

**COMPACT DISC Recordable/ReWritable
Auto Changer DRIVE**

MC104S

SPECIFICATIONS

(Preliminary)

RICOH Company, Ltd.

Dec. 22, 1999

NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device , pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates , uses and can radiate radio frequency energy and , if not installed and used in accordance with the instructions , may cause harmful interference to radio communication.

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 to correct the interference by one or 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.

FCC WARNING

Changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION

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

- a) Pay careful attention not to let the invisible laser beam emitted from the optical pickup enter into your eyes.
- b) When you find a troubled state of the component in the optical pickup containing the laser diode , change to the specified new optical pickup. Do not open the optical pickup housings.

Akustischer Geräuschpegel

Dieser Drucker überschreitet einen Geräuschpegel von 70 dB (A) während dem Betrieb nicht.



Declaration of Conformity

“The Product complies with the requirements of the EMC Directive 89/336/EEC and the **Low Voltage Directive 73/23/EEC.**”

Revision History

No.	Revised Data	Revision	Contents	Description	Page
1	Dec. 22, 1999	Preliminary			

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I. OUTLINE

1. Overview

The Compact Disc Recordable/ReWritable Auto Changer drive MC104S can do much more than read and write the usual CD-R discs. When you load it with a rewritable CD-RW disc, you can record, read, and edit any kind of data, because these discs allow you to rewrite information that has already been recorded.

2. Features

- 1) Running OPC*1 gives a flatter writing signal that improves reliability.
- 2) An improved anti-heat design means that no cooling fan is needed.
- 3) Uses the world standard SCSI interface.
- 4) Can read not only CD-R and CD-RW discs, but also video CDs, music CDs, and photo CDs.
- 5) Half-height space but a great capacity.
- 6) Conforms to the world standard Orange Book Part II (CD-R) and Part III (CD-RW). Can use "TRACK AT ONCE", "DISC AT ONCE", "MULTISESSION", "PACKET WRITE" and "SESSION AT ONCE".
- 7) Supports packet write for easy writing to CD-R and CD-RW discs.

*1 Continuously monitors the signal level during recording and adjusts the laser power to compensate when the disc is dirty, insuring a flat signal.

II. CONSTRUCTION AND INSTALLATION

1. Basic Construction

The Compact Disc Recorder / Rewriter Auto Changer Drive: MC104S consists of following parts.

The Compact Disc Recorder / Rewriter Auto Changer Drive's configuration and Connector are shown below;

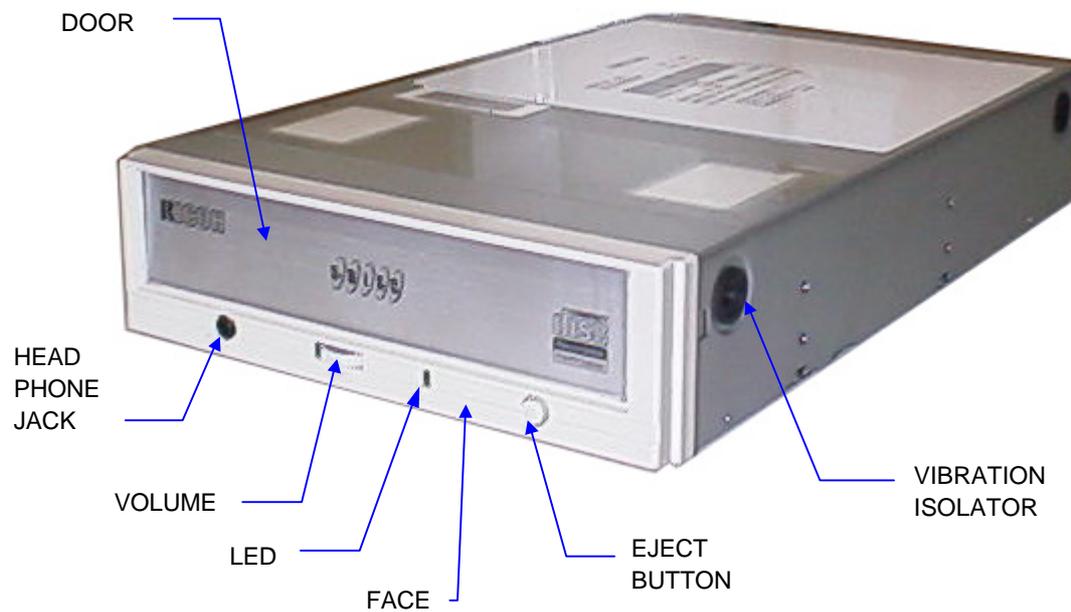


Fig. II - 1 Compact Disc Rewritable Auto Changer Drive configuration

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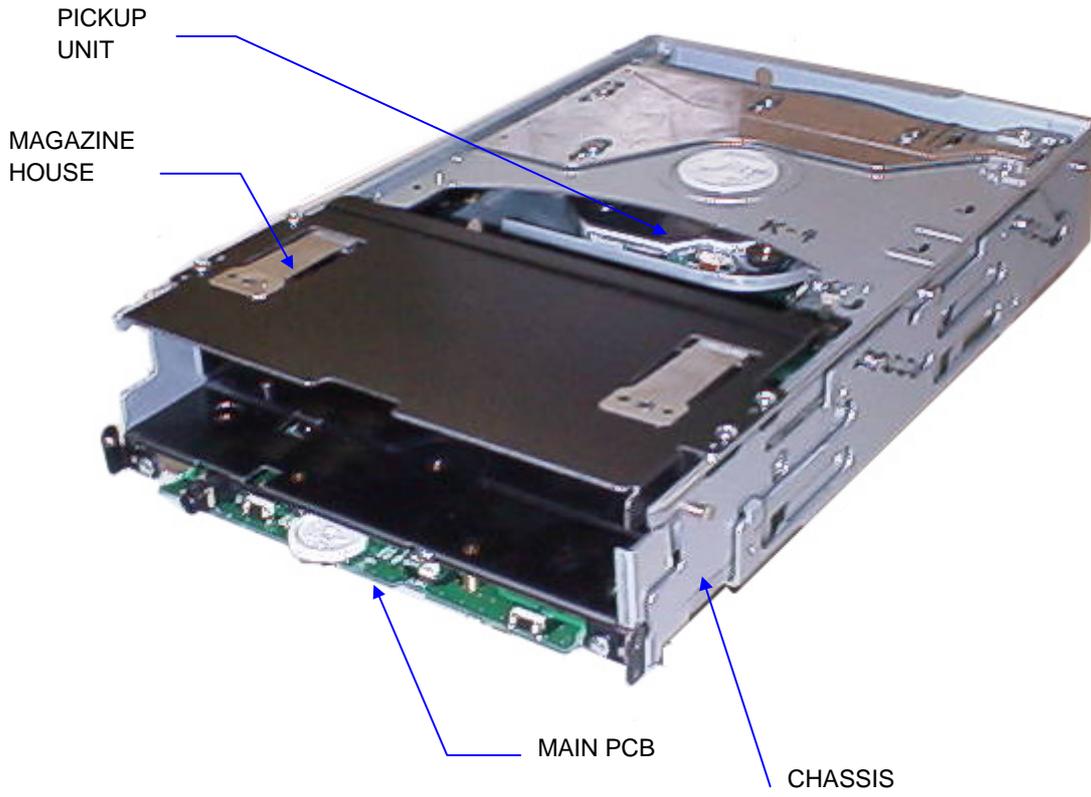


Fig. II - 2 Inside

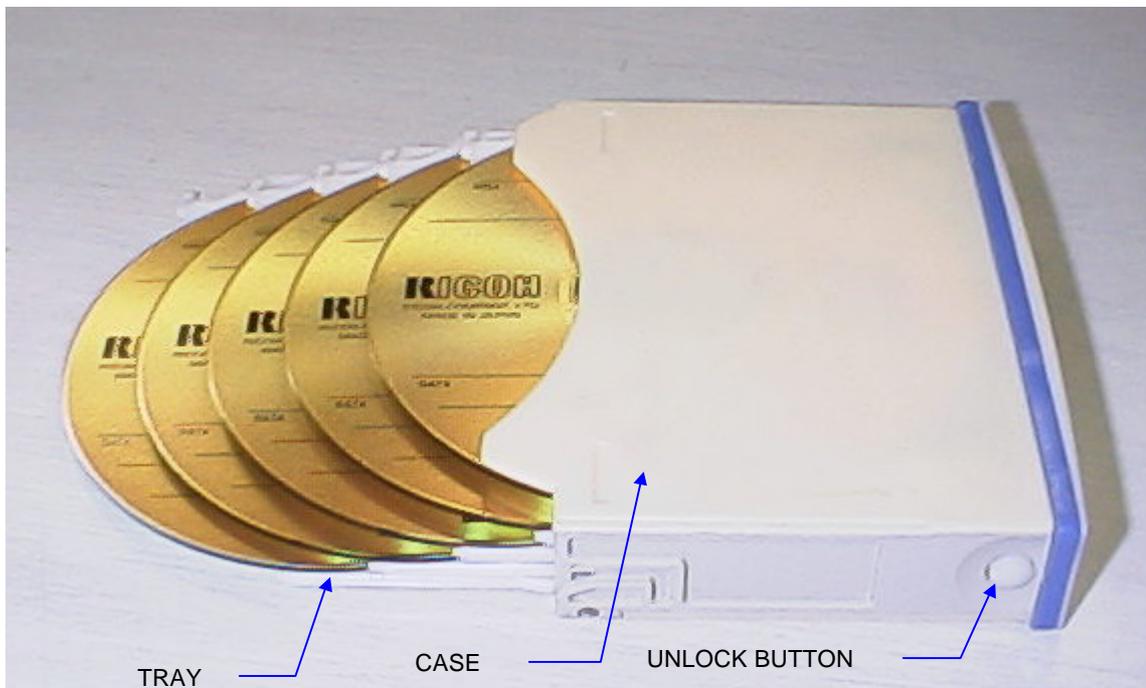


Fig. II - 3 Magazine

2. Connector

The Connectors are located as shown below. The function of each parts are also described below.

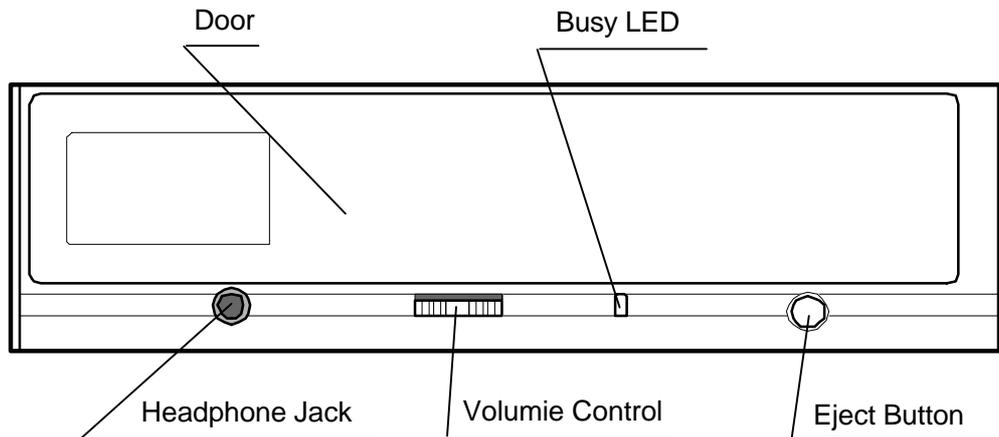


Fig. II - 4 Front

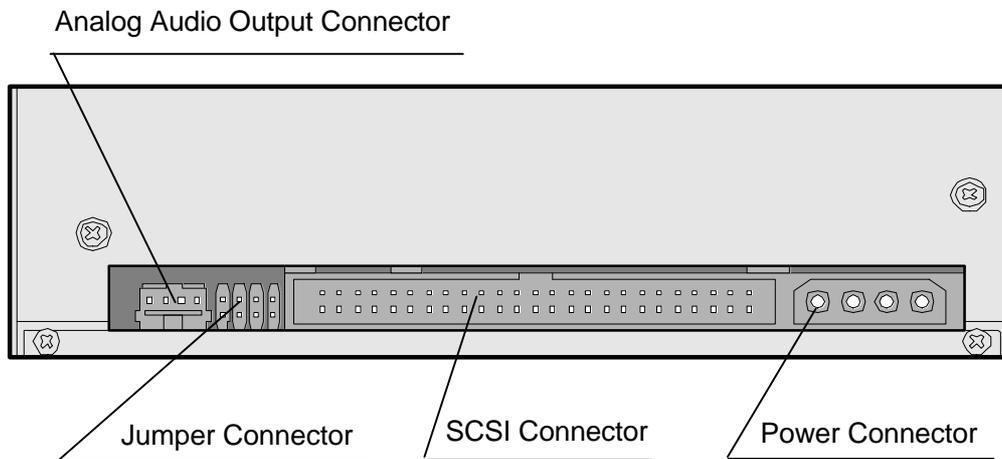


Fig. II - 5 Rear

2.1. Door

This is the door to insert the magazine. Place discs on disc trays of the magazine, then insert the magazine and the CDs will be loaded. The system need to be installed the driver to load discs on disc trays of the magazine. The only lowest disc in the magazine is loaded if the driver would not be installed.

! - Don't use force to pull out or push in the magazine. This might cause damage to the loading section of the drive.

2.2. Eject Button

This is the button used to eject or bring in the disc tray.

2.3. Busy indicator

This indicator light shines green when power is on. When the disc tray or disc is being accessed, the light shines or flashes orange. Even when a disc is loaded or a disc is not being accessed, the light shines green. When a illegal disc is loaded or some hardware trouble occurs, the indicator blinks.

2.4. Headphone Jack

This jack is for connecting headphones or mini-speakers.

2.5. Volume control

This is used to adjust the output volume of the headphone jack. It can't be used to adjust the output volume for the audio output connectors on the rear panel.

2.6. Power Connector

Used to connect to the host computer's power supply (DC 5V / 12V)

! - Be careful not to reverse the power connector when attaching it. A reversed connection may cause damage to the equipment (not covered by the warranty).

2.7. SCSI Connector

Use a 50 pin double-end flat SCSI cable to connect to the SCSI interface.

! - Connecting or disconnecting connectors while power is on may result in a short circuit, causing damage to the equipment. When connecting or disconnecting connectors, make sure to turn off the power beforehand.

2.8. Analog Audio Output Connector

Used to connect to the sound card.

2.9. Jumper Connector

Used when selecting the SCSI ID number and terminator. SCSI ID and terminator changes become valid after power is turned off, then on again.

! - If two peripheral devices use the same SCSI ID number, it will cause the host computer to operate abnormally or fail to start up.

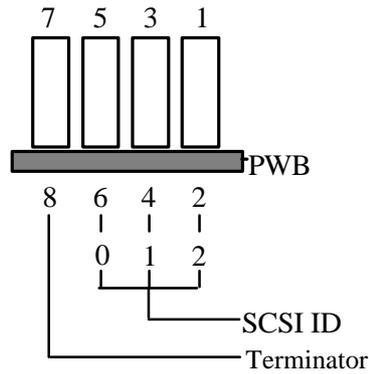


Fig. II - 6 Jumper Connector

Table II - 1 Jumper Connector Setting

Jumper pin	Function	Factory setting
1 - 2	SCSI ID (2)	0 (OFF/Open)
3 - 4	SCSI ID (1)	0 (OFF/Open)
5 - 6	SCSI ID (0)	0 (OFF/Open)
7 - 8	Terminator	1 (ON/Short)

No. 1 - 2, 3 - 4, 5 - 6 : SCSI ID

Table II - 2 SCSI ID

SCSI ID	Pin No. 2	Pin No.3	Pin No.4	Remark
0	OFF	OFF	OFF	Factory setting
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	*1

Note: ON : Jumper Pin is attached

OFF : Jumper Pin is not attached

*1: Don't use this setting. It is located as the setting for SCSI Adapter Card usually.

No. 7 - 8 : Terminator

When no other SCSI peripheral devices besides the CD-R/RW drive are connected to the host computer, a terminator must be attached to the drive. Also, when multiple peripheral devices are connected, this drive needs a terminator if it is the last in the line.

The terminator of this product can be set by installing (terminator: ON) or removing (terminator: OFF) the jumper pin from the jumper connector.

III. SPECIFICATIONS

1. Functionality

1.1. Recording

Data should be recorded on the optical disc in response to host computer command.

- 1) Drive receives necessary information such as logical block address, number of block and data to be recorded from the host computer.
- 2) Recording to pre-recorded area can not be executed. (CD-R disc)
- 3) Overwriting to pre-recorded area can be executed. (CD-RW disc)

1.2. Reading

Data on optical disc should be read in response to the host computer command. Audio playing (CD-DA) can be executed when receiving the Audio playing command from the host computer.

1.3. Load / Eject of Disc

1) Load

Place discs on disc trays of the magazine, then insert the magazine and the CDs will be loaded. The system need to be installed the driver to load discs on disc trays of the magazine. The only lowest disc in the magazine is loaded if the driver would not be installed.

2) Eject

Operator can eject the magazine (discs) by pushing this button.

1.4. Spindle Motor Start / Stop

The controller of the drive senses the disc to be set on the turn-table connected with the spindle motor and then starts to rotate the spindle motor, in response to the host computer command

1.5. Seek Motor

The controller of the drive starts to move the optical pick up carriage, in response to the host computer command.

1.7. Eject Button

Operator can eject the magazine (discs) by pushing this button.

1.8. Busy indicator

This indicator light shines green when power is on. When the disc tray or disc is being accessed, the light shines or flashes orange. Even when a disc is loaded or a disc is not being accessed, the light shines green. When a illegal disc is loaded or some hardware trouble occurs, the indicator blinks.

2. Basic Specification

Type : Tray Type

Supported Function (Write / Read / Play)

	Write	Read	Play*1
CD-DA	✓	✓	✓
CD-ROM	✓	✓	
CD-Extra	✓	✓	✓
CD-ROM XA	✓	✓	
Photo CD *2	✓	✓	
CD-I *2	✓	✓	
CD-G *3	✓	✓	
CD-Text	✓	✓	

*1): Play means Audio play back. Read means Data Transfer.

*2): CD-I, Photo-CD requires special reader/player.
Photo-CD writing requires Kodak license.

*3): RAW Sub-channel Data

Writing Mode :
Track at Onse
Disk at Onse
Multisession
Packet Write

Read Error Rate : 10^{-12} Bits or less

Write Error Rate : 10^{-10} Bits or less

Recording Capacity :
CD-R disc 700/650/550MByte (Type80/74/63)
CD-RW disc 700/650MByte (Type80/74)

Controller :
Host I/F SCSI II (Small Computer System Interface II)
Data Transfer speed Max.5 MB/sec.(Async), 8 MB/sec.(Sync)

Buffer Memory : 2 Mbytes

3. Audio Specification

Audio output :

Line Output Level	0.70 V \pm 0.1 V rms (output resistance: 100k Ω , 1kHz) S/N = over 83dB, distortion rate = less than 0.05%
Headphone Output Level	0.48 V \pm 0.1 V rms (output resistance: 100k Ω , 1kHz)

4. Performance Specification

Rotation Speed :	1x, 2x, 4x, 6x, 8x : CLV 8x - 20x : Full CAV
Write/Read Speed (Ave.):	20x : 3.00 MB/sec. (Mode1, Mode2, Form1) ^{*1} 20x : 3.40 MB/sec. (Mode2, Form2) ^{*1} 20x : 3.45 MB/sec. (CD-DA) ^{*1} 8x : 1,200 KB/sec. (Mode1, Mode2, Form1) ^{*1} 8x : 1,362 KB/sec. (Mode2, Form2) ^{*1} 6x : 900 KB/sec. (Mode1, Mode2, Form1) ^{*1} 6x : 1,021 KB/sec. (Mode2, Form2) ^{*1} 6x : 1,034 KB/sec. (CD-DA) 4x : 600 KB/sec. (Mode1, Mode2, Form1) 4x : 681 KB/sec. (Mode2, Form2) 4x : 689 KB/sec. (CD-DA) 2x : 300 KB/sec. (Mode1, Mode2, Form1) 2x : 342 KB/sec. (Mode2, Form2) 2x : 345 KB/sec. (CD-DA) 1x : 150 KB/sec. (Mode1, Mode2, Form1) 1x : 170 KB/sec. (Mode2, Form2) 1x : 172 KB/sec. (CD-DA)
	^{*1} Reading only
Access Time :	120msec. or less
Initial Time :	CD-ROM : less than 14 seconds CD-R, CD-RW : less than 19 seconds (including blank disc)
Changing Disc Time :	Less than 5 seconds (except spining down and mounting time)
Loading/Unloading Disc Tray Time :	Less than 2 seconds (except spining down and mounting time)
Magazine	
Loading Time :	Less than 5 seconds (until chacking from setting the magazine) *except mounting time
Ejecting Time :	Less than 4 seconds (until ejecting from pushing the eject button)

*except spinning down time

Acoustic Noise :	
Idle	40 dB or less (Sound Power Level)
Operating	55 dB or less (Sound Power Level)
Non-Operating	49 dB or less (Sound Pressure Level)

5. Condition for use and Safety standard

5.1. Power Supply :

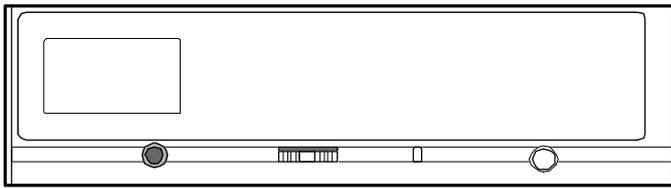
5V Power Supply :	
Voltage	DC5V \pm 5%
Ripple	50mVp-p or less
Current	2.0A (Typ.), 3.0A or less (peak)
12V Power Supply :	
Voltage	DC12V \pm 10%
Ripple	100mVp-p or less
Current	0.7A (Typ.), 1.5A or less (peak)
Power Consumption :	15W or less (Normal Operation) 8W or less (Stand by)

5.2. Environment Conditions

Temperature :	
Operating	5 - 40 °C(Without Fan)
Non-Operating	-30 - 65 °C (Power OFF, Without the magazine)
Humidity :	
Operating	5 - 90 %(No Condensation)
Non-Operating	5 - 95 %(No Condensation) (Power OFF, Without the magazine)
Temperature Gradient :	20 °C /hour(Max.)
Humidity Gradient :	10 %/hour(Max.)
Wet-Bulb Gradient :	30 °C (Max.)
Vibration :	
Operating	0.035mm p-p (10 - 45Hz) 0.025mm p-p (45 - 65Hz) 0.2 x 9.8 m/s ² (0.2G) (65 - 150Hz)
Non-Operating	1 x 9.8 m/s ² (1.0G) (5 - 300Hz) (Power OFF, Without the magazine)
Shock :	
Operating	1 x 9.8 m/s ² (1.0G) or less (6msec. Half Sine)
Non-Operating	40 x 9.8 m/s ² (40G) or less (11msec. Half Sine) (Power OFF, Without the magazine)
Altitude :	
Operating	-305 - 3,048 m

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Magnetic Condition :	4,000 A/m (50 Oe) or less
Dust :	Class 3,000,000 or less (Typ.)
Illuminance :	3,000 Lux or less
Against Electrostatic Stress :	
Contact discharge :	Over 6kV
Air discharge :	Over 12kV
Installation Conditions :	
Mounting direction	Horizontal/Vertical (Eject Button must be right side.)
Installation Angle	15° or less



Horizontal

Fig. III - 1 Installation Condition

6. Reliability and Usable Life

MTBF :	30,000 hours
MTTR :	30 min.
Equipment Life :	3 Years
Loading/Unloading the magazine cycle :	5,000 times
Loading/Unloading the disc tray cycle :	50,000 times (drive) 10,000 times (disc tray)
Seek endurance :	Over 100,000 times
Duty :	
POH	40 hours/week, 50 weeks/year, 3 years
Active	20%
Write/Active	50%
Load/Eject the magazine	5 times/day
Load/eject the disc tray	25 times/day (drive) 5 times/day (disc tray)
Error rate :	
Unrecoverable Errors	Once per 10^{12} bits or less

7. Safety Standards

Application Standard :	UL , cUL , TUV , CE , CDRH
Radio Interference :	Vcci-ClassB , FCC-ClassB , EN55022-ClassB

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8. Appearance

Dimensions : 146 mm x 233 mm x 41.3 mm
 (Width) (Depth) (Height)
 Weight : 1.5 kg or less

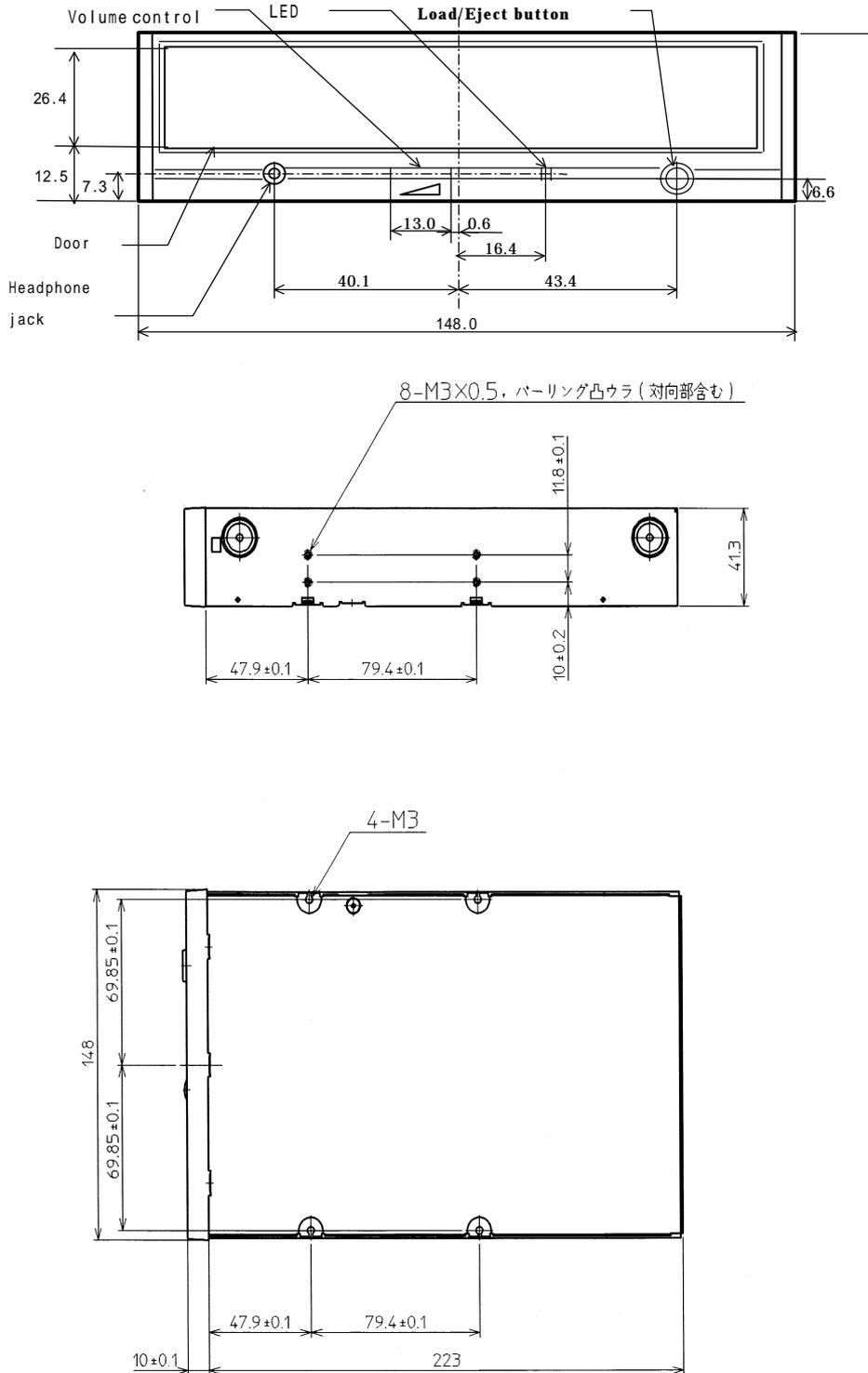


Fig. III - 2 CD-R/RW Drive Dimension

9. Storage Conditions

9.1. Storage Conditions

Temperature :	-30 - 65 °C (Max.)
Humidity :	5 - 95 % (No Condensation)
Temperature Gradient :	20 °C /Hour (Max.)
Humidity Gradient :	10 %/Hour (Max.)
Wet-Bulb Gradient :	30 °C (No Condensation)
Vibration :	1.0 x 9.8 m/s ² (1.0 G) or less (5 - 300 Hz)
Shock :	40 x 9.8 m/s ² (40.0 G) or less (11 msec. Halfsine)
Drop :	60.0 cm (JIS Z0202)
Altitude :	-305 - 15,240 m
Illuminance :	3,000 Lux or less
Preservation term :	1 year or less

9.2. Transportation Condition

Container :	Cardboard Packing Case
Means of Transportation :	Mixed loading possible
Stacking Layers :	6 or less (6 units package) 9 or less (1 unit package)
Attached Articles :	Caution and the magazine

9.2. Storage Conditions

1) 1 unit package

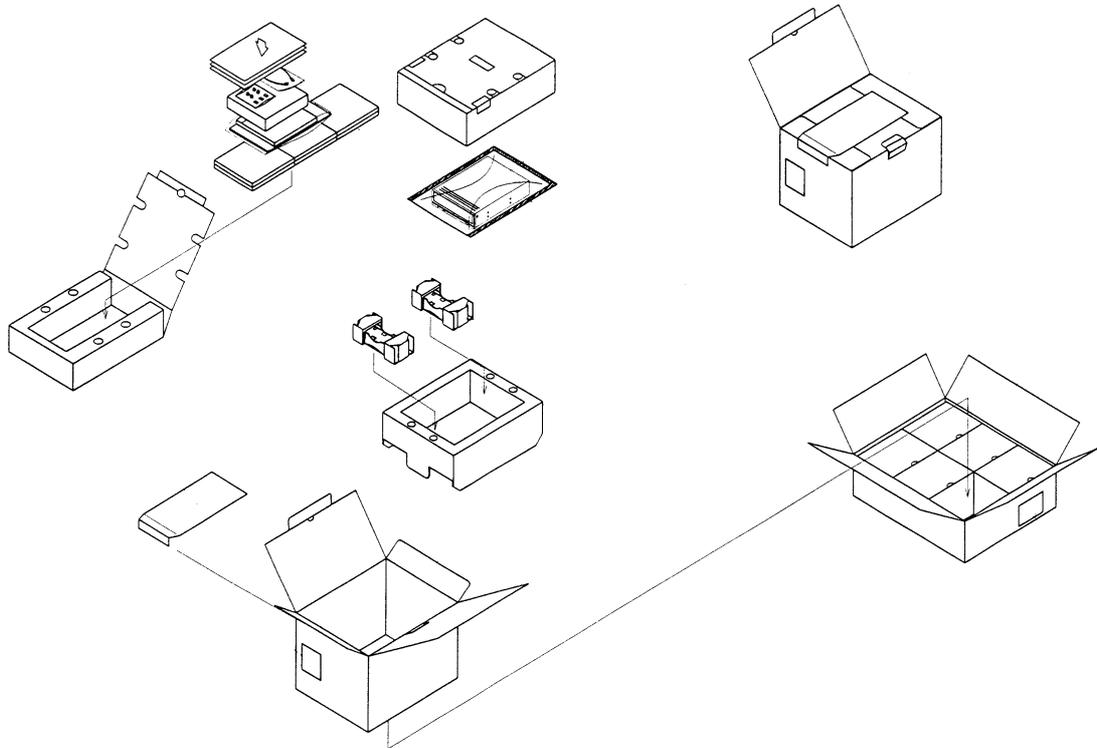


Fig. III - 3 Packing Arrangement 1)

1 unit package
Size : 278mm x 224mm x 195mm
 (W) (L) (H)
Weight : 3.0kg
6 units package
Size : 695mm x 572mm x 215mm
 (W) (L) (H)
Weight : 19.8kg

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2) 6 units package

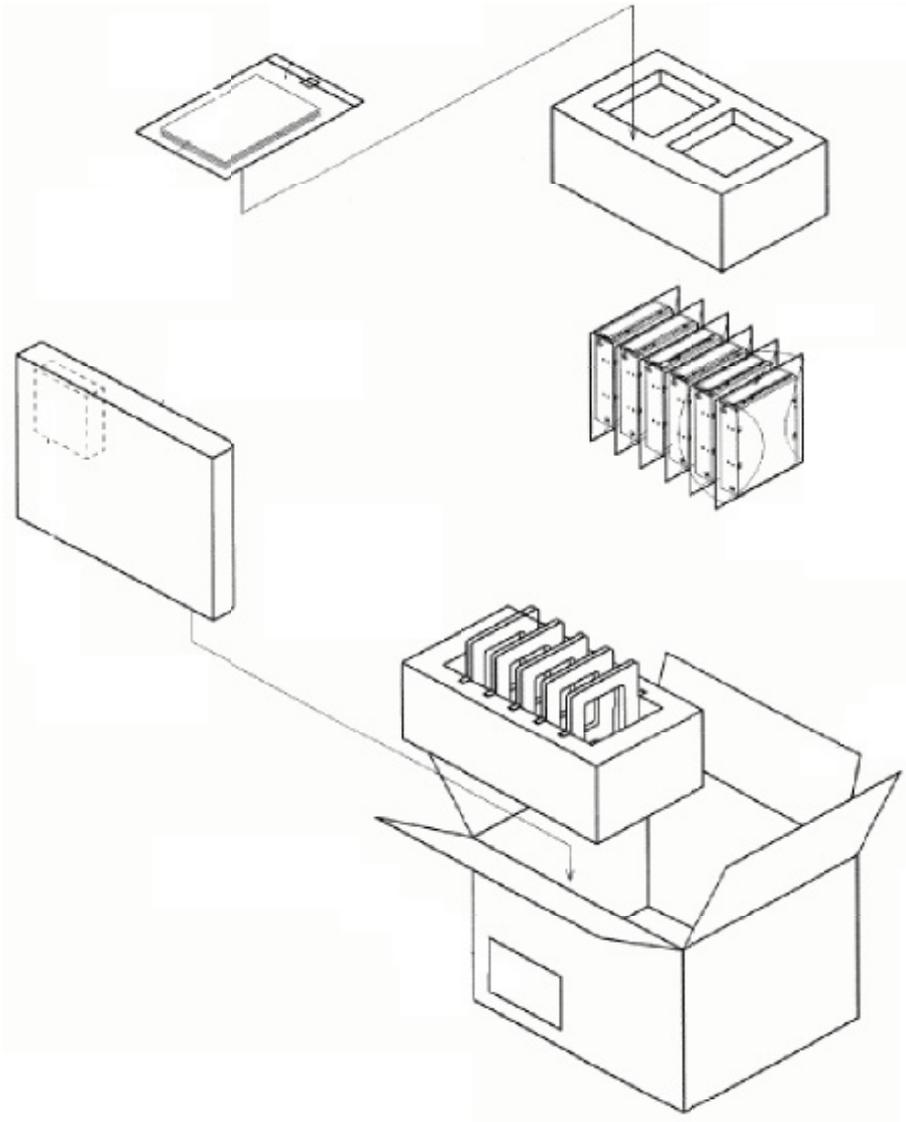


Fig. III - 4 Packing Arrangement 2)

Size : 435mm x 280 mm x 350 mm
(W) (L) (H)
Weight : 10.7kg

9.3. Set/Release the transport mode

Set the transport mode when transporting as follows;

1. Turn on the drive unit and take out the magazine.
2. Push the eject button five seconds or more, and the busy LED light turns orange and the drive works, and then confirm the busy LED light turns green.
3. Turn off the drive unit. Do not turn on the drive unit during transportation. Follow above procedure again in case of turning on.
4. Turn on the drive unit to release the transport mode.

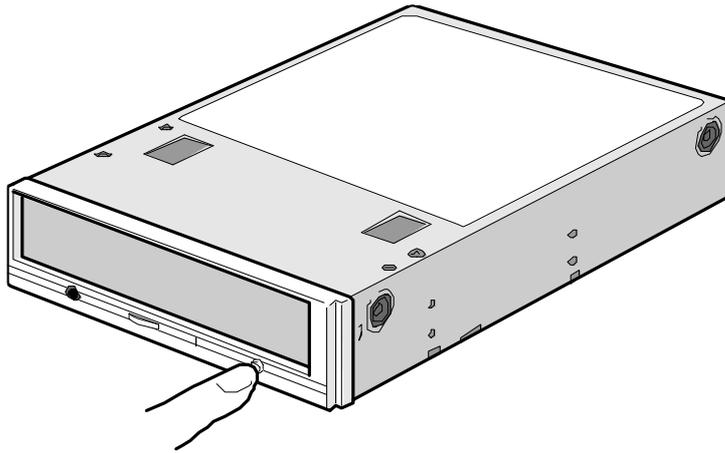


Fig. III - 5 Transport Mode

10. Magazine

10.1 How to eject/insert CDs from/in the magazine

1. While pushing the unlock button on the side of the magazine, pull out a claw of a disc tray and pull out the disc tray.
 2. Place a disc in the hollow of the disc tray keeping the label side of the disc upper to prevent a touch on the recording side. Do not place over two discs on one disc tray.
 3. Put the disc tray back to the magazine along by rails in the magazine slowly. Put the disc tray back for certain.
 4. Insert five discs or less taking above procedure over again.
- ! - Don't use cleaning discs on the market.
- Insert five disc trays in case there are some empty disc trays.

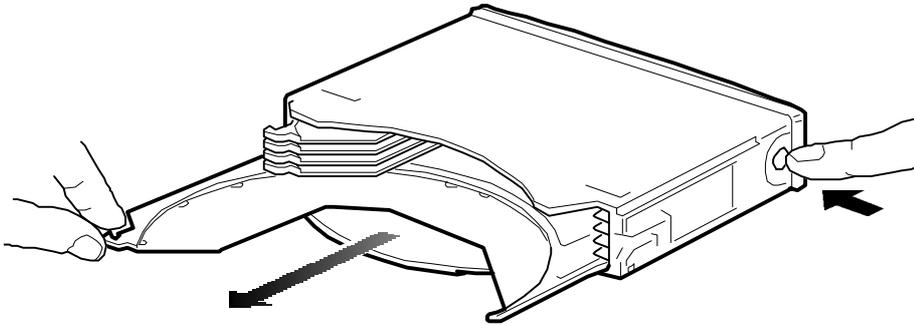


Fig. III - 6 How to eject/insert CDs from/in the magazine

10.2 How to insert/eject the magazine

Insert

1. Insert the magazine straight into the drive unit from the door in the front of the drive. Follow mentioned on the outside of the magazine.
2. Push the magazine straight in until locking.

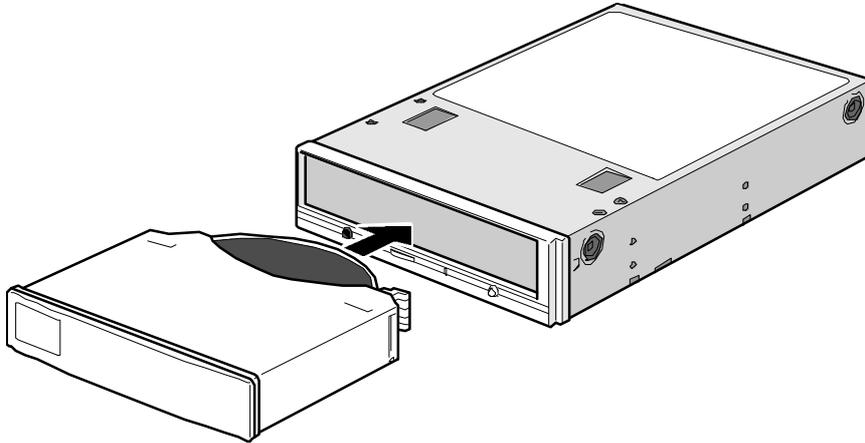


Fig. III -7 How to insert the magazine

Eject

1. Push the eject button on the Face.

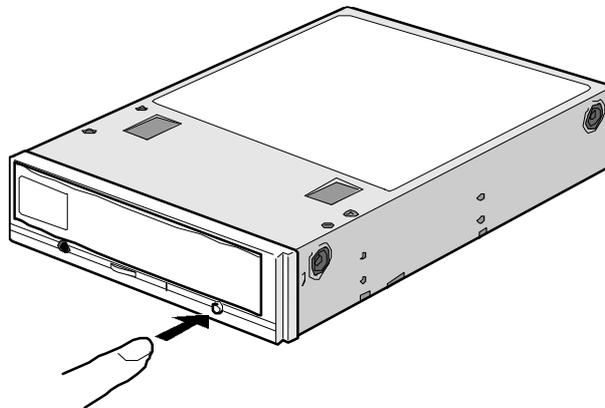


Fig. III -8 How to eject the magazine

11. Disc

Dimensions :													
Outside Diameter	$\phi 120 \pm 0.3$ mm												
Inside Diameter	$\phi 15 +0.1/-0.0$ mm												
Thickness	$1.2 +0.3/-0.1$ mm												
Recording area (User area) :	$\phi 50 - 116$ mm												
Recording capacity :													
	<table border="1"> <thead> <tr> <th>Media Type</th> <th>Type63</th> <th>Type74</th> <th>Type80</th> </tr> </thead> <tbody> <tr> <td>CD-R</td> <td>550 MB</td> <td>650 MB</td> <td>700 MB</td> </tr> <tr> <td>CD-RW</td> <td>-----</td> <td>650 MB</td> <td>700 MB</td> </tr> </tbody> </table>	Media Type	Type63	Type74	Type80	CD-R	550 MB	650 MB	700 MB	CD-RW	-----	650 MB	700 MB
Media Type	Type63	Type74	Type80										
CD-R	550 MB	650 MB	700 MB										
CD-RW	-----	650 MB	700 MB										
Track pitch :	1.6 ± 0.1 μ m												
Recording material :													
CD-R	Organic pigment (phthalocyanine) / Au or Ag lamination (Organic protective layer attached)												
CD-RW	Ag-In-Sb-Te phase change recording material												
Substrate material :	PC (Polycarbonate)												
Reflectance :													
CD-R	65 % or more												
CD-RW	15 - 20%												
Eccentricity :	70 μ m or less												
Maximum camber angle :	0.4° or less												
Recommend recording power :													
CD-R	6 - 7mW (at λ =785nm, NA=0.5)												
CD-RW	8 - 14mW (at λ =785nm, NA=0.5)												
Playback power :	1mW or less												
Playback stability :													
CD-R	10 ⁶ times or more (0.7mW)												
CD-RW	10 ⁶ times or more (1.0mW)												
Storage life :													
CD-R	10 years or more (5 - 25°C, 5 - 60%RH, Avoiding direct sunlight)												
CD-RW	30years or more (5 - 25°C, 5 - 60%RH)												
Environment for use :													
CD-R	-5 - 55 °C , 5 - 95 %RH												
CD-RW	10 - 40 °C , 10 - 80 %RH												

12. SCSI Command

SCSI command supported by MC104S are shown below.

Table III - 1 Group 0 Command

Operation Code	Type	Command Name
00H	M	Test Unit Ready
01H	O	Rezero Unit
03H	M	Request Sense
04H	O	Format Unit
08H	O	Read (6)
0AH	O	Write (6)
0BH	O	Seek (6)
12H	M	Inquiry
15H	O	Mode Select (6)
16H	M	Reserve
17H	M	Release (6)
1AH	O	Mode Sense (6)
1BH	M	Start/Stop Unit
1DH	M	Send Diagnostic
1EH	O	Prevent/Allow Medium Removal

Table III - 2 Group 1 Command

Operation Code	Type	Command Name
25H	M	Read CD Recoeded Capacity
28H	M	Read (10)
2AH	M	Write (10)
2BH	O	Seek (10)
2FH	O	Verify (10)
35H	M	Synchronize Cache
3BH	O	Write Buffer
3CH	O	Read Buffer

O : Option、 V : Vendor Unique、 M : Mandatory、 R : Reserved

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Table III - 3 Group 2 Command

Operation Code	Type	Command Name
42H	O	Read Sub-Channel
43H	O	Read TOC/PMA/ATIP
43H	O	Read TOC (Old Version)
44H	O	Read Header
45H	O	Play Audio (10)
47H	O	Play Audio MSF
48H	O	Play Audio Track/Index
4AH	R	Get Event Status Notification
4BH	O	Pause/Resume
4EH	V	Stop Play/Scan CD-ROM
51H	V	Read Disc Information
52H	V	Read Track Information
53H	V	Reserve Track
54H	V	Send OPC Information
55H	M	Mode Select (10)
5AH	M	Mode Sense (10)
5BH	V	Close Track/Session
5CH	V	Read Buffer Capacity
5DH	R	Send Cue Sheet

Table III - 4 Group 5 Command

Operation Code	Type	Command Name
A1H	V	Blank
A5H	O	Play Audio (12)
A8H	O	Read (12)
A6H	M	Load/Unload CD
AAH	R	Write (12)
B9H	V	Read CD MSF
BAH	O	Scan
BBH	V	Set CD Speed
BDH	V	Mechanism Status
BEH	V	Read CD

Table III - 5 Group 6 Command

Operation Code	Type	Command Name
D8H	V	Read CD-DA
D9H	V	Read CD-DA MSF

Table III - 6 Group 7 Command

Operation Code	Type	Command Name
EFH	V	Eject Check

O : Option, V : Vendor Unique, M : Mandatory, R : Reserved

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