DDP Specification

Version 2.00

(For CD and DVD)

DCA

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TABLE OF CONTENTS

Introduction

Disc Description Protocol (DDP) identifies and describes collections of data that will be recorded onto a compact disc (CD) or digital versatile disc (DVD). DDP allows for automated transfer of data from data publishers to disc manufacturers.

This document describes DDP according to the 2.00 specification. It introduces Disc Description Protocol and the files, called streams that make up DDP.

The appendices for this document describe how DDP is stored, usage recommendations for various CD formats, specifications for Digital Audio Tape (DAT) and a glossary of terms used in this document.

If you have any questions or comments regarding the DDP specification, please contact ddpinfo@dcainc.com.

General Description of DDP

DDP consists of several files referred to as streams. (In level 2.00 three streams are necessary.) The following describes the DDP streams.

DDPID

DDPID contains the DDP level identifier, Master ID and UPC/EAN number. It also locates the DDPMS map stream for physically addressed direct access input media. The DDP level identifier specifies the level of DDP implemented and the interpretation of the other DDP streams.

DDPMS

DDPMS contains information to locate and process each stream of TS (Text), DS (Subcode) or DM (Main channel) input data. It contains enough information to automatically develop PQ subcode data.

- **TS (Text)**

TS (Text) contains volume/track/index titling, commentary or customer information text. All TS (Text) files are optional.

- **DS (Subcode)**

DS (Subcode) contains either a PQ descriptor file or R-W subchannel data.

- **DM (Main)**

DM (Main) contains user-supplied main channel data, including all modes and forms of CD.

Although DDP uses the ASCII character set, this should not be interpreted to mean that DDP should be created or modified by using a text editor. Careful consideration should be given to user interface issues when properly implementing any system that uses DDP.

It is recommended that any system that uses DDP should allow easy display of all information in human-readable form. Further, it is recommended that provisions be made to display and enter track and index information along with any relevant data associated with the track or index item.

For CD-ROM applications, it is recommended that DDP be integrated into formatting and premastering software that is used to create CD applications so that the presence of DDP is totally transparent to the user of such systems. Users of such systems should not be required to invoke a special “DDP build” operation.

For mastering applications, it is recommended that operators be allowed to view DDP at a level that makes it easy to understand and correct problems. A user should be able to display and print all relevant track, index and text data in context.

All fields in the DDP streams must contain valid ASCII text. All numeric fields should be right justified and padded with either zeros (30h) or spaces (20h). All alphanumeric fields should be left-justified and padded with spaces (20h).

CD Red, Yellow and Green Book Implementation

The CD Red, Yellow and Green Book Implementation describes compact discs that conform to the Red, Yellow and Green books. These discs contain one lead-in, program area and lead-out.

DDPID

DDPID identifies the presence and level of DDP. The DDPID stream is similar to the DDPID in levels 1.00 and 1.01. The contents of the DDPID stream are listed in Table 3-1.

Table 3-1: DDPID Stream Contents

Byte	Length	Symbol	Name
0-7	8	DDPID	DDP level identifier
8-20	13	UPC	UPC/EAN number
21-28	8	MSS	Map stream start
29-36	8	MSL	Reserved
37	1	MED	Media number
38-85	48	MID	Master ID
86	1	BK	Orange/Yellow book specifier
87-88	2	TYPE	Type of CD
89	1	NSIDE	Reserved
90	1	SIDE	Reserved
91	1	NLAYER	Reserved
92	1	LAYER	Reserved
93-94	2	SIZ	Size of user text
95-127	33	TXT	User-defined text

The DDPID stream consists of one ID packet of 128 bytes. When physically addressed direct access media is used, the ID Stream is located at sector 0. When sequential access media is used, a file named **`DDPID`** is the first file in the DDP sequence.

DDPID — DDP level IDentifier
Definition: DDPID contains both the DDP identifier and the DDP level number.
Byte: 0-7
Length: 8
Usage: **`nnnnnnnn`** = ASCII characters (**`44h 44h 50h 20h 32h 2Eh 30h 30h 'DDP 2.00'`** for DDP level 2.00)

UPC — UPC/EAN number
Definition: UPC contains the UPC/EAN number for the CD.
Byte: 8-20
Length: 13
Usage: **`nnnnnnnnnnnnn`** = valid UPC/EAN number or ASCII spaces if there is no UPC/EAN

MSS — Map Stream Start
Definition: MSS contains the physical address where the map stream begins when used with physically addressed direct access input media. For sequential access media, MSS is filled with ASCII spaces and mastering will look instead for a file named **`DDPMS`** or the next file in sequence.
Byte: 21-28

Length: 8
Usage: **`nnnnnnnn`** = decimal address of first sector of map stream expressed in ASCII form

MSL — Reserved
Definition: MSL is reserved in level 2.00.
Byte: 29-36
Length: 8
Usage: **`nnnnnnnn`** = ASCII spaces

MED — MEDia number
Definition: MED contains the sequential number identifying this media as one of several in an input media set. Only physically addressed direct access devices such as WORM and M-O discs use it. Valid numbers are from **`0`** to **`9`**. MED numbers must begin with **`0`** and be used consecutively. When only a single input media of any type is used, MED is filled with an ASCII space.
Byte: 37
Length: 1
Usage: **`n`** = ASCII numbers between **`0`** and **`9`** or an ASCII space

MID — Master ID
Definition: MID contains the Master ID, a unique character string used by mastering to identify jobs or clients. MID is filled with ASCII spaces when it is not used or when Master ID is not known.
Byte: 38-85
Length: 48
Usage: **`nnnnnn...nnnnnn`** = ASCII characters

BK — Orange/Yellow BooK specifier
Definition: BK contains information whether the DDP specifies a CD conforming to Orange Book or Red, Yellow and Green book specifications.
Byte: 86
Length: 1
Usage: **`n`** = an ASCII space indicating the CD conforms to the Red, Yellow or Green book

TYPE — TYPE of disc
Definition: TYPE contains the type of the disc being mastered.
Byte: 87-88
Length: 2
Usage: **`CD`** = standard CD

NSIDE — Reserved
Definition: NSIDE is reserved for DV formats.
Byte: 89
Length: 1
Usage: **`n =`** ASCII space

SIDE — Reserved
Definition: SIDE is reserved for DV formats.

Byte: 90
Length: 1
Usage: **`n =`** ASCII space

NLAYER — Reserved
Definition: NLAYER is reserved for DV formats.
Byte: 91
Length: 1
Usage: **`n =`** ASCII space

LAYER — Reserved
Definition: LAYER is reserved for DVD formats.
Byte: 92
Length: 1
Usage: **`n =`** ASCII space

DIR -----DIRection of translation
Definition: DIR is reserved for DVD formats.
Byte: 93

SIZ — SIZe of user text
Definition: SIZ contains the number of bytes of the TXT field that contain valid text information. When no valid text data is present in TXT, ASCII spaces are used.
Byte: 94-95
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

TXT — user-defined TeXT
Definition: TXT contains text that can be used for any purpose. This information is not placed on the CD. When no text information is present, TXT is filled with ASCII spaces.
Byte: 96-127
Length: 32
Usage: **`nnnn...nnnn`** = ASCII characters

DDPMS

DDPMS ties together the various files required to complete the CD image. These files constitute not only the files to be placed in the main channel of the CD program area, but also subchannel files that may be present, and other data such as ordering information. The contents of the DDPMS stream are listed in Table 3-2.

Table 3-2: DDPMS Stream Packet Contents

Byte	Length	Symbol	Name
0-3	4	MPV	Map packet valid
4-5	2	DST	Data stream type
6-13	8	DSP	Data stream pointer
14-21	8	DSL	Data stream length
22-29	8	DSS	Data stream start
30-37	8	SUB	Subcode descriptor
38-39	2	CDM	CD mode
40	1	SSM	Source storage mode
41	1	SCR	Source materials scrambled
42-45	4	PRE1	Pregap 1 in data stream
46-49	4	PRE2	Pregap 2 or pause in data stream
50-53	4	PST	Postgap in data stream
54	1	MED	Number for multiple input media
55-56	2	TRK	Track number
57-58	2	IDX	Index number
59-70	12	ISRC	ISRC code
71-73	3	SIZ	Size of data stream identifier
74-90	17	DSI	Data stream identifier
91	1	NEW	Reserved
92-95	4	PRE1NXT	Pregap 1 of next track in data stream
96-103	8	PAUSEADD	Number of blocks of pause to add
104-112	9	OFS	Starting file offset
113-127	15	PAD	Pad characters

DDPMS consists of one or more 128-byte packets. Each packet contains pointers and other information about data, text and subcode streams. Any unused data space in MS units are padded with **`00h`**. Packets are stored in the order in which the data is to be stored on the CD. The first map packet in any MS unit begins on unit byte 0. Multiple map packets are allowed in a single MS unit, provided they are stored consecutively with unused unit space filled with **`00h`**. When physically addressed direct access media is used, the map stream begins at the sector identified in the DDPID MSS. When sequential access media is used, a file named **`DDPMS`** is the second file in the DDP sequence.

MPV — Map Packet Valid
Definition: MPV has the ASCII value of **`VVVM`** and identifies valid 128-byte map packets from invalid unused space in the map stream.
Byte: 0-3
Length: 4
Usage: **`VVVM`** = a valid 128-byte map packet

DST — Data Stream Type
Definition: DST contains an identification for the type of data described by this map packet. DM (Main) data is placed in the main channel of the CD, while DS (Subcode) data is destined for the subchannel of the CD. TS (Text) data is text data for comments and customer information and is not placed on the CD today. In the future, ITTS format (T3) will be converted to text display commands in the subcode.
Byte: 4-5
Length: 2
Usage: `D0` = DM (Main) — data stream
`D2` = DM (Main) — lead-in data (optional)
`D3` = DM (Main) — lead-out data (optional)
`D4` = DM (Main) — fill data (optional)
`T0` = TS (Text) — volume/track/index text (optional)
`T1` = TS (Text) — commentary text (optional)
`T2` = TS (Text) — customer information (optional)
`T3` = TS (Text) — ITTS format (typically a `*.dct` file)
`S0` = DS (Subcode) — subcode data (optional)
All others reserved

DSP — Data Stream Pointer
Definition: DSP contains the address of a physical sector for the data. It is used only for physically addressed direct access input media such as WORM or CD and direct access sequential tape devices such as U-matic or R-DAT. Sequential access devices, such as 9-track tape, do not make use of DSP. When not in use, DSP is filled with ASCII spaces.
Byte: 6-13
Length: 8
Usage: `nnnnnnnn` = decimal address of physical sector for direct access devices expressed in ASCII form. For disc-based direct access devices, this is the exact sector number. For tape-based direct access devices this number is based upon SMPTE time conventions of 30 per second (for example, a SMPTE time of 00:01:02:03 is 1863 decimal).

DSL — Data Stream Length
Definition: DSL contains the amount of data in the stream described by the map packet. In the case of DM (Main) data, DSL contains the number of CD sectors, including any pauses and gaps that have already been included with the input data. In the case of DS (Subcode) data containing R-W subcode information, DSL contains the number of CD A-time frames of R-W data included in the stream. In the case of DS (Subcode) data containing PQ Descriptor information or TS (Text) data, DSL contains the exact number of valid bytes in the input data.
Byte: 14-21
Length: 8
Usage: `11111111` = the decimal number of sectors for DM (Main) data or the decimal number of bytes for DS and TS (Text) data

DSS — Data Stream Start
Definition: DSS contains the address of the physical CD sector where DM (Main) or certain types of DS (Subcode) data are placed on the CD. When DSS entries are filled with ASCII spaces, mastering equipment places DM (Main) data at the next available location, using Red, Yellow and Green book specified minimums for pause and gap. DSS can also be used for DS (Subcode) data that contain fully processed subcode data.
Byte: 22-29
Length: 8
Usage: **`ssssssss`** = the decimal address of physical sector expressed in ASCII characters. If filled with spaces, mastering will record DM (Main) data in the order in which they occur on the input media and map packets.

SUB — SUBcode descriptor
Definition: SUB contains a description of the subcode information on the input media. There are two basic types of subcode data allowed: PQ descriptors and R-W subcode. SUB is filled with ASCII spaces when the map packet is used for DM (Main) or TS (Text) data. One exception exists, however: If R-W subcode data is appended to each block of the main channel data (SSM = **`8`**), this field describes the format of that data. SUB is not used for Super Density (DV) or Multimedia CD (MMCD).
Byte: 30-37
Length: 8
Usage:
`PQ DESCR (50h 51h 20h 44h 45h 53h 43h 52h)` = PQ descriptor data.
`RW24XX (52h 57h 32h 43h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are not interleaved. Bit order is xxRSTUVW.
`RW24XI (52h 57h 32h 34h 58h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are interleaved. Bit order is xxRSTUVW.
`RW24PI (52h 57h 32h 34h 50h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are interleaved. Bit order is xxRSTUVW.
`RW24PX (52h 57h 32h 34h 50h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are not interleaved. Bit order is xxRSTUVW.
`RW18XX (52h 57h 31h 38h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 18-byte packets. Bit order is xxRSTUVW.
`WR24XX (57h 52h 32h 34h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are not interleaved. Bit order is WVUTSRxx.
`WR24XI (57h 52h 32h 34h 58h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are interleaved. Bit order is WVUTSRxx.
`WR24PI (57h 52h 32h 34h 50h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are interleaved. Bit order is WVUTSRxx.
`WR24PX (57h 52h 32h 34h 50h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are not interleaved. Bit order is WVUTSRxx.
`WR18XX (57h 52h 31h 38h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 18-byte packets. Bit order is WVUTSRxx.

CDM — CD Mode

Definition: CDM describes what mode of data is to be recorded on the CD for this particular map packet. This is independent of how data is stored on the input media. CDM is used by mastering equipment to determine proper subcode and, with SSM and SCR, what processing is required. CDM is filled with ASCII spaces when map packet is used for DS (Subcode) and TS (Text) data.

Byte: 38-39

Length: 2

Usage: **00** = Mode 0 (PSEC = **00h**)
10 = Mode 1 (PSEC = **00h**)
20 = Mode 2 (PSEC = **00h**)
2I = CD-I (PSEC = **10h**)
2R = CDI-Ready (PSEC = **10h**)
2X = CD-XA (PSEC = **20h**)
DA = CD-DA (PSEC = **10h**)

NOTE: *Default Psec Flag: The default Psec flag in the TOC is set according to the CD mode of the first track on the disc.*
CDM for other common disc formats:
CD-I Bridge = CD-XA (2X)
CD-BGM = CD-I (2I)
Video CD = CD-XA (2X)
CD-I FMV = CD-I (2I)

SSM — Source Storage Mode
Definition: SSM contains a description of how the input data is stored on the input media and is used in conjunction with CDM. For example, if SSM is `0` (user data only) and CDM is `10` (mode 1), the data is stored as 2048-byte records. If CDM is `DA,` the data is 2352-byte records. If SSM is `6` (incomplete 2352 bytes), only the user data fields are used for mastering. All other fields, including header, sync, EDC and ECC, are ignored. For CDM types `2B`, `2I`, `2R` and `2X`, only SSM types `1`, `2`, `3`, `4` and `7` are valid and mastering equipment will process data based upon subheader values with sync, header, EDC and ECC ignored for all but type `7`. SSM is filled with an ASCII space when a map packet is used for DS (Subcode) and TS (Text) data.
Byte: 40
Length: 1
Usage: `0` = User data only
`1` = Interleaved Form 1 and Form 2 2332 bytes
`2` = Interleaved Form 1 and Form 2 2336 bytes
`3` = Interleaved Form 1 and Form 2 2340 bytes
`4` = Interleaved Form 1 and Form 2 2352 bytes
`6` = Incomplete 2352 bytes
`7` = Complete 2352 bytes
`8` = Complete 2352 bytes plus R-W data

NOTE: *An SSM of* `8` *specifies the data is interleaved with R-W subcode data. The SUB field defines the format of this data. Four packets are present for each data block, appending 96 or 72 bytes to the end of the 2352 main channel data bytes, depending on the format.*

SCR — Source material sCRambled
Definition: SCR contains information whether the data on input media has already been scrambled. An SCR of `1` is used only when SSM = `4, 6, 7` or `8`. SCR is filled with an ASCII space when the map packet is used for DS (Subcode) and TS (Text) data.
Byte: 41
Length: 1
Usage: `0` = indicates data on input media is not scrambled
`1` = indicates data on input media is scrambled

PRE1 — PREgap part 1 included in data stream
Definition: PRE1 contains the number of sectors of pregap part 1 information included at the beginning of DM (Main) data. PRE1 sectors must have the same storage mode as the DM (Main) data and belong to track index 00.
Byte: 42-45
Length: 4
Usage: **nnnn** = the decimal count of number of sectors supplied, expressed in ASCII characters

NOTE: *Any PRE1 information contained in DM (Main) data streams must contain all 00h. The data supplied in DM (Main) is not used on the CD, but serves only as a placeholder for the correct structure of pregap part 1 data that is generated by the mastering equipment. DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PRE1 is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PRE1 is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.*

PRE2 — PREgap part 2 or pause in data stream
Definition: PRE2 contains the number of sectors of pause or pregap part 2 information included at the beginning of DM (Main) data. PRE sectors must have the same storage and CD mode structure as the DM (Main) data and must be in index 00.
Byte: 46-49
Length: 4
Usage: **nnnn** = the decimal count of number of sectors supplied, expressed in ASCII form

NOTE: *DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PRE2 is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PRE2 is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.*

PST — PoSTgap included in data stream
Definition: PST contains the number of sectors of postgap information included at the end of DM (Main) data. PST sectors must have the same storage and CD mode structure as the DM (Main) data.
Byte: 50-53
Length: 4
Usage: **nnnn** = decimal count of number of sectors supplied, expressed in ASCII form

NOTE: *DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PST is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PST is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.*

MED — MEDia number
Definition: MED contains information on which media (in a multiple media set) the data described in this map packet is stored. For sequential access devices such as tape, this will contain an ASCII space. For direct access devices such as WORM or M-O discs, valid MED numbers begin with `0` and end with `9`.
Byte: 54
Length: 1
Usage: `n` = `0` through `9` or an ASCII space

TRK — TRacK number
Definition: TRK contains the track number for the data described by the map packet. It is valid only when Yellow Book-compatible mode is selected in the DDPID. TRK is filled with ASCII spaces for all TS (Text) data and DS (Subcode) data that contains PQ information. When TRK is filled with ASCII spaces for DM (Main) data, mastering assigns tracks based upon the Red, Yellow and Green book specifications for forced track changes.
Byte: 55-56
Length: 2
Usage: `nn` = the decimal track number expressed in ASCII form (except lead-out, which is ASCII `AA`)

IDX — InDeX number
Definition: IDX contains the index number described by the map packet. It is valid only when Yellow Book compatible mode is selected in the DDPID. IDX is filled with ASCII spaces for all TS (Text) data and DS (Subcode) data that contains PQ information. When IDX is filled with ASCII spaces for DM (Main) data, mastering assigns index numbers based upon the Red, Yellow and Green book specifications (either `00` or `01`).
Byte: 57-58
Length: 2
Usage: `nn` = the decimal index number expressed in ASCII form

ISRC — ISRC code
Definition: ISRC contains the ISRC code for each track. Only one ISRC entry is allowed for each track. ISRC is filled with ASCII spaces when map packet is used for DS (Subcode) and TS (Text) data, as well as DM (Main) lead-in and lead-out.
Byte: 59-70
Length: 12
Usage: `nnnnnnnnnnnn` = the ISRC code expressed in ASCII form

SIZ — SIZe of DSI
Definition: SIZ contains the size, in decimal, of the data stream identifier (DSI) entry immediately following SIZ. For DDP level 2.00, DSI is 17 characters. SIZ is filled with ASCII spaces when no DSI is present.
Byte: 71-73
Length: 3
Usage: `nnn` = a decimal number expressed in ASCII form (`017` for DDP level 2.00)

DSI — Data Stream Identifier
Definition: DSI contains the name of the TS (Text) or DS (Subcode) file when used with logically accessed input media such as labeled tape or disc files. DSI also contains the name of DM (Main) files when used with logically accessed direct access media such as DOS files. Since DM (Main) type files must be mastered in the order in which they are stored on sequential logically accessed input media, such as 8mm tape, DSI is not required for DM (Main) files, but is included anyway for operator convenience, although it is ignored by mastering. When physically addressed direct access media is used for input, DSI is included for operator convenience but is ignored by mastering. DSI is filled with ASCII spaces when not used.
Byte: 74-90
Length: 17
Usage: **nnnnnnnnnnnnnnnnn** = 17 ASCII characters

NEW — Reserved
Definition: NEW is reserved for Orange Book discs.
Byte: 91
Length: 1
Usage: **n** = an ASCII space

PRE1NXT — PREgap 1 of the NeXT track included in data stream
Definition: PRE1NXT contains the number of CD blocks present at the end of this stream that belong to the pregap part 1 for the next stream. It is used when duplicating from a CD to specify that the pregap part 1 of the next track is to be read off the CD and placed on the duplicate, instead of creating data for the pregap part 1. If this field is filled, then the PRE1 field of the next stream must be blank. The default value if the field is blank is zero.
Byte: 92-95
Length: 4
Usage: **nnnn** = the decimal number of sectors supplied, expressed in ASCII form

PAUSEADD — number of blocks of PAUSE to ADD
Definition: PAUSEADD contains the number of sectors that are to be encoded as pause for the data stream. When this field is blank, mastering equipment defaults to the standard pauses as defined by the appropriate standard (Red, Yellow or Orange book).
Byte: 96-103
Length: 8
Usage: **nnnnnnnn** = the decimal number of sectors to be inserted, expressed in ASCII form

OFS — starting file OFfSet
Definition: OFS contains the starting byte offset in an input file for the data described by a map packet when using random access media, such as the DOS file allocation table-based filing system. This field allows mastering from mixed-mode CD images recorded as a single file.
Byte: 104-112
Length: 9
Usage: **`nnnnnnnnn`** = a decimal number expressed in ASCII characters

PAD — PAD characters
Definition: PAD contains ASCII space characters to complete the 128-byte map packet for DDP level 2.00. This field might be used in future levels of DDP for longer input file names.
Byte: 113-127
Length: 15
Usage: **`nnnn...nnnn`** = 37 ASCII space characters

Subcode Stream Contents

The subcode streams define the contents of the subchannel as it appears on the outgoing CD. There are currently two types of subcode streams that can be defined, both of which are optional.

The **PQ descriptor** contains the location of the changes in track, index and control of the subchannel, as well as ISRC and UPC numbers. The fields in the PQ descriptor file override the track, index, ISRC and UPC fields in the DDPID and DDPMS streams. The P bit of subchannel is implied by the contents of the PQ descriptor file.

The **R-W subcode stream** contains the R-W bit information. When subcode streams are used with physically addressed direct access media, they are located at the sector identified in the map packet DSP. When subcode streams are used with sequential access media, they have the same name as the map packet DSI.

The CD A-time gives the A-time at which the new subcode format occurs, except for lead-in, where CD A-time refers to the length of lead-in. The changes that occur may be in the track number, index number or the control byte.

Lead-in, program area and lead-out regions of the disk are identified by the track number, with lead-in as track 00 and lead-out as track AA. The end of lead-out is identified by an entry identical to the lead-out entry except that CD A-time is the first block just after lead-out (the last lead-out sector plus 1). CD A-time hours (HRS) and control byte 2 (CB2) are reserved for future use.

PQ Descriptor

The PQ descriptor gives an outline of changes that occur in the Q code information in the subcode channel. The descriptor is formatted in 64-byte packets. Descriptor packets are stored in the order in which they will appear on the CD.

On a Yellow Book CD, there is one lead-in entry and two lead-out entries. The length of the lead-in and lead-out entries is zero.

On an Orange Book CD, each session contains one lead-in entry and one lead-out entry, except the last session (or the only session of a single session CD) which contains a second lead-out entry at the same A-time as the previous lead-out entry. For the second and subsequent sessions, the lead-in and lead-out entries specify the A-time at which the entry starts. The ISRC, track and index numbers given in this subcode packet take precedence over ISRC, TRK and IDX in DDPMS.

The contents of each packet are listed in Table 3-3.

Table 3-3: PQ Descriptor Stream Contents

Byte	Length	Symbol	Name
0-3	4	SPV	Subcode packet valid
4-5	2	TRK	Track number
6-7	2	IDX	Index number
8-9	2	HRS	CD A-time hours (Reserved)
10-11	2	MIN	CD A-time minutes
12-13	2	SEC	CD A-time seconds
14-15	2	FRM	CD A-time frames
16-17	2	CB1	Control byte 1
18-19	2	CB2	Control byte 2 (Reserved)
20-31	12	ISRC	ISRC code
32-44	13	UPC	UPC/EAN number
45-63	19	TXT	User-defined text

SPV — Subcode Packet Valid
Definition: SPV contains a four-byte character with the ASCII value of **VVVS** and identifies valid 64-byte subcode packets from invalid unused space in the subcode stream.
Byte: 0-3
Length: 4
Usage: **VVVS** = a valid 64-byte subcode packet.

TRK — TRacK number
Definition: TRK contains the track number associated with the A-time entries in this packet. The lead-out entry is **AA**.
Byte: 4-5
Length: 2
Usage: **nn** = a decimal track number expressed in ASCII form (except lead-out, which is **AA**)

IDX — InDeX number
Definition: IDX contains the index number associated with the A-time entries in this packet. If track is **00h** and IDX is **A0h**, the SEC field contains the Psec field for the CD, overriding the assumed Psec from the CDM field in the DDPMS stream.
Byte: 6-7
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

HRS — CD A-time HouRS (Reserved for future use)
Definition: HRS contains the hours portion of the A-time where this track or index item occurs on the CD.
Byte: 8-9
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

MIN — CD A-time MINutes
Definition: MIN contains the minutes portion of the A-time where this track or index item occurs on the CD.
Byte: 10-11
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

SEC — CD A-time SEConds
Definition: SEC contains the seconds portion of the A-time where this track or index item occurs on the CD. If TRK is **`00h`** and IDX is **`A0h`**, this field contains the Psec value for the CD.
Byte: 12-13
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

FRM — CD A-time FRaMe
Definition: FRM contains the frame portion of the A-time where this track or index item occurs on the CD.
Byte: 14-15
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

CB1 — Control Byte 1
Definition: CB1 contains the control information for this track or index item. The contents of CB1 are taken from the Red, Yellow and Green books. This field contains two sub fields, each one byte long. The upper byte contains the control for the entry. The lower byte contains either **`1`** for a normal entry or **`S`** if the Serial Copy Management System is to be used.
Byte: 16-17
Length: 2
Usage: **`nn`** = an ASCII representation of HEX control byte

CB2 — Control Byte 2 (Reserved for future use)
Definition: CB2 contains control information for new CD formats to be defined later.
Byte: 18-19
Length: 2
Usage: **`nn`** = an ASCII representation of HEX control byte

ISRC — ISRC code for track or index
Definition: ISRC contains the ISRC code for the track or index. It is valid only for the first entry for each track number greater than 0.
Byte: 20-31
Length: 12
Usage: **`nnnnnnnnnnnn`** = an ASCII ISRC code

UPC — UPC/EAN number for disc
Definition: UPC contains the catalog number for the CD. Only one UPC entry is allowed for each PQ packet stream. It is recommended that it be placed in the first packet.
Byte: 32-44
Length: 13
Usage: **`nnnnnnnnnnnnn`** = an ASCII UPC/EAN number

TXT — User-defined TeXT
Definition: TXT contains user comments. This data will not be recorded to the CD. If no text is provided, this field is filled with ASCII spaces.
Byte: 45-63
Length: 19
Usage: **`nnnn...nnnn`** = ASCII text

R-W Subcode Stream

R-W subcode data is organized in 24-byte packs, with four packs contained in a 96-byte packet. One 96-byte packet is stored with each CD sector. Each 24-byte pack consists of one byte of mode/item, one byte of instruction, two bytes of Q parity, 16 bytes of data and four bytes of P parity information. In addition, there is an interleaving specification given in the Red Book standard for the R-W data. DDP level 2.00 supports eight input storage forms for R-W data as described below.

Partially processed R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The two Q parity and four P parity bytes may contain zero data and will not be used during mastering, since they are recomputed. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24XX**. The format of the R-W pack is described in Table 3-4.

Table 3-4: Partially processed R-W (xxRSTUVW)

Byte	7	6	5	4	3	2	1	0	Definition
	Msb							lsb	
0	0	0	R	S	T	U	V	W	Mode item
1	0	0	R	S	T	U	V	W	Instruction
2	0	0	R	S	T	U	V	W	Q parity
3	0	0	R	S	T	U	V	W	Q parity
4	0	0	R	S	T	U	V	W	Data field
.....									
19	0	0	R	S	T	U	V	W	Data field
20	0	0	R		T	U	V	W	P parity
21	0	0	R	S	T	U	V	W	P parity
22	0	0	R	S	T	U	V	W	P parity
23	0	0	R	S	T	U	V	W	P parity

Partially processed interleaved R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack contains invalid P and Q parities. The packs are interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24XI**. The format of the R-W pack is described in Table 3-4.

Fully processed interleaved R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24PI**. The format of the R-W pack is described in Table 3-4.

Fully processed flat R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24PX**. The format of the R-W pack is described in Table 3-4.

18-byte user data only R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 18-byte pack contains no parities. The subcode descriptor in the DDP Map Stream is **RW18XX**. The format of the R-W pack is described in Table 3-5.

Table 3-5: 18-byte user data only R-W (xxRSTUVW)

Byte	7	6	5	4	3	2	1	0	Definition
	Msb							lsb	
0	0	0	R	S	T	U	V	W	Mode item
1	0	0	R	S	T	U	V	W	Instruction
2	0	0	R	S	T	U	V	W	Data field
.....									
17	0	0	R	S	T	U	V	W	Data field

Partially processed R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes may contain zero data and will not be used during mastering since they are recomputed. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24XX**. The format of the R-W pack is listed in Table 3-6.

Table 3-6: Partially processed R-W (WVUTSRxx)

Byte	7	6	5	4	3	2	1	0	Definition
	Msb							lsb	
0	W	V	U	T	S	R	0	0	Mode item
1	W	V	U	T	S	R	0	0	Instruction
2	W	V	U	T	S	R	0	0	Q parity
3	W	V	U	T	S	R	0	0	Q parity
4	W	V	U	T	S	R	0	0	Data field
.....									
19	W	V	U	T	S	R	0	0	Data field
20	W	V	U	T	S	R	0	0	P parity
21	W	V	U	T	S	R	0	0	P parity
22	W	V	U	T	S	R	0	0	P parity
23	W	V	U	T	S	R	0	0	P parity

Partially processed interleaved R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes will not be used during mastering. The packs must be interleaved in the DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24XI**. The format of the R-W pack is listed in Table 3-6.

Fully processed interleaved R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes must be properly computed and are used during mastering. The packs must be interleaved in the DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24PI**. The format of the R-W pack is listed in Table 3-6.

Fully processed flat R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24PX**. The format of the R-W pack is listed in Table 3-6.

Byte user data only R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The 18-byte pack contains no parities. The subcode descriptor in the DDP Map Stream is **WR18XX**. The format of the R-W pack is listed in Table 3-7.

Table 3-7: Byte user data only R-W (WVUTSRxx)

Byte	7	6	5	4	3	2	1	0	Definition
	Msb							lsb	
0	W	V	U	T	S	R	0	0	Mode item
1	W	V	U	T	S	R	0	0	Instruction
2	W	V	U	T	S	R	0	0	Data field
.....									
17	W	V	U	T	S	R	0	0	Data field

CD Multisession Read-Only Implementation

The CD Multisession Read-Only Implementation describes compact discs that conform to the Multisession Read-Only Specification.

DDPID

DDPID identifies the presence and level of DDP. The DDPID stream is similar to the DDPID in levels 1.00 and 1.01. The contents of the DDPID stream are listed in Table 4-1.

Table 4-1: DDPID Stream Contents

Byte	Length	Symbol	Name
0-7	8	DDPID	DDP level identifier
8-20	13	UPC	UPC/EAN number
21-28	8	MSS	Map stream start
29-36	8	MSL	Reserved
37	1	MED	Media number
38-85	48	MID	Master ID
86	1	BK	Orange/Yellow book specifier
87-88	2	TYPE	Type of CD
89	1	NSIDE	Reserved
90	1	SIDE	Reserved
91	1	NLAYER	Reserved
92	1	LAYER	Reserved
93-94	2	SIZ	Size of user text
95-127	33	TXT	User-defined text

The DDPID stream consists of one ID packet of 128 bytes. When physically addressed direct access media is used, the ID Stream is located at sector 0. When sequential access media is used, a file named **`DDPID`** is the first file in the DDP sequence.

DDPID — DDP level IDentifier
Definition: DDPID contains both the DDP identifier and the DDP level number.
Byte: 0-7
Length: 8
Usage: nnnnnnnn = ASCII characters (**`44h 44h 50h 20h 32h 2Eh 30h 30h 'DDP 2.00'`** for DDP level 2.00)

UPC — UPC/EAN number
Definition: UPC contains the UPC/EAN number for the CD.
Byte: 8-20
Length: 13
Usage: nnnnnnnnnnnnn = valid UPC/EAN number or ASCII spaces if there is no UPC/EAN

MSS — Map Stream Start
Definition: MSS contains the physical address where the map stream begins when used with physically addressed direct access input media. For sequential access media, MSS is filled with ASCII spaces and mastering instead looks for a file named **`DDPMS`** or the next file in sequence.
Byte: 21-28
Length: 8
Usage: **`nnnnnnnn`** = decimal address of first sector of map stream expressed in ASCII form

MSL — Reserved
Definition: MSL is reserved in level 2.00.
Byte: 29-36
Length: 8
Usage: **`nnnnnnnn`** = ASCII spaces

MED — MEDia number
Definition: MED contains the sequential number identifying this media as one of several in an input media set. Only physically addressed direct access devices such as WORM and M-O discs use it. Valid numbers are from `0` to `9`. MED numbers must begin with `0` and be used consecutively. When only a single input media of any type is used, MED is filled with an ASCII space.
Byte: 37
Length: 1
Usage: **`n`** = ASCII numbers between `0` and `9` or an ASCII space

MID — Master ID
Definition: MID contains the Master ID, a unique character string used by mastering to identify jobs or clients. MID is filled with ASCII spaces when it is not used or when Master ID is not known.
Byte: 38-85
Length: 48
Usage: **`nnnnnn...nnnnnn`** = ASCII characters

BK — Orange/Yellow BooK specifier
Definition: BK contains information whether the DDP specifies a CD conforming to Orange Book or Red, Yellow and Green book specifications.
Byte: 86
Length: 1
Usage: `O` = indicates the CD conforms to the Orange Book

TYPE — TYPE of disc
Definition: TYPE contains the type of the disc being mastered.
Byte: 87-88
Length: 2
Usage: **`CD`** = standard CD

NSIDE — Reserved
Definition: NSIDE is reserved for DVD formats.
Byte: 89
Length: 1
Usage: **`n`** = ASCII space

SIDE — Reserved
Definition: SIDE is reserved for DVD formats.
Byte: 90
Length: 1
Usage: **`n`** = ASCII space

NLAYER — Reserved
Definition: NLAYER is reserved for DVD formats.
Byte: 91
Length: 1
Usage: **`n`** = ASCII space

LAYER — Reserved
Definition: LAYER is reserved for DVD formats.
Byte: 92
Length: 1
Usage: **`n`** = ASCII space

SIZ — SIZe of user text
Definition: SIZ contains the number of bytes of the TXT field that contain valid text information. When no valid text data is present in TXT, ASCII spaces are used.
Byte: 93-94
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

TXT — user-defined TeXT
Definition: TXT contains text that can be used for any purpose. This information is not placed on the CD. When no text information is present, TXT is filled with ASCII spaces.
Byte: 95-127
Length: 33
Usage: **`nnnn...nnnn`** = ASCII characters

DDPMS

DDPMS ties together the various files required to complete the CD image. These files constitute not only the files to be placed in the main channel of the CD program area, but also subchannel files that may be present, and other data such as ordering information. The contents of the DDPMS stream are listed in Table 4-2.

Table 4-2: DDPMS Stream Packet Contents

Byte	Length	Symbol	Name
0-3	4	MPV	Map packet valid
4-5	2	DST	Data stream type
6-13	8	DSP	Data stream pointer
14-21	8	DSL	Data stream length
22-29	8	DSS	Data stream start
30-37	8	SUB	Subcode descriptor
38-39	2	CDM	CD mode
40	1	SSM	Source storage mode
41	1	SCR	Source materials scrambled
42-45	4	PRE1	Pregap 1 in data stream
46-49	4	PRE2	Pregap 2 or pause in data stream
50-53	4	PST	Postgap in data stream
54	1	MED	Number for multiple input media
55-56	2	TRK	Track number
57-58	2	IDX	Index number
59-70	12	ISRC	ISRC code
71-73	3	SIZ	Size of data stream identifier
74-90	17	DSI	Data stream identifier
91	1	NEW	New track, session or incremental
92-95	4	PRE1NXT	Pregap 1 of next track in data stream
96-103	8	PAUSEADD	Number of blocks of pause to add
104-112	9	OFS	Starting file offset
113-127	15	PAD	Pad characters

DDPMS consists of one or more 128-byte packets. Each packet contains pointers and other information about data, text and subcode streams. Any unused data space in MS units are padded with **`00h`**. Packets are stored in the order in which the data is to be stored on the CD unless DSS values are included in all MS packets. The first map packet in any MS unit begins on unit byte 0. Multiple map packets are allowed in a single MS unit, provided they are stored consecutively with unused unit space filled with **`00h`**. Individual MS packets may not span MS unit boundaries. When physically addressed direct access media is used, the map stream begins at the sector identified in the DDPID MSS. When sequential access media is used, a file named **`DDPMS`** is the second file in the DDP sequence.

MPV — Map Packet Valid
Definition: MPV has the ASCII value of **`VVVM`** and identifies valid 128-byte map packets from invalid unused space in the map stream.
Byte: 0-3
Length: 4
Usage: **`VVVM`** = a valid 128-byte map packet

DST — Data Stream Type
Definition: DST contains an identification for the type of data described by this map packet. DM (Main) data is placed in the main channel of the CD, while DS (Subcode) data is destined for the subchannel of the CD. TS (Text) data is text data for comments and customer information and is not placed on the CD today. In the future, ITTS format (T3) will be converted to text display commands in the subcode.
Byte: 4-5
Length: 2
Usage: `D0` = DM (Main) — data stream
`D2` = DM (Main) — lead-in data (optional)
`D3` = DM (Main) — lead-out data (optional)
`D4` = DM (Main) — fill data (optional)
`T0` = TS (Text) — volume/track/index text (optional)
`T1` = TS (Text) — commentary text (optional)
`T2` = TS (Text) — customer information (optional)
`T3` = TS (Text) — ITTS format (typically a `*.dct` file)
`S0` = DS (Subcode) — subcode data (optional)
All others reserved

DSP — Data Stream Pointer
Definition: DSP contains the address of a physical sector for the data. It is used only for physically addressed direct access input media such as WORM or CD and direct access sequential tape devices such as U-matic or R-DAT. Sequential access devices, such as 9-track tape, do not make use of DSP. When not in use, DSP is filled with ASCII spaces.
Byte: 6-13
Length: 8
Usage: `nnnnnnnn` = decimal address of physical sector for direct access devices expressed in ASCII form. For disc-based direct access devices, this is the exact sector number. For tape-based direct access devices this number is based upon SMPTE time conventions of 30 per second (for example, a SMPTE time of 00:01:02:03 is 1863 decimal).

DSL — Data Stream Length
Definition: DSL contains the amount of data in the stream described by the map packet. In the case of DM (Main) data, DSL contains the number of CD sectors, including any pauses and gaps that have already been included with the input data. In the case of DS (Subcode) data containing R-W subcode information, DSL contains the number of CD A-time frames of R-W data included in the stream. In the case of DS (Subcode) data containing PQ Descriptor information or TS (Text) data, DSL contains the exact number of valid bytes in the input data.
Byte: 14-21
Length: 8
Usage: `11111111` = the decimal number of sectors for DM (Main) data or the decimal number of bytes for DS and TS (Text) data

DSS — Data Stream Start
Definition: DSS contains the address of the physical CD sector where DM (Main) or certain types of DS (Subcode) data are placed on the CD. When DSS entries are filled with ASCII spaces, mastering equipment places DM (Main) data at the next available location, using Red, Yellow and Green book specified minimums for pause and gap. DSS can also be used for DS (Subcode) data that contain fully processed subcode data.
Byte: 22-29
Length: 8
Usage: **`ssssssss`** = the decimal address of physical sector expressed in ASCII characters. If filled with spaces, mastering records DM (Main) data in the order in which they occur on the input media and map packets.

SUB — SUBcode descriptor
Definition: SUB contains a description of the subcode information on the input media. There are two basic types of subcode data allowed: PQ descriptors and R-W subcode. SUB is filled with ASCII spaces when the map packet is used for DM (Main) or TS (Text) data. One exception exists, however: If R-W subcode data is appended to each block of the main channel data (SSM = **`8`**), this field describes the format of that data.
Byte: 30-37
Length: 8
Usage: **`PQ DESCR (50h 51h 20h 44h 45h 53h 43h 52h)`** = PQ descriptor data. See section *PQ Descriptor*. For more information on the following, see section *R-W Subcode Stream*.

`RW24XX (52h 57h 32h 43h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are not interleaved. Bit order is xxRSTUVW.

`RW24XI (52h 57h 32h 34h 58h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are interleaved. Bit order is xxRSTUVW.

`RW24PI (52h 57h 32h 34h 50h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are interleaved. Bit order is xxRSTUVW.

`RW24PX (52h 57h 32h 34h 50h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are not interleaved. Bit order is xxRSTUVW.

`RW18XX (52h 57h 31h 38h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 18-byte packets. Bit order is xxRSTUVW.

`WR24XX (57h 52h 32h 34h 58h 58h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are not interleaved. Bit order is WVUTSRxx.

`WR24XI (57h 52h 32h 34h 58h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with invalid P and Q parities. The packets are interleaved. Bit order is WVUTSRxx.

`WR24PI (57h 52h 32h 34h 50h 49h 20h 20h)` = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are interleaved. Bit order is WVUTSRxx.

WR24PX (57h 52h 32h 34h 50h 58h 20h 20h) = R-W Data. R-W data has the format of 24-byte packets with valid P and Q parities. The packets are not interleaved. Bit order is WVUTSRxx.

WR18XX (57h 52h 31h 38h 58h 58h 20h 20h) = R-W Data. R-W data has the format of 18-byte packets. Bit order is WVUTSRxx.

CDM — CD Mode

Definition: CDM describes what mode of data is to be recorded on the CD for this particular map packet. This is independent of how data is stored on the input media. CDM is used by mastering equipment to determine proper subcode and, with SSM and SCR, what processing is required. CDM is filled with ASCII spaces when map packet is used for DS (Subcode) and TS (Text) data.

Byte: 38-39

Length: 2

Usage: **00** = Mode 0 (PSEC = **00h**)
10 = Mode 1 (PSEC = **00h**)
20 = Mode 2 (PSEC = **00h**)
2I = CD-I (PSEC = **10h**)
2R = CDI-Ready (PSEC = **10h**)
2X = CD-XA (PSEC = **20h**)
DA = CD-DA (PSEC = **10h**)

NOTE: *The default Psec flag in the TOC is set according to the CD mode of the first track on the disc. See the* Usage *section above for the appropriate Psec flag values.*

CDM for other common disc formats

CD-I Bridge = CD-XA (2X)
CD-BGM = CD-I (2I)
Video CD = CD-XA (2X)
CD-I FMV = CD-I (2I)

SSM — Source Storage Mode
Definition: SSM contains a description of how the input data is stored on the input media and is used in conjunction with CDM. For example, if SSM is **0** (user data only) and CDM is **10** (mode 1), the data is stored as 2048-byte records. If CDM is **DA,** the data is 2352-byte records. If SSM is **6** (incomplete 2352 bytes), only the user data fields are used for mastering. All other fields, including header, sync, EDC and ECC, are ignored. For CDM types **2B**, **2I**, **2R** and **2X**, only SSM types **1**, **2**, **3**, **4** and **7** are valid and mastering equipment will process data based upon subheader values with sync, header, EDC and ECC ignored for all but type **7**. SSM is filled with an ASCII space when a map packet is used for DS (Subcode) and TS (Text) data.
Byte: 40
Length: 1
Usage: **0** = User data only
1 = Interleaved Form 1 and Form 2 2332 bytes
2 = Interleaved Form 1 and Form 2 2336 bytes
3 = Interleaved Form 1 and Form 2 2340 bytes
4 = Interleaved Form 1 and Form 2 2352 bytes
6 = Incomplete 2352 bytes
7 = Complete 2352 bytes
8 = Complete 2352 bytes plus R-W data

NOTE: *An SSM of* ***8*** *specifies the data is interleaved with R-W subcode data. The SUB field defines the format of this data. Four packets are present for each data block, appending 96 or 72 bytes to the end of the 2352 main channel data bytes, depending on the format.*

SCR — Source material sCRambled
Definition: SCR contains information whether the data on input media has already been scrambled. An SCR of **1** is used only when SSM = **4, 6, 7** or **8**. SCR is filled with an ASCII space when the map packet is used for DS (Subcode) and TS (Text) data.
Byte: 41
Length: 1
Usage: **0** = indicates data on input media is not scrambled
1 = indicates data on input media is scrambled

PRE1 — PREgap part 1 included in data stream
Definition: PRE1 contains the number of sectors of pregap part 1 information included at the beginning of DM (Main) data. PRE1 sectors must have the same storage mode as the DM (Main) data and belong to track index 00.
Byte: 42-45
Length: 4
Usage: **`nnnn`** = the decimal count of number of sectors supplied, expressed in ASCII characters

NOTE: Any PRE1 information contained in DM (Main) data streams must contain all ***`00h`****. The data supplied in DM (Main) is not used on the CD, but serves only as a placeholder for the correct structure of pregap part 1 data that is generated by the mastering equipment. DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PRE1 is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PRE1 is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.*

PRE2 — PREgap part 2 or pause in data stream
Definition: PRE2 contains the number of sectors of pause or pregap part 2 information included at the beginning of DM (Main) data. PRE sectors must have the same storage and CD mode structure as the DM (Main) data and must be in index 00.
Byte: 46-49
Length: 4
Usage: **`nnnn`** = the decimal count of number of sectors supplied, expressed in ASCII form

NOTE: DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PRE2 is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PRE2 is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.

PST — PoSTgap included in data stream
Definition: PST contains the number of sectors of postgap information included at the end of DM (Main) data. PST sectors must have the same storage and CD mode structure as the DM (Main) data.
Byte: 50-53
Length: 4
Usage: **`nnnn`** = decimal count of number of sectors supplied, expressed in ASCII form.

NOTE: DSL minus any PRE1, PRE and PST gives the exact number of actual data sectors supplied in DM (Main) data. When no PST is specified, the mastering facility inserts the required minimum values as listed in Red, Yellow and Green book specifications when forced track changes occur. PST is filled with ASCII spaces when the map packet is used for DS (Subcode) and TS (Text) data.

MED — MEDia number
Definition: MED contains information on which media (in a multiple media set) the data described in this map packet is stored. For sequential access devices such as tape, this will contain an ASCII space. For direct access devices such as WORM or M-O discs, valid MED numbers begin with `0` and end with `9`.
Byte: 54
Length: 1
Usage: `n` = `0` through `9` or an ASCII space

TRK — TRacK number
Definition: TRK contains the track number for the data described by the map packet. It is valid only when Yellow Book-compatible mode is selected in the DDPID. TRK is filled with ASCII spaces for all TS (Text) data and DS (Subcode) data that contains PQ information. When TRK is filled with ASCII spaces for DM (Main) data, mastering assigns tracks based upon the Red, Yellow and Green book specifications for forced track changes.
Byte: 55-56
Length: 2
Usage: `nn` = the decimal track number expressed in ASCII form (except lead-out, which is ASCII `AA`)

IDX — InDeX number
Definition: IDX contains the index number described by the map packet. It is valid only when Yellow Book compatible mode is selected in the DDPID. IDX is filled with ASCII spaces for all TS (Text) data and DS (Subcode) data that contains PQ information. When IDX is filled with ASCII spaces for DM (Main) data, mastering assigns index numbers based upon the Red, Yellow and Green book specifications (either `00` or `01`).
Byte: 57-58
Length: 2
Usage: `nn` = the decimal index number expressed in ASCII form

ISRC — ISRC code
Definition: ISRC contains the ISRC code for each track. Only one ISRC entry is allowed for each track. ISRC is filled with ASCII spaces when map packet is used for DS (Subcode) and TS (Text) data, as well as DM (Main) lead-in and lead-out.
Byte: 59-70
Length: 12
Usage: `nnnnnnnnnnnn` = the ISRC code expressed in ASCII form

SIZ — SIZe of DSI
Definition: SIZ contains the size, in decimal, of the data stream identifier (DSI) entry immediately following SIZ. For DDP level 2.00, DSI is 17 characters. SIZ is filled with ASCII spaces when no DSI is present.
Byte: 71-73
Length: 3
Usage: **`nnn`** = a decimal number expressed in ASCII form (**`017`** for DDP level 2.00)

DSI — Data Stream Identifier
Definition: DSI contains the name of the TS (Text) or DS (Subcode) file when used with logically accessed input media such as labeled tape or disc files. DSI also contains the name of DM (Main) files when used with logically accessed direct access media such as DOS files. Since DM (Main) type files must be mastered in the order in which they are stored on sequential logically accessed input media, such as 8mm tape, DSI is not required for DM (Main) files, but is included anyway for operator convenience, although it is ignored by mastering. When physically addressed direct access media is used for input, DSI is also included for operator convenience but is ignored by mastering. DSI is filled with ASCII spaces when not used.
Byte: 74-90
Length: 17
Usage: **`nnnnnnnnnnnnnnnnn`** = 17 ASCII characters

NEW — NEW track, new session or track incremental field
Definition: NEW contains information about tracks, sessions or track increments on Orange Book discs. It specifies if the data stream being specified either starts a new Orange Book track, session or an increment within a track.
Byte: 91
Length: 1
Usage: **`n`** = an ASCII space character that indicates if no forced track change occurs, this stream occurs in .
`S` = indicates this stream is the first track of a new session, causing the insertion of a lead-out and lead-in between the last stream and this stream.
`T` = indicates this stream begins a new track in the same session. If the main channel block structures are the same, 152 blocks are inserted between the last stream and this stream. The first two blocks are encoded with the last track and the next 150 blocks are encoded as a pause of the new track. If there is a block mode change, 227 blocks are inserted. The first two blocks are encoded with the last track and the next 225 blocks are encoded as a pregap for the new track.
`I` = indicates this stream is in the same track, but the runout-link-runin block combination (seven blocks total) is inserted between this stream and the previous stream. This value is invalid if a forced track change is present.

PRE1NXT — PREgap 1 of the NeXT track included in data stream
Definition: PRE1NXT contains the number of CD blocks present at the end of this stream that belong to the pregap part 1 for the next stream. It is used when duplicating from a CD to specify that the pregap part 1 of the next track is to be read off the CD and placed on the duplicate, instead of creating data for the pregap part 1. If this field is filled, then the PRE1 field of the next stream must be blank. The default value if the field is blank is zero.
Byte: 92-95
Length: 4
Usage: **nnnn** = the decimal number of sectors supplied, expressed in ASCII form

PAUSEADD — number of blocks of PAUSE to ADD
Definition: PAUSEADD contains the number of sectors that are to be encoded as pause for the data stream. When this field is blank, mastering equipment defaults to the standard pauses as defined by the appropriate standard (Red, Yellow or Orange book).
Byte: 96-103
Length: 8
Usage: **nnnnnnnn** = the decimal number of sectors to be inserted, expressed in ASCII form

OFS — starting file OFfSet
Definition: OFS contains the starting byte offset in an input file for the data described by a map packet when using random access media, such as the DOS file allocation table-based filing system. This field allows mastering from mixed-mode CD images recorded as a single file.
Byte: 104-112
Length: 9
Usage: **nnnnnnnnn** = a decimal number expressed in ASCII characters

PAD — PAD characters
Definition: PAD contains ASCII space characters to complete the 128-byte map packet for DDP level 2.00. This field might be used in future levels of DDP for longer input file names.
Byte: 113-127
Length: 15
Usage: **nnnn...nnnn** = 37 ASCII space characters

Subcode Stream Contents

The subcode streams define the contents of the subchannel as it appears on the outgoing CD. There are currently two types of subcode streams that can be defined, both of which are optional.

The **PQ descriptor** contains the location of the changes in track, index and control of the subchannel, as well as ISRC and UPC numbers. The fields in the PQ descriptor file override the track, index, ISRC and UPC fields in the DDPID and DDPMS streams. The P bit of subchannel is implied by the contents of the PQ descriptor file.

The **R-W subcode stream** contains the R-W bit information. When subcode streams are used with physically addressed direct access media, they are located at the sector identified in the map packet DSP. When subcode streams are used with sequential access media, they have the same name as the map packet DSI.

The CD A-time gives the A-time at which the new subcode format occurs, except for lead-in, where CD A-time refers to the length of lead-in. The changes that occur may be in the track number, index number or the control byte.

Lead-in, program area and lead-out regions of the disk are identified by the track number, with lead-in as track 00 and lead-out as track AA. The end of lead-out is identified by an entry identical to the lead-out entry except that CD A-TIME is the first block just after lead-out (the last lead-out sector plus 1). CD A-time hours (HRS) and control byte 2 (CB2) are reserved for future use.

PQ Descriptor

The PQ descriptor gives an outline of changes that occur in the Q code information in the subcode channel. The descriptor is formatted in 64-byte packets. Descriptor packets are stored in the order in which they will appear on the CD.

On a Yellow Book CD, there is one lead-in entry and two lead-out entries. The length of the lead-in and lead-out entries is zero.

On an Orange Book CD, each session contains one lead-in entry and one lead-out entry, except the last session (or the only session of a single session CD) which contains a second lead-out entry at the same A-time as the previous lead-out entry. For the second and subsequent sessions, the lead-in and lead-out entries specify the A-time at which the entry starts. The ISRC, track and index numbers given in this subcode packet take precedence over ISRC, TRK and IDX in DDPMS.

The contents of each packet are listed in Table 4-3.

Table 4-3: PQ Descriptor Stream Contents

Byte	Length	Symbol	Name
0-3	4	SPV	Subcode packet valid
4-5	2	TRK	Track number
6-7	2	IDX	Index number
8-9	2	HRS	CD A-time hours (Reserved)
10-11	2	MIN	CD A-time minutes
12-13	2	SEC	CD A-time seconds
14-15	2	FRM	CD A-time frames
16-17	2	CB1	Control byte 1
18-19	2	CB2	Control byte 2 (Reserved)
20-31	12	ISRC	ISRC code
32-44	13	UPC	UPC/EAN code
45-63	19	TXT	User-defined text

SPV — Subcode Packet Valid
Definition: SPV contains a four-byte character with the ASCII value of **VVVS** and identifies valid 64-byte subcode packets from invalid unused space in the subcode stream.
Byte: 0-3
Length: 4
Usage: **VVVS** = a valid 64-byte subcode packet

TRK — TRacK number
Definition: TRK contains the track number associated with the A-time entries in this packet. The lead-out entry is **AA**.
Byte: 4-5
Length: 2
Usage: **nn** = a decimal track number expressed in ASCII form (except lead-out, which is **AA**)

IDX — InDeX number
Definition: IDX contains the index number associated with the A-time entries in this packet. If track is **00h** and IDX is **A0h**, the SEC field contains the Psec field for the CD, overriding the assumed Psec from the CDM field in the DDPMS stream.
Byte: 6-7
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

HRS — CD A-time HouRS (Reserved for future use)
Definition: HRS contains the hours portion of the A-time where this track or index item occurs on the CD.
Byte: 8-9
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

MIN — CD A-time MINutes
Definition: MIN contains the minutes portion of the A-time where this track or index item occurs on the CD.
Byte: 10-11
Length: 2
Usage: **nn** = a decimal number expressed in ASCII form

SEC — CD A-time SEConds
Definition: SEC contains the seconds portion of the A-time where this track or index item occurs on the CD. If TRK is **`00h`** and IDX is **`A0h`**, this field contains the Psec value for the CD.
Byte: 12-13
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

FRM — CD A-time FRaMe
Definition: FRM contains the frame portion of the A-time where this track or index item occurs on the CD.
Byte: 14-15
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

CB1 — Control Byte 1
Definition: CB1 contains the control information for this track or index item. The contents of CB1 are taken from the Red, Yellow and Green books. This field contains two sub fields, each one byte long. The upper byte contains the control for the entry. The lower byte contains either **`1`** for a normal entry or **`S`** if the Serial Copy Management System is to be used.
Byte: 16-17
Length: 2
Usage: **`nn`** = an ASCII representation of HEX control byte

CB2 — Control Byte 2 (Reserved for future use)
Definition: CB2 contains control information for new CD formats to be defined later.
Byte: 18-19
Length: 2
Usage: **`nn`** = an ASCII representation of HEX control byte

ISRC — ISRC code for track or index
Definition: ISRC contains the ISRC code for the track or index. It is valid only for the first entry for each track number greater than 0.
Byte: 20-31
Length: 12
Usage: **`nnnnnnnnnnnn`** = an ASCII ISRC code

UPC — UPC/EAN number for disc
Definition: UPC contains the catalog number for the CD. Only one UPC entry is allowed for each PQ packet stream. It is recommended to be placed in the first packet.
Byte: 32-44
Length: 13
Usage: **`nnnnnnnnnnnnn`** = an ASCII UPC/EAN number

TXT — User-defined TeXT
Definition: TXT contains user comments. This data will not be recorded to the CD. If no text is provided, this field is filled with ASCII spaces.
Byte: 45-63
Length: 19
Usage: **`nnnn...nnnn`** = ASCII text

R-W Subcode Stream

R-W subcode data is organized in 24-byte packs, with four packs contained in a 96-byte packet. One 96-byte packet is stored with each CD sector. Each 24-byte pack consists of one byte of mode/item, one byte of instruction, two bytes of Q parity, 16 bytes of data and four bytes of P parity information. In addition, there is an interleaving specification given in the Red Book standard for the R-W data. DDP level 2.00 supports eight input storage forms for R-W data as described below.

Partially processed R-W (xxRSTUVW)

The two most significant bits, 7 and 6, may contain zero and will not be used. The two Q parity and four P parity bytes may contain zero data and will not be used during mastering, since they are recomputed. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24XX**. The format of the R-W pack is described in Table 4-4.

Table 4-4: Partially processed R-W (xxRSTUVW)

Byte	7	6	5	4	3	2	1	0	**Definition**
	Msb							lsb	
0	0	0	R	S	T	U	V	W	Mode item
1	0	0	R	S	T	U	V	W	Instruction
2	0	0	R	S	T	U	V	W	Q parity
3	0	0	R	S	T	U	V	W	Q parity
4	0	0	R	S	T	U	V	W	Data field
.....									
19	0	0	R	S	T	U	V	W	Data field
20	0	0	R		T	U	V	W	P parity
21	0	0	R	S	T	U	V	W	P parity
22	0	0	R	S	T	U	V	W	P parity
23	0	0	R	S	T	U	V	W	P parity

Partially processed interleaved R-W (xxRSTUVW)

The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack contains invalid P and Q parities. The packs are interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24XI**. The format of the R-W pack is described in Table 4-4.

Fully processed interleaved R-W (xxRSTUVW)

The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24PI**. The format of the R-W pack is described in Table 4-4.

Fully processed flat R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **RW24PX**. The format of the R-W pack is described in Table 4-4.

18-byte user data only R-W (xxRSTUVW)
The two most significant bits, 7 and 6, may contain zero and will not be used. The 18-byte pack contains no parities. The subcode descriptor in the DDP Map Stream is **RW18XX**. The format of the R-W pack is described in Table 4-5.

Table 4-5: 18-byte user data only R-W (xxRSTUVW)

Byte	7	6	5	4	3	2	1	0	**Definition**
	Msb							lsb	
0	0	0	R	S	T	U	V	W	Mode item
1	0	0	R	S	T	U	V	W	Instruction
2	0	0	R	S	T	U	V	W	Data field
.....									
17	0	0	R	S	T	U	V	W	Data field

Partially processed R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes may contain zero data and will not be used during mastering since they are recomputed. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24XX**. The format of the R-W pack is listed in Table 4-6.

Table 4-6: Partially processed R-W (WVUTSRxx)

Byte	7	6	5	4	3	2	1	0	**Definition**
	Msb							lsb	
0	W	V	U	T	S	R	0	0	Mode item
1	W	V	U	T	S	R	0	0	Instruction
2	W	V	U	T	S	R	0	0	Q parity
3	W	V	U	T	S	R	0	0	Q parity
4	W	V	U	T	S	R	0	0	Data field
.....									
19	W	V	U	T	S	R	0	0	Data field
20	W	V	U	T	S	R	0	0	P parity
21	W	V	U	T	S	R	0	0	P parity
22	W	V	U	T	S	R	0	0	P parity
23	W	V	U	T	S	R	0	0	P parity

Partially processed interleaved R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes will not be used during mastering. The packs must be interleaved in the DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24XI**. The format of the R-W pack is listed in Table 4-6.

Fully processed interleaved R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The two Q parity and four P parity bytes must be properly computed and are used during mastering. The packs must be interleaved in the DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24PI**. The format of the R-W pack is listed in Table 4-6.

Fully processed flat R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The 24-byte pack must contain valid P and Q parities. The packs are not interleaved in the input DS (Subcode) stream. The subcode descriptor in the DDP Map Stream is **WR24PX**. The format of the R-W pack is listed in Table 4-6.

Byte user data only R-W (WVUTSRxx)
The two least significant bits, 0 and 1, may contain zero and will not be used. The 18-byte pack contains no parities. The subcode descriptor in the DDP Map Stream is **WR18XX**. The format of the R-W pack is listed in Table 4-7.

Table 4-7: Byte user data only R-W (WVUTSRxx)

Byte	7	6	5	4	3	2	1	0	**Definition**
	Msb							Lsb	
0	W	V	U	T	S	R	0	0	Mode item
1	W	V	U	T	S	R	0	0	Instruction
2	W	V	U	T	S	R	0	0	Data field
.....									
17	W	V	U	T	S	R	0	0	Data field

DVD Implementation

The DVD Implementation describes compact discs that conform to the DVD Specification.

In earlier versions of the Data Description Protocol, DDP consisted of two files, DDPID and DDPMS. In this version, when the input media is SCSI-based tape, the DDPID and DDPMS streams can be placed in one tape file. In this case the tape file must be named DDPID. The first 128 bytes of the tape file will contain the DDPID information, and the bytes immediately following will contain the DDPMS information. For identification purposes, the first four bytes of the DDPMS packets will contain the symbols *VVVM*.

All fields in the DDP streams shall contain valid ASCII text. All numeric fields shall be right justified and padded with either '0' (30h) or space (20h). All alphanumeric fields shall be left justified and shall be padded with space (20h).

DDPID

DDPID identifies the presence and level of DDP. The contents of the DDPID stream are listed in Table 6-1.

Table 6-1: DDPID Stream Contents

Byte	Length	Symbol	Name
0-7	8	DDPID	DDP level identifier
8-20	13	UPC	Reserved
21-28	8	MSS	Map stream start
29-36	8	MSL	Reserved
37	1	MED	Reserved
38-85	48	MID	Master ID
86	1	BK	Reserved
87-88	2	TYPE	Type of disc
89	1	NSIDE	Number of sides on final disc
90	1	SIDE	Side of current surface
91	1	NLAYER	Number of layers on final disc
92	1	LAYER	Layer of current surface
93	1	DIR	Direction of Translation
94	1	DSIZE	Replicate Size (8 or 12 cm)
95	1	SSCRST	Security Scrambling Status
96	1	SSCRMD	Security Scrambling Mode
97-98	2	SIZ	Size of user text
99-127	29	TXT	User-defined text

The DDPID stream consists of one ID packet of 128 bytes. When physically addressed direct access media is used, the ID Stream is located at sector 0. When sequential access media is used, a file named **`DDPID`** is the first file in the DDP sequence.

DDPID — DDP level IDentifier
Definition: DDPID contains both the DDP identifier and the DDP level number.
Byte: 0-7
Length: 8
Usage: **`nnnnnnnn`** = ASCII characters (**`44h 44h 50h 20h 32h 2Eh 30h 30h 'DDP 2.00'`** for DDP level 2.00)

UPC — Reserved
Definition: UPC is reserved.
Byte: 8-20
Length: 13
Usage: **`nnnnnnnnnnnnn`** = ASCII spaces

MSS — Map Stream Start
Definition: MSS contains the physical address where the map stream begins when used with physically addressed direct access input media. For sequential access media, MSS is filled with ASCII spaces and mastering instead looks for a file named **`DDPMS`** or the next file in sequence.
Byte: 21-28
Length: 8
Usage: **`nnnnnnnn`** = decimal address of first sector of map stream expressed in ASCII form

MSL — Reserved
Definition: MSL is reserved in level 2.00.
Byte: 29-36
Length: 8
Usage: **`nnnnnnnn`** = ASCII spaces

MED — Reserved
Byte: 37
Length: 1
Usage: **`n`** = ASCII space

MID — Master ID
Definition: MID contains the Master ID, a unique character string used by mastering to identify jobs or clients. MID is filled with ASCII spaces when it is not used or when Master ID is not known.
Byte: 38-85
Length: 48
Usage: **`nnnnnn...nnnnnn`** = ASCII characters

BK — Reserved
Definition: BK is reserved.
Byte: 86
Length: 1
Usage: **`n`** = an ASCII space

TYPE — TYPE of disc
Definition: TYPE contains the type of the disc being mastered.
Byte: 87-88
Length: 2
Usage: **`DV`** = DVD disc

NSIDE — Number of SIDEs on final disc
Definition: NSIDE contains the total number of readable sides on the final disc.
Byte: 89
Length: 1
Usage: `1` = the final disc will have one readable side
`2` = the final disc will have two readable sides

SIDE — current SIDE of disc
Definition: SIDE contains the current side of the image being mastered.
Byte: 90
Length: 1
Usage: `0` = (hex 30) side 0
`1` = (hex 31) side 1

NLAYER — Number of LAYERs on final disc
Definition: NLAYER contains the total number of layers on a side of the final disc.
Byte: 91
Length: 1
Usage: `1` = (hex 31) the final disc will have one readable layer
`2` = (hex 32) the final disc will have two readable layers

LAYER — current LAYER of disc
Definition: LAYER contains the current layer of the image being mastered.
Byte: 92
Length: 1
Usage: `0` = (hex 30) layer 0
`1` = (hex 31) layer 1

DIR ----- Direction of Translation
Definition: This field describes the direction of translation of Layer 1 of a dual layer DVD disc. It is valid only when there is more than one layer on the disc. Since there are unique sets of DDP for each layer, this field must contain the same value for the DDP used on both layers. That is, if Layer 1 is Opposite track path, then this field shall contain *O* for both layers.
Byte: 93
Length: 1
Usage: `I` = (hex 49) From inner radius to outer radius
`O` = (hex 4F) From outer radius to inner radius

DSIZE ---- Size of Disc
Definition: This field specifies the size of the disc to be mastered. A value of ***A*** indicates an 8 cm disc; a value of ***B*** indicates a 12 cm disc.
Byte: 94
Length: 1
Usage: **`A`** = 8 cm
`B`= 12 cm

SSCRST----Security Scrambling Status
Definition: This field specifies the status of security scrambling for the disc to be created.
Byte: 95
Length: 1
Usage: 0 = (hex 30) The data for the disc contains no security scrambling. The final disc will not be scrambled for security.
1 = (hex 31) The data for the disc contains no security scrambling. The final disc will be scrambled for security.
2 = (hex 32) The data for the disc contains security scrambling. The final disc will be scrambled for security.
3 = (hex 33) The data for the disc contains no security scrambling. The security scrambling keys are read from a floppy disk. Format the floppy according to CSS Site Guide Book. The final disc will be scrambled for security.

SSCRMD----Security Scrambling Mode
Definition: This field specifies the type of security scrambling that is to be on the final disc.
Byte: 96
Length: 1
Usage: 0 = (hex 30) DVD Video Version 1.0 Security Scrambling

SIZ — SIZe of user text
Definition: SIZ contains the number of bytes of the TXT field that contain valid text information. When no valid text data is present in TXT, ASCII spaces are used.
Byte: 97-98
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

TXT — user-defined TeXT
Definition: TXT contains text that can be used for any purpose. This information is not placed on the CD. When no text information is present, TXT is filled with ASCII spaces.
Byte: 99-127
Length: 29
Usage: **`nnnn...nnnn`** = ASCII characters

DDPMS

DDPMS ties together the various files required to complete the DVD image. These files constitute not only the files to be placed in the main channel of the DVD program area, but also subchannel files that may be present, and other data such as ordering information. The contents of the DDPMS stream are listed in Table 6-2.

Table 6-2: DDPMS Stream Packet Contents

Byte	Length	Symbol	Name
0-3	4	MPV	Map packet valid
4-5	2	DST	Data stream type
6-13	8	DSP	Data stream pointer
14-21	8	DSL	Data stream length
22-29	8	DSS	Data stream start
30-37	8	SUB	Reserved
38-39	2	CDM	DVD mode
40	1	SSM	Source storage mode
41	1	SCR	Source materials scrambled
42-45	4	PRE1	Reserved
46-49	4	PRE2	Reserved
50-53	4	PST	Reserved
54	1	MED	Number for multiple input media
55-56	2	TRK	Reserved
57-58	2	IDX	Reserved
59-70	12	ISRC	Reserved
71-73	3	SIZ	Size of data stream identifier
74-90	17	DSI	Data stream identifier
91	1	NEW	Reserved
92-95	4	PRE1NXT	Reserved
96-103	8	PAUSEADD	Reserved
104-112	9	OFS	Starting file offset
113-127	15	PAD	Pad characters

DDPMS consists of one or more 128-byte packets. Each packet contains pointers and other information about data, text and subcode streams. Any unused data space in MS units are padded with **`00h`**. Packets are stored in the order in which the data is to be stored on the DVD Disc. The first map packet in any MS unit begins on unit byte 0. Multiple map packets are allowed in a single MS unit provided they are stored consecutively with unused unit space filled with **`00h`**. Individual MS packets may not span MS unit boundaries. When physically addressed direct access media is used, the map stream begins at the sector identified in the DDPID MSS. When sequential access media is used, a file named **`DDPMS`** is the second file in the DDP sequence.

MPV — Map Packet Valid
Definition: MPV has the ASCII value of **`VVVM`** and identifies valid 128-byte map packets from invalid unused space in the map stream.
Byte: 0-3
Length: 4
Usage: **`VVVM`** = a valid 128-byte map packet

DST — Data Stream Type
Definition: DST contains identification for the type of data described by this map packet. DM (Main) data is placed in the main channel of the DVD Disc. TS (Text) data is text data for comments and customer information and is not placed on the DVD Disc in this version of the DDP Specification. See section *Text Stream*.
Byte: 4-5
Length: 2
Usage: **`D0`** = DM (Main) — data stream
`D2` = DM (Main) — lead-in data*
`D3` = DM (Main) — lead-out data (optional)
`D4` = DM (Main) — fill data (optional)
`T0` = TS (Text) — volume/track/index text (optional)
`T1` = TS (Text) — commentary text (optional)
`T2` = TS (Text) — customer information (optional)
`T3` = TS (Text) — ITTS text packets (optional)
All others reserved

NOTE: *D2 describes streams that contain 16 sectors of control data to be placed in the lead-in of the DVD Disc. The stream does not contain the entire contents of lead-in. DVD Disc formatters must insert the contents of the stream into the lead-in being generated during mastering.*

DSP — Data Stream Pointer
Definition: DSP contains the address of a physical sector for the data. It is used only for physically addressed direct access input media such as WORM or DVD Disc. Sequential access devices, such as 9-track tape, do not make use of DSP. When not in use, DSP is filled with ASCII spaces.
Byte: 6-13
Length: 8
Usage: **`nnnnnnnn`** = decimal address of physical sector for direct access devices expressed in ASCII form. For disc-based direct access devices, this is the exact sector number.

DSL — Data Stream Length
Definition: DSL contains the amount of data in the stream described by the map packet. In the case of DM (Main) data, DSL contains the number of DVD sectors, including any pauses and gaps that have already been included with the input data. In the case of TS (Text) data, DSL contains the exact number of valid bytes in the input data.
Byte: 14-21
Length: 8
Usage: **`11111111`** = the decimal number of sectors for DM (Main) data or the decimal number of bytes for DS and TS (Text) data

DSS — Data Stream Start
Definition: DSS contains the address of the physical DVD Disc sector where DM (Main) data are placed on the DVD Disc. When DSS entries are filled with ASCII spaces, mastering equipment places DM (Main) data at the next available location.

NOTE: This field is required for all surfaces. For Layer 1 Opposite Track Path DVD discs, this field shall contain the 1's complement of the actual value that will be placed on the DVD disc.

Byte: 22-29
Length: 8
Usage: **`ssssssss`** = the decimal address of physical sector expressed in ASCII characters.

SUB — Reserved
Definition: SUB is reserved for standard CD.
Byte: 30-37
Length: 8
Usage: **`nnnnnnnn`** = 8 ASCII spaces.

CDM — DVD Disc Mode
Definition: CDM describes what mode of data is to be recorded on the DVD Disc for this particular map packet. This is independent of how data is stored on the input media. CDM is filled with ASCII spaces when map packet is used for TS (Text) data.
Byte: 38-39
Length: 2
Usage: **`DV`** = DVD Disc

SSM — Source Storage Mode
Definition: SSM contains a description of how the input data is stored on the input media and is used in conjunction with CDM. SSM is filled with an ASCII space when a map packet is used for TS (Text) data.
Byte: 40
Length: 1
Usage: **`0`** = User data only, 2048 bytes
`1 = Complete 2054 bytes`
`6 = Incomplete 2064 bytes`
`7` = Complete 2064 bytes

NOTE: DVD discs contain 2064 bytes of information per sector, divided as follows: ID (4 bytes), IEC (2 bytes), reserved (6 bytes), user data (2048 bytes) and error detection code (EDC) (4 bytes). When SSM=0, ID, IEC, and EDC are generated; the reserved bytes are set to 0; and the user data are sent without modification. When SSM=1, ID, IEC, and EDC are generated; and the reserved bytes and user data are sent without modification. When SSM=6, ID, IEC, and EDC are ignored and regenerated; and the reserved bytes and user data are sent without modification. When SSM=7, the entire sector is sent without modification. On D2 (Leadin Control) map packets **0** *or* **1** *are the only valid values for this field.*

SCR — Source material sCRambled

Definition: SCR contains information about whether the data on input media has already been scrambled. An SCR of `1` is used only when SSM = `6` or `7`. SCR is filled with an ASCII space when the map packet is used for TS (Text) data.

Byte: 41
Length: 1
Usage:
`0` = (hex 30) indicates data on input media is not scrambled
`1` = (hex 31) indicates data on input media is scrambled

PRE1 — Reserved
Definition: PRE1 is reserved for standard CD.
Byte: 42-45
Length: 4
Usage: `nnnn` = 4 ASCII spaces

PRE2 — Reserved
Definition: PRE2 is reserved for standard CD.
Byte: 46-49
Length: 4
Usage: `nnnn` = 4 ASCII spaces

PST — Reserved
Definition: PST is reserved for standard CD.
Byte: 50-53
Length: 4
Usage: `nnnn` = 4 ASCII spaces

MED — MEDia number
Definition: MED contains information on which media (in a multiple media set) the data described in this map packet is stored. For sequential access devices such as tape, this will contain an ASCII space. For direct access devices such as WORM or M-O discs, valid MED numbers begin with `0` and end with `9`.
Byte: 54
Length: 1
Usage: `n` = `0` through `9` or an ASCII space

TRK — Reserved
Definition: TRK is reserved for standard CD.
Byte: 55-56
Length: 2
Usage: `nn` = 2 ASCII spaces

IDX — Reserved
Definition: IDX is reserved for standard CD.
Byte: 57-58
Length: 2
Usage: `nn` = 2 ASCII spaces

ISRC — Reserved
Definition: ISRC is reserved for standard CD.
Byte: 59-70
Length: 12
Usage: `nnnnnnnnnnnn` = 12 ASCII spaces

SIZ — SIZe of DSI
Definition: SIZ contains the size, in decimal, of the data stream identifier (DSI) entry immediately following SIZ. For DDP level 2.00, DSI is 17 characters. SIZ is filled with ASCII spaces when no DSI is present.
Byte: 71-73
Length: 3
Usage: `nnn` = a decimal number expressed in ASCII form (`017` for DDP level 2.00)

DSI — Data Stream Identifier
Definition: DSI contains the name of the TS (Text) file when used with logically accessed input media such as labeled tape or disc files. DSI also contains the name of DM (Main) files when used with logically accessed direct access media such as DOS files. Since DM (Main) type files must be mastered in the order in which they are stored on sequential logically accessed input media, such as 8mm tape, DSI is not required for DM (Main) files, but is included anyway for operator convenience, although it is ignored by mastering. When physically addressed direct access media is used for input, DSI is also included for operator convenience but is ignored by mastering. DSI is filled with ASCII spaces when not used.
Byte: 74-90
Length: 17
Usage: `nnnnnnnnnnnnnnnnn` = 17 ASCII characters

NEW — Reserved
Definition: NEW is reserved for standard CD.
Byte: 91
Length: 1
Usage: `n` = an ASCII space

PRE1NXT — Reserved
Definition: PRE1NXT is reserved for standard CD.
Byte: 92-95
Length: 4
Usage: **nnnn** = 4 ASCII spaces

PAUSEADD — Reserved
Definition: PAUSEADD is reserved for standard CD.
Byte: 96-103
Length: 8
Usage: **nnnnnnnn** = 8 ASCII spaces

OFS — starting file OFfSet
Definition: OFS contains the starting byte offset in an input file for the data described by a map packet when using random access media, such as the DOS file allocation table-based filing system.
Byte: 104-112
Length: 9
Usage: **nnnnnnnnn** = a decimal number expressed in ASCII characters

PAD — PAD characters
Definition: PAD contains ASCII space characters to complete the 128-byte map packet for DDP level 2.00. This field might be used in future levels of DDP for longer input file names.
Byte: 113-127
Length: 15
Usage: **nnnn...nnnn** = 37 ASCII space characters

Text Stream

There are four types of text streams that DDP describes:

- Volume/Track/Index (T0)
- Commentary (T1)
- Customer Information (T2) and
- ITTS packets (T3)

The types T0, T1 and T3 are arranged in text packets, while type T2 is free ASCII data.

Type T0 text is for titling of volume, track and index information, and should be used only for this purpose, as in the future this information might be placed on the DVD Disc.

Type T1 text is for general comments related to volume, track and index that may be of technical use, such as identifying noise, clicks or periods of long silence. T1 text will not be placed on the DVD Disc.

Type T2 text is for general customer information when mastering may require such information. T2 takes the place of **`IDENT.TXT`** type information that is used by some mastering companies.

Type T3 text specifies the ITTS subcode information for the disc.

The contents of the T0, T1 and T3 text streams are listed in Table 6-3.

Table 6-3: T0, T1 and T3 Text Stream Contents

Byte	Length	Symbol	Name
0-3	4	TPV	Text packet valid
4-5	2	TRK	Track number
6-7	2	IDX	Index number
8-10	3	SIZ	Size of valid text
11-127	117	TXT	Text information

When text streams are used with physically addressed direct access media, they are located at the sector identified in map packet DSP. When text streams are used with sequential access media, they have the same name as the map packet DSI.

TPV — Text Packet Valid

Definition: TPV contains a four-byte character with the ASCII value of **`VVVT`** and identifies valid 128-byte text packets from invalid unused space in the text stream.

Byte: 0-3

Length: 4

Usage: **`VVVT`** = a valid 128-byte text packet

TRK — TRacK number

Definition: TRK contains the number of the track to which the text contained in this packet is related. Multiple packets with the same track number are allowed. Volume text is identified with a track **`00`** index **`00`** entry, lead-in is identified as track **`00`** index **`01`** and lead-out is identified as track **`AA`**.

Byte: 4-5

Length: 2

Usage: **`nn`** = the decimal track number expressed in ASCII form (except lead-out, which is **`AA`**)

IDX — InDeX number
Definition: IDX contains the index number for the text contained in this packet. Multiple packets with the same track and index number are allowed. If no index number is used, IDX is filled with ASCII spaces.
Byte: 6-7
Length: 2
Usage: **`nn`** = a decimal number expressed in ASCII form

SIZ — SIZe of valid text
Definition: SIZ contains the number of valid bytes in the TXT field.
Byte: 8-10
Length: 3
Usage: **`nnn`** = a decimal number expressed in ASCII form

TXT — TeXT information related to track and index
Definition: TXT contains either type T0 title text or type T1 commentary text. The TXT field is padded to the end with ASCII spaces.
Byte: 11-127
Length: 117
Usage: **`nnnn...nnnn`** = ASCII text or spaces
The contents of the T2 text stream are listed in Table 6-4.

Table 6-4: T2 Text Stream Contents

Byte	
0-end	Contain any information related to customers. Mastering facilities will establish the guidelines for use.

Data stream contents

The data stream is formatted as a sequence of packs in one of the forms described above. When data streams are used with physically addressed direct access media, they are located at the sector identified in the map packet DSP. When data streams are used with sequential access media, they may have the same name as the map packet DSI. Because DDP uses this data as a stream of bytes, the sector size, record size and blocking factor on the input media are irrelevant.

Input files may span multiple physically addressed direct access surfaces. In this case, two or more map packets describe the input file with fields MPV, DST, CDM, SSM, SCR, TRK and IDX being identical for each map packet. DSP, DSL and MED are different, and DSS, PRE1, PRE, PST, ISRC, SIZ, DSI and PAD may be different if these fields are being used. See *Appendix B: Usage Recommendations*.

Tape Layout --- DVD Universal Tape Format

Tape Drives

SCSI tape drives of sufficient capacity and performance (i.e., DLT 2000ST, DLT 4000, DLT 7000, Exabyte Mammoth, Sony AIT)

Tape File System

ANSI Tape Labels

ANSI Block and Record Size Usage

DDPID file, 128 byte record, 128-byte block. File must contain a multiple of 128 bytes.
Lead-in Control Data File, 2048-byte record, 32,768 byte block. File must contain exactly 32,768 bytes.
DVD Image file, 2048 byte record, 32,768 byte block. File must contain a multiple of 32,768 bytes.

Tape Protocol

DDP 2.00 Draft 3 or higher

DDP Usage for DVD Universal Tape Format

File Names:

DDPID and DDPMS will be combined into one file named DDPID.
Lead-in Control Data file name is set in DDPMS map packet 1.
DVD Image file name is set in DDPMS map packet 2.

File Contents:

DDPID will contain DDPID and DDPMS data concatenated together.
Lead-in Control Data will contain one 32K Block (32,678 bytes) of the DVD Lead-in Control Data, DVD sector 0-15.

NOTE: *DVD formatter systems will use lead-in control data sector 0 and 2-15 as is, but may allow for replacement of sector 1.*

The DVD image file will contain only the program data. The DVD image file must contain a multiple of 32,768 bytes. Lead-in, middle area, and Lead-out are not allowed in the DVD image file.

Sector Contents of Tape File:

Lead-in control data will contain 2048 bytes per sector and will have DDPMS map packet 1 SSM=0 (2048 bytes per sector). The DVD formatter will compute IEC, ED, and EDC for each Lead-in sector and place 6 bytes of zero data in RSV.

The DVD image file will contain unscrambled 2048 bytes per sector and will have DDPMS map packet 2 SSM=0 (2048 bytes per sector). The DVD formatter will compute the IEC, ED, and EDC for each program sector. Copy protection scrambling will be performed on the 2048 bytes of user data as well as the 6-byte RSV field when so indicated in DDPID.

DVD Physical Tape Layout

The following diagrams detail the recommended and optional tape formats for DVD input tapes to be used for mastering. DCA DVD signal processing equipment supports both tape formats.

The layouts shown in Figure 1 are used for DVD Single Layer, Dual Layer-layer 0, and Dual Layer-layer 1 parallel track path tapes.

NOTE: *Only one DVD layer or side is allowed on each DVD physical tape. Therefore, a dual layer DVD application, for example, will require two DVD physical tapes, each conforming to the DVD Universal Tape Format. DVD Dual Layer, layer 1 opposite track path discs do not contain Lead-in control data, therefore this file is omitted in DDPID, and the Lead-in control data is not included on the DVD physical tape.*

Figure 2 illustrates the layout for a DVD Dual Layer-layer 1 opposite track path.

Recommended Tape Format

In the diagram below, the DDPID and DDPMS information has been combined into one file named DDPID. This is the recommended format for DVD tapes.

Figure 1: DVD single layer, DVD Dual Layer-Layer 0 (any track path), and DVD Dual Layer-Layer 1 (parallel track path)

80 bytes	80 bytes	80 bytes		128 bytes	128 bytes	128 bytes		80| bytes	80 bytes	
VOL1	HDR1	HDR2	FM	DDPID	DDPMS	DDPMS	FM	EOF1	EOF2	FM

80 bytes	80 bytes		32,768 bytes		80 bytes	80 bytes	
HDR1	HDR2	FM	Leadin Control Data	FM	EOF1	EOF2	FM

80 bytes	80 bytes		Multiple of 32,768 bytes		80 bytes	80 bytes		
HDR1	HDR2	FM	DVD Image Data	FM	EOF1	EOF2	FM	FM

Only one DVD layer or side is allowed on each DVD physical tape. Therefore, a dual layer DVD application will require two DVD physical tapes, each conforming to the DVD Universal Tape Format.

Figure 2: DVD Dual Layer-Layer 1 (opposite track path)

80 bytes	80 bytes	80 bytes		128 bytes	128 bytes	128 bytes		80 bytes	80 bytes	
VOL1	HDR1	HDR2	FM	DDPID	DDPMS	DDPMS	FM	EOF1	EOF2	FM

80 bytes	80 bytes		Multiple of 32,768 bytes		80 bytes	80 bytes		
HDR1	HDR2	FM	DVD Image Data	FM	EOF1	EOF2	FM	FM

DVD dual layer, layer 1 opposite track path discs do not contain lead-in control data. Therefore this file is omitted in DDPID and the lead-in data is not included on the DVD physical tape.

APPENDIX A: Storage of DDP

DDP can be stored on four types of media, as described below.

Logically addressed direct access media

Examples of logically addressed direct access media are DOS files. Each stream is stored in a named file. **`DDPID`** and **`DDPMS`** are the file names of DDPID and DDPMS streams. TS (Text), DS (Subcode) and DM (Main) file names may be any valid file name. All streams may be stored at any physical location.

Physically addressed direct access media

Examples of physically addressed direct access media are removable disc devices in which a file system (such as DOS) is not used. DDPID begins at the first addressable unit. DDPID points to DDPMS data, which, in turn, points to all other TS (Text), DS (Subcode) and DM (Main) files. DDPMS, TS (Text), DS (Subcode) and DM (Main) streams may be stored at any physical location.

Sequential access media

Examples of sequential access media are 8mm. **`DDPID`** and **`DDPMS`** are the file names of DDPID and DDPMS streams. TS (Text), DS (Subcode) and DM (Main) file names may be any valid file name. DDPID, DDPMS, TS (Text) and DS (Subcode) files must be stored in this order, and must be the first files on the tape. This collection of DDP may either precede the DM (Main) stream or follow the DM (Main) stream.

Direct access sequential media

Examples of direct access sequential media are U-matic and R-DAT tape.

The tape order for sequential access media is displayed in Figure A-1.

Figure A-1: The tape order for sequential access media

Beginning of tape:

DDPID	DDPMS	DDPTEXT (One or more) *Optional*	DDPSUB (One or more) *Optional*	DDPMAIN (One or more)

APPENDIX B: Usage Recommendations

Single track, single index

For single track, single index CDs, such as the majority of CD-ROM discs, it is recommended that map packet fields DSS, SUB, PRE1, PRE, PST, TRK and IDX are filled with ASCII spaces. In this case, mastering will place this single track at track 1, according to Red, Yellow and Green specifications. When multiple input files are stored on a single mode CD, the TRK and IDX fields identify whether the data is stored on the same track and index or a different track and index. Because there is no forced track change, mastering will not insert any pause or gap between the files.

Mixed mode, single index

For mixed mode, single index-per-track CDs, it is recommended that the data for each separate track be brought in as a separate input file and map packet, with map packet fields DSS, SUB, PRE1, PRE, PST, TRK and IDX filled with ASCII spaces. In this case, mastering will place this data according to the forced track change rules (using minimum values for gaps and pauses), as listed in Red, Yellow and Green book specifications.

Single mode, multiple track or index

For single mode, multiple track or index CDs, such as the majority of audio discs, it is recommended that the data for the entire CD be brought in as one input file and one DM (Main) type MAP PACKET, with DM (Main) map packet fields DSS, SUB, PRE1, PRE, PST, TRK and IDX filled with ASCII spaces. A separate PQ subcode data file and corresponding map packet entry, with fields DSS, CDM, SSM, SCR, PRE1, PRE, PST, TRK, IDX and ISRC filled with ASCII spaces, describe the PQ subcode file.

Mixed mode, multiple index

For mixed mode, multiple index CDs, it is recommended that the data for each separate track be brought in as a separate input file and map packet, with map packet fields DSS, SUB, PRE1, PRE, PST, TRK and IDX filled with ASCII spaces. A separate PQ subcode data file and corresponding map packet entry, with fields DSS,CDM, SSM, SCR, PRE1, PRE, PST, TRK, IDX and ISRC filled with ASCII spaces, describe the PQ subcode file.

Special applications

For applications that cannot be done just with a separate PQ file, separate input files and map packets can be used for each track and index change. In addition, if the application calls for non-standard pauses and gaps or other special placement specifications, these gaps and pauses can be included with the input data. This can be done either by describing them using the map packet PRE1, PRE and PST entries, or by specifying an absolute CD starting location using the map packet DSS entry.

APPENDIX C: DAT CD Master Tape Specifications

Overview

The DCA DAT specification allows the following from an appropriate DAT cassette tape:

- Placement of program audio materials,
- Placement of DDP PQ cue code data on the DAT cassette,
- The use of DDP files for direct CD mastering.

DCA specification makes use of DDP (ANSI Z39.72-199X) data for complete PQ cue code for DAT tapes. This DDP-PQ-Cue Code is placed on the DAT cassette according to the following rules:

1. DDP PQ cue code data is placed in the main digital audio channel, both left and right,
2. DDP PQ cue code data may be placed at BOT +20 seconds ±10 seconds, or at EOT -2 minutes ±10 seconds.
3. DDP PQ cue code data is recorded at approximately -40 dB VU.
4. DDP PQ cue code data is repeated three times.

Program audio should not begin before DAT time 2 minutes to allow for later insertion of DDP PQ cue code data.

The DDP PQ cue code data is still referenced to SMPTE time code, whether or not the DAT player makes use of SMPTE. It is up to editing and recorder systems to convert between the native DAT time code and the SMPTE time code.

When DDP PQ cue code information is not present on the DAT tape, DDP on a DOS-formatted floppy may be used instead. DDP uses SMPTE time references for all entries.

DAT tapes must contain DAT time code. SMPTE time code is not required or used for DCA products. DAT time code must be continuous from the beginning of the tape until end of program area. Even when DDP PQ cue code is at the end of the tape minus 2 minutes, DAT time code is not required at this position.

CD Master Tape Specification

- Sampling Frequency: 44.10 KHz
- Source Coding: linear, two's complement, 16 bit
- Emphasis (optional): 15 + 50us
- Number of Channels: 2
- Minimum Playing Time: Program duration + minimum 4 min
- Maximum Program Duration: Consult disc-mastering facility
- Tape Format: DAT (need spec number)
- Cassette Type: DAT (need spec number)
- Tape Modulation
- Tape lead-in/lead-out period: Minimum 30 seconds each (these parts must contain time code as specified in point 10).
- PCM-audio signal during lead-in/lead-out period: The encoded data words are "zero". Note: zero = 000000000000XXXX (LSB) or two's complement. X means 0 or 1. Offset or noise is allowed within defined zero level.
- Program modulation: Complete catalog stereo program assembled as final product. It is recommended to add a period of two seconds digital silence "0000" (HEX), room noise or ambience to the program period of the first piece of music prior to the actual music start. Furthermore, it is recommended to encode digital silence "0000" (HEX), room noise of ambience during the pauses between the different track numbers of the stereo program.

Time code information

- Type: DAT A-time
- Time code standard: DAT A-time
- Sequence: Continuous up-counting time code covering lead-in, program area and lead-out periods

CD Subcode Information

Format according to DDP PQ cue information code:

- Track : DAT main channel Position
- Signal: According to DDP PQ cue code format: ANSI Z39.72-199X as modified for DAT recording according to DCA DDP DAT specification
- Record: Approximately -40 dB VU Level

Recommended Equipment: Consult disc-mastering facility

NOTE: *DDP PQ cue code can be recorded at the front of the tape beginning at DAT BOT +20 seconds ±10 seconds, or at DAT EOT -2 minutes ±10 seconds.*
If no DDP PQ cue code is recorded on DAT tape, then information is to be supplied according to DDP on a DOS formatted floppy disk.
CD R-W Subcode information (RSTUVW) is according to DDP (ANSI Z39.72-199X)

DCA DDP DAT Specification

- Data Contents: DDP/ ANSI Z39.72-199X
- Sampling Frequency: 44.1KHz
- Modulation: 16-bit words. High byte contains **00000000** (HEX), low byte contains DDP data.
- Low Byte contains 128 bytes of DDPID, immediately followed by 256 bytes of DDPMS, in turn followed by required bytes of PQ_DESCR, except as noted below:
  DDPMS contains 256 bytes only when a PQ_DESCR file is included. When R-W subcode information is also present, DDPMS contains 384 bytes. Currently, the use of 384-byte DDPMS is not allowed.
- Modulation Sequence: Modulation may begin on either left or right channel.
- Recording Density: Channel rate of 176.4 Kbytes per second, data rate of 88.2 Kbytes per second.
- Repeating of DDP: Data modulated with DDP is repeated three times. There is a separation 1024 data bytes (2048 channel bytes) between each copy of DDP modulated data.

Time code information

- Time code standard: DAT tape has DAT time code
  Sequence: Continuous up-counting time code covering lead-in, program area and lead-out periods.
- Time code reference: DDP treats the R-DAT tape as having 30 Hz (SMPTE) time code. Both cue point editing products as well as mastering products must convert from DAT time code to 30Hz SMPTE and back.

General Guidelines

In general, DAT tapes that are sent for direct mastering must conform to the following general specifications:

1. Must conform to the DCA DDP DAT Specification
2. Reserved Areas for PQ Data
   - Reserved at beginning of tape: The first 90 seconds of tape are reserved for DCA PQ data. The next 30 seconds are reserved for lead-in. As a result, program area should begin no earlier than 120 seconds.
   - Reserved at end of tape: The last 120 seconds of tape are reserved for alternate DCA PQ data.

APPENDIX D: Glossary

CD sector
A physical space on the CD that is 2352 bytes in length and $^{1}/_{75}$-second in duration. Thus, the 2048 byte user data for a CD-ROM Mode 1 disc is the same as a physical 2352-byte CD sector.

Character set
Characters conform to the ISO 8859-1 character set. All alphabet characters are uppercase unless stated otherwise. The exception for upper/lower case is in the DSI and TXT fields used in the various packets.

Direct access sequential
Tape-based storage devices that are accessed by specifying a direct location, then sequentially accessed from that point.

Green Book
Common name given to the Philips/Sony standard for CD-I and CD-XA discs.

Logically addressed direct access
Disc-based storage devices which are accessed by a logical file name.

Map packet
The map stream (MS) is composed of one or more 128-byte map packets. Each map packet describes one TS (Text), DS (Subcode) or DM (Main) stream of information. The first map packet in any unit must begin on unit byte 0. Multiple map packets are allowed in a single unit, with unused unit space filled with `00h`.

Numerical values
All fields are right justified. Numerical fields are stored as an ASCII representation of a decimal number.

Physically addressed direct access
Disc-based storage devices which are accessed by a physical address.

Red Book
Common name given to the Philips/Sony standard for CD Audio discs.

Sequential access
Tape-based storage devices which are accessed sequentially from the beginning to the end.

SMPTE time code
The Society of Motion Picture and Television Engineers' time code standard for videotape.

Streams

All streams begin on the first byte of the first unit used for that particular stream. Streams may span unit boundaries. Unused space in the last unit of any stream is filled with **00h**.

Unit

A wholly contained part of information. For each different carrier that is used, (such as WORM, tape, LAN, CD-R), unit is equal to the native access method (sector, block, packet). Error detection and correction is the responsibility of the native carrier. Any unit size equal to or greater than 128 bytes is acceptable.

Unused characters

Unused characters in defined fields are filled with ASCII spaces. Unused characters in undefined fields are filled with **00h**. Values not shown are considered illegal.

Yellow Book

Common name given to the Philips/Sony standard for CD-ROM discs.

INDEX

N

O

P

R

S

T

U

V

Y