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Consumer Products Division

Disc Format Standards

Specification Sheet

Ver. 1.0

Doc. # ST-040-R4-051795

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REFERENCES

In translating/creating this document, certain technical words and/or phrases were interpreted with the assistance of the technical literature listed below.

1. *KenKyusha New Japanese-English Dictionary*
   1974 Edition

2. *Nelson's Japanese-English Character Dictionary*
   2nd revised version

3. *Microsoft Computer Dictionary*

4. *Japanese-English Computer Terms Dictionary*
   Nichigai Associates
   4th version

TABLE OF CONTENTS

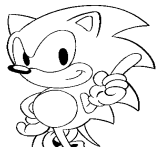
Introduction

This standard specification defines how SEGA SATURN application software is organized on a CD. CD's that do not follow this standard specification will not be recognized as a SEGA SATURN Game-CD. All application software that operate with the SEGA SATURN must conform to this standard specification.

The contents of this specification document provides the necessary information for a programmer to develop SEGA SATURN application software. While standards for the basic physical CD format and the copy protection settings must always be adhered to, compliance with these standards are done automatically through the use of disc mastering software and hardware specified by SEGA as well as the manufacturing processes implemented at SEGA certified disc manufacturers. Therefore, the details of these processes will not be discussed in this document. Accordingly, major problems may surface if non-SEGA approved CD mastering tools are used. Please use SEGA-approved CD mastering tools whenever possible. Please also note that the mass production of SEGA SATURN discs is impossible at non-SEGA certified CD manufacturing sites.

Be sure to use a CD tool specified by SEGA.

Because the CD tool must be approved, please inquire with SEGA before using a CD tool other than those designated by SEGA.



1.0 Disc Format Overview

1.1 Features

The physical format of the SEGA SATURN Game-CD for this game device conforms to the Semi CD-ROM XA standard for this game. As a result, an interleave record that has always been dependent on the application can be recognized as the system, and images and sound can be played concurrently.
"Semi CD-ROM XA" : CD-ROM XA with Model 1 track

1.2 Disc Size and Record Time

Only a 12 cm CD can be produced. To avoid potential problems, the start time of the read out area is restricted to the following ranges.

- Start LSN (#0) time: 00:02:00
- End LSN (~#283499) time: ~63:01:74
- Read out area start time: ~63:04:00

The maximum recording time is 63 minutes. Multisession cannot be used.

1.3 Linear Speed and Track Pitch

To increase the track jump precision and seek speed, the Game-CD linear speed and track pitch are set to the following fixed values.

- Linear speed: 1.25 m/sec
- Track pitch: 1.6 µm

1.4 Disc Format

The disc format conforms to the following standards.

- Physical format : Sony and Philips CD standards "Red Book" and "Yellow Book", as well as "CD-ROM XA."
- Logical format : ISO9660
- MPEG format : ISO11172

1.5 Track Layout

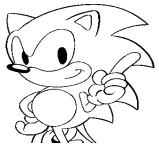
The inner circumference is the CD-ROM area and the outer circumference is the CD-DA area.

1.6 Sector Structure

In addition to the conventional Mode 1, there are Mode 2 Form 1 and Mode 2 Form 2 that have subheaders. Various interleaving records that use file numbers or channel numbers are allowed.

1.7 ISO9660 Conformity

The contents of logical sector numbers 0 to 15 are not specified in the ISO9660 standard. A boot program or protection information can be utilized to enable the CD producer to startup the system. Game-CD startup is enabled by defining this area in the disc format. A startup cartridge is not required. Logical sector numbers starting from 16 conform to ISO9660.



2.0 Physical Disc Format

The physical format conforms to the CD-ROM standard (Yellow Book) and CD-ROM XA standard. Items within these standards that are particularly restricted by SEGA, as well as those required for application development, are described in this section.

2.1 Area Divisions Within a Disc and Organization of Each Area

A disc is divided and organized starting from the innermost track, in the following order:

1. Lead-in area
2. Program area
3. Lead-out area

TOC information is written in the lead-in area in compliance with the CD-ROM XA standard.

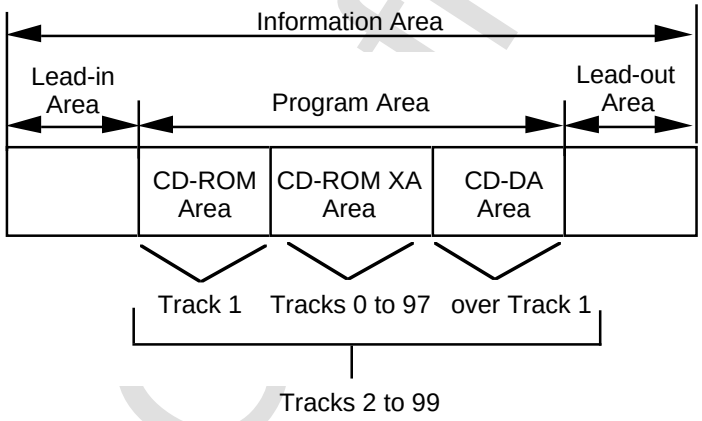


Figure 2.1 Organization of Areas within the Disc

Only 1 track is required for CD-ROM area (Mode 1).
At least 1 track is required for the CD-DA area.

2.2 Program Area Track Layout

The disc is configured with a CD-ROM XA track that continues after one CD-ROM track; the CD-DA track continues afterwards. As a result, the program area is divided and arranged in the following order.

- CD-ROM area (Mode 1 track)
- CD-ROM XA area (Mode 2 Form 1 and Form 2 tracks)
- CD-DA area

This prevents the sudden play of the CD-ROM track while playing the CD-DA track on an audio CD player. Also, if this disc is set to the CD-ROM drive that corresponds to Mode 1 track only, the Mode 1 track is placed at the start to prevent any trouble. Therefore, each track must be arranged in the order listed above.

Do not alternate the arrangement of CD-ROM tracks and CD-DA tracks. Also, do not arrange CD-ROM areas and CD-DA areas in reverse order.

- Track number

  The CD-ROM area track number is 01. The CD-ROM XA area track number can be set from 02 to 98 consecutively. The CD-DA area track number is from 02 when there is no CD-ROM XA area. When there is a CD-ROM XA area, it can be set from the next track number continuously up to 99. Do not arrange track numbers discontinuously. One track must be at least four seconds.

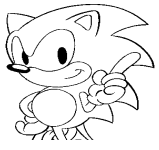
Except for the pause area, the pre gap, and post gap areas, 1 track requires 4 seconds or more.

- Pauses between tracks

  According to the "Yellow Book," a two second pause (silent interval) must be placed before and after a CD-ROM track, before and after a CD ROM XA area, before each CD-DA track, and after the final CD-DA track. This is so that the end of the prior song is not played while seeking with an audio CD player.

- CD-DA tracks

  Data of at least one song must be placed in the CD-DA area. When CD-DA data is not required, a warning message like *"This CD is a Game-CD. Please play this disc on a dedicated game machine"* should be entered. When the audio CD player is turned on, it'll display what CD it is. This message is not required when there is data for at least one song. The user may also play the CD to listen to songs only.



Recording Range of the Program Area

	ABS TIME	LSN	FAD
Start frame	00:00:00	-	0
Start sector	00:02:00	0	150
End sector	63:01:74	283499	283647
End frame	63:03:74	-	283799
Lead-out area start time	63:04:00		

- "Start frame, start sector" must be at the times shown above. Values for "End sector, end frame, lead-out area start time" must be at or smaller than the times shown above or at values that are smaller.

Track image diagram when data track is maximized (audio track is minimized)

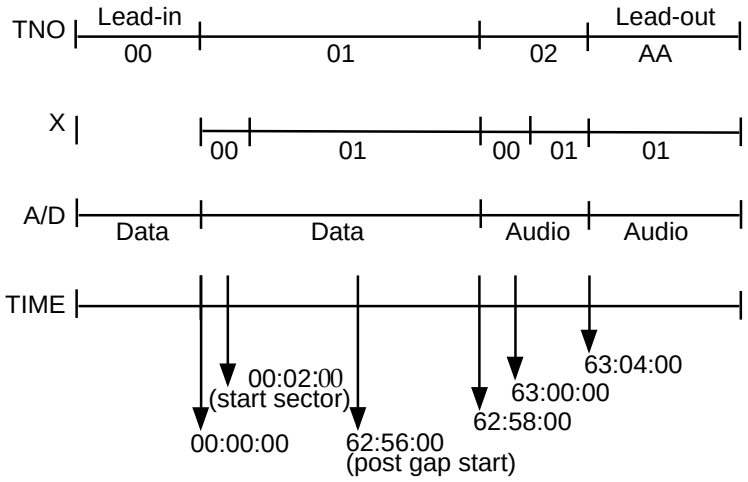


Figure 2.4 Track image when data track is maximized

- The usable data sector is from the start sector up to 1 sector before the post gap begins (about 566 MB.) 9 MB of data sectors are used up for every 1 minute increase of the audio track usage time.

2.3 Disc Position Indicator Key

In addition to the absolute time (Atime) and logical sector number (LSN), the frame address (FAD) is incorporated in order to specify a position on the disc.

- Logical Sector Number (LSN)
  Numbers are continuously assigned in sector (frame) units, with the absolute time 00:02:00 as 0.
- Frame Address (FAD)
  Numbers are continuously assigned in sector (frame) units, with the absolute time 00:00:00 as 0, and corresponds with the absolute time at a ration of 1 to 1.

  The logical sector number and frame address have the following relationship.

```
logical sector number = frame address – 150
```

  The frame address acts as a key for accessing the CD block.

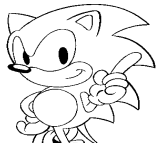
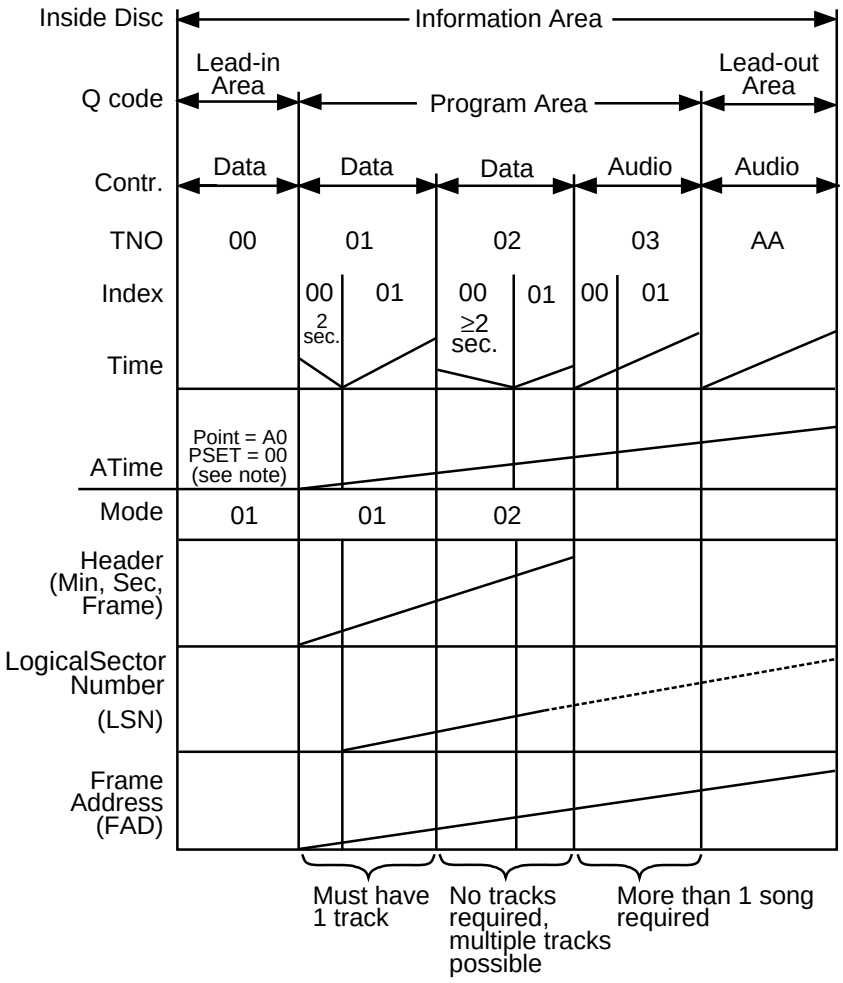


Figure 2.4 shows the relationship between the access key and track structure in order to explain the meaning of the frame address.



Note: With the CD-ROM XA standard, PSEC=20H when POINT=A0H; however, with the Semi CD-ROM XA standard, PSEC=00H.

Figure 2.4 General Game-CD Structure

2.4 Sector Structure

Figure 2.5 shows the physical format of the CD-ROM and CD-ROM XA. Game-CD uses three types of sectors: Mode 1, Mode 2 Form 1, and Mode 2 Form 2.

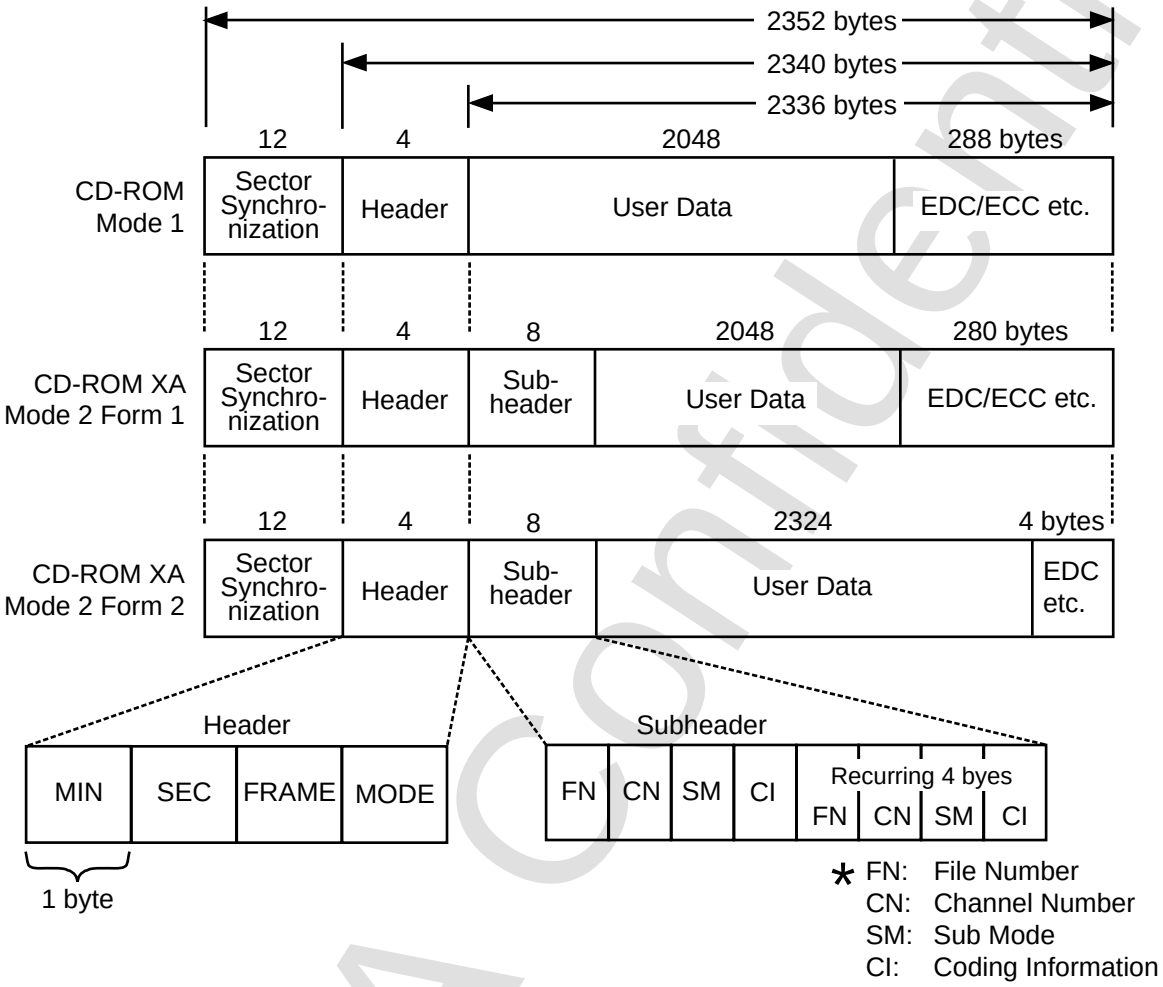
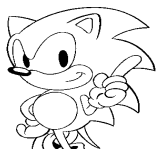


Figure 2.5 CD-ROM and CD-ROM XA Sector Format

Mode 2 format without form specification cannot be used.



2.4.1 Header Field

The header field is composed of the sector address (absolute time) and mode byte. The configuration of the header field is shown in Table 2.2.

A deviation may occur between the ATIME value of the subcode Q channel and sector address inside the header. Therefore, the header value, not the subcode Q channel, should be used when specifying a sector.

Table 2.2 Header Field Layout

Sector Byte #	Value
12	minute
13	second
14	frame
15	mode

2.4.2 Subheader Field

A subheader has 8 bytes. Each byte of the file number, channel number, submode, and coding information (total of 4 bytes) is written twice for data reliability.

(1) File Number

A file number is used to identify sectors belonging to one file which can be interleaved with another file and recorded. The file number of each sector of a logical file has the same value at this time. The file number is used for selecting sectors belonging to identical files, as well as eliminating other files.

A list of restrictions according to file number values is shown below.

Table 2.3 File Number Restrictions

File No.	Explanation
0	Used in the following files or areas: • Files continuously being recorded on disc. • Directory • Other (Path Table, Volume Descriptor) Cannot interleave with other files
1 to 255	Could be interleaved or continuous (is not clear if interleaved with other files or not.)

(2) Channel Number

The channel number is used to identify sectors belonging to one channel within a file.

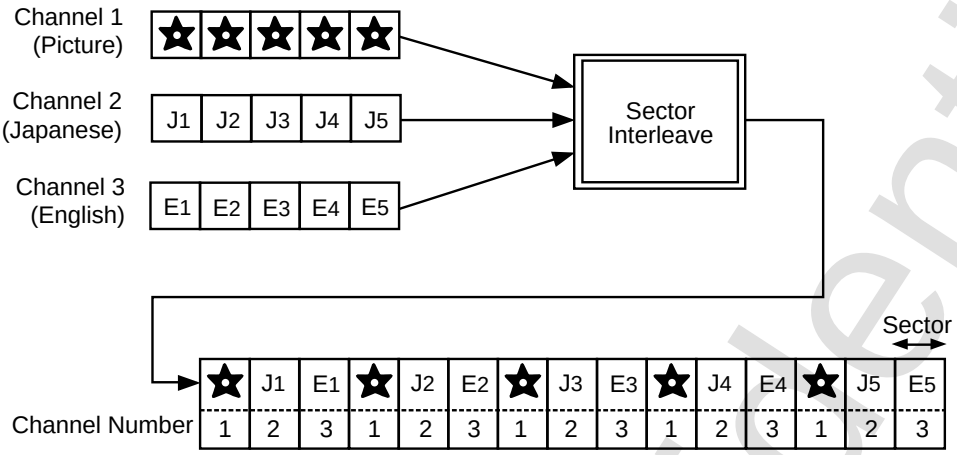


Figure 2.6 Sector Interleave by Channel Number

(3) Submode

Submodes are used in synchronization, ending files or records, and for sector assignments in the system. The submode byte configuration is listed in Table 2.4.

Table 2.4 Submode Bit Configuration

Bit No.	Bit Name	Abbreviated Value
7	End of File (EOF)	0
6	Real Time Sector (RT)	0
5	Form (F)	0
4	Trigger (T)	0
3	Data (D)	1
2	Audio (A)	0
1	Video (V)	0
0	End of Record (EOR)	0

End of File (EOF): Only the last sector of a file is set to 1. Other sectors are set to 0.

Real Time Sector (RT): When this bit is 1, processing must be done without interrupting the actual time process of CD-ROM XA.

Form (F): Indicates recording has been performed per Form-1 at 0 and Form-2 at 1.

Trigger (T): Used for synchronization in applications with various coding information.

Data (D):	Set to 1 for sector data related to the program. When this bit is 1, the Form bit must be 0.
Audio (A):	The audio sector is set to 1. When this bit is 1, the Form bit is also set to 1.
Video (V):	The video sector is set for 1.
End of Record (EOR):	1 is set when the last sector of a logical record is reached.

When bits 1, 2, and 3 (Video, Audio, Data) are used simultaneously, only one can be set to 1. In addition, either bit 1, 2, or 3 must be set to 1 for all sectors, excluding the empty sector.

(4) Coding Information

The coding information byte defines the details of the sector data type. This is not defined in GAME-CD.

3.0 Logical Disc Format

3.1 Overview

The CD-ROM area and CD-ROM XA area are comprised of a system area and a data area. To describe the disc volume/file structure, a volume descriptor set, directory, and path table are recorded at the start of the data area (Figure 3.1).

The system area, volume descriptor set, root directory, and path table must be recorded on the Mode 1 track.

LSN	0	16
FAD	150	166
ATIME	00:02:00	00:02:16

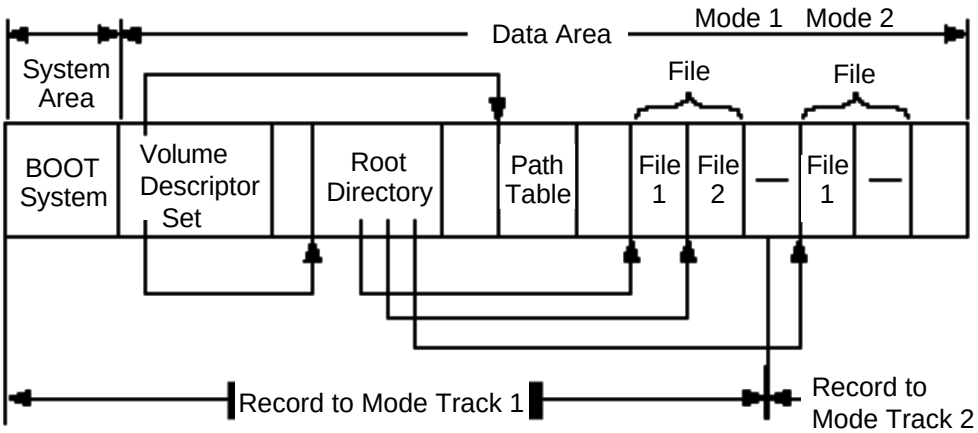


Figure 3.1 Overview of CD-ROM and CD-ROM XA Areas

3.2 Volume / File Structure

- Overview
  The volume/file structure conforms to the ISO9660. Information is added to the directory record system area.

- Abbreviations Express Types of Data
  The following abbreviations are used for the volume/file structure.

Table 3.1 Abbreviations of Data Types

Abbrev.	Name	Description
N	Numeric Value	8 bit binary number
NL	Least Significant Byte First	LSBF notation 16/32 bit binary numeric value Ex: recorded as hexadecimal 1234 → 34 12
NM	Most Significant Byte First	MSBF notation 16/32 bit binary numeric value. Ex: recorded as hexadecimal 1234 → 12 34
NB	Both-type orders	LSBF notation + MSBF notation Ex: recorded as hexadecimal 1234 → 34 12 12 34
ND	Any digit from ZERO-NINE	Numeric value in decimal notation
A	A-characters	ASCII character string (20-22/25-3F/41-5A/5F)
D	D-characters	Directory character string (30-3F/41-5A/5F)
DS	D-characters, SEPARATOR 1, SEPARATOR 2	D-characters + ". ; " (2E/3B)
DE	Directory Entry	Directory Entry Format
A1	A1-characters	A-characters + Kanji
D1	D1-characters	D-characters + Kanji
D1S	D1-characters, SEPARATOR 1, SEPARATOR 2	D1-characters + ". ; " (2E/3B)
00	Zero fill	Not used. Fill the reserve areas, etc., with (00)

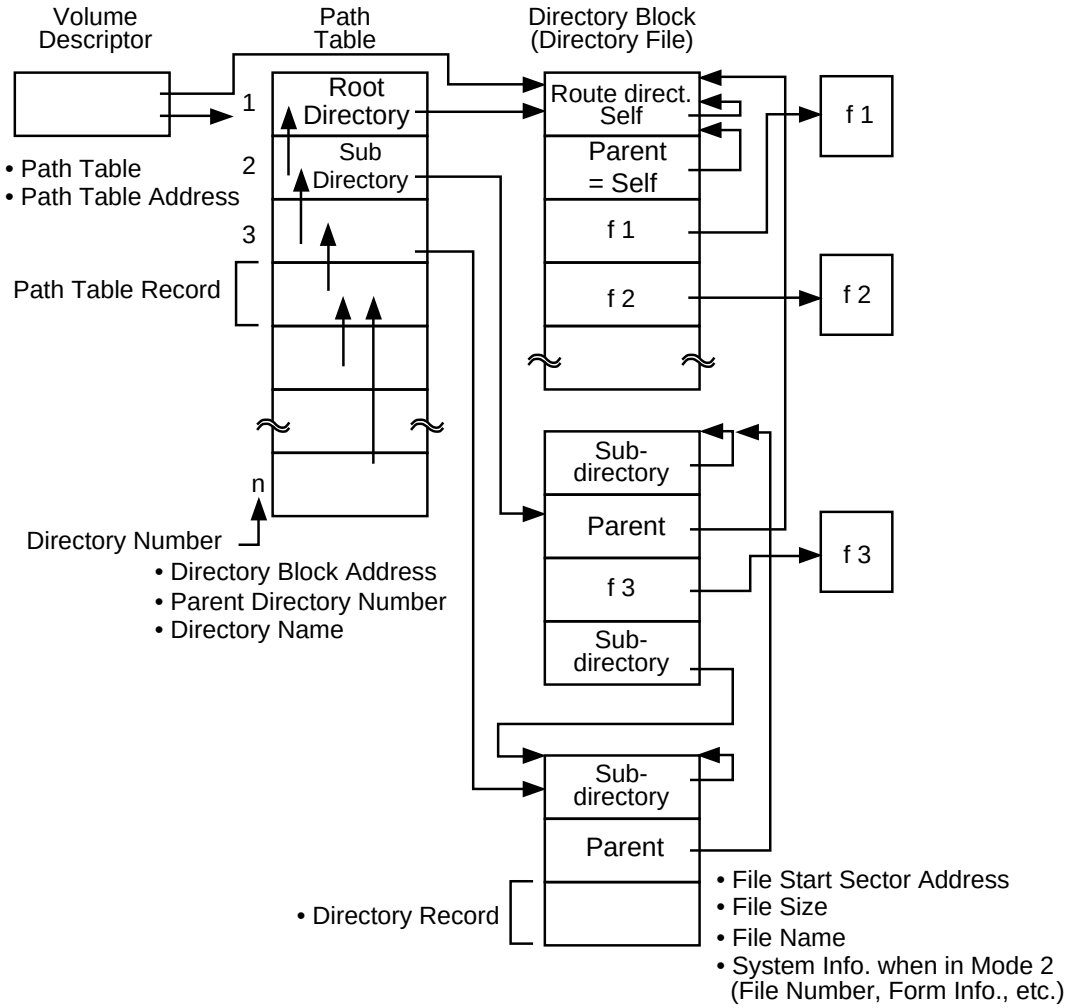
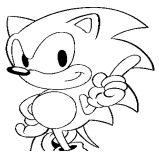


Figure 3.2 CD-ROM (ISO9660) Data Configuration for File Management

- Volume Descriptor: Arranged from the start of the data area. Fixed length by type.
- Path Table: Set of Path Table Records.
  Path Table size and address are recorded in the volume descriptor.
- Path Table Record: Corresponds to one directory (root, sub).
  The record position is the directory number (1 to n).
  Directory information is described in the directory block.
- Directory Block: Set of Directory Records.
  A directory block is considered as one file (directory file.)
  The size of the directory block is recorded in the directory record file size of the block start (size of own directory file.)
- Directory Record: Corresponds to one file (including directory.)



3.2.1 Volume Descriptor Set

The volume descriptor set is a group of volume descriptors recorded in a sector from logical sector number 16. The following are the five types of volume descriptors. The volume section descriptors are not used.

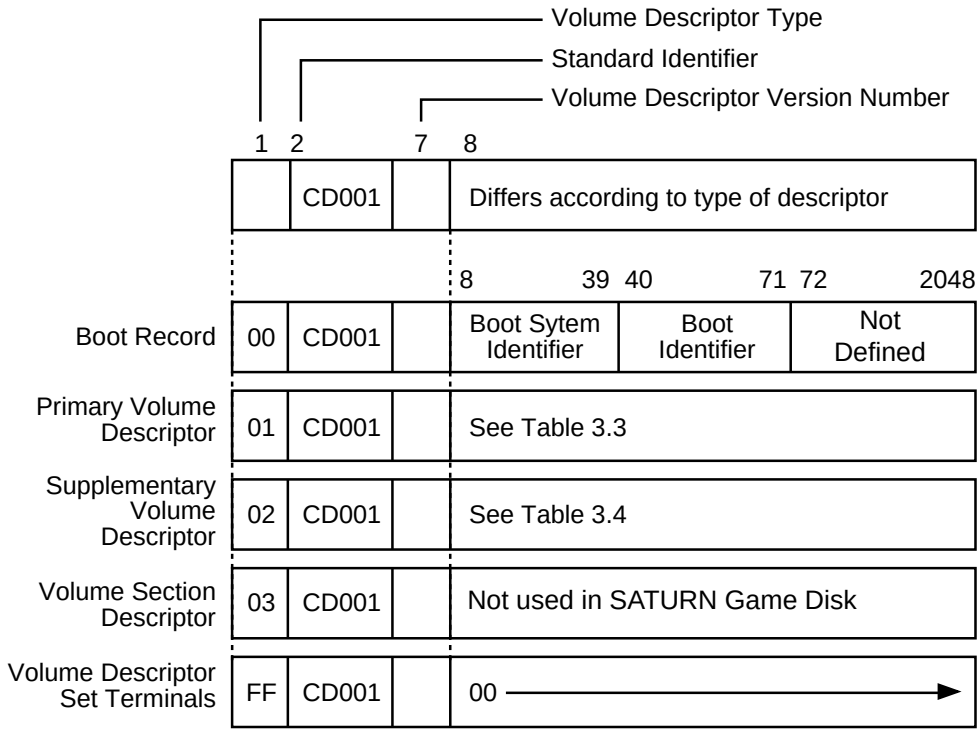


Figure 3.3 Volume Descriptors

1. Boot Record

Table 3.2 Boot Record Configurations

Byte Position	Type	Field Name	Description
1	N	Volume Descriptor Type	Volume descriptor type
2 - 6		Standard Identifier	"CD001"
7	N	Volume Descriptor Version	Version number
8 - 39	A	Boot System Identifier	Boot system identifier
40 - 71	A	Boot Identifier	Boot identifer
71 - 2048		Boot System Use	Not defined

In a normal Game-CD, the primary volume descriptor and volume descriptor set terminal are each recorded by 1 sector. These two sectors must be recorded.

The supplementary volume descriptor and boot record should be used after usage method is well understood.

2. Primary Volume Descriptor

A volume descriptor set contains one primary volume descriptor, which describes volume attributes, root directory position, positions of path tables set, and others. Table 3.3 lists the details of a primary volume descriptor structure .

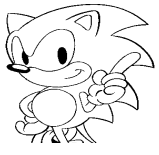
Table 3.3 Primary Volume Descriptor Structure

Byte Position	Type	Field Name	Description
1	N	Volume Descriptor Type	Volume Descriptor Type = 01
2~6		Standard Identifier	"CD001"
7	N	Volume Descriptor Version Number	
8	00	Unused Field	
9~40	A	System Identifier	System using LSN 0~15
41~72	D	Volume Identifier	Volume Name
73~80	00	Unused Field	
81~88	NB	Volume Space Size	
89~120	00	Unused Field	
121~124	NB	Volume Set Size	Volume no. = 1 when in multi-volume
125~128	NB	Volume Sequence Number	Ordinal number of volume logical block length when in mulit-volume
129~132	NB	Logical Block Size	
133~140	NB	Path Table Size	Bite number of total path table
141~144	NL	Occurrence of Type L Path Table location	LSBF listed Path Table position
145~148	NL	Optional Occurrence of Type L Path Table location	Spare
149~152	NM	Occurrence of Type M Path Table location	MSBF listed Path Table position
153~156	NM	Optional Occurrence of Type M Path Table location	Spare
157~190	DE	Directory Record for Root Directory	
191~318	D	Volume Set Identifier	General name when in multi-volume
319~446	A	Publisher Identifier	
447~574	A	Data Preparer Identifier	Data Editor Identifier
575~702	A	Application Identifier	Identification related to data usage method
703~739	DS	Copyright File Identifier	Abstract file name
740~776	DS	Abstract File Identifier	
777~813	DS	Bibliographic File Identifier	Number of book
814~830	ND	Volume Creation Date and Time	
831~847	ND	Volume Modification Date & Time	
848~864	ND	Volume Expiration Date & Time	
865~881	ND	Volume Effective Date & Time	
882	N	File Structure Version	Number of file configuration
883	00	Reserved for future standardization	
884~1395		Application Use	Conforms to CD-ROM XA specification
1396~2048		Reserved for future standardization	

The areas below are defined as disc labels with the CD-ROM XA standard.

Table 3.4 CD-ROM XADisc Labels

Byte Position	Type	Field Name	Remarks
1025 - 1032		Identifying Signature	"CD-XA001"
1033 - 1034		CD-ROM XA Flags	Reserved area
1035 - 1042	D	Startup Directory	Start up directory name
1043 - 1050	00	Reserved	Reserved area



3. Supplementary Volume Descriptor
   A volume descriptor set contains any number of supplementary volume descriptors. The supplementary volume descriptor describes volume attributes, root directory position, positions of path table set, and others. When using Japanese, identifiers such as the volume name and publisher identifier are recorded in the supplementary volume descriptor. Table 3.5 lists the details of a supplementary volume descriptor.

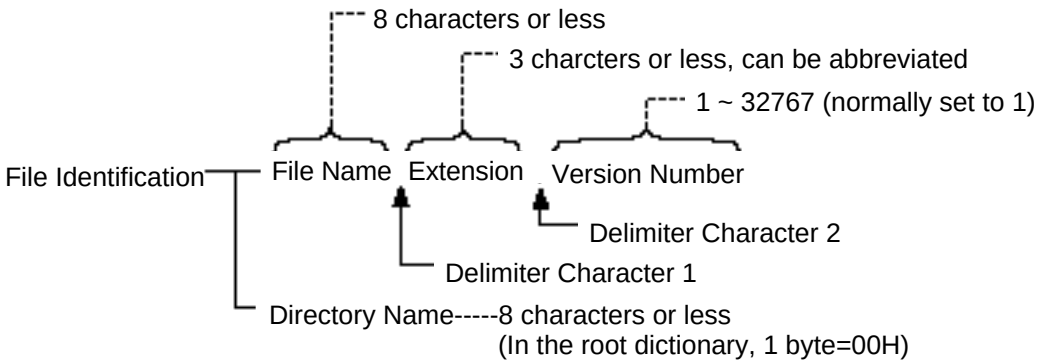
Table 3.5 Supplementary Volume Descriptor Structure

Byte Position	Type	Field Name	Description
1	N	Volume Descriptor Type	
2~6		Standard Identifier	"CD001"
7	N	Volume Descriptor Version	Number of version
8		Volume Flag	
9~40	A1	System Identifier	Using LSN 0~15
41~72	D1	Volume Identifier	Volume name
73~80	00	Unused Field	
81~88	NB	Volume Space Size	The number of sectors for total volume.
89~120	00	Unused Field	
121~124	NB	Volume Set Size	Volume = 1, when multi-volume
125~128	NB	Volume Sequence Number	Volume ordinal number when multi-volume.
129~132	NB	Logical Block Size	Logical block length
133~140	NB	Path Table Size	Total number of path table bytes
141~144	NL	Occurrence of Type L Path Table location	LSBF listed Path Table position
145~148	NL	Optional Occurrence of Type L Path Table location	
149~152	NM	Location of Occurrence of Type M Path Table location	MSBF listed Path Table position
153~156	NM	Location of Optional Occurrence of Type M Path Table location	Spare
157~190	DE	Directory Record for Root Directory	
191~318	D1	Volume Set Identifier	General name when multi-volume
319~446	A1	Publisher Identifier	
447~574	A1	Data Preparer Identifier	Data editor identifier
575~702	A1	Application Identifier	Identification related to the data usage method.
703~739	D1S	Copyright File Identifier	Copyright File Name
740~776	D1S	Abstract File Identifier	Extra at (Summary) file name
777~813	D1S	Bibliographic File Identifier	
814~830	ND	Volume Creation Date and Time	
831~847	ND	Volume Modification Date & Time	
848~864	ND	Volume Expiration Date & Time	
865~881	ND	Volume Effective Date & Time	
882	N	File Structure Version Number	Number of version
883	00	Reserved for future standardization	
884~1395		Application Use	Not prescribed
1396~2048		Reserved for future standardization	

3.2.2 Directory

The directory is recorded as one file composed of a number of directory records. Each directory record is identified exclusively within the same directory through file identification.

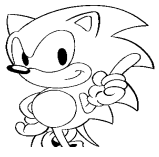
File identification displays the filename or directory name and stores them as follows.



- Directory Record Structure

Table 3.6 Directory Records

Byte Position	Type	Field Name
1	N	Length of Directory Record
2	N	Extended Attribute Record Length
3 - 10	NB	Location of Extent (LSN)
11 - 18	NB	Data Length
19 - 25	N	Recording Date and Time
26		File Flags
27	N	File Unit Size
28	N	Interleave Gap Size
29 - 32	NB	Volume Sequence Number
33	N	Length of File Indicator
34 - (33+ LEN_FI)	D1S	File Identifier: • File Name, Extension, Version Number • Directory Name
34+LEN_FI	00	Padding Field
		System Use



- Format of Recorded Date and Time

Table 3.7 Format of Recording Date and Time

Relative Byte Position	Type	Field Name
1	N	Number of years since 1900.
2	N	Month of the year from 1 to 12.
3	N	Day of the month from 1 to 31.
4	N	Hour of the day from 0 to 23.
5	N	Minute of the hour from 0 to 59.
6	N	Second of the minute from 0 to 59.
7	N	Offset from Greenwich Mean Time in number of 15 minute intervals from -48 (west) to +52 (east).

- File Flag

Table 3.8 File Flag

Bit Position	Field Name	Remarks
0	Existence	
1	Directory	
2	Associated File	(=0)
3	Record	(extend attribute record structure file)
4	Protection	File (=0)
5	Reserved	
6	Reserved	
7	Multi-Extent	File (=0)

- File Identification
  Filename or directory name is stored according to the value of the File Flag Directory bit (bit 1).
  Directory bit = 0: Specifies identification information for file.

Table 3.9 File Identification

Directory bit value	Format	Explanation
0	File name. Extension; Version number Example: aaaaaaaa.bbb; xxxxxx	File name: 8 characters or less Extension: 3 characters or less (can be omitted) Version number: Normally set to 1
1	Directory name	Directory name: 8 characters or less In the root directory, 1 byte is 00H.

The length of the file identification is an even number; 1 byte (00H) is filled in.

- System Information
  Extensions for ISO9660 Standard are shown in the tables below.

Table 3.10 System Information

Byte Position	Type	Field Name	Remarks
1 - 4	NM	Owner ID	(or Group ID)
5 - 6		Attributes	Attribute bit
7		Signature byte 1	"X" ($58)
8		Signature byte 2	"A" ($41)
9	N	File Number	
10 - 14	00	Reserved	Reserved Area

- Attribute bits

Table 3.11 Attribute bits

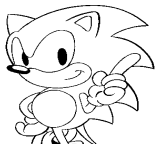
Bit Position	Field Name	Description
0	Owner Read	
1	Reserved	
2	Owner execute	
3	Reserved	
4	Group read	
5	Reserved	
6	Group execute	
7	Reserved	
8	World read	
9	Reserved	
10	World execute	
11	File contains Form 1 sectors	Includes Form 1 sector
12	File contains Form 2 sectors	Includes Form 2 sector
13	File contains interleaved sector	Includes interleave sector
14	CD-DA file	CD-DA file
15	Directory	Directory file

3.2 (3) Path Table

A path table record is recorded for each directory except for modification of a root directory. Path table records are assigned numbers starting from 1, and the first record represents the root directory The table below details the Path Table Record.

Table 3.12 Path Table Records

Byte Position	Type	Field Name	Remarks
1	N	Length of Directory Identifier	Length of Directory Name
2	N	Extended Attribute Record Length	
3 – 6	N	Location of Extent	LSN of start extent
7 – 8	N	Parent Directory Number	Parent Directory Entry Number
9 – (8+ LEN_DI)	D1	Directory Identifier	Directory Name
9+LEN_DI	00	Padding Field	Only when Directory Name is an odd number.



3.3 User File

The user file is arranged in the data area. A single file is not necessarily organized continuously, as it is generally interleaved. The Mode 2 sector mixes Form 1 and Form 2 , and all sectors are converted to 2048 bytes. For convenience, the Mode 1 sector is handled in form as a Form 1 sector with a 0 subheader. Form 2 sector data must be in 2324 byte units, fractional bytes are not permitted.

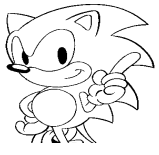
3.4 Other Items

1. Directory Structure
   The SEGA SATURN Game-CD supports a sub-directory structure as well.
2. Multi-Volume
   Not supported.

4.0 Boot System

This material provides rules that must be followed when application software uses the boot system. CDs that do not follow these standards are not recognized as a SATURN Game-CD. All application software run by the SATURN must follow these standards.

This material is an extract of the disc format standard specification, and only particularly important information is listed. Be sure to read the contents of the disc Format Standard Specification as well.



4.1 System Area

The system area is placed at the beginning of the CD-ROM. System information used during application start-up is written in the system area.

The system information and the initial program must be placed continuously within the system area as the IP. The IP consists of the boot code and application initial program (AIP). The boot code includes ID data, such as the game name, and security code. Code such as the initial program is contained in the AIP.

Table 4.1 IP Structure

Structure			Size	Remarks
IP	Boot Code	System ID	100H	Game title, product no., version, etc.
		Security Code	D00H	Security code
		Area Code Group	20H ~ 100H	Area code group
	Application Initial Program		20 ~ 71E0H	Initial program, file system, etc.

4.2 System ID

This data is placed at the start of the system area.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00H	Hardware Identifier															
10H	Maker ID															
20H	Product Number										Version					
30H	Release date								Device information							
40H	Compatible area symbols										Space					
50H	Compatible peripherals															
60H	Game Title															
70H																
80H																
90H																
A0H																
B0H																
C0H																
D0H	Reserved															
E0H	IP Size				Reserved				Stack-M				Stack-S			
F0H	1st Read Address				1st Read Size				Reserved				Reserved			

Figure 4.1 System ID Structure

4.3 Description of the System ID

Basic Information

Usable Characters

All of the characters that can be used within the System ID are ASCII code English alphanumeric characters. However, "**./-:**" can be used depending on the item. All upper case and lower case characters can be used if nothing is specified.

Entering Data

- Characters are left justified unless otherwise specified. No space is inserted at the beginning.
- All empty areas are filled in with the ASCII "space" character code 20H unless otherwise specified.
  Expression definition: " Δ" and/or spaces in the following descriptors are considered to be ASCII code 20H.

Other Rules

RESERVED areas must be filled in with 00H.

Description of Each Item

Hardware Identifier (Start address: 00H)

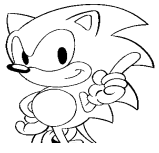
Definition:	Unique ID for hardware.
Usable characters:	Only upper case English characters.
Number of characters:	16 characters
Entry rules:	"**SEGA**Δ**SEGASATURN**Δ" must be entered.

Maker ID (Start address: 10H)

Definition:	Enter the maker ID specified by SEGA.
Usable characters:	English alphanumeric characters only.
Number of characters:	16 characters.
Entry rules:	
For SEGA brand:	Fixed at 16 characters of "**SEGA**Δ**ENTERPRISES**"
For 3rd party brand:	"**SEGA**Δ**TP**Δ**KAISHA-A**" 16 characters Unique company code given to all third parties is entered in **KAISHA-A**. Example: "**SEGA**Δ**TP**Δ**T-999**ΔΔΔ" Standard: The underlined part above is entered as left justified, the remainder is filled in with spaces and must be 16 characters in total.

Product Number (Start address: 20H)

Definition:	Enter the SEGA specified product number.
Usable characters:	English alphanumeric characters only.
Number of characters:	10 characters.
Entry rules:	A blank area is filled in with spaces.
Entry example:	SEGA brand title: "**GS-9099**ΔΔΔ" Third party title: "**T-99901G**ΔΔ"



Version (Start address: 2AH)

Definition:	Enter the application version.
Usable characters:	Upper case "**V**", numbers, and "**.**" (period).
Number of characters:	6 characters
Entry rules:	Must start with "**V**" followed by a 1 digit number, followed by a "**.**", and 3 digit numbers. The final release is **V1.000**
Entry example:	For a sample disc: "**V0.801**" For a master disc: "**V1.000**"

Release Date (Start address: 30H)

Definition:	Enter the creation date of the master disc (write-once disc)
Usable characters:	Only numbers.
Number of characters:	8 characters
Entry rules:	Must enter all 4 digits of the year; 2 digits of both the month and date.
Entry sample:	"**19940912**" (September 12, 1994)

Device Information (Start address: 38H)

Definition:	Enter device information. For a CD, enter the page number and the set number it belongs to.
Usable characters:	English alphanumeric characters as well as "**/**" and "**-**"
Number of characters:	8 characters
Entry rules:	A blank area is filled in with a space.
Entry sample:	CD set of 1, 1st CD: "**CD-1/1**ΔΔ" CD set of 3, 2nd CD: "**CD-2/3**ΔΔ"

Compatible Area Symbol (Start address: 40H)

Definition:	Enter the area symbol of the region where the application is to operate.
Usable characters:	Only the upper case English alphabets specified below in the character list.
Number of characters:	10 characters
Entry rules:	May enter multiple characters. Area symbols are entered closely, without spaces and commas in between. A blank area is filled in with a space. Enter: • List of Area Symbols

Japan	**"J"**
Asia NTSC (Taiwan, Philippines, Korea)	**"T"**
North America (U. S., Canada, Central South America (Brazil))	**"U"**
Europe PAL, East Asia PAL, Central South America PAL	**"E"**

Entry sample: For applications that run in Japan, Taiwan, Philippines, and Korea (do not run in other regions): **"JT**ΔΔΔΔΔΔΔΔ"

Note: The area code that corresponds with the region entered here must be entered in the area code group. (See "4.5 Area Code")

Supplement: Hardware has "area symbols" information that differ according to the sales region. The application starts only when the "area symbol," "area symbol within the corresponding area symbol," and "area code" match.

Compatible Peripheral (Start address: 50H)

Definition: Enter information of fully compatible input peripherals.
Usable characters: English alphanumeric characters only.
Number of characters: 16 characters
Entry rules: May enter multiple characters. Characters are not required to be in order. Characters are entered closely, with no spaces and commas inserted in between. A blank area is filled in with a space.

- List of Characters

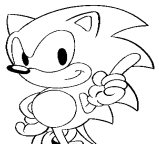
Control Pad	**"J"**
Analog Controller	**"A"**
Mouse	**"M"**
Keyboard	**"K"**
Steering Controller	**"S"**
Multitap	**"T"**

Entry sample: For applications that support the standard joy pad and mouse: "**JM**ΔΔΔΔΔΔΔΔΔΔΔΔΔΔΔ"
Supplement: Plans to increase characters as the peripherals increase.

See section **2.3 Peripheral Compatibility** in the **SEGA SATURN Software Development Standards** document (ST-151-R3) for more details.

Game Title (Start address: 60H)

Definition: Enter the title of the game.
Usable characters: The game title uses English alphanumeric characters only. A space can be inserted in the game title. "**/-:**" can be used as a delimiter between titles when more than one title is listed.
Number of characters: 112 characters
Entry rules: Titles can be multiple listed when names differ by sales area. There are no detailed rules for multiple entries, but all entries allow titles to be distinguished easily by looking at the information part. A blank area is filled in with a space.
Entry sample: When there are multiple titles:
1) **"TITLE1/TITLE2/TITLE3**ΔΔΔΔ"
2) **"J:TITLE1**ΔΔ**U:TITLE2**ΔΔΔΔΔΔ"



IP SIZE (Start address: E0H)

Definition:	Specifies the size (byte number) of the Initial Program (IP).
Size:	4 bytes.
Rules:	AIP is placed immediately after the boot code, creating a single file, and the size of the file is specified. Parameters must be all long-word aligned (multiples of 4H).
Range:	1000 ~ 8000H

STACK-M (Start address: E8H)

Definition:	Master-SH2 stack pointer address.
Default (0 specified)	6001000H ~ 6001FFFH becomes the stack area.
Rules:	Parameters are all long-word aligned (multiples of 4H).

STACK-S (Start address: ECH)

Definition:	Slave-SH2 stack pointer address.
Default (0 specified)	6000D00H ~ 6000FFFH becomes the stack area.
Rules:	Parameters are all long-word aligned (multiples of 4H).

1st READ ADDRESS (Start address: F0H)

Definition:	Transfer destination address of files transferred to the WORK-RAM by the boot system while the SEGA logo is being displayed.
Rules:	Transfer is not performed when 0H. The file identifier [2] file is transferred when the data is transfered from a CD. Parameters must all be aligned in long-word (multiples of 4H).
Range:	Larger than (60020000H+IP SIZE), smaller than (6100000-4)
Supplement:	See item "4.7 Application Initial Program and 1st READ FILE."

1st READ SIZE (Start address: F4H)

Definition:	Ignored for CDs.
Rules:	Parameters are all long-word aligned (multiples of 4H).

4.4 Security Code

The security code is placed immediately after the SYSTEM ID. Because the code is provided in object code form from SEGA, **IT MUST BE USED AS-IS WITHOUT MODIFICATION**. Content of the security code includes data, and programs displaying the SEGA license information. Because an application that does not have the correct security code is not recognized as a SEGA SATURN CD, the game will not launch.

The filename of the security code found in the SEGA SATURN software Library is underlined below.

```
\SATURN\SEGALIB\LIB\SYS_SEC.OBJ
```

4.5 Area Codes

Area codes are placed immediately after the security code. The code is provided in object code form from SEGA, and it must be used without modification. There are eight types of area codes for each of the hardware sales areas, but area codes corresponding to the SYSTEM ID "compatible area symbols" must be entered. The entry order for "compatible area symbols" and "area codes" do not have to match when there are multiple listings.

The sizes of the various area codes are the same, enabling them to be easily changed. A common disc can be created by linking multiple area codes. (See samples in the appendix.)

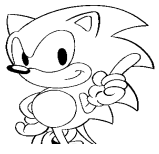
An area code supplied filename within the directory after the software library disc is installed is underlined below.

```
\SATURN\SEGALIB\LIB\SYS_ARE?.OBJ     ; ? is the same character as the
                                       compatible area
                                     ; 4 types exist
```

The relationship of the corresponding area symbol with the hardware sales region and area codes are as follows.

Table 4.3 Area Code andArea Symbol Relation

Area	Hardware Sales Region	Area Code Filename
J	Japan	SYS_AREJ.OBJ
T	Asia NTSC Region	SYS_ARET.OBJ
U	North America	SYS_AREU.OBJ
E	Europe PAL, East Asia PAL, Central South America PAL	SYS_AREE.OBJ



4.6 Application Initial Program

This program is executed immediately after the area code is executed by placing it after the area code group. The program then advances under the control of the application.

4.7 Application Initial Program and 1st Read File

Both are systems in which the boot ROM automatically transfers files from the CD-ROM. By using this at the time of startup, a specified file can be transferred without programming by application.

1st Read File

While the SEGA logo license is displayed (while executing the security code), the file read by the boot system (file identifier [2]) is called the 1st Read File. Display of the SEGA logo license continues until reading of the 1st Read File has ended. Consequently, the display time of the SEGA logo license screen increases as the size of the transfer file increases. The minimum display time is 2 seconds; the maximum is 3.5 seconds.

When the 1st Read Address is set, the 1st Read File is read but not executed. This may not be specified, but to use time during SEGA Logo License display effectively, its use is recommended.

Application Initial Program

By placing the file system within the program, access to the CD can be easily achieved thereafter in file units. By skillfully using both, an efficient application can be created.

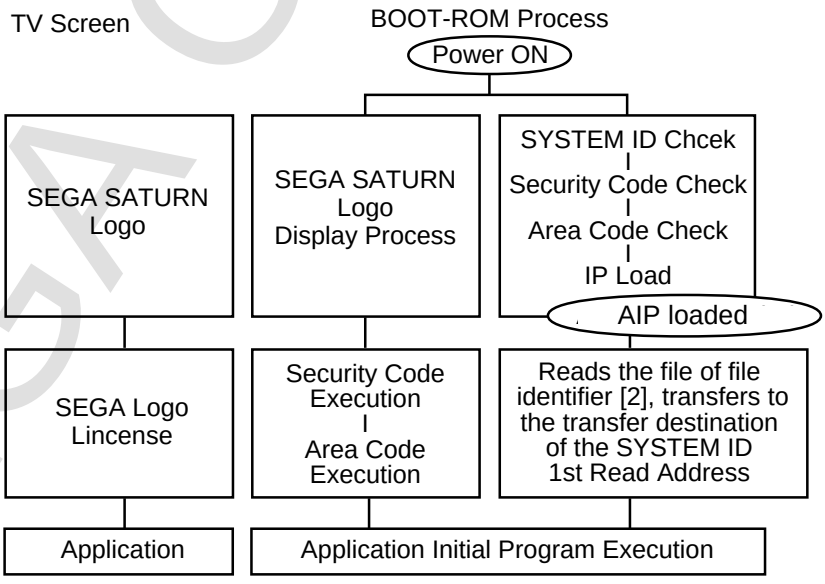


Figure 4.1 Overview from when the power is turned on

4.8 IP Creation Method

- **SYS_ID.SRC**
  This is an assembler source program for SYSTEM ID creation.
  Change according to the application. (See "4.3 SYSTEM ID Description")
  Be sure to place at the start of the program.

  The file below is a sample source program:
  \SATURN\SEGASMP\SYS\SYS_ID.SRC

- **SYS_SEC.OBJ**
  Security code object file. (See "4.4 Security Code")
  Link and build as is.

- **SYS_ARE?.OBJ**
  Area code object file. (See "4.5 Area Code")
  Link and build as is.

The files above are linked in the order of **SYS_ID.OBJ, SYS_SEC.OBJ, SYS_ARE?.OBJ . . .**, to create **SYS_IP.BIN**. Please place this file in the CD system area.

IP Placement

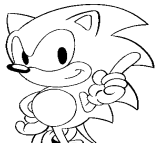
The IP size can be created within a range of the minimum sector and the maximum 16 sectors. If the required IP size is 8 sectors or less, multiple IPs can be recorded in order to improve reliability. Make sure that each IP is at the starting sector boundary. This increases the chances of startup even if a failure occurs when reading the first sector.

APPENDIX Various Sample Code Listings

```
;=====================================================================
;  smp_id0.src  —  System ID for SEGA          (Ver. 1994-11-11)
;=====================================================================
      .SECTION  SYSID, CODE, ALIGN=4
;
      .SDATA   “SEGA SEGASATURN   “   ;00: hardware identifier (cannot change)
      .SDATA   “SEGA ENTERPRISES  “   ;10: maker ID
      .SDATA   “999999999 V1.000  “   ;20: product number, version
      .SDATA   “19941122CD-1/1    “   ;30: release date, device information
      .SDATA   “JTUE              “   ;40: compatible area symbol
      .SDATA   “J                 “   ;50: compatible peripheral
      .SDATA   “GAME TITLE        “   ;60: game title
      .SDATA   “                  “   ;70:
      .SDATA   “                  “   ;80:
      .SDATA   “                  “   ;90:
      .SDATA   “                  “   ;A0:
      .SDATA   “                  “   ;B0:
      .SDATA   “                  “   ;C0:
      .DATA.L  H’00000000, H’00000000, H’00000000, H’00000000     ;D0:
      .DATA.L  H’00001000, H’00000000, H’00000000, H’00000000     ;E0:
      .DATA.L  H’06010000, H’00000000, H’00000000, H’00000000     ;F0:
;
      .END
;========   End of file   ==========================================
```

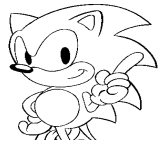
```
;=====================================================================
;  smp_id1.src  —  System ID for 3rd Party           (Ver. 1994-11-11)
;=====================================================================
      .SECTION SYSID, CODE, ALIGN=4
;
      .SDATA   "SEGA SEGASATURN   "   ;00: hardware identifier (cannot change)
      .SDATA   "SEGA TP KAISHA-A  "   ;10: maker ID
      .SDATA   "999999999 V1.000  "   ;20: product number, version
      .SDATA   "19941122CD-1/1    "   ;30: release date, device information
      .SDATA   "JTUE              "   ;40: compatible area symbol
      .SDATA   "J                 "   ;50: compatible peripheral
      .SDATA   "GAME TITLE        "   ;60: game title
      .SDATA   "                  "   ;70:
      .SDATA   "                  "   ;80:
      .SDATA   "                  "   ;90:
      .SDATA   "                  "   ;A0:
      .SDATA   "                  "   ;B0:
      .SDATA   "                  "   ;C0:
      .DATA.L  H'00000000, H'00000000, H'00000000, H'00000000     ;D0:
      .DATA.L  H'00001000, H'00000000, H'00000000, H'00000000     ;E0:
      .DATA.L  H'06010000, H'00000000, H'00000000, H'00000000     ;F0:
;
      .END
;========   End of file   ===============================================
```

```
;=====================================================================
;  smpsys. lnk   — SH Linkage Subcommand File for IP     (Ver. 1994-11-11)
;=====================================================================
Input   sys_id.obj
Input   .. \ .. \segalib\lib\sys_sec.obj
Input   .. \ .. \segalib\lib\sys_arej.obj
Input   .. \ .. \segalib\lib\sys_aret.obj
Input   .. \ .. \segalib\lib\sys_areu.obj
Input   .. \ .. \segalib\lib\sys_aree.obj
Input   .. \ .. \segalib\lib\sys_init.obj
Input   smpsys.obj
STart   SYSID (06002000)
Output  sys_ip.abs
Print   sys_ip.map
EXIT
;========   End of file   ===============================================
```

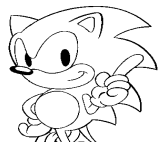
```
;=======================================================================
;  sample0.scr  —  CD-ROM           (Ver. 1994-11-11)
;Note:  CD-ROM (MODE1 + CD-DA) Disc Sample Script.
; Use Ver. 3.10 or later for versions VCDPRE and VCDBUILD.
; R:  Required
; O:  Optional
; NC: No change, cannot change parameters (Please use without changing)
; CP: Can change parameters
; --: No parameters
; A command name heads the beginning of each line. Please use unchanged.
;=======================================================================
Define      dirsmpdisc  .\sample\                          ;    O     CP
Disc        sample0. DSK                                   ; R        CP
Session     CDROM                                          ; R    NC
LeadIn      MODE1                                          ; R    NC
EndLeadIn                                                  ; R    --
;
SystemArea  [dirsmpdisc]sys_ip.bin                         ; R        CP
;
Track       MODE1                                          ; R    NC
    Volume                      ISO9660 sample0.PVD        ; R        CP
    PrimaryVolume               00:02:16                   ; R    NC
    SystemIdentifier            “SEGA SEGASATURN”          ; R    NC
    VolumeIdentifier            “SAMPLE_GAME_TITLE”        ; R        CP
    VolumeSetIdentifier         “SAMPLE_GAME_TITLE”        ; R        CP
    PublisherIdentifier         “SEGA ENTERPRISES, LTD.”   ; R        CP
    DataPreparerIdentifier      “SEGA ENTERPRISES, LTD.”   ; R        CP
    CopyrightFileIdentifier     “SMP_CPY.TXT”              ; R        CP
    AbstractFileIdentifier      “SMP_ABS.TXT”              ; R        CP
    BibliographicFileIdentifier “SMP_BIB.TXT”              ; R        CP
    VolumeCreationDate    22/11/1994  00:01:02:00:36       ;    O     CP
    VolumeModificationDate 22/11/1994  00:01:02:00:36      ;    O     CP
    EndPrimaryVolume                                       ; R    --
    EndVolume                                              ; R    --
;
    File           SMP_CPY.TXT                             ; R        CP
    FileSource     [dirsmpdisc] smp_cpy.txt                ; R        CP
    EndFileSource                                          ; R    --
    EndFile                                                ; R    --
    File           SMP_ABS.TXT                             ; R        CP
    FileSource     [dirsmpdisc]smp_abs.txt                 ; R        CP
    EndFileSource                                          ; R    --
    EndFile                                                ; R    --
    File           SMP_BIB.TXT                             ; R        CP
    FileSource     [dirsmpdisc]smp_bib.txt                 ; R        CP
    EndFileSource                                          ; R    --
```

```
    EndFile                                                 ; R    --
;
    File            FILE0.BIN                               ;    O     CP
    FileSource      [dirsmpdisc] file0.bin                  ;    O     CP
    EndFileSource                                           ;    O   --
    EndFile                                                 ;    O   --
    ;
    ;     File ~ EndFile                                    ;    O     CP
    ;
    PostGap         150                                     ; R      NC
EndTrack                                                    ; R      --
;
Track               CDDA                                    ; R      NC
    Pause           150                                     ; R      NC
    FileSource      [dirsmpdisc] sound0.da                  ; R        CP
    EndFileSource                                           ; R      --
EndTrack                                                    ; R      --
;
;    Track ~ EndTrack                                       ;    O     CP
;
LeadOut     CDDA                                            ; R      NC
Empty       500                                             ; R      NC
EndLeadOut                                                  ; R      --
EndSession                                                  ; R      --
EndDisc                                                     ; R      --
;========   End of file   ================================================
```

```
;=======================================================================
;  sample1.scr  —  CD-ROM XA        (Ver. 1994-11-11)
;Note: CD-ROM XA (MODE1 + MODE2 + CD-DA) Disc Sample Script.
; Use Ver. 3.10 or later for versions VCDPRE and VCDBUILD.
; R:  Required
; O:  Optional
; NC: No change, cannot change parameters (Please user without changing)
; CP: Can change parameters
; --: No parameters
; A command name heads the beginning of each line.  Please use unchanged.
;=======================================================================
Define      dirsmpdisc  .\sample\                          ;    O     CP
Disc        sample1. DSK                                   ; R        CP
Session     SEMIXA                                         ; R      NC
LeadIn      MODE1                                          ; R      NC
EndLeadIn                                                  ; R      --
;
SystemArea  [dirsmpdisc]sys_ip.bin                         ; R        CP
;
Track       MODE1                                          ; R      NC
    Volume                      ISO9660 sample1.PVD        ; R        CP
    PrimaryVolume               00:02:16                   ; R      NC
    SystemIdentifier            “SEGA SEGASATURN”          ; R      NC
    VolumeIdentifier            “SAMPLE_GAME_TITLE”        ; R        CP
    VolumeSetIdentifier         “SAMPLE_GAME_TITLE”        ; R        CP
    PublisherIdentifier         “SEGA ENTERPRISES, LTD.”   ; R        CP
    DataPreparerIdentifier      “SEGA ENTERPRISES, LTD.”   ; R        CP
    CopyrightFileIdentifier     “SMP_CPY.TXT”              ; R        CP
    AbstractFileIdentifier      “SMP_ABS.TXT”              ; R        CP
    BibliographicFileIdentifier “SMP_BIB.TXT”              ; R        CP
    VolumeCreationDate     22/11/1994  00:01:02:00:36      ;    O     CP
    VolumeModificationDate 22/11/1994  00:01:02:00:36      ;    O     CP
    EndPrimaryVolume                                       ; R      --
    EndVolume                                              ; R      --
;
    File          SMP_CPY.TXT                              ; R        CP
    FileSource    [dirsmpdisc] smp_cpy.txt                 ; R        CP
    EndFileSource                                          ; R      --
    EndFile                                                ; R      --
    File          SMP_ABS.TXT                              ; R        CP
    FileSource    [dirsmpdisc]smp_abs.txt                  ; R        CP
    EndFileSource                                          ; R      --
    EndFile                                                ; R      --
    File          SMP_BIB.TXT                              ; R        CP
    FileSource    [dirsmpdisc]smp_bib.txt                  ; R        CP
    EndFileSource                                          ; R      --
    EndFile                                                ; R      --
```

```
;
    File           FILE0.BIN                          ;    O     CP
    FileSource     [dirsmpdisc] file0.bin             ;    O     CP
    EndFileSource                                     ;    O   --
    EndFile                                           ;    O   --
    ;
    ;     File ~ EndFile                              ;    O     CP
    ;
    PostGap        75                                 ; R      NC
EndTrack                                              ; R      --
;
Track              MODE2                              ; R      NC
    PreGap         150                                ; R      NC
  Extent                                              ; R      --
  FileInterleave   1 3                                ;    O     CP
    File           INTFILE0.BIN                       ;    O     CP
    FileSource     [dirsmpdisc] intfile0.bin          ;    O     CP
    EndFileSource                                     ;    O   --
    EndFile                                           ;    O   --
  EndFileInterleave                                   ;    O   --
  FileInterleave   1 3                                ;    O     CP
    File           INTFILE1.BIN                       ;    O     CP
    FileSource     [dirsmpdisc] intfile1.bin          ;    O     CP
    EndFileSource                                     ;    O   --
    EndFile                                           ;    O   --
  EndFileInterleave                                   ;    O   --
  FileInterleave   1 3                                ;    O     CP
    File           INTFILE2.BIN                       ;    O     CP
    FileSource     [dirsmpdisc] intfile2.bin          ;    O     CP
    EndFileSource                                     ;    O   --
    EndFile                                           ;    O   --
  EndFileInterleave                                   ;    O   --
  FileInterleave   1 3                                ;    O     CP
    File           INTFILE3.BIN                       ;    O     CP
    FileSource     [dirsmpdisc] intfile3.bin          ;    O     CP
    EndFileSource                                     ;    O   --
    EndFile                                           ;    O   --
  EndFileInterleave                                   ;    O   --
  EndExtent                                           ; R      --
    PostGap 150                                       ; R      NC
EndTrack                                              ; R      --
;
Track              CDDA                               ; R      NC
    Pause          150                                ; R      NC
    FileSource     [dirsmpdisc] sound0.da             ; R        CP
    EndFileSource                                     ; R      --
EndTrack                                              ; R      --
```

```
;
;    Track ~ EndTrack                                          ;    O   CP
;
LeadOut     CDDA                                               ; R     NC
Empty       500                                                ; R     NC
EndLeadOut                                                     ; R     --
EndSession                                                     ; R     --
EndDisc                                                        ; R     --
;========   End of file   ================================================
```