

Specifications

Model

GD-ROM Format Basic Specifications Ver. 2.14

Model No.
GDP-0000-02

Published: March 17, 1999		
Created	Checked	Approved

Sega Enterprises, Ltd.
SEGA Consumer Product Development Headquarters
First Development Group

THIS DOCUMENT MUST NOT BE COPIED IN ANY WAY.
TO BE RETURNED ON DEMAND.

<< Revisions >>

Rev	Change Order No.	Reasons for Revision	Date	No. Pages	Created	Exam	Apprv
0.01		Revised the CD-ROM General Specification of the First Development. Department to target programmers.	12/24/97		Nakayama		
0.02		Modified single-density media information structure. 1st distribution version.	1/7/98		Nakayama		
0.03		Modified track structure figure. Modified chapter organization.	1/14/98		Nakayama		
0.04		Miscellaneous corrections in each section.	1/16/98		Nakayama		
0.05		Miscellaneous corrections in each section.	1/21/98		Nakayama		
0.06		Miscellaneous corrections in each section. Added Path Table details.	1/26/98		Nakayama		
0.07		Modified logical format structure. Modified section arrangement.	1/29/98		Nakayama		
0.08		Miscellaneous corrections in each section. Modified section arrangement.	2/17/98		Nakayama		
2.00		Changed version numbering from 0.08 to 2.00.	2/18/98		Nakayama		
2.00		Changed title, but not version number. Miscellaneous corrections in each section.	2/23/98		Shoji		
2.01		Miscellaneous corrections in each section.	2/25/98		Nakayama		
2.02		Modified line numbers in 'Figure 4-4: TOC Data Format'.	2/25/98		Nakayama		
2.03		Added 1sec of PostGap to the pattern III in the High-Density Area Track Structure (Figure 3-1).	6/18/98		Nakayama		
2.04		Corrections in List 4-1. Conversion corrections for Word'97.	6/19/98		Nakayama		
2.05		Deleted 1sec of PostGap from the pattern III.	6/30/98		Nakayama		
2.06		Changed the max value and GAP loacation of High-Density Area. Correction in TOC Data example.	6/30/98		Nakayama		
2.07		Added sentences on pages 7 & 9. Correction in Figure 3-1.	7/1/98		Nakayama		
2.08		Correction in Audio part of the Pattern III in Figure 3.1. Correction in 3.1.3.	7/2/98		Nakayama		
2.09		Deleted the last line on page 13. Modified in Figure 4-10 on page 20.	7/31/98		Nakayama		
2.10		Corrected SystemID examples in Chapter 2 and 3, Figures 4-1 and 4-2, Table 4-8, and section 4.2, "System Area."	10/23/98		Nakayama		
2.11		Corrected representation of "at least 4 seconds" on pages 7 to 9; On page 18, changed description examples to all uppercase, corrected Table 4-3, and added " $\leq 112 \text{ min}$ " to Figure 3-1.	11/11/98		Nakayama		
2.13		P12 changed to "Media Information", P13 changed to "Media information", added "(decimal format)" to P17, added "(binary format)" to P20, Corrected "Data Prepare Identifier" preparation standards on P18	12/16/98		Nakayama		
2.14		Changed to " $\leq 112 \text{ min}+2\text{sec}$ " and added " $\geq 4\text{sec}$ " in Figure 3.1. Corrected File Identifier, File name and Directory Name in Table 4-3.	3/17/99		Nakayama		

Contents

1. GD-ROM FORMAT OVERVIEW	5
1.1. TERMINOLOGY.....	5
1.2. BASIC SPECIFICATIONS.....	5
1.2.1. Features.....	5
1.2.2. Disc Size and Recording Time.....	6
1.2.3. Disc Format.....	6
1.2.4. Sector Structure.....	6
2. SINGLE-DENSITY AREA FORMAT	7
2.1. SINGLE-DENSITY AREA TRACK STRUCTURE.....	7
2.1.1. Data Track.....	7
2.1.2. Audio Track.....	7
3. HIGH-DENSITY FORMAT	8
3.1. HIGH-DENSITY AREA TRACK STRUCTURE.....	8
3.1.1. Data Tracks.....	9
3.1.2. Audio Tracks.....	9
3.1.3. Gap.....	9
4. DISC LOGICAL FORMAT	10
4.1. SPECIFYING DISC POSITION.....	10
4.2. SYSTEM AREA.....	12
4.2.1. System ID.....	12
4.2.2. TOC Data.....	14
4.2.3. Security Code.....	15
4.2.4. Area Code Group.....	15
4.2.5. Application Initial Program.....	15
4.3. VOLUME DESCRIPTOR.....	16
4.3.1. Primary Volume Descriptor.....	16
4.3.2. Volume Descriptor set Terminator.....	16
4.4. FILE STRUCTURE.....	19
4.4.1. Path Table.....	19
4.4.2. Directory Record.....	19
5. APPENDIX	21
5.1.1. System ID Example.....	21
5.1.2. TOC Data Example.....	22
5.1.3. ASCII A-Characters.....	23
5.1.4. ASCII D-Characters.....	23

Table 1-1: Basic Specifications.....	6
Table 4-1: Specified Addresses.....	11
Table 4-2: System ID Details.....	13
Table 4-3: Control (Ctr) Bit Values.....	14
Table 4-4: Relationship Between Area Code and Compatible Area Symbols.....	15
Table 4-5: Data Coding Types.....	16
Table 4-6: Primary Volume Descriptor.....	17
Table 4-7: Volume Descriptor Set Terminator.....	17
Table 4-8: Primary Volume Descriptor Creation Standards.....	18
Table 4-9: Path Table.....	19
Table 4-10: Directory Record.....	20
Table 4-11: Recording Date/Time Format.....	20
Table 4-12: File Flags.....	20
Table 4-13: File Identifier.....	20
Figure 1-1: GD-ROM Disc Structure.....	5
Figure 1-2: GD-ROM Physical Format.....	6
Figure 2-1: Single-Density Area Track Structure.....	7
Figure 3-1: High-Density Area Track Structure.....	8
Figure 4-1: Single-Density Area Logical Format.....	10
Figure 4-2: High-Density Area Logical Format.....	11
Figure 4-3: System ID Structure.....	12
Figure 4-4: TOC Data Format.....	14

1. GD-ROM Format Overview

1.1. Terminology

This specification defines a unique disc format standard originated by Sega.

A disc conforming to this specification is called a GD (Gigabyte Disc) or GD-ROM.

The audio data format recorded on the “High-Density Area” defined in this specification is called GD-DA.

The program data format recorded on the “High-Density Area” defined in this specification is called GD-ROM.

The access unit of CD blocks for program development is the “Frame Address (FAD)”.

1.2. Basic Specifications

1.2.1. Features

The unique Sega GD-ROM format consists of a region of normal-density tracks (the ‘Single-Density Area’) nearest the center of the disc, and a region of high-density tracks (the ‘High-Density Area’) nearest the outer edge of the disc.

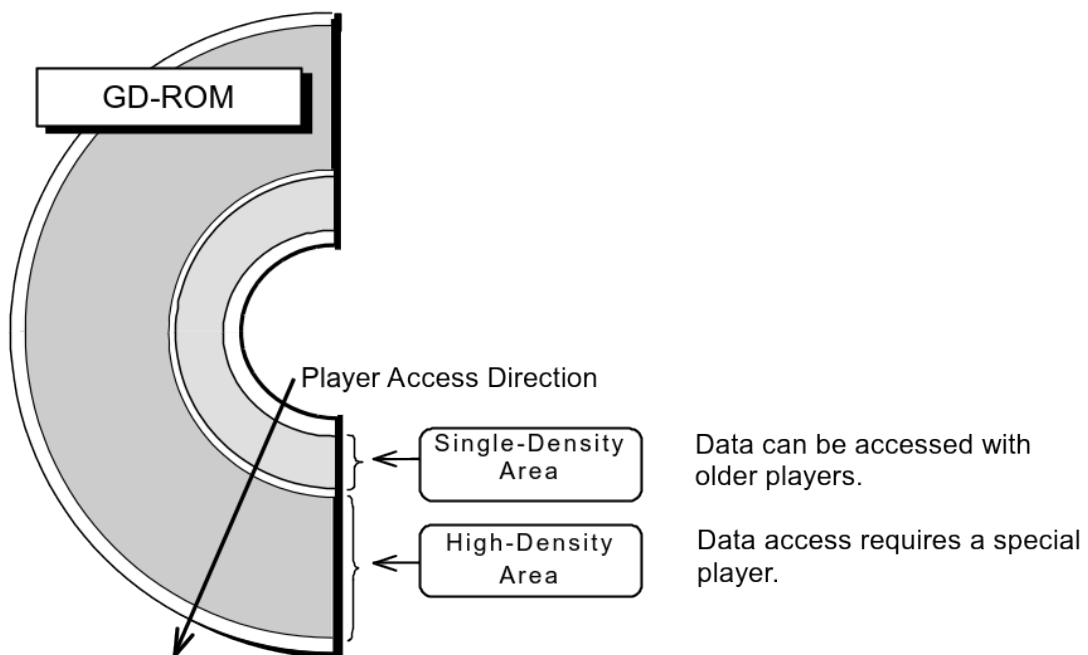


Figure 1-1: GD-ROM Disc Structure

1.2.2. Disc Size and Recording Time

The Single-Density Program Area holds up to 4 minutes (18,000 sectors), which equates to a data storage capacity of 36,000 KB.

The High-Density Program Area holds up to 112 minutes and 4 seconds (504,300 sectors), which equates to a data storage capacity of 1,008,600 KB.

The physical format of the entire GD-ROM is as follows:

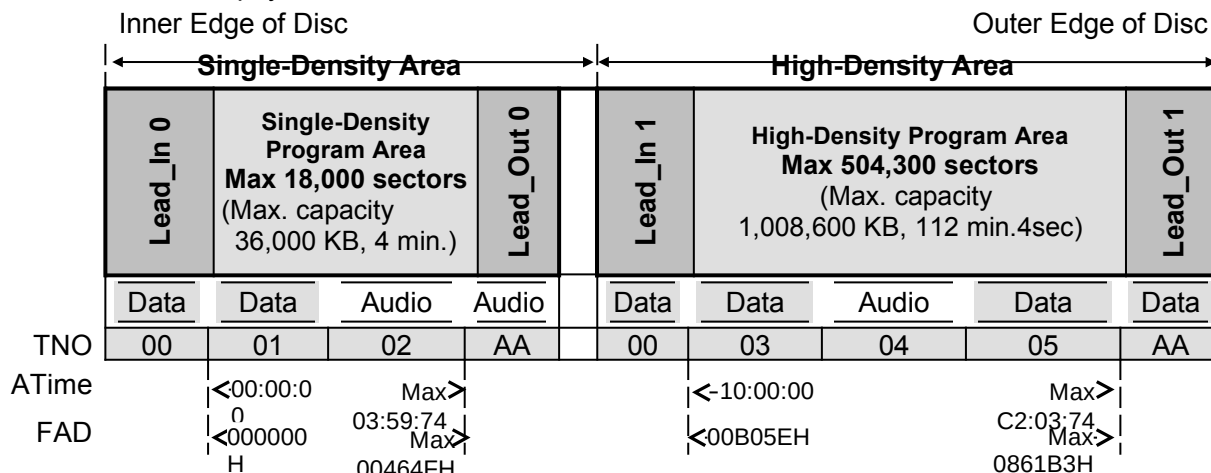


Figure 1-2: GD-ROM Physical Format

1.2.3. Disc Format

Data in the Single-Density Area is readable by common CD players. Its format complies with the following standards:

- Physical Format: 'Red Book' and 'Yellow Book'
- Logical Format: ISO9660

Data in the High-Density Area is readable only with special players compatible with Sega's unique standard. Its format complies with the following standards:

- Physical Format: Sega Custom Format
- Logical Format: ISO9660

1.2.4. Sector Structure

The sector data format is only compatible with Mode1, so the CD-ROM XA format used by Mode2 is not supported.

Table 1-1: Basic Specifications

	Single-Density Program Area	High-Density Program Area
Track Location	Inner Region	Outer Region
Disc Size	Max 18,000 sectors (Max capacity: 36,000KB, 4 min.)	Max 504,300 sectors (Max: 1,008,600 KB, 112 min. 4 sec)
Physical Format	Red Book, Yellow Book CD-DA, CD-ROM (Mode1)	Sega Unique Standard GD-DA, GD-ROM (Mode1)
Logical Format	ISO9660	ISO9660
Plays on ordinary CD player	Yes	No

2. Single-Density Area Format

2.1. Single-Density Area Track Structure

The Single-Density Program Area provides a maximum data storage capacity of 36,000 KB (18,000 sectors, or 4 minutes).

The first track of the Single-Density Program Area is a data (CD-ROM) track, which is followed by an Audio (CD-DA) track.

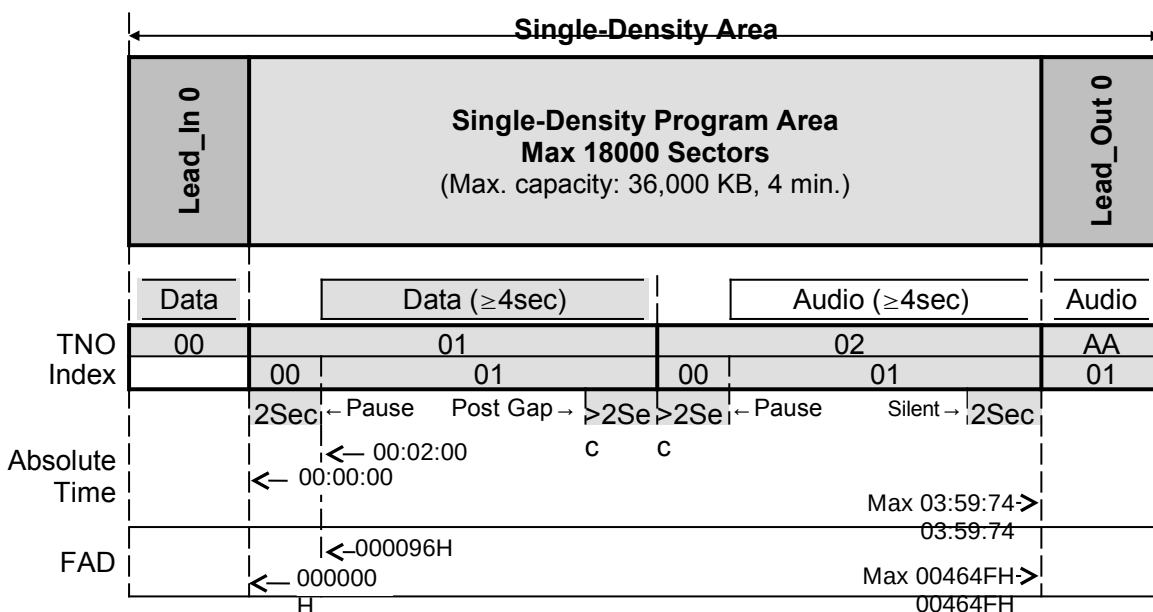


Figure 2-1: Single-Density Area Track Structure

2.1.1. Data Track

Track number 01 in the Single-Density Area is allocated as a data track. 2 seconds of Pause at the beginning and 2 seconds of Post gap at the end of the data track are required. As shown the Index-01 in Figure 2-1, a data track must be at least 4 seconds long including Post gap, but excluding Pause area.

The disc format of Single-Density Area data tracks is compatible only with Mode1 format: Mode2 format (CD-ROM XA, etc.) is not supported.

2.1.2. Audio Track

Track number 02 in the Single-Density Area is allocated as an audio track. 2 seconds of pause at the beginning and 2 seconds of silent area at the end of the audio track are required. As shown the Index-01 in Figure 2-1, an Audio track must be at least 4 seconds long including Silent, but excluding Pause area.

If there is no music data on the disc, an audio message playable on a standard audio CD player, such as (for example), "This CD is a GD-format game disc for use with a special game machine," should be recorded on the audio track.

Such a message is unnecessary if any music data is present on the disc.

3. High-Density Format

3.1. High-Density Area Track Structure

The High-Density Program Area provides a maximum data storage capacity of 1,008,600 KB (504,300 sectors, or 112 min. 4 sec), using one of three track patterns. The minimum recording time is 30 minutes.

Pattern I: Stores maximum program data in one data track (Track 03).

Pattern II: Stores data in one data track (Track 03) immediately following audio tracks. In this case, up to 96 tracks can be used for audio.

Pattern III: Special system data is stored in one data track (Track 03), followed by some audio tracks, and finally by additional data tracks written near the outer edge of the disc (where they can be read fastest).

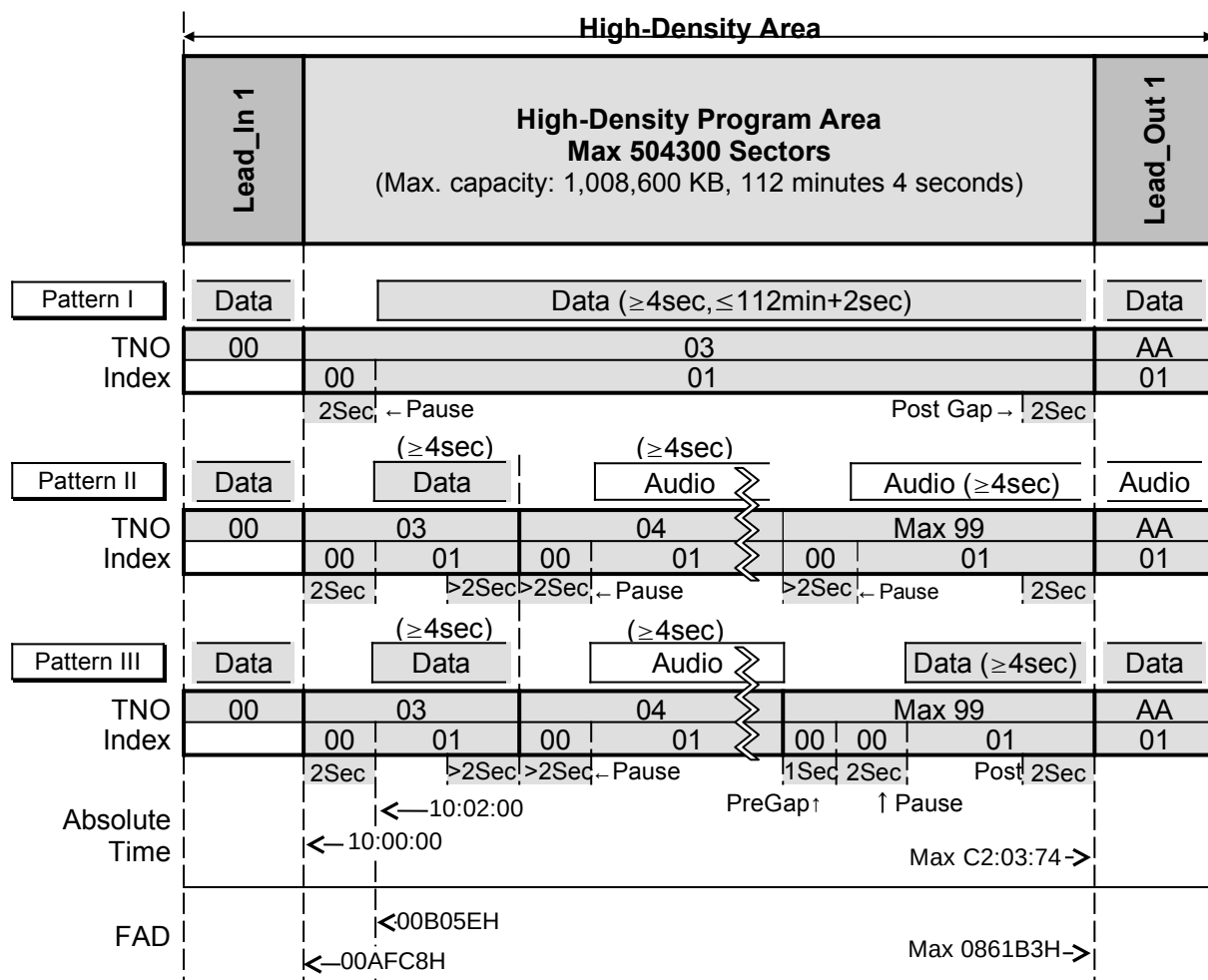


Figure 3-1: High-Density Area Track Structure

3.1.1. Data Tracks

The High-Density Program Area always begins with data track 03.

Data for Pattern I and Pattern II is allocated to track 03, while Pattern III uses at least two tracks for data: track 03 and the last track on the disc.

The data tracks for Pattern III are located nearest the outer edge of the disc for fastest access.

2 seconds of Pause at the beginning and 2 seconds of Post gap at the end of the data track are required. As shown the Index-01 in Figure 3-1, a data track must be at least 4 seconds long including Post gap, but excluding Pause area.

The High-Density Area data track disc format is compatible only with Mode1 format, so it does not support Mode2 format (CD-ROM XA, etc).

3.1.2. Audio Tracks

Audio for Pattern II may be allocated to tracks 04 to 99 consecutively; or for Pattern III, to tracks 04 to 98 consecutively.

2 seconds of pause at the beginning of each track, and 2 seconds of silent area at the end of the last audio track are required.

As shown the Index-01, 02, ... in Figure 3-1, an Audio track must be at least 4 seconds long including Silent, but excluding Pause area.

3.1.3. Gap

The following gaps must be placed in between Data track and Audio track:

Postgap ... When data track is followed by audio track, a 2 seconds of postgap must exist at the end of data track.

Pregap ... When audio track is followed by data track, a 3 seconds of pregap must exist at the head of data track.

Out of the 3 seconds, the first 1 sec is audio encode and the rest 2 seconds are data encode.

Also, at the end of track immediately before Lead Out 1, the followings must be placed:

- 1) For Data track: 2 seconds of Postgap.
- 2) For Audio track: 2 seconds of Silent area.

4. Disc Logical Format

4.1. Specifying Disc Position

Disc position is specified by the Frame Address (FAD).

The Frame Address is the number of consecutive sectors added to Absolute Time (ATime) 00:00:00, so that Frame Address 1 corresponds to Absolute Time 00:00:01.

(Note: **1 sector = 800H bytes**)

The Single- and High-Density Program Area logical formats are shown in Figure 4-1 and Figure 4-2.

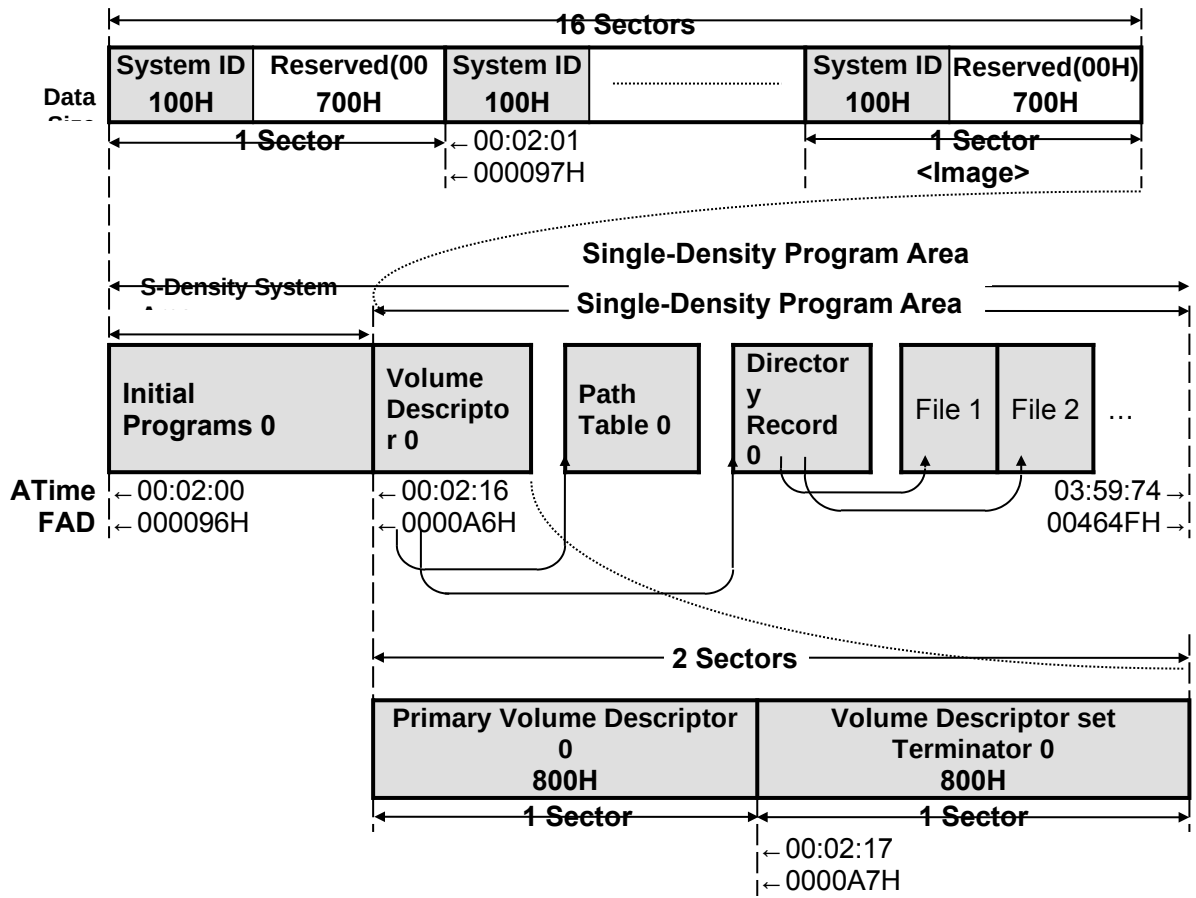


Figure 4-1: Single-Density Area Logical Format

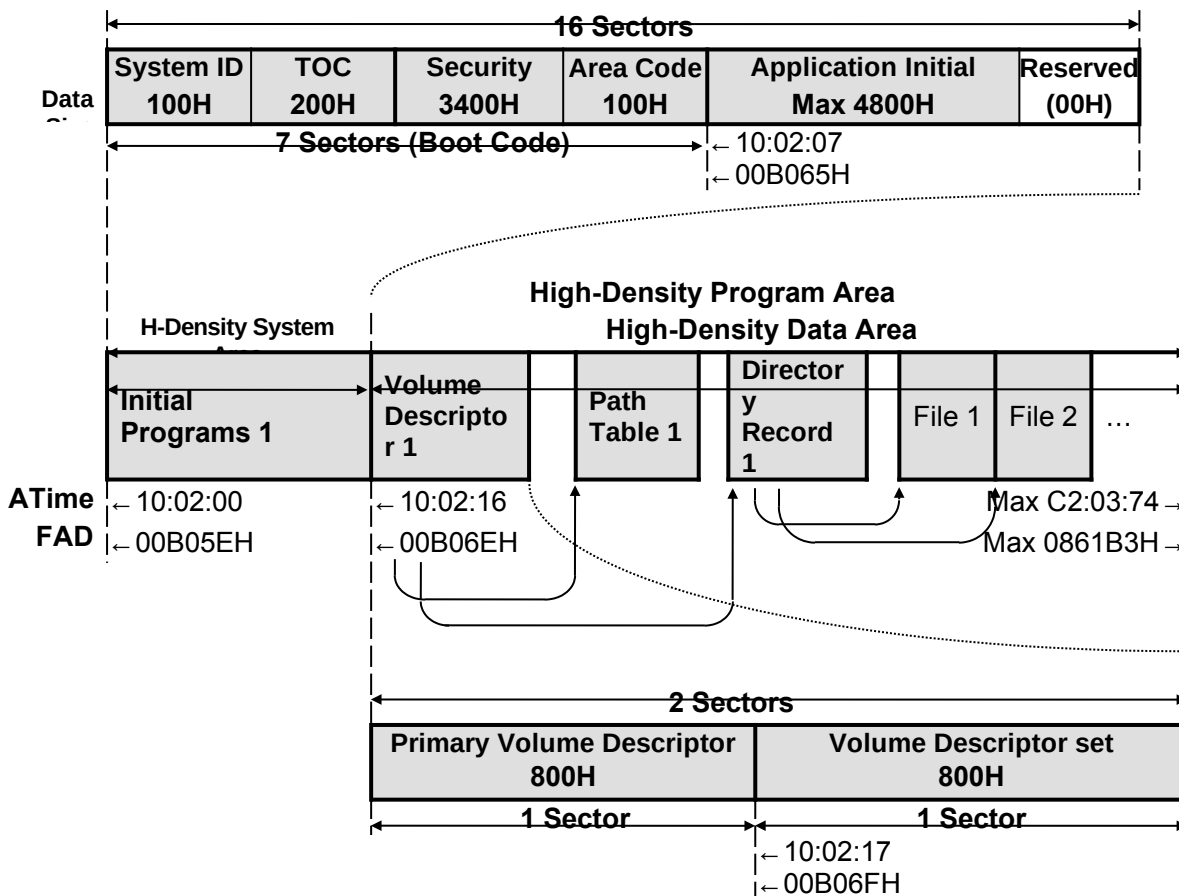


Figure 4-2: High-Density Area Logical Format

Table 4-1: Specified Addresses

	Area	Head FAD	Head ATim
Single-Density	Track No. 01	000000H	00:00:00
	System ID 0	000096H	00:02:00
	Primary Volume Descriptor 0	0000A6H	00:02:16
	Lead Out 0 (Max. value)	004650H	04:00:00
High-Density	Track No. 03	00AFC8H	10:00:00
	System ID 1	00B05EH	10:02:00
	Primary Volume Descriptor 1	00B06EH	10:02:16
	Lead Out 1 (Max. value)	0861B4H	C2:04:00

4.2. System Area

The System Area consists of 16 sectors at 000096H (FAD) in the Single-Density Area, and at 00B05EH (FAD) in the High-Density Area.

Boot code consisting of the System ID and Application Initial Program (AIP) are stored in the System Area. These are named Initial Program 0 (IP0) for the Single-Density Area, and Initial Program 1 (IP1) for the High-Density Area.

The System ID and Reserved data are allocated one sector in the Single-Density System Area, which contains 16 copies of this data (see Figure 4-1).

In the High-Density System Area, if the size of the Application Initial Program is less than 800H bytes, Initial Program 1 (IP1) can be allocated in 8 sectors. So by providing two copies of these 8 sectors, read errors can be minimized.

If the size of the Application Initial Program is greater than 800H bytes, the remaining space in the High-Density System Area is filled with Reserved data (00H).

4.2.1. System ID

The System ID is the unique disc identification information read first during system boot.

System ID 0 is located at the head of the Single-Density System Area, and System ID1 is at the head of the High-Density Area. System ID 0 and System ID 1 both contain the same data.

The System ID data size is 100H bytes.

Referring to “How to make the Initial Program” for more details, the System ID is to be created by developers. An example is provided in the Appendix.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00H	Hardware Identifier															
10H	Hardware Vender ID															
20H	Media ID						Media Information									
30H	Compatible area symbols								Peripheral Information							
40H	Product number										Version number					
50H	Release date								Reserved (Space)							
60H	First read file												Reserved (Space)			
70H	Maker Identifier															
80H	Game Title															
E0H	Reserved (Space)															

Figure 4-3: System ID Structure

Table 4-2: System ID Details

Offset	Size	Name	Value	Description
00H	16 bytes	H/W identifier	"SEGA Δ SEGAKATANA Δ"	Target H/W system Constant
10H	16 bytes	H/W Vender ID	"SEGA Δ ENTERPRISES"	Target H/W manufacturer Constant
20H	5 bytes	Media ID	"FC94 Δ "	4-digit media peculiar number space-padded
25H	11 bytes	Media information	"GD-ROM1/1 Δ Δ " "GD-ROM7/10 Δ "	For single GD. For seventh of ten-GD set.
30H	8 bytes	Compatible Area Symbol	"JΔE Δ Δ Δ Δ Δ Δ " "ΔU Δ Δ Δ Δ Δ Δ Δ "	For Asia & Europe For North/South. America.
38H	8 bytes	Compatible peripherals	"0799000 Δ "	Supported peripheral info. 8-digit peripheral symbol
40H	10 bytes	Product number	"HDR-0900 Δ Δ "	Up to 10 alphanumeric characters, space-padded
4AH	6 bytes	Version number	"V0.800" "V1.000"	Samples numbered below 1.00 Masters numbered 1.000+
50H	8 bytes	Release date	"19980901"	8-digits in YYYYMMDD format
58H	8 bytes	Reserved (Space)	"Δ Δ Δ Δ Δ Δ Δ Δ "	Spaces (20H)
60H	12 bytes	1st read file name	"1ST_READ.BIN"	Upper case 8+3 format binary filename
6CH	4 bytes	Reserved (Space)	"Δ Δ Δ Δ "	Spaces (20H)
70H	16 bytes	Maker identifier	"SEGA Δ LC-KAISYAIΔ" "SEGA Δ ENTERPRISES"	For license title For Sega title
80H	96 bytes	Game Title	"SAMPLE Δ GAME Δ Δ ..."	Upper case English title
E0H	32 bytes	Reserved (Space)	"Δ Δ Δ Δ Δ Δ Δ Δ...Δ Δ Δ Δ Δ Δ Δ Δ Δ Δ "	Spaces (20H)

Valid SYSTEM ID characters are alphabet and numbers in ASCII codes.

The following four characters are context dependent ". / - :"

Upper and lower case letters may be used except where otherwise noted.

All fields must be filled from the left, with no leading spaces unless noted otherwise.

Fill any unused space with ASCII code 20H unless noted otherwise.

In the above table, 'Δ' represents ASCII code 20H.

4.2.2. TOC Data

The TOC Data defines track information for the entire disc.

The TOC Data is located immediately after the System ID.

TOC Data consists of 128 four-byte data elements, in which any unused track information is written as FFFFFFFFh.

The TOC Identifier indicates whether the builder is to overwrite the TOC information. The keyword "TOC1" indicates that TOC information is to be overwritten. Otherwise, this keyword is FFFFFFFFh.

After Lead-Out Information (A2), the Reserve area is filled with 00000000h.

TOC Data size is 200H bytes.

TOC Data is created by the Desk Builder, but can also be created by users.

An example of TOC Data is shown in the Appendix.

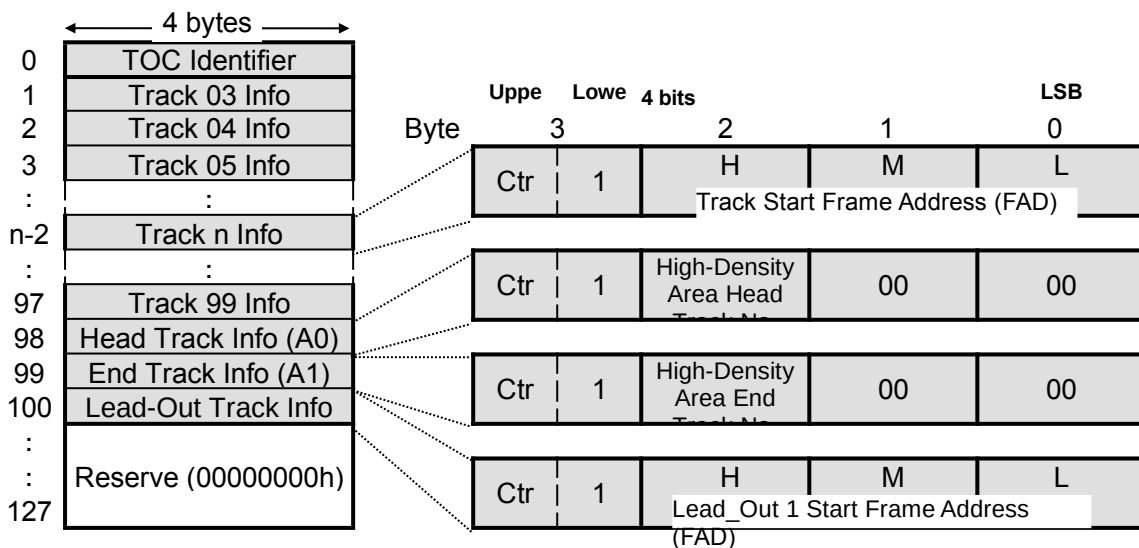


Figure 4-4: TOC Data Format

Table 4-3: Control (Ctr) Bit Values

Control Field value	Description
MSB → 00x0 ← LSB	2 audio without pre-emphasis
00x1	2 audio with pre-emphasis
01x0	data track
0x0x	digital copy prohibited
0x10	digital copy permitted

4.2.3. Security Code

The Security Code is located immediately after the TOC Data.

The Security Code data size is 3400H bytes.

If the correct Security Code is not detected, the system will not boot.

Sega provides this item in object code format, which should be linked without modification.

4.2.4. Area Code Group

The Area Code Group indicates compatible hardware market regions. Up to eight Areas can be specified. Each Area is allocated 20H bytes of data space.

The data space for the Area Codes in the Area Code Group are located immediately after the Security Code.

The Area Code Group size is 100H bytes.

Sega provides this item in object code files (Table 4.4), which should be linked without modification.

Compatible Area Symbols must be written in the System ID. When multiple Area Codes are specified, their data in the Area Code Group are stored in the same sequence as their Symbols. An example System ID is shown in the Appendix.

Table 4-4: Relationship Between Area Code and Compatible Area Symbols

Compatible Area Symbols	Hardware Market	Compatible System	Area Code file name
J	Japan, Korea, Asian NTSC	NTSC	sg_arejp.obj
U	North American NTSC, Brazilian PALM, Argentine PALN	NTSC/PAL	sg_areus.obj
E	European PAL	PAL	sg_areec.obj

4.2.5. Application Initial Program

The Application Initial Program is the program run when an application boots.

It is located immediately after the Area Code, and may be up to 4800H bytes in size.

It is executed under control of the application after the Security and Area Codes have been processed.

4.3. Volume Descriptor

The Volume Descriptor is special file information located at the head of the data area. It complies with ISO9660, and so is located from 000A6H (FAD) in the Single-Density Area, and from 0B06EH (FAD) in the High-Density Area.

The Volume Descriptor consists of a Primary Volume Descriptor (PVD) and a Volume Descriptor set Terminator (VDT), allocated sequentially.

4.3.1. Primary Volume Descriptor

The Primary Volume Descriptor (PVD) specifies the volume attributes, and the locations of the root directory and Base Table Group.

The Primary Volume Descriptors for the Single- and High-Density Data Areas are named Primary Volume Descriptor 0 (PVD0) and Primary Volume Descriptor 1 (PVD1), respectively.

PVD0 is located at the head of the Single-Density Area, and PVD1 is located at the head of the High-Density Area.

Each Primary Volume Descriptor is one sector (800H bytes) in size.

4.3.2. Volume Descriptor set Terminator

The Volume Descriptor set Terminator (VDT) indicates the end of the Volume Descriptor.

The Volume Descriptor set Terminators for the Single- and High-Density Data Areas are named Volume Descriptor set Terminator 0 (VDT0) and Volume Descriptor set Terminator 1 (VDT1), respectively.

VDT0 is located immediately after Primary Volume Descriptor 0 (PVD0), and VDT1 is located immediately after Primary Volume Descriptor 1 (PVD1).

Each Volume Descriptor set Terminator is one sector (800H bytes) in size.

Table 4-5: Data Coding Types

Type	Coding	Description
N	Numeric Value	8-bit binary value
NL	Least-Significant Byte First	LSBF applies to a 16- or 32-bit binary value. ex: 1234H encodes as 34H 12H.
NM	Most-Significant Byte First	MSBF applies to a 16- or 32-bit binary value. ex: 1234H encodes as 12H 34H.
NB	Both-type orders	Both LSBF and MSBF encoding. ex: 1234H encodes as 34H 12H 12H 34H.
ND	Any digit from 0 to 9	Decimal integer value
A	A-Characters	ASCII character set string (20-22/25-3F/41-5A/5F)
D	D-characters	Directory character set string (30-39/41-5A/5F)
DS	D-characters, Separator1, Separator2	D-characters + ' . ; ' (2E/3B)
DE	Directory Entry	Directory entry format
00	Zero fill	Unused field, fill with 00 for reserved area

Details of the ASCII codes corresponding to the A-Character set and the D-character set are provided in the Appendix.

Table 4-6: Primary Volume Descriptor

Byte No.	Typ	Field name	Description
1	N	Volume Descriptor Type	Volume Descriptor Type
2 ~ 6	N	Standard Identifier	ISO Standard Identifier
7	N	Volume Descriptor Version	Volume Descriptor Version
8	00	Unused Field	- Unused -
9 ~ 40	A	System Identifier	Name of system which uses System Area
41 ~ 72	D	Volume Identifier	Volume name
73 ~ 80	00	Unused Field	- Unused -
81 ~ 88	NB	Volume Space Size	Total number of volume sectors
89 ~ 120	00	Unused Field	- Unused -
121 ~ 124	NB	Volume Set Size	Number of volumes
125 ~ 128	NB	Volume Sequence Number	Volume number in multivolume set
129 ~ 132	NB	Logical Block Size	Size of Logical block in bytes
133 ~ 140	NB	Path Table Size	Total byte length of Path Table
141 ~ 144	NL	Location of Occurrence of Type L Path Table	Position of LSBF Path Table
145 ~ 148	NL	Location of Optional Occurrence of Type L Path Table	- Reserved area -
149 ~ 152	NM	Location of Occurrence of Type M Path Table	Position of MSBF Path Table
153 ~ 156	NM	Location of Optional Occurrence of Type M Path Table	- Reserved area -
157 ~ 190	DE	Directory Record for Root Directory	Directory Record for Root Directory
191 ~ 318	D	Volume Set Identifier	Volume name for multivolume
319 ~ 446	A	Publisher Identifier	Publisher name
447 ~ 574	A	Data Prepare Identifier	Name of data editor
575 ~ 702	A	Application Identifier	Name of data use method
703 ~ 739	DS	Copyright File Identifier	Copyright file name
740 ~ 776	DS	Abstract File Identifier	Abstract (summary) file name
777 ~ 813	DS	Bibliographic File Identifier	Bibliographic (reference) file name
814 ~ 830	ND	Volume Creation Date and Time	Creation date, time (decimal format)
831 ~ 847	ND	Volume Modification Date and Time	Modification (change) date, time (decimal format)
848 ~ 864	ND	Volume Expiration Date and Time	Expiration (invalid) date, time (decimal format)
865 ~ 881	ND	Volume Effective Date and Time	Effective (valid) date, time (decimal format)
882	N	File Structure Version	File structure version
883	00	Reserved for future standardization	Reserved for future use
884 ~ 1395	00	Application Use	Reserved for future use
1396 ~ 2048	00	Reserved for future standardization	Reserved for future use

Table 4-7: Volume Descriptor Set Terminator

Byte No.	Type	Field Name	Description
1	N	Volume Descriptor Type	Volume Descriptor Type
2 ~ 6	N	Standard Identifier	ISO Standard Identifier
7	N	Volume Descriptor Version	Volume Descriptor Version
8 ~ 2048	00	Reserved bytes	- Reserved Area -

Those parts of the Primary Volume Descriptor shown in gray in Table 4-6 must be created by the user, according to the following standards:
Of these items, the Copyright File Identifier, the Abstract File Identifier, and the Bibliographic File Identifier are written only to the single density area, and the corresponding parts of the high-density area are filled with spaces.

Table 4-8: Primary Volume Descriptor Creation Standards

41 ~ 72	Volume Identifier	Volume Name	"SAMPLE_GAME_TITLE"
<p>A string of up to 32 directory set characters indicating the title of the game. Allows the title to be recognized by the character string. Note: the Space character is not valid in the directory character set, so it cannot be used.</p>			
191 ~ 318	Volume Set Identifier	Multivolume Set	"SAMPLE_GAME_TITLE"
<p>A string of up to 128 directory set characters indicating the title of the game. Usually the same as the Volume Identifier. May be used to describe the entire set in case of multiple volumes.</p>			
319 ~ 446	Publisher Identifier	Publisher	"SEGA Δ ENTERPRISES, LTD."
<p>A string of up to 128 ASCII characters indicating the name of the publisher. Appears as shown when intended for use outside the company. Shows the company name if a third party.</p>			
447 ~ 574	Data Prepare Identifier	Data Editor	"Tool information."+"Version No."
<p>A string of up to 128 ASCII characters of information regarding the CD tool. EX: CRI CD CRAFT VER.2.27</p>			
703 ~ 739	Copyright File Identifier	Copyright file name	"COPYRIGHT.TXT" (S-Density only)
<p>An 8-character + "." + 3-character string of Directory set characters representing the copyright file name, which file must be located in the root directory. All copyrights related to the game should be described in the file. File contents are free-form, but when intended for external use, the contents must be: "Copyright(c) Δ SEGA Δ ENTERPRISES, LTD. 1998"</p>			
740 ~ 776	Abstract File Identifier	Abstract (Summary) file	"ABSTRACT.TXT" (S-Density only)
<p>An 8-character + "." + 3-character string of Directory set characters representing the abstract file name, which file must be located in the root directory. The abstract file contains an overview of the game, like the preface or summary of book. There are no limitations on the contents of this file.</p>			
777 ~ 813	Bibliographic File Identifier	Biblio. (Reference) file	"BIBLIOGR.TXT" (S-Density only)
<p>An 8-character + "." + 3-character string of Directory set characters representing the bibliographic file name, which file must be located in the root directory. The bibliographic file contains the name of the original author of the game, and the name of any game from which this game derives, like the bibliography of a book. There are no limitations on the contents of this file.</p>			
814 ~ 830	Volume Creation Date & Time	Creation Date/Time	07/01/1998 15:30:02:01,0
<p>Specified when desired to distinguish from the modification date. This field does not normally need to be specified. If not specified, the creation date of the CD image file is recorded.</p>			
831 ~ 847	Volume Modification Date & Time	Change Date/Time	07/01/1998 15:30:02:01,0
<p>Specified when desired to distinguish from the modification date. This field does not normally need to be specified. If not specified, the creation date of the CD image file is recorded.</p>			

Note: Δ indicates a Space character (20H)

4.4. File Structure

The file structure complies with ISO9660.

The Path Table and Directory Record are allocated in the Single- and High-Density Data areas as file control information.

4.4.1. Path Table

The Path Table contains the directory tier information for each directory.

The Path Tables in the Single-Density and High-Density Data Areas are named Path Table 0 and Path Table 1, respectively.

The location of the Path Tables is determined by the Disc Builder, and consists of one file containing several Path Table Units.

Each Path Table is created by the Disc Builder.

Table 4-9: Path Table

Byte	Typ	Field Name	Description
1	N	Length of Directory Identifier	Directory size
2	N	Extended Attribute Record	Extended Attribute size
3 ~ 6	N	Location of Extent	Starting Directory location
7 ~ 8	N	Parent Directory Number	Parent Directory number
9 ~(8+LEN_DI)	D1	Directory Identifier	Directory identifier

4.4.2. Directory Record

The Directory Record contains the directory tier structure.

The Directory Records in the Single-Density and High-Density Data Areas are named Directory Record 0 and Directory Record 1, respectively.

The location of the Directory Records is determined by the Disc Builder, and consists of one file containing several Directory Record Units.

Directory Records must be located so as not to cross sector boundaries.

Directory Records are created by the Disc Builder.

Table 4-10: Directory Record

Byte	Typ	Field Name	Description
1	N	Length of Directory Record	Size of current record
2	N	Extended Attribute Record Length	Size of extended attribute
3 ~ 10	NB	Location of Extent	Location of beginning of file (LSN)
11 ~ 18	NB	Data Length	Data size
19 ~ 25	N	Recording Date and Time	Creation date and time (binary format)
26	N	File Flags	File flags
27	N	File Unit Size	Unit size during interleave
28	N	Interleave Gap Size	Cache size during interleave
29 ~ 32	NB	Volume Sequence Number	Volume sequence number
33	N	Length of File Identifier : (LEN_FI)	Size of File Identifier
34~(33+ LEN_FI)	DS	File Identifier	File Identifier
34 + LEN_FI ~	00	Padding Field	Set File Identifier to odd number

The grayed items in the above Directory Record are described below.

Table 4-11: Recording Date/and Time

Byte No.	Type	Field Name	Description
1	N	Number of Year since 1900	Years since 1900
2	N	Month of the year from 1 to 12	Months
3	N	Day of the month from 1 to 31	Days
4	N	Hour of the day from 0 to 23	Hours
5	N	Minute of the hour from 0 to 59	Minutes
6	N	Second of the minute from 0 to 59	Seconds
7	N	Offset from Greenwich Mean Time in number of 15 min intervals from -48 (West) to +52 (East)	GMT offset in 15-min. intervals from -48 (West) to +52 (East)

Table 4-12: File Flags

Bit Position	Field Name	Description
0	Existence	Hidden File
1	Directory	Directory (Identity) bit
2	Associated File	Related file (=0)
3	Record	Expanded record structure file
4	Protection	Protected File (=0)
5	Reserved	Reserved (=0)
6	Reserved	Reserved (=0)
7	Multi-Extent	Multi-extent file (=0)

Table 4-13: File Identifier

Directory Bit	Format	Description
0	Filename.Ext; Edition No. <ex.> aaaaaaaa.bbb;1 xxxxxxxx;1	Filename: up to 30 characters Ext.: up to 3 chars (optional) Edition No: always 1
1	Directory Name	Directory Name: up to 31 characters The root directory is 1 byte (00H)

Whether a file or directory name is stored depends on the Directory bit in the File flags. If the length of the File Identifier is an odd number, one byte (00H) is inserted.

5. Appendix

5.1.1. System ID Example

```

=====
;
; sysid.src — System ID
;
=====
;
; .SECTION SYSID, CODE, ALIGN=4
;
; .SDATA "SEGA SEGAKATANA " ;00:H/W identifier (Do NOT change!)
; .SDATA "SEGA ENTERPRISES" ;10:H/W vendor ID (Do NOT change!)
; .SDATA "FC94 " , "GD-ROM1/1 " ;20:Media ID / Device information
; .SDATA "JUE " , "0799000 " ;30:Area symbols / Peripherals
; .SDATA "HDR-0900 " , "VO. 800" ;40:Product number / Version
; .SDATA "19980107" , " " ;50:Release date / Reserved (Space)
; .SDATA "1ST_READ.BIN" , " " ;60:1st read file name / Reserved (Space)
; .SDATA "SEGA ENTERPRISES" ;70: Maker identifier
; .SDATA "SAMPLE GAME " ;80:Game Title
; .SDATA " " ;90: :
; .SDATA " " ;A0: :
; .SDATA " " ;B0: :
; .SDATA " " ;C0: :
; .SDATA " " ;D0: :
; .SDATA " " ;E0:Reserved (Space)
; .SDATA " " ;F0:Reserved (Space)
;
; .END
;===== End of file =====

```

5.1.2. TOC Data Example

```

=====
;
;   toc.src -- TOC data
;
=====
;
;   .SECTION SYSID, CODE, ALIGN=4
;
;   .SDATA "TOC1"
;   .DATA.L H'41000000+(10*60+2)*75 ;03 10:02:00
;   .DATA.L H'01000000+(10*60+2)*75+450 ;04 10:08:00
;   .DATA.L -1,-1,-1 ;05-07
;   .DATA.L -1,-1,-1,-1 ;08
;   .DATA.L -1,-1,-1,-1 ;12
;
;   .DATA.L -1,-1,-1,-1 ;16
;   .DATA.L -1,-1,-1,-1 ;20
;   .DATA.L -1,-1,-1,-1 ;24
;   .DATA.L -1,-1,-1,-1 ;28
;
;   .DATA.L -1,-1,-1,-1 ;32
;   .DATA.L -1,-1,-1,-1 ;36
;   .DATA.L -1,-1,-1,-1 ;40
;   .DATA.L -1,-1,-1,-1 ;44
;
;   .DATA.L -1,-1,-1,-1 ;48
;   .DATA.L -1,-1,-1,-1 ;52
;   .DATA.L -1,-1,-1,-1 ;56
;   .DATA.L -1,-1,-1,-1 ;60
;
;   .DATA.L -1,-1,-1,-1 ;64
;   .DATA.L -1,-1,-1,-1 ;68
;   .DATA.L -1,-1,-1,-1 ;72
;   .DATA.L -1,-1,-1,-1 ;76
;
;   .DATA.L -1,-1,-1,-1 ;80
;   .DATA.L -1,-1,-1,-1 ;84
;   .DATA.L -1,-1,-1,-1 ;88
;   .DATA.L -1,-1,-1,-1 ;92
;
;   .DATA.L -1,-1,-1,-1 ;96
;   .DATA.L H'41030000 ;A0
;   .DATA.L H'01040000 ;A1
;   .DATA.L H'01000000+(112*60+4)*75 ;A2 C2:04:00
;   .DATA.L 0
;
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;   .DATA.L 0, 0, 0, 0
;
;
;   .END
;===== End of file =====

```

5.1.3. ASCII A-Characters

		bit5~7					
		2	3	4	5	6	7
hit1~4	0	SP	0	@	P	`	p
	1	!	1	A	Q	a	q
	2	"	2	B	R	b	r
	3	#	3	C	S	c	s
	4	\$	4	D	T	d	t
	5	%	5	E	U	e	u
	6	&	6	F	V	f	v
	7	'	7	G	W	g	w
	8	(	8	H	X	h	x
	9	)	9	I	Y	i	y
	A	*	:	J	Z	j	z
	B	+	;	K	[	k	{
	C	,	<	L	\	l	|
	D	-	=	M	]	m	}
	E	.	>	N	^	n	~
	F	/	?	O	_	o	DEL

Note: The A-character set consists of the non-grayed characters.

5.1.4. ASCII D-Characters

		bit5~7					
		2	3	4	5	6	7
hit1~4	0	SP	0	@	P	`	p
	1	!	1	A	Q	a	q
	2	"	2	B	R	b	r
	3	#	3	C	S	c	s
	4	\$	4	D	T	d	t
	5	%	5	E	U	e	u
	6	&	6	F	V	f	v
	7	'	7	G	W	g	w
	8	(	8	H	X	h	x
	9	)	9	I	Y	i	y
	A	*	:	J	Z	j	z
	B	+	;	K	[	k	{
	C	,	<	L	\	l	|
	D	-	=	M	]	m	}
	E	.	>	N	^	n	~
	F	/	?	O	_	o	DEL

Note: The D-character set consists of the non-grayed characters.
 DS characters include 2EH (period) and 3BH (semicolon).