TA Document 2000001
AV/C Disc Media Specification - DVD

July 23, 2001

Sponsored by:
1394 Trade Association

Accepted for Release by:
1394 Trade Association Board of Directors.

Abstract:
This document describes the DVD media-specific part of the Disc General Subunit Specification

Keywords:
Disc Subunit, AV/C, DVD.
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1 Overview

1.1 Purpose

This document describes the DVD media-specific specification for the AV/C Disc Subunit General Specification and should be used in conjunction with [R1] AV/C Disc Subunit General Specification, version 1.0.

1.2 Scope

This proposal describes the specification of the parameters to be used with the DVD specification and also the items specific to DVD.
2 References

2.1 Related Specifications

[R1] AV/C Disc Subunit General Specification, version 1.0 (TA Document 1998013)


3 Definitions

3.1 Conformance levels

3.1.1 expected: A key word used to describe the behavior of the hardware or software in the design models assumed by this Specification. Other hardware and software design models may also be implemented.

3.1.2 may: A key word that indicates flexibility of choice with no implied preference.

3.1.3 shall: A key word indicating a mandatory requirement. Designers are required to implement all such mandatory requirements.

3.1.4 should: A key word indicating flexibility of choice with a strongly preferred alternative. Equivalent to the phrase is recommended.

3.1.5 reserved fields: A set of bits within a data structure that are defined in this specification as reserved, and are not otherwise used. Implementations of this specification shall zero these fields. Future revisions of this specification, however, may define their usage.

3.1.6 reserved values: A set of values for a field that are defined in this specification as reserved, and are not otherwise used. Implementations of this specification shall not generate these values for the field. Future revisions of this specification, however, may define their usage.

NOTE–IEEE is investigating whether the “may, shall, should” and possibly “expected” terms will be formally defined by IEEE. If and when this occurs, draft editors should obtain their conformance definitions from the latest IEEE style document.

3.2 Glossary of terms

3.2.1 byte: Eight bits of data, used as a synonym for octet.


3.2.3 quadlet: Four bytes of data.

3.3 Acronyms and abbreviations

AV/C Audio Video Control
4 The DVD Disc Subunit Identifier Descriptor

The DVD uses the Disc Subunit Identifier, as defined in [R1], AV/C Disc Subunit General Specification, version 1.0.

The DVD-specific items for the Subunit Identifier Descriptor are shown below:

4.1 Size of list ID, object ID and object position

The size value of list ID, object ID, and object position shall be as follows.

<table>
<thead>
<tr>
<th>field name</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>size of list ID</td>
<td>02&lt;sub&gt;16&lt;/sub&gt;</td>
</tr>
<tr>
<td>size of object ID</td>
<td>00&lt;sub&gt;16&lt;/sub&gt;</td>
</tr>
<tr>
<td>size of object position</td>
<td>02&lt;sub&gt;16&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

4.2 DVD-specific media_type information

The DVD supported_media_type information is shown below:

<table>
<thead>
<tr>
<th>supported_media_type (MSB)</th>
<th>value</th>
<th>supported_media_type (LSB)</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD</td>
<td>09&lt;sub&gt;16&lt;/sub&gt;</td>
<td>DVD-Audio</td>
<td>01&lt;sub&gt;16&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DVD-Video</td>
<td>02&lt;sub&gt;16&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reserved</td>
<td>All others</td>
</tr>
</tbody>
</table>

These details shall be added to the relevant table in the AV/C Disc Subunit General Specification [R1] at its next update.

The DVD type_dependent_information field in the DVD-specific media_type information contains information that is specific to the DVD media_type.

<table>
<thead>
<tr>
<th>Address Offset</th>
<th>msb</th>
<th>lsb</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD type-dependent information</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 00<sub>16</sub> | DVD_media_spec_version |
| 01<sub>16</sub> | FF<sub>16</sub> |

Figure 4.1 – DVD type_dependent information

The DVD media_spec_version field indicates the version number of DVD medium type specification that this disc subunit conforms to. The upper 4 bits shows the major version number, and lower 4 bits shows the minor version number:
### 4.3 Other Subunit Identifier information

This DVD-specific specification is used in conjunction with the Disc Subunit General specification [R1]. The disc_subunit_version indicates which version of the Disc Subunit specification this unit implements. For this version, it shall be set to $10_{16}$.

The generation_ID shall be set to $01_{16}$ to indicate that devices implementing this specification conform to [R3], Enhancements to the AV/C General Specification 3.0, Version 1.0. However, this specification also contains some extra clarifications (see section 5.5) which may also conform to later versions of the AV/C General specifications.

### 4.4 Disc Subunit Identifier data and reading

The Disc Subunit Identifier and its data, as specified in [R1], is mandatory in all Profiles. The whole descriptor shall be read using a READ DESCRIPTOR command set to a data_length of $0000_{16}$ (read all), see [R2], AV/C Digital Interface Command Set General Specification Version 3.0.

<table>
<thead>
<tr>
<th>DVD_Media_spec_version</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10_{16}$</td>
<td>Version 1.0 of the DVD specification</td>
</tr>
<tr>
<td>all others</td>
<td>Reserved for future specification</td>
</tr>
</tbody>
</table>
5 The DVD Disc Subunit Status Descriptor

All profiles of the DVD player shall support at least the `general_disc_subunit_status_area_info_block`, which contains the `media_and_edit_status_info_block`. Information in these and other disc subunit info blocks is defined in [R1] AV/C Disc Subunit General Specification, version 1.0, [R3] Enhancements to the AV/C General Specification 3.0, Version 1.0 and [R4] AV/C Disc Media Type Specification – CD-DA, Version 1.0.

5.1 Disc Subunit Status Descriptor structure and data

The conceptual structure of the Disc Subunit Status Descriptor that can implement all data likely to be needed for Profile_ID 1016 (Single-deck player, not capable of recording or automatic control) is shown in Figure 5.1:

![Diagram of Disc_subunit_status_descriptor]

Section 7, Profiles, specifies what information is mandatory for each Profile_ID.

5.2 media_and_edit_status_info_block

The `media_and_edit_status_info_block` contains details of the state of the disc in the drive and the current status of editing progress.
For an implementation conforming to Profile ID 10_{16} (Single-deck player, not capable of recording or automatic control), only the disc_in_drive data bits (in the first byte of the primary fields) is mandatory. In this case, data contained in subsequent bytes is not mandatory and both the compound_length and primary_fields_length should reflect the actual length. The byte that contains the disc_in_drive bits also contains the optional error_position bits, which shall be set to 00b if not implemented. The remainder of the byte shall be filled with zeros.

5.3 Reporting DVD-Video and DVD-Audio Playing Position

A DVD-Video disc may contain several Titles. Often, one is the main movie Title, with other Titles providing associated data. Each Title may be sub-divided into Chapters.

A DVD-Audio disc may contain a number of Tracks and each Track may have Indexes. However, the Track may be part of a Group containing several such Tracks.

Position information shall be reported in two formats: time within the current Title or Group (using the absolute_HMSF count) and time within the current Chapter or Track (using the relative_segment_HMSF count).

5.3.1 position_info_block

The position_info_block contains a descriptor_reference which identifies the current Title or Group. These items are identified by their respective list_ID’s: the mapping of Title number and Group number to the relevant list_ID is shown in Table 5.1:

Table 5.1 – Mapping of list_ID’s for Titles and Groups

<table>
<thead>
<tr>
<th>list_ID number</th>
<th>mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>List_ID number (for DVD-Video Titles)</td>
<td>(DVD-Video Title Number) + 100F_{16}</td>
</tr>
<tr>
<td>List_ID number (for DVD-Audio Groups)</td>
<td>(DVD-Audio Group Number) + 1000_{16}</td>
</tr>
</tbody>
</table>

For further details of list_ID’s, see 6.1, List ID Assignment.

5.3.2 position_indicator_info_blocks

The position info block shall contain two position_indicator_info_blocks, which report time in the two formats mentioned above. The info block using the absolute_HMSF format shall precede the info block using the relative_segment_HMSF format – see Figure 5.1 above.

When reporting time within the Title or Group, the position_indicator_info_block uses an indicator_type of 02_{16} (absolute_HMSF format) and contains Hours:Minutes:Seconds:Frame data, as described in [R1].

The second position_indicator_info_block uses an indicator_type of 08_{16} (relative_segment_HMSF format) to report time within the currently playing Chapter or Track, as described in [R4].

The mapping of DVD items to AV/C status data is shown in Table 5.2:
### Table 5.2 – Reporting of DVD-Video and DVD-Audio playing position

<table>
<thead>
<tr>
<th>DVD-Video</th>
<th>DVD-Audio</th>
<th>AV/C Status name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Group</td>
<td>Mapped to descriptor_reference (list_ID)</td>
</tr>
<tr>
<td>Chapter</td>
<td>Track</td>
<td>Mapped to object_position_number</td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>Mapped to segment number</td>
</tr>
<tr>
<td>Time HMSF</td>
<td>Time HMSF</td>
<td>Time HMSF</td>
</tr>
</tbody>
</table>

The relationship of DVD items to object_position_number and segment_number is shown in Table 5.3:

### Table 5.3 – Mapping of object_position_number and segment_number to DVD items

<table>
<thead>
<tr>
<th>AV/C Status item</th>
<th>DVD-Video or DVD-Audio item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object_position_number (for DVD-Video Chapters)</td>
<td>(DVD-Video Chapter Number) - 1</td>
</tr>
<tr>
<td>Object_position_number (for DVD-Audio Tracks)</td>
<td>(DVD-Audio Track Number) - 1</td>
</tr>
<tr>
<td>Segment_number (for DVD-Video Indexes)</td>
<td>FF16</td>
</tr>
<tr>
<td>Segment_number (for DVD-Audio Indexes)</td>
<td>(DVD-Audio Index Number) - 1</td>
</tr>
</tbody>
</table>

For further details of list_ID’s, see 6.1, List ID Assignment.

In both info blocks, time is reported in Hours:Minutes:Seconds:Frames (HMSF) format. Support for Frames is optional and this byte shall be filled with FF16 if Frames are not implemented.

### 5.4 DVD SEARCH and SKIP functions

In the operating_mode_info_block, the DVD SEARCH function shall be reported as the AV/C PLAY status response, with a speed faster than normal. For further details, see [R1].

The DVD SKIP function shall be reported as the AV/C SEARCH status response. The search_type shall be fixed to 00 16 (relative_unit) to model the actual behaviour of the SKIP function. For further details, see [R1].

### 5.5 Reading the Disc Subunit Status Descriptor

When reading specific data, a controller shall read the whole of the info block which contains that data, using the READ INFO BLOCK command with a data_length of 000016 (read all), see [R3] Enhancements to the AV/C General Specification 3.0, Version 1.0. For example, when reading the disc_in_drive data, the whole of the media_and_edit_status_info_block shall be read. However, info blocks which contain only optional data need not be implemented (see section 7 Profiles). If these info blocks have not been implemented, requests to read these info blocks shall reply with the REJECTED response.

As a minimum, info blocks shall be specified by an info block reference path using a descriptor_specifier_type of 30 16 (info_block_reference_by_type_and_instance_count) throughout the whole path. Details of the path structure is shown in Figure 5.1 above. Attempts to read info blocks by other methods shall return NOT IMPLEMENTED if they have not been implemented in addition to the above method.

When reading position information, a controller shall read the position_info_block so that position information in both formats can be read at the same time.
6 Object Lists

6.1 List ID Assignment

The Root Contents List has a list_ID of 1000₁₆.

A DVD-Video disc identifies the current Title that is playing using the Title list_ID (see 5.3, Reporting DVD-Video and DVD-Audio Playing Position). Titles are assigned list_ID’s in the range 1010₁₆ - 1074₁₆.

A DVD-Audio identifies the Group that contains the current Track with a Group list_ID (see 5.3). Group list_ID’s are in the range 1001₁₆ - 1009₁₆.

The list assignment for Profile_ID 10₁₆ (Single-deck player, not capable of recording or automatic control) is shown below:

<table>
<thead>
<tr>
<th>List type</th>
<th>List_ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>root_contents_list</td>
<td>1000₁₆</td>
</tr>
<tr>
<td>Group (for DVD-Audio)</td>
<td>1001₁₆ - 1009₁₆</td>
</tr>
<tr>
<td>Title (for DVD-Video)</td>
<td>1010₁₆ - 1074₁₆</td>
</tr>
<tr>
<td>Reserved</td>
<td>All others</td>
</tr>
</tbody>
</table>

Other list_ID’s will be defined for other Profiles.

6.2 Root Contents List

media_type shall indicate the type of content on the disc currently in the player:

<table>
<thead>
<tr>
<th>media_type (MSB)</th>
<th>value</th>
<th>media_type (LSB)</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD</td>
<td>09₁₆</td>
<td>DVD-Audio</td>
<td>01₁₆</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DVD-Video</td>
<td>02₁₆</td>
</tr>
<tr>
<td></td>
<td></td>
<td>other</td>
<td>0E₁₆</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reserved</td>
<td>all others</td>
</tr>
</tbody>
</table>

These details shall be added to the relevant table in the AV/C Disc Subunit Specification [R1] when it is next updated. For other types of disc, see the relevant media-specific specification.

Other data, such as object-specific data, is not required for a player supporting Profile_ID 10₁₆ (Single-deck player, not capable of recording or automatic control).
6.3 Time Stamp Info Block

The Root Contents List Descriptor contains a Time Stamp info block, which is defined in [R3].

For a DVD conforming to Profile_ID 10_{16} (Single-deck player, not capable of recording or automatic control), the stamp_type bit shall be set to 1. This indicates that the following time stamp data does not contain a time, but a Counter which is incremented every time a disc is inserted into the player.

The counter shall at least implement the “Minutes” field (as it’s MSB) and the “Seconds” field (as it’s LSB) of the time_stamp_data. In order to support this, the info block shall have an info_block_type of 00 06_{16} (descriptor_creation_date_and_time). Remaining fields (hours, day, month, year (LSB) and year (MSB)) shall be set to zero if they are not used.

6.4 AV Object Type-Specific Capacity Info Block

The AV_Object_Type-Specific_Capacity Info Block reports the total playing time of a disc. It is defined in [R1].

For this application, the capacity_format_indicator shall be set to 00_{16} (time in HMSF format). Data for this shall be in BCD format, with two bytes used for hours (giving up to 9999 hours). One byte shall be used for each of Minutes, Seconds and Frames, see Table 6.3:

<table>
<thead>
<tr>
<th>Offset</th>
<th>HMSF Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 00</td>
<td>Hours (thousands)</td>
</tr>
<tr>
<td>00 01</td>
<td>Hours (tens)</td>
</tr>
<tr>
<td>00 02</td>
<td>Minutes (MSB)</td>
</tr>
<tr>
<td>00 03</td>
<td>Seconds (MSB)</td>
</tr>
<tr>
<td>00 04</td>
<td>Frames (MSB)</td>
</tr>
</tbody>
</table>

If the number of Hours is 99 or less, then the thousands and hundreds nibbles shall be set to zero.

Currently, the Frames byte shall be set to FF_{16}.

The AV_Object_total_playback_time is set to the total time recorded on the disc. For a read-only disc, the AV_Object_maximum_recording_capacity and the AV_Object_remaining_recording_capacity shall be set to zero. The Disc General specification defines these lengths as 2 bytes.
6.5 Root Contents List structure and support level

All Profiles shall implement the basic Root Contents List structure. This includes the disc_subunit_list_attributes, media_type, disc_recordable_information, time_stamp_info_block and default_playlist_info_block, as defined in [R1].

Section 7, Profiles, specifies what information is mandatory for each Profile_ID.

For a player conforming to Profile_ID $10_{16}$ (Single-deck player, not capable of recording or automatic control), the default_playlist_info_block shall specify the root_contents_list.

6.6 Reading the Root Contents List

The root contents list shall be read using the READ DESCRIPTOR command using one read command, see [R2], AV/C Digital Interface Command Set General Specification Version 3.0. If the controller is expecting to be reading from a DVD player conforming to Profile_ID $10_{16}$, it is not recommended for that controller to read the complete root contents list. This is because some implementations could hold much data in the root contents list. For this reason, a controller which is expecting to read from a DVD player implementing Profile_ID $10_{16}$ should read the first 33 bytes of information using $data_{length} = 21_{16}$, $address = 00 00_{16}$. This includes all data up to and including the default_playlist_info_block.

Controllers capable of working with DVD players conforming to other Profile_ID’s should first check the length of the root contents list (e.g. by reading the first 33 bytes as above).
7 Profiles

DVD players may be implemented with different levels of functionality. Profiles identify what are the minimum mandatory items in each Profile.

All Profiles shall implement the Subunit Identifier Descriptor.

The Disc Subunit Status descriptor structure, as detailed below in Table 7.1 and in section 5.1 shall be implemented in all Profiles.

All Profiles shall implement the basic Root Contents List structure, as described in section 6.5.

Table 7.1 shows the minimum mandatory support level for descriptor structures, their data and the relevant command support for each Profile.

Table 7.1 – Profiles

<table>
<thead>
<tr>
<th>Implementation _Profile_ID</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>10₁₆</td>
<td>Single-deck player, not capable of recording or automatic control:</td>
</tr>
<tr>
<td></td>
<td>1) Subunit identifier descriptor</td>
</tr>
<tr>
<td></td>
<td>2) Disc subunit status descriptor (see 5.1)</td>
</tr>
<tr>
<td></td>
<td>Disc_in_Drive, contained in the media_and_edit_status_info_block;</td>
</tr>
<tr>
<td></td>
<td>3) Root Contents List (see 6.5)</td>
</tr>
<tr>
<td></td>
<td>Media_type;</td>
</tr>
<tr>
<td></td>
<td>Time Stamp Info Block (implemented as a Counter);</td>
</tr>
<tr>
<td></td>
<td>Default Play List Info Block, set to the root_contents_list;</td>
</tr>
<tr>
<td></td>
<td>4) Command Support</td>
</tr>
<tr>
<td></td>
<td>OPEN DESCRIPTOR;</td>
</tr>
<tr>
<td></td>
<td>READ DESCRIPTOR;</td>
</tr>
<tr>
<td></td>
<td>READ INFO BLOCK.</td>
</tr>
<tr>
<td>All Others</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
8 DVD Implementation Guidelines document (informative)

Further details of a DVD implementation can be found in the DVD Guidelines document, "Guideline of Transmission and Control for DVD-Video / Audio through IEEE1394 bus". This document also contains many examples.

The document can be obtained from the DVD Forum.