ENGINEERING CHANGE ORDER

Project Engineer	Stephen L. Robinson	Number 03-	
Change Requested By	Stephen L. Robinson	Cross Ref. Doc. Type & Number: None	Page 1 of 1

Description of Change

Release of technical documentation for archive:

Sanyo Security Protocol Ver 1.02, Apr. 8, 1999

Reason for Change None

Scope of Change

- ☐ Changes Form, Fit, or Function
- ☐ Other performance enhancement
- ☒ Internal

Type of Change

- ☐ New Product
- ☐ Error
- ☐ Design Improvement
- ☒ Additional Info
- ☐ Cost Reduction
- ☐ Conform to Present Practices

Material Disposition

- ☒ None
- ☐ Scrap
- ☐ Rework
  - ☐ Finished Goods
  - ☐ Work In Progress
  - ☐ Stock
- ☐ Running Change

Documentation Affected

Product Model Number: None

Drawing Number	Old Rev	New Rev
None		

Approvals	Engineering Signature		Date
	Materials Signature		Date
Cost Impact	0	New Comp. Cost	0
Obsol. Impact	0	New Comp. Lead Time	0

Manager's Initials in Appropriate Box

☐ EWS ☐ Hot ☒ Normal

Required Tasks (use attachments if necessary)	Initials	Date
Manufacturing None		
Production None		
Materials None		
Stock Room None		
Sales / Marketing None		
Repair None		
Quality Assurance None		
Other None		

Memo to: SSP Licensees
From: Neil Heller
Date: 15 April 1999
Subject: SSP Ver1.02

Please find attached up to date SSP, Ver 1.02 (Issued Apr.8) It has been changed about some points and modified the mistake and added the commands for the camera.Please refer following detail points which were changed from last one(issued 21.Jan.).

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page 3 : *Note about the maximum node was deleted, because we could confirm maximum units 256.

page 15 : *[shift □ª] is not a command for VCR (Device category VR is -)

page 16 : *[T/D SEARCH-1][T/D SEARCH-2] are added .
*The camera commands [ZOOM T]□c.[CAM STATUS SENSE] are added.
*The command name are changed to [MPX STATUS SENSE] from [ALARM STATUS SENSE]
*[STATUS SENSE] and [ENTER] are command also for the camera. (Device category CM is x)

page 17 : *[ROM VER.] and [NAK] are added.

page 19 : *The explanation about the [ALARM SCAN] is added.
*[T/D SEARCH-1][T/D SEARCH-2] (delete [T/D SEARCH])are added.

page 20 : *The code about [TRACKING UP][TRACKING DOWN][TRACKING CENTER] are changed.

page 21 : *The explanation of byte 1 , byte 3 and bit 3,2 of Fourth byte, bit 3,0 of Fifth byte on T/L STATUS SENSE bit allocation are changed.

page 22 : *The explanation of bit allocation are changed.
First byte bit 7 and Fourth byte bit 3.

page 23 : *(NOTE 1) about the limit of the data is added.

page 24 : *[RS232C TABLE ON][RS232C TABLE OFF][VCR INQUIRY]are added.

page 25 : *Command name is changed to [MPX STATUS SENSE] from [ALARM STATUS SENSE]
Data will be six byte instead of five.

page 27 : *(NOTE 1) about the limit of the data is added.
*The bit 4 of STATUS data bit allocation is changed.
*Camera commands [ZOOM T].[AWC RESET] are added.

page 28 : *[CONTINUOS][CONCLUSION]are added.

page 29 : *(NOTE 1) about the limit of the data is added.
*STATUS data bit allocation is added.
*[STATUS SENSE]is added.

page 30 : *[CAM STATUS SENSE][ACK][NAK]are added.

page 31 : *Command for Controller [STATUS SENSE]is added.
*The explanation about [GRAUP SET] is added.

page 32 : *The explanation about [GRAUP CLEAR] is added.

SANYO

Security Serial Protocol

Ver1.02

Issued on 8 Apr.1999

Copy 002A

SANYO Electric Co. ,Ltd.
Multi Media Company
Video Imaging Systems Division
Product Planning Department

□ RS485 Serial Control Protocol □

□□Outline of Prescriptions on Communication

1)Electrical Specification : RS-485

2) Total Maximum Nodes : 256 nodes
¥Device Category Nodes : Up to 8 nodes
(Note : Devices of the same kind category are connected to the bus line with the exception of Controller : Up to 128 nodes.)
¥Controller Nodes : Up to 5 nodes
¥Grouping : Up to 15 groups
(Note : Any group can be consist of any kind of category device.)

3) Two wire system : Twisted pair cable
(Note : The RJ-11 or Pushed lock terminal are used for the connector)

4) Transmission distance : Theoretically Up to 1.2km (4000 ft) with more thicker cable than 26 AWG.
(Note : Transmission distance is depend on the material of the wire and condition of wiring, therefore distance is just theoretical figure.)

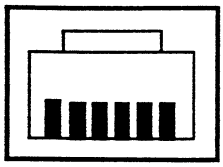
5) Transmission system : Half-duplex

6) Data format
Data Transfer System : asynchronous start-stop system
Character length : 1 start bit, 8 bit data, None parity bit, 1 stop bit
Baud rate (selective) : 2400, 4800, 9600, 19200 bits per second

7) Bus system : Bi-directional

8) Wire Connection : Daisy chain

*RJ-11 terminal



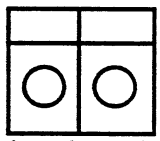
1 2 3 4 5 6

(OUTSIDE VIEW)

* Pin assignment

	Terminal A	Terminal B
1pin	NC	NC
2pin	NC	NC
3pin	A□signal	B□signal
4pin	B□signal	A□signal
5pin	NC	NC
6pin	NC	NC

*Push lock terminal



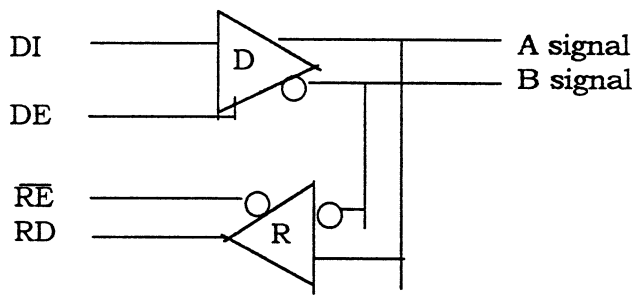
A signal B signal

(OUTSIDE VIEW)

* Connection

To connect one device to the other device,
A signal should be connected to A signal
And B signal should be connected to B signal.

*Interface of the terminal on the device (Driver IC : MAX3082XSA)



□□Outline of SANYO communication protocol

1)Outline of address system

An address code peculiar to each device is consist of 2 bytes(16 bits) code. The first byte of each device indicates the device category and the second byte of it indicates the device address or the broadcast.(User can only set the device address.) The total 128 address codes from 00H to 7FH can be allocated separately to each device and the same address number can be assigned when used in the different device category.

For example: [VCR 01, MPX 01, CAM 01 etc.]

(Note : The same address code cannot be allocated within the identical device category.)

Maximum nodes connected to the bus line are limited up to 256 ones. That is why a system configuration with 120 VCRs, 120 cameras,3 multiplexers and 5 controllers [Total 248 nodes] is theoretically possible, however as the total device nodes in the identical category is limited up to 128 nodes the system configuration with 70 VCRs, 140 cameras and 1 controller[Total 211 nodes] is not possible.

(Note : Up to 5 controller can be connected to the same bus line)

2)Broadcast communication

The device address code of "1110****" in the second byte has been reserved as the broadcast address and the broadcast communications are available for both the all devices connected to the bus line and each group(total grouping are available up to 15).

User can make freely the setting of each group configuration and can do the broadcast communication for the each group.

3)Detail description of the address assignment

3-1)**The first byte : Device Category Code** : 1111 XXXX(User cannot set this code)

a)All device category : 1111 0000
b) Controller : 1111 0001
c) Multiplexer : 1111 0010
d)VCR : 1111 0011
e)Camera : 1111 0100
1111 0101
f) Reserved for Extension : 1111 0110
1111 0111
1111 1000
g)Not used : |
1111 1111

(Note : Totally 8 kinds of devices are available.)

3-2)**The second byte : For each device address or the broadcast communication**

a) Each device address : 0000 0000 (00H □ 7FH)
|
: 0111 1111

(Note : The total 128 address codes from 00H to 7FH can be allocated separately to each device. Up to 5 address codes from 00H to 04H can be assigned for Controller.)

b)Broadcast communication : 1110 XXXX
b-1)For any devices on the bus line : 1110 0000
b-2)For any devices within each group : 1110 0001 (For Group 1)
□
: 1110 1111 (For Grope 15)

(Note : Up to 15 address codes from E1H to EFH can be allocated to any group.)

□ **Address designation for the individual device:**

First byte								Second byte							
1	1	1	1	X	X	X	X	0	X	X	X	X	X	X	X
(Device category code)								(Individual device address)							

(Note: The upper 4 digits(half byte) from MSD of the first byte is used for *both the header* identification *and the device category code*.)

□ **Address designation for the broadcast communication:**

First byte								Second byte							
1	1	1	1	X	X	X	X	1	1	1	0	X	X	X	X
(Device category code)								(Individual device address)							

(Note: The upper 4 digits(half byte) from MSD of the first byte is used for both the header identification and the device category code.)

□ **Examples**

Ex.1) Multiplexer No.5

First byte								Second byte							
1	1	1	1	0	0	1	0	0	0	0	0	0	1	0	1
(Multiplexer category code)								(Multiplexer address No.5)							

Ex.2) Broadcast to all VCRs on the bus line

First byte								Second byte							
1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0
(VCR category code)								(Broadcast for any device on the bus line)							

Ex.3) Broadcast to all VCRs within Group No.3

First byte								Second byte							
1	1	1	1	0	0	1	1	1	1	1	0	0	0	1	1
(VCR category code)								(Broadcast for any device in Group No.3)							

Ex.4) Broadcast for all devices on the bus line

First byte								Second byte							
1	1	1	1	0	0	0	0	1	1	1	0	0	0	□	□
(All device category address)								(Broadcast for any device on the bus line)							

3. Detail description of communication protocol

3-1.The Process of Point-To-Point Communication

The process of the point to point communication is prescribed in this clause.

(1) Process of Sending Point-To-Point Data

1. **Ascertaining if the Bus Line is free:**

A sending device should make sure the Bus Line is free in the beginning that is there is no data on it for not less than 170 milliseconds.

2.**Ascertaining if no data collision occurs:**

2-1)When the Bus Line is free, a sender outputs the first byte of its own address(**Device Category Code**) on the Bus. The sender itself receives that code. If it is different from the issued one then the waiting process on the data collisions on the Bus described in the clause of 3-3. is being executed consecutively after that the sender returns to the process described in the first place of this paragraph.

2-2)When there is no data collision of the first byte of the sender's own address, the sender issues the second byte of its own address(**Device Address**) again within the period of time from not less than 15 to not more than 50 milliseconds after outputting the first byte.

The sender receives the code and if it is different from the issued one then the waiting process is being executed consecutively. After that the sender returns to the process described in the first place of paragraph 2-1).

3. **Sending the designated receiver's address & Ascertaining the overlapping of the address:**

3-1)In case there are no data collisions of the sender's own address, the sender outputs the **first byte(Device Category Code) of the designated receiver's address** on the Bus Line within the period of time from not less than 15 to not more than 50 milliseconds after outputting the second byte of its own address.

The sender should make sure if there is the overlapping of the address before outputting the second byte(**Device Address**) of the designated receiver's address.

a) If the **[Receive check(FEH)]** code is received then the overlapping of the address is recognized to be occurred. After that the communication will be suspended.

b) If any code is not received then it is recognized for no overlapping of the address to occur. The ascertainment at the sending side is to be completed. Further communication process will be continued.

3-2)The sender outputs the second byte(Device Address) of the designated receiver's address on the bus within the period of time from not less than 15 to not more than 50milliseconds after outputting the first byte of the designated receiver's address.

Then the sender is waiting the **[Receive check(FEH)]** code from the receiving device.

3-3)In waiting the **[Receive check(FEH)]** code the sender executes the following process in less than 100 milliseconds.

a) If the only one **[Receive check(FEH)]** code is received then the sender outputs the **[Transmission start(FDH)]**code on the Bus Line and it will wait the **[ACK(0AH)]** code from the receiving device.

[Transmission start(FDH)]code should be output in less than 100 milliseconds after outputting the Second Byte of Recorder(Device Address),and moreover **[Transmission start(FDH)]**code should be output within 50ms after receiving the **[Receive check(FEH)]** code.

If the second **[Receive check(FEH)]** codes is received before outputting the **[Transmission start(FDH)]**code, then they are recognized for the overlapping of the address to occur and after that the communication will be suspended.

b) If the code other than the **[Receive check(FEH)]** is received, then they are recognized for the communication error to occur and after that the communication will be suspended.

4.**Waiting the [ACK(0AH)] code & Establishing the communication:**

4-1)After the sender goes into the waiting the **[ACK(0AH)]** code mode from the receiving device if it receives the following data within 100 milliseconds;

a)If no data is received or if the code other than the **[ACK]** is received, then they are recognized for the communication error to occur and after that the communication will be suspended.

b)If the **[ACK]** code is received then the communication between the sending device and the designated receiver has been established and the further process will be proceeded.

□ The communication protocol between the individual device after this are provided separately for each device.

4-2)After establishing the communication between the sending device and the designated receiver within the period of time from not less than 15 to not more than 100 milliseconds the sender should output the command.

4-3)If the sender will proceed the communication with the same designated device after having received the response(like **[ACK]**), it should continue to output the further command within the period of time from not less than 15 to not more than 100 milliseconds.

In case of outputting the commands successively its interval must be within the period of time from not less than 15 to not more than 100 milliseconds.

4-4)In the sender's waiting the **[ACK(0AH)]** code from the receiving device if the Bus Line is free for not less than 130 milliseconds during the communication then it is recognized for the communication to be interrupted and the code or the data being transmitted are annulled.

5. In some special commands for instance like as **[COUNT CODE(D0)], [HEAD TIME(D2)], [STATUS SENSE(D7)], [GROUP CHECK(6D)]**, more than two bytes data will be returned.

(2) Process of Receiving Point-To-Point Data

1. A receiving device should be making sure if there is no data on the Bus Line for not less than 150 milliseconds.

2. When the receiving device receives the data during making sure Bus Line is free, it examines first if it is **the first byte(Device Category Code) of a sending device**.

a) If the received data is any one of "F1H" through "F7H"then they are recognized to be **the first byte(Device Category Code)** of a sending device. And then the receiver is waiting for the next data.

b) If the received data is other code than "1H" through "7H" then the receiver returns to the process described in the first place of paragraph 1.

3. When the receiving device receives the next data within 100 milliseconds after having recognized the first byte of a sending device, it examines if it is **the second byte(Device Address) of a sending device**.

a) If the received data is any one of "00H" through "7FH" then they are recognized to be **the second byte(Device Category Code)** of the sending device. And then the receiver is waiting for the next data.

b) If the received data is other code than "00H" through "7FH" or If any code is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

4.When the receiving device receives the next data in less than 100 milliseconds after receiving the second bytes of a sending device then it will make sure that is same code as **the first byte(Device Category Code)** of the receiver's own address.

a)If the received data is same as **the first byte(Device Category Code)** of its own address then the receiving device is waiting for the next data.

b) If the received data is the [**All Device Category Code "F0H"**] then the receiving device will do the process of receiving broadcast data which is described later.

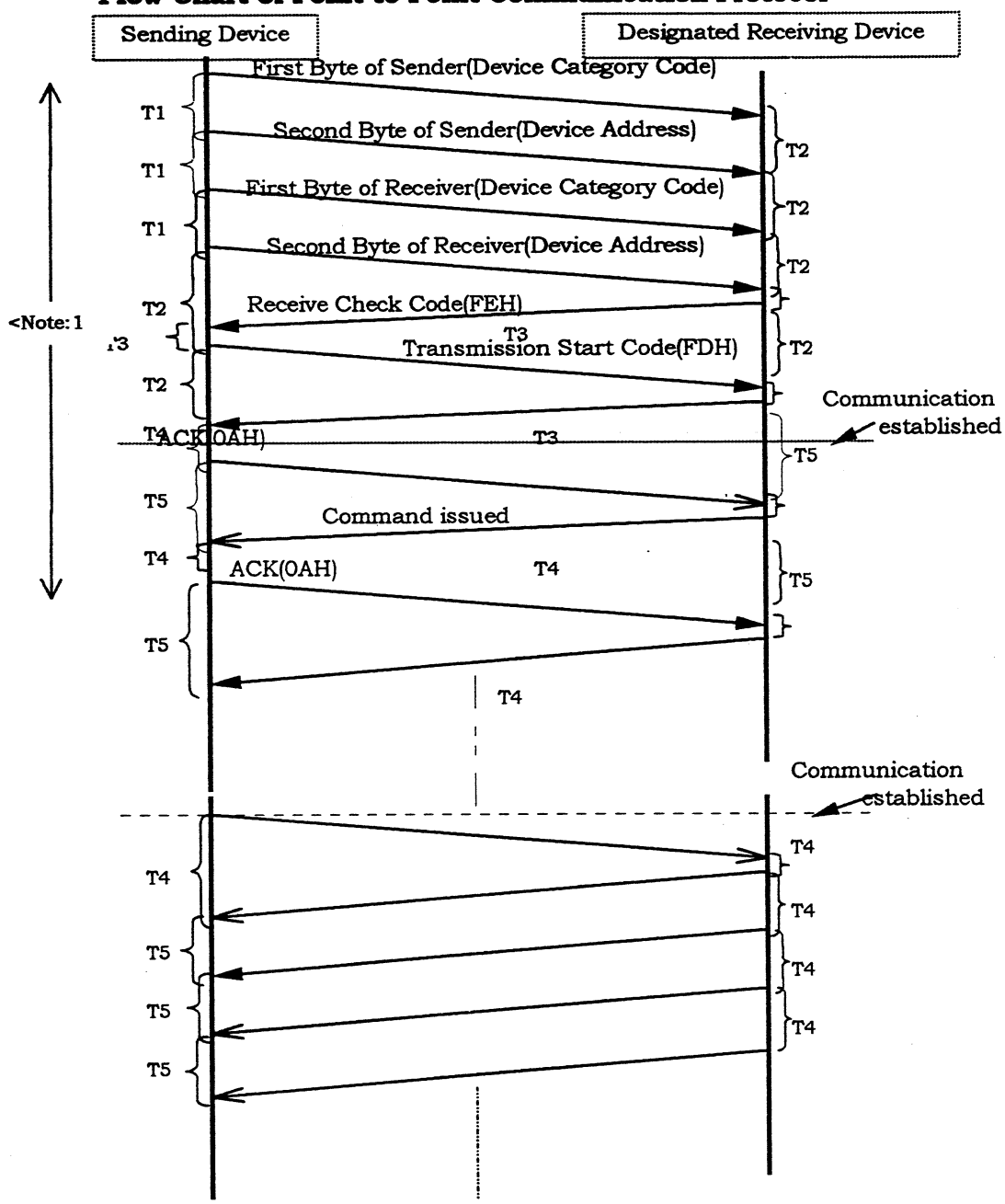
receiver's own address or if any data is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

5. When the receiving device receives the next data in less than 100 milliseconds after having recognized its own first byte to be output, then it will make sure if that data is the same as either **the second byte(Device Address)** of receiver's own address or the broadcast address.
   a) If the received data is same as the second byte then within 50 milliseconds the receiver should output the **[Receive Check(FEH)]** code and is waiting for the **[Transmission Start(FDH)]** code.
   b) If the received data is same as any one of the broadcast codes of "E0H" through "EFH" then the receiving device will do the process of receiving broadcast data which is described later.
   c) If the received data is different from the second byte of the receiver's own address or if any data is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

6. In waiting the **[Transmission Start(FDH)]** code when the receiver receives the following data in less than 100 milliseconds;
   a) If the **[Transmission Start(FDH)]** code is detected then in less than 50 milliseconds the receiver should output the **[ACK]** code and is waiting for the command from the sender.
   b) If the code other than **[Transmission Start(FDH)]** is received or if any code is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

7. After the communication between the sending device and the receiving device is established, when the receiving device is waiting for the coming command the following process is performed.
   a) If the command from the sender is received within 130 milliseconds then the receiver should transmit the command like the **[ACK]**code to the sender within the period of time from not less than 15 to not more than 100 milliseconds.
   b) If the special command defined separately is received within 130 milliseconds then the receiver should output the number of command or data successively which is defined for each command within the period of time from not less than 15 to not more than 100 milliseconds.
   c) If any command is not received in less than 130 milliseconds then it is recognized for the communication to be interrupted and the code or the data being sent or received are annulled.

Flow Chart of Point to Point Communication Protocol



Note: T1(15ms□T1□50ms), T2(T2□100ms), T3(T3□50ms), T4(15ms□T4□100ms), T5(T5□130ms),

<Note:1> Based on the above chart it takes about 390 through 580 milliseconds for any one command to be completed, for example this is the case the controller issues "PLAY" command and receives ACK from VCR.

3-2.The Process of Broadcast Communication

The process of the broadcast communication of which purpose is to transmit a command or message to all devices in a designated device category or group connected to the bus is prescribed in this clause.

The command requiring the individual device to respond cannot be issued with the broadcast communication.

(1) Process of Sending Broadcast Data

1. **Ascertaining whether the bus line is free:**
A sending device should be making sure if there is no data on the bus line for not less than 170 milliseconds.

2.**Ascertaining whether the no data collision occurs:**

2-1)When the bus line is free, the sender issues the first byte of its own address**(Device Category Code)** on the bus line. The sender itself receives this code and if the received code is different from the issued one then the waiting process on the data collisions on the bus described in clause of 3-3. is being executed consecutively. After that the sender returns to the first place of the process described in this paragraph.

2-2)When there is no data collision of the first byte of the sender's own address, the sender issues **the second byte of it(Device Address)** within the period of time from not less than 15 to not more than 50 milliseconds after outputting the first byte . The sender receives them and if the their code is different from the issued one then the waiting process on the data collisions is being executed consecutively. After that the sender returns to the first place of the process described in the paragraph.2-1)

3.**Ascertaining whether the overlapping of the address occurs:**

In case there are no data collisions of the sender's own address, the sender outputs **the first byte(Device Category Code)** of the designated receiver's address within the period of time from not less than 15 to not more than 50 milliseconds after outputting the second byte of its own address. During that period the sender checks if there is an overlapping of the address.

a) If the sender receives the **[Receive check(FEH)]** code, then it recognizes the overlapping of the address occurs. After that the communication will be suspended.

b) If any code are not received by the sender, then the sender recognizes no overlapping of the address. The ascertaining process at the sending side is to be completed. Further communication will be continued.

4. **Sending the designated receiver's address:**

4-1)In case that there are no data collision of both the first and second bytes of the sender's own address, the sending device issues **the first byte(Device Category Code)** of the designated receiver's address on the bus as the broadcast code.

4-2)After that the sending device issues **the second byte(Broadcast Code)** of the designated device address which is one of sixteen codes from (E0H) to (EFH) within the period of time from not less than 15 to not more than 50 milliseconds.
In this case each device will not answer any response like the **[ACK]**.

5. The sender should output the broadcast command within the period of time from not less than 15 to not more than 100 millisecond after having transmitted the broadcast code and finish the broadcast communication. In the broadcast communication any command cannot be issued continuously except **[STATUS" command (BCH-BFH)]**.

6. It is possible for the status data to be issued successively after **[STATUS]** command. In this case the data should be sent within the period of time from not less than 15 to not more than 100 milliseconds after the **[STATUS]** command having been issued.

7. If some data or codes are recognized on the bus line during the sender's issuing the

error process.
The transmitted code as not having been recognized will be annulled.

8.To make the further broadcast communication again, return to the step 1 in this paragraph.

(2)Process of Receiving Broadcast Data

1. A receiving device should be making sure if there is no data on the bus line for not less than 150 milliseconds.

2. When the receiving device receives the data during making sure the bus line is free, it examines first if it is **the first byte(Device Category Code)** of a sending device.
   a)If the received data is any one of "F1H" through "F7H"then they are recognized to be **the first byte(Device Category Code)** of the sending device. And then the receiver is waiting for the next data.
   b)If the received data is other code than "F1H" through "F7H" then the receiver returns to the process described in paragraph 1.

3.When the receiving device receives the next data within 100 milliseconds after having recognized **the first byte(Device Category Code)** of a sending device, it examines if it is **the second byte(Device Address)** of a sending device.
   a)If the received data is any one of "00H"through "7FH" then they are recognized to be **the second byte(Device Category Code)** of the sending device. And then the receiver is waiting for the next data.
   b) If the received data is other code than "00H" through "7FH" or If any code is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

4.When the receiving device receives the next data in less than 100 milliseconds after receiving the second byte of a sending device then it will make sure that is same code as **the first byte(Device Category Code)** of the receiver's own address.
a)If the received data is same as **the first byte(Device Category Code)** of its own address then the receiving device is waiting for the next data.
b)If the received data is the **[All Device Category "F0H"]** then the receiving device will do the process of receiving broadcast data which is described later.
c)If the received data is different from **the first byte(Device Category Code)** of the receiver's own address or if any data is not received in less than 100 milliseconds then the receiver returns to the process described in paragraph 1.

5. When the receiving device receives the following broadcast codes(from E0H to EFH) in less than 100 milliseconds after having recognized its own **first byte(Device Category Code)** or **all Device Category "F0H"** to be output, the receiving device is waiting the broadcast command.
a) If the received data is "E0H"(the broadcast communication for any device on the bus line), the receiving device is waiting the broadcast command.
b)If the received data is same as any one of the group broadcast codes of "E1H" through "EFH" and if that received data is same code as the group in which the receiver is registered, then the receiving device is waiting for the broadcast command .(For instance :If the device is belong to Group 2, the received code should be "E2H".)
c) If the received data is same as the second byte of the receiver's own device address, in this case the process of receiving Point-To-Point Data is executed. But in case the **all Device Category "F0H"** has been recognized and if any other type of code than the broadcast code are received as the second byte, it is considered to be error and the receiver returns to the process described in paragraph 1.
d)If the received data is different from the second byte of the receiver's own address or different from any **broadcast code (E0H□EFH)** or if any data is not received within less than 100 milliseconds, then the receiver returns to the process described in

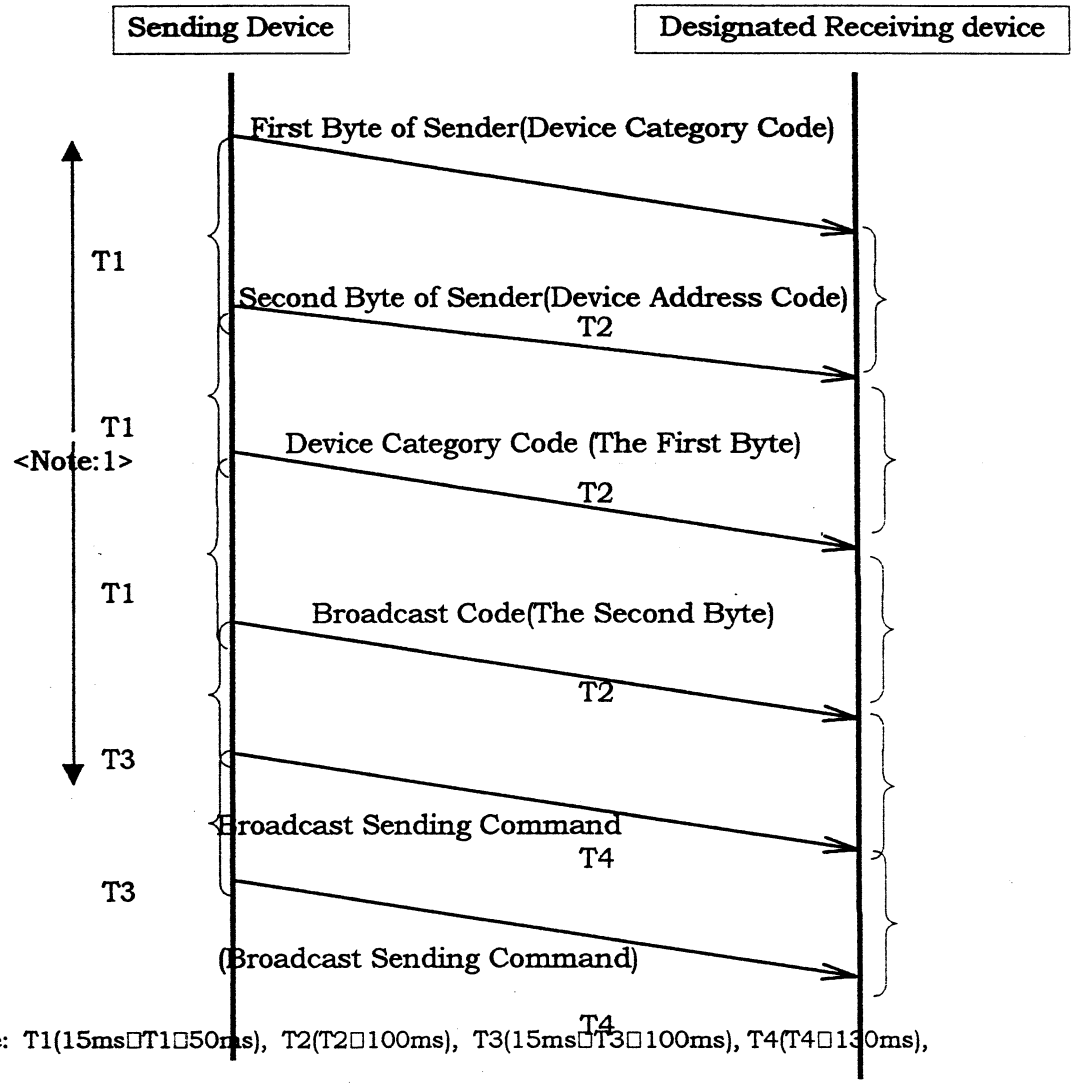
6.If the device receive the command in less than 130 millisecond when it is waiting the broadcast command, then it will be regard as broadcast command.
The receiving device will stop the waiting the broadcast command if any one command is received, except **[STATUS command (BCH-BFH)]**.

7.If the device receives the **[STATUS" command (BCH-BFH)]**, other data should be received in less than 130 millisecond after that.

8.The individual designated device will not answer any response like the **[ACK]** code even if it receives the broadcast address and command.

9.If the bus goes to be free for not less than 130 millisecond after receiving the broadcast address, then it is recognized for the broadcast communication to be interrupted and finish the waiting status of the broadcast command.

Flow Chart of broadcast Communication Protocol



Note: T1(15ms□T1□50ms), T2(T2□100ms), T3(15ms□T3□100ms), T4(T4□130ms),

<Note 1>

Based on the above chart it takes about 60 through 250 milliseconds for any one command to be completed by broadcast, for example this is the case the controller issues "PLAY" command to VCR.

3-3.Waiting Process When Data Collision Occurs On The Bus

When a sending device will try to start to communicate with the designated device, if it receives a different code from its own issued one then it is recognized that the data collision on the bus occurs. In this case after it waits the processing time described in this clause and then it is issuing **the first byte(device category code)** of own address again to try to establish the communication with the designated device.

Before proceeding the waiting process from 1 to 3 below , the sending device should confirm that the bus line is free for not less than 150 milliseconds.

(Note : This process is applied to data collisions on both the first byte and the second byte of the sending device's own address respectively.)

1. First a sender execute the following process. It is issuing **the first byte(device category code)** of own address again after waiting for the period of the calculated result of this process.
   1 A sender make an operation of shifting the first byte of own address code to the left (to the upper digit side) by 2 bits and then setting the shifted lower 2 bits to"00". This calculation makes a new 8 bit data.
   2 It makes another operation of subtracting 1 from the lower half byte(the lower 4 bits) of own device category code and then extracting the lower 2 bits from the former result. This calculation makes another new 8 bit data.
   3 It makes the other operation of logical adding with using the above two 8 bit data and then multiply 50msec by the result of this logical adding 8 bit data.
   □[The Logical Add of the results of□and□] X [5msec](+0□25msec)□
   After waiting for the period of getting this value it is issuing the first byte of own address again

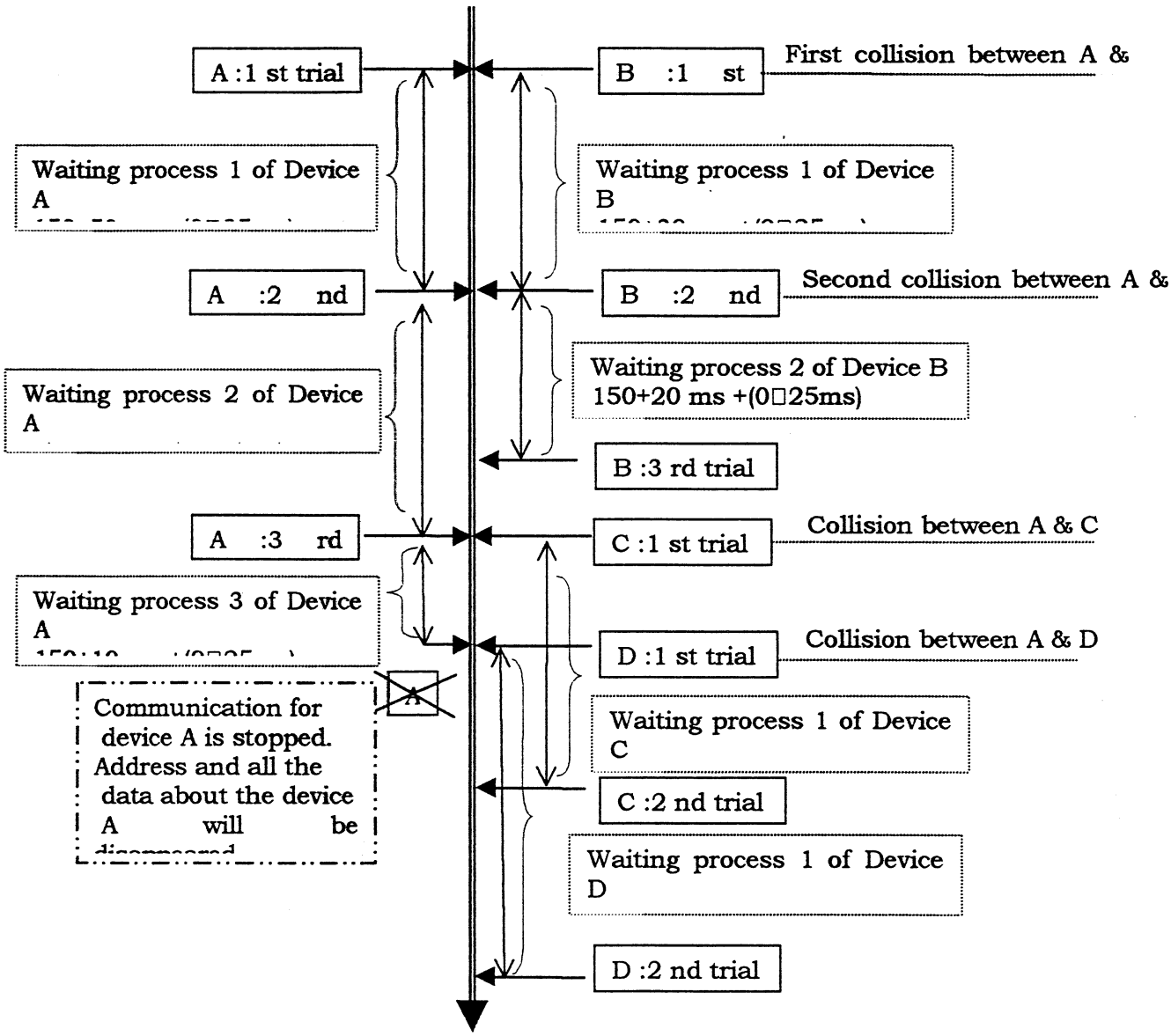
2.If the data collision on the bus occurs again after executing the process of item 1 then the sender is issuing the first byte of own address again after waiting for the period of the calculated result of the following process.
   1 It makes an operation of shifting the first byte of own address code to the left(to the upper digit side) by 2 bits and then setting the shifted lower 2 bits to "00". This calculation makes a new 8 bit data.
   2 It makes another operation of subtracting 1 from the lower half byte(the lower 4 bits) of own device category code and further shifting that result to the right(to the lower digit side) and then extracting the lower 2 bits from the former result. This calculation makes another new 8 bit data.
   3 It makes the other operation of logical adding with using the above two 8 bit data and then multiply 50msec by the result of this logical adding 8 bit data.
   □[The Logical Add of the results of□and□] X [5msec](+0□25msec)□
   After waiting for the period of getting this value it is issuing the first byte of own address again.

3. If the data collision occurs yet again after executing the process of item 1 and 2, the sender is issuing the first byte of own address again after waiting for the period of the result of following calculation.
   [Sender's device category code(half byte) □5msec](+0□+25msec)

4. After executing the processes of item 1, 2, and 3 if there will be being the data collision then the sender is proceeding the error process and after that the further communication is being stopped.
   The error process is prescribed in the individual device communication process.

Note: With above calculation, the waiting time is depend on the category and address of each devices, therefore even if one collision is happened, in most of case the collision should be solved after the waiting process.
But if a lot of collisions are happened at the same time, above three times of retry could not be enough.
After the 3 rd trial, if the other collision is still happened, the communication will be stopped and all address and all data which on the way to send will be disappeared.

[Example of the waiting process]
Ex : device A = VCR address:002 B = VCR address001
C = Multiplexer address 001 D = Camera address 001



4 COMMAND FOR CONTROL

COMMAND FROM CONTROLLER		RETURN FROM DEVICE		DEVICE CATEGOLY			CONTROL		COMMAND TYPE	
NAME	CODE (H)	MANE	CODE (H)	VR	MX	CM	RS 485	RS 232C	PtoP	Broad cast
PLAY	3A	ACK	0A	X	-	-	X	X	X	X
STOP	3F	ACK	0A	X	-	-	X	X	X	X
REV PLAY	4A	ACK	0A	X	-	-	X	X	X	X
STILL	4F	ACK	0A	X	-	-	X	X	X	X
EJECT	A3	ACK	0A	X	-	-	X	X	X	X
FF	AB	ACK	0A	X	-	-	X	X	X	X
REW	AC	ACK	0A	X	-	-	X	X	X	X
TRACKING +	50	ACK	0A	X	-	-	X	X	X	X
TRACKING-	51	ACK	0A	X	-	-	X	X	X	X
TRACKING CENTER	52	ACK	0A	X	-	-	X	X	X	X
TIMER ON/OFF	60	ACK	0A	X	-	-	X	X	X	X
AUDIO/SEARCH	22	ACK	0A	X	-	-	X	X	X	X
COUNTER RESET	E2	ACK	0A	X	-	-	X	X	X	X
COUNTER MEMORY	E3	ACK	0A	X	-	-	X	X	X	X
MENU	74	ACK	0A	X	X	X	X	X	X	X
SHIFT □	53	ACK	0A	X	X	X	X	X	X	X
SHIFT □	63	ACK	0A	X	X	X	X	X	X	X
SHIFT □	54	ACK	0A	-	X	X	X	X	X	X
SHIFT □	64	ACK	0A	X	X	X	X	X	X	X
SET+/RP UP	65	ACK	0A	X	X	-	X	X	X	X
SET-/RP DOWN	66	ACK	0A	X	X	-	X	X	X	X
SECURITY LOCK ON	69	ACK	0A	X	X	-	X	X	X	X
SECURITY LOCK OFF	6A	ACK	0A	X	X	-	X	X	X	X
POWER ON/OFF	7B	ACK	0A	X	X	-	X	X	X	X
SET ON	7C	ACK	0A	X	X	-	X	-	X	X
SET OFF	7D	ACK	0A	X	X	-	X	-	X	X
CLOCK ADJUST	E0	ACK	0A	X	X	-	X	X	X	X
MENU RESET	E1	ACK	0A	X	X	-	X	X	X	X
NEXT	75	ACK	0A	-	X	-	X	X	X	X
EXIT	76	ACK	0A	-	X	-	X	X	X	X
LIVE	80	ACK	0A	-	X	-	X	X	X	X
VCR PB	81	ACK	0A	-	X	-	X	X	X	X
MULTI	82	ACK	0A	-	X	-	X	X	X	X
QUAD	83	ACK	0A	-	X	-	X	X	X	X
PLUS	84	ACK	0A	-	X	-	X	X	X	X
ZOOM	85	ACK	0A	-	X	-	X	X	X	X
STILL	86	ACK	0A	-	X	-	X	X	X	X
SEQUENCE	87	ACK	0A	-	X	-	X	X	X	X
MON 2	88	ACK	0A	-	X	-	X	X	X	X
FULL 1	90	ACK	0A	-	X	-	X	X	X	X
FULL 2	91	ACK	0A	-	X	-	X	X	X	X
FULL 3	92	ACK	0A	-	X	-	X	X	X	X
FULL 4	93	ACK	0A	-	X	-	X	X	X	X
FULL 5	94	ACK	0A	-	X	-	X	X	X	X
FULL 6	95	ACK	0A	-	X	-	X	X	X	X
FULL 7	96	ACK	0A	-	X	-	X	X	X	X
FULL 8	97	ACK	0A	-	X	-	X	X	X	X
FULL 9	98	ACK	0A	-	X	-	X	X	X	X
FULL 10	99	ACK	0A	-	X	-	X	X	X	X
FULL 11	9A	ACK	0A	-	X	-	X	X	X	X
FULL 12	9B	ACK	0A	-	X	-	X	X	X	X
FULL 13	9C	ACK	0A	-	X	-	X	X	X	X
FULL 14	9D	ACK	0A	-	X	-	X	X	X	X
FULL 15	9E	ACK	0A	-	X	-	X	X	X	X
FULL 16	9F	ACK	0A	-	X	-	X	X	X	X

COMMAND FROM CONTROLLER		RETURN FROM DEVICE		DEVICE CATEGOLY			CONTROL		COMMAND TYPE	
NAME	CODE (H)	MANE	CODE (H)	VR	MX	CM	RS 485	RS232C	PtoP	Broad Cast
ALARM SEARCH WITH DATA + ENTER + FF/REW	B0	ACK	0A	X	-	-	X	X	X	-
		COMPLETION	01							
		NOT TARGET	05							
ALARM SCAN WITH FF/REW	B1	ACK	0A	X	-	-	X	X	X	-
		COMPLETION	01							
		NOT TARGET	05							
R/P SPEED SET WITH DATA + ENTER	7E	ACK	0A	X	-	-	X	X	X	-
T/D SEARCH-1 WITH DATA + ENTER + FF/REW	B2	ACK	0A	X	-	-	X	X	X	-
		COMPLETION	01							
		NOT TARGET	05							
T/D SEARCH-2 WITH DATA + ENTER + FF/REW	B3	ACK	0A	X	-	-	X	X	X	-
		COMPLETION	01							
		NOT TARGET	05							
REC WITH REC/DUB REQUEST	CA	ACK	0A	X	-	-	X	X	X	X
COUNT CODE	D0	DATA	-	X	-	-	X	X	X	-
HEAD TIME	D2	DATA	-	X	-	-	X	X	X	-
POWER ON TIME	D3	DATA	-	X	-	-	X	X	X	-
ZOOM T	10	ACK	0A	-	-	X	X	-	X	X
ZOOM W	11	ACK	0A	-	-	X	X	-	X	X
ZOOM ON	12	ACK	0A	-	-	X	X	-	X	X
ZOOM OFF	13	ACK	0A	-	-	X	X	-	X	X
IRIS +	14	ACK	0A	-	-	X	X	-	X	X
IRIS -	15	ACK	0A	-	-	X	X	-	X	X
IRIS CENTER	16	ACK	0A	-	-	X	X	-	X	X
ELS ON	17	ACK	0A	-	-	X	X	-	X	X
ELS OFF	18	ACK	0A	-	-	X	X	-	X	X
BLC ON	19	ACK	0A	-	-	X	X	-	X	X
BLC OFF	1A	ACK	0A	-	-	X	X	-	X	X
AWC SET	1B	ACK	0A	-	-	X	X	-	X	X
AWC RESET	1C	ACK	0A	-	-	X	X	-	X	X
CONCLUTION	1E	ACK	0A	-	-	X	X	-	X	X
CONTINUOUS	1F	ACK	0A	-	-	X	X	-	X	X
CAM STATUS SENSE	D4	DATA	-	-	-	X	X	X	X	-
MPX STATUS SENSE	D5	DATA	-	-	X	-	X	X	X	-
T/L STATUS SENSE	D6	DATA	-	X	-	-	X	X	X	-
STATUS SENSE	D7	DATA	-	X	X	X	X	X	X	-
RS232C TABLE ON	F6	ACK	0A	X	-	-	-	X	X	-
RS232C TABLE OFF	F7	ACK	0A	X	-	-	-	X	X	-
REC/DUB REQUEST	FA	ACK	0A	X	-	-	X	X	X	X
VCR INQUIRY	FB	ACK	0A	X	-	-	-	X	X	X
CLEAR	56	ACK	0A	X	-	-	X	X	X	X
CLERR ERROR	41	ACK	0A	X	-	-	X	X	X	X
ENTER	40	ACK	0A	X	X	X	X	X	X	X

COMMAND FROM CONTROLLER		RETURN FROM DEVICE		DEVICE CATEGOLY			CONTROL		COMMAND TYPE	
NAME	CODE (H)	MANE	CODE (H)	VR	MX	CM	RS485	RS232C	PtoP	Broad Cast
MASTER LOCK ON (only for CONTROLLER)	68	-	-	-	-	-	X	-	-	X
MASTER LOCK OFF (only for CONTROLLER)	6B	-	-	-	-	-	X	-	-	X
GROUP SET WITH DATA	6C	ACK	0A	X	X	X	X	-	X	-
GROUP CHECK WITH DATA	6D	DATA	-	X	X	X	X	-	X	-
GROUP CLEAR WITH DATA	6E	ACK	0A	X	X	X	X	-	X	-
ROM VER.	72	DATA	-	X	X	X	X	X	X	-
-	-	NAK	0B	X	X	X	X	X	X	-
-	-	ALARM IN	06	X	-	-	-	X	X	-
-	-	CASSETE OUT	03	X	-	-	-	X	X	-
-	-	STATUS WITH DATA	BC	X	X	X	X	-	-	X
-	-	STATUS WITH DATA	BD	X	X	X	X	-	-	X
-	-	STATUS WITH DATA	BE	X	X	X	X	-	-	X
-	-	STATUS WITH DATA	BF	X	X	X	X	-	-	X
-	-	ERROR	02	X	X	X	X	X	X	X
COMMAND For Establishment of the RS-485 Communication										
RS-485 RCV CHECK	FE			X	X	X	X	-	X	-
ACK	0A	RS-485 TRANSMISSION START	FD							

Note:

DEVICE CATEGOLY

VR : Command for VCR

MX : Command for Multiplexer

CM : Command for Camera

CONTROL

RS485 : Command for RS485 communication

RS232C : Command for RS232C communication

COMMAND TYPE

PtoP :"PtoP" command can be sent by point to point communication control.

Broadcast :"Broadcast" command can be sent by broad cast communication control.

5.Command Reference

5-1. Command for Time lapse VCR

- **PLAY (3A)**
  Play back a tape.
  When this command is sent while recording, the VCR enters REC CHECK.
- **STILL (4F)**
  Pause tape.
  When this command is sent while recording, the VCR enters REC PAUSE.
- **STOP (3F)**
  Stop tape.
- **FF (AB)**
  Fast forwards the tape.
  When this command is sent while playing, the VCR enters LOCKED CUE.
  During still , the VCR advances forward one image.
  During search/scan, the VCR switches to forward search/scan.
- **REW (AC)**
  Rewinds the tape.
  When this command is sent while playing, the VCR enters LOCKED REVIEW.
  During still , the VCR advances reverse one image.
  During search/scan, the VCR switches to reverse search/scan.
- **EJECT□□(A3)**
  Ejects the tape.
  The VCR returns ACK(0A) at ones when it receives this command, then returns CASSETTE OUT (03) after it ejects the tape.
- **REC□□(CA)**
  Records.
  Before sending this command, REC/DUB REQUEST(FA) should be sent.

RXD	FA	CA	
TXD		OA	OA

- **REV.PLAY (4A)**
  Plays back a tape in reverse at normal speed.
- **TIMER ON/OFF (60)**
  Switches on/off timer recording.
- **MENU□(74)**
  Displays the menu.
  The menu screen changes each time you send this command.
- **SHIFT□, (63)**
  Shift the position of display to the right.
  When menu is displayed, it shifts the cursor to the next input position.
- **SHIFT□, (53)**
  When menu is displayed, it brings the cursor back to the preceding position.
- **SHIFT□, (64)**
  Shifts the position of display to the below .
- **SET+,R/P UP□(65) / SET+,R/P DOUN (66)**
  Changes the setting of the selected item.

- **POWER ON/OFF (7B) , SET ON (7C) , SET OFF (7D)**
  Turns on/off the VCR.
- **SECURITY LOCK ON (69) / SECURITY LOCK OFF (6A)**
  Switches on/off security lock.
- **AUDIO/SEARCH (22)**
  When this command is sent while playing in the 12/24 hour mode, the sound switches on/off.
  During stop , the VCR enters SEARCH/SCAN mode.
  When the menu is displayed, this command ends the menu.
  When the VCR receives the commands above, the VCR returns ACK(0A).
- **ALARM SEARCH (BO)**
  Initiates search for a specific alarm point. Send this command, then enter the alarm point (date,time) and send FF(AB) to search forward or REW(AC) to search backward.
  Eg:Search forward for alarm point 23.

RXD	B0	32	33	40	AB			
TXD	OA	OA	0A	0A	0A	---	01	

  When the alarm point is located, the VCR returns COMPLETION(01).If the tape comes to the end or beginning without the alarm point being located, the VCR returns NOT TARGET(05).
- **ALARM SCAN (B1)**
  Initiates scanning of alarm point(five seconds each).
  Send this command, then send FF(AB) to scan forward or REW(AC) to scan backward.

RXD	B1	AB						
TXD	OA	OA	---	01	---	01	---	05

  When every alarm point VCR returns COMPLETION(01) and returns NOT TARGET(05) at the end of tape.
- T/D SEARCH-1 (B2)
  Initiates search for a specific time(hour)/date. Send this command, followed by the date and hour then send FF(AB) to search forward or REW(AC) to search backward.
  Eg:Search forward for the 16 th , 15 o'clock.

RXD	B0	31	36	31	35	40	AB	
TXD	OA	OA	0A	0A	0A	0A	0A	

  When the time/date is located, the VCR returns COMPLETION(01) . If the tape comes to the end or beginning without the time/date being located, the VCR return NOT TARGET(05).
- T/D SEARCH-2 (B3)
  Initiates search for a specific time(hour ,minutes)/date. Send this command, followed by the date and hour.minutes then send FF(AB) to search forward or REW(AC) to search backward.
  Eg:Search forward for the 16 th , 15 o'clock , 30 minutes.

RXD	B0	31	36	31	35	31	30	40	AB	
TXD	OA	OA	0A	0A	0A	0A	0A	OA	OA	

  When the time/date is located. the VCR returns COMPLETION(01) . If the tape comes to the end or beginning without the time/date being located. the VCR return NOT TARGET(05).
  (Note for the all search command :
  If the other command except numeral command (30)-(39) are sent for the search data.
  each device return ERROR(02) instead of ACK(0A). and when each search data is not proper to search ,ERROR(02) is returned after ENTER(40).

Reset the MENU setting.

- **CLOCK ADJUST□(E0)**

  Adjust the CLOCK setting of the VCR. Minute and second are adjusted to 00:00

- **TRACKING UP (50) / TRACKING DOUN (51)**

  Move the trucking adjustment one step to the up/down side.

  When this command is sent while STILL mode, then V STILL adjustment is moved one step to the up/down side.

- **TRACKING CENTER (52)**

  Return the trucking adjustment to the center.

- **COUNT RESET (E2)**

  Resets the counter. The VCR returns ACK(0A).

- **COUNT MEMORY (E3)**

  Switches on/off the counter memory. The VCR returns ACK(0A).

  When the memory is switched on, the tape being fast forwarded or rewound stops automatically at the point of counter "0:00:00".

- **COUNT CODE (D0)**

  In response to this command, the VCR returns the counter value(six bytes).

  "30H" indicates "+" and "31H" indicates "-".

  Eg:□-1:23:45

RXD	D0					
TXD	31	31	32	33	34	35

- **HEAD TIME (D2)**

  In response to this command , the VCR returns the operation time of the video heads.

  This command does not function when the menu is displayed.

  Eg: "00529H"

RXD	D2				
TXD	30	30	35	32	39

- **POWER TIME (D3)**

  In response to this command, the VCR returns the power on time (five bytes).

  This command does not function when the menu is displayed.

- **R/P SPEED SET (7E)**

  Set the recording/playing speed.

  Send this command, then enter the speed.

  Eg: Setting the speed to 120h.

RXD	7E	31	32	30	40
TXD	OA	OA	0A	0A	0A

- **T/L STATUS SENSE (D6)**

  In response to this command, the VCR returns the time lapse status information (five bytes).

RXD	D6				
TXD	d1	d2	d3	d4	d5

- **T/L STATUS SENSE bit allocation**

  *First, second, third bytes: Indicates the time lapse recording/playback speed.

  Byte 1 : Indicate the third digit.

  Byte 2 : Indicate the second digit.

  Byte 3 : Indicate the first digit.

  Eg: 120hour mode. 30 32 31

  *Fourth byte

  Bit 7: ALARM REC MODE ON
  Bit 6: 1 SHOT REC MODE ON
  Bit 5: SERIES REC MODE ON
  Bit 4: TIMER REC MODE ON
  Bit 3: Reserved for future use
  Bit 2: Reserved for future use
  Bit 1: POWER ON
  Bit 0: AUDIO ON
  VCR is in audio playback mode
  (12 or 24h mode).

  *Fifth byte

  Bit 7: MENU MODE ON
  Bit 6: T/D SEARCH MODE ON
  Bit 5: T/D SEARCH SET
  Bit 4: ALARM SCAN MODE ON
  Bit 3: Reserved for future use
  Bit 2: ALARM SEARCH MODE
  Bit 1: ALARM SEARCH SET
  Bit 0: Reserved for future use

- **STATUS SENSE (D7)**

  In response to this command, the VCR returns the status information (five bytes).

RXD	D7				
TXD	d1	d2	d3	d4	d5

STATUS SENSE bit allocation

*First byte
- Bit 7: Always 1
- Bit 6: Reserved for future use
- Bit 5: Reserved for future use
- Bit 4: REC INHIBIT
- Bit 3: CASESET OUT
- Bit 2: Reserved for future use
- Bit 1: Reserved for future use
- Bit 0: ERROR

*Second byte
- Bit 7: Reserved for future use
- Bit 6: Reserved for future use
- Bit 5: Reserved for future use
- Bit 4: Reserved for future use
- Bit 3: WARNING
- Bit 2: Reserved for future use
- Bit 1: Reserved for future use
- Bit 0: Reserved for future use

*Third byte
- Bit 7: Reserved for future use
- Bit 6: TIMER REC ON
- Bit 5: COUNTER MEMORY
- Bit 4: Reserved for future use
- Bit 3: Reserved for future use
- Bit 2: REPEAT MODE
- Bit 1: Reserved for future use
- Bit 0: Reserved for future use

*Fourth byte
- Bit 7: PLAY MODE
- Bit 6: FF MODE
- Bit 5: REW MODE
- Bit 4: STOP MODE
- Bit 3: REVERSE PLAY MODE
- Bit 2: EJECT MODE
- Bit 1: REC MODE
- Bit 0: Reserved for future use

*Fifth byte
- Bit 7: Reserved for future use
- Bit 6: Reserved for future use
- Bit 5: CUE MODE
- Bit 4: REVIEW MODE
- Bit 3: Reserved for future use
- Bit 2: Reserved for future use
- Bit 1: PAUSE MODE
- Bit 0: STILL MODE

- **STATUS (BC,BD,BE,BF)**

  When status is changed on the VCR, each VCR issues this command with 1 byte data.

  (Note1:Only "00-EF"can be sent as the 1 byte data. "F0-FF" are not allow to be used as the data.)

  When the controller issued broadcast command, then VCR does not issue this STATUS command.

  (Note2: Only "BF" "BE" is used for the status of VCR. Other "BC, BD" are spare command for future use.)

  TXD BF d1

  ***STATUS (BF)data bit allocation**

  Bit 7: WARNING

  1:WARNING ON

  0: normal

  Bit 6,5 : Indicate ALARM REC START, ALARM REC STOP with these 2 bits.

  1,0:ALARM REC START

  0,1:ALARM REC STOP

  0,0:normal

  Bit 4,3,2,1,0 : Indicate the MODE of VCR with these 5 bits.

  0,0,0,0,0:NO MODE CHANGE
  0,0,0,0,1:CASSETTE OUT(POWER ON)
  0,0,0,1,0:CASSETTE OUT(POWER OFF)
  0,0,0,1,1:STANDBY(POWER ON)
  0,0,1,0,0:STANDBY(POWER OFF)
  0,0,1,0,1:TIMER STANDBY
  0,0,1,1,0:PLAY STILL
  0,0,1,1,1:REC PAUSE
  0,1,0,0,0:PLAY
  0,1,0,0,1:REC
  0,1,0,1,0:REVERSE PLAY
  0,1,0,1,1:CUE
  0,1,1,0,0:REVIEW
  0,1,1,0,1:FF
  0,1,1,1,0:REW
  0,1,1,1,1:FORWARD FRAME ADVANCE
  1,0,0,0,0:REVERSE FRAME ADVANCE

  TXD BE d1

  ***STATUS (BE)data bit allocation**

  Bit 7-1 : Always 0

  Bit 0 : Indicate VIDEO LOSS

  1:VIDEO LOSS

  0:Noemal

- **ACK (0A)**

  Acknowledges the command.

- **NCK (0B)**

  Rejects the command.

- **COMPLETION (01)**

  Notifies that a search/scan point has been located.

- **NOT TERGET (05)**

  Notifies that the tape has come to the end or beginning without the search/scan point being located..

- **ERROR (02)**

  Indicates an error in the second or following byte of a multiple-byte command.

- **REC/DUB REQUEST (FA)**

  Send this command just before sending the REC or DUB command..

- **ENTER (40)**

  Send this command to indicate the end of a numeric command.

- **CLEAR (56)**
  Clears a multiple-byte command.
- **CLEAR ERROR (41)**
  Clears the last byte entered of a multiple-byte command.
- **CASSETE OUT (03) (only for RS232C, not used for RS485 control)**
  Confirms that the cassette has been ejected.
- **ALARM IN (06) (only for RS232C, not used for RS485 control)**
  Notifies that an alarm signal has been input.
- **RS232C TABLE ON (F6)** (only for RS232C, not used for RS485 control)
  Start the RS232C control.
- **RS232C TABLE OFF (F7)** (only for RS232C, not used for RS485 control)
  Stop the RS232C control.
- **VCR INQUIRY (FB)** (only for RS232C, not used for RS485 control)
  To confirm that connect unit is a VCR.

5-2. Command for Multiplexer

- **FULL 1□16 (90□9F)**
  Display the FULL picture of selected channel on the monitor 1.
- **MULTI (82)**
  Display the MULTI picture on the monitor 1.
  When MULTI picture is displayed, 16 or 9 divided multi picture are switched.
- **QUAD (83)**
  Display the QUAD picture on the monitor 1.
  When QUAD picture is displayed, Switch the Quad picture.
  (1,2,3,4/5,6,7,8/9,10,11,12/13,14,15,16)
- **SEQUENCE (87)**
  When FULL picture is displayed on monitor 1, switch the channel sequentially automatically with FULL picture.
  When QUAD picture is displayed , switch the quad picture sequentially.
- **PLUS (84)**
  Add the picture on the display of monitor1.
- **ZOOM (85)**
  Zoom up the display of monitor 1.
- **STILL (86)**
  Still the display of monitor 1
- **LIVE (80)**
  Change the function of MUX to the LIVE mode.
- **VCR (81)**
  Change the function of MUX to the VCR mode.
- **MON2 (88)**
  Turn on / off the setup mode of monitor 2.
- **MENU (74)**
  Display the menu.
  The menu screen changes each time you send this command.
- **+,- (65,66)**
  Change the setting of the selected item.
- **□,□,□□, (63,64,53,54)**

- **NEXT (75)**
  Change the layer of the menu.
- **EXIT (76)**
  Exit from the menu.
- **MENU RESET (E1)**
  Reset the menu setting.
- **CLOCK ADJUST (E0)**
  Adjust the CLOCK setting of device. Minute and second are adjusted to 00:00
- **POWER ON/OFF (7B) , SET ON (7C) , SET OFF (7D)**
  Turns on/off the device.
- **SECURITY LOCK ON (69) / SECURITY LOCK OFF (6A)**
  Switches on/off security lock.
- **MPX STATUS SENSE (D5)**
  In response to this command, the device returns the status information (six bytes).

RXD	D5					
TXD	d1	d2	d3	d4	d5	d6

*First byte
- Bit 7: ALARM ON 8
- Bit 6: ALARM ON 7
- Bit 5: ALARM ON 6
- Bit 4: ALARM ON 5
- Bit 3: ALARM ON 4
- Bit 2: ALARM ON 3
- Bit 1: ALARM ON 2
- Bit 0: ALARM ON 1

*Second byte
- Bit 7: ALARM ON 16
- Bit 6: ALARM ON 15
- Bit 5: ALARM ON 14
- Bit 4: ALARM ON 13
- Bit 3: ALARM ON 12
- Bit 2: ALARM ON 11
- Bit 1: ALARM ON 10
- Bit 0: ALARM ON 9

*Third byte
- Bit 7: SENSOR ON 8
- Bit 6: SENSOR ON 7
- Bit 5: SENSOR ON 6
- Bit 4: SENSOR ON 5
- Bit 3: SENSOR ON 4
- Bit 2: SENSOR ON 3
- Bit 1: SENSOR ON 2
- Bit 0: SENSOR ON 1

*Fourth byte
- Bit 7: SENSOR ON 16
- Bit 6: SENSOR ON 15
- Bit 5: SENSOR ON 14
- Bit 4: SENSOR ON 13
- Bit 3: SENSOR ON 12
- Bit 2: SENSOR ON 11
- Bit 1: SENSOR ON 10
- Bit 0: SENSOR ON 9

*Fifth byte
- Bit 7: VIDEO LOSS ON 8
- Bit 6: VIDEO LOSS ON 7
- Bit 5: VIDEO LOSS ON 6
- Bit 4: VIDEO LOSS ON 5
- Bit 3: VIDEO LOSS ON 4
- Bit 2: VIDEO LOSS ON 3
- Bit 1: VIDEO LOSS ON 2
- Bit 0: VIDEO LOSS ON 1

*Sixth byte
- Bit 7: VIDEO LOSS ON 16
- Bit 6: VIDEO LOSS ON 15
- Bit 5: VIDEO LOSS ON 14
- Bit 4: VIDEO LOSS ON 13
- Bit 3: VIDEO LOSS ON 12
- Bit 2: VIDEO LOSS ON 11
- Bit 1: VIDEO LOSS ON 10
- Bit 0: VIDEO LOSS ON 9

- **STATUS SENSE (D7)**

In response to this command, the device returns the status information (five bytes).

RXD	D7				
TXD	d1	d2	d3	d4	d5

STATUS SENSE bit allocation

*First byte

Bit 7: 0:LIVE,1:VCR

Bit 6,5,4:Indicate the Display Mode.

0:FULL / 1:QUAD / 2:MULTI / 3:PLUS / 4:MENU

Bit 3,2,1,0:Indicate the channel of display

FULL picture : 0:FULL CH1 /... /15:FULL CH16

QUAD picture : 0:QUAAD 1,2,3,4 / 1:QUAD 5,6,7,8 /
2:QUAD 9,10,11,12 / 3:QUAD 13,14,15,16

MULTI picture: 0:FULL / 8:9 divided picture / 15:16 divided picture

MENU picture: 0:Menu 0 / .../15:Menu 15

PLUS picture: Cannel of on PLUS picture 0:CH1 /... /15:CH16

*Second byte

Bit 7: EXT.ALARM ON

Bit 6: VIDEO LOSS ON

Bit 5: SENSOR ON

Bit 4: Reserved for future use

Bit 3,2,1,0: Indicate the status of display.

0:NORMAL / 1:SEQUENCE / 2:ZOOM / 3:STILL / 4:ZOOM-STILL / 5:STILL-ZOOM /
6:ZOOM POSITION / 7STILL-ZOOM POSITION

*Third byte

Bit 7: Reserved for future use

Bit 6: Reserved for future use

Bit 5: MON2 SET UP

Bit 4: MON2 0:FULL / 1:SEQUENCE

Bit 3,2,1,0: Indicate the channel No. displayed on MON2

0:CH1 / ... / 15:CH16

*Fourth byte : Reserved for future use

*Fifth byte : Reserved for future use

- **STATUS (BC,BD,BE,BF)**

  When alarm is activated on the device then device issues this command with 1 byte data.

  TXD BF d1

  (Note1:Only "00-EF"can be sent as the 1 byte data, "F0-FF" are not allow to be used as the data.)

  (Note2: Only "BF" is used for the status of alarm. Other "BC, BD, BE" are spare command for future use.)

  ***STATUS (BF)data bit allocation**

  Bit 7,6: Indicate the type of ALARM

  0:NO ALARM / 1:EXT.ALARM / 2:VIDEO LOSS / 3:SENSOR ALARM

  Bit 5: Reserved for Extension

  Bit 4: Always 0

  Bit 3,2,1,0:Indicate the ALARM channel

  0:CH 1 / ... / 15:CH 16

- **ACK (0A)**

  Acknowledges the command.

- **NCK (0B)**

  Rejects the command.

5-3 Command for Camera

- **ZOOM T (10)**
  Move the ZOOM position to TELE
- **ZOOM W (11)**
  Move the ZOOM position to WIDE
- **ZOOM ON (12)**
  Set the electronic zoom function
- **ZOOM OFF (13)**
  Reset the electronic zoom function
- **IRIS + (14)**
  Shift the IRIS setting to open
- **IRIS - (15)**
  Shift the IRIS setting to close
- **IRIS CENTER (16)**
  Set the IRIS setting to center position
- **ELS ON (17)**
  Set the Electronic Shutter
- **ELS OFF (18)**
  Reset the Electronic Shutter
- **BLC ON (19)**
  Set the Back Light Compensation
- **BLC OFF (1A)**
  Reset the Back Light Compensation
- **AWC SET (1B)**
  Set the Auto White Control (Push lock white balance)
- **AWC RESET (1C)**
  Reset the Auto White Control (Return to previous position)

Display the menu.

The menu screen changes each time you send this command.

- **□,□,□□, (63,64,53,54)**

  Shifts the cursor to the item on the right/below/left/up.

  Change the setting of the selected item.

- **ENTER (40)**

  Send this command to fix the menu setup.

- **CONTINUOS (1F)**

  Start the continuos operation.

- **CONCLUSION (1E)**

  Stop the continuos operation.

Note: Continuos operation

Carry out the following continuos operation process(2) for the continuos smooth operation of next continuous operation command (1).

1) Continuos operation command

- □ ZOOM T (10)
- □ ZOOM W (11)
- □ IRIS + (14)
- □ IRIS - (15)
- □ □,□,□□, (63,64,53,54)
- □ ENTER (40)

2) Continuos operation process

a) When continuos operation is necessary , sender output CONTIUOUS(1F) command after more than 500msec from above Continuous operation command.

(CONTINUOS is issued after more than 500msec. therefore buss is already free.

and CONTINUOS command should be sent with sender address.)

b)Send the CONCRUSION (1E) to stop the continuos operation.

	|t|	|t|		|t|		(t□500msec)		
RXD	10	1F	1F	.....	1F	1F	1E		
TXD	0A	0A	0A	.....	0A	0A	0A		

c)Even CONCRUSION is not issued , continuos operation is finished at the camera side after the fixed time. (Time is depend on the specification of the camera.)

d)If other command is issued during the this continuous operation, stop the continuous operation and execute the new command.

e)Continuos process can operate as the broadcast communication.

	|t||t|		|t|		(t□500msec)		
RXD	10	1F	1F	.....	1F	1F	1E	

- **STATUS (BC,BD,BE,BF)**

  When alarm is activated on the device then device issues this command with 1 byte data.

  TXD BF d1

  (Note1:Only "00-EF" can be sent as the 1 byte data, "F0-FF" are not allow to be used as the data.)

  (Note2: Only "BF" is used for the status of alarm. Other "BC, BD, BE" are spare command for future use.)

  ***STATUS (BF)data bit allocation**

  Bit 7: Always 0
  Bit 6: Reserved for Extension
  Bit 5: ALARM ON
  Bit 4: Reserved for Extension
  Bit 3: MENU ON
  Bit 2: BLC ON
  Bit 1: SENSE UP ON
  Bit 0: ZOOM ON

- **STATUS SENSE (D7)**

  In response to this command, the Camera returns the status information (five bytes).

  RXD D7
  TXD d1 d2 d3 d4 d5

  STATUS SENSE bit allocation

  *First byte

  Bit 7: Always 0
  Bit 6: Reserved for future use
  Bit 5: ALARM ON
  Bit 4: Reserved for future use
  Bit 3: MENU
  Bit 2: BLC
  Bit 1: SENSE UP
  Bit 0: ZOOM ON

  *Second byte

  Bit 7,6,5,4:
  Indicate the maximum sense up value.
  Bit 3,2,1,0:
  Indicate the maximum electric zoom value.

  *Third byte

  Bit 7,6,5,4:
  Indicate the electric shutter speed (short).
  Bit 3,2,1:
  Indicate the electric shutter speed (long).
  Bit 0: Electronic Shutter 1:LONG 0:SHORT

*Fourth byte

Bit 7,6:

Indicate the AGC.

0:OFF 1:HIGH 2:NORMAL 3: Reserved

Bit 5: GAMMA ON

Bit 4: MOTION ON

Bit 3,2:

Indicate the Wite balance

0:ATW 1:AWC 2:MANUAL 3: Reserved

Bit 1,0:

Indicate the LENS.

0:AI DC 1:AI VIDEO 2:MANUAL EI

*Fifth byte

Bit 7: Reserved for future use

Bit 6: Reserved for future use

Bit 5: Reserved for future use

Bit 4: MIRROR ON

Bit 3,2,1:

Indicate the SYNC MODE.

0:INT 1:L-L 2:VBS 3:VS 4:VBS-V 5-7: Reserved

Bit 0: APERTURE ON

- **CAM STATUS SENSE (D4)**

In response to this command. the Camera returns the status information (five bytes).

RXD	D4				
TXD	d1	d2	d3	d4	d5

CAM STATUS SENSE bit allocation

*First byte

AUTO IRIS DRIVE value

*Second byte

AGC CONT value

*Third byte

Electronic Iris value

*Fourth byte

SENSE UP value

*Fifth byte

Electronic Zoom value

- **ACK (0A)**

Acknowledges the command.

- **NCK (0B)**

Rejects the command.

5-4 Command for Controller

- **STATUS SENSE (D7)**

  In response to this command. the Controller returns the status information (five bytes).

RXD	D7					
TXD		d1	d2	d3	d4	d5

STATUS SENSE bit allocation

*First byte

Bit 7-1 Reserved for future use

Bit 0: SECURITY LOCK ON

*Second byte – Fifth byte : Reserved for future use

5-5. The other command for each devise

- **MASTER LOCK ON(68)**

  Block the communication of bus line.

- **MASTER LOCK OFF(6B)**

  Release the communication of bus line.

- **RS485 TRANSMISSION START (FD)**

  Send this command to indicate that the sender will start to send the command .

- **RS485 RECEIVE CHECK (FE)**

  Send this command to confirm that the receiver is ready to receive the command.

- **GROUP SET (6C)**

  Controller send this command with 2 bytes group data to resister the group of the device.

RXD	6C	d1	d2	
TXD		OA	OA	0A

When data "d1" and "d2" are both "00". or bit 0 of "d1" is "1" . device return ERROR (02) instead of ACK(0A) after receiving "d2"or after receiving "d1".

Group data bit allocation

*First byte	*Second byte
Bit 7 :Group 7	Bit 7 :Group 15
Bit 6 :Group 6	Bit 6 :Group 14
Bit 5 :Group 5	Bit 5 :Group 13
Bit 4 :Group 4	Bit 4 :Group 12
Bit 3 :Group 3	Bit 3 :Group 11
Bit 2 :Group 2	Bit 2 :Group 10
Bit 1 :Group 1	Bit 1 :Group 9
Bit 0 :0 (not used)	Bit 0 :Group 8

(More than two groups can be indicated with these two byte data at the same time.)

Eg: Register group 5 and 14

RXD	6C	20	40	
TXD		OA	OA	0A

- **GROUP CLEAR (6E)**

  Controller send this command with 2 bytes group data to clear the group of the device.

RXD	6E	d1	d2
TXD	OA	OA	0A

  Group data bit allocation are same as above.

  When data "d1" and "d2" are both "00", or bit 0 of "d1" is "1" . device return ERROR (02) instead of ACK(0A) after receiving "d2"or after receiving "d1".

- **GROUP CHECK (6D)**

  In response to this command , the device returns the registered group number.

RXD	6D		
TXD	d1	d2	

  Group data bit allocation are same as above.

- **ROM VER. (72)**

  In response to this command , the device returns the program version number of SSP control software with two byte data.

RXD	72		
TXD	d1	d2	