}$
GND	9	10	$\overline{\text{TRANSFER ACK}}$
GND	11	12	$\overline{\text{ATTENTION}}$
GND	13	14	Reserved
GND	15	16	$\overline{\text{SECTOR}}$
GND	17	18	Reserved
GND	19	20	$\overline{\text{INDEX}}$
GND	21	22	$\overline{\text{READY}}$
GND	23	24	$\overline{\text{TRANSFER ACK}}$
GND	25	26	$\overline{\text{DRIVE SELECT 2(0)}}$
GND	27	28	$\overline{\text{DRIVE SELECT 2(1)}}$
GND	29	30	$\overline{\text{DRIVE SELECT 2(2)}}$
GND	31	32	$\overline{\text{READ GATE}}$
GND	33	34	$\overline{\text{COMMAND DATA}}$

Fig.6.3 : Pin Assignments of ESDI Control Connector (J1)

6.2.4 ESDI Data Connector (J2)

The 20 pin PCB edge connector is for connecting the radial ESDI data signal lines with the controller. The pins are numbered 1 through 20 with the odd pins located on the upper side of the PCB. The pin assignments of the connector are shown in Fig.6.4.



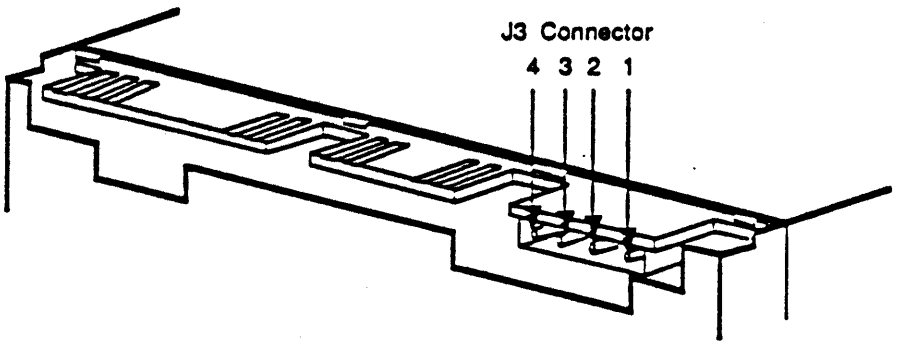
J2 Connector

Signal Name	Pin No.		Signal Name
$\overline{\text{DRIVE SELECTED}}$	1	2	$\overline{\text{SECTOR}}$
$\overline{\text{COMMAND COMPLETE}}$	3	4	Reserved
GND	5	6	GND
+ WRITE CLOCK	7	8	- WRITE CLOCK
GND	9	10	+ READ REF. CLOCK
- READ REF. CLOCK	11	12	GND
+ NRZ WRITE DATA	13	14	- NRZ WRITE DATA
GND	15	16	GND
+ NRZ READ DATA	17	18	- NRZ READ DATA
GND	19	20	$\overline{\text{INDEX}}$

Fig.6.4 : Pin Assignments of ESDI Data Connector (J2)

2.5 ESDI DC Power Connector (J3)

e 4 pin header connector is for DC voltage power supply. The pin are numbered 1 through rom right side. The pins assignments of the connector are shown in Fig.6.5.



Pin No.	Voltage
1	+12 V DC ±5%
2	12V Return
3	5V Return
4	+5V DC ±5%

Fig.6.5 : Pin Assignments of DC Power Connector (J3)