**TEAC CD-224E-R83/R93
CD-ROM DRIVE**

HARDWARE SPECIFICATION

Rev. A

20 sheets in Total

8114a

TABLE OF CONTENTS

1. SCOPE

This is hardware specification of the TEAC CD-224E-R83/R93 built-in type CD-ROM drive (hereinafter referred to as CD-ROM drive or simply drive). As for the software specification, refer to "CD-224E-R90 Software Specification".

2. OUTLINE

The outline of this CD-ROM drive is given in Table 2-1.

(Table 2-1) Outline of the specification

Model name	CD-224E-R83	CD-224E-R93
TEAC P/N	1977178R-83	1977178R-93
Applicable safety and EMC standards	UL, CSA, TÜV, CE, CB, NEMKO, SEMKO, C-tick, BSMI, MIC	
Data transfer rate (burst) (sustained)	33.3MBytes/sec max 1,545 ~ 3,600kB/sec	
Average access time	110msec average	
Disc speed	5,136rpm typ	
Host interface	IDE (ATAPI)	
IDE input/output signal	CSEL	–CSEL
Power source	+5VDC	
Starting time	15sec max	
Applicable discs	CD-ROM, CD-R, CD-RW	
Applicable format	CD-DA CD-ROM (Mode1, Mode2), CD-ROM XA Mode2 (Form1, Form2), Photo CD (Single/Multi-session), CD-Extra (CD-Plus)	
Front bezel	Black	
Eject button	Black	
Access indicator	Green	
Laser class	Class 1 laser product	
RoHS directive	Complies with	

3. CONSTRUCTION

3.1 External Construction

(1) Dimensions
  (a) Height   : 12.7mm (excluding the front bezel)
  (b) Width   : 128mm (excluding the front bezel)
  (c) Depth   : 129.4mm (excluding the eject button)
(2) Mass   : 165g or less
(3) Disc clamp system   : Ball clamp
(4) Loading   : Manual loading using the tray
(5) Ejection
  (a) Manual eject using the eject button
  (b) Automatically eject using the command
  (c) Eject distance   : 10mm or more
(6) External view   : Refer to Fig. 3.1-1.

(Fig. 3.1-1)   External view of the drive

3.2 Installation

(1) Installation direction   : Refer to Fig. 3.2-1

(2) Tilt   : Refer to Fig. 3.2-1 below.

(3) Installation method   : The fixing holes in the side of the unit are used.

         Separate discussions and arrangements are required when the installation holes are not used.
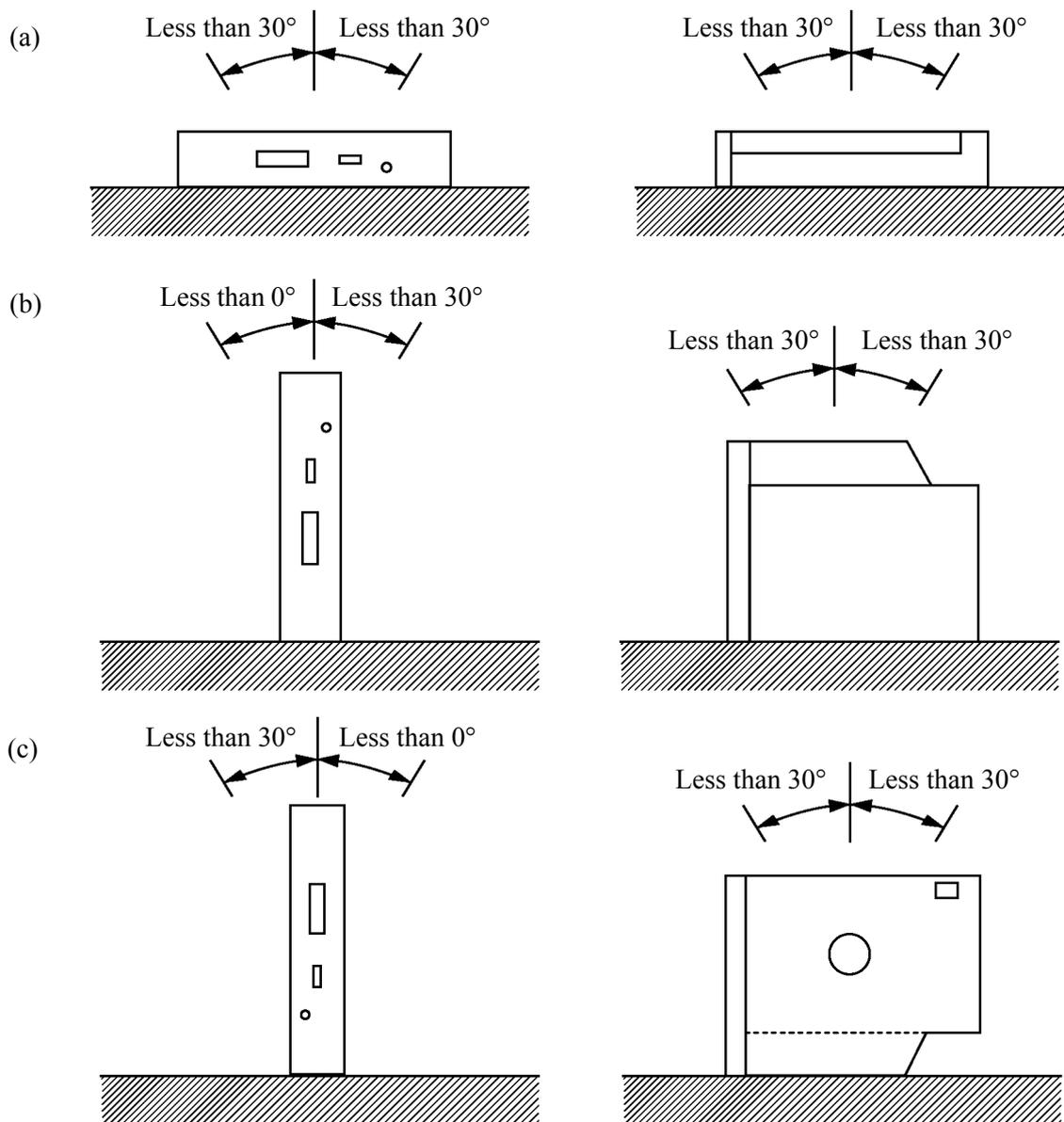
(Fig. 3.2-1) Tilt of the drive

– 4 –

4. PERFORMANCE

4.1 Operating Performance

(1) Average random access time : 110msec average (except in Audio play mode)

(2) Full stroke access time   : 240msec average (except in Audio play mode)

(3) Disc speed   : 5,136rpm typ (except in Audio play mode)

(4) Data transfer rate

  (a) Read sustained   : 1,545 to 3,600kB/sec

  (b) Programmed I/O   : 16.7MB/sec max (Mode 0 to 4)

  (c) Multi-word DMA   : 16.7MB/sec max (Mode 0 to 2)

  (d) Ultra DMA   : 33.3MB/sec max

(5) Starting time

  (a) When power is switched on/when disc is loaded

                             : 15sec max (excluding the multi-session CD)

  (b) Return time from the standby mode

                             : 5sec or less

(6) Data buffer capacity   : 768kbit

4.2 Audio

(1) Line output

    The following specifications apply during audio play.

  (a) Number of channels   : 2 channels (stereo)

  (b) Frequency response   : 20 to 20kHz (±3dB)

  (c) S/N   : 85dB or more (IHF A, 1kHz, LPF 20kHz)

  (d) Distortion factor   : 0.07% or less (BPF 400Hz to 30kHz, 1kHz)

  (e) Channel separation   : 70dB or more (BPF 400Hz to 20kHz, 1kHz)

  (f) Output level   : 0.8Vrms ±3dB (load = 47kΩ ATT = 0dB)

  (g) Muting   : each channel independent (using the ATAPI command)

  (h) Volume   : Software volume using the ATAPI command;

                          255 steps from volume level 0 to $-\infty$ (infinity) dB; variable for each channel independently.

4.3 Acoustic Noise

(1) Operating   : 45dBA or less (during seek/read/Active/Idle, distance 0.5m)

(2) Ejecting   : 65dBA typ (distance 0.5m)

(3) Others   : 35dBA or less (distance 0.5m)

5. ENVIRONMENTAL CONDITIONS

The environmental conditions as specified here do not include the environmental conditions of the disc. The environmental conditions of the disc should follow the specifications of the applicable disc.

(1) Ambient temperature
  (a) During operation   : 5 to 55°C (Surface temperature on the top cover; 5 to 60°C)
  (b) During non-operation   : –20 to 60°C
  (c) During transportation (packaged)
                            : –40 to 65°C

(2) Temperature gradient
  (a) During operation   : 11°C/hour or less (noncondensing)
  (b) During non-operation/transportation
                            : 20°C/hour or less (noncondensing)

(3) Relative humidity
  (a) During operation   : 8 to 80% (noncondensing)
                            provided that the maximum wet-bulb temperature is 29.4°C or less.
  (b) During non-operation/transportation
                            : 5 to 95% (noncondensing)
                            provided that the maximum wet-bulb temperature is 29.4°C or less.
  (c) During transportation (packaged)
                            : 5 to 95% (noncondensing)
                            provided that the maximum wet-bulb temperature is 29.4°C or less.

(4) Vibrations
  (a) During operation:
                            When installed horizontally : 2.9m/s^2 (0.3G) or less
                            When installed vertically   : 1.96m/s^2 (0.2G) or less
                            provided that the sweep frequency is 5 to 500Hz and sweep rate, 1oct/min.
  (b) Transportation (packaged) : 19.6m/s^2 (2G) or less provided that the sweep frequency is 5 to 500Hz and sweep rate, 1oct/min.

(5) Shock
  (a) During operation (free from malfunction)
                            When installed horizontally : 68.6m/s^2 (7G) or less (half-sine shock pulse; 11msec, intervals; 10sec)
                            When installed vertically   : 49m/s^2 (5G) or less (half-sine shock pulse; 11msec, intervals; 10sec)
                            excluding while the CD-DA is playing.
  (b) During non-operation/transportation
                            : 588m/s^2 (60G) or less (half-sine shock pulse; 11msec)
                            $1,960 \text{m/s}^2$ (200G) or less (half-sine shock pulse; 2msec)

(6) Dust   : office environment
(7) Cooling   : natural air cooling

6. RELIABILITY

(1) Mean time between failures (MTBF)

         : 60,000POH or more (the frequency of use should be 10% at normal temperature and humidity)

(2) Mean time to repair (MTTR) : 30minutes

(3) Loading/ejecting life   : 10,000times or more

(4) Power ON/OFF life   : 60,000times or more

(5) Laser diode life   : Cumulative failure rate 0.1% or less in 5,000 hours (25°C)

(6) Seeking life   : 2×10^6 times or more (random access, 25°C, duty; 20% or less)

(7) Error rate

  (a) Read error rate   : MODE 1 and MODE 2 (FORM 1): once per 10^{12} bits or less

                                MODE 2 (FORM 2) and CDDA   : once per 10^9 bits or less

  (b) Seek error rate   : once per 10^6 seeks or less

(8) Self-diagnosis

  (a) When power is switched ON: Various controllers, ROM, RAM, buffer, ECC circuit, etc.

  (b) When disc is inserted   : Servo circuit, signal processors, etc.

7. SAFETY AND EMC STANDARDS

The drive complies with the following safety standards.

(1) Safety standards

     UL, CSA, TÜV, CE, CB, NEMKO, SEMKO

(2) EMC standards

     CE, C-tick, BSMI, MIC

8. FRONT INDICATOR

(1) Location   : Refer to Fig. 3.1-1.

(2) Size   : 4.7mm × 1.8mm

(3) Color   : Green

(4) Lighting conditions

  (a) Continuous on

    • During seek

    • Transfer of the data to the host is under way.

  (b) Flashing with a period of 3 second (Duty 50%)

    • While audio is being played

  (c) Flashing with a period of 1 second (Duty 50%)

    • From POR or tray closing to the end of TOC read (when the disc is present)

    • From POR or tray close to the end of detecting the disc (when the disc is not present). If an error which is considered to arise from the disc occurs, flashing continues until the disc is ejected. If an error which seems to rest with the drive's hardware, flashing continues until the power is switched OFF.

9. DRIVE CONFIGURATION

The setting to master or slave is determined by the CSEL signal (interface connector Pin-No. 47).

    • **CD-224E-R83:** If the signal is at low level, the drive is set to the slave, and if it is open or at high level, it is set to the master.

    • **CD-224E-R93:** If the signal is at low level, the drive is set to the master, and if it is open or at high level, it is set to the slave.

10. INTERFACE CONNECTOR

(1) Connector on the CD-ROM drive : JAE KX15-50KLDLE or equivalent
(2) Applicable connector on the host : JAE KX14-50K5D1 or equivalent
(3) Pin assignment : Refer to Table 10-1, Fig. 10-1.

(Table 10-1) Interface connector pin assignment

No.	SIGNAL	No.	SIGNAL
1	LOUT	2	ROUT
3	AGND	4	N.C
5	–RESET	6	DD8
7	DD7	8	DD9
9	DD6	10	DD10
11	DD5	12	DD11
13	DD4	14	DD12
15	DD3	16	DD13
17	DD2	18	DD14
19	DD1	20	DD15
21	DD0	22	DMARQ
23	GROUND	24	–DIOR (–HDMARDY/HSTROBE)
25	–DIOW (STOP)	26	GROUND
27	IORDY (–DDMARDY/DSTROBE)	28	–DMACK
29	INTRQ	30	–IOCS16
31	DA1	32	–PDIAG (–CBLID)
33	DA0	34	DA2
35	–CS0	36	–CS1
37	–DASP	38	+5V
39	+5V	40	+5V
41	+5V	42	+5V
43	GROUND	44	GROUND
45	GROUND	46	GROUND
47	CSEL	48	GROUND
49	RESERVED	50	RESERVED

Pin No.1

Pin No.50
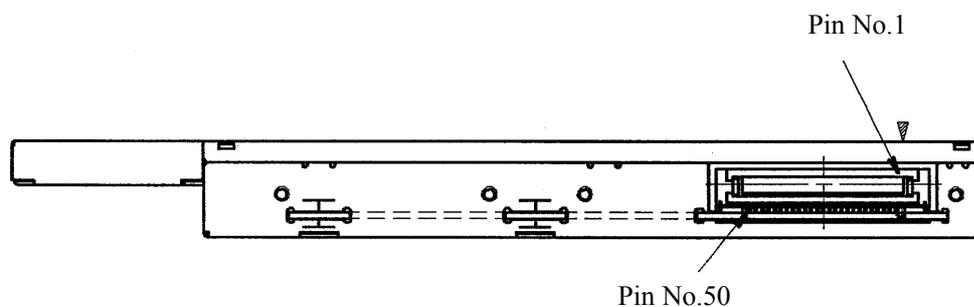
(Fig. 10-1) Interface connector assignment

– 8 –

11. AUDIO INTERFACE
   (1) LOUT   : Line output of the left channel (unbalanced)
   (2) ROUT   : Line output of the right channel (unbalanced)
   (3) AGND   : Ground of audio line output.
For the electrical specification of the line output, refer to 4.2.

12. POWER INTERFACE
The following specifications apply to the interface connector terminals of the CD-ROM drive. The power should be supplied from a power supply unit with reinforced insulation or double insulation.
   (1) Allowable supply voltage range
                                  : +5VDC ±5% (4.75 to 5.25V)
                                  There should be no abnormal operations by DC +5V ±10%.
   (2) Allowable ripple voltage   : 100mVp-p or less, 50 to 20MHz (including the spike noise)
   (3) Current consumption   : Refer to Table 12-1.

(Table 12-1) Current consumption

Mode	Average current max (A)	Peak current max (A)
Standby/Sleep	0.04	
Idle	0.35	
Active	0.75	
Random access (Duty 100%)	1.0	
During starting/seek		1.0
During eject (Solenoid)		1.0

   Remarks:
     1. The supply voltage should be 5V+5%.
     2. For each of the sleep, standby, and active modes, refer to "14. POWER MANAGEMENT SPECIFICATION".
     3. Does not include pulse-like current below 10msec.

13. IDE HARDWARE INTERFACE

13.1 Outline

(1) Applicable standard

ANSI standard	: X3T13/1321D (ATA-5)
SFFC	: SFF-8020i Rev. 2.6 and SFF-8090v5

13.2 Electrical Characteristics

The following specifications apply to the interface connector terminal for the IDE signal of the drive. The input signals refer to the signals input to the drive whereas the output signals refer to the signals output from the drive.

(1) Tri-state input/output signals (DD0 to DD15, –PDIAG)

  (a) Input signal level

    • Low level   : 0 to 0.8VDC

    • High level   : 2.0 to 5.25VDC

    • Hysteresis   : possessed

    • Maximum input current   : $\pm25\mu A$

  (b) Output signal level

    • Low level   : 0 to 0.4VDC (output sink current 8mA)

    • High level   : 2.7 to 3.3VDC (output source current 8mA)

    • Maximum output current at high impedance

                             : $\pm25\mu A$

  (c) Termination (DD0 to DD15)

    • Pull-up resistance   : Not equipped

    • Series resistance   : 33Ω

  (d) Termination (–PDIAG)

    • Pull-up resistance   : $10k\Omega$

    • Series resistance   : 0Ω

(2) Open drain input/output signals (–DASP)

  (a) Input signal level

    • Low level   : 0 to 0.8VDC

    • High level   : 2.0 to 5.25VDC

    • Hysteresis   : possessed

    • Maximum input current   : $\pm25\mu A$ (excluding the pull-up resistance)

  (b) Output signal level

    • Low level   : 0 to 0.4VDC (output sink current 8mA)

    • Maximum output current at high impedance

                             : $\pm25\mu A$

  (c) Termination

    • Pull-up resistance   : $10k\Omega$

    • Series resistance   : 0Ω

(3) Tri-state output signals (DMARQ, INTRQ, IORDY)

    • Low level   : 0 to 0.4VDC (output sink current 8mA)

    • High level   : 2.7 to 3.3VDC (output source current 8mA)

    • Maximum output current at high impedance

                             : $\pm25\mu A$

    • Series resistance   : 22Ω

(4) Open-drain output signals (–IOCS16)
- Low level   : 0 to 0.4VDC (output sink current 8mA)
- Maximum output current at high impedance
                  : ±25µA

(5) Input signals (–RESET, –DIOW, –DIOR, CSEL, –DMACK, DA0 to DA2, –CS0, –CS1)

  (a) Input signal level
- Low level   : 0 to 0.8VDC
- High level   : 2.0 to 5.25VDC
- Hysteresis (excluding RESET, CSEL)
                  : possessed
- Maximum input current   : ±25µA (excluding the pull-up resistance)
- Pull-up resistance (–RESET): 10kΩ
            (CSEL)   : 47kΩ
- Series resistance (–RESET, –DIOW, –DIOR, –DMACK, DA0 to DA2, –CS0, –CS1)
                  : 82Ω

13.3 Input/Output Signals

Refer to Table 13.3-1.

Among the following signals, the input signal refers to the signal input to the CD-RW drive and the output signal refers to the signal output from the CD-RW drive and the input/output signal refers to the bidirectional signal.

(Table 13.3-1) IDE Interface signal summary (Sheet 1 of 2)

Signal	Description	Direction
CSEL	Cable select	IN
–CS0	Chip select0	IN
–CS1	Chip select1	IN
DD0	Data bus bit 0	IN/OUT
DD1	Data bus bit 1	IN/OUT
DD2	Data bus bit 2	IN/OUT
DD3	Data bus bit 3	IN/OUT
DD4	Data bus bit 4	IN/OUT
DD5	Data bus bit 5	IN/OUT
DD6	Data bus bit 6	IN/OUT
DD7	Data bus bit 7	IN/OUT
DD8	Data bus bit 8	IN/OUT
DD9	Data bus bit 9	IN/OUT
DD10	Data bus bit 10	IN/OUT
DD11	Data bus bit 11	IN/OUT
DD12	Data bus bit 12	IN/OUT
DD13	Data bus bit 13	IN/OUT
DD14	Data bus bit 14	IN/OUT
DD15	Data bus bit 15	IN/OUT
–DASP	Device active/Slave present	IN/OUT
DA0	Device address bit 0	IN

– 11 –

(Table 13.3-1) IDE Interface signal summary (Sheet 2 of 2)

Signal	Description	Direction
DA1	Device address bit 1	IN
DA2	Device address bit 2	IN
–DMACK	DMA acknowledge	IN
DMARQ	DMA request	OUT
INTRQ	Interupt request	OUT
–IOCS16	Drive 16 bit I/O	OUT
–IOR –HDMARDY HSTROBE	I/O read DMA ready during Ultra DMA data in bursts Data strobe during Ultra DMA data out bursts	IN IN IN
IORDY –DDMARDY DSTROBE	I/O ready DMA ready during Ultra DMA data out bursts Data strobe during Ultra DMA data in bursts	OUT OUT OUT
–DIOW STOP	I/O write Stop during Ultra DMA data bursts	IN IN
–PDIAG –CBLID	Passed diagnostics Cable assembly type identifier	IN/OUT –
–RESET	Reset	IN

13.4 Notice

After A0h is written to command register and before 6 word packets re written to data register, any write access, regardless of CS0, CS0, DA0, DA1 and DA2 signals is taken as write access to data register, that is, the word packet is written to data register.

this is due to LSI restriction !

There is no problem as long as the IDE pus is not shared with another kind of pus, such as CPU pus.

13.5 COMMAND SET

13.5.1 ATA COMMAND

Refer to table 13.5.1-1.

(Table 13.5.1-1) ATA COMMAND

CODE	COMMAND
08	ATAPI SOFT RESET
E5	CHECK POWER MODE
90	EXECUTE DRIVE DIAGNOSTIC
E3	IDLE
E1	IDLE IMMEDIATE
00	NOP
A0	ATAPI PKT.
A1	ATAPI IDENTIFY DEVICE
EF	SET FEATURE
E6	SLEEP
E2	STANDBY
E0	STANDBY IMMEDIATE

13.5.2 ATAPI COMMAND

Refer to table 13.5.2-1.

(Table 13.5.2-1) ATAPI COMMAND

CODE	COMMAND
12	INQUIRY
55	MODE SELECT (10)
5A	MODE SENSE (10)
4B	PAUSE/RESUME
45	PLAY AUDIO (10)
A5	PLAY AUDIO (12)
47	PLAY AUDIO MSF
1E	PREVENT/ALLOW MEDIUM REMOVAL
28	READ (10)
A8	READ (12)
25	READ CD/CAPACITY
BE	READ CD
B9	READ CD MSF
44	READ HEADER
42	READ SUB-CHANNEL
43	READ TOC
03	REQUEST SENSE
01	REZERO UNIT
2B	SEEK
BB	SET CD-ROM SPEED
4E	STOP PLAY/SCAN
1B	START STOP UNIT
00	TEST UNIT READY
BD	MECHANISM STATUS
4A	GET EVENT STATUS NOTIFICATION
23	READ FORMATTED CAPACITIES
46	GET CONFIGURATION
51	READ DISC INFORMATION
52	READ TRACK/RZONE INFORMATION
A2	SEND EVENT

14. POWER MANAGEMENT SPECIFICATION

This drive has a power management function to reduce power consumption.
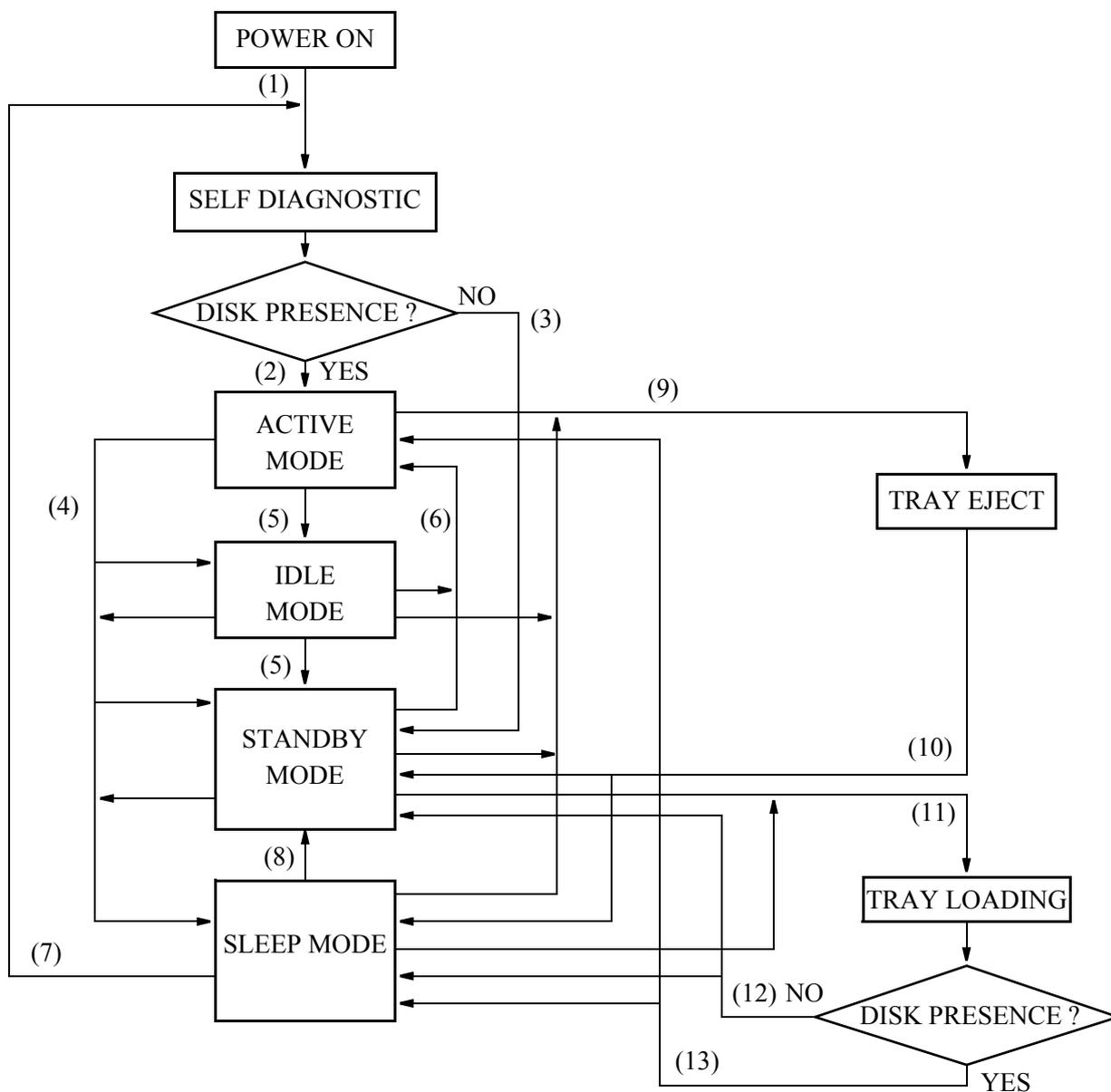
14.1 Power Management Modes

The drive has the following four power management modes. The transition between these modes is performed by the timer within the drive or a command issued by the host.

- Active mode
- Idle mode
- Standby mode
- Sleep mode

14.1.1 Transition in power management mode

The transition in the power management mode is shown in Fig. 14.1.1-1.

(Fig. 14.1.1-1)   Transition in power management mode

(1) When the RESET signal is released, the disc detection is performed after self-diagnostics are completed.
(2) If the disc is loaded, the mode will switch to the active mode and starting operation will begin.
(3) If the disc is not loaded, the mode will switch to the standby mode.
(4) Using the power management command (IDLE, IDLE IMMEDIATE, STANDBY, STANDBY IMMEDIATE, SLEEP), the transition from the active mode to the idle, standby or sleep mode, from the idle mode to the standby or sleep mode, or from the standby mode to the idle or sleep mode is possible.
(5) The transition from the active mode to the idle mode or from the idle mode to the standby mode is also performed by the timer the has. The timer will be initialized to the specified value when disc detection operation is under way or when a command which requires disc access is executed. The timer will not be initialized when a command which does not require disc access is executed in the active mode.
(6) The resumption from the idle or standby mode to the active mode is initiated when a command which requires disc access is executed.
(7) The resumption after the sleep mode is possible only after the RESET signal, the SRST (bit 2 of the DEVICE Control Register) or the ATAPI SOFT RESET command is detected. If resumption after the sleep mode is initiated using the RESET signal, an operation similar to when the power is switched ON occurs.
(8) If resumption after the sleep mode is initiated using the SRST or the ATAPI SOFT RESET command, the drive enters the standby mode.
(9) Tray ejection in each of the active, idle, standby and sleep modes is possible.
(10) If the tray is ejected in the active, idle or standby mode, the drive enters the standby mode when the tray is out or the sleep mode when the tray is ejected in the sleep mode.
(11) If the tray is inserted when the tray is out, the disc detection operation is performed.
(12) If no disc is loaded, the drive will resume a mode when the tray is out.
(13) If the disc is loaded, the drive will resume the active mode. However, the drive resumes the sleep mode following the TOC read only when the tray is ejected in the sleep mode.

14.2 Active Mode
A state in which the drive is capable of responding in the shortest possible time to an access using a command, and all the electrical circuitry of the drive, the pickup, spindle motor and sled motor are operating. In the following cases, the drive will enter the active mode:
(1) While it is being booted after the power is switched ON and self diagnosis is under way.
(2) While the booting operation or Reading of the TOC is under way when the tray is inserted and the disc is loaded.
(3) While the booting operation or Reading of the TOC is in progress with the power ON and the disc loaded.
(4) While an command that requires disc access is being executed.
(5) Until the drive switches over to other power management mode using the timer in the drive or the command after either (2), (3) or (4) above is performed.

14.3 Idle Mode
The idle mode has the same operational functions as the active mode. However, the current consumption is reduced by lowering the rotational speed of the spindle motor in the idle mode.
The transition to the idle mode comes in the following two ways:
(1) When using the timer in the drive:
After executing (2), (3) and (4) in 14.2, if the specified time elapses by the timer in the drive, the mode will switch from the active mode to the idle mode.
The specified time of the timer is set to 8 seconds.
(2) When using the power management command (IDLE, IDLE IMMEDIATE):

The transition from the active or standby mode is possible using the power management command (IDLE, IDLE IMMEDIATE).

For details, refer to the Software Specification.

14.4 Standby Mode

Except for the functions required for the reception of a command, all other functions are in the power save condition. And although the command can be received, a time is required to restore the functions that are in the power save condition for the command that requires disc access. The transition to the standby mode comes in the following three ways:

(1) When using the timer in the drive:

After executing (2), (3) and (4) in 14.2, if the specified time elapses by the timer in the drive, the mode will switch from the active to the standby mode via the idle mode.

Although the specified time of the timer can be preset using the STANDBY command or MODE SELECT command, it is set to 32 seconds by default. The transition time to the idle mode is included in the preset value of the timer.

For details, refer to the Software Specification. The timer will be initialized to the specified value after executing (2), (3) and (4) in 14.2. The timer will not be initialized when a command which does not require disc access is executed in the active mode.

(2) When using the power management command (STANDBY, STANDBY IMMEDIATE) or START/STOP UNIT command:

The transition from the active or idle mode is possible using the power management command (STANDBY, STANDBY IMMEDIATE) or START/STOP UNIT command.

For details, refer to the Software Specification.

(3) When the power is switched ON or a disc is not detected by the disc detection operation while the tray is being retracted, the drive will enter the standby mode.

14.5 Sleep Mode

The drive enters a state in which all functions are stopped and no command can be received.

The transition to the sleep mode is possible using the SLEEP command.

For details, refer to the Software Specification. The resumption from the sleep mode is possible using the RESET signal, the SRST (bit 2 of the Device Control Register) or the ATAPI SOFT RESET command.

14.5.1 Tray ejection/insertion in the sleep mode

If the eject button is pressed in sleep mode, the tray will be ejected before sleep mode is entered. If the tray is inserted while in this state, disc detection is performed; If the disc is loaded on the tray, the start-up operation is performed before sleep mode is entered. If the disc is not loaded on the tray, sleep mode is entered.

15. OTHERS

15.1 Using the Lens Cleaner

Some commercially available wet-type lens cleaners may sometimes actually make the lens dirtier rather than cleaning it. In general, we recommend that you avoid using a wet-type lens cleaner.

Use a dry-type lens cleaner.

15.2 RoHS Compliance

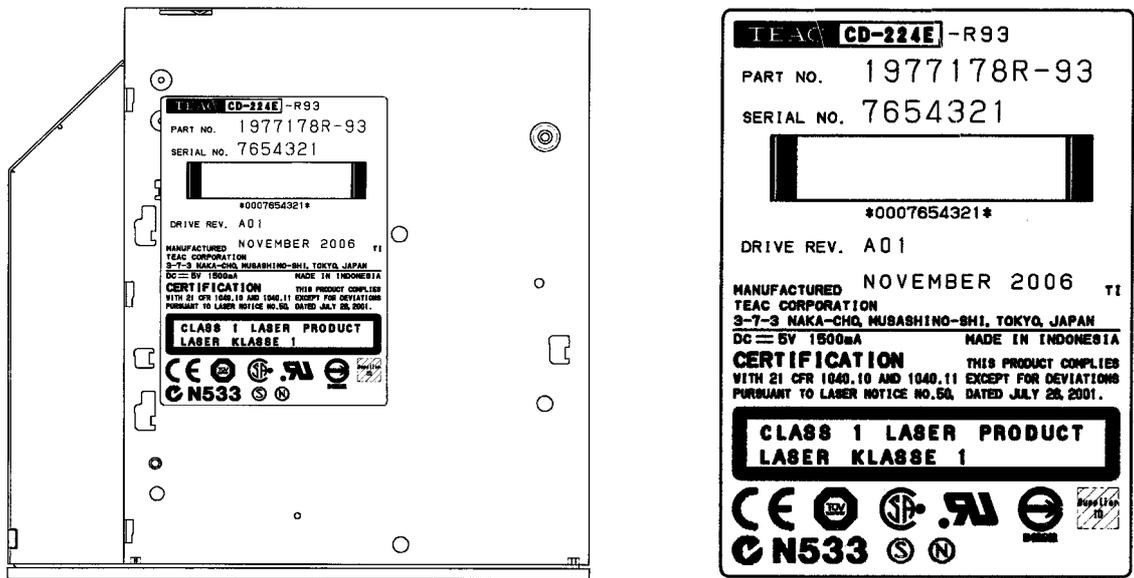The drive complies with European directive "2002/95/EC".

15.3 Safety of Laser Products

When selling this unit or a system with this unit to an end user, print the following text in the instruction manual or enclose the separate sheet on which the following text is printed with the instruction manual.

This product has been designed and manufactured according to FDA regulations "title 21. CFR. chapter1, subchapter J. based on the radiation Control for Health and Safety Act of 1968", and is classified as a class 1 laser product. There is no hazardous invisible laser radiation during operation because invisible laser radiation emitted inside of this product is completely confined in the protective housings.
The label required in this regulation is shown bellow.

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

<div style="text-align:center">Optical pickup</div>

Type	: PU-2200
Manufacturer	: TEAC CORPORATION
Laser output	: Less than 0.2mW on the objective lens
Wavelength	: 790nm
Standard	: IEC60825-1 : 2001

(Fig. 15.3-1)

– 18 –