

TOSHIBA CD-ROM DRIVE

XM-3301B Product Specification

EDITION # 2.0
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TOSHIBA CORPORATION
Imaging & Information Systems Division

Contents

1. Introduction	1
2. Features	2
3. Specifications	3
3.1. Performance	3
3.2. Environmental Conditions	4
3.2.1. Temperature and Humidity	4
3.2.2. Dust and Dirt	5
3.2.3. Vibration	5
3.2.4. Atmospheric Pressure and Altitude	5
3.2.5. Shock	5
3.3. Installation Conditions	5
3.4. Dimensions and Weight	5
3.5. Reliability	7
3.5.1. Error Rate	7
3.5.2. MTBF	7
3.5.3. MTTR	7
3.5.4. Drive Life	7
4. Configuration	7
4.1. Electrical Parts	7
4.2. Optical Pickup	7
4.3. Spindle Motor	7
4.4. Feed Motor	7
4.5. CD Caddy Loading Motor	7
5. Functions	9
5.1. CD-ROM Data Configurations	9
5.2. Power On/Off Timing	9
6. Interface	9
6.1. Signal Lines	9
6.1.1. Signal Line Termination	11
6.1.2. Receivers and Drivers	11
6.1.3. Connector	11

7.	Power Requirements	11
7.1.	Source Voltage	11
7.1.1.	Spike	11
7.1.2.	Ripple	11
7.2.	Current Drain	11
7.3.	Connector	16
7.4.	Fuse for Terminator Power	16
8.	Audio	16
8.1.	Line Output	16
8.1.1.	Connector	16
8.2.	Headphones Output	16
8.2.1.	Connector	16
8.3.	Audio Modes	16
9.	Jumper Setting/Feature Selections	17
9.1.	SCSI-ID	17
9.2.	Parity	17
9.3.	Media Eject Prevention	18
9.4.	Audio Playback	18
9.5.	Terminator Power	18
9.6.	Jumper(Part Number T/E)	18
9.7.	Recognition of Setting	18
10.	Busy Indicator	19
11.	Connections	20
11.1.	Power Supply Cable	20
11.2.	Interface Cable	20
11.3.	Audio Cable	20
11.4.	Terminators	20
12.	Maintenance	20
12.1.	Disc	20
12.2.	Optical Pickup	20
13.	Safety Standards/Agency Approvals	20
14.	Electrostatic Discharge	21
15.	Accessories	21
16.	Packaging	21

1. Introduction

This document describes Toshiba's XM-3301B CD-ROM Drive. This drive reads digital data stored on CD-ROM discs and can be configured within computer systems.

The CD-ROM disc is single sided and has a 12 cm or 8 cm diameter. It typically contains approximately 600M bytes or 200M bytes of information respectively.

Compact Discs offer long life and high durability because the disc is read by a LASER, thereby eliminating physical contact with the disc.

A CD-ROM disc can also store other types of information in addition to digital/binary data. It is capable of storing audio information. The XM-3301B drive is therefore capable of reproducing CD-audio (such as music Compact Discs) and can be used as a CD-audio player, independent of the computer system.

2. Features

- (1) Built-in SCSI-2 Interface Controller
- (2) Sealed Enclosure and Closed Door to protect against Contamination
- (3) 5-1/4 inch Half Height Form Factor
- (4) High System Reliability Through Advanced CIRC Error Correction
- (5) Snap-on Bezel
- (6) Prevent Media Removal Function via Jumper as well as by software
- (7) Emergency Eject Feature
- (8) Built-in MODE-1 ECC and MODE-2 EDC(command selectable)
- (9) Embedded CD-ROM XA type ECC(in addition to standard type ECC)
- (10) Efficient Data Transmission Throughput via 64K bytes Buffer Memory
and Buffer Algorithm
- (11) Automatic Lens Cleaner
- (12) High Speed Access by New Retrieval System with Learning Method
- (13) Broader Allowance for Mounting($H \pm 45\text{deg}$, $V \pm 45\text{deg}$)
- (14) Low Power Consumption
- (15) Remote SCSI-ID Jumper Block
- (16) 16-Mode Output for CD Audio
- (17) 4X Sampling & Digital Filter for CD Audio
- (18) Software Volume Control via SCSI-2 Mode Select Command
- (19) Continuous Rotary Volume Control for Headphones Output
- (20) MTBF 30,000H(POH)
- (21) CD-CADDY Auto Loading
- (22) Modular Assembly for Easy Serviceability
- (23) Can be used as an Independent CD Audio Player Disconnected from PC
- (24) Built-in Terminator

3. Specifications

3.1. Performance

- | | |
|---|--------------------------|
| (1) Standard Disc Format | YELLOW-BOOK and RED-BOOK |
| (2) Transfer Rate | |
| Average | 150k bytes/Sec(Mode 1) |
| Maximum | 1.5M bytes/Sec(burst) |
| Blocks/Sec | 75 blocks/Sec |
| (3) Data Capacity(YELLOW-BOOK) | |
| User Data/Block | 2048 bytes/block(Mode 1) |
| | 2336 bytes/block(Mode 2) |
| (4) Access Time | |
| Average Access Time *1 | 325 mSec TYP |
| | 350 mSec MAX |
| Maximum Average Access Time *2 | 480 mSec TYP |
| | 650 mSec MAX |
| (5) Spin up Time (Focus Search Time and Disc Motor Start up Time) | |
| | 1 Sec TYP |
| | 1.5 Sec MAX |
| (6) Data Buffer Capacity | |
| Standard | 64k Bytes |

*1 : Measured by performing multiple random access which means reads of data blocks over the whole area of the media from 00 Min 02 Sec 00 Blk to 60 Min 01 Sec 74 Blk more than 3000 times. Includes positioning, setting, and latency time. TYP value is for the average drive and MAX value is absolute maximum average time for any one drive.

*2 : Measured by performing multiple maximum access which means reads of data blocks from 00 Min 02 Sec 00 Blk to 60 Min 01 Sec 74 Blk more than 100 times. Includes positioning, setting, and latency time. TYP value is for the average drive and MAX value is absolute maximum average time for any one drive.

(7) Optical Pickup	Semiconductor Laser and 3-beam System
(8) Disc Motor	DC Motor
(9) Feed Motor	DC Motor
(10) Disc Loading	CD-Caddy Auto Front Loading
(11) Disc Revolutions(approx.)	200 to 530 rpm (CLV)
(12) Air Flow	Not Required
(13) Acoustic Noise	40 dB(A) MAX at 1 meter
(14) Power Supply	+12 V and +5 V (details in Section 7)

3.2. Environmental Conditions

This drive should be used under the conditions listed below.

3.2.1. Temperature and Humidity

(1) Operating Temperature	5 deg C to 50 deg C
(2) Storage Temperature	-10 deg C to 65 deg C
(3) Shipping Temperature(Packaged)	-40 deg C to 65 deg C
(4) Operating Temperature Gradient	11 deg/Hour(max)
(5) Storage Temperature Gradient	20 deg/Hour(max)
(6) Shipping Temperature Gradient	20 deg/Hour(max)
(7) Operating Humidity	8 % to 80 %
(8) Storage Humidity	5 % to 95 %
(9) Shipping Humidity	5 % to 95 %
(10) Condensation	In all the above conditions there must be no condensation.

3.2.2. Dust and Dirt Unspecified

3.2.3. Vibration(Tentative)

- (1) Operating (1 Oct/Min) ---no soft error within 5 retries---
 - 5 to 17 Hz 0.44 mm p-p
 - 17 to 150 Hz 0.25 G o-p
 - 150 to 200 Hz Linear interpolation
 - 200 to 500 Hz 0.33 G o-p
- (2) Non-operating (1 Oct/Min) ---no damage must result---
 - 5 to 10 Hz 5 mm p-p
 - 10 to 500 Hz 1 G o-p
- (3) Shipping(Packaged)(1 Oct/Min) ---no damage must result---
 - 10 to 20 Hz 2 mm p-p XYZ/30 min each

3.2.4. Atmospheric Pressure and Altitude

- (1) Operating 0 to 3000 meter
- (2) Shipping 0 to 12000 meter

3.2.5. Shock

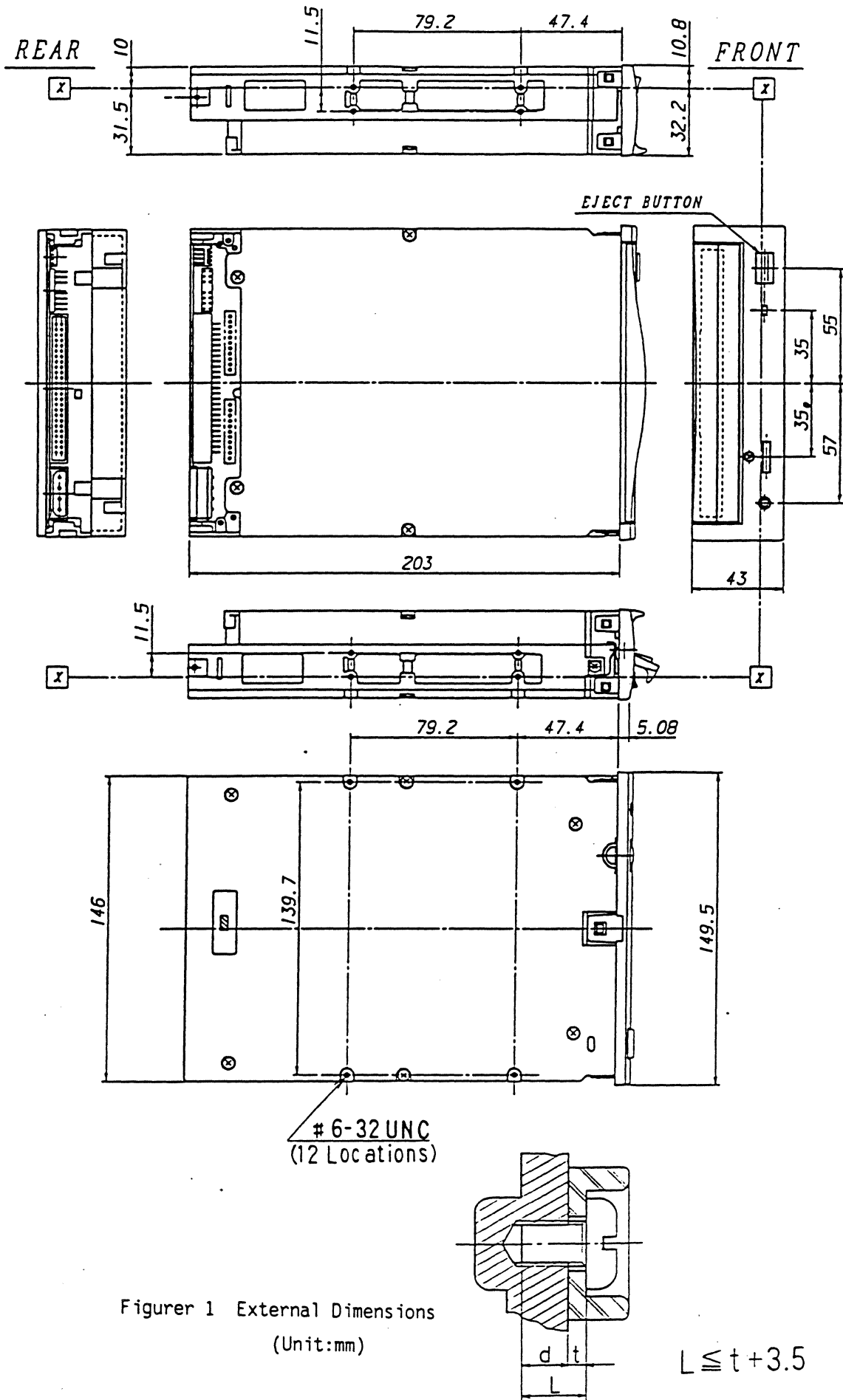
- (1) Operating ---no soft error within 5 retries---
 - 2 G(Half sine wave 11 mS/10 Sec interval)
 - data read recoverable---
 - 10 G(Half sine wave 11 mS/10 Sec interval)
- (2) Non-operating (with no CD-Caddy loaded) ---no damage must result---
 - 50 G(Half sine wave 11 mS)
- (3) Drop(Packaged) ---no damage must result---
 - a. Palletized Package 2 drops at 200 mm & 10 drops at 50 mm (Z)
 - b. Individual Package 0.9 meter drops once for each 6-surfaces,
1-edge and 1-corner

3.3. Installation Conditions

Mount the drive within 45 degrees of the horizontal or vertical (left or right side down) positions, keeping the Front Bezel Plane vertical.

3.4. Dimensions and Weight ---See Figure 1 for details---

- (1) External Dimensions(W x H x D) 146 mm x 41.5 mm x 203 mm
- (2) Weight
 - 0.9 kgram (Net)
 - 1.5 kgram (Individual Packaged)
 - 11.9 kgram (Bulk Packaged)



3.5. Reliability

3.5.1. Error Rate

(1) Hard Read Error Rate(Byte Error Rate) ---Allowing 5 Retries---

Mode 1: 10^{-12} Max

Mode 2: 10^{-9} Max

(2) Seek Error Rate ---Allowing 5 Retries---

10^{-6} Max

3.5.2. MTBF 30,000 POH

3.5.3. MTTR 0.5 H

3.5.4. Drive Life 15,000 POH or 5 Years(earlier one)

(1) Caddy Load/Unload 10,000 times or more

(2) Interface Connector Attach/Detach 500 times or more

4. Configuration

See Figure 3 for details of the configurations.

4.1. Electrical Circuits

(1) CD Caddy Load Detector Switch and Unload Detector Switch

(2) Optical Pickup Servo Control Circuit

(3) Feed Motor Drive Circuit

(4) CD Caddy Loading Control Circuit

(5) Laser Diode Control Circuit

(6) EFM Demodulator and CD-ROM Error Correction Circuit

(7) SCSI Interface Control Circuit

(8) System Control Circuit

(9) Digital to Analog Converter

4.2. Optical Pickup : Semiconductor Laser and 3-beam System

4.3. Spindle Motor : DC Motor

4.4. Feed Motor : DC Motor with Non-contact Type Velocity Sensor

4.5. CD Caddy Loading Motor : DC Motor

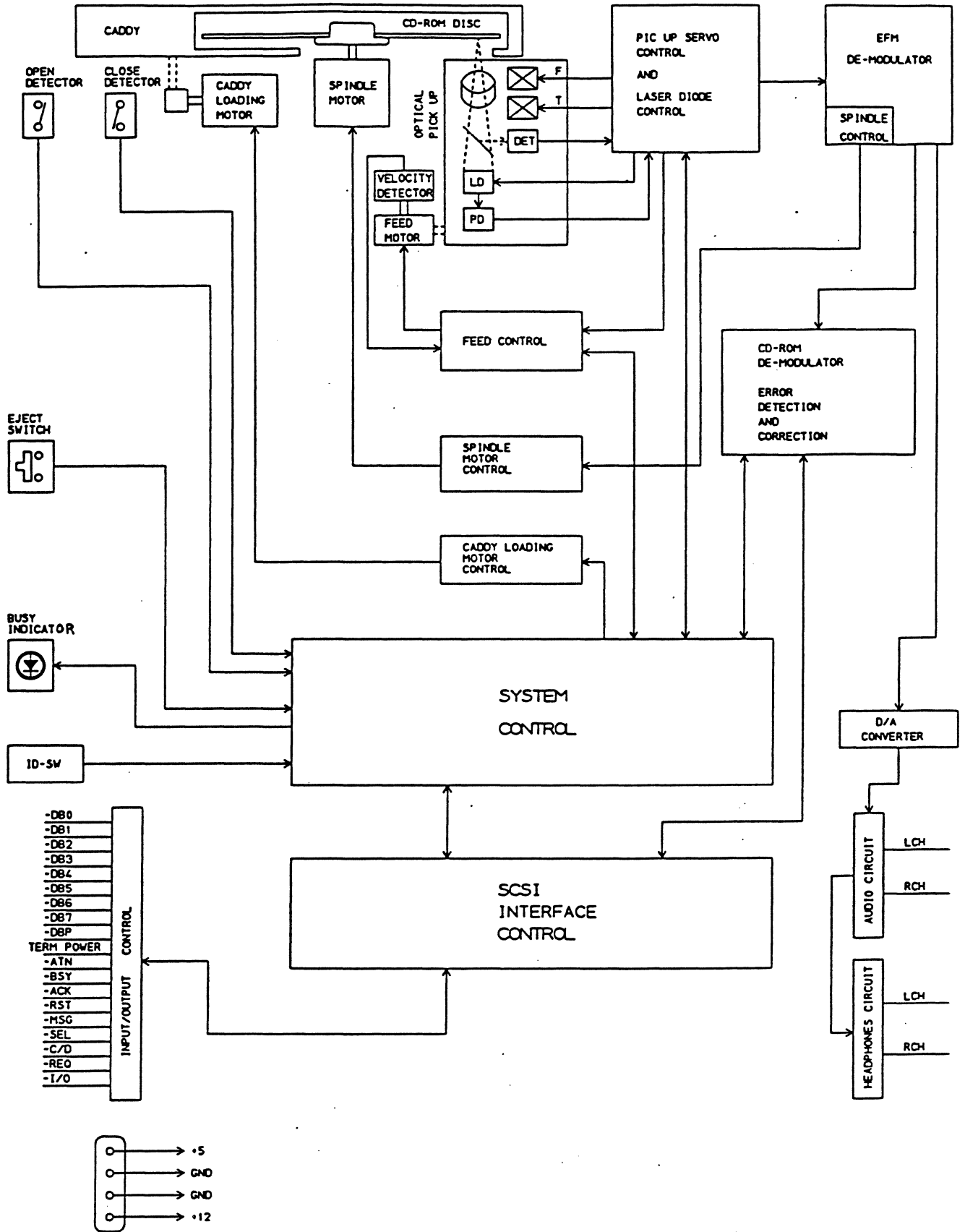


Figure 3 Configuration

5. Functions

5.1. CD-ROM Data Configurations

Figure 4 shows how the data is structured in program units. 1 block=1/75 Sec.

5.2. Power ON/OFF Timing

Synchronize the two (+12V and +5V) power supplies' ON/OFF timing within ± 100 mSec.

Figure 5 shows the initialization sequence.

6. Interface

- (1) The interface is based on ANSI standard X3.131-1986SCSI(SCSI-1) and SCSI-2 X3T9.2/86-109 Revision 10c.
- (2) 39 types of commands are usable including CD-ROM unique commands.
- (3) The CD-ROM drive is usually runs as the target.
- (4) The 64 K byte data buffer handles both high speed and low speed data transmission.
- (5) The largest block size on playback is 2352 bytes. The data length for each block is changeable by command.
- (6) On command execution, DIDCONNECT processing and RECONNECT processing can be specified.
- (7) Command link functions are usable.

For further details, see the "TOSHIBA CD-ROM SCSI INTERFACE SPECIFICATIONS VER. 5.0".

6.1. Signal Lines

- (1) Logical levels of every Inputs and Outputs are logically false signals.

Input Low = 0.0 to +0.4 V = Logic '1'(true)

Input High = +2.5 V to +5.25 V = Logic '0'(false)

Output Low \geq 48 mA

Output High = Open collector(high impedance)

Subcode Address

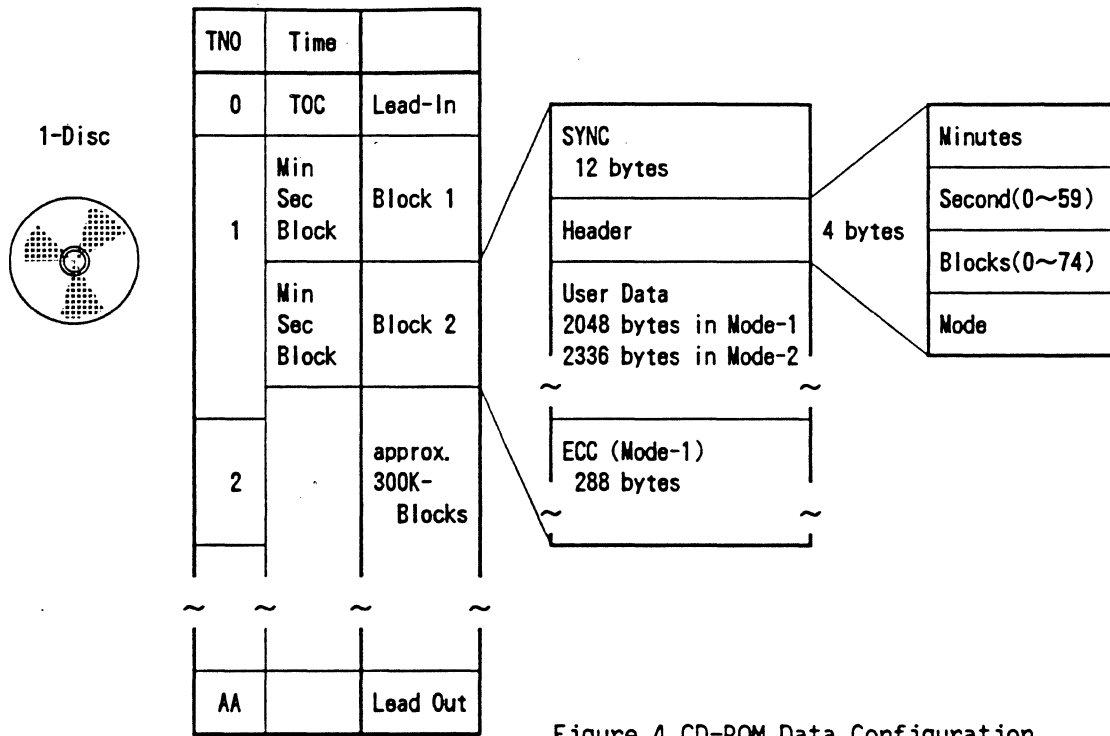


Figure 4 CD-ROM Data Configuration

XM-3301B PRODUCT SPEC E-2(JUL/91)

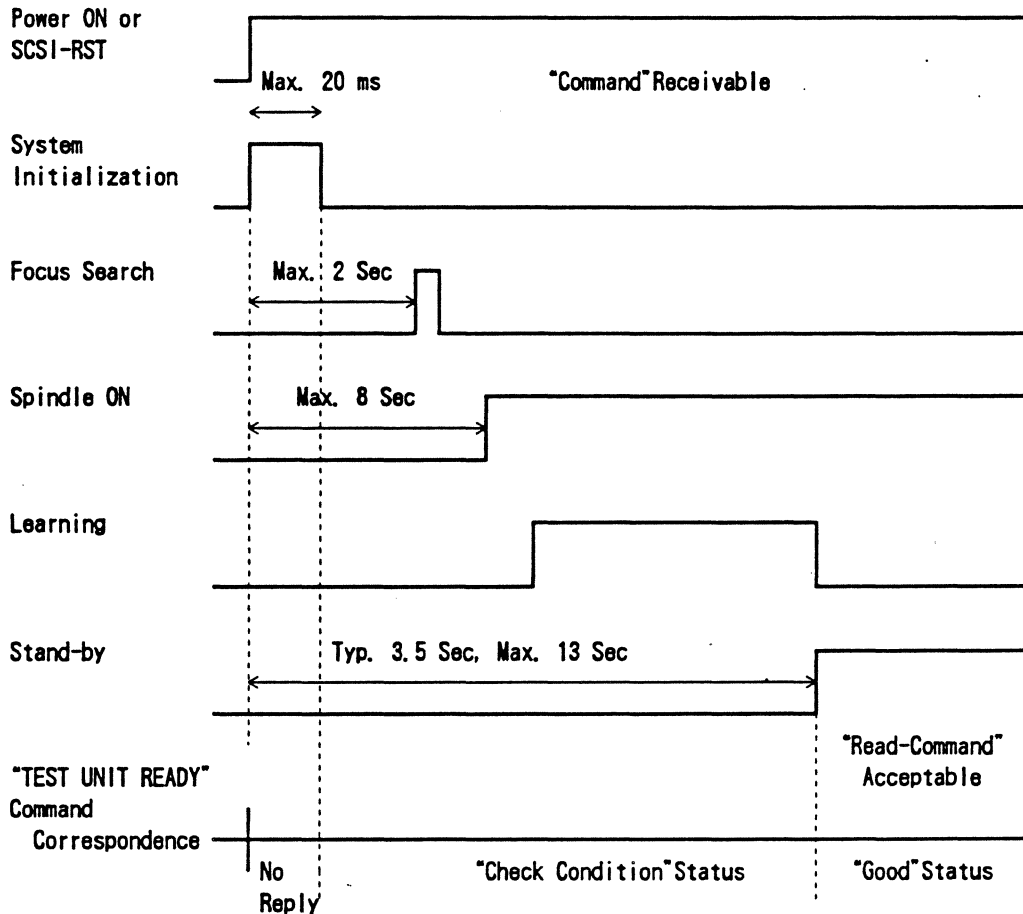


Figure 5 Initialization Sequence

- (2) The terminator power line has a 1A fuse within the drive to protect the power supply. This is shown in Figure 6.

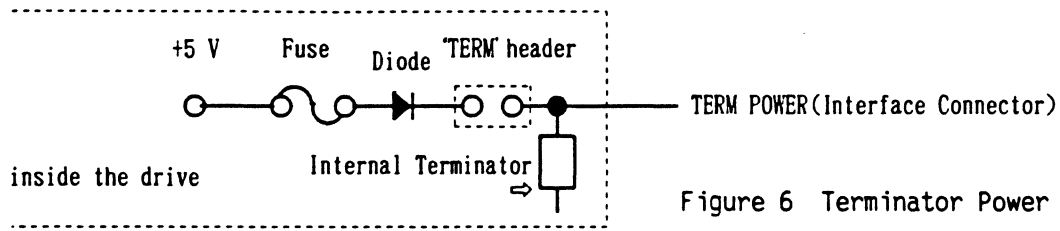


Figure 6 Terminator Power

6.1.1. Signal Line Termination

Figure 7 shows the method for daisy chain connection and Figure 8 shows the method for radial connection. Always connect the terminator for SCSI interface because of the open collector configuration output drive.

Also be sure to attach the frame ground for grounding with the host system.

6.1.2. Receivers and Drivers

Figure 9 shows how the signal lines should be set up and used.

6.1.3. Connector

Figure 10 shows the connector and Figure 11 shows the interface pin assignments.

7. Power Requirements

7.1. Source Voltage DC +12 V $\pm 5\%$ ($\pm 8\%$ for startup time)

DC +5 V $\pm 5\%$

7.1.1. Spike +12 V : 150 mV_{p-p}, Max

+5 V : 50 mV_{p-p}, Max

7.1.2. Ripple +12 V : 150 mV_{p-p}, Max

+5 V : 50 mV_{p-p}, Max

7.2. Current Drain (Typical value) ---excluding 'Term Power' current---

	<u>+12 V</u>	<u>+5 V</u>
7.2.1. Idle State	0.10 A (Average)	0.48 A (Average)
	0.25 A (Maximum)	0.73 A (Maximum)
7.2.2. Read State	0.09 A (Average)	0.48 A (Average)
	0.16 A (Maximum)	0.56 A (Maximum)
7.2.3. Seek State	0.22 A (Average)	0.49 A (Average)
	0.77 A (Maximum)	0.79 A (Maximum)

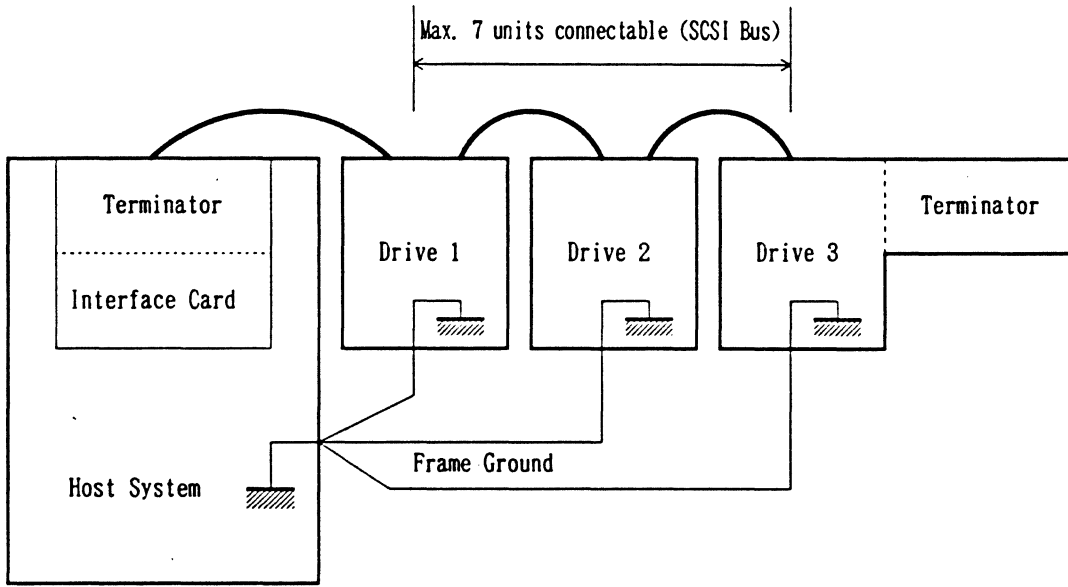


Figure 7 Daisy Chain Connection

---Disconnect the Internal Terminators from the drive if XM-3301Bs are used as Drive 1 and/or Drive 2.---

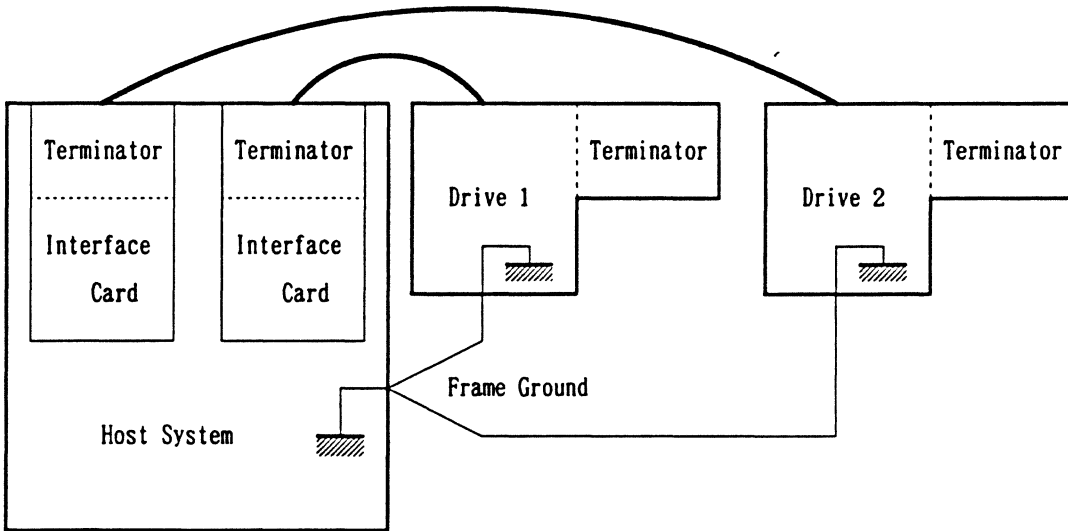


Figure 8 Radial Connection

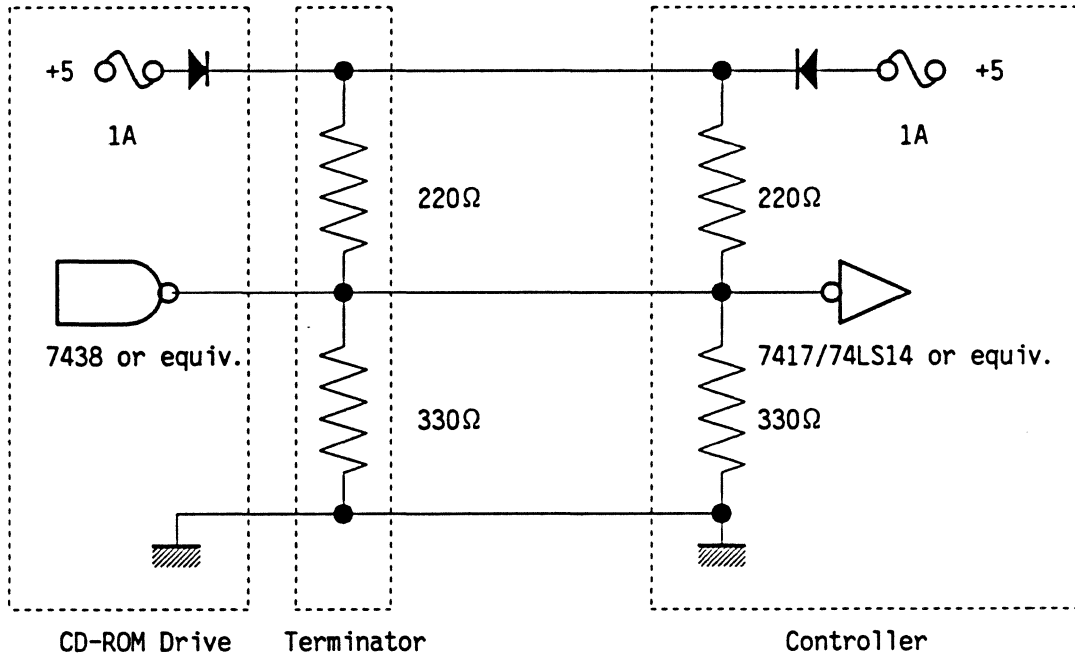
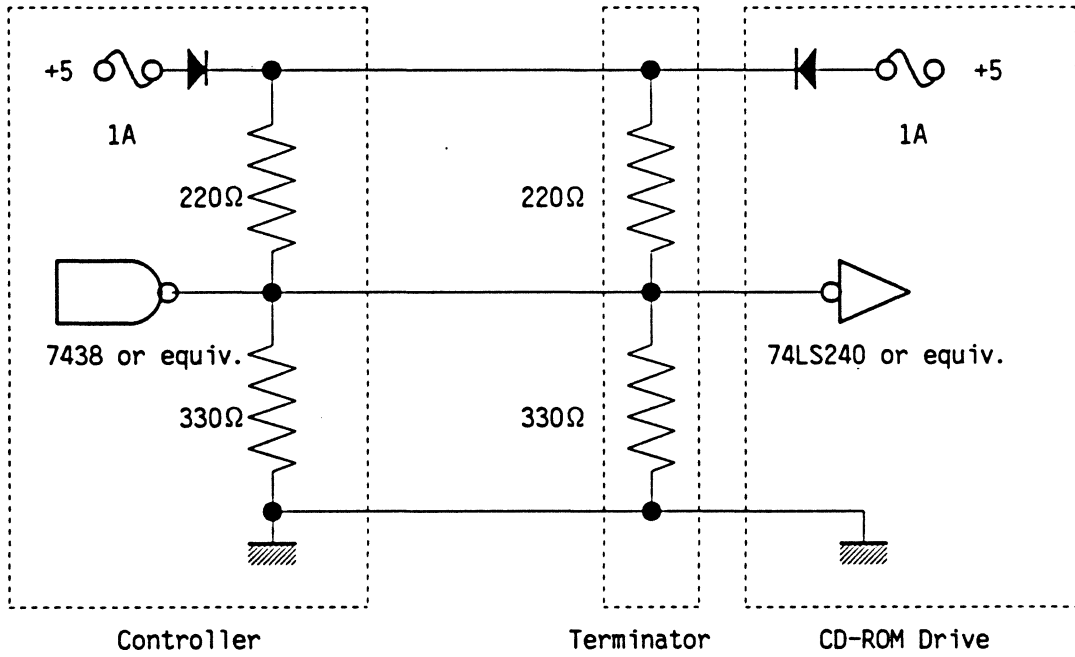


Figure 9 Receivers and Drivers

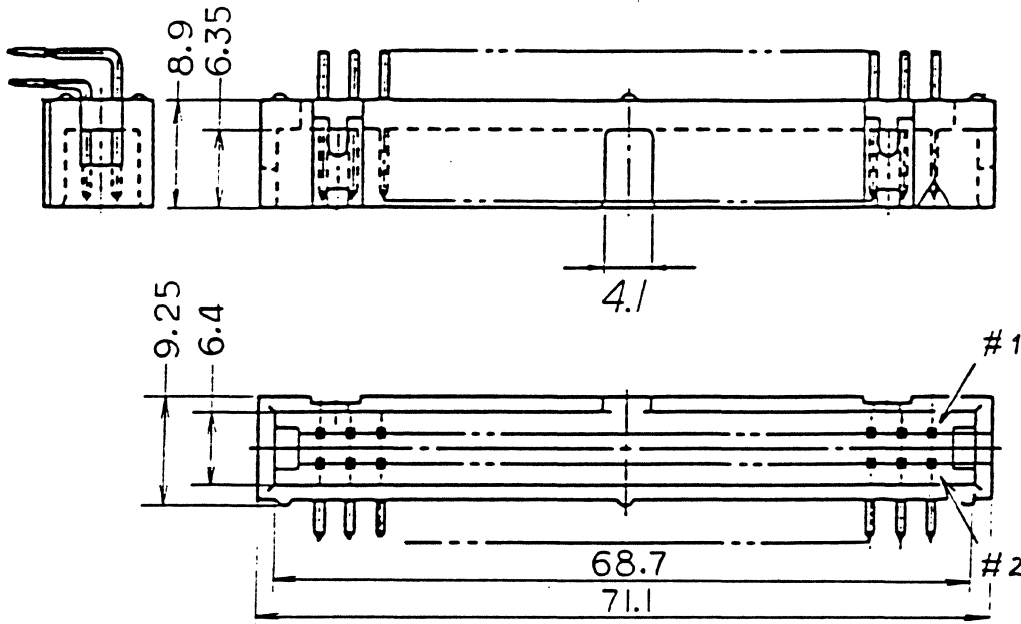


Figure 10 Interface Connector

PIN No	SIGNAL NAME	PIN No	SIGNAL NAME
2	-DB 0	1	GND
4	-DB 1	3	"
6	-DB 2	5	"
8	-DB 3	7	"
10	-DB 4	9	"
12	-DB 5	11	"
14	-DB 6	13	"
16	-DB 7	15	"
18	-DBP	17	"
20	GND	19	"
22	GND	21	"
24	GND	23	"
26	TERMPower (+5V)	25	NO CONNECTION
28	GND	27	GND
30	GND	29	"
32	-ATN	31	"
34	GND	33	"
36	-BSY	35	"
38	-ACK	37	"
40	-RST	39	"
42	-MSG	39	"
44	-SEL	41	"
46	-C/D	43	"
48	-REQ	45	"
50	-I/O	49	"

Figure 11 Interface Connector Pin Assignment

7.3. Connector

Figure 12 shows the external appearance of the Power Supply Connector.
Use AMP JAPAN P/N 174552-1, MOLEX JAPAN P/N 53109-0410 or equivalent.

PIN #1 : +12 V
PIN #2 : +12 V return
PIN #3 : +5 V return
PIN #4 : +5 V

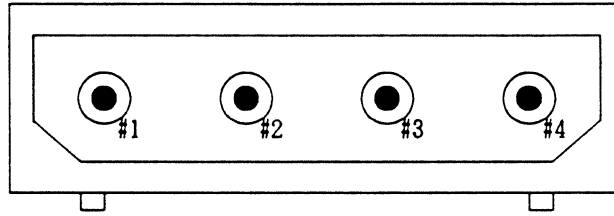


Figure 12 Power Supply Connector

7.4. Fuse for Terminator Power

1 A /125 V S.O.C. Co., Ltd Type SSFC or equivalent.

8. Audio

8.1. Line Output ---in case of the attenuator is set at 0 dB by the command---

(1) Output Level	0.5 V rms (Typ)
(2) Type	Unbalanced
(3) Load Impedance	10 k Ω min.
(4) Frequency Response	20 Hz to 20kHz \pm 3 dB
(5) Distortion	0.03 % Max.(at 1 kHz w/30 kHz LPF)
(6) Signal to Noise Ratio	84 dB Typ (JIS A-weighted)

8.1.1. Connector

3P connector(ELco International Co.,Ltd, 8283 Series or equivalent)

8.2. Headphones Output ---in case of the attenuator is set at 0 dB by the command---

(1) Output Level	0.65 V rms (Typ)
(2) Level Adjust Controller	Continuous Type(Thumb Wheel Knob)
(3) Load Impedance	100 Ω (Nominal)

8.2.1. Connector

3.5 mm diam. Stereo Headphone Jack

8.3. Audio Modes

- (1) 16 Modes including 'Stereo', 'Lch Mono', 'Rch Mono' and 'Mute' are selectable by command. Default mode is 'Stereo'.

Audio Out is automatically muted in the digital data area and seek state.

- (2) 16 Steps of attenuation level for the Audio Output(both Line Out and Headphones Out together) is selectable by command. Default level is -12 dB.

9. Jumper Setting/Feature Selections

Set up of SCSI-ID number, Parity Check function, Eject Button Inhibit function and CD-Audio Playback mode etc. are available by shorting these Headers.

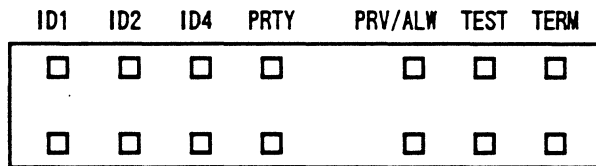


Figure 13 Mode Select Headers

9.1. SCSI-ID (ID1, ID2, ID4)

This 3 bit binary header sets the SCSI-ID number. When setting numbers, follow the application software instructions.

Header	LSB		MSB
	ID1	ID2	ID4
0	O	O	O
1	S	O	O
2	O	S	O
3	S	S	O
4	O	O	S
5	S	O	S
6	O	S	S
7	S	S	S

O :open S :short

9.2. Parity (PRTY)

To enhance data bus reliability, set this Header to 'S' to activate the parity bit check function on SCSI data bus. This setting cannot be used if no parity generation function is provided on the I/F card.

Header	Description
O	The drive does not check parity although the output data is issued the parity bit.
S	The drive checks parity, and also the output data is issued the parity bit.

O :open S :short

9.3. Media Eject Prevention(PRV/ALW)

This Header Setting enables or disables the media(CD-Caddy) removal.

Header	Description
O	Allow the CD-Caddy removal.
S	Prevent the CD-Caddy removal. Eject Button is ignored.

O :open S :short

9.4. Audio Playback(TEST)

This Header Setting selects the drive operation between normal CD-ROM and CD-Audio player mode. When 'S' is selected, command from the host computer is ignored. Also CD-Audio disc or audio tracks in CD-ROM disc is playable by the command when the Header is set for 'O'.

Header	Description
O	Normal operation mode to connect the host computer.
S	(ID1, ID2, ID4 and PRTY Headers should be set for O) CD-Audio disc playback mode. Allows repeated play from beginning of the program area up to the last when the disc is loaded. Pushing the Eject Button for shorter than 1 sec. allows proceeding to beginning of the next track number but not acceptable during access. Pushing the Button more than 2 sec. stops playing and ejects the CD-Caddy.

O :open S :short

9.5. Terminator Power (TERM)

This Header Setting selects termination power(+5 V) Shared/None mode.

Header	Description
O	No termination power is supplied from the drive.
S	Termination power is supplied to the internal terminator and also supplied to the other peripherals through SCSI Interface Connector (Pin No.26).

O :open S :short

9.6. Jumper(Part Number T/E)

Use P/N HIF3GA-2.54SP made by Hirose Electric Co.,(Hirose USA) or equivalent.

9.7. Recognition of Setting

As the Setting Recognition performed only right after power On, turn power Off and then power On again whenever change is made.

10. Busy Indicator

The LED at Front Bezel (Busy Indicator) indicates the drive status.

- (1) Continuously Off when no CD-Caddy is loaded.
- (2) After CD-Caddy is loaded, Busy Indicator start blinking at 0.8 Sec. intervals, and then...
 - (2-1) Turns Off when the drive in the 'Data Read' or 'Stand-by' status.



Figure 14 Data Read or Stand-by

- (2-2) Ejects the CD-Caddy when no disc in the CD-Caddy, disc is set upside down in the CD-Caddy or extremely dirty or badly scratched disc is set in the CD-Caddy.



Figure 15 Media Problem

- (2-3) Still blinking at 3.2 Sec. intervals when cleaning for disc or optics in the drive is required.

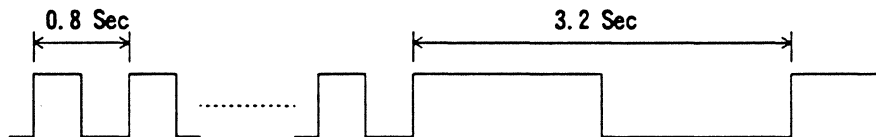


Figure 16 Maintenance Required

- (3) When playing an audio track, Busy Indicator is blinking at 1.6 Sec. intervals.

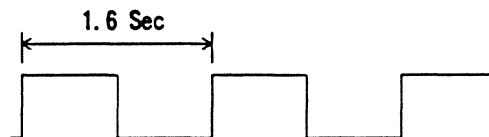


Figure 17 CD-Audio Playback

- (4) When performing 'Data Access' Busy Indicator keep turn On, and then start blinking at 0.2 Sec. intervals during 'Data Transfer'.

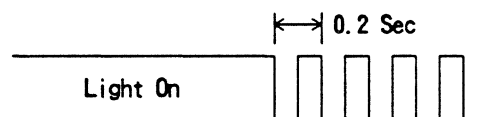


Figure 18 Data Access and Data Transfer

11. Connections

11.1. Power Supply Cable

- | | |
|-------------|--|
| (1) Housing | AMP JAPAN P/N 1-480424-0 or equivalent |
| (2) Contact | AMP JAPAN P/N 170148-2 or equivalent |
| (3) Cable | AWG 18 to 20 |
| Length | Max. 2 meters |

11.2. Interface Cable

- | | |
|--------------------|--|
| (1) Connector | SCSI standard |
| (2) Cable | 50 core type |
| Specific Impedance | 100 Ω \pm 10 % (without shield) |
| Length | Max. of 6 meters for total SCSI bus length |

11.3. Audio Cable

Unbalanced and shielded

- | | |
|-----------------|-------------------|
| (1) Capacitance | Less than 1000 pF |
| (2) Length | Max. 3 meters |

11.4. Terminators

2-Standard 11-Pin Terminator with Pull-Tab.
See Figure 19 for details.

- | | |
|---|------------------------------|
| (1) Pull up resistor | 220 Ω \pm 5 % |
| (2) Pull down resistor | 330 Ω \pm 5 % |
| (3) Rated Power($T_a = 70^\circ\text{C}$) | 125 mW |
| (4) Maximum Rated Voltage | 100 V |
| (5) Operating Free-Air Temperature | -55 to +125 $^\circ\text{C}$ |

12. Maintenance

In case of Figure 16 (Page 19), cleaning for disc or optics in the drive is required.

12.1. Disc

Try to avoid touching the read area (underside) of the disc as dirt and smears will degrade the disc accessing speed.

If the disc is dirty, wipe it with a soft cloth.

12.2. Optical Pickup

A dirty Optical Pickup will also degrade the access time.

When the Pickup is dirty, gently wipe the objective lens of the Pickup.

13. Safety Standards/Agency Approvals

- | | |
|------------|---|
| (1) Safety | IEC 950
UL 1950
CSA 22.2 No.220 |
| (2) Laser | FDA 21, IEC Pub 825 |
| (3) EMI | Based upon FCC 15J-B
Based upon VDE 0871 |

14. Electrostatic Discharge

- | | |
|----------------------|---------------|
| Standard | IEC-801 |
| (1) Operating | 10 kV or less |
| (2) Damage including | 20 kV or more |

15. Accessories

- 1-Instruction Manual
- 1-CD-Caddy
- 2-Terminators(installed)
- 1-Short Jumper(installed in 'TERM'header)

16. Packaging

- 10 units with 10 CD-Caddy in a Bulk Pack
- 16 Bulk Packs on one Pallet.
- (Individual Packaging available)

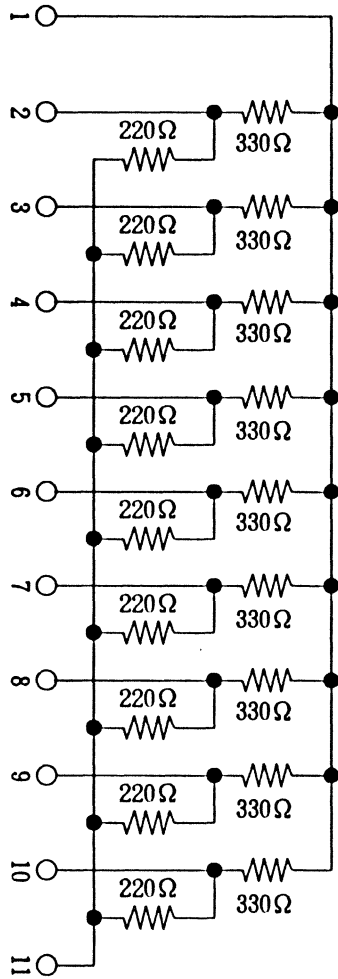
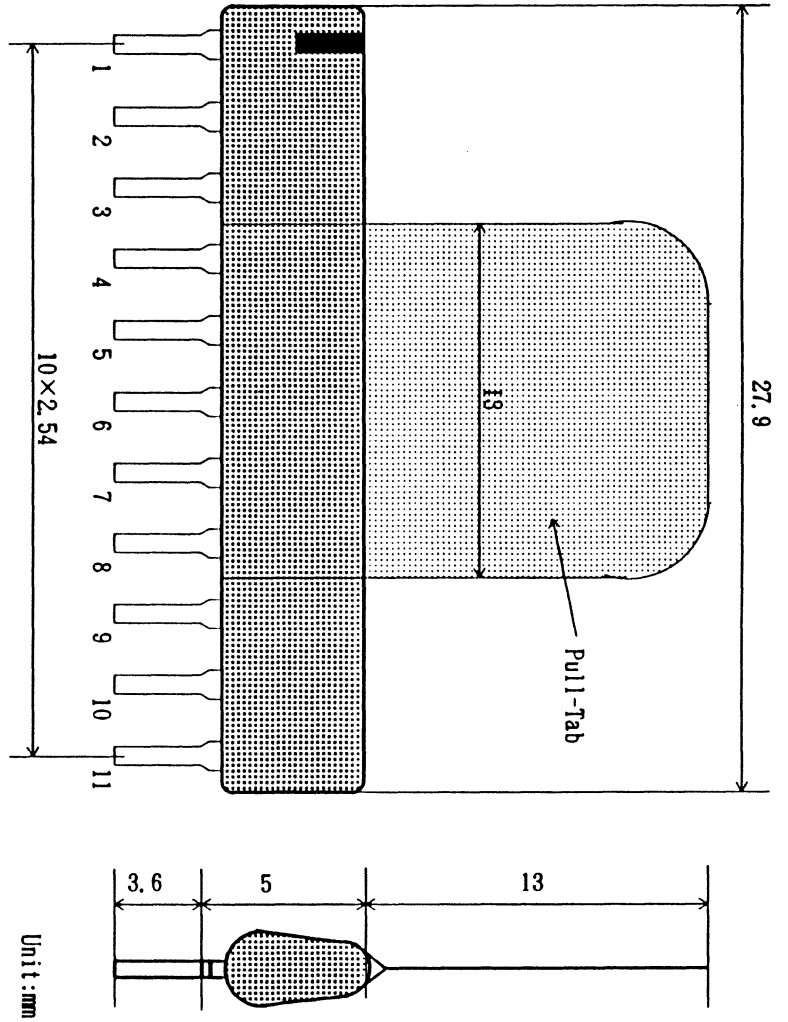


Figure 19 Terminator