

**SONY**

***SMO-F551-SD***

***Magneto-Optical  
Disk Drive***

---

**Version 1.0**

**Technical Guide and  
Specifications**

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# Safety Regulations

## Owner's Record

The model and serial numbers are located on the top of the drive. Record these numbers in the spaces provided below. Refer to them whenever you call upon your sales representative regarding this product.

Model No. SMO-F551-SD      Serial No. \_\_\_\_\_

## Information

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment.

Note: This equipment generates, uses and can radiate radio frequency energy and may cause harmful interference to radio communications in spite of a particular installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try correct the interference by one more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.




## WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

To avoid electrical shock, do not open the cabinet.  
Refer servicing to qualified personnel only.

## CAUTION

As the laser beam used in the SMO-F551 is harmful to the eyes, do not attempt to disassemble the unit. Refer servicing to qualified personnel only.

DC INPUT 12V±5% GND 5V±5%	SCSI CONNECTOR 1 PIN	FUNCTIONAL SWITCH ID SELECT 0 1 2													
<b>SONY®</b> MODEL NO. SMO-F551 MO DISK DRIVE -SD															
CE   SERIAL NO. 300001 MADE IN JAPAN	5V == 12V == 	<b>CERTIFICATION</b> PRODUCT COMPLIES WITH DHHS RULES 21 CFR SUBCHAPTER J APPLICABLE AT DATE OF MANUFACTURE. SONY CORPORATION 7-35 KITASHINAGAWA6-CHOME, SHINAGAWA-KU, TOKYO 141, JAPAN MANUFACTURED : ASCO TOGANE, JAPAN MAY 1998 VERSION F551:11 AAAAA													
This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe Best conforme à la norme NMB-003 du Canada.		<b>CLASS 1 LASER PRODUCT</b> <b>LASER KLASSE 1 PRODUKT</b>													
<table border="1"> <tr> <td>DANGER</td> <td>LASER RADIATION WHEN OPEN. AVOID DIRECT EXPOSURE TO BEAM.</td> </tr> <tr> <td>DANGER</td> <td>RADIATIONS DU LASER EN CAS D'OUVERTURE. EVITER TOUTE EXPOSITION DIRECTE AU FAISCEAU.</td> </tr> <tr> <td>VORSICHT</td> <td>LASERSTRAHLUNG, WENN ABDECKUNG GEÖFFNET. NICHT DEM STRAHL AUSSETZEN.</td> </tr> <tr> <td>ADVARSEL</td> <td>LASERSTRÅLING VED ÅBNING, UNNGÅ UDSÆTTELSE FOR STRÅLING.</td> </tr> <tr> <td>ADVARSEL</td> <td>LASERSTRÅLING NÄR DEKSEL ÅPNES, UNNGÅ EKSPONERING FÖR STRÅLEN.</td> </tr> <tr> <td>VARNING</td> <td>LASERSTRÅLNING NÄR DENNA DEL ÄR ÖPPNAD, STRÅLEN ÄR FARLIG.</td> </tr> <tr> <td>VARO!</td> <td>AVATTAESSA OLET ALTTIINA LASERSÄTEILYLLE, ÄLÄ KATSO SÄTEESSEN.</td> </tr> </table>			DANGER	LASER RADIATION WHEN OPEN. AVOID DIRECT EXPOSURE TO BEAM.	DANGER	RADIATIONS DU LASER EN CAS D'OUVERTURE. EVITER TOUTE EXPOSITION DIRECTE AU FAISCEAU.	VORSICHT	LASERSTRAHLUNG, WENN ABDECKUNG GEÖFFNET. NICHT DEM STRAHL AUSSETZEN.	ADVARSEL	LASERSTRÅLING VED ÅBNING, UNNGÅ UDSÆTTELSE FOR STRÅLING.	ADVARSEL	LASERSTRÅLING NÄR DEKSEL ÅPNES, UNNGÅ EKSPONERING FÖR STRÅLEN.	VARNING	LASERSTRÅLNING NÄR DENNA DEL ÄR ÖPPNAD, STRÅLEN ÄR FARLIG.	VARO!
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4-637-964-02															

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VARO!	AVATTAESSA OLET ALTTIINA LASERSÄTEILYLLE, ÄLÄ KATSO SÄTEESEN.

This label is affixed both on the top cover and, internally, on the cartridge tray of this unit.

**CLASS 1**  
**LASER PRODUCT**  


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**LASER KLASSE 1**  
**PRODUKT**

4-631-572-01

This MO disk unit is classified as a CLASS 1 LASER PRODUCT.

The CLASS 1 LASER PRODUCT label is located at the top cover of the unit.

이 기기는 가정용으로 전자파 적합등록을 한 기기로서  
주거지역에서는 물론 모든 지역에서 사용할 수 있습니다.

0-258-157-01

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## **Version 1.0 (July, 1999)**

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## References

- SMO-F551 series SCSI Specifications
- ANSI-X3.131-1994: Small Computer System Interface-2 (SCSI-2)
- ISO/IEC 15286-1999 : Information Technology - 130 mm Optical Disk Cartridges - Capacity: 5.2 Gbytes per Cartridge - For Information Interchange
- ISO/IEC 14517-1997 : Information Technology - 130 mm Optical Disk Cartridges - Capacity: 2.6 Gbytes per Cartridge - For Information Interchange
- ISO/IEC 13549-1994 : Data Interchange on 130 mm Optical Disk Cartridges - Capacity: 1.3 Gbytes per Cartridge -
- ISO/IEC 10089-1991 Format A : 130 mm rewritable Optical Disk Cartridges for Information Interchange.
- ISO/IEC 11560-1992 : 130 mm Write Once Optical Disk Cartridges for Information Interchange - Capacity 650Mega-bytes per Cartridge -

## Printing History

July 1, 1999

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# Using This Guide

This guide contains information on Sony SMO-F551-SD Magneto-Optical Disk Drive.

This guide is divided into the following sections.

## ■ Chapter 1. INTRODUCTION

This chapter provides a general overview of the drive, touching upon its features.

## ■ Chapter 2. INSTALLATION

This chapter explains how to set the functions and SCSI ID address.

## ■ Chapter 3. PRECAUTIONS

This chapter lists precautions regarding the operation of the drive and the disk cartridges. It also explains the proper cleaning method of the disk cartridges.

## ■ Chapter 4. SPECIFICATIONS

This chapter provides performance data, environmental, electrical, and physical specifications.

## ■ Chapter 5. SYSTEM CONFIGURATION

This chapter contains detailed descriptions on the drive's subassemblies.

## ■ Chapter 6. HOST INTERFACE

This chapter provides information on the host interface signal lines, diagnostics and SCSI command summary.

## ■ Chapter 7. BUSY INDICATOR

This chapter provides information on the BUSY indicator notification.

## ■ APPENDIX

The appendix contains mechanical dimensions.

# Chapter 1. INTRODUCTION

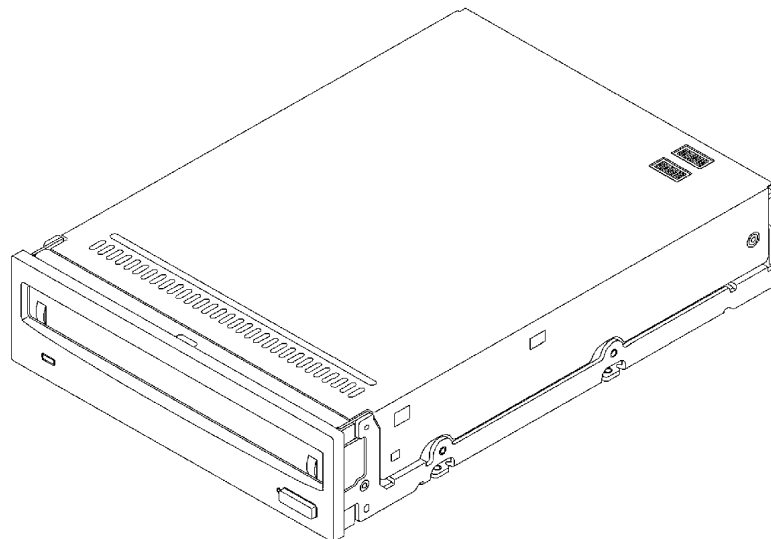
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## Product Brief

The Sony SMO-F551-SD is a 5.2 Gbytes 5 1/4 inch (130mm) multi-function optical disk drive in a half height form factor. It is compatible with ISO standard 5.2 Gbytes optical disk cartridge. The drive also maintains backward compatibility with ISO 2.6 Gbytes, 1.3 Gbytes and 650 Mbytes cartridges. Write-Once type media can be used as well as rewritable media. The related international standards are listed below.

ISO/IEC 15286 -1999	5.2GB/4.8GB/4.1GB Rewritable and Write-Once Cartridge
ISO/IEC 14517 -1997	2.6GB/2.3GB Rewritable and Write-Once Cartridge
ISO/IEC 13549 -1994	1.3GB/1.2GB Rewritable and Write-Once Cartridge
ISO/IEC 10089 -1991	650MB/594MB Rewritable Cartridge (Format A)
ISO/IEC 11560 -1992	650MB/594MB Write-Once Cartridge

High power 685 nm wave length laser diode, mark edge recording technology and Run Length Limited coding known as RLL(1,7) achieve 5.2 Gbytes capacity within the 5 1/4 inch form factor.



**Fig. 1.1 : SMO-F551-SD MO Disk Drive**

The drive spins the media at 3,300 min<sup>-1</sup> (rpm). This provides sustained read transfer rates of up to 5.07 MB/s with 5.2 Gbytes media.

The drive is attached to the host computer through its single ended SCSI-2 interface.

## Compatible Media

SMO-F551-SD is compatible with the following 5 1/4 inch (130 mm) Magneto Optical Disks.

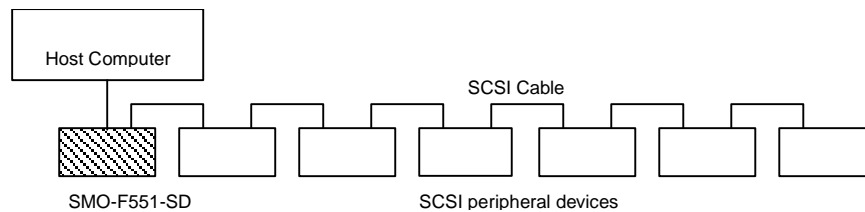
Compatibility		Type	Description	ISO Standard
Read	Write			
o	o	8X R/W	5.2GB 2048 bytes/sector	ISO/IEC 15286
o	o	8X R/W	4.8GB 1024 bytes/sector	
o	o	8X R/W	4.1GB 512 bytes/sector	
o	o	8X WO	5.2GB 2048 bytes/sector	
o	o	8X WO	4.8GB 1024 bytes/sector	
o	o	8X WO	4.1GB 512 bytes/sector	
o	o	4X R/W	2.6GB 1024 bytes/sector	ISO/IEC 14517
o	o	4X R/W	2.3GB 512 bytes/sector	
o	o	4X WO	2.6GB 1024 bytes/sector	
o	o	4X WO	2.3GB 512 bytes/sector	
o	o	4X DOW	2.6GB 1024 bytes/sector	
o	o	4X DOW	2.3GB 512 bytes/sector	
o	o	2X R/W	1.3GB 1024 bytes/sector	ISO/IEC 13549
o	o	2X R/W	1.2GB 512 bytes/sector	
o	o	2X WO	1.3GB 1024 bytes/sector	
o	o	2X WO	1.2GB 512 bytes/sector	
o	o	1X R/W	650MB 1024 bytes/sector	ISO/IEC 10089
o	o	1X R/W	594MB 512 bytes/sector	
o	o	1X WO	650MB 1024 bytes/sector	ISO/IEC 11560
o	o	1X WO	594MB 512 bytes/sector	

W/R : Rewritable, WO : Write-Once, DOW : Direct Overwrite

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## System Configuration

SMO-F551-SD is connected to a host computer through its SCSI interface. The maximum of seven peripheral devices can be linked as a daisy chain on the SCSI bus.



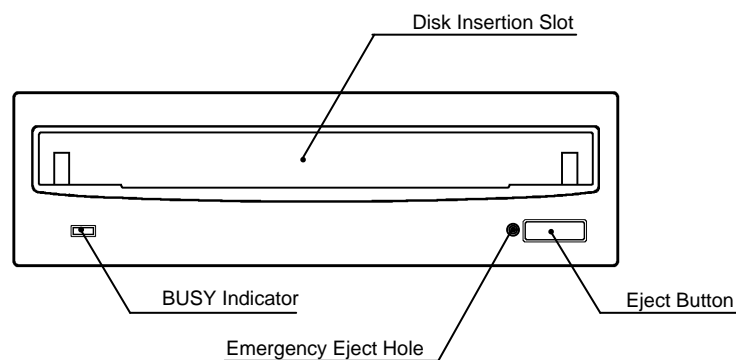
**Fig. 1.2 : System Configuration Example**

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## Location and Function of Parts

This section provides a general description of the SMO-F551-SD Magneto-Optical disk drive.

### Front Panel



**Fig. 1.3 : Front View**

#### ■ Disk Insertion Slot

Insert the disk cartridge into this slot.

## ■ BUSY Indicator

The indicator turns from green to amber while the drive is reading or writing data. Do not eject the disk cartridge when this indicator is amber. Refer to Chapter 7. BUSY INDICATOR.

## ■ Emergency Eject Hole

If a disk cartridge cannot be ejected using the eject button or SCSI command, turn off the power and insert the emergency eject tool(sold separately) or other similar object, such as a straightened paper clip into the emergency eject hole.

## ■ Eject Button

Press this button to eject the disk cartridge from the drive. The drive suspends the ejection of disk cartridge while executing a SCSI command or while holding data to be flushed from its cache buffer.

Manual eject by this eject button can be disabled by the functional switch or software settings.

## Rear Panel

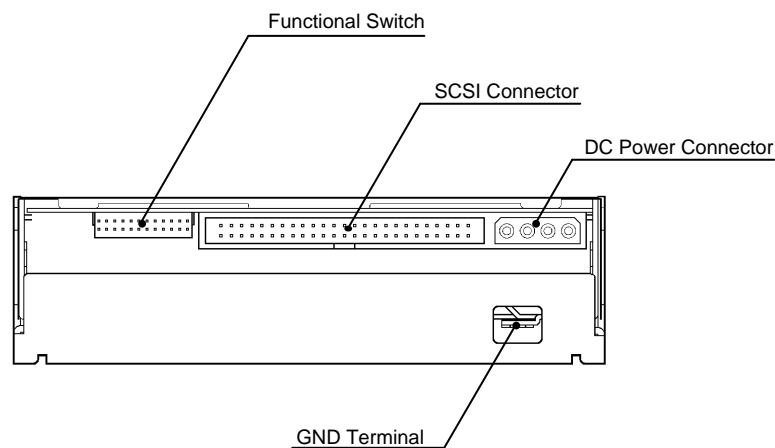


Fig. 1.4 : Rear View

## ■ Functional Switch

A 24 pin header socket jumper block is used for setting the SCSI ID and other drive configurations. Refer to section "Functional Switch Settings" for more information.

## ■ SCSI and DC Power Connector

A combination 50-pin SCSI and 4-pin power connector is used to connect a standard SCSI cable as well as +12V and +5V power line. Refer to Chapter 2., "SCSI and DC Power Connector" section for more information.

## ■ GND Terminal

This is the ground terminal of the drive.

## Top Panel

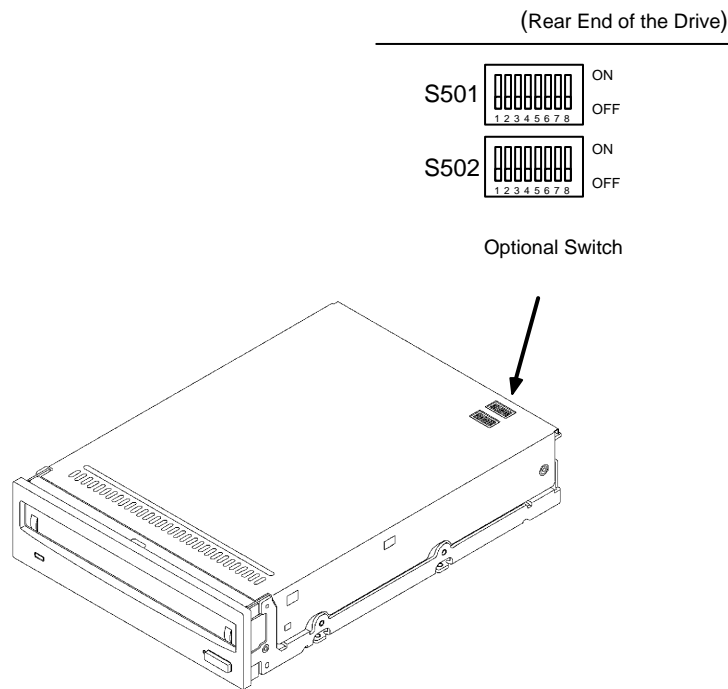


Fig. 1.5 : Top view

## ■ Optional Switches (S501, S502)

These two dip switches allow the user to set drive configuration. Refer to Chapter 2., "Optional Switch Setting" section.

# Chapter 2. INSTALLATION

Before setting up the SMO-F551-SD Magneto-Optical disk drive, be sure to check that all required components and accessories are present.

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## Component and Accessory Check List

Upon opening the carton, check that all the following items are provided:

- SMO-F551-SD Magneto-Optical Disk Drive
- Short Socket for Functional Switch (5 pieces)

---

## Installation Requirements

This section provides information on the installation of the drive.

---

### Location Requirements

SMO-F551-SD must be operated in a well-ventilated area, ideally in an air-conditioned room. The temperature and relative humidity should be between 5 to 45 °C (41 to 113 °F) and between 10 to 90 %, respectively.

The drive may be placed horizontally or vertically on a flat and stable surface. The maximum permissible mounting tilt is 10 degrees for the bottom placed surface.

Neither the drive nor the disk cartridge should be placed at a location subject to dust, continuous vibration and/or shock. Any place close to a strong magnetic field must be avoided, too. Since moisture condensation may cause serious problems for both the drive and the disk cartridge, avoid sudden changes in temperature and/or humidity.

The drive must not be moved with a disk cartridge inserted.

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## Cooling Requirements

Forced-air cooling is required throughout the drive, preventing overheat of the drive mechanism and electrical components. Forced-air cooling must be provided as a system integration.

This maximum temperature is applicable to all operating conditions specified in this manual.

Measuring Point	Maximum Temperature
Disk Cartridge	55 °C (131 °F)

**The temperature conditions specified in this manual must always be met for the SMO-F551-SD to function properly.**

---

## Temperature Alarm

Excessive internal temperature raise may cause the drive to stop functioning. In case of drive overheat, the BUSY indicator LED of the drive will flash at 2 second intervals. The drive sets the Temperature Alarm sense data (Sense key: 4H, ASC/ASCQ: 40H/84H) and returns a CHECK CONDITION status.



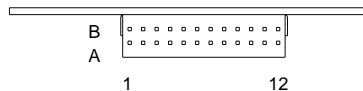
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## Functional Switch Settings

The functional switch pin header is located in the upper left of the drive as seen from the rear. These switches are used for setting the SCSI drive ID and other configurations as shown in the table 2.1.

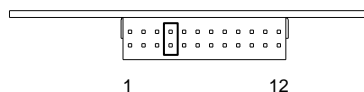
The drive uses a 2 mm pitch 24 pin (12 pairs) male header socket (DDK part number DZF-PB24-R1031 or equivalent (Fig. 2.1)). The header is designed for use with 24 pin female connector (Molex part number 51110-24, 87259-2412 or equivalent).

Recommend jumper socket : IMSA-9215H-GF (IRISO Electronics Co. Ltd.)



**Fig. 2.1 : Functional Switch**

Placing a jumper socket over the desired pair of pins A#/B# will turn the corresponding function ON. For example, placing a jumper socket over the pair of pins A4/B4 turn "Disable SCSI Parity Check" function ON. (This means the SCSI Parity Check is disabled.) No jumper socket means the function is OFF.



**Fig. 2.2 : Functional Switch Usage**

There is no jumper pin placed as factory default.

**Caution:** "Disable Write Cache" and "Disable Auto Spin-up" settings work as an "OR" function with the optional dip switch settings.

**Table 2.1 : Functional Switch Connector Pin Assignments**

A1	SCSI ID2	B1	GND
A2	SCSI ID1	B2	GND
A3	SCSI ID0	B3	GND
A4	Disable SCSI Parity	B4	GND
A5	Disable Write Cache	B5*	Reserved
A6	Disable Auto Spin-up	B6*	Reserved
A7	Force Verify for Write command	B7*	Reserved
A8	Disable Manual Eject	B8*	Reserved
A9	Enable Fast SCSI	B9*	Reserved
A10	Device Type	B10*	Reserved
A11	Enable Termination	B11	GND
A12	Terminator Power	B12	Terminator Power Source

**SCSI ID2, 1, 0**

These pins are used for setting the SCSI ID of the drive. The following table describes the setting combinations of SCSI ID.

**Table 2.2 : SCSI ID Setting**

SCSI ID	Connector Pin		
	A1/B1	A2/B2	A3/B3
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

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\* This pin is NOT directly connected to the GND. Do not use this pin as GND. SMO-F551-SD drives the signal to GND level depending on the functional switch setting. Otherwise, the signal is not driven to GND level.

**Disable SCSI Parity** When the pair of pins A4/B4 is open, the drive performs SCSI parity checking (factory default). Shorting pins A4/B4 with a jumper socket forces the drive NOT to perform the SCSI parity checking.

**Disable Write Cache** When the pair of pins A5/B5 is open, the drive performs write back caching (factory default). Shorting pins A5/B5 with a jumper socket forces the drive NOT to perform the write back caching.

**WARNING: Write cache is enabled as default setting. The integrity of the buffer memory content is not guaranteed through power cycling.**

**Caution:** "Disable Write Cache" setting works as an "OR" function with the optional dip switch setting.

**Disable Auto Spin-up** This function switch (A6/B6) controls drive's automatic spin-up mode. When the pair of pins A6/B6 is open, the drive automatically spins up the media upon loading (factory default). Shorting this pair of pins with a jumper pin disables the automatic spin up.

**Caution:** "Disable Auto Spin-up" setting works as an "OR" function with the optional dip switch setting.

**Force Verify for Write command** Shorting the pair of pins (A7/B7) forces the drive to perform Write and Verify operation whenever the drive executes **WRITE** command.

**Disable Manual Eject** Shorting the pair of pins A8/B8, disables the eject button operation. (i.e. the medium cannot be manually unloaded.)

<b>Device Type</b>	This switch is for changing the <b>INQUIRY</b> command response of the drive (Peripheral Device Type field). When the pair of pins A10/B10 is left open, the drive responds as an Optical Memory Device (type 7) (Factory Default). Shorting this pair of pins forces the drive to respond as a Direct Access Device (type 0).
<b>Enable Fast SCSI</b>	Shorting the pair of pins A9/B9 enables Fast SCSI mode. (See <b>*Caution.</b> )
<b>Enable Termination</b>	This functional switch informs the drive whether to adapt the internal SCSI active terminator. Shorting the pair of pins A11/B11 enables the SCSI Termination. Leaving them open disables the termination.
<b>Terminator Power</b>	This line is connected to the SCSI bus TERMPWR line.
<b>Terminator Power Source</b>	This line supplies +5V DC through an isolation diode for SCSI terminator power to the SCSI bus TERMPWR line. Connecting pair of pins A12/B12 enables the SCSI TERMPWR signal.

**\*Caution:**

When the Fast SCSI function is used, it is recommended that the host system and SCSI cables should conform to the Fast SCSI. The cable requirement which is stated in the ANSI SCSI-2 document is as follows:

Minimum conductor size:	28AWG
Characteristic impedance:	90 $\Omega$ to 132 $\Omega$
Signal attenuation:	0.095 dB maximum per meter at 5
MHz	
Pair-to-pair propagation delay delta:	0.20 ns maximum per meter
DC resistance:	0.230 $\Omega$ maximum per meter at 20 °C

It is also recommended that the cumulative cable length should be minimized and the SCSI bus termination should be well maintained.

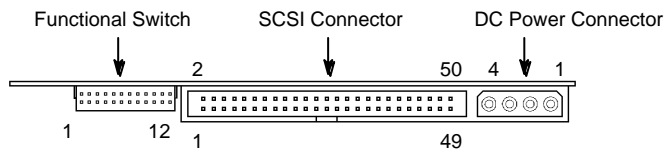
# SCSI and DC Power Connector

The SCSI and DC Power Connector is located at the upper rear of the drive. The drive uses a Molex 53450-5431 combination 50 pin SCSI and 4 pin DC Power male header.

Recommended female connectors:

SCSI connector: 3M type number 7950-6500

DC Power connector: AMP 1-480424-0 MATE-N-LOCK



**Fig. 2.3 : SCSI and DC Power Connector**

**Table 2.3 : DC Power Connector Pin Assignments**

Pin Number	Description
1	DC +12V
2	+12V Return
3	+5V Return
4	DC +5V

**Table 2.4 : Pin Assignments of SCSI Connector**

Signal Name	Pin No.	Pin No.	Signal Name
G N D	1	2	<u>D B 0</u>
G N D	3	4	<u>D B 1</u>
G N D	5	6	<u>D B 2</u>
G N D	7	8	<u>D B 3</u>
G N D	9	10	<u>D B 4</u>
G N D	11	12	<u>D B 5</u>
G N D	13	14	<u>D B 6</u>
G N D	15	16	<u>D B 7</u>
G N D	17	18	<u>D B P</u>
G N D	19	20	G N D
G N D	21	22	G N D
G N D	23	24	G N D
O P E N	25	26	(TERM PW)
G N D	27	28	G N D
G N D	29	30	<u>G N D</u>
G N D	31	32	<u>A T N</u>
G N D	33	34	G N D
G N D	35	36	<u>B S Y</u>
G N D	37	38	<u>A C K</u>
G N D	39	40	<u>R S T</u>
G N D	41	42	<u>M S G</u>
G N D	43	44	<u>S E L</u>
G N D	45	46	<u>C / D</u>
G N D	47	48	<u>R E Q</u>
G N D	49	50	<u>I / O</u>

The bar "—" above the signal indicates active low.

## SCSI Terminator

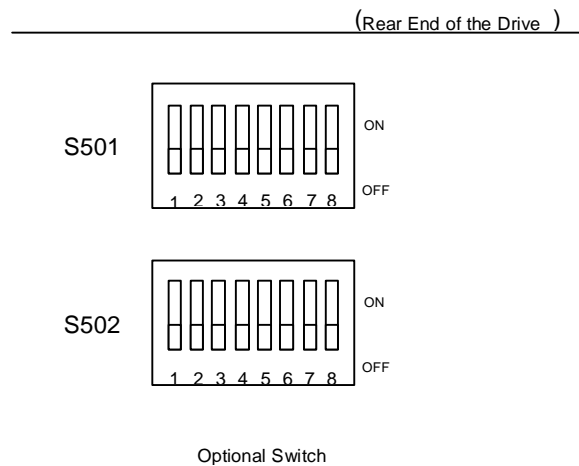
SMO-F551-SD features an internal SCSI bus terminator. When the drive is connected at the end of the SCSI chain, functional switch #11 (Enable Terminator) may be used to terminated the SCSI connection.

For a single ended cable, 50-signal conductor flat cable or a 25-signal twisted cable can be used. The cable length shall not exceed six meters.

---

## Optional Switch Setting

SMO-F551-SD features Optional Switch S501 and S502. These two optional dip switches allow the user to set the drive configurations.



**Fig. 2.4 : Top Panel View**

**Caution:** "Disable Write Cache" and "Disable Auto Spin-up" settings work as an "OR" function with the functional switch settings.

**Table 2.4 : Optional Dip Switch Assignments**

Optional Switch	Switch Number	Description
<b>S501</b>	1	Reserved
	2	Reserved
	3	Disable Command Eject
	4	Reserved
	5	Enable Library I/F Mode
	6	Reserved
	7	Disable Write Cache
	8	Disable Auto Spin-up
<b>S502</b>	1	Reserved
	2	Reserved
	3	Reserved
	4	Reserved
	5	Disable SCAM Selection
	6	Reserved
	7	Enable Fast SCSI
	8	Enable Write Cache for Write and Verify Command

**Disable Command Eject**      Disables Eject by command.

**Enable Library I/F Mode**      Library I/F Mode will be valid.

**Disable Write Cache**      Disables Write Cache setting upon power on.

**Disable Auto Spin-up**      Disables Auto Spin-up upon cartridge loading.

**Disable SCAM Selection**      Disables SCAM (SCSI Configuration Auto Magically) function.

**Enable Write Cache for Write and Verify Command**      Write Cache for Write and Verify command will be valid.

**Enable Fast SCSI**      Fast SCSI Mode will be set.

**Reserved:**      Reserved switches are only for internal use. Do not turn any of the reserved switched ON.



# Chapter 3. PRECAUTIONS

---

## Drive Handling Precautions

- Ensure that the operating environment satisfies all environmental specifications as listed in Chapter 4.
- Make sure that the power supplies are within the following range:
  - DC: + 5V  $\pm$  5%
  - +12V  $\pm$  5%.
- Do not subject the drive to shock and/or vibration.
- Inserting a disk cartridge into the mechanism when moisture is present may cause damage to both the disk and the drive.

---

## Disk Handling Precautions

- Do not drop the disk or hit it against other object.
- Disk cartridge's shutter automatically opens when it is inserted in the drive. Do not open the shutter manually or touch the disk inside.
- Do not disassemble the disk cartridge. Precise adjustments are made at the factory prior to shipping.
- Write protection tabs are provided on the disk cartridge. To set protection for the data recorded on the disk, slide the red tab in the direction of the arrow; to release the protection, slide the tab in the opposite direction.

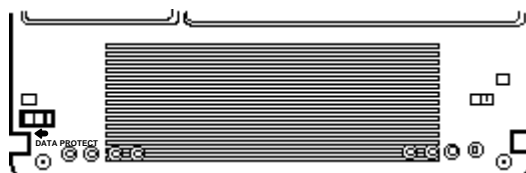


Fig. 7.1: Write Protection Tab

- Moisture condensation caused by a sudden temperature change or high humidity may impair writing or reading capabilities.

**Notes on storage:**

- Store cartridges in their protection cases.
- Keep cartridges away from heat sources, such as radiators, or places subject to direct sunlight, excessive dust and/or moisture.

---

## Notes on Cleaning

### Cleaning the Drive Unit

**DO NOT USE ANY KIND OF LENS CLEANING DEVICES.** Preventive measures are taken into account in the drive design to guard against dust. Therefore, there is no need to clean the optical lens of the drive. **Using a lens cleaning device, such as Sony's Cleaning Cartridge (model number: \*MOA-L55/2) may damage the drive.**

\*MOA-L55/2 may only be used for SMO-F531 series.

### Cleaning the Disks

DISKS SHOULD BE CLEANED PERIODICALLY TO INSURE SATISFACTORY OPERATION. To avoid read/write error, use the optical disk cleaner sold separately, such as the following:

Disk Cleaning Kit: Sony model number **MOA-D51** (manual)

To maintain the high performance and prolong the disk life, cleaning at least once every three months is recommended. Refer to each user's manual for more details on cleaning procedure.

# Chapter 4. SPECIFICATIONS

## Drive Specifications

This section provides the complete information of the SMO-F551-SD.

### Media Related Characteristics

The SMO-F551-SD has read/write compatibility with ISO standard 5.2 Gbytes (8X Capacity) , 2.6 Gbytes (4X Capacity) , 1.3 Gbytes (2X Capacity) , and 650 Mbytes (1X Capacity) media. **The SMO-F551-SD can record on 1X and 2X capacity media in addition to 4X and 8X capacity on Write operation. All operation of the SMO-F551-SD is guaranteed ONLY upon usage of Sony media.**

**Table 4.1 : 8X Capacity Media Related Characteristics**

Conformed Standard	ISO/IEC 15286		
Disk Format	Continuous Composite Servo		
Rotational Mode	ZCAV : Zoned Constant Angular Velocity		
Modulation Code	RLL (1,7) : Run Length Limited Coding		
Bytes per Sector	2048	1024	512
Sectors per Logical Track	7	17	31
Number of Tracks per Side			
Physical Tracks	38,136	37,485	37,696
Logical Tracks	182,508	138,915	130,112
Formatted Address			
Start Address	Track 0 Sector 0 (located at OD)	Track 0 Sector 0 (located at OD)	Track 0 Sector 0 (located at OD)
End Address	Track 182,507 Sector 6	Track 138,914 Sector 16	Track 130,111 Sector 30
Capacity			
per Disk	5.24 Gbytes	4.84 Gbytes	4.14 Gbytes
per Side	2.62 Gbytes	2.42 Gbytes	2.07 Gbytes
User Data Transfer Rate			
Outer Diameter	5.07 Mbytes/s (max.)	4.79 Mbytes/s (max.)	4.06 Mbytes/s (max.)
Inner Diameter	2.48 Mbytes/s (max.)	2.31 Mbytes/s (max.)	1.97 Mbytes/s (max.)
Number of Spare Blocks	4,095 sectors (max.)	4,095 sectors (max.)	4,095 sectors (max.)

**Table 4.2 : 4X Capacity Media Related Characteristics**

Conformed Standard	ISO/IEC 14517	
Disk Format	Continuous Composite Servo	
Rotational Mode	ZCAV : Zoned Constant Angular Velocity	
Modulation Code	RLL (1,7) : Run Length Limited Coding	
Bytes per Sector	1024	512
Sectors per Logical Track	17	31
Number of Tracks per Side		
Physical Tracks	26,010	26,040
Logical Tracks	75,735	73,080
Formatted Address		
Start Address	Track 0 Sector 0 (located at OD)	Track 0 Sector 0 (located at OD)
End Address	Track 75,734 Sector 16	Track 73,079 Sector 30
Capacity		
per Disk	2.607 Gbytes	2.298 Gbytes
per Side	1,303.5 Mbytes	1,149.4 Mbytes
User Data Transfer Rate		
Outer Diameter	4.06 Mbytes/s (max.)	3.56 Mbytes/s (max.)
Inner Diameter	2.03 Mbytes/s (max.)	1.78 Mbytes/s (max.)
Number of Spare Blocks	4,095 sectors (max.)	4,095 sectors (max.)

**Table 4.3 : 2X Capacity Media Related Characteristics**

Conformed Standard	ISO/IEC 13549	
Disk Format	Continuous Composite Servo	
Rotational Mode	ZCAV : Zoned Constant Angular Velocity	
Modulation Code	RLL (2,7) : Run Length Limited Coding	
Bytes per Sector	1024	512
Sectors per Logical Track	17	31
Number of Tracks per Side		
Physical Tracks	21,600	21,600
Logical Tracks	37,600	37,600
Formatted Address		
Start Address	Track 0 Sector 0 (located at ID)	Track 0 Sector 0 (located at ID)
End Address	Track 37,599 Sector 16	Track 37,599 Sector 30
Capacity		
per Disk	1.304 Gbytes	1.191 Gbytes
per Side	652.3 Mbytes	595.6 Mbytes
User Data Transfer Rate		
Outer Diameter	2.40 Mbytes/s (max.)	2.16 Mbytes/s (max.)
Inner Diameter	1.24 Mbytes/s (max.)	1.13 Mbytes/s (max.)
Number of Spare Blocks	2,057 sectors (max.)	2,077 sectors (max.)

**Table 4.4 : 1X Capacity Media Related Characteristics**

Conformed Standard	ISO/IEC 10089 format A for Rewritable media ISO/IEC 11560 for Write Once media	
Disk Format	Continuous Composite Servo	
Rotational Mode	CAV : Constant Angular Velocity	
Modulation Code	RLL (2,7) : Run Length Limited Coding	
Bytes per Sector	1024	512
Sectors per Track	17	31
Total Number of Tracks	18,750	18,750
Formatted Address		
Start Address	Track 0 Sector 0 (located at ID)	Track 0 Sector 0 (located at ID)
End Address	Track 18,750 Sector 16	Track 18,750 Sector 30
Capacity		
per Disk	644.2 Mbytes	590.8 Mbytes
per Side	322.1 Mbytes	295.4 Mbytes
User Data Transfer Rate	0.85 Mbytes/s (max.)	0.78 Mbytes/s (max.)
Spare Block	2,048 sectors (max.)	2,048 sectors (max.)

## Drive Specifications

**Table 4.5 : Mechanical**

Item	Specification
Dimension (H x W x D)	41.3 x 146.0 x 203 mm (1.63 x 5.75 x 8.00 inch) without panel, without projection
Weight	1.5 kg (3 lb. 5 oz.), Without Cartridge

**Table 4.6 : Controller Block**

Item	Specification
Host Interface	SCSI-2 : ANSI X3.131-1994
Bus Type	Single Ended
Burst Data Transfer Rate	Synchronous 5 Mbytes/s (maximum) (Fast SCSI disabled) Synchronous 10 Mbytes/s (maximum) (Fast SCSI enabled) Asynchronous 3 Mbytes/s (maximum)
Buffer Memory Size	4 Mbytes
Error Correction Length	
2,048 byte/sector	160 bytes (maximum)
1,024 byte/sector	80 bytes (maximum)
512 byte/sector	40 bytes (maximum)

**Table 4.7 : Laser Diode**

Item	Specification
Laser Diode	
Type	Semiconductor Laser (GaAlInP)
Wavelength	685 +/-10 nm
Output Power	30 mW (maximum)

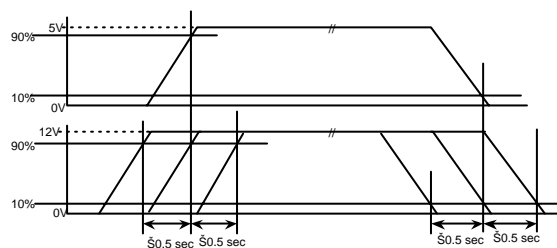
**Table 4. 8 : Performance**

Item	Specification		
	8X	4X / 2X	1X
Disk Rotation Speed	3,300 min <sup>-1</sup> (rpm)	3,600 min <sup>-1</sup> (rpm)	3,000 min <sup>-1</sup> (rpm)
Average Latency	9.1 ms	8.3 ms	10 ms
Seek Time			
Single Track	2 ms (typ.)		2 ms (typ.)
Average	25 ms (typ.)		25 ms (typ.)
Full Stroke	55 ms (typ.)		45 ms (typ.)
Loading Time *	5.5 s (typ.), including spin-up time		
Unloading Time *	3.5 s (typ.), including spin-down time		
Spin-up Time *	2.5 s (typ.)		
Spin-down Time *	2.2 s (typ.)		

\* Measured at SCSI level, excluding SCSI communication overhead.

**Table 4.9 : Electrical Power Requirements**

Item	Specification
DC Voltage	+5 V +/-5% (Maximum ripple voltage 50mV peak to peak) +12V +/-5% (Maximum ripple voltage 100mV peak to peak)
Current Consumption +5V +12V	0.8 A (typ.) , 2.0 A (max.) 0.9 A (typ.) , 3.0 A (max.)
Power Consumption	14.8 W (typ.)
Power Supply Delay (Sequencing)	Less than 0.5 s at 90% of the final value for both power on and off. Refer to below chart.





**Table 4.10 : Environmental**

<b>Item</b>	<b>Specification</b>
Ambient Temperature	
Operating	5 to 45 °C (41 to 113 °F)
Non-operating	-30 to 60 °C (-22 to 140 °F)
Maximum Gradient	10 °C per hour (18 °F per hour)
Cooling Requirement	55 °C (131 °F) maximum measured inside the disk cartridge
Humidity	
Operating	10 % to 90 % RH, Non Condensing
Non-operating	5 % to 90 % RH, Non Condensing
Max. Wet-bulb Temp.	29 °C (84.2°F)
Vibration	
Operating	No Customer Perceivable Error f: 5 to 350 Hz               PSD: 0.014 m <sup>2</sup> /s <sup>3</sup> (0.00015G <sup>2</sup> /Hz) f: 350 to 500 Hz           -6 dB/Oct f: 500 Hz                    PSD: 0.0096 m <sup>2</sup> /s <sup>3</sup> (0.0001 G <sup>2</sup> /Hz)
Non-operating	No Permanent Damage f: 5 to 100 Hz               PSD: 1.92 m <sup>2</sup> /s <sup>3</sup> (0.02 G <sup>2</sup> /Hz) f: 100 to 137 Hz           -6 dB/Oct f: 137 to 350 Hz           PSD: 1.03 m <sup>2</sup> /s <sup>3</sup> (0.0107 G <sup>2</sup> /Hz) f: 350 to 500 Hz           -6 dB/Oct f: 500 Hz                    PSD: 0.50 m <sup>2</sup> /s <sup>3</sup> (0.0052 G <sup>2</sup> /Hz)
Shock	
Operating	294 m/s <sup>2</sup> (30 G), 3 ms half sine, No Data Loss
Non-operating	873 m/s <sup>2</sup> (89 G), 3 ms half sine, No Permanent Damage
Transportation	No Permanent Damage
Vibration	f: 5 to 50 Hz                PSD: 1.44 m <sup>2</sup> /s <sup>3</sup> (0.015G <sup>2</sup> /Hz)
Impact	91 cm (36 inch)
Altitude	
Operating	-305 to 4,572 m (-1,000 to 15,000 ft.)
Non-operating	-305 to 12,192 m (-1,000 to 40,000 ft.)
Acoustic Noise	45 dB(A) maximum Measured with a microphone located 1 meter from the front of the drive. Except Loading/Unloading.
Mounting	
Orientation	Horizontal or Vertical
Tilt	< +/-10°

**Table 4.11 : System Environmental**

<b>Item</b>	<b>Specification</b>
Electrostatic Discharge Operating Non-operating	+/- 10 kV, No Data Loss +/- 15 kV, No Permanent Damage C = 200 pF, R = 100 Ω Discharge to the front panel only.
Magnetic Field Susceptibility	0.5 x 10 <sup>-4</sup> T (0.5 Gauss), 47.5 Hz to 198 Hz
Radiated Field Susceptibility	1 V/m, 14 kHz to 1 GHz
Magnetic Field Interference	< 10 x 10 <sup>-4</sup> T (10 Gauss) peak to peak
Radiated Interference (Tested as subsystem)	FCC 47 CFR Part 15 Subpart B Class B, USA DOC SOR/88-475 Class B, Canada VFG 243, Germany VCCI Class 2 Information Technology Equipment, Japan

**Table 4.12 : Reliability**

<b>Item</b>	<b>Specification</b>
MTBF	100,000 POH, 60% confidence level
MSBF	750,000 cycles
MTTR	30 minutes

**Table 4.13 : Safety and Compliance**

<b>Item</b>	<b>Specification</b>
Regulatory	UL 1950 2nd Edition, USA CUL CSA C22.2 No. 950, Canada DHHS Laser Compliance 21 CFR Subchapter J, USA TÜV Certification according to EN 60 950, Europe TÜV Certification according to EN 60 825, Europe EN55022 Class B IEC801-2, IEC801-3

# Chapter 5. SYSTEM CONFIGURATION

SMO-F551-SD consists of mechanical, electrical and optical subsystems. The electrical subsystem consists of analog and digital circuitry.

The analog circuitry includes the laser diode driver, RF circuit and servo systems for focusing and tracking. The digital circuitry includes analog and mechanical control logic, modulator/ demodulator, drive interface logic and SCSI control block.

## Optical Head

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

## Laser Diode Driver

This circuit drives the laser diode at the proper power level for read, write and erase process using the Automatic Power Control (APC) circuit.

## 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. Data separation block consists of RPML channel and bit-by-bit detection channel. PRML channel is used for mark edge detection in order to detect the RLL(1,7). For peak data detection, data separation block can also separate the RLL(2,7) by bit-by-bit method. The PLL generates phase locked clock in order to separate the data of the each channel correctly. The demodulator decodes the RLL(1,7) or RLL(2,7) in accordance with this PLL clock.

## Bias Magnet Block

Electrical magnet is used to generate the erasing bias magnetic field with the polarity opposite to writing bias polarity.

## Loading Block

Loading block consists of a loading motor and sensors for both loading and ejecting.

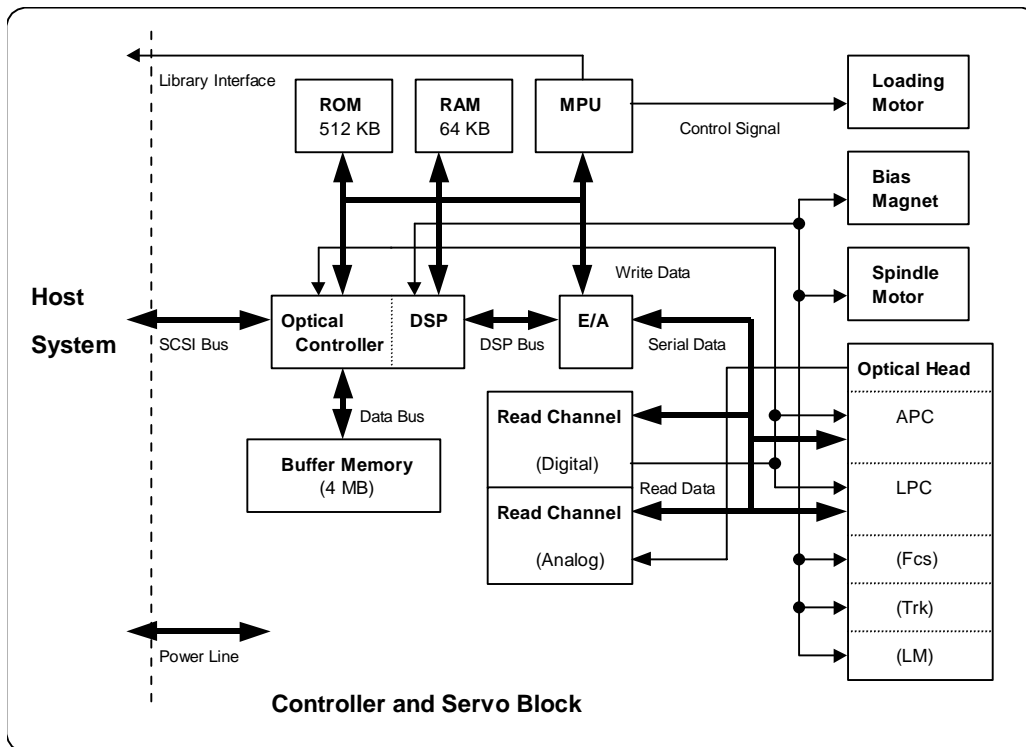


Fig. 5.1: SMO-F551-SD Block Diagram

## Microprocessor

The microprocessor unit (MPU) has 512 kbytes(External) and 64 kbytes(Internal) programmed ROM and 64 kbytes of working RAM on the MPU bus. This module performs the following functions:

- SCSI modules management
- SCSI communication management
- Drive control via the SCSI
- Error recovery and management
- Diagnostic functions.
- Data Caching Management

## DSP/Servo Blocks

The SMO-F551-SD contains the following four servo blocks:

### Spindle Servo

The spindle servo block rotates the disk at 3,000 min<sup>-1</sup>(rpm) or 3,300 min<sup>-1</sup>(rpm) or 3,600 min<sup>-1</sup>(rpm) using a phase-locked-loop servo system which uses the Frequency Generator (FG) signal.

### Focus Servo

The focus servo block controls the two axis actuator to focus the laser diode beam on the disk's surface by the beam-spot-size method.

### Tracking Servo

The tracking servo block controls the two axis actuator to follow the track using the Push-Pull servo system.

### Slide Servo

The slide servo block drives the slide motor(flat linear motor) for accessing to the designated track(s).

These servos are controlled by the Digital Signal Processor (DSP) block, consisting of 12 kwords RAM. This block controls the analog and mechanical blocks.

## Integrated Optical Controller Block

The integrated optical controller includes the following blocks:

### Buffer Memory Manager

This module performs the internal data bus management and generates address for Buffer Memory. The data to/from the Buffer Memory is transferred in the DMA mode. The Buffer Memory Manager arbitrates DMA requests according to the priority of each channel.

### SCSI Controller

The SCSI controller controls the SCSI bus and transfers data to/from the internal bus. This SCSI implementation conforms to SCSI specification, ANSI X3.131-1994. User data to/from the Buffer Memory are transferred in the DMA mode.

### **ECC Encoder/Decoder**

This module encodes the Read-Solomon Long Distance Code and the CRC during the write operations, and generates the syndrome during read operations. It also generates the correction vendor and corrects the data during read operations.

### **Drive Interface**

This module performs encoding and decoding of the RLL(1,7) and RLL(2,7) data and defects the ID data of the disk. The SYNC and RESYNC in the format are encoded and detected in this module.

## **Buffer Memory**

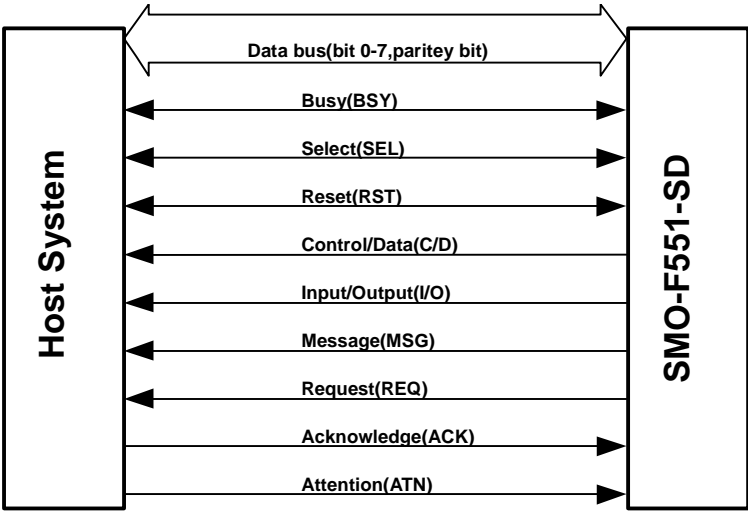
Buffer Memory is composed of 4 Mbytes of DRAM. User data is stored in reading or writing data upon request.

# Chapter 6. HOST INTERFACE

For connection with a host system, SMO-F551-SD uses the SCSI-2 (Small Computer System Interface) which complies with specifications of ANSI X3.131-1994. In this section, a summary of the drive's SCSI specification is described. Refer to the *SMO-F551 SCSI Specifications* for more details.

---

## Data Bus and Signal Lines



**Fig. 6.1: SCSI Data Bus and Signal Lines**

The SCSI interface uses the 18 signal lines as shown in Fig. 6.1. 9 signals are used for control and the rest is for Data Bus. (Data Bus includes the optional parity signal.)

The following are the descriptions on the signals:

**Busy (BSY)**

An "OR-tied" signal that indicates whether the bus is being used.

**Select (SEL)**

A signal used either by the initiator to select the target or by the target to reselect an initiator.

**Control/Data (C/D)**

A signal driven by the target to indicate whether CONTROL or DATA information is on the DATA BUS. True indicates CONTROL.

**Input/Output (I/O)**

A signal driven by the target to control the direction of data flow on the DATA BUS with respect to the initiator. True indicates input to the initiator. This signal also distinguishes phases between SELECTION and RESELECTION.

**Message (MSG)**

A signal driven by the target during the MESSAGE phase.

**Request (REQ)**

A signal driven by the target to indicate a request for REQ/ACK data transfer handshake.

**Acknowledge (ACK)**

A signal driven by the initiator to indicate an acknowledgment for an REQ/ACK data transfer handshake.

**Attention (ATN)**

A signal driven by the initiator to indicate the ATTENTION condition.

**Reset (RST)**

An "OR-tied" signal that indicates the RESET condition.



**Data bus (7-0,P) (DB)**

Eight data-bit signals and a parity-bit signal form the Data Bus. DB(7) is the most significant bit and the highest priority during the ARBITRATION phase. Bit number, significance, and priority of Data Bus bit decreases as the bit number decreases. (DB(0) is the least significant.) A data bit is defined as ONE when the signal value is true. And it is defined as ZERO when the signal value is false. Data parity DB(P) is odd.

For the status of the signals relating to control of the drive and details of the timing of the SCSI bus, refer to the ANSI X3.131-1994 (SCSI-2) documents. Single-ended drivers have been adopted for the bus drive. Use a device which satisfies the standards for the driving and receiving circuits.

# Control Method and Procedures

The following flow chart is an example(the case of Read Command) of the procedure for controlling the drive through SCSI interface.

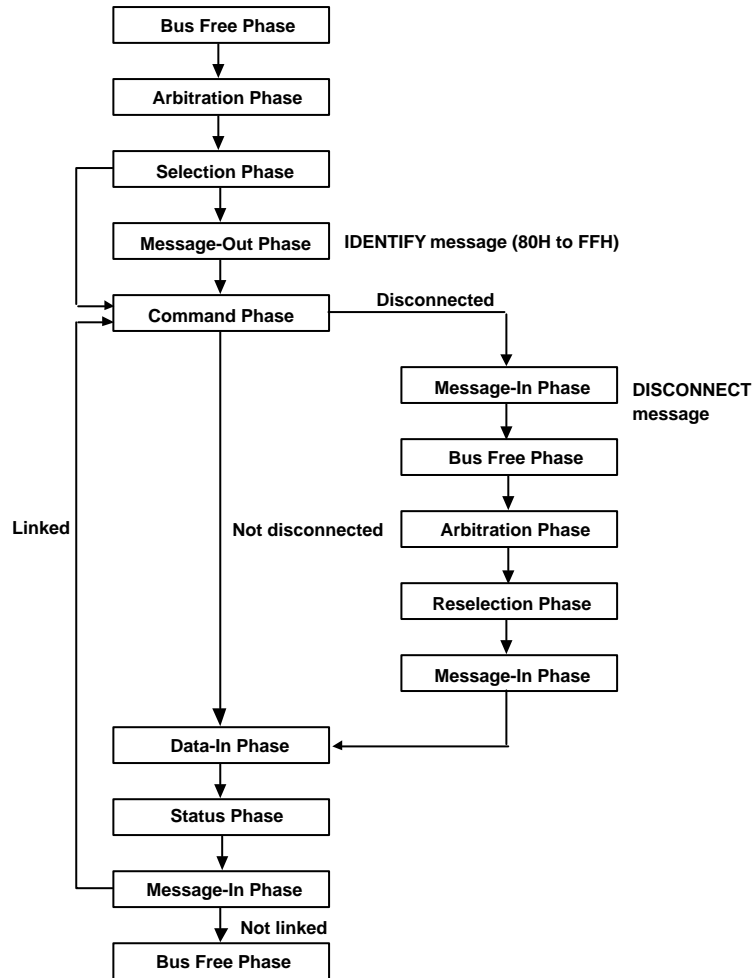


Fig. 6.2: Drive Control Flow Chart through SCSI

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## Command Summary

The SMO-F551-SD supports the following SCSI commands. Refer to the *SMO-F551 SCSI Specifications* for more information.

Code	Name	Description
00H	<b>TEST UNIT READY</b>	Provide a means to check whether the logical unit is ready.
01H	<b>REZERO UNIT</b>	The function of this command is exactly as same as the <b>TEST UNIT READY</b> command.
03H	<b>REQUEST SENSE</b>	Transfer sense data to the host.
04H	<b>FORMAT UNIT</b>	Initialize the optical disk.
07H	<b>REASSIGN BLOCKS</b>	Reassign the defective sectors.
08H	<b>READ (6)</b>	Read the specified number of data blocks.
0AH	<b>WRITE (6)</b>	Write the specified number of data blocks.
0BH	<b>SEEK (6)</b>	Move the optical head to the physical track where the specified logical block exists.
12H	<b>INQUIRY</b>	Transfer the information related to the SMO-F551-SD.
15H	<b>MODE SELECT (6)</b>	Specify the drive and media parameters.
16H	<b>RESERVE</b>	Reserve a logical unit for the exclusive use of the initiator.
17H	<b>RELEASE</b>	Release the logical unit from the reservation state.
1AH	<b>MODE SENSE (6)</b>	Read the drive and media parameters.
1BH	<b>START/STOP UNIT</b>	Start, stop and/or load, eject the medium.
1CH	<b>RECEIVE DIAGNOSTIC RESULTS</b>	Request analysis data be sent to the initiator.
1DH	<b>SEND DIAGNOSTIC</b>	Request the SMO-F551-SD to perform diagnostic tests.
1EH	<b>PREVENT/ALLOW MEDIUM REMOVAL</b>	Prevent or allow removal of the medium in the drive.
25H	<b>READ CAPACITY</b>	Request information regarding the capacity of the medium.
28H	<b>READ (10)</b>	Read the specified number of data blocks.
2AH	<b>WRITE (10)</b>	Write the specified number of data blocks.
2BH	<b>SEEK (10)</b>	Move the optical head to the physical track where the specified logical block exist.
2CH	<b>ERASE (10)</b>	Erase the specified number of data blocks.

Code	Name	Description
2EH	<b>WRITE AND VERIFY (10)</b>	Write the specified number of data blocks and then verify the write by reading the written data and checking the error correction code.
2FH	<b>VERIFY (10)</b>	Verify the specified number of data blocks by reading the data and checking the error correction code.
34H	<b>PRE-FETCH</b>	Transfer the specified number of data blocks to cache memory.
35H	<b>SYNCHRONIZE CACHE</b>	Synchronize the data in the cache memory to the medium.
37H	<b>READ DEFECT DATA (10)</b>	Request the medium defect information.
38H	<b>MEDIUM SCAN</b>	Scans the medium of written or blank logical blocks.
3BH	<b>WRITE BUFFER</b>	Write data to the data buffer of the SMO-F551-SD.
3CH	<b>READ BUFFER</b>	Read data from the data buffer of the SMO-F551-SD.
3EH	<b>READ LONG</b>	Read the specified number of data blocks including data bytes and ECC bytes.
3FH	<b>WRITE LONG</b>	Write data to the specified data blocks without using the ECC generation circuitry.
40H	<b>CHANGE DEFINITION</b>	Modify the operating definition of the SMO-F551-SD.
4CH	<b>LOG SELECT</b>	Clear drive resident logs.
4DH	<b>LOG SENSE</b>	Read drive resident logs.
55H	<b>MODE SELECT (10)</b>	Specify the drive and media parameters.
5AH	<b>MODE SENSE (10)</b>	Read the drive and media parameters.
A8H	<b>READ (12)</b>	Read the specified number of data blocks.
AAH	<b>WRITE (12)</b>	Write the specified number of data blocks.
ACH	<b>ERASE (12)</b>	Erase the specified number of data blocks.
AEH	<b>WRITE AND VERIFY (12)</b>	Write the specified number of data blocks and then verify the write by reading the written data and checking the error correction code.
AFH	<b>VERIFY (12)</b>	Verify the specified number of data blocks by reading the data and checking the error correction code.
B7H	<b>READ DEFECT DATA (12)</b>	Request the medium defect information.
DEH*	<b>READ LONG</b>	Read the specified number of data blocks including data bytes and ECC bytes. The definition of the CDB is different from ANSI <b>READ LONG</b> command.
DFH*	<b>WRITE LONG</b>	Write data to the specified data blocks without using the ECC generation circuitry. The definition of the CDB is different from ANSI <b>WRITE LONG</b> command.

---

\* Vendor Unique command

# Chapter 7. BUSY INDICATOR

The SMO-F551-SD supports the BUSY indicator notification. The following table shows the flashing pattern of the LED and their means.

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## Flashing Pattern and Drives Internal Condition

LED Flashing Pattern	BUSY (amber)	READY (green)
Lights ON	<ul style="list-style-type: none"> <li>- accessing disk</li> <li>- loading/unloading (spin up/spin down)</li> <li>- Power-On Diagnostic</li> </ul>	<ul style="list-style-type: none"> <li>- disk at accessible state</li> <li>* (Drive Ready)</li> </ul>
NORMAL Flashing 0.8 sec cycle ON : OFF = 1 : 1	<ul style="list-style-type: none"> <li>- pending Eject (Eject requested while accessing/loading/spinning up)</li> </ul>	<ul style="list-style-type: none"> <li>- inaccessible disk inserted (example: unformatted disk)</li> <li>* (Drive NOT Ready)</li> </ul>
RAPID Flashing 0.2 sec cycle ON : OFF = 1 : 1	<ul style="list-style-type: none"> <li>- Power-On Diagnostic error</li> </ul>	<ul style="list-style-type: none"> <li>- not available</li> </ul>
SLOW Flashing 2 sec cycle ON : OFF = 1 : 19	<ul style="list-style-type: none"> <li>- temperature warning</li> </ul>	<ul style="list-style-type: none"> <li>- not available</li> </ul>
Lights OFF	<ul style="list-style-type: none"> <li>- disk NOT inserted</li> <li>- after spin down</li> <li>- power off</li> <li>* (Drive NOT Ready)</li> </ul>	

SMO-F551-SD

# **Magneto-Optical Disk Drive**

Technical Guide and Specifications