DVD/CD-Rewritable Drive
Product Specification
Model : DV-W5500S-000

Drive Specification

Confidential

Revision 0.94

Mar., 1, 2012

TEAC Corporation

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Appendix : Revision

Figure 1: MECHANICAL DRAWING (Attached sheet of paper)
1 INTRODUCTION AND SCOPE

This document contains information for OEM customer to purchase the internal are DVD/CD-Rewritable drive model DV-W5500S that is a half height 5.25" form factor with a Serial ATA interface. The drive is capable to write DVD-RAM(Ver.2) 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. The drive has 5xCAV speed DVD-RAM(Ver.2) writing, 24xCAV speed DVD+R writing, 12xCAV speed DVD+R DL writing, 8xZCLV speed DVD+RW writing, 24xCAV speed DVD-R writing, 12xCAV speed DVD-R DL writing, 6xCLV speed DVD-RW writing, 48x CAV speed CD-R writing and 32xZCLV speed CD-RW writing, 16xCAV speed DVD-ROM reading and 48xCAV speed CD-ROM reading capabilities, and supports various DVD and CD formats. The drive have a power tray disc loading mechanism. The drive will be mounted and used in the horizontal orientation and vertical orientation. The drive has Busy LED.

2 APPLICABLE DOCUMENTS

DV-W5500S ATAPI/IDE(SATA) Command Set Specification
CD-Audio "Red Book" Reference (Reference Only)
CD-ROM "Yellow Book" Reference (Reference Only)
CD-ROM XA Reference (Reference Only)
CD-I "Green Book" Reference (Reference Only)
CD-WO "Orange Book, Part 2" Reference (Reference Only)
CD-RW "Orange Book, Part 3" Reference (Reference Only)
Video CD "White Book" Reference (Reference Only)
ATAPI CD-ROM specification :SFF-8020i Rev 2.6(Reference only)
CD-TEXT “Red Book” Reference (Reference Only)
ANSI Document, AT Attachment with Packet Interface -7 Volume1-3 (ATA/ATAPI-7)
T13/1532D Rev.4b 21-Apr-2004
CD-TEXT "Red Book" Reference (Reference Only)
DVD Specifications for Read-Only Disc Ver. 1.0 August 1996 (Reference Only)
DVD Specifications for Recordable Disc for General Ver 2.0 May 2000 (Reference Only)
DVD Specifications for Re-recordable Disc Ver 1.2 December 2003 (Reference Only)
DVD +R 4.7Gbytes Basic Format Specifications Ver 1.2 July 2003 (Reference Only)
DVD +R 8.5GBytes Basic Format Specifications Ver 1.0 March 2004 (Reference Only)
DVD Specifications for Recordable Disc for Dual Layer Version 3.0 February 2005 (Reference Only)
DVD +ReWritable 4.7Gbytes Basic Format Specifications Ver 1.2 December 2002 (Reference Only)
SFF8096iv5 Rev.0.7; Mt. Fuji Commands for Multimedia Devices (Reference Only)
ANSI Document, SCSI Multimedia Commands -5 (MMC-5)
T10/1363D Rev.10g Nov. 12, 2001 (Reference Only)
DVD-RAM Part1 Physical Specifications Version 2.0
DVD Specifications for Re-recordable Disc for Dual Layer Part1 Ver 1.9 Nov. 29 2005 (Reference Only)
Serial ATA: High Speed Serialized AT Attachment Revision 1.0a.
Serial ATA: International Organization Serial ATA Rev2.6
3 PRODUCT DEFINITION

3.1 GENERAL

This drive unit is compatible of playing 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(sing les and multiple sessions), CD Extra, CD-R, CD-RW, CD-TEXT discs. This drive unit can playback CD-I (FMV) and VIDEO CD with special hardware. This drive unit can also play DVD-Video with special function, such as MPEG decoder. This drive unit can operate in 6.6-16xCAV(Constant Angular Velocity) speed at DVD-ROM data and 20-48xCAV speed at reading CD-ROM for data tracks with a sustained mode 1 data transfer rate of 7200kBytes/sec. (outside track), respectively. This drive supports these writing modes and methods as below:

- 5xCAV speed DVD-RAM (Ver.2) writing
  - Random and Sequential.
- 24xCAV speed DVD+R writing and 12xCAV speed DVD+R DL writing and 8xZCLV speed DVD+RW writing
  - Random, Sequential and Multi-Session.
- 24xCAV speed DVD-R writing and 12xCAV speed DVD-R DL writing and 6xCLV speed DVD-RW writing
  - Disc at Once, Incremental, and Multi-Border. Restricted overwrite (DVD-RW only)
- 48xCAV speed CD-R writing and 32xZCLV speed CD-RW writing
  - Disc at Once, Track at Once, Session at Once Variable size Packets and Fixed size Packets.

This drive does not have CD-DA audio circuitry, and ADPCM audio circuitry required to support audio modes other than CD-DA specified in CD-ROM XA. Also the audio circuitry inside this drive is not for DVD-Audio. This drive unit is designed with a sealed construction to ensure dust free operation. This drive unit accepts a standard CD disc using a power tray for both loading and unloading, and can operate in both the horizontal and vertical orientation. This drive unit is used inside the host computer.

3.2 PRODUCT DESCRIPTION

The 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 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 6.6-16xCAV speed for DVD-ROM data tracks transfer rate of 22MBytes/sec. (outside track) and 20-48xCAV speed for data tracks with a sustained mode 1 data transfer rate of 7200kBytes/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 4.3.7. As for the drive, it is equipped with the buffer under run protection feature in writing.

The mechanical design of this drive is a completely sealed construction to prevent any air passage through the unit and dust contamination. All of the through holes especially, the openings around the connectors in the rear panel is sealed.
4 PERFORMANCE AND FUNCTIONAL REQUIREMENTS

4.1 GENERAL

The performance and functionality of the DVD/CD rewritable drive system is determined in part by the world-wide standards. It is the intention of this document to adhere to these standards unless otherwise specifically noted. A summary of these standard specifications are presented here for reference purposes only. Refer to the applicable documents for additional detail.

4.2 SUMMARY OF STANDARD PERFORMANCE

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

4.2.1 DVD medium

<table>
<thead>
<tr>
<th>USER DATA CAPACITY*</th>
<th>4.7GBytes, Single layer 12cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1 GBytes = 1000 x 1000 x 1000)</td>
<td>8.54GBytes, Dual(Double) layer 12cm</td>
</tr>
<tr>
<td></td>
<td>1.46Gbytes, Single layer 8cm</td>
</tr>
<tr>
<td></td>
<td>2.66GBytes, Dual layer 8cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USER DATA/BLOCK (Excluding sync, header, and ECC bytes)</th>
<th>2048Bytes</th>
</tr>
</thead>
</table>

ADDRESS DESCRIPTION Block

RECORDING SURFACES 2

LAYER Single or Dual

DISC DIAMETER 120 mm or 80 mm

DISC CENTER HOLE 15 mm diameter

THICKNESS 1.2 mm

TRACK PITCH 0.74 microns, typical

SCANNING VELOCITY 3.49 meters/sec, Single layer(Normal Speed)
| 3.84 meters/sec, Dual layer(Normal Speed) |

ROTATION SPEED Varies over radius.
| ~1388 to 574 rpm (Normal Speed). Variable |
4.2.2 CD medium

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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER DATA CAPACITY*</td>
<td>656MBytes, Mode 1</td>
</tr>
<tr>
<td>(1 MBytes = 1024 x 1024)</td>
<td>748MBytes, Mode 2</td>
</tr>
<tr>
<td>RECORDING/PLAYING TIME</td>
<td>74 minutes and 42 seconds</td>
</tr>
<tr>
<td>NUMBER OF BLOCKS/DISC*</td>
<td>336,150</td>
</tr>
<tr>
<td>USER DATA/BLOCK</td>
<td></td>
</tr>
<tr>
<td>(Excluding sync, header, subheader, and ECC bytes)</td>
<td></td>
</tr>
<tr>
<td>2048 Bytes, Mode 1 and Mode 2 Form 1</td>
<td></td>
</tr>
<tr>
<td>2336 Bytes, Mode 2</td>
<td></td>
</tr>
<tr>
<td>2328 Bytes, Mode 2 Form 2</td>
<td></td>
</tr>
<tr>
<td>ADDRESS DESCRIPTION</td>
<td>Min.,Sec.,Frame</td>
</tr>
<tr>
<td>BLOCK RATE</td>
<td>1500 ~ 3600 Blocks/Sec.,</td>
</tr>
<tr>
<td></td>
<td>(20-48x CAV speed)</td>
</tr>
<tr>
<td>AUDIO</td>
<td></td>
</tr>
<tr>
<td>PLAYING TIME*</td>
<td>74 minutes and 42 seconds</td>
</tr>
<tr>
<td>DISC</td>
<td></td>
</tr>
<tr>
<td>RECORDING SURFACES</td>
<td>1</td>
</tr>
<tr>
<td>DISC DIAMETER</td>
<td>120 mm or 80 mm</td>
</tr>
<tr>
<td>DISC CENTER HOLE</td>
<td>15 mm diameter</td>
</tr>
<tr>
<td>THICKNESS</td>
<td>1.2 mm</td>
</tr>
<tr>
<td>TRACK PITCH</td>
<td>1.6 microns (15,875 TPI),</td>
</tr>
<tr>
<td></td>
<td>typical</td>
</tr>
<tr>
<td>SCANNING VELOCITY</td>
<td>1.2 ~ 1.4 meters/sec (Normal Speed)</td>
</tr>
<tr>
<td>ROTATION SPEED</td>
<td>Varies over radius.</td>
</tr>
<tr>
<td></td>
<td>~535 to 198 rpm (Normal Speed). Variable</td>
</tr>
<tr>
<td>LATENCY (AVERAGE)</td>
<td>~55 to 150 msec (Normal Speed), Variable</td>
</tr>
<tr>
<td>BLOCKS/ROTATION</td>
<td>~9.1 to 21.1 blocks/rotation , Variable</td>
</tr>
</tbody>
</table>
4.3 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.

The drive can write in maximum 24X CAV speed for DVD+R and DVD-R discs, 8X ZCLV speed for DVD+RW discs, 6X ZCLV speed for DVD-RW discs, 12X CAV speed for DVD+R DL discs, 12X CAV speed for DVD-R DL discs, 5xCAV speed for DVD-RAM(Ver.2) discs, 48X CAV speed for CD-R discs and 32X ZCLV for CD-RW discs. The drive can operate in maximum 16X speed for DVD data tracks and maximum 48X speed for CD-ROM data tracks. The drive can read 5x CAV for DVD-RAM discs. (Note: The drive can read 12x speed for the DVD-RAM that was written at 12x by the drive which supports 12x write for DVD-RAM.) The drive changes operating speed automatically based on the disc quality. The default setting is maximum speed.

4.3.1 DVD MODES AND BLOCK LENGTH SUPPORTED

4.3.1.1 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

4.3.1.2 DVD WRITABLE FORMAT, MODES AND BLOCK LENGTH SUPPORTED
a) Format and Modes Supported
   - DVD-Video, DVD-ROM, Multi-Border(DVD-R/-RW), Multi-Session(DVD+R)
b) Block Length Supported
   - 2048 bytes/sector

4.3.2 DVD WRITE METHOD SUPPORTED

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

4.3.3 DVD WRITABLE MEDIA

Refer to “Support Media List” for details of media and recording speed.

a) DVD+R Media (max.16x Media)
   - Mitsubishi (Verbatim), Taiyo-Yuden
b) DVD+R DL Media(max.16x Media)
   - Mitsubishi (Verbatim)
c) DVD+RW Media (max.16x Media)
   - Mitsubishi (Verbatim), Sony
d) DVD-R Media  (max.8x Media)
   - Mitsubishi (Verbatim), Taiyo-Yuden
e) DVD-R DL Media(max.12x Media)
   - Mitsubishi (Verbatim), Taiyo-Yuden
f) DVD-RW Media  (max.6x Media)
   - JVC, Mitsubishi (Verbatim)
g) DVD-RAM – Ver.2 Media (max.5x Media)
   - Panasonic, Hitachi maxell
4.3.4 CD MODES AND BLOCK LENGTH SUPPORTED

4.3.4.1 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

4.3.4.2 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

4.3.5 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)

4.3.6 CD WRITABLE MEDIA

Refer to “Support Media List” for details of media and recording speed.

a) CD-R Media (max.52x Media)
   - Mitsubishi (Verbatim), Taiyo-Yuden

b) CD-RW Media (max.32x Media)
   - Mitsubishi (Verbatim)
### 4.3.7 TRANSFER RATE

#### 4.3.7.1 READ SPEED AND TRANSFER RATE

**USER BYTES/SEC. (SUSTAINED)** \( (1 \text{ kBytes} = 1024 \text{ Bytes}, 1 \text{Mbyte} = 1024 \text{KByte}) \)

<table>
<thead>
<tr>
<th>Type</th>
<th>Layer</th>
<th>CAV</th>
<th>Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) DVD-ROM Read Speed and Transfer Rate</td>
<td>Single Layer</td>
<td>6.6-16x</td>
<td>8.7 - 21.1 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>Dual Layer</td>
<td>5-12x</td>
<td>6.6 - 15.8 MBytes/sec</td>
</tr>
<tr>
<td>b) DVD+/R Data tracks Read Speed and Transfer Rate</td>
<td>6.6-16x</td>
<td>8.7 - 21.1 MBytes/sec</td>
<td></td>
</tr>
<tr>
<td>c) DVD+/R DL Data tracks Read Speed and Transfer Rate</td>
<td>5-12x</td>
<td>6.6 - 15.8 MBytes/sec</td>
<td></td>
</tr>
<tr>
<td>d) DVD+/R-W Data tracks Read Speed and Transfer Rate</td>
<td>5-13x</td>
<td>6.6 - 17.2 MBytes/sec</td>
<td></td>
</tr>
<tr>
<td>e) DVD-Video with CSS protection Read Speed and Transfer Rate</td>
<td>SL</td>
<td>6.6-16x</td>
<td>8.7 - 21.1 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>DL</td>
<td>5-12x</td>
<td>6.6 - 15.8 MBytes/sec</td>
</tr>
<tr>
<td>f) DVD-RAM Data tracks Read Speed and Transfer Rate</td>
<td>5x</td>
<td>6.6 MBytes/sec</td>
<td></td>
</tr>
<tr>
<td>g) CD-ROM/CD-R Read Speed and Transfer Rate</td>
<td>Mode 1 and Mode 2 Form 1 (2048 Bytes)</td>
<td>20-48x</td>
<td>3000 - 7200 kBytes/sec</td>
</tr>
<tr>
<td>h) CD-RW Read Speed and Transfer Rate</td>
<td>Mode 1 and Mode 2 Form 1 (2048 Bytes)</td>
<td>17-40x</td>
<td>2550-6000 kBytes/sec</td>
</tr>
<tr>
<td>i) DAE Read Speed and Transfer Rate</td>
<td>17-40x</td>
<td>2550-6000 kBytes/sec</td>
<td></td>
</tr>
<tr>
<td>j) Mode 2 and Mode 2 Form2 Read Speed and Transfer Rate</td>
<td>8-20x</td>
<td>1200-3000 kBytes/sec</td>
<td></td>
</tr>
</tbody>
</table>

#### 4.3.7.2 WRITE SPEED AND TRANSFER RATE

<table>
<thead>
<tr>
<th>Type</th>
<th>CAV</th>
<th>Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) DVD+R Write Speed</td>
<td>24x</td>
<td>13.2 - 31.7 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>20x</td>
<td>11.0 - 26.4 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>18x</td>
<td>9.9 - 23.8 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>16x</td>
<td>8.7 - 21.1 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>13x</td>
<td>6.6 - 17.2 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>12x ZCLV</td>
<td>7.9 - 15.8 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>8x ZCLV</td>
<td>7.9 - 10.6 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>6x CLV</td>
<td>7.9 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>4x CLV</td>
<td>5.3 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>2x4 CLV</td>
<td>3.2 MBytes/sec</td>
</tr>
<tr>
<td>b) DVD+R DL Write Speed</td>
<td>6.6 - 15.8 MBytes/sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8x ZCLV</td>
<td>5.3 - 10.6 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>6x ZCLV</td>
<td>5.3 - 8.7 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>4x CLV</td>
<td>5.3 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>2x4 CLV</td>
<td>3.2 MBytes/sec</td>
</tr>
<tr>
<td>c) DVD+RW Write Speed</td>
<td>8x ZCLV</td>
<td>7.9 - 10.6 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>6x CLV</td>
<td>7.9 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>4x CLV</td>
<td>5.3 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>2x4 CLV</td>
<td>3.2 MBytes/sec</td>
</tr>
<tr>
<td>d) DVD-R Write Speed</td>
<td>24x</td>
<td>13.7 - 33 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>20x</td>
<td>11.0 - 26.4 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>18x</td>
<td>9.9 - 23.8 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>16x</td>
<td>8.7 - 21.1 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>13x</td>
<td>6.6 - 17.2 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>12x ZCLV</td>
<td>7.9 - 15.8 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>8x ZCLV</td>
<td>7.9 - 10.6 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>6x CLV</td>
<td>7.9 MBytes/sec</td>
</tr>
<tr>
<td></td>
<td>4x CLV</td>
<td>5.3 MBytes/sec</td>
</tr>
</tbody>
</table>
2x CLV 2.6 MBytes/sec

e) DVD-R DL Write Speed
   12x CAV 6.6 - 15.8 MBytes/sec
   8x ZCLV 5.3 - 10.6 MBytes/sec
   6x ZCLV 5.3 - 8.7 MBytes/sec
   4x CLV 5.3 MBytes/sec
   2x CLV 2.6 MBytes/sec

f) DVD-RW Write Speed
   6x CLV 7.9 MBytes/sec
   4x CLV 5.3 MBytes/sec
   2x CLV 2.6 MBytes/sec
   1x CLV 1.3 MBytes/sec

g) DVD-RAM(Version.2) Write Speed
   5x CAV 6.6 MBytes/sec
   3x CLV 4.0 MBytes/sec
   2x CLV 2.6 MBytes/sec

h) CD-R Write Speed
   48x CAV 3000-7200 kBytes/sec
   40x CAV 2550-6000 kBytes/sec
   32x ZCLV 3000-4800 kBytes/sec
   24x ZCLV 3000-3600 kBytes/sec
   16x CLV 2400 kBytes/sec
   8x CLV 1200 kBytes/sec

i) CD-RW Write Speed
   32x ZCLV 2400-4800 kBytes/sec
   24x ZCLV 2400-3600 kBytes/sec
   16x CLV 2400 kBytes/sec
   10x CLV 1500 kBytes/sec
   4x CLV 600 kBytes/sec

4.3.8 Serial ATA Interface
   PIO support
   DMA support

4.3.9 ROTATION SPEED

4.3.9.1 DVD Rotation Speed
   a) 10-24x CAV 13900 rpm Constant
   b) 8.3-20x CAV 11500 rpm Constant
   c) 7.5-18x CAV 10350 rpm Constant
   d) 6.6-16x CAV 9200 rpm, Constant
   e) 5-13x CAV(SL), 5-12xCAV(DL) 7400 rpm, Constant
   f) 12x ZCLV [6600 ~ 8800 rpm]
   g) 8x ZCLV(SL) [4400 ~ 8800 rpm]
   h) 8x ZCLV(DL) [4400 ~ 6600 rpm]
   i) 6x CLV(SL) 3450 ~ 8300 rpm
   j) 6x ZCLV(DL) [3450 ~ 6600 rpm]
   k) 3.3-8x CAV(DL) 5100 rpm, Constant
   l) 3.3-8x CAV(SL) 4580 rpm, Constant
   m) 2-5x CAV(DL) 3200 rpm, Constant
   n) 2-5x CAV(SL) 2900 rpm, Constant
   o) 4x CLV 2298 ~ 5554 rpm
   p) 2.4x CLV 1379 ~ 3333 rpm
   q) 2x CLV 1149 ~ 2777 rpm
   r) 1x CLV 574 ~ 1389 rpm

4.3.9.2 DVD-RAM (Version.2) Rotation Speed
   a) 12x PCAV 8253 ~ 9738 rpm
   b) 5x CAV 3439 ~ 8115 rpm
   c) 3x CLV 2063 ~ 4869 rpm
4.3.9.3 CD Rotation Speed

- a) 20-48x CAV 9600 rpm, Constant
- b) 20-48x ZCLV [7970 ~ 9600 rpm]
- c) 17-40x PCAV 8350 rpm, Constant
- d) 20-40x ZCLV [7930 ~ 9600 rpm]
- e) 13-32x CAV 6950 rpm, Constant
- f) 17-32x PCAV [6350 ~ 8350 rpm]
- g) 20-32x ZCLV(CD-R) [6350 ~ 9600 rpm]
- h) 16-32x ZCLV(CD-RW) [4940 ~ 7400 rpm]
- i) 10-24x CAV 5460 rpm, Constant
- j) 17-24x PCAV [4760 ~ 8350 rpm]
- k) 20-24x ZCLV(CD-R) [4760 ~ 9600 rpm]
- l) 16-24x ZCLV(CD-RW) [4760 ~ 7400 rpm]
- m) 8-20x CAV 4200 rpm, Constant
- n) 4-10x CAV 2100 rpm, Constant
- o) 16x CLV 3424 ~ 7952 rpm
- p) 10x CLV 2140 ~ 4970 rpm
- q) 8x CLV 1712 ~ 3976 rpm
- r) 4x CLV 856 ~ 1988 rpm

4.3.10 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 /IOCSC16 of after the first data byte returned to host (assumes no disconnect) at horizontal operation. This measurement is done per 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 deg C ~ +30 deg C |
| Reliative humidity | : < 85% (no condensation) |

4.3.10.1 DVD medium

FULL STROKE

Average 200 seeks after 10 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
A total of 400 seeks
6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 250 msec (typical)

1/3 STROKE

Average over 100 seeks after 10 seeks from LBA 532,480 to 1,265,664
6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 160 msec (typical)

RANDOM STROKE

Average over 500 random access after 10 seeks
6.6-16x CAV(Spindown to 5-13xCAV without sequential access) 160 msec (typical)

4.3.10.2 CD medium

FULL STROKE

Average 200 seeks after 10 seeks from block 0 to block 269,999 and from block 269,999 to block 0
A total of 400 seeks
20-48x CAV(Spindown to 8-20xCAV without sequential access) 230 msec (typical)

1/3 STROKE

Average over 100 seeks after 10 seeks from block 67,350 to 157,350
20-48x CAV(Spindown to 8-20xCAV without sequential access) 140 msec (typical)

RANDOM STROKE

Average over 500 random access after 10 seeks
20-48x CAV(Spindown to 8-20xCAV without sequential access) 140 msec (typical)

4.3.10.3 DVD-RAM medium

FULL STROKE

Average 200 seeks after 10 seeks from LBA 0 to 2,293,759 and from block 2,293,759 to block 0
A total of 400 seeks
5x CAV 700 msec (typical)
1/3 STROKE
Average over 100 seeks after 10 seeks from LBA 532,480 to 1,265,664
5x CAV 300 msec (typical)

RANDOM STROKE
Average over 500 random access after 10 seeks
5x CAV 300 msec (typical)

4.3.11 SPIN UP AND TRAY OPEN TIME
Drive's firmware has 10 seconds time out for the Start/Stop Unit command for spin up, spin down and tray open.

SPIN UP TIME (Spin up to drive ready)
(Time to pause position from disc complete stop. Tested with disc without scratches or dust.)
Normal Speed or 20-48xCAV 6.5 sec (Max.)

SPIN DOWN TIME
Normal Speed or 20-48xCAV 6 sec (Max.)

TRAY OPEN TIME (not include spin down time) 5 sec (Max.)
TRAY CLOSE TIME (not include spin up time) 5 sec (Max.)

4.3.12 USER ERROR RATES
Hard Error Rate : DVD and CD Mode 1 (with up to 5 retries and layered ECC on)
< 10^{-12} Block/bit

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

4.3.13 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.

4.3.14 FLASH ROM UPDATE
The firmware is updated via Serial ATA interface with Flash ROM Utility.

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

4.3.16 Region Playback Control
This drive supports RPC phase II provided by SFF8090v4 Rev. 1.5. 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.

4.3.17 Maximum Playback Speed with various Disc
The maximum playback speed with various disc is limited as follows.

<table>
<thead>
<tr>
<th>Disc Type</th>
<th>Maximum Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD-ROM (Dual Layer)</td>
<td>5-12x CAV</td>
</tr>
<tr>
<td>DVD-Video with CSS protection:</td>
<td>3.3-8x CAV</td>
</tr>
<tr>
<td>DVD+-/R DL (Data tracks)</td>
<td>5-12x CAV</td>
</tr>
<tr>
<td>DVD+-/RW (Data tracks)</td>
<td>5-13x CAV</td>
</tr>
<tr>
<td>DVD-RAM (Data tracks)</td>
<td>5x CAV</td>
</tr>
<tr>
<td>CD-DA(DAE)</td>
<td>8-20x CAV</td>
</tr>
<tr>
<td>CDROM (mode2 form2)</td>
<td>8-20x CAV</td>
</tr>
<tr>
<td>CD-RW (mode1, mode2 form1)</td>
<td>17-40x PCAV</td>
</tr>
</tbody>
</table>

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.

4.3.18 Tolerance pertaining to Media

TEAC Corporation
DVD/CD-Rewritable Drive Specification DV-W5500S-000 Rev. 0.94
The drive can read the following Media

<table>
<thead>
<tr>
<th>Media</th>
<th>Black dot</th>
<th>Finger Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD:</td>
<td>less than 0.6 mm</td>
<td>less than 65 um</td>
</tr>
<tr>
<td>DVD:</td>
<td>less than 0.6 mm</td>
<td>less than 65 um</td>
</tr>
</tbody>
</table>
5 ENVIRONMENTAL

This section establishes the environmental and physical conditions which apply to the product. The CD-R/RW meet the following environmental requirements under normal operating conditions.

5.1 TEMPERATURE (NON-CONDENSING)

5.1.1 NON-OPERATING

-40 deg C to +65 deg C

5.1.2 OPERATING

5 deg C to +50 deg C

5.2 HUMIDITY

5.2.1 NON-OPERATING

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

5.2.2 OPERATING

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

5.3 VIBRATION

5.3.1 OPERATING

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

<table>
<thead>
<tr>
<th>Acceleration</th>
<th>CD</th>
<th>Write 0.2Grms</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD</td>
<td>: Read 0.45Grms,</td>
<td>Write 0.2Grms</td>
</tr>
</tbody>
</table>

Vibration : Random mode (5 to 500 Hz)

Direction of vibration : X, Y and Z axis

5.3.2 NON-OPERATING

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

<table>
<thead>
<tr>
<th>Acceleration</th>
<th>0.712GRMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of vibration</td>
<td>X, Y and Z axis</td>
</tr>
<tr>
<td>Frequency : 7-800Hz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hz</th>
<th>G²/Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>0.0003</td>
</tr>
<tr>
<td>20</td>
<td>0.00275</td>
</tr>
<tr>
<td>140</td>
<td>0.00275</td>
</tr>
<tr>
<td>312</td>
<td>0.00013</td>
</tr>
<tr>
<td>400</td>
<td>0.00008</td>
</tr>
<tr>
<td>600</td>
<td>0.00008</td>
</tr>
<tr>
<td>700</td>
<td>0.00007</td>
</tr>
<tr>
<td>800</td>
<td>0.000045</td>
</tr>
</tbody>
</table>

5.4 SHOCK

5.4.1 NON-OPERATING

The drive unit can withstand shock with a 1/2 sine wave shape.

Discs are not in the drive at all and the drive is powered off.

| Pulse Duration and Peak level | 10ms / 100G and 2ms / 200G |
| Direction of shock            | +/-X, +/-Y, and +/-Z axes (2 directions per axis, so a total of 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 | 11 msec |
| Peak level     | CD Read 6G, Write 1.5G |
|                | DVD Read 6G, Write 1G |

| Direction of shock | CD & DVD |
| : +/-X, +/-Y, and +/-Z axes (2 directions per axis, so a total of 6 shocks) |

<table>
<thead>
<tr>
<th>Pulse Duration and Peak level</th>
<th>2ms / 60G (Read)</th>
</tr>
</thead>
</table>
5.5 VIBRATION AND DROP (PACKAGED)

5.5.1 VIBRATION (PACKAGED)

The unit meets the specification described below.

<table>
<thead>
<tr>
<th>Test time</th>
<th>30 minutes/side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Axes</td>
<td>6 surface</td>
</tr>
<tr>
<td>Vibration</td>
<td>Random mode</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spectrum Break Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency  G2/Hz</td>
</tr>
<tr>
<td>1Hz</td>
</tr>
<tr>
<td>4Hz</td>
</tr>
<tr>
<td>100Hz</td>
</tr>
<tr>
<td>200Hz</td>
</tr>
</tbody>
</table>

*Total random vibration spectrum energy shall be 1.146 Grms.

Packaged : Bulk Carton (20 sets)

5.5.2 DROP (PACKAGED)

The unit meets the specification described below.

<table>
<thead>
<tr>
<th>Height</th>
<th>76cm (6 surfaces / 1 corners / 3 edges)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaged</td>
<td>Bulk Carton (20 sets)</td>
</tr>
</tbody>
</table>

6 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 they look at them at the distance of 600 mm from away it.

6.2 TRAY LOADER MECHANISM LIFE

This drive shall have a power tray to load and unload the disc. The drive is capable of at least 30,000 tray loading/unloading operations without degradation or failure. Both motions of extending and retracting the tray from the drive is smooth and quiet.

6.3 MTBF

The MTBF is 70,000 power on hours (POH) when operated at 25 deg 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 block 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.

The spindle motor is a brushless-motor.

6.4 OPTICAL PICKUP ACTUATOR MECHANISM

The drive is capable at least 4,000,000 Random seeks.

6.5 MTTR (MEAN TIME TO REPAIR)

30 minutes.
6.6 **ELECTROSTATIC DISCHARGE SUSCEPTIBILITY (ESD)**

6.6.1 **GENERAL**

The drive installed in specified shielded case meets the ESD specified as below.

Tested in the IEC 61000-4-2 (EN61000-4-2).

- **Contact discharge**: +/-6kV (No performance degradation or failure.)
- **Air discharge**: +/-8kV (Temporary performance degradation or failure. No destroy.)
- **Energy storage capacitance**: 150pF +/-10%
- **Discharge resistance**: 330 ohm +/-10%

7 **REGULATIONS AND STANDARDS**

7.1 **SAFETY APPROVAL**

UL(UL60950), C-UL(cUL C22.2 NO.60950), TUV(EN60950,EN60825), CB(IEC60950,IEC60825)

7.2 **EMC AND COMPLIANCE**

CE Marking(EN55022 Class B, EN55024), C-tick(AS/NZS CISPR 22 ,2006 ClassB), BSMI, MIC

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.

8 **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 ISO 7779 Seated Operator Position

8.2 **TEST CONDITION**

The test condition is free field condition over are flexing plane. This condition can be simulated in an echoic chamber with the disc drive sitting on a reflecting plane. The drive is acoustically isolated from the plane with:

- e.g. a polyurethane foam.

Test Media : 0.3gfcm unbalanced media

Mode : Read DVD at 16x CAV speed.

8.3 **NOISE SPECIFICATION**

A - Weighted RMS. - Slow.

Drive On (Seeking) 45dB(A) : Average, 47.5dB(A) : Max.

Drive On (non-Seek) 45dB(A) : Average, 47.5dB(A) : Max.
9 MECHANICAL

9.1 DIMENSIONS AND MOUNTING ORIENTATION

9.1.1 DIMENSIONS

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:

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Front Side</th>
<th>Left Side</th>
<th>Top Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>+/-15 deg</td>
<td>+/-15 deg</td>
<td>+/-15 deg</td>
</tr>
<tr>
<td>Vertical</td>
<td>+/-15 deg</td>
<td>+/-15 deg</td>
<td>+/-15 deg</td>
</tr>
</tbody>
</table>

9.1.3 WEIGHT

0.630Kg

9.2 COLOR

9.2.1 EJECT BUTTON, FRONT BEZEL AND TRAY DOOR

Manual eject button, front bezel and tray door shall be molded as follows:

- Material: PC/ABS
- Flame Retardant Grade: UL94-5V (Tray door: 94V-0)
- Color: BLACK
- Finish: Mat

9.2.2 TRAY

Tray shall be molded as follows:

- Material: ABS
- Frame Retardant Grade: UL94V-2
- Color: BLACK
- Finish: Mat

9.2.3 ACTIVITY LED

Busy: Green
9.3 **APPLICABLE CABLE**

9.3.1 **SIGNAL CABLE**

The signal cable is a 7-wire flat ribbon cable. It has a 7-pin female connector on one side to connect to the 7-pin shrouded male Serial ATA connector on the PC mother board or else. The pin out of the Serial ATA connector is shown in section 10.2.2.2.

9.4 **DRIVE CONNECTORS**

There are 2 connectors DC power connector(section 9.4.1) and Serial ATA signal connector(section 9.4.2). DC power connector and Serial ATA signal connector are molded to a piece of connector.

9.4.1 **POWER CONNECTOR**

The drive has a DC power connector assembly, which consists of a 15-pin shrouded, keyed, male power connector as shown below.

9.4.2 **Serial ATA CONNECTOR**

The drive has a standard 7-pin shrouded, keyed, male connector for Serial ATA signal. For pin out description of Serial ATA interface, refer to section 10.2.2.2, Serial ATA interface connectors.
9.5 DISC TRAY LOAD MECHANISM

This drive uses motor powered tray mechanism to extend and retract the tray for loading and removing the disc from the drive. When the drive is mounted in the vertical orientation, only 120 mm discs can be used.

9.5.1 MANUAL EJECT BUTTON

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

9.5.2 PIN HOLE (EMERGENCY) EJECT

A pin hole eject mechanism is required to open the tray in emergency situation. Maximum force required is 1.5kg. The pin hole is located on the front bezel.

9.5.3 EJECT COMMAND

The host can also open the tray load from the drive through a ATAPI command.

9.5.4 PUSH TRAY IN POSITION

In addition to the eject button for closing the tray, the tray will automatically close, when the tray is in the open (extended) position, by pushing the tray in 10 mm typical distance with a 500 g typical force.

9.5.5 OPEN/CLOSE TIME OUT

TRAY OPEN TIME OUT:

If there is a physical obstruction that prevents the tray from opening(extend-ing) all the way, the power tray will remain on for two seconds. If tray is still prevented from opening at the end of two seconds, the drive will try to close the tray. If tray is prevented to close, after two seconds the power tray is turned off, The user has to either push the manual eject button or send a ATAPI CD-ROM eject command to reset the power tray.

TRAY CLOSE TIME OUT:

If there is a physical obstruction that prevents the tray from closing(retracting) all the way, the power tray will remain on for two seconds. If tray is still prevented from closing at the end of two seconds, the drive will try to open the tray. If tray is prevented to open, then after two seconds the power tray is turned off. The user has to either push the manual eject button or send a ATAPI eject command to reset the power tray.
10 ELECTRICAL

10.1 POWER

10.1.1 VOLTAGE
This drive requires two power supplies: +5V (DC) / +12V (DC).

10.1.1.1 VOLTAGE TOLERANCE
<table>
<thead>
<tr>
<th>DC Voltage</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V (DC)</td>
<td>+/- 5%</td>
</tr>
<tr>
<td>+12V (DC)</td>
<td>+/- 10%</td>
</tr>
</tbody>
</table>

10.1.1.2 RIPPLE AND NOISE TOLERANCE
<table>
<thead>
<tr>
<th>DC Voltage</th>
<th>Ripple and Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V (DC)</td>
<td>&lt; 120 mV (peak to peak)</td>
</tr>
<tr>
<td>+12V (DC)</td>
<td>&lt; 200 mV (peak to peak)</td>
</tr>
</tbody>
</table>

10.1.2 CURRENT (max/average)

<table>
<thead>
<tr>
<th>Operation</th>
<th>+5V (DC)</th>
<th>+12V (DC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinup</td>
<td>&lt; 1050/1000 (mA)</td>
<td>&lt; 2400/2300 (mA)</td>
</tr>
<tr>
<td>Seek(CD 20-48x CAV)</td>
<td>&lt; 1000/800 (mA)</td>
<td>&lt; 1200/1000 (mA)</td>
</tr>
<tr>
<td>Read(CD 20-48x CAV)</td>
<td>&lt; 1000/800 (mA)</td>
<td>&lt; 1200/1000 (mA)</td>
</tr>
<tr>
<td>Read(DVD 6.6-16x CAV)</td>
<td>&lt; 1100/900 (mA)</td>
<td>&lt; 1200/1000 (mA)</td>
</tr>
<tr>
<td>Write (CD 20-48x CAV)</td>
<td>&lt; 1300/1200 (mA)</td>
<td>&lt; 1000/900 (mA)</td>
</tr>
<tr>
<td>Write (DVD+R 10-24x CAV)</td>
<td>&lt; 1450/1400 (mA)</td>
<td>&lt; 2300/2200 (mA)</td>
</tr>
<tr>
<td>Tray Open Close</td>
<td>&lt; 700/600 (mA)</td>
<td>&lt; 1000/300 (mA)</td>
</tr>
<tr>
<td>Idle (CD 4-10x CAV Pause)</td>
<td>&lt; 750/650 (mA)</td>
<td>&lt; 500/400 (mA)</td>
</tr>
<tr>
<td>Standby (laser &amp; motor off)</td>
<td>&lt; 300/300 (mA)</td>
<td>&lt; 50/30 (mA)</td>
</tr>
<tr>
<td>Sleep</td>
<td>&lt; 300/300 (mA)</td>
<td>&lt; 50/30 (mA)</td>
</tr>
</tbody>
</table>

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 used Serial ATA interface, which conforms to the Mt. Fuji Commands for CD and DVD Devices: SFF8090v4 rev. 1.00 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.

10.2.2 ELECTORICAL
The Serial ATA bus uses differential drivers and receivers.

10.2.2.1 CONNECTORS
A standard 7-pin flat ribbon cable.

10.2.2.2 CONNECTOR PIN DEFINITION
7-pin Serial ATA male connector.

<table>
<thead>
<tr>
<th>Signal</th>
<th>n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1</td>
<td>GND 2&lt;sup&gt;nd&lt;/sup&gt; mate</td>
</tr>
<tr>
<td>S2</td>
<td>2</td>
<td>A+ Differential signal pair A from Phy</td>
</tr>
<tr>
<td>S3</td>
<td>3</td>
<td>A-</td>
</tr>
<tr>
<td>S4</td>
<td>4</td>
<td>GND 2&lt;sup&gt;nd&lt;/sup&gt; mate</td>
</tr>
<tr>
<td>S5</td>
<td>5</td>
<td>B- Differential signal pair B from Phy</td>
</tr>
<tr>
<td>S6</td>
<td>6</td>
<td>B+</td>
</tr>
<tr>
<td>S7</td>
<td>7</td>
<td>GND 2&lt;sup&gt;nd&lt;/sup&gt; mate</td>
</tr>
</tbody>
</table>

10.2.2.3 SIGNAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Nom</th>
<th>Min</th>
<th>Max</th>
<th>units</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vcm dc</td>
<td>250</td>
<td>200</td>
<td>450 mV</td>
<td>Common mode DC level measured at Receiver connector.</td>
</tr>
</tbody>
</table>

10.2.3 COMMANDS

10.2.3.1 GENERAL
This drive unit implements the ATAPI DVD-R/-RW/+R/+RW/RAM 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 ATAPI CD-R/RW specification:
- ATA Packet Interface for CD-ROMs: SFF-8020i Revision 2.6
- SCSI-3 Multimedia Commands: X3T10/1048D Revision 10A
- SCSI Multimedia Commands - 2: T10/1228-D Revision 10a
- SCSI Multimedia Commands - 5 (MMC-5)
- SFF8090v5 Rev.0.7; Mt. Fuji Commands for Multimedia Devices
- DV-W5500S ATAPI/IDE(SATA) Command Set Specification

10.2.3.2 TASK FILE RESISTER

10.2.3.3 TASK FILE COMMANDS

<table>
<thead>
<tr>
<th>Command</th>
<th>Op-code</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Execute drive diagnostic</td>
<td>90h</td>
<td></td>
</tr>
<tr>
<td>NOP</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>ATAPI Packet Command</td>
<td>A0h</td>
<td></td>
</tr>
<tr>
<td>ATAPI Identify Device</td>
<td>A1h</td>
<td></td>
</tr>
<tr>
<td>ATAPI Soft Reset</td>
<td>08h</td>
<td></td>
</tr>
<tr>
<td>Check Power Mode</td>
<td>E5h</td>
<td></td>
</tr>
<tr>
<td>Idle Immediate</td>
<td>E1h</td>
<td></td>
</tr>
<tr>
<td>Idle</td>
<td>E3h</td>
<td></td>
</tr>
<tr>
<td>Set Features</td>
<td>EFh</td>
<td></td>
</tr>
<tr>
<td>Standby immediate</td>
<td>E0h</td>
<td></td>
</tr>
<tr>
<td>Standby</td>
<td>E2h</td>
<td></td>
</tr>
<tr>
<td>Sleep</td>
<td>E6h</td>
<td></td>
</tr>
</tbody>
</table>
10.2.3.4 PACKET COMMANDS

<table>
<thead>
<tr>
<th>Command</th>
<th>Op-code</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK</td>
<td>A1h</td>
<td></td>
</tr>
<tr>
<td>CLOSE TRACK/SESSION</td>
<td>5Bh</td>
<td></td>
</tr>
<tr>
<td>FORMAT UNIT</td>
<td>04h</td>
<td></td>
</tr>
<tr>
<td>GET CONFIGURATION</td>
<td>46h</td>
<td></td>
</tr>
<tr>
<td>GET PERFORMANCE</td>
<td>ACh</td>
<td></td>
</tr>
<tr>
<td>GET EVENT/STATUS NOTIFICATION</td>
<td>4Ah</td>
<td></td>
</tr>
<tr>
<td>INQUIRY</td>
<td>12h</td>
<td></td>
</tr>
<tr>
<td>MECHANISM STATUS</td>
<td>BDh</td>
<td></td>
</tr>
<tr>
<td>MODE SELECT(10)</td>
<td>55h</td>
<td></td>
</tr>
<tr>
<td>MODE SENSE(10)</td>
<td>5Ah</td>
<td></td>
</tr>
<tr>
<td>PREVENT/ALLOW MEDIUM REMOVAL</td>
<td>1Eh</td>
<td></td>
</tr>
<tr>
<td>READ(10)</td>
<td>28h</td>
<td></td>
</tr>
<tr>
<td>READ(12)</td>
<td>A8h</td>
<td></td>
</tr>
<tr>
<td>READ BUFFER CAPACITY</td>
<td>5Ch</td>
<td></td>
</tr>
<tr>
<td>READ CAPACITY</td>
<td>25h</td>
<td></td>
</tr>
<tr>
<td>READ CD</td>
<td>B6h</td>
<td></td>
</tr>
<tr>
<td>READ CD MSF</td>
<td>B9h</td>
<td></td>
</tr>
<tr>
<td>READ DISC INFORMATION</td>
<td>51h</td>
<td></td>
</tr>
<tr>
<td>READ DVD STRUCTURE</td>
<td>ADh</td>
<td></td>
</tr>
<tr>
<td>READ FORMAT CAPACITIES</td>
<td>23h</td>
<td></td>
</tr>
<tr>
<td>READ HEADER</td>
<td>44h</td>
<td></td>
</tr>
<tr>
<td>READ SUB-CHANNEL</td>
<td>42h</td>
<td></td>
</tr>
<tr>
<td>READ TOC/PMA/ATIP</td>
<td>43h</td>
<td></td>
</tr>
<tr>
<td>READ TRACK INFORMATION</td>
<td>52h</td>
<td></td>
</tr>
<tr>
<td>REPAIR TRACK</td>
<td>58h</td>
<td></td>
</tr>
<tr>
<td>REPORT KEY</td>
<td>A4h</td>
<td></td>
</tr>
<tr>
<td>REQUEST SENSE</td>
<td>03h</td>
<td></td>
</tr>
<tr>
<td>RESERVE TRACK</td>
<td>53h</td>
<td></td>
</tr>
<tr>
<td>REZERO UNIT</td>
<td>01h</td>
<td></td>
</tr>
<tr>
<td>SEND DVD STRUCTURE</td>
<td>BFh</td>
<td></td>
</tr>
<tr>
<td>SEEK</td>
<td>2Bh</td>
<td></td>
</tr>
<tr>
<td>SEND CUE SHEET</td>
<td>5Dh</td>
<td></td>
</tr>
<tr>
<td>SEND EVENT</td>
<td>A2h</td>
<td></td>
</tr>
<tr>
<td>SEND KEY</td>
<td>A3h</td>
<td></td>
</tr>
<tr>
<td>SEND OPC INFORMATION</td>
<td>54h</td>
<td></td>
</tr>
<tr>
<td>SET CD-ROM SPEED</td>
<td>BBh</td>
<td></td>
</tr>
<tr>
<td>SET STREAMING</td>
<td>B6h</td>
<td></td>
</tr>
<tr>
<td>START STOP UNIT</td>
<td>1Bh</td>
<td></td>
</tr>
<tr>
<td>SYNCHRONIZE CACHE</td>
<td>35h</td>
<td></td>
</tr>
<tr>
<td>TEST UNIT READY</td>
<td>00h</td>
<td></td>
</tr>
<tr>
<td>VERIFY(10)</td>
<td>2Fh</td>
<td></td>
</tr>
<tr>
<td>WRITE(10)</td>
<td>2Ah</td>
<td></td>
</tr>
<tr>
<td>WRITE(12)</td>
<td>AAh</td>
<td></td>
</tr>
<tr>
<td>WRITE AND VERIFY(10)</td>
<td>2Eh</td>
<td></td>
</tr>
</tbody>
</table>

10.3 DATA BUFFER

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

11 PACKAGING

11.1 GENERAL

The drives (20 sets) will be packed in a bulk carton using a foam insert to protect against shock and vibration.