DDP Specification

Version 1.01

(For CD Only)

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Introduction

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

This document describes DDP according to the 1.01 specification.

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.

General Description of DDP

DDP consists of several files referred to as streams. Only two streams are necessary in level 1.01. (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. In level 1.01, all DS (Subcode) files are optional.

- **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).

DDP 1.01 Specifications

DDPID

DDPID identifies the presence and level of DDP. The DDPID stream is almost identical among DDP levels. The contents of the DDPID stream are listed in Table 2-1.

Table 2-1: 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	Map stream maximum length
37	1	MED	Media number
38-85	48	MID	Master ID
86-87	2	SIZ	Size of user text
88-127	40	TXT	User defined text

The DDPID stream consists of one ID packet of 128 bytes. The location of the DDPID stream varies depending on the media used:

- 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 on the media.
- When multiple physically addressed direct access media are used, each contains an ID packet at sector 0, with all ID packets containing identical DDPID, UPC and MID information. MED increments for each disc in the set. MSS and MSL are filled with ASCII spaces for all but media 0. SIZ and TXT may be unique for each media in the set.

DDPID — DDP level Identifier
Definition: DDPID contains the DDP identifier and the DDP level number.
Byte: 0-7
Length: 8
Usage: **nnnnnnnn** = ASCII characters (**DDP 1.01** for DDP level 1.01)

UPC — UPC/EAN number
Definition: UPC contains the UPC/EAN number for the CD. UPC is not used if a valid UPC/EAN number is present in a PQ descriptor subcode stream. It should be filled with ASCII spaces if there is no UPC. See the section *PQ Descriptor*.
Byte: 8-20
Length: 13
Usage: **nnnnnnnnnnnnn** = a valid UPC/EAN number

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

MSL — Map Stream maximum Length
Definition: MSL contains the maximum length used by or reserved for the map stream, expressed in bytes. The actual size of the map stream is determined by appropriate MPV symbols in map packets.
Byte: 29-36
Length: 8
Usage: **nnnnnnnn** = the decimal number of bytes expressed in ASCII characters

MED — MEDia number
Definition: MED contains identification of a specific media in a set of media. Only physically addressed direct access devices such as WORM and M-O discs use this. Valid numbers are from 0 to 9. MED numbers must begin with 0 and be used consecutively. MED is filled with an ASCII space when only a single input media is used.
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 facilities to identify jobs and or clients. MID is filled with ASCII spaces when it is not used or when the Master ID is not known.
Byte: 38-85
Length: 48
Usage: **nnnnnn . . . nnnnnn** = ASCII characters

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: 86-87
Length: 2
Usage: **nn** = decimal number expressed in ASCII characters

TXT — user defined TeXT
Definition: TXT contains text that can be used for any purpose. This data will not be placed on the CD. When no text information is present, TXT is filled with ASCII spaces.
Byte: 88-127
Length: 40
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 2-2.

Table 2-2: 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 included in data stream
46-49	4	PRE2	Pregap 2 or pause in data stream
50-53	4	PST	Postgap included in data stream
54	1	MED	Media 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
91-127	37	PAD	Pad characters

The 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 is 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 on the tape.

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 being described by this map packet. DM (Main) data is placed in the main channel of the CD, while SD (Subcode) data is destined for the subchannel of the CD. TS (Text) data is text data for comments and customer information that is not placed on the CD.
Byte: 4-5

Length: 2
Usage: **`D0`** = DM (Main) — data stream
`D1` = DM (Main) — ISO stream (optional)
`D2` = DM (Main) — lead-in data (optional)
`D3` = DM (Main) — lead-out data (optional)
`T0` = TS (Text) — volume/track/index text (optional)
`T1` = TS (Text) — commentary text (optional)
`T2` = TS (Text) — customer information (optional)
`S0 = SD` (Subcode) — subcode data (optional)
All others are 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 this 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 SD (Subcode) 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 SD (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 SD (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 it occurs on the input media and map packets.

SUB — SUBcode descriptor
Definition: SUB contains a description of the subcode information present 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.
Byte: 30-37
Length: 8
Usage: **`PQ DESCR`** = PQ descriptor data.
`01RSTUVW` = Partially processed subchannel data where the presence of characters indicates a valid channel
`02RSTUVW` = Fully processed subchannel data where the presence of characters indicates a valid channel.

CDM — CD Mode
Definition: CDM contains a description for the mode of the data to be recorded on the CD for this 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, the processing that is required. CDM is filled with ASCII spaces when a map packet is used for SD (Subcode) and TS (Text) data.
Byte: 38-39
Length: 2
Usage: **`00`** = Mode 0
`10` = Mode 1
`20` = Mode 2
`21` = Mode 2 Form 1
`22` = Mode 2 Form 2
`2B` = CD-I Bridge
`2I` = CD-I
`2R` = CD-I Ready
`2X` = CD-XA
`2G` = CD-BGM
`DA` = CD-DA (Digital Audio)

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 processes the 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 SD (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)

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

MED — MEDia number
Definition: MED contains information on which media of a multiple media set the data described in this map packet is stored. For sequential access devices such as tape, this contains 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 of the data described by the map packet. TRK is filled with ASCII spaces for all TS (Text) data and SD (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. IDX is filled with ASCII spaces for all TS (Text) data and SD (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 SD (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 decimal size of the DSI entry immediately following SIZ. For DDP level 1.01, DSI is 17 characters long. SIZ is filled with ASCII spaces when no DSI is present.
Byte: 71-73
Length: 3
Usage: **`nnn = 017`** for DDP level 1.01

DSI — Data Stream Identifier
Definition: DSI contains the name of the TS (Text) or SD (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 also filled with ASCII spaces when not used.
Byte: 74-90
Length: 17
Usage: **nnnnnnnnnnnnnnnn** = 17 ASCII characters

PAD — PAD characters
Definition: PAD contains ASCII spaces to fill out the 128-byte map packet for DDP level 1.01. This field may be used for other purposes in future levels of DDP.
Byte: 91-127
Length: 37
Usage: **nnnn**…**nnnn** = 37 ASCII spaces

Text Stream

There are three types of text streams that DDP describes:

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

Both T0 and T1 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 may be placed on the CD.
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 is not placed on the CD.
Type T2 text is for general customer information when mastering may require such information. Type T2 takes the place of **IDENT.TXT** type information that is used by some mastering companies.
When text streams are used with physically addressed direct access media, they are located at the sector identified in the map packet DSP. When text streams are used with sequential access media, they will have same name as the map packet DSI.
The contents of the T0 and T1 text streams are listed in Table 2-3.

Table 2-3: T0 and T1 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

TPV — Text Packet Valid
Definition: TPV contains a four-byte character with the ASCII value of **VVVT**, which distinguishes 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 number of the index to which the text contained in this packet is related. 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** = the decimal index number expressed in ASCII form.

SIZ — SIZe of valid text
Definition: SIZ contains the number of bytes used in the TXT field.
Byte: 8-10
Length: 3
Usage: **nnn** = the 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. TXT field is padded to the end with ASCII spaces.
Byte: 11-127
Length: 117
Usage: **nnnn . . . nnnn** = ASCII characters
The contents of the T2 text stream are listed in Table 2-4.

Table 2-4: T2 Text Stream Contents

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

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 disc 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. Lead-in and lead-out entries are included even if the length is zero. The UPC/EAN number given in this subcode packet takes precedence over UPC in DDPID. ISRC, track and index numbers given in this subcode packet take precedence over ISRC, TRK and IDX in DDPMS. The format of each packet is described in Table 2-5.

Table 2-5: 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, which distinguishes 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.
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.
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.
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 supports two input storage forms for R-W data: partially processed R-W and fully processed R-W.

Partially Processed R-W

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 SD (Subcode) stream. The subcode descriptor in the DDP level 1.01 map stream is **01RSTUVW**. The format of the R-W pack is described in Table 2-6.

Table 2-6: Partially Processed R-W

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	S	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

Fully Processed R-W

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 SD (Subcode) stream. The subcode descriptor in the DDP Map Stream is **02RSTUVW**. The format of the R-W pack is described in Table 2-7.

Table 2-7: Fully processed R-W

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

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*.

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. This collection of DDP may either precede the DM (Main) stream or follow the DM (Main) stream.

When DDP is written to the end of sequential access media, rewritable file marks should be used to allow for updating the DDP information. Exabyte 82xx 8mm drives should not be used for updateable DDP at the end of the tape, due to the drive's lack of high-speed search. Exabyte 85xx drives should have long (rewritable) file marks selected.

Direct access sequential media

Examples of direct access sequential media are U-matic and RDAT 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)

End of tape:

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

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 with just 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, then these gaps and pauses can be included with the input data, 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". (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 or 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. In DDP V1.01, 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:
  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 RDAT 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.

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