# Sony Optiarc
# DVD/CD-Rewritable Drive
# Product Specification
# Model: AD-7760H-01

## Drive Specification

*Confidential*

## Revision 0.90

*Jul 22, 2011*

## **Sony Optiarc Inc.**

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Figure 1: Mechanical Drawing (Attached Sheet of Paper)

## 1.0 INTRODUCTION AND SCOPE

This document contains information for OEM customer to purchase the internal bare DVD/CD-Rewritable drive model AD-7760H-01 that is 12.7mm height form factor with a Serial ATA interface. This drive unit is capable to write DVD-RAM (Ver2) discs, DVD+R discs, DVD+R Double Layer (DVD+R DL) discs, DVD+RW discs, DVD-R discs, DVD-R Dual Layer (DVD-R DL) discs, DVD-RW discs, CD-R discs and CD-RW discs, and also has the same function as ordinary DVD-ROM drive. This drive unit has 5x PCAV Speed DVD-RAM writing, 8x CAV speed DVD+R and DVD-R writing, 6x ZCLV speed DVD+R DL and DVD-R DL writing, 8x ZCLV speed DVD+RW writing, 6x ZCLV speed DVD-RW writing, 24x CAV speed CD-R writing and 24x ZCLV speed CD-RW writing, 8x CAV speed DVD-ROM reading and 24x CAV speed CD-ROM reading capabilities, and supports various DVD and CD formats. This drive unit has a drawer type disc loading mechanism. This drive unit is designed to be mounted and used in the horizontal and vertical orientation. This drive unit has Busy LED.

## 2.0 APPLICABLE DOCUMENTS

N/A    Optiarc AD-7760H ATAPI/IDE (SATA) Command Set Specification
N/A    CD-Audio "Red Book" Reference (Reference Only)
N/A    CD-ROM "Yellow Book" Reference (Reference Only)
N/A    CD-ROM XA Reference (Reference Only)
N/A    CD-I "Green Book" Reference (Reference Only)
N/A    CD-WO "Orange Book, Part 2" Reference (Reference Only)
N/A    CD-RW "Orange Book, Part 3" Reference (Reference Only)
N/A    Video CD "White Book" Reference (Reference Only)
N/A    CD-TEXT "Red Book" Reference (Reference Only)
N/A    ATAPI CD-ROM specification: SFF-8020i Rev 2.6 (Reference only)
N/A    DVD Specifications for Read-Only Disc Ver 1.0 August 1996 (Reference Only)
N/A    DVD Specifications for Recordable Disc for General Ver 2.0 May 2000 (Reference Only)
N/A    DVD Specifications for Re-recordable Disc Ver 1.2 December 2003 (Reference Only)
N/A    DVD Specifications for Re-recordable Disc for Dual Layer Part1 Ver 1.9 Nov. 29 2005 (Reference Only)
N/A    DVD-RAM Part1 Physical Specifications Version 2.2 (Reference Only)
N/A    DVD +R 4.7Gbytes Basic Format Specifications Ver 1.2 July 2003 (Reference Only)
N/A    DVD+R 8.5Gbytes Basic Format Specifications Version 1.0 March 2004 (Reference Only)
N/A    DVD +ReWritable 4.7Gbytes Basic Format Specifications Ver 1.2 December 2002 (Reference Only)
N/A    ANSI Document, AT Attachment with Packet Interface -8 Volume1-3 (ATA/ATAPI-7) T13/1532D Rev.4b
N/A    SFF80.91iv5 Rev.1.4: Mt. Fuji Commands for Multimedia Devices
N/A    ANSI Document, SCSI Multimedia Commands -5 (MMC-5) T10/1675D
N/A    T10/1363D Rev.10g November 12, 2001
N/A    MMC4 T10/1545-D Rev.3d
N/A    Serial ATA: International Organization Serial ATA Rev3.0

## 3.0 PRODUCT DEFINITION

### 3.1 GENERAL

This drive unit is compatible of play DVD-ROM, DVD+R, DVD+R DL, DVD+RW, DVD-R, DVD-R DL, DVD-RW, DVD-RAM (Ver.2), CD-Audio, CD-ROM (Mode 1 and mode 2), CD-ROM XA (Mode 2, form 1 and form 2), Photo CD (Single and multiple sessions), CD Extra, CD-text, CD-R and CD-RW discs. This drive unit can play CD-I (FMV) and VIDEO CD with special function. This drive unit can also play DVD-Video with special function, such as MPEG decoder. This drive unit can operate in 3.3-8x CAV (Constant Angular Velocity) speed at reading DVD-ROM data and10-24x CAV speed at reading CD-ROM for data tracks. This drive unit supports writing modes and methods as below.

    5x PCAV speed DVD-RAM (Ver.2) writing
      : Random and Sequential.
    8x CAV speed DVD+R writing, 8x ZCLV speed DVD+RW writing and 6x ZCLV speed DVD+R DL writing
      : Random, Sequential and Multi-Session.
    8x CAV speed DVD-R writing, 6x ZCLV speed DVD-RW writing and 6x ZCLV speed DVD-R DL writing
      : Disc at Once, Incremental, and Multi-Border. Restricted overwrite (DVD-RW only)
    24x CAV speed CD-R writing and 24x ZCLV speed CD-RW writing
      : Disc at Once, Track at Once, Session at Once Variable size Packets and Fixed size Packets.

This drive unit is designed with a sealed construction to ensure dust free operation. This drive unit accepts a standard CD or DVD disc using a drawer loading and unloading, and can operate in both the horizontal and vertical orientation. This drive unit is designed to be used inside the host PC. This drive unit communicates with the host PC through the Serial ATA interface.

### 3.2 PRODUCT DESCRIPTION

This drive unit has an optical pickup head, servo electronics to maintain correct focus, tracking, feed position, radial tilt and spindle speed, digital electronics to recover the recorded data and provide error correction in Mode 1 and Mode 2 Form 1 to the maximum capabilities of the CD-ROM ECC, and a Serial ATA interface to the host computer. This drive unit has hardware layered error correction (LECC) for the main channel data of the CD-ROM. This drive unit also provides error correction of the DVD-Video and DVD-ROM. This device supports 3.3-8x CAV speed for DVD-ROM data tracks transfer rate of 11MBytes/sec. (Outside track) and 10-24x CAV speed for data tracks with a sustained mode 1 data transfer rate of 3600KBytes/sec. (Outside track), respectively. The Serial ATA controller has a 1Mbytes data buffer, and insures that in all cases a full block of data is transferred at the designated data transfer rate on the Serial ATA bus as specified in section 10.2. As for the drive, it is equipped with the buffer under run protection feature in writing.

A 13 pin connector is located at the back of the drive unit. A more detailed description of the connectors and eject mechanism is included in the mechanical section (Section 9) of this document.

This drive unit is designed to be mounted inside of a host PC enclosure. This drive unit has Busy LED. The front bezel of this drive unit has a manual eject button and emergency pin hole.

The applicable media are DVD+R (Single and Double Layer), DVD-R (Single and Dual Layer), DVD+RW, DVD-RW, DVD-RAM (Ver.2), DVD (Single and Dual Layer), CD, CD-ROM, CD-R and CD-RW (MS, HS, US and US+) discs. Alternatively, any standard CD-Audio disc is playable and compatible with this drive. These discs shall conform to optical and mechanical standards as set forth in the DVD, RED, YELLOW and ORANGE (Part 2, 3) BOOK.

## 4.0 PERFORMANCE AND FUNCTIONAL REQUIREMENTS

### 4.1 SUMMARY OF STANDARD PERFORMANCE

Below is a brief summary of performance and functional specifications as set forth by the standards cited above to be used as quick reference.

#### 4.1.1 DVD MEDIUM

| | | | |
|---|---|---|---|
| USER DATA CAPACITY | 4.7 Gbytes | Single layer | 12cm |
| (1 Gbytes = 10E9 bytes) | 8.54 Gbytes | Dual layer | 12cm |
| | 1.46 Gbytes | Single layer | 8cm |
| | 2.66 Gbytes | Dual layer | 8cm |

USER DATA/BLOCK          2048 Bytes

ADDRESS DESCRIPTION      Block

RECORDING SURFACES       1 or 2

RECORDING LAYER          Single or Dual

DISC DIAMETER            120 mm or 80 mm

DISC CENTER HOLE         15 mm diameter

THICKNESS                1.2mm (0.6mm x 2)

TRACK PITCH              0.74 microns, typical

| | | |
|---|---|---|
| SCANNING VELOCITY | 3.49 m/sec | Single layer (Normal Speed) |
| | 3.84 m/sec | Dual layer (Normal Speed) |

ROTATION SPEED           1388 to 574 rpm (Normal Speed) Varies over radius

#### 4.1.2 CD MEDIUM

The following specification marked with an * is a calculated and practical maximum figure based on a 1.6mm track pitch.

| | |
|---|---|
| USER DATA CAPACITY* | 656 MBytes, Mode 1 |
| (1 MBytes = 1024 x 1024 ) | 748 MBytes, Mode 2 |

RECORDING/PLAYING TIME*   74 minutes and 42 seconds

NUMBER OF BLOCKS/DISC*    336,150

USER DATA/BLOCK (Excluding sync, header, sub header, and ECC bytes)
                          2048 Bytes, Mode 1 and Mode 2 Form 1
                          2336 Bytes, Mode 2
                          2328 Bytes, Mode 2 Form 2

ADDRESS DESCRIPTION       Min, Sec, Block

RECORDING SURFACES        1

DISC DIAMETER             120 mm or 80 mm

DISC CENTER HOLE          15 mm diameter

THICKNESS                 1.2 mm

TRACK PITCH               1.6 microns (15,875 TPI), typical

|                      |                                                     |
|----------------------|-----------------------------------------------------|
| SCANNING VELOCITY    | 1.2 ~ 1.4 m/sec (Normal Speed)                      |
| ROTATION SPEED       | 497 to 214 rpm (Normal Speed), Varies over radius   |
| LATENCY (AVERAGE)    | 60 to 140 msec (Normal Speed), Varies over radius   |
| BLOCKS/ROTATION      | 9.1 to 21.1 Blocks/rotation, Variable               |

## 4.2 PERFORMANCE REQUIREMENTS

Unless otherwise indicated, the following performance specifications will be met over the temperature, humidity, and voltage range called out in section 5.0 and 10.0 of this document and will be verified using a test disc.

### 4.2.1 DVD MODES AND BLOCK LENGTH SUPPORTED

#### 4.2.1.1 DVD READABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
DVD-Video (8cm/12cm, Single and Dual Layer), DVD-ROM (8cm/12cm, Single and Dual Layer), Multi-Border, Multi-Session
b) Block Length Supported
2048 Bytes/sector

#### 4.2.1.2 DVD WRITABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
DVD-Video, DVD-ROM, Multi-Session (DVD+R/+RW), Multi-Border (DVD-R/-RW)
b) Block Length Supported
2048 Bytes/sector

### 4.2.2 DVD WRITE METHOD SUPPORTED

a) Uninterrupted Write
Disc at once
b) Interrupted Write
Random write (DVD+R/+RW, DVD-RAM Ver.2)
Sequential write (DVD+R/+RW, DVD-RAM Ver.2)
Incremental (DVD-R/-RW)
Multi-Border (DVD-R/-RW)
Layer Jump Recording (DVD-R DL)
Restricted overwrite (DVD-RW)

### 4.2.3 DVD WRITABLE MEDIA

Refer to "Supported Media List" for details of media and recording speed.

a) DVD+R Media (16x/8x/4x/2.4x)
Taiyo-Yuden, Mitsubishi (Verbatim), TDK
b) DVD+R Double Layer Media (8x/2.4x)
Mitsubishi (Verbatim)
c) DVD+RW Media (8x/4x/2.4x)
Mitsubishi (Verbatim), TDK
d) DVD-R Media (16x/8x/4x/2x)
Mitsubishi (Verbatim), TDK, Taiyo-Yuden, PVC, Fuji Film, Ritek
e) DVD-R DL Media (4x)
Mitsubishi (Verbatim)
f) DVD-RW Media (6x/4x/2x/1x)
JVC, PVC, Mitsubishi (Verbatim), TDK
g) DVD-RAM (Ver.2) Media (5x/3x/2x)
Panasonic,Hitachimaxell
h) DVD+RW/-RW Rewrite
1,000 times
i) DVD-RAM Rewrite
10,000 times

## 4.2.4 CD MODES AND BLOCK LENGTH SUPPORTED

### 4.2.4.1 CD READABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   CD-Audio (8cm/12cm), CD-ROM (Mode 1 and mode 2), CD-ROM XA (Mode 2, form 1 and form 2), Photo CD (Single or multiple sessions), CD-I (FMV), Video CD, CD Extra., CD-TEXT
b) Block Length Supported

| | | |
|---|---|---|
| CD-Audio | 2352 and 2368 Bytes | |
| CD-ROM (Mode 1) | 2048 and 2352 Bytes | |
| CD-ROM XA/CD-I | Form 1 | 2048, 2328, 2336, 2340 and 2352 Bytes |
| | Form 2 | 2328, 2336, 2340 and 2352 Bytes |

### 4.2.4.2 CD WRITABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED

a) Format and Modes Supported
   CD-Audio (8cm/12cm), CD-ROM (Mode 1 and mode 2), CD-ROM XA (Mode 2, form 1 and form 2), Photo CD (Single or multiple sessions), CD-I (FMV), Video CD, CD Extra, CD-TEXT
b) Block Length Supported

| | | |
|---|---|---|
| CD-Audio | 2352 Bytes | |
| CD-ROM (Mode 1) | 2048 Bytes | |
| CD-ROM XA/CD-I | Form 1 | 2048 and 2332 Bytes |
| | Form 2 | 2332 Bytes |

## 4.2.5 CD WRITE METHOD SUPPORTED

a) Uninterrupted Write
   Disc at once
b) Interrupted Write
   Track at once
   Session at Once
   Packet Writing (Fixed size Packets, Variable size Packets)

## 4.2.6 CD WRITABLE MEDIA

Refer to "Supported Media List" for details of media and recording speed

a) CD-R Media (48x/40x/32x/24x/16x/8x)
   Mitsubishi (Verbatim), Taiyo-Yuden, Sony, CMC, JVC, TDK
b) CD-RW Media (US+/US/HS/MS)
   Mitsubishi (Verbatim), RITEK,
c) CD-RW Rewrite

## 4.2.7 TRANSFER RATE

### 4.2.7.1 READ SPEED AND TRANSFER RATE
USER BYTES/SEC. (SUSTAINED)  (1 kBytes = 1024 bytes)

a) DVD-ROM

| | | |
|---|---|---|
| Single / Dual Layer | 3.3-8x CAV | 4.5-11 MBytes/sec |

b) DVD+R/-R/+RW/-RW

| | | |
|---|---|---|
| | 3.3-8x CAV | 4.5-11 MBytes/sec |

c) DVD+R DL/-R DL

| | | |
|---|---|---|
| | 3.3-8x CAV | 4.5-11 MBytes/sec |

d) DVD-RAM

| | | |
|---|---|---|
| | 3-5x PCAV | 4.1-6.9 MBytes/sec |

e) DVD-Video with CSS protection

| | | |
|---|---|---|
| | 1.6-4x CAV | 2.2-5.5 MBytes/sec |

f) CD-ROM/CD-R/RW
   Mode 1 and Mode 2 Form 1 (2048 Bytes)

| | | |
|---|---|---|
| | 10-24x CAV | 1500 - 3600 kBytes/sec |

g) CD-DAE

| | | |
|---|---|---|
| Ripping | 10-24x CAV | 1500 - 3600 kBytes/sec |

h) Mode 2 and Mode 2 Form2

        7-16x CAV        1050 - 2400 kBytes/sec

<u>4.2.7.2 WRITE SPEED AND TRANSFER RATE</u>

a) DVD+R
| | |
|---|---|
| 8x CAV | 4.5 - 11 MBytes/sec |
| 8x ZCLV | 3.3 - 11 MBytes/sec |
| 6x ZCLV | 3.3 - 8.2 MBytes/sec |
| 4x ZCLV | 3.3 - 5.5 MBytes/sec |
| 2.4x CLV | 3.3 MBytes/sec |

b) DVD+R DL
| | |
|---|---|
| 6x ZCLV | 3.3 - 8.3 MBytes/sec |
| 4x ZCLV | 3.3 - 5.5 MBytes/sec |
| 2.4x CLV | 3.3 MBytes/sec |

c) DVD+RW
| | |
|---|---|
| 8x ZCLV | 4.5 - 11 MBytes/sec |
| 6x ZCLV | 4.5 - 8.2 MBytes/sec |
| 4x ZCLV | 3.3 - 5.5 MBytes/sec |
| 2.4x CLV | 3.3 MBytes/sec |

d) DVD-R
| | |
|---|---|
| 8x CAV | 4.5 - 11 MBytes/sec |
| 8x ZCLV | 2.7 - 11 MBytes/sec |
| 6x ZCLV | 2.7 - 8.3 MBytes/sec |
| 4x ZCLV | 2.7 - 5.5 MBytes/sec |
| 2x CLV | 2.7 MBytes/sec |

e) DVD-R DL
| | |
|---|---|
| 6x ZCLV | 3.3 - 8.3 MBytes/sec |
| 4x ZCLV | 2 .7- 5.5 MBytes/sec |
| 2x CLV | 2.7 MBytes/sec |

f) DVD-RW
| | |
|---|---|
| 6x ZCLV | 2.7 - 8.2 MBytes/sec |
| 4x ZCLV | 2.7 - 5.5 MBytes/sec |
| 2x CLV | 2.7 MBytes/sec |
| 1x CLV | 1.38 MBytes/sec |

g) DVD-RAM (Version 2)
| | |
|---|---|
| 5x PCAV | 4.1-6.9 MBytes/sec |
| 3x CLV | 4.1 MBytes/sec |
| 2x CLV | 2.7 MBytes/sec |

h) CD-R
| | |
|---|---|
| 24x CAV | 1500 - 3600 kBytes/sec |
| 24x ZCLV | 1200 - 3600 kBytes/sec |
| 16x ZCLV | 1200 - 2400 kBytes/sec |
| 8x CLV | 1200 kBytes/sec |

i) CD-RW (US+/US/HS/MS)
| | |
|---|---|
| 24x ZCLV (US+/US-RW) | 1200 – 3600 kByte/sec |
| 10x ZCLV (HS-RW) | 1200 - 1500 kBytes/sec |
| 4x CLV (MS-RW) | 600 kBytes/sec |

## 4.2.8 SERIAL ATA INTERFACE BURST RATE

Generation 1
| | |
|---|---|
| PIO | support |
| DMA | support |

## 4.2.9 ROTATION SPEED

### 4.2.9.1 DVD MEDIUM

| | |
|---|---|
| 3.3-8x CAV | 4600 rpm, Constant |
| 2.5-6x CAV | 3480 rpm, Constant |
| 1.6-4x CAV | 2300 rpm, Constant |
| 6x ZCLV | 1984 ~ 4600 rpm |
| 4x ZCLV | 1984 ~ 3333 rpm |
| 2.4x CLV | 1379 ~ 3333 rpm |
| 2x CLV | 1149 ~ 2777 rpm |

### 4.2.9.2 DVD-RAM (VERSION 2)

| | |
|---|---|
| 3-5x PCAV | 3439 ~ 4869 rpm |
| 3x CLV | 2063 ~ 4869 rpm |
| 2x CLV | 1375 ~ 3246 rpm |

### 4.2.9.3 CD MEDIUM

| | |
|---|---|
| 10-24x CAV | 5100 rpm, Constant |
| 8-20x CAV | 4200 rpm, Constant |
| 7-16x CAV | 3500 rpm, Constant |
| 4-10x CAV | 2100 rpm, Constant |
| 20x ZCLV | 3150 ~ 5000 rpm |
| 16x ZCLV | 3150 ~ 5000 rpm |
| 10x ZCLV | 2140 ~ 4970 rpm |
| 8x CLV | 1712 ~ 3976 rpm |
| 4x CLV | 856 ~ 1988 rpm |

## 4.2.10 ACCESS TIME (INCLUDING LATENCY)

Access time is the time from the raising edge of /DA0 of the last command byte to the falling edge of /IOCS16 of after the first data byte returned to host (Assumes no disconnect) at horizontal operation. This measurement is done after 200 times of random seeks after a disc insertion. Access time specifications will be met at horizontal operation and in the following environmental conditions.

| | |
|---|---|
| Temperature | +10°C ~ +30°C |
| Relative humidity | < 85% (No condensation) |

### 4.2.10.1 DVD MEDIUM

a) Full Stroke
   Average 200 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
   A total of 400 seeks. (Seek command instead of read command is used.)

| | | |
|---|---|---|
| DVD-5 | 3.3-8x CAV | 340 msec typ |
| | | 410 msec max |
| DVD-9 | 2.5-6x CAV | 370 msec typ |
| | | 450 msec max |

b) Random Stroke
   Average over 500 random access. (Seek command instead of read command is used.)

| | | |
|---|---|---|
| DVD-5 | 3.3-8x CAV | 180 msec typ |
| | | 220 msec max |
| DVD-9 | 2.5-6x CAV | 200 msec typ |
| | | 240 msec max |

### 4.2.10.2 CD MEDIUM

a) Full Stroke
   Average 200 seeks from block 0 to block 269,999 and from block 269,999 to block 0
   A total of 400 seeks. (Seek command instead of read command is used.)

   | | | |
   |---|---|---|
   | 10-24x CAV | 310 msec typ | |
   | | 370 msec max | |

b) Random Stroke
   Average over 500 random access. (Seek command instead of read command is used.)

   | | |
   |---|---|
   | 10-24x CAV | 150 msec typ |
   | | 180 msec max |

### 4.2.10.3 DVD-RAM MEDIUM

a) Full Stroke
   Average 200 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
   A total of 400 seeks. (Seek command instead of read command is used.)

   | | |
   |---|---|
   | 3-5x PCAV | 450 msec typ |

b) 1/3 Stroke
   Average over 100 seeks from LBA 532,480 to 1,265,664. (Seek command instead of read command is used.)

   | | |
   |---|---|
   | 3-5x PCAV | 300 msec typ |

c) Random Stroke
   Average over 500 random access. (Seek command instead of read command is used.)

   | | |
   |---|---|
   | 3-5x PCAV | 300 msec typ |

## 4.2.11 SPIN UP AND TRAY EJECT TIME

| | | |
|---|---|---|
| a) Spin Up Time | CD-ROM | 11 sec typ |
| (Power on to drive ready) | DVD-ROM | 11 sec typ |
| b) Spin Down Time | | 6 sec typ |
| C) Tray Eject Time (Include spin down time) | | 7 sec typ |

## 4.2.12 USER ERROR RATES

a) Hard Error Rate: DVD and CD Mode 1 (With up to 5 retries and layered ECC on)

$< 10^{-12}$ Block/bit

b) Soft Error Rate: CD Mode 2 (With up to 5 retries)  $< 10^{-9}$ Block/bit

c) Seek Error Rate  $< 10^{-6}$ Block/bit

## 4.2.13 MPC3 COMPLIANCE

This drive complies with the Microsoft specification for MPC3. The CPU utilization is less than 40% at data rate of 600 KB/sec, less than 20% at data rate of 300 KB/sec, and no less than 16 KB of block size.

## 4.2.14 FLASH ROM UPDATE

The firmware is updated via Serial ATA interface with the Optiarc Flash ROM Utility.

## 4.2.15 DVD CONTENT SCRAMBLE SYSTEM AUTHENTICATION

This drive fully complies with the ATAPI DVD Key Exchange and Authentication specification, which is a digital cryptograph.

## 4.2.16 REGION PLAYBACK CONTROL

This drive supports RPC phase II provided by SFF80.91v5 Rev. 1.4.
The user can change the region code, which is stored in the drive up to 5 times by sending the appropriate command. Usually, the command is issued by MPEG Player application.

## 4.2.17 MAXIMUM PLAYBACK SPEED

The maximum playback speed with various discs is limited as follows.

| | |
|---|---|
| DVD-ROM (Dual Layer): | 3.3 - 8x |
| DVD-Video with CSS protection: | 1.6 - 4x |
| DVD-RAM (Data tracks) | 3 - 5x |
| DVD+/-R DL (Data tracks) | 3.3 - 8x |
| CD-DAE Playback: | 8 - 24x |
| CDROM (Mode 2 form2): | 7 - 16x |
| CD-RW (Mode 1): | 10 - 24x |

In addition, the drive will limit the maximum playback speed automatically by the quality of the disc.
The drive may playback with lower speed than the speed mentioned above.

## 4.2.18 TOLERANCE PERTAINING TO MEDIA

The drive can read the following Media

| | Black dot | Finger Print |
|---|---|---|
| CD: | Less than 0.6 mm | Less than 65 um |
| DVD: | Less than 0.6 mm | Less than 65 um |

5.0 ENVIRONMENTAL

This section establishes the environmental and physical conditions which apply to the product. This drive meets the following environmental requirements under normal operating conditions.

5.1 TEMPERATURE (NON-CONDENSING)

5.1.1 NON-OPERATING

–40°C to +65°C

5.1.2 OPERATING

5°C to +50°C (Writing) / 5°C to +55°C (Reading)

Note) Temperature is measured on the top cover.

5.2 HUMIDITY

5.2.1 NON-OPERATING

5% to 95% (No condensation, Maximum wet bulb temp 38°C)

5.2.2 OPERATING

20% to 80% (No condensation, Maximum wet bulb temp 29°C)

5.3 VIBRATION

5.3.1 NON-OPERATING

The drive unit meets specification described below with continuous random vibration.

| | |
|---|---|
| Acceleration | 3.94 Grms |
| Frequency | 5 to 800 Hz |
| Direction of vibration | X, Y and Z axis |

5.3.2 OPERATING

The drive unit meets specification described below with random sine wave vibration.

| | |
|---|---|
| Acceleration | CD: Read 0.45Grms, Write 0.2 Grms |
| | DVD: Read 0.45Grms, Write 0.2 Grms |
| Frequency | 5 to 300 Hz Flat, 300 to 500 Hz -6dB |
| Direction of vibration | X, Y and Z axis |

5.4 SHOCK

5.4.1 NON-OPERATING

The drive unit can withstand following shock.
Discs are not in the drive at all and the drive is powered off.

| | |
|---|---|
| Pulse Duration and Peak level | 300G / 2ms |
| | 150G / 10ms |
| Direction of Shock | ±X, ±Y, and ±Z axis (2 directions per axis, so total 6 shocks) |

5.4.2 OPERATING

The drive unit can withstand shock with a 1/2 sine wave shape.
Data read with retry (Not specified about audio play)

| Pulse Duration and Peak level | CD | Read 6G, Write 1G |
| | DVD | Read 6G, Write 1G |
| Pulse Duration | 11msec | |
| Direction of shock | ±X, ±Y, and ±Z axis | |

## 5.5 VIBRATION AND DROP (PACKAGED)

### 5.5.1 VIBRATION (PACKAGED)

| Test time | 30 min/side |
| Test Axis | 6 surface |
| Vibration | Random mode |
| Packaged | Bulk Carton (40 sets) |

| Spectrum Break Points | Frequency | G2/Hz |
| | 1Hz | 0.0001 |
| | 4Hz | 0.01 |
| | 100Hz | 0.01 |
| | 200Hz | 0.001 |

Total random vibration spectrum energy shall be 1.146 Grms.

### 5.5.2 DROP (PACKAGED)

| Height | 92cm (6 surfaces / 1 corners / 3 edges) |
| Packaged | Bulk Carton (40 sets) |

# 6.0 QUALITY AND RELIABILITY

## 6.1 COSMETIC

No scratches, cracks, stains and damages are visible on the front panel in case that you take a look at them at the distance of 400 mm from away it. No scratches, cracks, stains and damages are visible on the top, bottom, side and rear panel in case that a look at them at the distance of 600 mm from away it.

## 6.2 DISC LOADER MECHANISM LIFE

This drive unit has a drawer loading mechanism.

The drive is capable of at least 20,000 disc loading/unloading operations at 25°C temperature without degradation or failure. Both motions of extending and retracting the tray from the drive are smooth and quiet.

## 6.3 MTBF

The MTBF is 80,000 power on hours (POH) when operated at 25°C temperature, nominal voltage, and other environmental limits, based on the following assumptions:
- The operating duty cycle is 10% of power on time. During this time, the drive is either reading or seeking (Random multiple blocks read).
- The drive is in dormant mode (i.e. the laser diode is off and spindle motor not spinning, the drive is power on) for 90% of power on time.

## 6.4 OPTICAL PICKUP ACTUATOR MECHANISM

The drive is capable at least 4,000,000 random seeks at +40°C

## 6.5 MTTR (MEAN TIME TO REPAIR)

30 minutes

## 6.6 ELECTROSTATIC DISCHARGE SUSCEPTIBILITY (ESD)

The drive is installed in Optiarc specified shielded case which meets the ESD specified in the IEC 61000-4-2 (EN61000-4-2).

| | |
|---|---|
| Contact discharge | +/-6kV (No performance degradation or failure) |
| | +/-8kV (Temporary performance degradation or failure, No destroy) |
| Air discharge | +/-12kV (No performance degradation or failure) |
| | +/-15kV (Temporary performance degradation or failure, No destroy) |
| Energy storage capacitance | 150pF +/-10% |
| Discharge resistance | 330 ohms +/-10% |

## 6.7 PRODUCTION FINAL TEST

Due to the integrated nature of this product, the Optiarc performs a final system test.

## 7.0 REGULATIONS AND STANDARDS

### 7.1 SAFETY APPROVAL

UL (UL60950-1), C-UL (CSA C22.2 No.60950-1-03), TÜV (EN60950-1, EN60825-1), CB (IEC 60950-1, IEC60825-1)

### 7.2 EMC AND COMPLIANCE

CE Marking (EN55022 Class B, EN55024), C-tick (AS/NZ CISPR22 Class B), BSMI, KCC

### 7.3 FDA COMPLIANCE

The product satisfies all the requirements specified in the Code of Federal Regulation 21CFR part 1040.10 and 1040.11.

### 7.4 RoHS COMPLIANCE

The product complies with EU Directive 2002/95/EC RoHS.

### 7.5 WHQL

The product complies with WHQL for Windows Vista and Windows 7. Both for 32 bits and 64 bits.

## 8.0 ACOUSTIC NOISE

### 8.1 GENERAL

Noise measurement must conform to the testing procedure for measuring Acoustic Noise on office equipment as specified by the:
ISO Standard            ISO9296 Using measurements defined in ISO
ECMA74

### 8.2 TEST CONDITION

The test condition is free field condition over are flexing plane. This condition can be simulated in unechoic chamber. Sound pressure shall measure as defined in standard ECMA-74(Seated Operator Position), while the drive (in Note-PC) is actively seeking and rotating at its maximum speed, with 0.3g/cm unbalanced test media. Both random access and sequential access should be tesetd.

8.3 <u>NOISE SPECIFICATION</u>

A- Weighted RMS
  Drive On (Seeking)          :   47.5 dB(A)
  Drive On (Non-Seeking)      :   47.5 dB(A)

Sound-level meter

30 degrees

0.45m

0.25m

Note PC
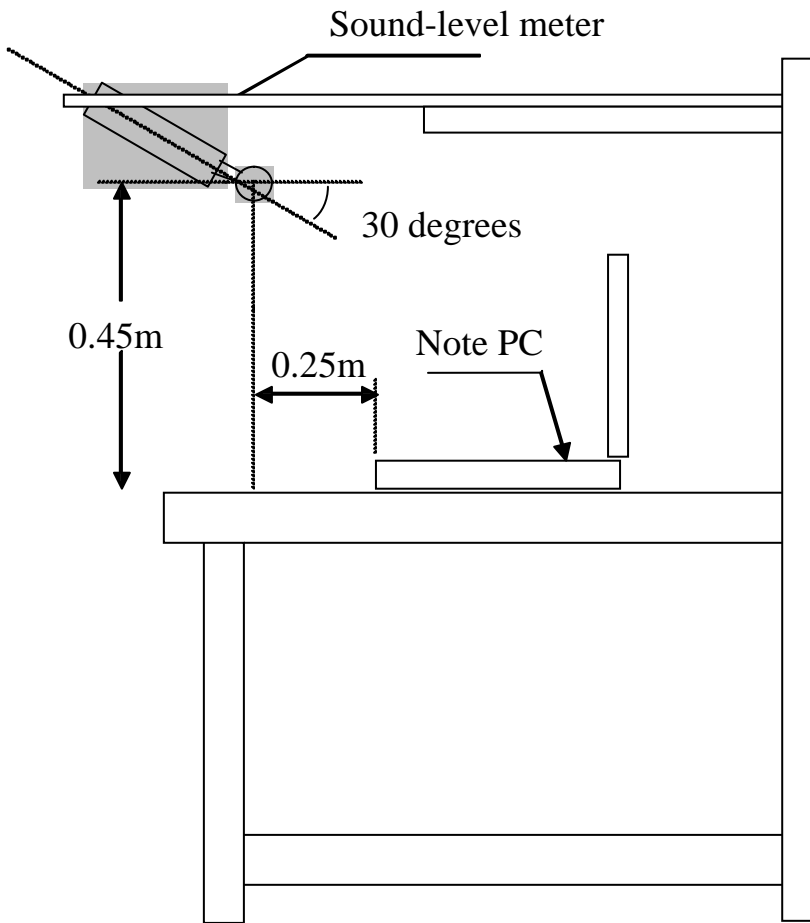
The number of measurement: Two sets.

9.0 MECHANICAL

9.1 DIMENSIONS AND MOUNTING ORIENTATION

9.1.1 DIMENSIONS

Attached Figure 1 shows the dimensions for this drive.

9.1.2 MOUNTING ORIENTATION

This drive unit shall be installed and operated in the horizontal and vertical orientation.
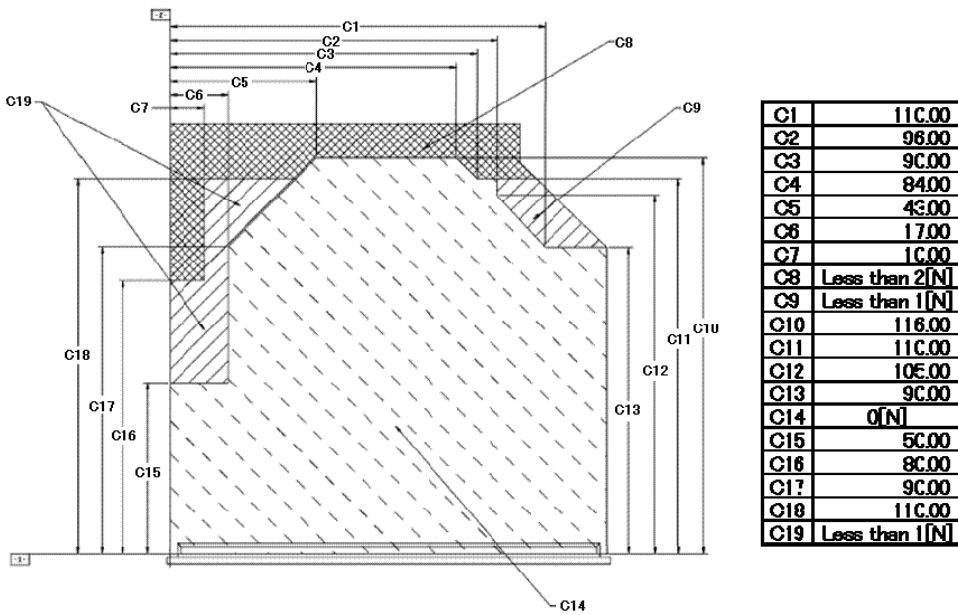The drive operates in the horizontal and vertical orientation within the angular tolerance range described below.

| | | |
|---|---|---|
| Horizontal | : front side up or down | ±15° |
| | : left side up or down | ±15° |
| Vertical | : front side up or down | ±15° |
| | : top side up or down | ±15° |

9.1.3 WEIGHT

160g max    without Bezel

## 9.1.4 FORCE RECOMMENDED VALUE RANGE ON TOP COVER

| | |
|---|---|
| C1 | 110.00 |
| C2 | 96.00 |
| C3 | 90.00 |
| C4 | 84.00 |
| C5 | 43.00 |
| C6 | 17.00 |
| C7 | 10.00 |
| C8 | Less than 2[N] |
| C9 | Less than 1[N] |
| C10 | 116.00 |
| C11 | 110.00 |
| C12 | 106.00 |
| C13 | 90.00 |
| C14 | 0[N] |
| C15 | 50.00 |
| C16 | 80.00 |
| C17 | 90.00 |
| C18 | 110.00 |
| C19 | Less than 1[N] |

## 9.2 MATERIAL & COLOR

### 9.2.1 EJECT BUTTON, FRONT BEZEL

Eject button and front bezel shall be molded as follows :

Material: PC/ABS
Flame Retardant Grade: UL94V-1
Color: Black (OEM Available)
Finish: Mat

### 9.2.2 TRAY

Tray shall be molded as follows:
| | |
|---|---|
| Material | PC/ABS |
| Flame Retardant Grade | UL94V-2 |
| Color | Black |
| Finish | Matt |

### 9.2.3 ACTIVITY LED

Busy                                Green

## 9.3 INTERFACE CONNECTOR

The drive has a standard 13-pin shrouded, keyed, male connector for Serial ATA signal. For pin out description of Serial ATA interface, refer to 10.2.2.1 Serial ATA interface connectors.

P6 P5 P4 P3 P2 P1        S7 S6 S5 S4 S3 S2 S1

Part of Power (6 pins)        Part of serial ATA signal connector (7 pins)
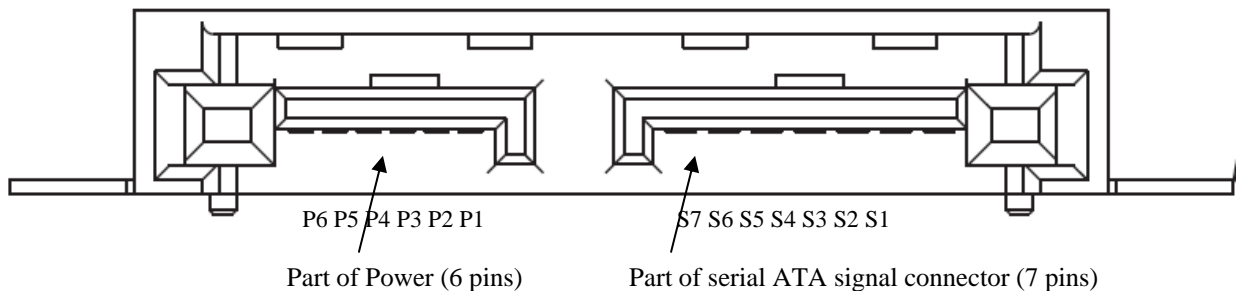
## 9.4 DISC LOADING MECHANISM

This drive uses a drawer type loading mechanism for loading and removing the disc from the drive.

### 9.4.1 EJECT BUTTON

The front bezel of the drive unit has a eject button to eject the tray. This eject button is enabled upon power up.

### 9.4.2 EMERGENCY EJECT

An emergency eject mechanism is equipped to unload the disc in emergency situation. The emergency hole is located on the front bezel.

### 9.4.3 EJECT COMMAND

The host can also eject the tray from the drive through an ATAPI CD-ROM command.

## 9.5 LABELING ON A DRIVE

The drive has the label indicated following contents and identifications visible from the outside of the unit:

(1) Production date, country of origin, serial number, model number.
(2) Safety and agency approvals
(3) Laser warning (NCDRH)
(4) Commodity Tracking (CT)

## 10.0 ELECTRICAL

### 10.1 POWER

#### 10.1.1 VOLTAGE

##### 10.1.1.1 VOLTAGE TOLERANCE

+5V (DC) +/− 5%

##### 10.1.1.2 RIPPLE AND NOISE TOLERANCE

+5V (DC)      1 kHz to 10MHz      100 mV (peak to peak)

#### 10.1.2 CURRENT

| | |
|---|---|
| Spinup | 1000 mA / 1300 mA |
| Continuous Random access (CD 10-24x CAV) | 1000 mA / 1000 mA |
| Continuous Random access (DVD-RAM ) | 1250 mA / 1500 mA |
| Continuous Read (CD 10-24x CAV) | 800 mA / 850 mA |
| Continuous Read (DVD 8x CAV) | 800 mA / 800 mA |
| Continuous Read (DVD-RAM) | 800 mA / 850 mA |
| Continuous Write (CD 24x CAV) | 1000 mA / 1100 mA |
| Continuous Write (DVD 8x CAV) | 950 mA / 1000 mA |
| Tray Eject | 600 mA / 700 mA |
| Idle (CD 4-10x CAV Pause) | 650 mA / 650 mA |
| Idle (DVD-RAM) | 750 mA / 750 mA |
| Standby      (Slumber) | 50 mA /   -   mA |
| Standby      (Partial ) | 100 mA /   -   mA |

Note:
"Average" current is the arithmetic mean value of the current measured during a typical 4 second period.
"Maximum" current is the arithmetic mean value of the current measured during a typical 0.5
second period.

## 10.2. SERIAL ATA INTERFACE

### 10.2.1 GENERAL

This drive unit uses Serial ATA interface, which conforms to the Mt. Fuji Commands for CD and DVD Devices: SFF80.91v5 rev. 1.40 to communicate with the host computer. IDE interface (ISO X3T9.2 791D) addresses the electrical interface. The ATAPI CD-ROM specification: SFF-8020 Rev.2.6 addresses command protocol. Specific command definition supported by this drive is provided by Optiarc AD-7760H ATAPI/ IDE (SATA) Interface Delta Specification Rev. 1.00 and this specification..

### 10.2.2 ELECTRICAL

The Serial ATA bus uses differential drivers and receivers.,

### 10.2.2.1 CONNECTOR PIN DIFINITION

7-pin Signal Segment

| Signal | n | Description | |
|--------|---|-------------|---|
| S1 | 1 | GND | $2^{nd}$ mate |
| S2 | 2 | A+ | Differential signal pair A from Phy |
| S3 | 3 | A- | |
| S4 | 4 | GND | $2^{nd}$ mate |
| S5 | 5 | B- | Differential signal pair B from Phy |
| S6 | 6 | B+ | |
| S7 | 7 | GND | $2^{nd}$ mate |

6-pin Power Segment

| Signal | n | Description | |
|--------|---|-------------|---|
| P1 | 1 | DP | Device present (1K Ohm Pull-down inside drive) |
| P2 | 2 | +5V | |
| P3 | 3 | +5V | |
| P4 | 4 | MD | Manufacturing Diagnostic (Eject Notification Circuit) |
| P5 | 5 | GND | |
| P6 | 6 | GND | |

### 10.2.2.2 SIGNAL CHARACTERITICS

|         | Nom | Min | Max | units | Comments |
|---------|-----|-----|-----|-------|----------|
| Vcm dc  | 250 | 200 | 450 | mV    | Common mode DC level measured at Receiver connector. |

## 10.2.3 COMMANDS

### 10.2.3.1 GENERAL

This drive unit implements The ATAPI DVD-R/-RW/+R/+RW and CD-R/-RW commands and features. The following is a brief description of the ATAPI DVD-R/-RW/+R/+RW and CD-R/RW features to be implemented.

Command description is provided by the following specifications:

ATA Packet Interface for CD-ROMs: SFF-8020i Revision 2.6
SCSI-3 Multimedia Commands: X3T10/1048D Revision10A
SCSI Multimedia Commands -2: T10/1228-D Revision10a
SCSI Multimedia Commands -3(MMC-3): T10/1363-D Revision 10g
Optiarc AD-7760H ATAPI/IDE (SATA) Command Set Specification
MMC4 T10/1545-D Rev.3d

### 10.2.3.2 TASK FILE COMMANDS

| Command | Op-code | Remark |
|---------|---------|--------|
| Execute drive diagnostic | 90h | |
| NOP | 00h | |
| ATAPI Packet Command | A0h | |
| ATAPI Identify Device | A1h | |
| ATAPI Soft Reset | 08h | |
| Check Power Mode | E5h | |
| Idle Immediate | E1h | |
| Idle | E3h | |
| Set Features | EFh | |
| Standby immediate | E0h | |
| Standby | E2h | |
| Sleep | E6h | |

### 10.2.3.3 PACKET COMMANDS

| Command | Op-code | Remark |
|---------|---------|--------|
| BLANK | A1h | |
| CLOSE TRACK/SESSION | 5Bh | |
| FORMAT UNIT | 04h | |
| GET CONFIGURATION | 46h | |
| GET PERFORMANCE | ACh | |
| GET EVENT/STATUS NOTIFICATION | 4Ah | |
| INQUIRY | 12h | |
| MECHANISM STATUS | BDh | |
| MODE SELECT(10) | 55h | |
| MODE SENSE(10) | 5Ah | |
| PREVENT/ALLOW MEDIUM REMOVAL | 1Eh | |
| READ(10) | 28h | |
| READ(12) | A8h | |
| READ BUFFER CAPACITY | 5Ch | |
| READ CAPACITY | 25h | |
| READ CD | BEh | |
| READ CD MSF | B9h | |
| READ DISC INFORMATION | 51h | |
| READ DVD STRUCTURE | ADh | |
| READ FORMAT CAPACITIES | 23h | Feature 0023h & 0028h |
| READ HEADER | 44h | |

| | | |
|---|---|---|
| READ SUB-CHANNEL | 42h | |
| READ TOC/PMA/ATIP | 43h | |
| READ TRACK INFORMATION | 52h | |
| REPAIR TRACK | 58h | |
| REPORT KEY | A4h | |
| REQUEST SENSE | 03h | |
| RESERVE TRACK | 53h | |
| REZERO UNIT | 01h | |
| SCAN | Bah | |
| SEND DVD STRUCTURE | BFh | |
| SEEK | 2Bh | |
| SEND CUE SHEET | 5Dh | |
| SEND EVENT | A2h | |
| SEND KEY | A3h | |
| SEND OPC INFORMATION | 54h | |
| SET CD-ROM SPEED | BBh | |
| SET STREAMING | B6h | |
| START STOP UNIT | 1Bh | |
| STOP PLAY/SCAN | 4Eh | |
| SYNCHRONIZE CACHE | 35h | |
| TEST UNIT READY | 00h | |
| VERIFY(10) | 2Fh | |
| WRITE(10) | 2Ah | |
| WRITE(12) | AAh | |
| WRITE AND VERIFY(10) | 2Eh | |

10.3 DATA BUFFER

The drive electronics includes 1 MBytes read ahead data buffer in the Serial ATA controller.

10.4 AUDIO SIGNAL INTERFACE

This drive unit has no analog audio circuit. Then CD-audio disc can be played by DAE function

11.0 PACKAGING

The drives (40 sets) will be packed in a bulk carton using a cardboard insert to protect against shock and vibration.

## *Revision

0.90        Jul 22 2011                          First Release