"Maple Bus 1.0"

Peripheral Hardware Specifications

Dreamcast Gun

Revision 0.61

Produced by:
CS Hardware DIV. 2
SEGA Enterprises Ltd.

Revision:

10/16-'98	0.50	Preliminary Specifications
10/20-'98	0.55	Changed the name from "Dreamcast Gun" to "Dreamcast Gun."
		Added section 4.1, "Read Format."
		Changed section 6.2, "Fixed Device Status."
		Changed other phrasing.
10/21-'98	0.60	Added section 2.2, "Operation as a Light Gun."
		Added section 5, "Support Commands."
6/21-'99	0.61	Added section 7.2, "Fixed Device Status," item (2), "Region Codes."
		Added section 7.3, "Contents of Fixed Device Status."

CONTENTS:

1 OVERVIEW

This chapter gives an overview of Dreamcast Gun, the gun-type controller for Dreamcast, the new generation game machine.

1.1 Overview of Dreamcast Gun

Dreamcast Gun is a scangun-type controller. It is equipped with direction buttons and an expansion slot, enabling new ways of playing that were hitherto not possible.

1.2 Definition of Dreamcast Gun

Dreamcast Gun conforms to the "Maple Bus 1.0" Standard Specifications and is equipped with the following functions.

1) "FT_0:Controller Function"
2) "FT_7:Light-Gun Function"

For a detailed description of each function type, refer to the corresponding function type specifications.

1.3 Function elements

Allocation of the function elements of the Dreamcast Gun is as follows.

FT_0:Controller Function

- Digital direction buttons: Ra, La, Ua, Da
- Digital buttons: A, B, Start

FT_7:Light-Gun Function

- Function for use in the SDCKB exclusive mode: the signal output from the sensor element is used as a timing signal.

1.4 Detailed description of constituent elements

This section provides details on the various elements of the functions that are used with the Dreamcast Gun.

○Controller function

Digital buttons: A, B, START, Ra, La, Ua, Da

These are digital type buttons which obtain 2 values: push and release. They detect multiple data simultaneously.

However, the direction buttons can sense only a maximum of two neighboring buttons being pushed simultaneously.

The values obtained are: push = '0'
release = '1'

○Light-Gun function

SDCKB exclusive mode

If the SDCKB exclusive enable pattern is received from the host, the Maple-Bus Serial Data Clock B (SDCKB) is monopolized between the falling and the rising edges of Serial Data Clock A (SDCKA).

During this interval, a signal is generated by the light sensor element, and is latched on to the Host's HV counter.

2 OPERATION

This section explains operation as a Dreamcast Gun function.

2.1 Operation as a controller

The Dreamcast Gun controller function conforms to "FT_0: Controller Function" operation.

- Key scan

  It is a requirement that the digital keys (buttons) are always being updated. There should always be a good response to data requests from the host. Accordingly, key scan should always be performed and held key data should always be retained in the newest condition. When there is a request from the host, the retained data should be in the condition to be sent. Since there is no order of priority for key scan, all the keys (buttons) should be concurrently readable.
- Optimization, conditions
  a) For the cross keys, no more than 3 keys (buttons) must be ON at the same time (key data must not be generated).
  b) The cross keys U and D, R and L must not be ON at the same time (key data must not be generated).
  c) The simultaneous ON statuses of multiple digital buttons must detectable.
  d) When two or more keys (buttons) are simultaneously pressed, keys (buttons) that are not pressed must not come ON (key data must not be generated).

2.2 Operation as a Light-Gun

The Dreamcast Gun Light-Gun function conforms to "FT_7: Light-Gun" operation.

- SDCKB exclusive mode support

  If the SDCKB exclusive enable pattern is received from the host, the Maple-Bus Serial Data Clock B (SDCKB) is monopolized between the falling and the rising edges of Serial Data Clock A (SDCKA). During this interval, a signal is generated by the light sensor element, and is latched on to the Host's HV counter.
- Optimization, conditions

  The Dreamcast Gun may not always strike the location at which it is aimed, depending on the precision with which the lens and optical elements have been attached, errors in the lens receptor area, delay in the monitor display, and other problems. Therefore, applications must apply a type of offset compensation. If this compensation is applied in the vertical direction, an area at the bottom of the monitor screen will become impossible to hit. Therefore, applications should also be designed so that targets are not displayed in the bottom 30 lines of the monitor screen.

3 DEVICE ID

In accordance with the device ID definition in the “Maple Bus 1.0” Standard Specifications.
The notation is that of the host’s memory image.

3.1 Configuration of the “Maple Bus 1.0” device ID

The device ID consists of 16 bytes (128 bits). The configuration is as shown in Table 3.1.

Table 3-1 Configuration of the device ID

bit	7	6	5	4	3	2	1	0
1st Data	FT_{31}	FT_{30}	FT_{29}	FT_{28}	FT_{27}	FT_{26}	FT_{25}	FT24
2nd Data	FT_{23}	FT_{22}	FT_{21}	FT_{20}	FT_{19}	FT_{18}	FT_{17}	FT16
3rd Data	FT_{15}	FT_{14}	FT_{13}	FT_{12}	FT_{11}	FT_{10}	FT_{9}	FT8
4th Data	FT_{7}	FT_{6}	FT_{5}	FT_{4}	FT_{3}	FT_{2}	FT_{1}	FT_{0}
5th Data	$FD1_{31}$	$FD1_{30}$	$FD1_{29}$	$FD1_{28}$	$FD1_{27}$	$FD1_{26}$	$FD1_{25}$	$FD1_{24}$
6th Data	$FD1_{23}$	$FD1_{22}$	$FD1_{21}$	$FD1_{20}$	$FD1_{19}$	$FD1_{18}$	$FD1_{17}$	$FD1_{16}$
7th Data	$FD1_{15}$	$FD1_{14}$	$FD1_{13}$	$FD1_{12}$	$FD1_{11}$	$FD1_{10}$	$FD1_{9}$	$FD1_{8}$
8th Data	$FD1_{7}$	$FD1_{6}$	$FD1_{5}$	$FD1_{4}$	$FD1_{3}$	$FD1_{2}$	$FD1_{1}$	$FD1_{0}$
9th Data	$FD2_{31}$	$FD2_{30}$	$FD2_{29}$	$FD2_{28}$	$FD2_{27}$	$FD2_{26}$	$FD2_{25}$	$FD2_{24}$
10th Data	$FD2_{23}$	$FD2_{22}$	$FD2_{21}$	$FD2_{20}$	$FD2_{19}$	$FD2_{18}$	$FD2_{17}$	$FD2_{16}$
11th Data	$FD2_{15}$	$FD2_{14}$	$FD2_{13}$	$FD2_{12}$	$FD2_{11}$	$FD2_{10}$	$FD2_{9}$	$FD2_{8}$
12th Data	$FD2_{7}$	$FD2_{6}$	$FD2_{5}$	$FD2_{4}$	$FD2_{3}$	$FD2_{2}$	$FD2_{1}$	$FD2_{0}$
13th Data	$FD3_{31}$	$FD3_{30}$	$FD3_{29}$	$FD3_{28}$	$FD3_{27}$	$FD3_{26}$	$FD3_{25}$	$FD3_{24}$
14h Data	$FD3_{23}$	$FD3_{22}$	$FD3_{21}$	$FD3_{20}$	$FD3_{19}$	$FD3_{18}$	$FD3_{17}$	$FD3_{16}$
15th Data	$FD3_{15}$	$FD3_{14}$	$FD3_{13}$	$FD3_{12}$	$FD3_{11}$	$FD3_{10}$	$FD3_{9}$	$FD3_{8}$
16th Data	$FD3_{7}$	$FD3_{6}$	$FD3_{5}$	$FD3_{4}$	$FD3_{3}$	$FD3_{2}$	$FD3_{1}$	$FD3_{0}$

FT : Function type the peripheral is equipped with.
FD1 : 1st function definition block.
FD2 : 2nd function definition block.
FD3 : 3rd function definition block.

① FT_{31}～FT_{0}: Function type

Defines the type of function the peripheral is equipped with.
There are 32 function types altogether.

② FD_{31}～FD_{0}: Function definition block

These blocks define the individual elements constituting the function.
(1 peripheral can be equipped with 3 different functions)

3.2 Function types

The function types (FT) within the device ID are as follows.
Dreamcast Gun has a controller function and a Light-Gun function.

Table 3-2 Dreamcast Gun function type

bit	7	6	5	4	3	2	1	0
1st Data	0	0	0	0	0	0	0	0
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	1	0	0	0	0	0	0	1

3.3 Function definition blocks

Because the Light-Gun function only supports SDCKB exclusive mode, function definition does not take place within the function definition blocks. Therefore, as Table 3.3 shows, the configuration is all '0's.
The following paragraph defines the controller function and the Light-Gun function. The Light-Gun function elements are defined in the 1st function definition block, and the controller function elements are defined in the 2nd function definition block. Also, because Light-Gun has no 3rd function, the 3rd function definition block is all '0's.

Table 3-3 1st function definition block (Light-Gun function)

bit	7	6	5	4	3	2	1	0
1st Data	0	0	0	0	0	0	0	0
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	0	0	0	0	0	0	0	0

'0' indicates fixed 0.

Table 3-4 2nd function definition block (Controller function)

bit	7	6	5	4	3	2	1	0
1st Data	0	0	0	0	0	0	0	0
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	1	1	1	1	1	1	1	0

'0' indicates fixed 0.

4 DATA FORMAT

To get key data from the Dreamcast Gun, issue the command to the Controller function. The Light Gun function does not have a data format.

4.1 Read format

This is the key data format of Dreamcast Gun. When the host transmits Get Condition, the controller returns data according to the data format. The command is Data Transfer.

Table 4-1 Get Condition

Data Address	Data	Setting example	Description
+0000h	Command code	09h	Specifies Get Condition.
+0001h	Destination AP	20h	Specifies device of port A.
+0002h	Origin AP	00h	Send from Port A.
+0003h	Data size	01h	Data size is 4 bytes.
+0004h	Function type	00h	The function type specifies the controller.
+0005h		00h	
+0006h		00h	
+0007h		01h	

Table 4-2 Data Transfer

Data Address	Data	Setting example	Description
+0000h	Command code	08h	Specifies Get Condition.
+0001h	Destination AP	00h	Specifies device of port A.
+0002h	Origin AP	30h	Send from Port A.
+0003h	Data size	03h	Data size is 12 bytes.
+0004h	Function type	00h	The function type specifies the controller.
+0005h		00h	
+0006h		00h	
+0007h		01h	
+0008h	Read format	FFh	For details on the data that is stored here, refer to Table 4-3.
+0009h		FFh	
+000Ah		00h	
+000Bh		80h	
+000Ch		80h	
+000Dh		80h	
+000Eh		80h	
+000Fh		80h	

The size of the data format is 8 bytes.

Table 4-3 Read Format

bit	7	6	5	4	3	2	1	0
1st Data	Ra	La	Da	Ua	Start	A	B	1
2nd Data	1	1	1	1	1	1	1	1
3rd Data	1	1	1	1	1	1	1	1
4th Data	1	1	1	1	1	1	1	1
5th Data	1	0	0	0	0	0	0	0
6th Data	1	0	0	0	0	0	0	0
7th Data	1	0	0	0	0	0	0	0
8th Data	1	0	0	0	0	0	0	0

Description of key data

1st Data: Digital button data. (ON = 0, OFF = 1)
2nd Data: Fixed at FFh.
3rd Data: Fixed at FFh.
4th Data: Fixed at FFh.
5th Data: Fixed at 80h.
6th Data: Fixed at 80h.
7th Data: Fixed at 80h.
8th Data: Fixed at 80h.

5 SUPPORT COMMANDS

This chapter describes the commands specified in the "Maple Bus 1.0" Standard Specifications which are supported by Dreamcast Gun.
If commands other than the following are sent, the function will return an error.
The concrete operations of the controller function of each command are also described.

5.1 Control commands

Device Request

Issuing right : Host
Command code : 01h
Data size : 00h
Data field : none
Expected return value : [Device Status]
Description : This command requests [Device Status] from the device connected to the destination AP. It is also used to check port connection. After initialization of the function, the device does not respond to other commands until this command is sent. The LM-Bus is also disconnected from the expansion device so that the expansion device operation is stopped.
Order of operation : (1) Receives command.
(2) Checks connection of each expansion device
(3) If connected, connects to corresponding LM-Bus
(4) Based on this result, the AP of originating device is created and returned to the host.

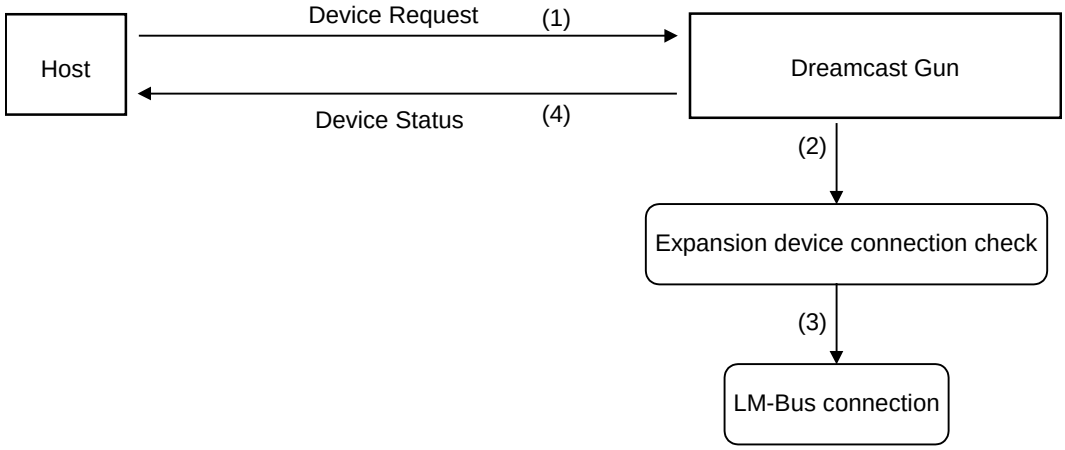

Fig. 5-1 Device Request

All Status Request

Issuing right : Host
Command code : 02h
Data size : 00h
Data field : none
Expected return value : [Device All Status]
Description : This command requests all device statuses (both Fixed Device Status and Free Device Status) from the device connected to the destination AP.

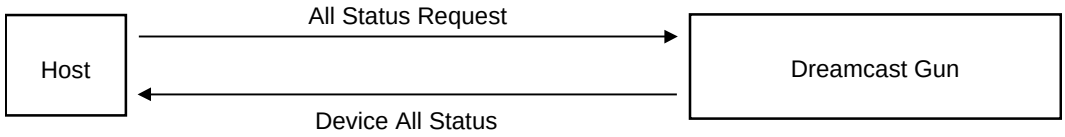

Fig. 5-2 All Status Request

Device Reset

Issuing right : Host
Command code : 03h
Data size : 00h
Data field : none
Expected return value : [Device Reply]
Description : This command enables the device specified by the destination AP to be initialized.
Order of operation : (1) [Device Reply] returned.
(2) Initialization.

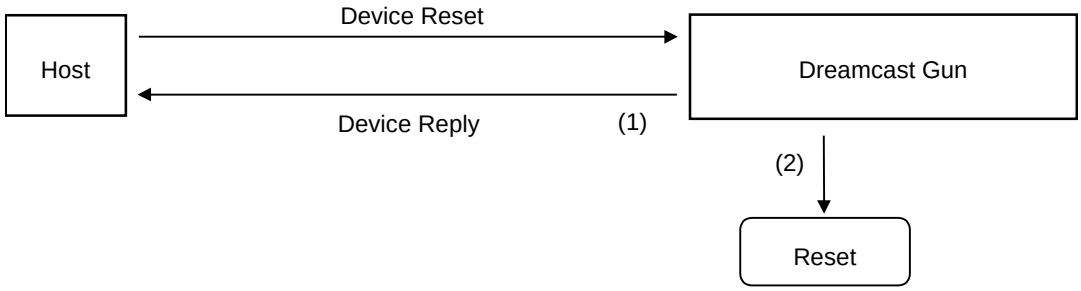

Fig. 5-3 Device Reset

Device Kill

Issuing right : Host
Command code : 04h
Data size : 00h
Data field : none
Expected return value : [Device Reply]
Description : Operation by the peripheral specified by the destination AP is not recognized. The function stands by in standby power consumption mode, and no commands can be received.
To start operation, a hard reset must be performed, or the power should be turned off and operation then started again.
When the Light-Gun function (the device) receives the Device Kill command, the ID0 and ID1 of the LM-Bus are reversed, the expansion device is reset, and the LM-Bus disconnected.
Order of operation : (1) LM-Bus reset and disconnected from the Maple-Bus
(2) [Device Reply] returned.
(3) Operation terminated.

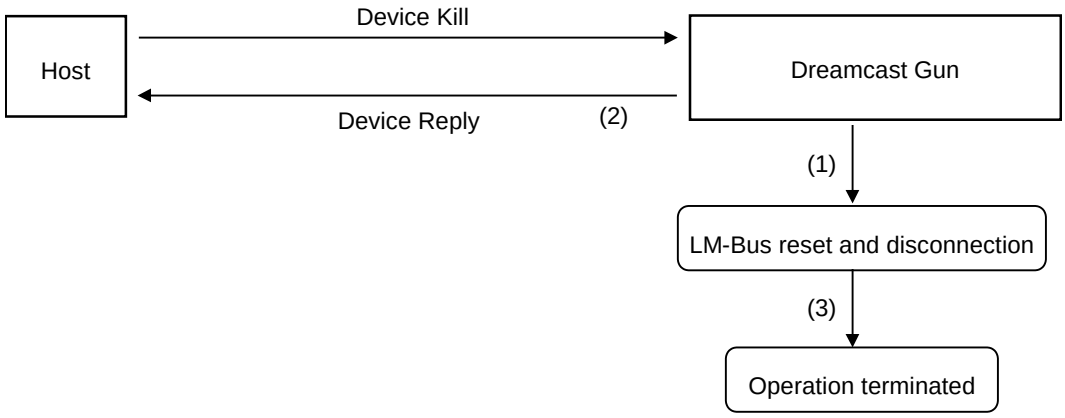

Fig. 5-4 Device Kill

Device Status

Issuing right : Device
Command code : 05h
Data size : 1Ch (28)
Data field : Device ID : 16 bytes
Destination code : 1 byte
Connection direction : 1 byte
Product name : 30 bytes
License : 60 bytes
Standby current consumption : 2 bytes
Maximum current consumption : 2 bytes
Description : This command returns Fixed Device Status data in response to [Device Request] from the host.

Device All Status

Issuing right	: Device		
Command code	: 06h		
Data size	: 1Ch + (n/4)		
Data field	: Fixed Device Status	: 112 bytes	
	Device ID	: 16 bytes	
	Destination code	: 1 byte	
	Connection direction	: 1 byte	
	Product name	: 30 bytes	
	License	: 60 bytes	
	Standby current consumption	: 2 bytes	
	Maximum current consumption	: 2 bytes	
	Free Device Status	: n bytes	

Device Reply

Issuing right	: Device
Command code	: 07h
Data size	: 00h
Data field	: none
Description	: Used as a response.

Data Transfer

Issuing right	: Controller function	
Command code	: 08h	
Data size	: 03h	
Data field	: Function type	: 4 bytes
		Specifies the controller (00-00-00-01h).
	Read format	: 8 bytes
Expected return value	: none	
Description	: This command is used to receive Get Condition from the host and when the controller's read format should be returned.	

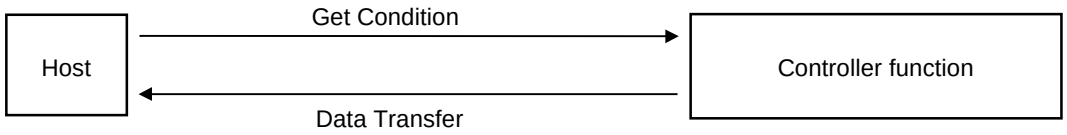

Fig. 5-5 Data Transfer

Table 5-1 Data transmission to host (host's memory image)

Data Address	Data	Setting example	Description
+0000	Command code	08h	Specifies Data Transfer.
+0001	Destination AP	00h	Specifies device of port A.
+0002	Origin AP	20h	No expansion device
+0003	Data size	03h	Data size is 12 bytes.
+0004	Function type	00h	The function type specifies the controller.
+0005		00h	
+0006		00h	
+0007		01h	
+0008	Read format	FFh	According to the controller format, the controller's data is stored. The blocks to be used have been declared already by the device ID.
+0009		FFh	
+000a		00h	
+000b		00h	
+000c		80h	
+000d		80h	
+000e		80h	
+000f		80h	

Get Condition

Issuing right : Host
Command code : 09h
Data size : 01h
Data field : Function type : 4 bytes
Specifies the controller (00-00-00-01h).
Expected return value : [Data Transfer]
Description : This command requests the physical status (buttons, keys, lever statuses) of the controller function.
Used when the Dreamcast Gun key data should be read.

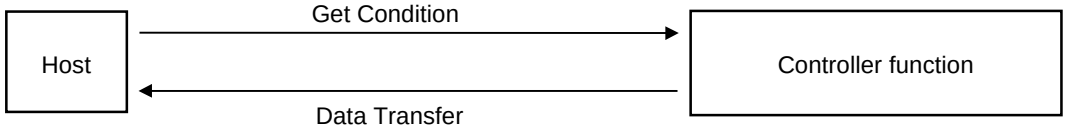

Fig. 5-6 Get Condition

Table 5-2 Data transmission from host (memory image)

Data Address	Data	Setting example	Description
+0000	Command code	09h	Specifies Get Condition.
+0001	Destination AP	20h	Specifies device of port A.
+0002	Origin AP	00h	Send from Port A.
+0003	Data size	01h	Data size is 4 bytes.
+0004	Function type	00h	The function type specifies the controller.
+0005		00h	
+0006		00h	
+0007		01h	

5.2 Error commands

The error command types supported by the Light-Gun function number only 4.

Transmit Again

Issuing right	: Host, Light-Gun function
Command code	: FCh
Data size	: 00h
Data field	: none
Description	: This command is used to request that data be transmitted again when the data contained some kind of error. However, the data from the Light-Gun is constantly updated. Therefore, there is no guarantee that the contents of the Light-Gun read data will be returned in the case of an error.
Possible causes	: (1) Parity error was generated. (2) Data overflowed. (3) Data became jumbled during communication. (4) Others
Remedies	: Send again (maximum of 3 times; subsequent attempts are processed as Time out).

Command Unknown

Issuing right	: Light-Gun function
Command code	: FDh
Data size	: 00h
Data field	: none
Description	: This command is returned when the Light-Gun function does not support the command sent.
Possible causes	: (1) Mistaken specification of command. (2) Data is written incorrectly. (3) Data of device ID is jumbled. (4) Data became jumbled during communication.
Remedies	: (1) Specify command correctly. (2) Write data correctly. (3) Resend Device Request to obtain device ID. (4) Send again (maximum of 3 times; subsequent attempts are processed as Time out).

Function Type Unknown

Issuing right	: Peripheral
Command code	: FEh
Data size	: 00h
Data field	: none
Description	: This command is returned when a function type other than the Light-Gun function is sent.
Possible causes	: (1) Mistaken specification of function type. (2) Data is written incorrectly. (3) Data of device ID is jumbled. (4) Data became jumbled during communication.
Remedies	: (1) Specify function type correctly. (2) Write data correctly. (3) Resend Device Request to obtain device ID. (4) Send again (maximum of 3 times; subsequent attempts are processed as Time out).

6 PROTOCOL FLOW

This chapter explains the basic transmission protocols used for the host and Dreamcast Gun.

6.1 Confirming connections in the initial state

The initial state resulting from power being supplied, hot connect-disconnect, or Device Kill, accepts only Device Request.

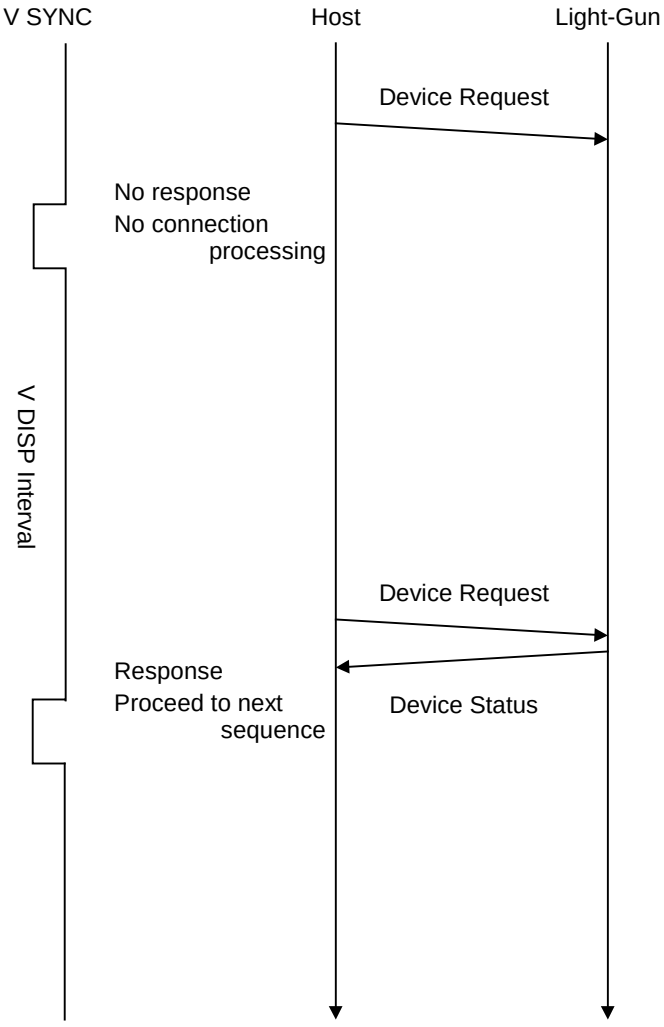

Fig. 6-1 Default configuration connection check

6.2 SDCKB exclusive mode

This section describes the order of monopolizing the SDCKB. The SDCKB is only monopolized when On is detected from the trigger.

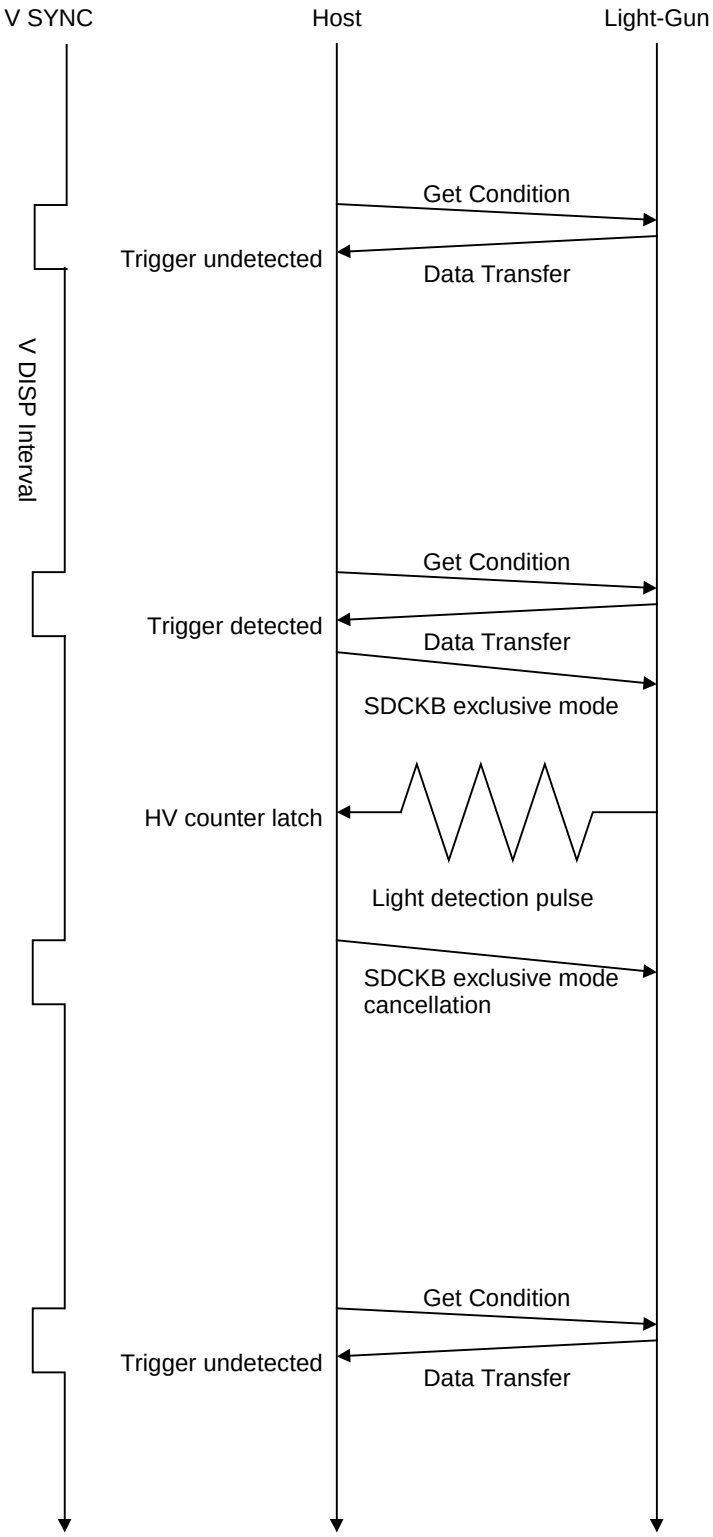

Fig. 6-2 SDCKB monopolization order

7 Dreamcast Gun INFORMATION

This chapter explains device-specific information (device statuses).
Data is recorded as is in order to prevent device statuses from being rewritten or erased.
* The details of the Fixed Device Status are pending.

7.1 Types

Fixed Device Status

This is a set form of device status that must be designated. It consists of a 112 byte format.
Operation and connection cannot be guaranteed unless all items are designated.

Free Device Status

This device status can be freely used by the individual devices.
The volume is a maximum of 908 bytes.

7.2 Fixed Device Status

The Fixed Device Status must designate all of the following items.

① Device ID

Capacity	: 16 bytes	
Description	: Function type	"FT_0", "FT_7"
	1st function definision	Light-Gun function definition
	2nd function definision	Ua, Da, Ra, La, A, B, Start
	3rd function definision	None
Data	:	

② Destination

Capacity : 1 bytes
Description : ~~Worldwide~~
There are two types: one for North America, and one for "worldwide."
Data : ~~FFh~~
North America: 01h/Worldwide: FFh

③ Connection direction

Capacity	: 1 byte	
Description	: Expantion socket	Downward
Data	: 01h	

④ Product name

Capacity : 30 bytes
Description : This designates "Dreamcast Gun" in English or romaji.
A space code (20h)is inserted for unused space.

⑤ License

Capacity : 60 bytes
Description : This designates the product license.
"Produced By or Under License From SEGA ENTERPRISES,LTD" is designated.
A space code (20h)is inserted for unused space.

⑥ Standby current consumption

Capacity : 60 bytes
Description : 22.0mA
Data : 00h-DCh

⑦ Maximum current consumption

Capacity : 2 bytes
Description : 30.0mA
Data : 01h-2Ch

7.3 Free Device Status

The Free Device Status area is available for product planners, developers, designers and programmers to enter any information they wish. The host obtains this status by the All Device Request.

~~The Free Device Status for Dreamcast Gun is~~

~~"Version 1.000,1998/09/16,315-6125-AG ,U,D,L,R,S,A,B Key & Scanning Line".~~

The contents of the Free Device Status differ, depending on the region:

- Worldwide

“Version 1.000,1998/09/16,315-6125-AG ,U,D,L,R,S,A,B Key & Scanning Line”

- North America

"Version 1.010,1999/04/26,315-6211-AN ,U,D,L,R,S,A,B Key & Scanning Line Amp."

8 AFTERWORD

Until the official version (Rev. 1.0) is distributed, contents will be modified to a small or large extent.