4.0 CD model

Data transfer may begin with any of the consecutively numbered logical blocks. Data on CD logical units is addressed the same as for (magnetic) direct-access logical units. Some CD logical units support a separate information stream (e.g., audio and/or video but referred to as audio in this Section) transmitted via a connection other than the ATA Bus. This specification defines commands for controlling these other information streams for CD logical units.

CD logical units are designed to work with any disc that meets IEC 908. Many new logical units read CD data discs, digital audio discs, and audio-combined discs (i.e., some Tracks are audio, some Tracks are data).

Note: Important notice to implementor of CD-R and CD-RW applications
There are still large number of logical units that can only record to CD-R and CD-RW media, and they are mostly MMC-1 compatible. This specification defines many commands, but implementor of this specification need to be notified that Legacy CD-R/-RW logical units may only recognize the MMC-1 command scheme.
Typical commands that are supported in this category of logical units are as follows:

BLANK
CLOSE TRACK/SESSION
FORMAT UNIT
INQUIRY
MODE SELECT
MODE SENSE
PREVENT ALLOW MEDIUM REMOVAL
READ BUFFER CAPACITY
READ DISC INFORMATION
READ TOC/PMA/ATIP
READ TRACK INFORMATION
REQUEST SENSE
RESERVE TRACK
SET CD SPEED
START STOP UNIT
SYNCHRONIZE CACHE (10)
TEST UNIT READY
WRITE (10)

4.1 CD media organization

The formats written on the CD-ROM and CD-DA (Digital Audio) media require special interfacing considerations.

Discs may contain either audio, data or a mixture of the two. Table 20 gives an example of an audio-combined disc to illustrate the relationship between the logical block addresses reported and the MSF address encoded on the media.

Note: The term “Frame” is used in two different ways in the CD media standards. The intended meaning can only be determined from the context. Whenever possible, this description replaces the larger data unit with the more familiar term sector. The primary exception to this policy is the use of frame when referring to the MSF address. In the MSF context, one frame (F field unit) equals one sector. On a typical two channel CD-DA media, each frame (F field unit) is played in 1/75th of a second.

Table 20 - Example mixed mode CD disc layout

Block Description	Logical Address (Decimal)	Absolute MSF Address[a] (Hex)	Track and Index	Sector is Info or is Pause	Mode Audio or Data	CD-ROM Data Mode[b]
Lead-in Area[c]	---	---	0/-	---	Audio	---
Pre-gap[c]	---	00/00/00	1/0	Pause	Data	Null
1st Track data	0 000[d]	00/02/00[e]	1/1	Info	Data	L-EC
2nd Track data	6 000[d]	01/16/00[e]	2/1	Info	Data	L-EC
	7 500	01/2A/00	2/2	Info	Data	L-EC
Post-gap	9 000	02/02/00	2/3	Pause	Data	Null
Pause-silence	9 150	02/04/00	3/0	Pause	Audio	---
3rd Track audio	9 300	02/06/00	3/1	Info	Audio	---
	11 400	02/22/00	3/2	Info	Audio	---
4th Track audio	21 825	04/35/00	4/1	Info	Audio	---
Pre-gap part 1	30 000	06/2A/00	5/0	Pause	Audio	---
Pre-gap part 2	30 075	06/2B/00	5/0	Pause	Data	Null
5th Track data	30 225	06/2D/00	5/1	Info	Data	L-EC
Last information	263 999	3A/29/4A	5/1	Info	Data	L-EC
Post-gap	264 000	3A/2A/00	5/2	Pause	Data	Null
Lead-out Track	264 150	3A/2C/00[f]	AA/0	Pause	Audio	---

a. Absolute MSF address repeated in the header field of data blocks.

b. The CD-ROM data mode is stored in the header of data Tracks. This indicates that the block is part of a data pre-gap or post-gap (null), that this is a data block using the auxiliary field for L-EC symbols (ECC - CD-ROM data mode one), or that this is a data block using the auxiliary field for user data (CD-ROM data mode two).

c. Table of contents information is stored in the sub-channel of Lead-in Area. The Lead-in Area is coded as Track zero. Track zero and the initial 150 sector pre-gap (or audio pause) are not accessible with logical addressing.

d. Exact value returned by READ TOC/PMA/ATIP Command.

e. Value stored in Table of Contents with zero tolerance.

f. Value stored in Table of Contents; exact, if Lead-out Track is coded as data, or plus or minus 75 blocks if coded as audio.

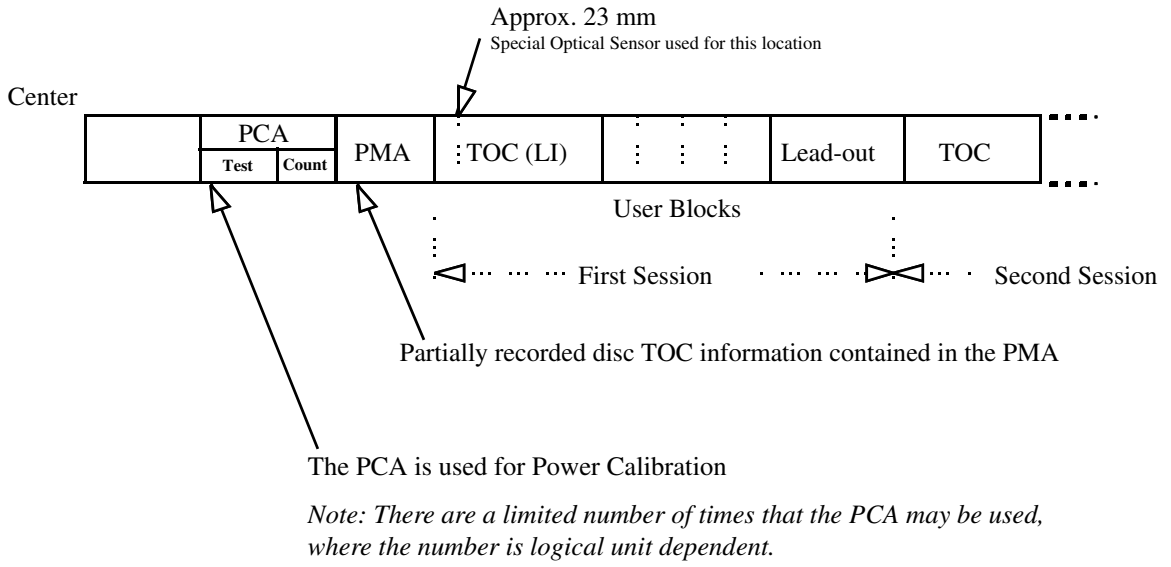

Figure 19 - CD-R/RW disc layout

The physical format defined by the CD-ROM media standards provides 2 352 bytes per sector. For usual computer data applications, 2 048 bytes are used for user data, 12 bytes for a synchronization field, 4 bytes for a sector address tag field and 288 bytes - the auxiliary field - for L-EC (CD-ROM data mode 1). In less critical applications, the auxiliary field may also be used for user data (CD-ROM data Mode 2 / Form 2).

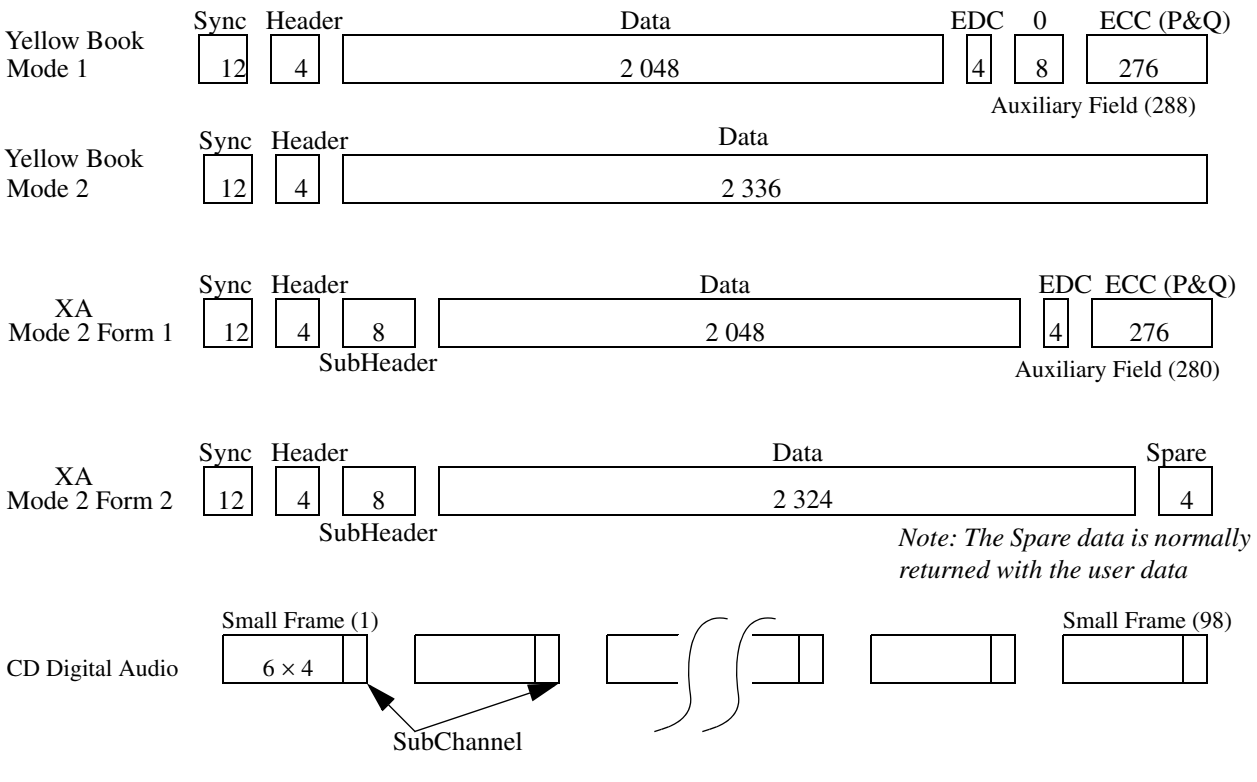

Figure 20 - CD-ROM sector formats

A CD logical sector size is 2 048, 2 052, 2 056, 2 324, 2 332, 2 336, 2 340 or 2 352 bytes per sector. These values correspond to the user data plus various configurations of header, subheader and EDC/ECC.

This same area of the CD-ROM or CD audio media may store 1/75th of a second of two channel audio information formatted according to the CD-DA specification. (These audio channels are usually the left and right components of a stereo pair.) An audio only density code value may be used to declare an area of the media to be invalid for data operations.

For data and mixed mode media (those conforming to ISO/IEC 10149), logical block address Zero ***shall*** be assigned to the block at MSF address 00/02/00. For audio media (those conforming only to IEC 908), logical block address Zero ***shall*** be assigned to the actual starting address of Track 1. This may be approximated by using the starting address of Track 1 contained in the Table of Contents (TOC) or by assigning logical block address Zero to the block at MSF address 00/02/00.

A Track may be viewed as a partition of the CD address space. The CD media contains from one to ninety-nine Tracks. All information sectors of a Track are required to be of the same type (audio or data) and mode. Each change in the type of information on the disc requires a change in Track number. A disc containing both audio and data would have at least two Tracks, one for audio and one for data.

The Tracks of a CD media are numbered consecutively with values between 1 and 99. However, the first information Track may have a number greater than 1. Tracks have a minimum length of 300 sectors including any transition area that is part of a Track.

The CD media standards require transition areas between Tracks encoded with different types of information. In addition, transition areas may be used at the beginning or end of any Track. For audio Tracks the transition areas are called pause areas. For data Tracks, transition areas are called pre-gap and post-gap areas. See Table 20 - *Example mixed mode CD disc layout* on page 110 for an example. The IEC 908 and ISO/IEC 10149 standards specify minimum time durations for these areas. Maximum time durations are not specified.

Transition areas are formatted and the logical address continues to increment through transition areas. Some media (i.e., discs with only one Track) may not have transition areas. The means to determine the location of the transition areas is vendor or application-specific and is addressed by other standards (e.g., ISO 9660).

CD is unique in the respect that some logical blocks on a disc may not be accessible by all commands. SEEK Commands may be issued to any logical block address within the reported capacity of the disc. READ (10) Commands cannot be issued to logical blocks that occur in some transition areas, or to logical blocks within an audio Track. PLAY AUDIO (10) Commands cannot be issued to logical blocks within a data Track.

CD media have Lead-in and Lead-out Areas. These areas are outside of the user-accessible area as reported in the READ CAPACITY Command data. The Lead-in Area of the media is designated Track zero. The Lead-out Area is designated Track AAh. The sub-channel Q in the Lead-in Track contains a Table of Contents (TOC) of the disc.

Note: The READ FORMAT CAPACITIES Command returns the logical block address of the last block prior to the Lead-out Area. This location may be in a transition area and therefore not a valid address for read operations.

The Table of Contents gives the absolute MSF location of the first information sector of each Track. Control information (e.g., audio/data, method of audio encoding) for each Track is also given in the TOC. However, the TOC does not distinguish between the different modes of data Tracks (i.e., CD-ROM Data Mode 1 vs. CD-ROM Data Mode 2).

The MSF locations of the beginning of data Tracks in the TOC are required to be accurate; however, the TOC values for audio Tracks have a tolerance of plus or minus 75 sectors. Information from the TOC can be used to reply to a READ CAPACITY Command. When this is done, the logical unit implementor ***shall*** consider the possible tolerances and return a value that allows access to all information sectors.

An index is a partition of a Track. Pre-gap areas are encoded with an index value of zero. Pause areas at the beginning of audio Tracks are also encoded with an index value of zero. The first information sector of a Track has an index value of one. Consecutive values up to 99 are permitted. Index information is not contained in the TOC. Not all sectors are encoded with the index value in the Q-sub-channel data (the requirement is 9 out of 10). A sector without an index value is presumed to have the same index as the preceding sector.

Tracks and indexes are not defined to be any particular length, (except for a minimum Track length of 300 sectors.) A CD disc may be created with a single information Track that has a single index; or with 99 information Tracks, each with 99 indices.

The sub-channel information which is part of each sector includes a Track relative MSF location value giving the distance from the first information sector of the Track. On the media, this value decreases during the pre-gap area (sectors with index values of 0) and increases for the rest of the Track. The data, returned by the READ SUBCHANNEL Command with MSF bit set to zero, converts this to a Track relative logical block address (TRLBA). The TRLBA is continually increasing over the whole Track, and pre-gap areas ***shall*** return negative values. When the MSF bit in the READ SUBCHANNEL Command is set to one, the MSF Track relative location value from the media is reported without change.

Note: The purpose of accessing MSF addresses less than 00/02/00 MSF is to retrieve information, such as packet size, from incrementally written discs. This information exists in the Track Descriptor Block in the pre-gap area. Users can read this information by scanning the area between 00/01/00 MSF to 00/02/00 MSF. While the media may contain multiple redundant copies of the pre-gap data, the logical unit ***shall*** *only return one copy. The logical unit may not be able to read 00/00/00 MSF since there is no Sub-Q information before this frame. See the Orange Book Part 2 for additional details.*

4.2 CD physical data format

The physical format of CD-ROM and CD-DA media uses a smaller unit of synchronization than the more familiar magnetic or optical recording systems. The basic data stream synchronization unit is a small frame. This is not the same large frame (sector) as referred to in the MSF unit. Each small frame consists of 588 bits. A sector on CD media consists of 98 small frames.

A CD small frame consists of:

1. 1 synchronization pattern (24+3 bits)
2. 1 byte of sub-channel data (14+3 bits)
3. 24 bytes of data (24 × (14+3) bits)
4. 8 bytes of CIRC code (8 × (14+3) bits) Total: 588 bits.

Data, sub-channel and CIRC bytes are encoded with an 8-bit to 14-bit code; then three merging bits are added. The merging bits are chosen to provide minimum low-frequency signal content and optimize phase lock loop performance.

4.2.1 Frame format for audio

Each small frame of an audio Track on a two-channel CD-DA or CD-ROM media consists of six digitized 16-bit samples of each audio channel. These 24 bytes of data are combined with a synchronization pattern, CIRC bytes and a sub-channel byte to make a frame. Each frame takes approximately 136.05 µs to play. This gives a sampling rate of 44.1 kHz for each channel. The sub-channel information creates the higher level sector grouping for audio Tracks.

4.2.2 Sector format for data

The data bytes of 98 small frames comprise the physical unit of data referred to as a sector. (98 small frames times 24 bytes per small frame equals 2 352 bytes of data per sector.)

A sector that contains CD-ROM Data Mode 1 data has the following format:

1. 12 byte synchronization field
2. 4 byte CD-ROM data header:
   - Absolute M field
   - Absolute S field
   - Absolute F field
   - CD-ROM data mode field
3. 2 048 byte user data field
4. 4 byte error detection code
5. 8 bytes zero
6. 276 byte layered error correction code

A sector that contains CD-ROM Data Mode 2 data has the following format:

1. 12 byte synchronization field
2. 4 byte CD-ROM data header
   - Absolute M field
   - Absolute S field
   - Absolute F field
   - CD-ROM data mode field
3. 2 336 byte user data field (2 048 bytes of mode 1 data plus 288 bytes of auxiliary data)

Note: Many logical unit*s are capable of returning CD-ROM data mode one data in a CD-ROM data mode two format. This allows the user to investigate the error detection and error correction codes. However data encoded as CD-ROM data mode two cannot be read as CD-ROM data mode one data.*

4.2.3 Sub-channel information formats

The sub-channel byte of each frame is assigned one bit for each of the 8 sub-channels, designated P, Q, R, S, T, U, V, W.

Sub-channel P is a simple flag bit that may be used for audio muting control and Track boundary determination.

Sub-channel Q has a higher level of structure. All the sub-channel Q bits of a sector define the sub-channel Q information block. (For audio Tracks, decoding the Q sub-channel is the only way to distinguish sector boundaries.)

The sub-channel Q block consists of 98 bits, one bit from each small frame in a sector. Three formats are defined for the sub-channel Q information block. The first format provides location information and is defined as follows:

1. 2-bit sub-channel synchronization field
2. 4-bit ADR field (defines the format)
3. 4-bit control field (defines the type of information in this sector)
4. 8-bit Track number
5. 8-bit index number
6. 24-bit Track relative MSF address
7. 8 bits Reserved (0)
8. 24-bit Absolute MSF address
9. 16-bit CRC error detection code

This format is required to exist in at least nine out of ten consecutive sectors.

The second and third formats are optional. If used, they ***shall*** exist in at least one out of 100 consecutive sectors. They include the absolute frame byte of the MSF address to provide location information continuity.

The second format gives the catalogue number of the disc (UPC/EAN bar code number). This information is constant over the whole media.

The third format gives the International Standard Recording Code (ISRC) for each Track. The ISRC is defined in ISO 3901. This format is not present on Lead-in or Lead-out Tracks and may change only after the Track number changes.

4.3 CD audio error reporting

PLAY AUDIO commands with the immediate bit set in the audio control mode return status as soon as the command has been validated (which may involve a seek to the starting address). The playback operation continues and may complete without notification to the host. Error termination of audio operations ***shall not*** be reported to the host.

The status of the play operation may be determined by issuing a REQUEST SENSE Command. The sense key is set to NO SENSE and the audio status is reported in the Additional Sense Code Qualifier field.

4.4 CD READY condition/NOT READY condition

The READY condition occurs after a disc is inserted and the logical unit has performed its initialization tasks. These tasks may include reading the Lead-in information from the media. This “READY” is different from and should not be confused with the ATA READY status. A CHECK CONDITION status ***shall*** be returned for the NOT READY condition only for commands that require or imply a disc access.

A NOT READY condition may occur for the following reasons:

1. There is no disc mounted.
2. The logical unit is unable to load or unload the disc.
3. The logical unit is performing an extended operation as the result of an Immediate mode command such as FORMAT UNIT or BLANK. This condition is defined in Logical Unit Not Busy condition/Busy condition.

The logical unit ***shall*** spin up and make the disc ready for media accesses when a new disc is detected.

After the logical unit becomes ready, the logical unit may enter the power state in which the logical unit was when the previous medium was removed.

Any media access that occurs when the logical unit is not spinning ***shall*** spin the media up and not generate an error. Any media access that is requested while a deferred operation is in progress (i.e., writing from a write cache) ***shall not*** generate an error.

Note: Accesses to the media can be satisfied from the logical unit’s cache and may not require the media to be spinning.

Some commands are allowed to generate a “NOT READY” CHECK CONDITION, and others are not. Table 326 - *NOT READY error and Timeout UNIT ATTENTION reporting (by command)* on page 568.

4.5 Logical Unit Not Busy condition/Busy condition

While a logical unit is in Logical Unit Busy condition after the logical unit becomes READY condition, the logical unit may not be able to execute some commands and will respond with CHECK CONDITION status. The following Sense Key/ASC/ASCQ are defined for possible Logical Unit Busy condition.

- 2/04/04 LOGICAL UNIT NOT READY, FORMAT IN PROGRESS,
- 2/04/07 LOGICAL UNIT NOT READY, OPERATION IN PROGRESS
- 2/04/08 LOGICAL UNIT NOT READY, LONG WRITE IN PROGRESS.

Some commands (e.g., RESERVE TRACK command, SEND OPC INFORMATION command) that do not have the Immed bit in their Command Descriptor Block may cause a Logical Unit Busy condition.

There are several cases that are not Logical Unit Busy conditions.

1. Commands that have an Immed bit set to one in their Command Descriptor Block may cause a Logical Unit Busy condition. During cached recording when the write buffer has become full, a logical unit may respond to a WRITE Command with CHECK CONDITION Status, 2/04/08 LOGICAL UNIT NOT READY, LONG WRITE IN PROGRESS. This case is not a Logical Unit Busy condition.
2. While a logical unit is recognizing a medium at the medium insertion, the logical unit responds to a TEST UNIT READY command with CHECK CONDITION Status, 2/04/01 LOGICAL UNIT IS IN PROCESS OF BECOMING READY. This case is not a Logical Unit Busy condition. It is because that the logical unit may not be Ready condition if the logical unit does not support the inserted medium. The logical unit cannot show the remaining time to be not busy before the logical unit recognizes the medium.
3. A logical unit may become Busy under the conditions described above, however, the logical unit is not required to become Busy. For example, if the host sends a CLOSE TRACK/SESSION command with Immed bit set to one to close a track and the track is already closed, the logical unit may terminate the command with GOOD status and never enter the Logical Unit Busy condition.

Note: LoChange event is defined to report user intervention that may be reported under above cases. Refer to *21.5.6, "Device Busy Class Events" on page 714*.

4.6 CD address reporting formats (MSF bit)

Several CD specific commands can return addresses either in logical block address or in MSF format. The READ SUBCHANNEL, and READ TOC/PMA/ATIP commands have this feature.

Table 21 - MSF address format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	M Field							
2	S Field							
3	F Field							

An MSF bit of zero requests that the logical block address format be used for the absolute address field or for the offset from the beginning of the current Track expressed as a number of logical blocks in a CD Track relative address field.

An MSF bit of one requests that the MSF format be used for these fields. In certain transition areas, the relative MSF addresses are decreasing positive values. The absolute MSF addresses are always increasing positive values. The M, S, and F Fields are expressed as binary numbers.

4.7 Error reporting

If any of the following conditions occur during the execution of a command, the CD logical unit ***shall*** return CHECK CONDITION status. The appropriate sense key and additional sense code ***shall*** be set. The following list illustrates some error conditions and the applicable sense keys. The list does not provide an exhaustive enumeration of all conditions that may cause the CHECK CONDITION status.

Table 22 - Error conditions and Sense Keys

Condition	Sense Key
Invalid logical block address	ILLEGAL REQUEST
Unsupported option requested	ILLEGAL REQUEST
Attempt to read a blank block	ILLEGAL REQUEST
Attempt to play a data block as audio	ILLEGAL REQUEST
Device reset or medium change since last command	UNIT ATTENTION
Self diagnostic failed	HARDWARE ERROR
Unrecorded read error	MEDIUM ERROR / HARDWARE ERROR
Recovered read error	RECOVERED ERROR
Overrun or other error that might be resolved by repeating the command	ABORTED COMMAND

In the case of an invalid logical block address, the sense data information field ***shall*** be set to the logical block address of the first invalid address.

In the case of an attempt to read a blank or previously unwritten block, the sense data information field ***shall*** be set to the logical block address of the first blank block encountered. The data read up to that block ***shall*** be transferred.

There are other special error situations for CD logical units. The following cases ***shall*** cause CHECK CONDITION Status, 5/63/00 END OF USER AREA ENCOUNTERED ON THIS TRACK:

1. a post-gap area is encountered (i.e., a block with CD-ROM Data Mode 0);
2. a pre-gap area is encountered (i.e., a block with index equal to 0);
3. The information type (e.g., Data Mode vs. Audio) changes.

When not performing audio playback, if the logical block address requested is not within a data Track, the command ***shall*** be terminated with CHECK CONDITION Status, 5/64/00 ILLEGAL MODE FOR THIS TRACK. This applies to audio-combined and audio media.

4.8 Recording for CD media

There are several kinds of writing method of recording data in CD media. Session-at-Once, Track-at-Once, and Packet Writing are all used as methods of recording CD media. There is a special case of Session-at-Once recording known as Disc-at-Once. Packet Writing can be further classified into Variable Packet Writing and Fixed Packet Writing.

4.8.1 Packet layout for CD

The layout of a Packet on CD media is shown in Figure 21. Each packet starts with Link block followed by four Run-in blocks. The User data blocks are placed directly after the Run-in blocks. Finally, two Run-out blocks are located following the User data blocks. In the case of Fixed packet writing, the size of each Packet in a Track is constant in length.

.

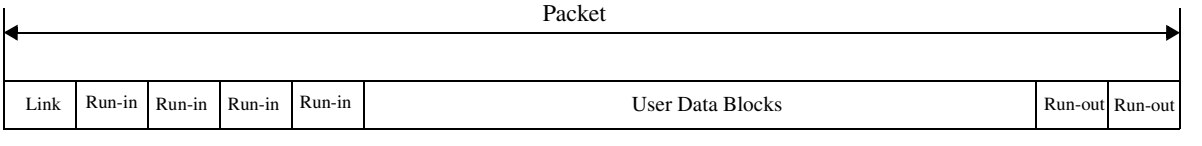

Figure 21 - Packet Layout

Figure 22 shows an example of the layout of packet written Track.

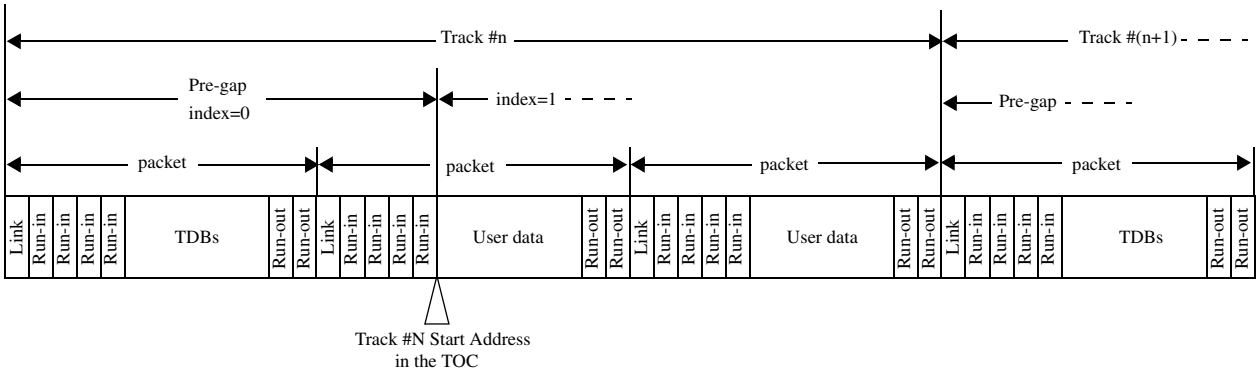

Figure 22 - Example of Packet written Track layout

4.8.2 Addressing method

For CD media, there are two kinds of addressing. Except for the space within a Fixed Packet written Track, the Logical Block Address has a one-to-one relationship to the physical block number. This type of addressing is called “Method 1 Addressing” and Logical Block Numbers are assigned to Link, Run-in, and Run-out blocks as well as User Data Blocks. In Fixed Packet written Tracks, the Logical Block Address is converted to the physical block number using “Method 2 Addressing.” In this case, Logical Block Addresses are not assigned to Link, Run-in, and Run-out blocks.

4.8.3 Track Descriptor Block (TDB)

Information about current Track attributes is encoded in the Pre-gap in a Track Descriptor Block (TDB). Optionally, all preceding Track attributes are included in the TDB. The TDB is recorded in all sectors in the second half of the Pre-gap. The TDB starts at byte 0 in the user data field of each sector. The TDB consists of Track descriptor table and Track descriptor unit(s). The Track descriptor unit gives the information such as the writing method of the Track and the packet size. The Track descriptor unit ***shall*** be used by the logical unit to determine Packet type and Packet size for a Packet recorded Track. If the disc is recorded using Session-at-Once, the TDB may not be present.

Table 23 - Track Descriptor Block

Bit / Byte	7	6	5	4	3	2	1	0
0 - 7	Track Descriptor Table							
0 - N	Track Descriptor Unit(s)							

Track Descriptor Table consists of 8 bytes and is structured as shown below.

Table 24 - Track Descriptor Table

Byte \ Bit	7	6	5	4	3	2	1	0
0	Track Descriptor Identification (54h)							
1	Track Descriptor Identification (44h)							
2	Track Descriptor Identification (49h)							
3	Pre-Gap Length							
4								
5	Type of Track Descriptor Unit							
6	Lowest Track Number							
7	Highest Track Number							

The Track Descriptor Identification fields contain the Hexadecimal code: '54 44 49' (ASCII “TDI”).

The Pre-Gap Length field contain the number of blocks of the second part of this Pre Gap, encoded in BCD.

The Type of Track Descriptor Unit field indicates which Track Descriptor Units are present. When this field set to 00h, indicates that Track Descriptor Units of previous Tracks are present in this Track Descriptor Block. When this field set to 01h, indicates that only the Track Descriptor Units of the current Track is present in this Track Descriptor Block. All other values are reserved for future use.

The Lowest Track Number field indicates that the lowest Track number described in this Track Descriptor Block, encoded in BCD.

The Highest Track Number field indicates that the highest Track number described in this Track Descriptor Block, encoded in BCD.

Track Descriptor Unit describes the data attributes of the Track and consists of 16 bytes. The contents of these 16 bytes are shown in Table 25.

Table 25 - Track Descriptor Unit

Byte \ Bit	7	6	5	4	3	2	1	0
0	Track Number							
1	(MSB)	Write Method of the Track						(LSB)
2	Packet Size							
3								
4								
5	Reserved							
:								
15								

The Track Number field contains that the number of the Track to which this Track Descriptor Unit belongs, BCD encoded.

The Write Method of the Track field when Bit 7 through Bit 4 set to 1000b, indicates that the Track is an uninterrupted written data Track that consists of only one packet. In this case, Bit 3 through Bit 0 are reserved and set to 0000b.

When the Bit 7 through Bit 4 set to 1001b, indicates that the Track is an incrementally written data Track that consists of more than one packet. In this condition, when Bit 3 through Bit 0 set to 0000b, indicates that the packet size is variable

length. And if Bit 3 through Bit 0 set to 0001b, indicates that the packet size is fixed length. All other values for Bit 3 through Bit 0 are reserved.

When the Bit 7 through Bit 4 set to 0000b, indicates that the Track is an uninterrupted written audio Track. In this condition, Bit 3 through Bit 0 are reserved and set to 0000b.

All other values for Bit 7 through Bit 4 are reserved. And any corresponded values for Bit 3 through Bit 4 are also reserved.

The Packet Size field ***shall*** be interpreted as follows:

For Incremental written Tracks with fixed Packet Size (Byte 1 = 91h), these bytes contains the BCD encoded Packet Size in sectors (MSBytes first). For Incremental written Tracks with variable Packet Size (Byte 1='90' hex), and Uninterrupted written Data Tracks (Byte 1 = 80h), these three bytes contain the code FFFFFFh.

4.8.4 High speed CD-RW media recording

High speed CD-RW is defined in Orange Book Part 3 volume 2. High speed CD-RW recording speed ranges are from 4× to 10× recording and also allows CAV recording. Upon CAV recording, write speed needs to be set for each track. If the logical unit is not capable of recording continuous track in CAV, then the logical unit ***shall*** use CLV mode with initial speed of CAV recording. For example, if the 4×-10× CAV recording is attempted for Track-at-Once (TAO) mode, but the logical unit does not support CAV for TAO mode, then the logical unit ***shall*** choose 4× CLV recording for that track. This condition is not considered as an error.

High speed CD-RW media cannot be recorded using logical units that comply with only Orange Book Part 3 volume 1. Upon write attempt to the High speed CD-RW media using Orange Book Part 3 volume 1 complying logical unit, some logical units returns CHECK CONDITION Status, 7/27/00 WRITE PROTECTED[1], or 3/02/00 NO SEEK COMPLETE. Recommended error code for this case is to return 5/30/05 CANNOT WRITE MEDIUM - INCOMPATIBLE FORMAT.

In order to minimize the impact to the large number of MMC-1 based CD-R/-RW logical units and software, extensions of SET CD SPEED Command and C/DVD Capabilities and Mechanical Status Mode Page are defined as an optional Feature. Also SET STREAMING Command and GET PERFORMANCE Command for CD-R/-RW implementation are defined.

Command Sequence example:

Upon media insertion, host issues READ TRACK INFORMATION Command to find the NWA. Then either C/DVD Capabilities and Mechanical Status Mode Page or GET PERFORMANCE Command are used to identify the logical unit's capability for the mounted media.

Host then issues either SET CD SPEED Command or SET STREAMING Command for the track to be recorded. Also the host sets an appropriate write parameters, and ready to write data.

1. Some CD-RW logical units may return 05/27/00.