Electromagnetic Inductive RFID System

V720-Series

Users Manual

Controller

V720-BC5D4-E

Supplementation

## (Provisionally)

SECTION 5
Communications Functions

This section provides the communications functions and provides details on communications-related data and commands.

5-1 Command and Response Frame Structure

5-1-1 Command Frame Structure

The ID Controller continuously receives signals from STX to ETX, and executes the command when the correct node number is received. If, after receiving an STX signal, another STX signal is received before an ETX signal is received, the second STX signal is given command priority.

STX	Node No.	Command Code	Option Text		BCC
	"□□"	"□□"		ETX	
1	2	2		1	1
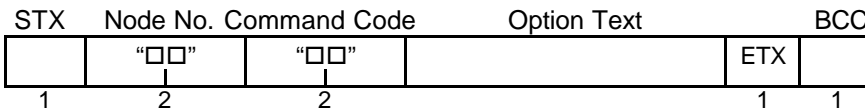
Name	Description
STX	Indicates the beginning of a communication frame (text). Expressed by ASCII code 02.
Node No.	Node number of the Controller - The values from "00" to "09" can be set. - No response is returned to the command with node numbers other than the number set to the Controller.
Command code	Indicates the command that the Controller executes. Refer to *5-2 Command List* for command codes available.
Option	Makes specified optional settings or specifies read/write data. Refer to each command format for details.
ETX	Indicates the end of a communication frame (text)
BCC	Block check character. The result of the horizontal parity calculation from immediately after STX through ETX is expressed using one character. Turn ON or OFF BCC using pin 8 on DIP switch 3. Refer to *5-1-3 BCC Calculation Method* for how BCC is calculated.

5-1-2 Response Frame Structure

The text of a response consists of a Retry flag, command code, response code, and text data.

STX	Node No.	Retry Flag	Command code	Response code	Text data		BCC
	"□□"	"□"	"□□"	"□□"		ETX	
1	2	1	2	2		1	1
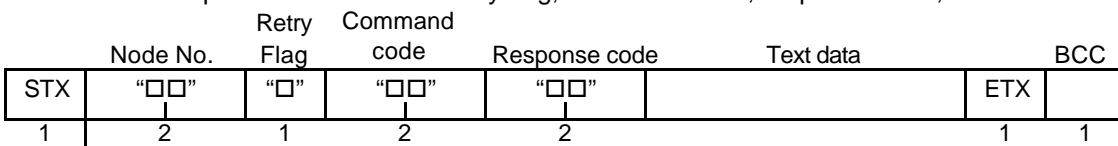
Name	Description
Retry Flag	In ACK/NACK control, when NACK is received and the previous response is returned, the retry flag is set to "1". In other cases, it is set to "0".
Command code	The received command code is returned.
Response code	Indicates the state of the Controller after command execution. Refer to *5-10 Response Code List.*
Text data	Sent in response to specific commands. For the content, refer to the frame structure of each command.

5-1-3 BCC Calculation Method

BCC is the result of the horizontal parity calculation of the data right after STX up to ETX inclusive. Refer to JIS5001 *Transmission Path Character Configuration and Using Horizontal Parity* for details.

		Node No.		Command Code					Text					BCC	
STX	0	0	R	D	S	T	A	0	0	0	0	1	ETX	62	

Command data	ASCII code data		
0	0011		0000
		EOR	
0	0011		0000
		EOR	
R	0101		0010
		EOR	
D	0100		0100
		EOR	
S	0101		0011
		EOR	
T	0101		0100
		EOR	
A	0100		0001
		EOR	
0	0011		0000
		EOR	
0	0011		0000
		EOR	
0	0011		0000
		EOR	
0	0011		0000
		EOR	
1	0011		0001
		EOR	
ETX	0000		0011
Calculation results	0110		0010

5-2 Command List

Command Name	Command Code	Description
Read	RD	Reads the memory data of a Tag.
Write	WT	Write data to the memory of a Tag.
Lock	LK	Write-protects Tag memory by page. Once a page has been write-protected, the write protection cannot be cleared.
Memory Check	MC	Compares check codes in Tag memory.
Memory Calculation	MK	Calculates check codes in Tag memory.
Polling Read	PR	Performs a single autoread using polling.
Polling Write	PW	Performs a single autowrite using polling.
Polling Check	PC	Checks polling.
Polling End	PE	Ends polling.
Stop	ST	Completes a command in execution.
Reset	XZ	Resets the Controller.
Controller Control	CC	Performs user input operation
Application ID setting	AI	Application ID setting for Controller
Family code setting	FC	Family code setting for Controller
Test	TS	Sends the received data to the host.
ACK	AK	Indicates that the host receives a response normally.
NACK	NK	Indicates that the host does not receive a response normally.
EAS Check	EA	Performs EAS check
Controller Control	CC	Performs user input operation
Node No.	NN	Sets and reads the node No.
Terminating Resist	TM	Sets and reads the terminating resist for RS485
Communication Port Set	CP	Sets and reads baud speed, data length, parity bits, stop bits, ACK/NAK Control, Timeout time BCC Addition.
Communication Type Set	CT	Sets and reads communication types.
Communication Mode	CM	Sets and reads communication modes.
Initialization Set	IS	Initializes the setting value.
EEPROM Write	EW	Writes the setting value to EEPROM.

Command Name	Command Code	Description
Antenna Change	AC	Set and reads the antenna changes.
SNR Addition	SN	Sets and reads SNR addition on the read response.
OFF Line Mode	FL	Sets and read the using status of the controller, ON- or OFF-Line.

These commands are new added or changed for this controller.

5-3 Communications Commands and Responses

This section shows the settings using BCC (i.e., pin 8 on DIP switch 3 is ON). BCC is not attached to either the command or response frames when using BCC is not set.

5-3-1 Single Access Commands and Responses

1) Read (RD)

Command for the use of reading data of an ID Tag.

Command Frame Structure

STX	Node No.	Command code "RD"	Communi-cations	Data type	Fixed "0"	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method.
	  ST: Single Trigger
	  SA: Single Auto
	  SR: Single Repeat
	For details, refer to *5-5 Communications Methods*.

Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch

Response Frame Structure

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified number	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code : No. of read pages x 4 HEX code : No. of read pages x 8

2) Write (WT)

Command for the use of writing data to an ID Tag.

Read verification processing is performed for this command and so it is not necessary to perform it again.

Command Frame Structure

STX	Node No.	Command code "WT"	Commu-nications	Data type	Fixed "0"	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	2	1	1	2	2	Specified number	1	1

Communications	Specifies a communications method. ST: Single Trigger SA: Single Auto SR: Single Repeat For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the write data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First write page	Specifies the first page of the Tag to which data is written in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of write pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: No. of write pages x 4 HEX code: No. of write pages x 8

Response Frame Structure

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.

5-3-2 FIFO Access Commands and Responses

1) Read (RD)

Command for the use of reading data of an ID Tag entering the Antenna area in entering order.

Command Frame Structure

STX	Node No.	Command code "RD"	Commu- nications	Data type	Fixed "0"	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method.
	FT: FIFO Trigger
	FA: FIFO Auto
	FR: FIFO Repeat
	For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the read data is represented in ASCII or HEX.
	A: ASCII code
	H: HEX code
	For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX.
	Setting range: 00h to 0Ah, FFh
	(FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX.
	Setting range: 01h to 0Ch

Response Frame Structure

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified number	1	1

Response code	00: Normal completion
	For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read.
	The number of characters of the data is as follows:
	ASCII code: No. of read pages x 4
	HEX code: No. of read pages x 8

2) Write (WT)

Command for the use of writing data to an ID Tag entering the Antenna area in entering order.
Read verification processing is performed for this command and so it is not necessary to perform it again.

Command Frame Structure

STX	Node No.	Command code "WT"	Commu-nications	Data type	Fixed "0"	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	2	1	1	2	2	Specified number	1	1

Communications	Specifies a communications method.
	   FT: FIFO Trigger
	   FA: FIFO Auto
	   FR: FIFO Repeat
	For details, refer to *5-5 Communications Methods*.

Data type	Specifies whether the write data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First write page	Specifies the first page of the Tag to which data is written in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of write pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: No. of write pages x 4 HEX code: No. of write pages x 8

Response Frame Structure

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.

5-3-3 Multiple Access Commands and Responses

1) Read (RD)

Command for the use of reading plural Tags

Command Frame Structure

STX	Node No.	Command code "RD"	Communi-cations	Data type	Tag No. setting	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method. MT: Multi-trigger MR: Multi-repeat For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: H.EX code For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Tag Number setting	Specifies the Tag Number setting. Setting range: 1 to 7 For details, refer to *5-7 Tag Number Setting*.

Response Frame Structure

■READ DATA RESPONSE

There are the same number of responses as the number of Tags in the Antenna area.

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified number	1	1

■COMMUNICATIONS END RESPONSE (Multi-trigger Only)

When communications have ended with all Tags within the communications area.

STX	Node No.	Retry flag	Command code "RD"	Response code "72"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion 72: COMMUNICATIONS END RESPONSE For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code: No. of read pages x 4 HEX code: No. of read pages x 8

2) Write (WT)

Command for the use of writing the same data to plural Tags.
Read verification processing is performed for this command and so it is not necessary to perform it again.

Command Frame Structure

STX	Node No.	Command code "WT"	Commu-nications	Data type	Tag No. setting	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	2	1	1	2	2	Specified number	1	1

Communications	Specifies a communications method.
	  MT: Multi-trigger
	  MR: Multi-repeat
	For details, refer to *5-5 Communications Methods*.

Data type	Specifies whether the write data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First write page	Specifies the first page of the Tag to which data is written in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of write pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: No. of write pages x 4 HEX code: No. of write pages x 8
Tag Number setting	Specifies the Tag Number setting. Setting range: 1 to 7 For details, refer to *5-7 Tag Number Setting*.

Response Frame Structure

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	No. of Tags writ-ten	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
No. of Tags written	Returns number of Tags to which data was written without error. Does not return signal unless end was normal.

5-3-4 Selective Access Commands and Responses

1) Detection of Tags

Command for the use of detecting Tags in communications area.

Command Frame Structure

STX	Node No.	Command code "RD"	Commu- nications	Data type	Tag No. setting	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method. LT: Selective Access For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Tag Number setting	Specifies the Tag Number setting. Setting range: 1 to 7 For details, refer to *5-7 Tag Number Setting*.

Response Frame Structure

• Read data response

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Temporary No.	Read data	ETX	BCC
1	2	1	2	2	2	Specified number	1	1

• Communications end response

STX	Node No.	Retry flag	Command code "RD"	Response code "72"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion 72: Detection response For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code: No. of read pages x 4 HEX code: No. of read pages x 8
Temporary No.	As a normal response, the values 00 to 7F are returned.

2) Read (RD)

Command for the use of designating a specific Tag and reading data after detection.

Command Frame Structure

STX	Node No.	Command code "RD"	Commu-nications	Data type	Fixed "0"	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies the temporary Tag No. to be read in HEX. ? ? : Temporary No. (For ? ? , the values from "00" to "7F" are available.) For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch

Response Frame Structure

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Temporary No.	Read data	ETX	BCC
1	2	1	2	2	2	Specified number	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code: No. of read pages x 4 HEX code: No. of read pages x 8
Temporary No.	As a normal response, the values 00 to 7F are returned.

3) Write (WT)

Command for the use of designating a specific Tag and writing data after detection.
Read verification processing is performed for this command and so it is not necessary to perform it again.

Command Frame Structure

STX	Node No.	Command code "WT"	Commu-nications	Data type	Fixed "0"	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	2	1	1	2	2	Specified number	1	1

Communications	Specifies the temporary Tag No. to be written in HEX. ? ? : Temporary No. (For ? ? , the values from "00" to "7F" are available.) For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the write data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First write page	Specifies the first page of the Tag to which data is written in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of write pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: No. of write pages x 4 HEX code: No. of write pages x 8

Response Frame Structure

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	Temporary No.	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
Temporary No.	As a normal response, the values 00 to 7F are returned.

5-3-5 Polling Commands and Responses

1) Polling Single Auto Read (PR)

Immediately after receiving the Polling Single Auto Read Command, the Controller returns a response indicating the acceptance of the command and waits for a Tag to enter the communications area of the Antenna. Then it reads the data of the entering Tag. The host can inquire of the Controller the results of communications processing using a subcommand.

Command Frame Structure

STX	Node No.	Command code "PR"	Data type	First read page	No. of read pages	ETX	BCC
1	2	2	1	2	2	1	1

Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First read page	Specifies the first page of the Tag containing data to be read in HEX. Setting range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of read pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch

Response Frame Structure

STX	Node No.	Retry flag	Command code "PR"	Response code "74"	ETX	BCC
1	2	1	2	2	1	1

Response code	74: Command received. For other response codes, refer to *5-10 Response Code List*.

Note: Philips' block 4 can be used as user memory with Controller software versions 1.5 or later. The software version can be read with the Version Command (VS).

2) **Polling Single Auto Write (PW)**

Immediately after receiving the Polling Single Auto Write Command, the Controller returns a response indicating the acceptance of the command and waits for a Tag to enter the communications area of the Antenna. Then it writes data to the entering Tag. The host can inquire of the Controller the results of communications processing using a subcommand.

Read verification processing is performed for this command and so it is not necessary to perform it again.

Command Frame Structure

STX	Node No.	Command code "PW"	Data type	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	1	2	2	Specified number	1	1

Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.
First write page	Specifies the first address for writing data to Tags in HEX. Specifiable range: 00h to 0Ah, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of write pages	Specifies the number of pages to which data is written in HEX. Setting range: 01h to 0Ch
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: No. of write pages x 4 HEX code: No. of write pages x 8

Response Frame Structure

STX	Node No.	Retry flag	Command code "PW"	Response code "74"	ETX	BCC
1	2	1	2	2	1	1

Response code	74: Command received. For other response codes, refer to *5-10 Response Code List*.

Note: Philips' block 4 can be used as user memory with Controller software versions 1.5 or later. The software version can be read with the Version Command (VS).

3) Polling Check (PC)

You can check the results while the Polling Single Autoread Command and Polling Single Autowrite Command are being executed. You can use Polling Check after the Polling Single Autoread Command and Polling Single Autowrite Command have been sent.

Command frame structure

STX	Node No.	Command code "PC"	ETX	BCC
1	2	2	1	1

Response Frame Structure

• **Response to Read commands**

STX	Node No.	Retry flag	Command code "PR"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified number	1	1

• **Response to Write commands**

STX	Node No.	Retry flag	Command code "PW"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

• **Response when a Tag is not yet detected**

This response is returned when the Polling Check Command is received before a Tag is detected.

STX	Node No.	Retry flag	Command code "PC"	Response code "74"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion 74: Before the completion of communications with the Tag For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code: No. of read pages x 4 HEX code: No. of read pages x 8

4) Polling End (PE)

Command for the use of canceling Execution of Polling commands.

Command frame structure

STX	Node No.	Command code "PE"	ETX	BCC
1	2	2	1	1

Response Frame Structure

• **Response when a Tag is not yet detected**

STX	Node No.	Retry flag	Command code "PE"	Response code "75"	ETX	BCC
1	2	1	2	2	1	1

• **Response after a Tag is detected**

STX	Node No.	Retry flag	Command code "PE"	Response code "76"	ETX	BCC
1	2	1	2	2	1	1

Response code	75: Before the completion of communications with a Tag
	76: After the completion of communications with a Tag
	For other response codes, refer to *5-10 Response Code List*.

5-3-6 System Commands and Responses

1) Serial Number Read (RD)

This command is used for reading a unique 64 bit serial number.

Command frame structure

STX	Node No.	Command code "RD"	Communi- cations	Data type "H"	Tag No. setting	Fixed "**"	Fixed "**"	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method. ST: Single Trigger SA: Single Auto SR: Single Repeat FT: FIFO Trigger FR: FIFO Repeat	MT: Multi-trigger MR: Multi-repeat LT: Selective Access (Tag detection) ? ? : Selective Access (read) (For ? ? , the values from "00" to "7F" are available.) (UT: Special Read Trigger UA: Special Read Auto UR: Special Read Repeat) For details, refer to *5-5 Communications Methods.*
Data type	"H" fixed (HEX code)	
Tag Number setting	In the Selective Access (read), Single, and FIFO Accesses, the Tag Number setting is "0" fixed. In the Multi Access and Selective Access (Tag detect) command, set the number of Tags with which to communicate simultaneously. Refer to *5-7 Tag Number Setting* for details. Setting range: 0 to 7	

- The serial number of a Tag is not changeable.
- For code representation, only HEX code is available.

Response Frame Structure

- Response frame structure for Single, FIFO, and Multi Accesses (excluding end detection response)

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Serial No.	ETX	BCC
1	2	1	2	2	16	1	1

- Response Frame Structure for Selective Access (excluding end Tag detection response)

TX	Node No.	Retry flag	Command code "RD"	Response code "00"	Temporary No.	Serial no	ETX	BCC
1	2	1	2	2	2	16	1	1

Response code	00: Normal end For other response codes, refer to *5-10 Response Code List*.
Serial Number	Written on each ID Tag at the time of factory shipments. This number cannot be overwritten.

2) Lock (LK)

The LK Command is used to set and check the write-protection of Tags. It can be applied to Tag memory in page units. To read lock information set in a Tag, set all lock information in the command to 0.

Command Frame Structure

STX	Node No.	Command code "LK"	Lock information	ETX	BCC
1	2	2	4	1	1

Lock setting	Set to 1 the bit corresponding to the page you want to lock.
Lock setting check	Set all lock settings to 0 to read the lock information set in a Tag.

The lock information for each page is represented by 1 bit.

Lock information															
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	B4	b3	b2	b1	b0
page 10	page 9	page 8	page 7	page 6	page 5	page 4	page 3	page 2	page 1	page 0	AI ,FC	Fixe d'0'	Fixe d'0'	Fixe d'0'	Fixe d'0'

AI: Application ID   FC: Family code
A format error will occur (error code 14) if a 1 is set for a bit marked "Fixed `0'."

Response Frame Structure

STX	Node No.	Retry flag	Command code "LK"	Response code " 00"	Lock information	ETX	BCC
1	2	1	2	2	4	1	1

Response code	00: Normal end
	Refer to *5-10 Response Code List* for other response codes.

Note   Once a page has been locked, it cannot be unlocked. Be careful when using locks.

3) Read of Application ID and Family Code (for Tag)

Command Frame Structure

STX	Node No.	Command code "RD"	Communi-cations	Data type	Tag No. setting	Fixed value "FF"	Fixed value "01"	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method. ST: Single Trigger SA: Single Auto SR: Single Repeat FT: FIFO Trigger FR: FIFO Repeat	MT: Multi-trigger MR: Multi-repeat LT: Selective Access (Tag detection) ? ? : Selective Access (read) (For ? ? , the values from "00" to "7F" are available.) (UT: Special Read Trigger UA: Special Read Auto UR: Special Read Repeat) For details, refer to *5-5 Communications Methods*.
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.	
Tag Number setting	In the Selective Access (read), Single, and FIFO Accesses, Tag Number setting is "0" fixed. In the Multi Access and Selective Access (Tag detect) command, set the number of Tags with which to communicate simultaneously. Setting range: 1 to 7 Refer to *5-7 Tag Number Setting* for details.	

Response Frame Structure
- **Response frame structure for Single, FIFO, and Multi Accesses**
  (excluding detection completed response)

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Read data					ETX	BCC
					Family code	Appli-cation ID	Not defined	Not defined			
1	2	1	2	2	4(ASCII),8(HEX)					1	1

- **Response frame structure for Selective Access**
  (excluding Tag detection completed response)

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Temporary No.	Read data					ETX	BCC
						Family code	Appli-cation ID	Not defined	Not defined			
1	2	1	2	2	2	4(ASCII),8(HEX)					1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
Read data	Indicates the data having been read. The number of characters of the data is as follows: ASCII code: 4 HEX code: 8

4) Write of Application ID and Family code (for Tag)

The WT Command is used to write application IDs and family codes to Tags.
Read verification processing is performed for this command and so it is not necessary to perform it again.

Command frame structure

STX	Node No.	Command code "WT"	Commu-nications	Data type	Tag No. setting "0"	Fixed "FF"	Fixed "01"	Write data				ETX	BCC
								Family code	Appli-cation ID				
1	2	2	2	1	1	2	2	4(ASCII),8(HEX)					1

Communications	Specifies a communications method.	MT: Multi-trigger
	ST: Single Trigger	MR: Multi-repeat
	SA: Single Auto	？？: Selective Access (write)
	SR: Single Repeat	(For ？？, the values from "00" to "7F"
	FT: FIFO Trigger	are available.)
	FR: FIFO Repeat	For detail, refer to *5-5 Communications Methods*.
Data type	Specifies whether the write data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to *5-6 Data Type*.	
Tag Number setting	In the Selective Access (write), Single, and FIFO Accesses, the Tag Number setting is "0" fixed. In the Multi Access, set the number of Tags with which to communicate simultane-ously. Setting range: 1 to 7 Refer to *5-7 Tag Number Setting* for details.	
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows: ASCII code: 4 HEX code: 8	

Response Frame Structure
• **Single and FIFO Accesses**

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

• **Multi-access (Excluding Communications End Response)**

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	No. of written Tags	ETX	BCC
1	2	1	2	2	2	1	1

• **Selective Access**

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	Temporary No.	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00: Normal completion
	For other response codes, refer to *5-10 Response Code List*.

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5) Setting of Family Code (for Controller) (FC)

The FC Command is used to set or read the family code in the Controller. Only Tags that have the same family code as the one set by this command can perform communications. If the family code in the Controller is set to 00, however, communications will be possible with all the Tags.
The default setting of the Controller is 00.

Command Frame Structure

STX	Node No.	Command code "FC"	Family code	ETX	BCC
1	2	2	2	1	1

Family code	The family code is designated in hexadecimal. Designation range: 00 to FF When the family code set to "∗∗", the family code currently set in the Controller will be read.

Response Frame Structure

STX	Node No.	Retry flag	Command code "FC"	Response code " 00"	Family code	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00: Normal completion For other response codes, refer to *5-10 Response Code List*.
Family code	Family code currently set is given in hexadecimal.

6) Setting of Application ID (for Controller) (AI)

The AI Command is used to set or read the application code in the Controller.
Only Tags that have the same application code as the one set by this command can perform communications. If the application ID in the Controller is set to 00, communications will be possible with all Tags.
The default setting of the Controller is 00.

Command Frame Structure

STX	Node No.	Command code "AI"	Application ID	ETX	BCC
1	2	2	2	1	1

Application ID	The application ID is designated in hexadecimal. Designation range: 00 to FF When the application ID is set to "∗∗", the application ID currently set in the Controller will be read.

Response Frame Structure

STX	Node No.	Retry Flag	Command code "AI"	Response code " 00"	Application ID	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.
Application ID	The Application ID currently set in the Controller is given in hexadecimal.

7) Setting of EAS (ES)

The ES Command is used to enable or disable the EAS Check Command. No response is returned for the EAS Check Command (EA) if it is disabled.

Command Frame Structure

STX	Node No.	Command code "ES"	Setting	ETX	BCC
1	2	2	2	1	1

Setting	Setting range: 00h to 01h 00h: EAS enabled (Responses are returned for the EAS Check Command.) 01h: EAS disabled (No responses are returned for the EAS Check Command.)

Response Frame Structure

STX	Node No.	Retry Flag	Command code "ES"	Response code " 00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.

Note If BCC is disabled (i.e., pin 8 on DIP switch 3 is set to ON), BCC is not attached to either command or response frames.

8)EAS Command(EA)

This command is used for the use of sending EAS commands to tags in sequence and responding the ratio that equal with the response code as percentage.

Command Frame Structure

STX	Node No.	Command code "EA"	ETX	BCC
1	2	2	1	1

Response Frame Structure

STX	Node No.	Retry flag	Command code "EA"	Response code "00"	Ratio	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00:Normal completion For other response codes, refer to the Response Code List.
Ratio	Indicates the ratio that agrees with the response code of EAS in ASCII.(00h – 64h[%])

In the case when the response is not 0%, even though there is no tags in the filed due to the external noise, and so on.

In a such a case, by judging about the tag existence please take those value into consideration.
.

9) Setting of Quiet Bit (QB)

The QB Command is used to set the Quiet Bit. If this bit is enabled, no responses are returned for commands (except the EAS Check Command).

Command Frame Structure

STX	Node No.	Command code "QB"	Setting	ETX	BCC
1	2	2	2	1	1

Setting	Setting range: 00h to 01h 00h: Quiet Bit disabled 01h: Quiet Bit enabled

Response Frame Structure

STX	Node No.	Retry Flag	Command code "QB"	Response code " 00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.

Note 1 If BCC is disabled (i.e., pin 8 on DIP switch 3 is set to ON), BCC is not attached to either command or response frames.

Note 2 This function can be used with Controller software versions 1.5 or later. The software version can be read with the Version Command (VS).

10) Version (VS)

The VS Command is used to read the Controller software version.

Command Frame Structure

STX	Node No.	Command code "VS"	ETX	BCC
1	2	2	1	1

Response Frame Structure

STX	Node No.	Retry Flag	Command code "VS"	Response code " 00"	Software version	ETX	BCC
1	2	1	2	2	4	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.

Note If BCC is disabled (i.e., pin 8 on DIP switch 3 is set to ON), BCC is not attached to either command or response frames.

5-3-7 General Commands and Responses

1) Special Read (RD)

If there is one Tag within the communications area, data will be read from the Tag at a speed faster than normal reading.

Command Frame Structure

STX	Node No.	Command code "RD"	Communi- cations	Data type	Fixed "0"	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications	Specifies a communications method UT : Special Read Trigger UA : Special Read Auto UR : Special Read Repeat For details, refer to *5-7 Communications Methods*
Data type	Specifies whether the read data is represented in ASCC or HEX. A : ASCII code H : HEX code For details, refer to *5-6 Data Type*
First read page	Specifies the first page in hexadecimal to read from the Tags. Specification range: 00 to 0A, FF (FF can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map.*)
No. of read page	Specifies the number of pages in hexadecimal to read from the Tags. Specification range: 01 to 0C

Response Frame Structure

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified number	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List.*
Read data	Indicates the data having been read. The number of characters of the data is as follows. ASCII code : No. of read pages x 4 HEX code : No. of read pages x 8

Note Although it is possible to access multiple Tags with the Special Read (RD) Command, unlike multiple access mode (refer to *5-3-3 Multiple Access Commands and Responses*), anti-collision processing (processing to prevent collisions between responses from Tags) is not performed for this command. Therefore, it is not possible to read information from Tags when their responses collide. In order to compensate for this, it is necessary to send the command from the host several times. Even with retry processing, if the number of Tags is small, the faster baud rate means that there are cases where using this command has advantages over using multiple access commands.

2) Stop (ST)

This command causes the Controller in auto mode, repeat mode, FIFO Access, or Selective Access to cancel the processing of communications when this command is received by the Controller. The Controller then waits for the next command.

Command Frame Structure

STX	Node No.	Command code "ST"	ETX	BCC
1	2	2	1	1

Response Frame Structure

STX	Node No.	Retry flag	Command code "ST"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00 : Normal completion
	For other response codes, refer to *5-10 Response Code List*.

3) Reset (XZ)

This command software-resets the Controller.

Command Frame Structure

STX	Node No.	Command code "XZ"	ETX	BCC
1	2	2	1	1

4)Controller Control Command(CC)

This command is used for changing the status on the user output terminals (OUT 1 to OUT 4) and reading the status of the user input terminals (IN 1 to IN 3).

Command Frame Structure

STX	Node No.	Command code "CC"	OUT 1	OUT 2	OUT 3	OUT 4	ETX	BCC
1	2	2	1	1	1	1	1	1

OUT1 to OUT4	Specifies the output status in DECIMAL.
	Specified range : 0 – 1 (1:ON / 0:OFF)
	When the application ID is set to "*", the status of the terminals, ON or OFF will be read.

Response Frame Structure

STX	Node No.	Retry flag	Command code "CC"	Response code "00"	OUT 1	OUT 2	OUT 3	OUT 4	IN 1	IN 2	IN 3	ETX	BCC
1	2	1	2	2	1	1	1	1	1	1	1	1	1

Response code	00:Normal completion
	For other response codes, refer to the Response Code List.
OUT1 to OUT4	Indicates the output status. 1:ON / 0:OFF
IN 1 to IN 3	Indicates the input status. 1:ON / 0:OFF

5) Test (TS)

This command returns test messages sent from the host with no change made.
The command is used for testing communications between the host and the Controller.

Command Frame Structure

STX	Node No.	Command code "TS"	Test message	ETX	BCC
1	2	2		1	1

Test message	The number of characters from 0 up to 64 max. is available.

Response Frame Structure

STX	Node No.	Retry flag	Command code "TS"	Response code "00"	Test message	ETX	BCC
1	2	1	2	2		1	1

Response code	00 : Normal completion
	For other response codes, refer to *5-10 Response Code List*.
Test message	Returns the test message received using commands.

6) Memory Check (MC)

This command uses the generating polynomial, $X^{16} + X^{12} + X^5 + 1$ to calculate the check block designated by a user and to compare the results with the check code attached to the check block.

Command Frame Structure

STX	Node No.	Command code "MC"	First page of check block	No. of pages in check block	ETX	BCC
1	2	2	2	2	1	1

First page of check block	Specifies the first page of the check block in HEX.
	Setting range: 00h to 09h, FFh
	(FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of pages in check block	Specifies the number of pages in the check block in HEX.
	Setting range: 02h to 0Ch

Response frame structure

STX	Node No.	Retry flag	Command code "MC"	Response code	ETX	BCC
1	2	1	2	2	1	1

Response code	75: When the check results are correct
	76: When the check results are incorrect
	For other response codes, refer to *5-10 Response Code List*.

Note Philips' block 4 can be used as user memory with Controller software versions 1.5 or later. The software version can be read with the Version Command (VS).

7) **Memory Calculation (MK)**

This command uses the generating polynomial, $X^{16} + X^{12} + X^5 + 1$ to calculate the check block designated by a user and to compare the results with the check code attached to the check block.

Command Frame Structure

STX	Node No.	Command code "MK"	First page of check block	No. of pages in check block	ETX	BCC
1	2	2	2	2	1	1

First page of check block	Specifies the first page of the check block in HEX. Setting range: 00h to 09h, FFh (FFh can be specified only when using Philips' block 4 as user memory. For details, refer to *2-5 Tag Memory Map*.)
No. of pages in check block	Specifies the number of pages in the check block in HEX. Setting range: 02h to 0Ch

Response Frame Structure

STX	Node No.	Retry flag	Command code "MK"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion
	For other response codes, refer to *5-10 Response Code List*.

> **Note** Philips' block 4 can be used as user memory with Controller software versions 1.5 or later. The software version can be read with the Version Command (VS).

8) **ACK (AK)**

This command is used during ACK/NACK control to inform the Controller that the host device normally received a response from the Controller. There is no response if this command is used in ACK/NACK control, but if the Controller is not waiting to receive ACK/NACK signals, an error will occur when the command is received. Refer to *5-9 ACK/NACK Control* for details.

Command Frame Structure

STX	Node No.	Command code "AK"	ETX	BCC
1	2	2	1	1

9) **NACK (NK)**

This command is used during ACK/NACK control to inform the Controller that the host device did not normally receive a response from the Controller. When the Controller receives a NACK command, the previous response is retried provided that the maximum number of retries (9) has not been exceeded. If the Controller is not waiting to receive ACK/NACK signals, an error will occur when the command is received. Refer to *5-9 ACK/NACK Control* for details.

Command Frame Structure

STX	Node No.	Command code "NK"	ETX	BCC
1	2	2	1	1

10)Response to undefined commands

This response is returned when the Controller receives an undefined command.

Response Frame Structure

STX	Node No.	Command code "IC"	ETX	BCC
1	2	2	1	1

11) Node No. Setting command(NN)

This command is used for setting and reading Node No. of the amplified controller.

Command Frame Structure

STX	Node No.	Command code "NN"	Changing Node No.	ETX	BCC
1	2	2	2	1	1

Changing Node No.	Specifies the Node No. to be changed in DECIMAL. Specified range : 00 - 31 When the application ID is set to "*", the set value will be read.

Response Frame Structure

STX	Node No.	Retry flag	Command code "NN"	Response code "00"	Node No.	ETX	BCC
1	2	1	2	2	2	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
Node No.	Indicates the Node No. in DECIMAL.

(Note)
- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

12)Terminating resistance (TM)

This command is used for the use of setting and writing the terminating resistance (RS-485).

<Command Fra me Structure>

STX	Node No.	Command code "TM"	Termi-nation	ETX	BCC
1	2	2	1	1	1

Termination set	Specifies the terminating resistance to be changed in DECIMAL Specified range : 0 to 1
	<table><tr><td>Specified No.</td><td>Terminating resistance</td></tr><tr><td>0</td><td>OFF</td></tr><tr><td>1</td><td>ON</td></tr></table> When the application ID is set to "*", the set value will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "TM"	Response code "00"	Termi-nation	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
Termination set	Indicates the set value that applies to the terminating resistance in DECIMEL.

<Note>
- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

13)Communication Port Set Command(CP)

This command is used for setting and reading baud, data length, parity bit, stop bit of the communication ports.

<Command Frame Structure>

STX	Node No.	Command code "CP"	Port No.	Baud	Data length	Parity Bit	Stop bit	BCC	ACK NACK	Time out	ETX	BCC
1	2	2	1	1	1	1	1	1	1	1	1	1

Port No.	Specifies the Port No. to be changed in DECIMAL Specified range : 1 to 2
Baud	Specifies the baud to be changed in DECIMAL Specified range : 0 to 3 <table><tr><td>Specified No.</td><td>Baud</td></tr><tr><td>0</td><td>9600bps</td></tr><tr><td>1</td><td>19200bps</td></tr><tr><td>2</td><td>38400 bps</td></tr><tr><td>3</td><td>115200 bps</td></tr></table>When the application ID is set to "*", the set value will be read.
Data length	Specifies the data length to be changed in DECIMAL. Specified range : 0 to 1 <table><tr><td>Specified No.</td><td>Data length</td></tr><tr><td>0</td><td>7Bit</td></tr><tr><td>1</td><td>8Bit</td></tr></table>When the application ID is set to "*", the set value will be read.
Parity bit	Specifies the parity bit to be changed in DECIMAL. Specified range : 0 to 2 <table><tr><td>Specified No.</td><td>Parity</td></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Odd</td></tr><tr><td>2</td><td>Even</td></tr></table>When the application ID is set to "*", the set value will be read.
Stop bit	Specifies the stop bit to be changed in DECIMAL. Specified range : 0 to 1 <table><tr><td>Specified No.</td><td>Stop bit</td></tr><tr><td>0</td><td>1Bit</td></tr><tr><td>1</td><td>2Bit</td></tr></table> When the application ID is set to "*", the set value will be read.
	Specifies the BBC to be changed in DECIMAL. Specified range : 0 to 1 <table><tr><td>Specified No.</td><td>BCC</td></tr><tr><td>0</td><td>OFF</td></tr><tr><td>1</td><td>ON</td></tr></table>When the application ID is set to "*", the set value will be read.
ACK/NACK	Specifies the communication mode to be changed in DECIMAL. Specified range: 0 to 1 <table><tr><td>Specified No.</td><td>ACK/NACK</td></tr><tr><td>0</td><td>OFF</td></tr><tr><td>1</td><td>ON</td></tr></table>When the application ID is set to "*", the set value will be read.
Time out	Specifies the time out to be changed in DECIMAL. Specified range: 0 to 1 <table><tr><td>Specified No.</td><td>Time out</td></tr><tr><td>0</td><td>5 sec.</td></tr><tr><td>1</td><td>0.5 sec.</td></tr></table>When the application ID is set to "*", the set value will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "CP"	Response code "00"	Port No.	Baud	Data length	Parity bit	Stop bit	BCC	ACK NACK	Time out	ETX	BCC
1	2	1	2	2	1	1	1	1	1	1	1	1	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
Port No..	Indicates the specified port No. in DECIMEL.
Baud	Indicates the set value that applies to the specified baud in DECIMEL.
Data length	Indicates the set value that applies to the specified data length in DECIMEL.
Parity bit	Indicates the set value that applies to the specified parity bit in DECIMEL.
Stop bit	Indicates the set value that applies to the specified stop bit in DECIMEL.
BCC	Indicates the set value that applies to the specified BBC in DECIMEL.
ACK/NACK	Indicates the set value that applies to the specified control mode in DECIMEL.
Time out	Indicates the set value that applies to the specified time out in DECIMEL

<Note>

- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

14) Communication Type(CT)

This command is used for selecting COM 1 as RS232C or RS485 in use.

Command Frame Structure

STX	Node No.	Command code "CT"	Commu- nication Type	ETX	BCC
1	2	2	1	1	1

Communication type	Specifies the set values depend on the communication type in DECIMAL. Specified range: 0 to 2
	<table><tr><td>Specified No.</td><td>Communication type</td></tr><tr><td>0</td><td>RS 232C</td></tr><tr><td>1</td><td>RS485</td></tr></table> When the application ID is set to "*", the set value will be read.

Response Frame Structure

STX	Node No.	Retry flag	Command code "CT"	Response code "00"	Commu- nication type	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
Communication type	Indicates the set value that applies to the communication type in DECIMEL.

<Note>

- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

15)Communication Mode with Tag (CM)

This command is used for setting and reading the communication mode with tag.

<Command Frame Structure>

STX	Node No.	Command code "CM"	Commu- nication mode	ETX	BCC
1	2	2	1	1	1

Communication mode	Specifies the set vale that applies the communication mode in DECIMAL. Specified range : 0 to 1

Specified No.	Communication Mode
0	Standard Mode
1	Fast Mode

When the application ID is set to "*", the set value will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "CM"	Response code "00"	Commu- nication mode	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
Communication mode	Indicates the set value that applies to the communication type in DECIMEL.

<Note>
- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

16) Initialization Set Command(IS)

This command is used for initializing the all set data.

<Command Frame Structure>

STX	Node No.	Command code "IS"	ETX	BCC
1	2	2	1	1

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "IS"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.

<Note>
- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

17)EEPROM Write Command(EW)

This command is used for writing the set value to EEPROM.

<Command Frame Structure>

STX	Node No.	Command code "EW"	ETX	BCC
1	2	2	1	1

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "EW"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	00 : Normal completion
	For other response codes, refer to the Response Code List.

18)Antenna Selection Command(AC)

This command is used to enable or disable the receiving antenna.

<Command Frame Structure>

STX	Node No.	Command code "AC"	Antenna selection	ETX	BCC
1	2	2	1	1	1

Antenna selection	Specifies the TX/RX ANT, RX ANT. Specified range: 0 to 3
	<table><tr><th>Specified No.</th><th>TX/RX ANT</th><th>RX ANT</th></tr><tr><td>0</td><td>disable</td><td>disable</td></tr><tr><td>1</td><td>enable</td><td>disable</td></tr><tr><td>2</td><td>disable</td><td>enable</td></tr><tr><td>3</td><td>enable</td><td>enable</td></tr></table> When the application ID is set to "*", the set values will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "AC"	Response code "00"	ETX	BCC
1	2	1	2	2	1	1

Response code	Normal completion For other response codes, refer to the Response Code List.

<Note>

- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

19)SNR Addition Set Command(SN)

This command is used to enable or disable the SNR to the read command (except special read).

⟨Command Frame Structure⟩

STX	Node No.	Command code "SN"	SNR mode	ETX	BCC
1	2	2	1	1	1

SNR mode	Specified whether SNR is enable d or disabled. Specified range: 0 to 1

Specified No.	SNR Addition mode
0	disable
1	enable

When the application ID is set to "*", the set value will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "SN"	Response code "00"	SNR mode	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
SNR addition mode	Indicates the set value that applies to the SNR addition mode.

<Response Frame Structure, when SNR is disabled.>

STX	Node No.	Retry flag	Command code "SN"	Response code "00"	Read data	ETX	BCC
1	2	1	2	2	Specified Number	1	1

<Response Frame Structure, when SNR is enabled>

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	SNR	Read data	ETX	BCC
1	2	1	2	2	8	Specified Number	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
SNR data	Indicates the read SNR data
Read data	Indicates the data For details, see "V720-CD1D, Host communication manual".

<Note>

- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.

20) OFF Line Mode (FL)

This command is used to select either ON Line mode or OFF Line mode at the start.

While OFF Line mode, the controller checks EAS command by itself. When the value is over the discrimination value, the controller sends the signal from output 1.

<Command Frame Structure>

STX	Node No.	Command code "FL"	ON/ OFF mode	Time	Discri- mina- tion value	ETX	BCC
1	2	2	1	1	2	1	1

ON/OFF mode	Specifies the value that applies the mode at the start in DECIMEL. Specified range: 0 to 1
	<table><tr><td>Specified No.</td><td>ON/OFF mode</td></tr><tr><td>0</td><td>ON Line mode</td></tr><tr><td>1</td><td>OFF Line mode</td></tr></table> When the application ID is set to "*", the set value will be read.
Time(*100ms)	Specified the time for sending signal to the OUT 1 in HEX, while OFF Line mode. Specified range: 1h to Ah (100 - 1000ms) When the application ID is set to "*", the set value will be read.
Discrimination value(%)	Specified the discrimination value to be send to the OUT 1 in HEX, while OFF Line mode. Specified range 00h to 64h (%) (See EAS Check Command) When the application ID is set to "*", the set value will be read.

<Response Frame Structure>

STX	Node No.	Retry flag	Command code "FL"	Response code "00"	ON/ OFF mode	Discri- mina- tion value	ETX	BCC
1	2	1	2	2	1	2	1	1

Response code	00 : Normal completion For other response codes, refer to the Response Code List.
ON/OFF mode	Indicates the value that applies the specified mode in DEDIMEL.

<Note>

- The setting is first valid, after resetting by reset command.
- For reuse the set values by the another starting again, writing to EEPROM is requested by EEPROM.
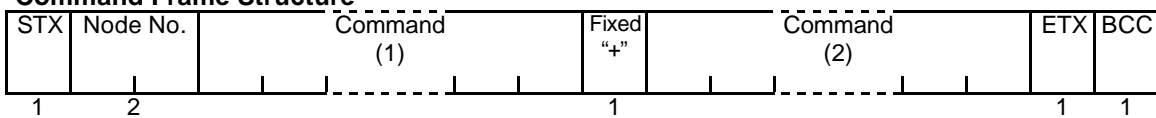
5-4 Command Connection

A command connection function allows the Controller to perform both read and write operations at a time by connecting commands from the host with "+". Any of the following commands can be paired.
- Read (RD)
- Write (WT)
- Polling Single Auto Read (PR)
- Polling Single Auto Write (PW)
- Memory Check (MC)
- Memory Calculation (MK)
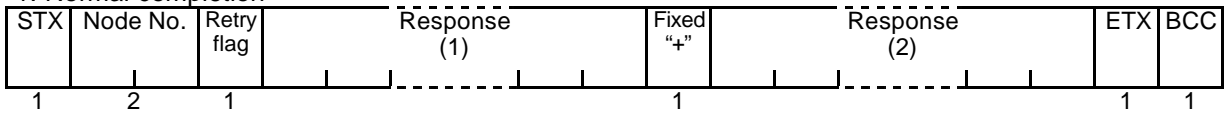
Example of command connection
In a command connection function, a single STX, Node No., BCC and ETX are shared each, and connected to each other using "+".

Command Frame Structure

STX	Node No.	Command (1)	Fixed "+"	Command (2)	ETX	BCC
1	2		1		1	1

Response Frame Structure

1. Normal completion

STX	Node No.	Retry flag	Response (1)	Fixed "+"	Response (2)	ETX	BCC
1	2	1		1		1	1

2. Abnormal completion

With abnormal completion, the command code and response code of a command (1) are returned.

STX	Node No.	Retry flag	Command(1) code	Response code	ETX	BCC
1	2	1	2	2	1	1
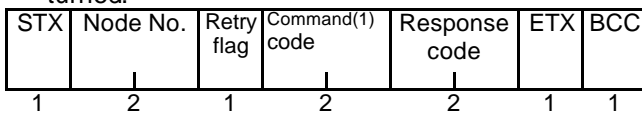
The Following Combinations of Command Connections Are Possible

		Command 1					
		RD	WT	MK	MC	PR	PW
Command 2	RD	✓	✓	–	–	–	–
	WT	✓	✓	–	–	–	–
	MK	–	✓	–	–	–	–
	MC	✓	–	–	–		–
	PR	–	–	–	–	✓	✓
	PW	–	–	–	–	✓	✓

✓ : able to connect , – : not able to connect

Note 1 The communications method specified using command 1 is given priority. Single Auto is specified for polling commands, and Single Trigger is specified for the memory check and memory calculations.

Note 2 When a polling system command is specified for command 1, the Controller performs polling.

Note 3 The number of timeslot setting made using command 1 is given priority.

5-5 Communications Methods

For communications, settings for access and mode should be made according to the state of Tags in the communications area of the Antenna and their operation after the Tags receive commands.

5-5-1 Access Settings

There are the following four access settings according to the number of Tags in the communications area and their states.

1) Single Access

In single access, a single Tag can exist in the communications area. The presence of two or more Tags in the communications area causes a communications error.
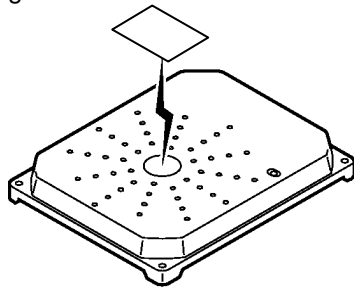
2) FIFO Access

In FIFO (first-in, first-out) access, communications with Tags entering the communications area one after another are carried out in sequence. Once communications with Tags are completed, access to them is prohibited. Consequently, even if Tags with which communications are already completed exist in the communications area, a newly entering Tag can be accessed. Simultaneous entering of two or more Tags causes a communications error. Once an access-prohibited Tag leaves the communications area, access to the Tag is enabled again.
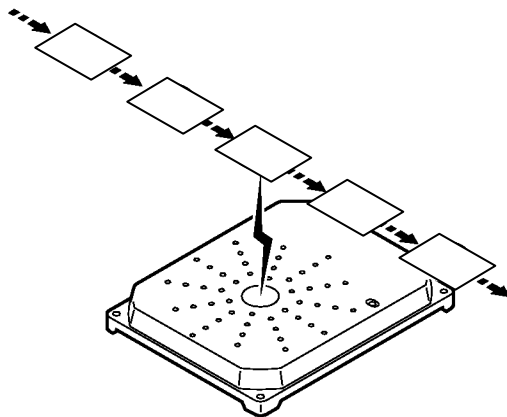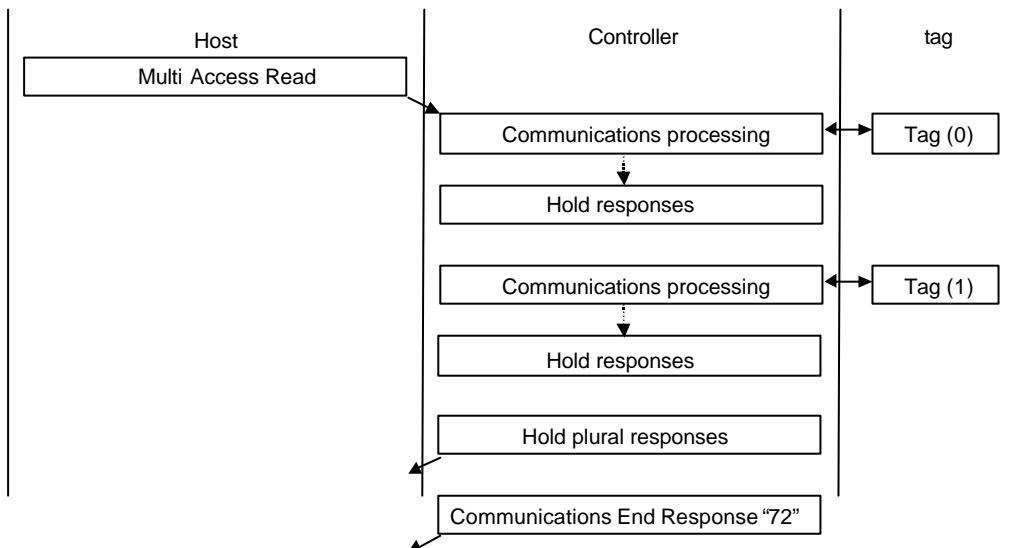
3) Multiple Access

In multiple access, communications with all of Tags existing in the communications area can be carried out. In this case, the Tag No. setting commensurate with the number of Tags within the communications range is set using the commands.
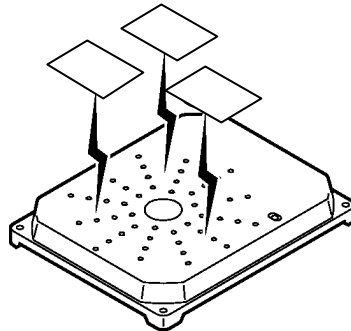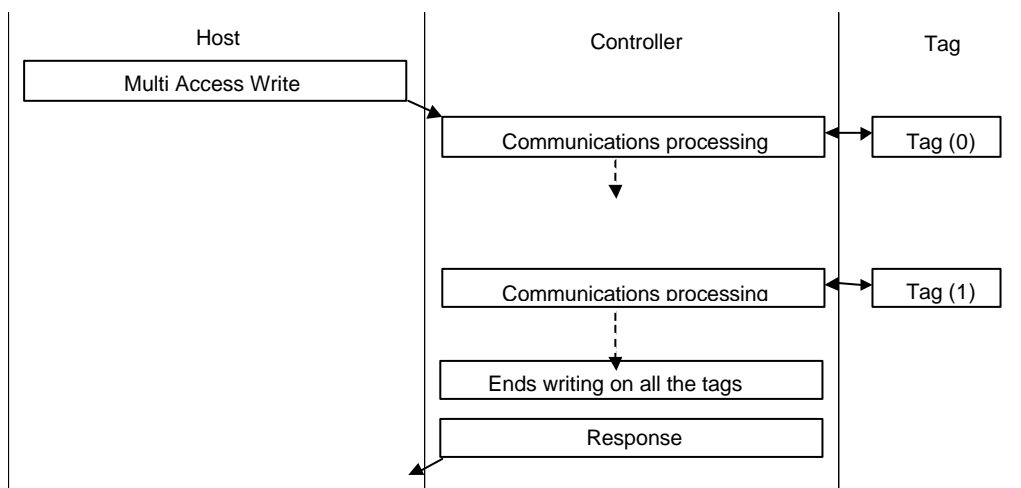

Multiple Access Read

A communications end response is returned when communications with all Tags within the communications range ends for the Multiple Access Read Command (RD).

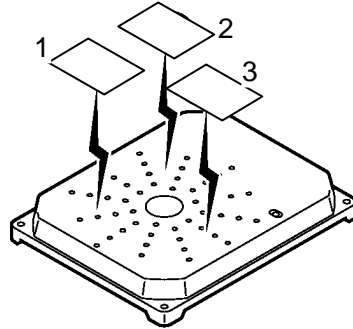| Host	Controller	tag
Multi Access Read		
	Communications processing	Tag (0)
	Hold responses	
	Communications processing	Tag (1)
	Hold responses	
	Hold plural responses	
	Communications End Response "72"	

Multiple Access Write

A response is returned once only when communications with all Tags within the communications range ends for the Multiple Access Write Command (WT).

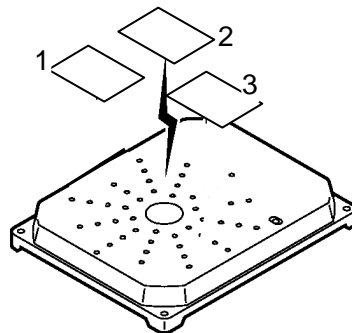| Host	Controller	Tag
Multi Access Write		
	Communications processing	Tag (0)
	Communications processing	Tag (1)
	Ends writing on all the tags	
	Response	

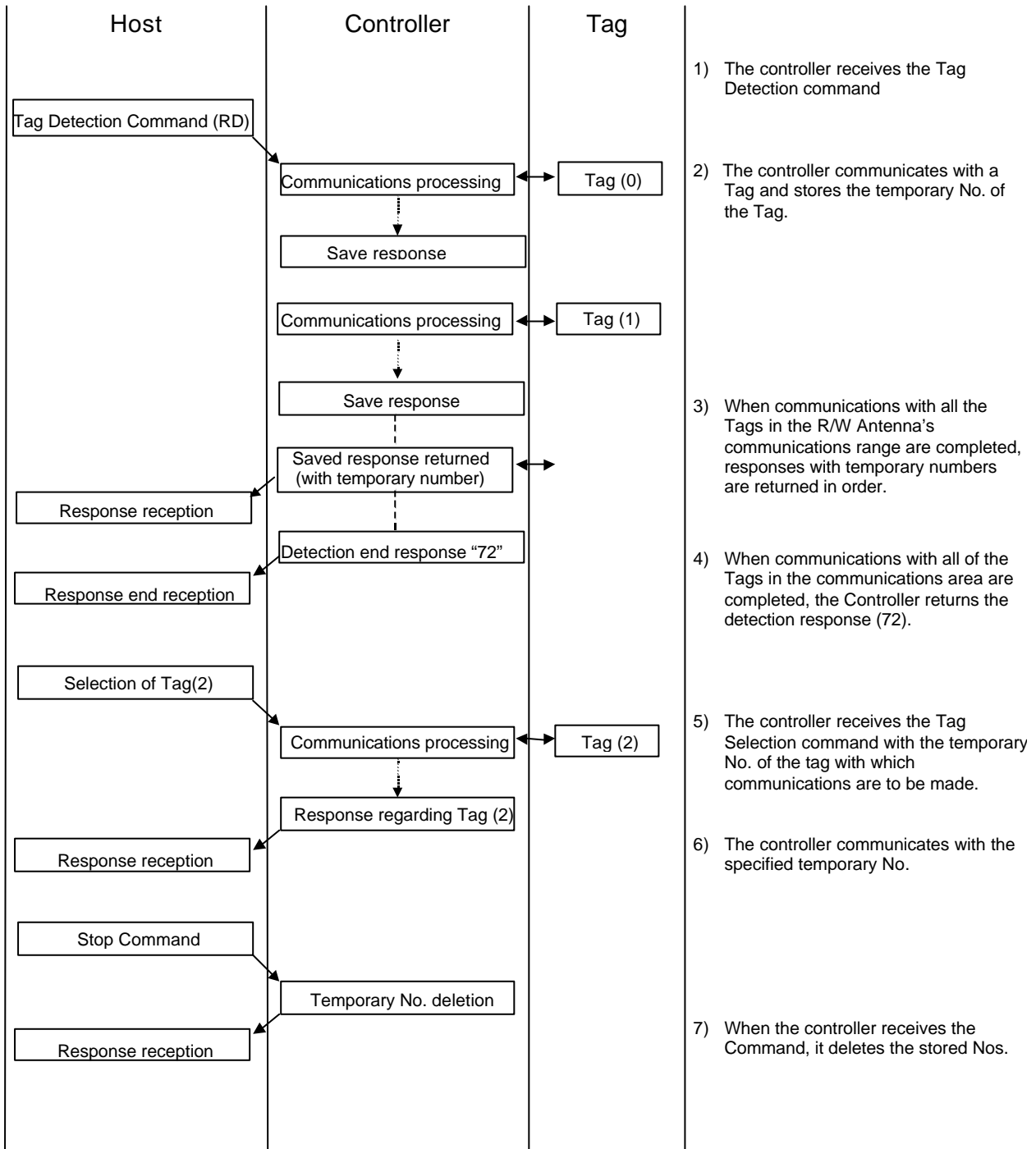### 4) Selective Access (Trigger Mode only on Selective Access)

In the selective access trigger function, a selected Tag from among multiple Tags in the communications area of the Antenna is accessed. First, temporary numbers are assigned to the Tags in the communications area. The Tag Selection Command allows the Controller to communicate with a selected Tag according to each temporary number assigned.

a. Temporary number assigned

b. Communications with Tag No. 2

Host	Controller	Tag

Tag Detection Command (RD)

Communications processing ↔ Tag (0)

Save response

Communications processing ↔ Tag (1)

Save response

Saved response returned (with temporary number)

Response reception

Detection end response "72"

Response end reception

Selection of Tag(2)

Communications processing ↔ Tag (2)

Response regarding Tag (2)

Response reception

Stop Command

Temporary No. deletion

Response reception

1) The controller receives the Tag Detection command

2) The controller communicates with a Tag and stores the temporary No. of the Tag.

3) When communications with all the Tags in the R/W Antenna's communications range are completed, responses with temporary numbers are returned in order.

4) When communications with all of the Tags in the communications area are completed, the Controller returns the detection response (72).

5) The controller receives the Tag Selection command with the temporary No. of the tag with which communications are to be made.

6) The controller communicates with the specified temporary No.

7) When the controller receives the Command, it deletes the stored Nos.

■ Exceptions to the Selective Access Trigger Function

1) When the Tags with the temporary numbers selected by the Tag Selection Command are not present, the Controller returns a communications error to the host.

2) When the Tag Selection Command selects temporary numbers other than those stored by the Controller by the Tag Detection Command, the Controller returns a format error to the host.

3) The temporary number once stored by the Controller is not deleted until the Controller executes the Stop Command. Commands other than selective access commands (excluding the Reset Command (XZ)) are not accepted until the Controller executes the Stop Command. When the Tag Detection Command has been executed once, it cannot be performed again until processing has been completed.

Note: The Tag Detection Command means that "LT" is set to the "communications" of a command frame. Also, the selection of Tag(1) means that "01" is set to the "communications" of the command frame.

5-5-2 Mode Settings

There are the following four mode settings according to the state of the Controller and of Tags.

1) Trigger Mode

In trigger mode, communications with a stationary Tag in the communications area are carried out. When no Tag is present in the area, an error response is returned.
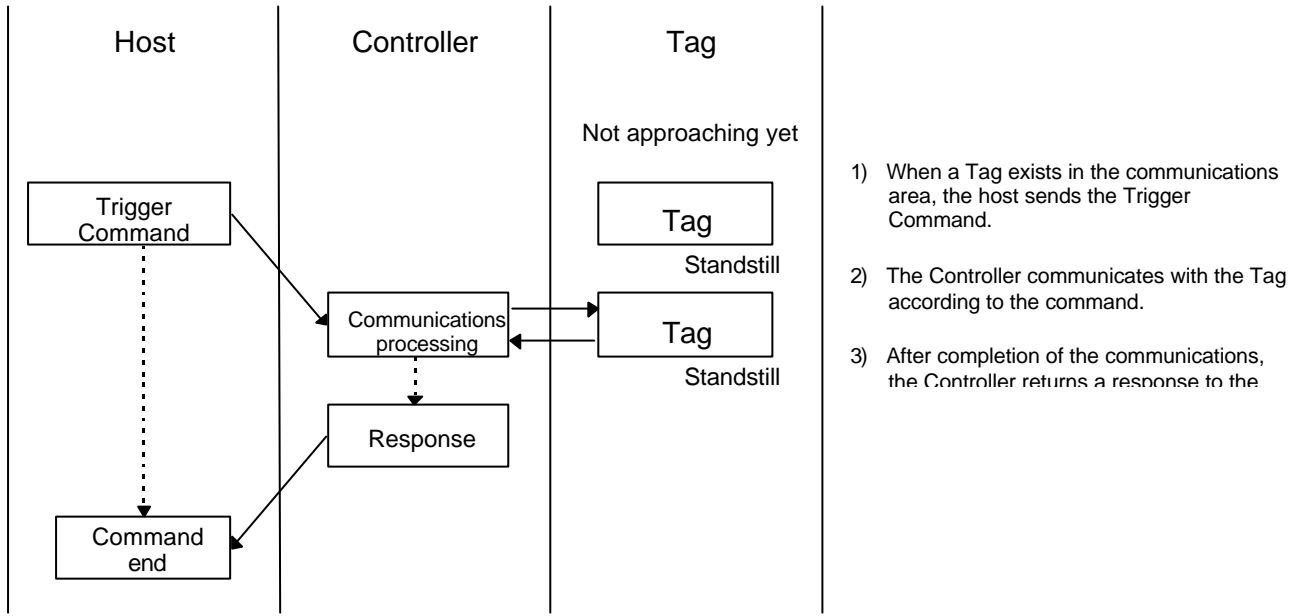

1) When a Tag exists in the communications area, the host sends the Trigger Command.

2) The Controller communicates with the Tag according to the command.

3) After completion of the communications, the Controller returns a response to the

Note: Before using Trigger Mode, check that the Tags are not moving and are within the Antenna's communications range.

2) Auto Mode

In auto mode, after receiving an Auto command from the host, the Controller waits for a Tag to enter the communications area. Since the Controller is in a busy state between Auto command reception and the completion of communications with the Tag, it does not accept any commands other than the Stop or Reset Command during the period.
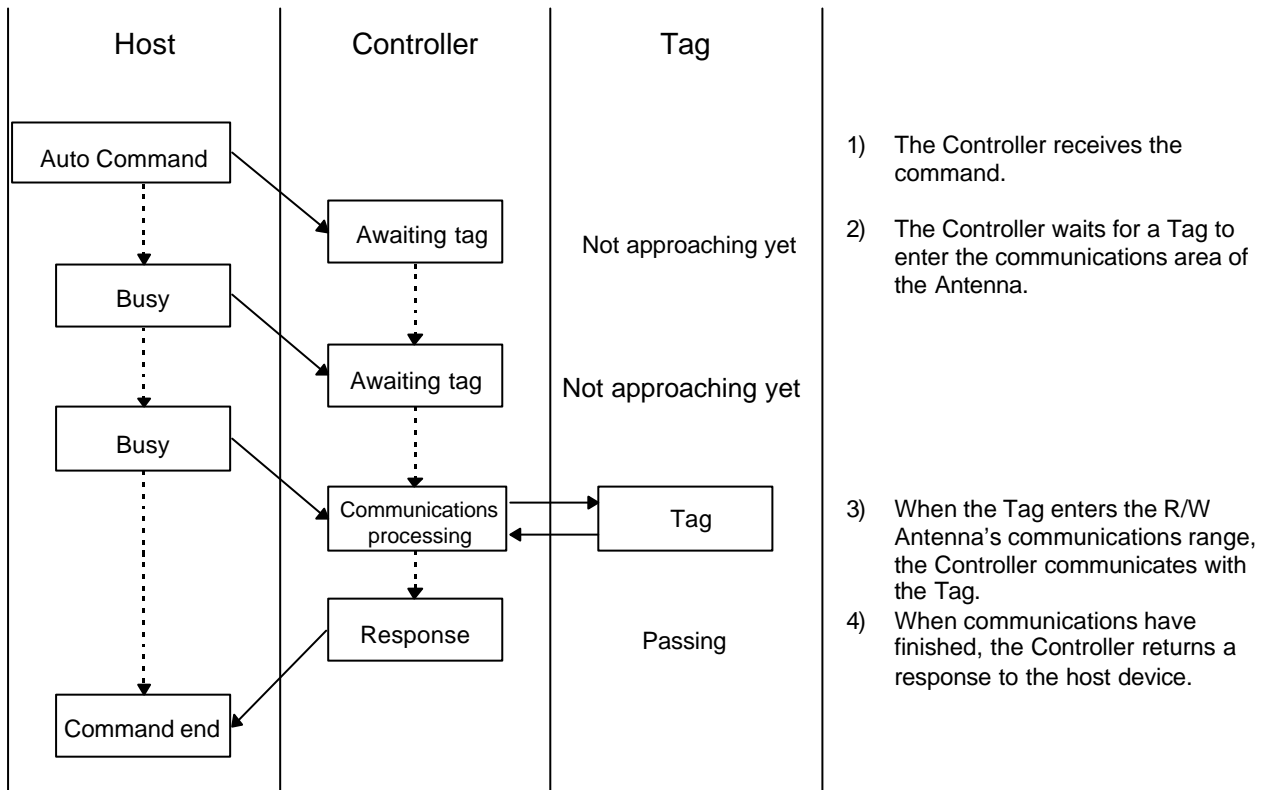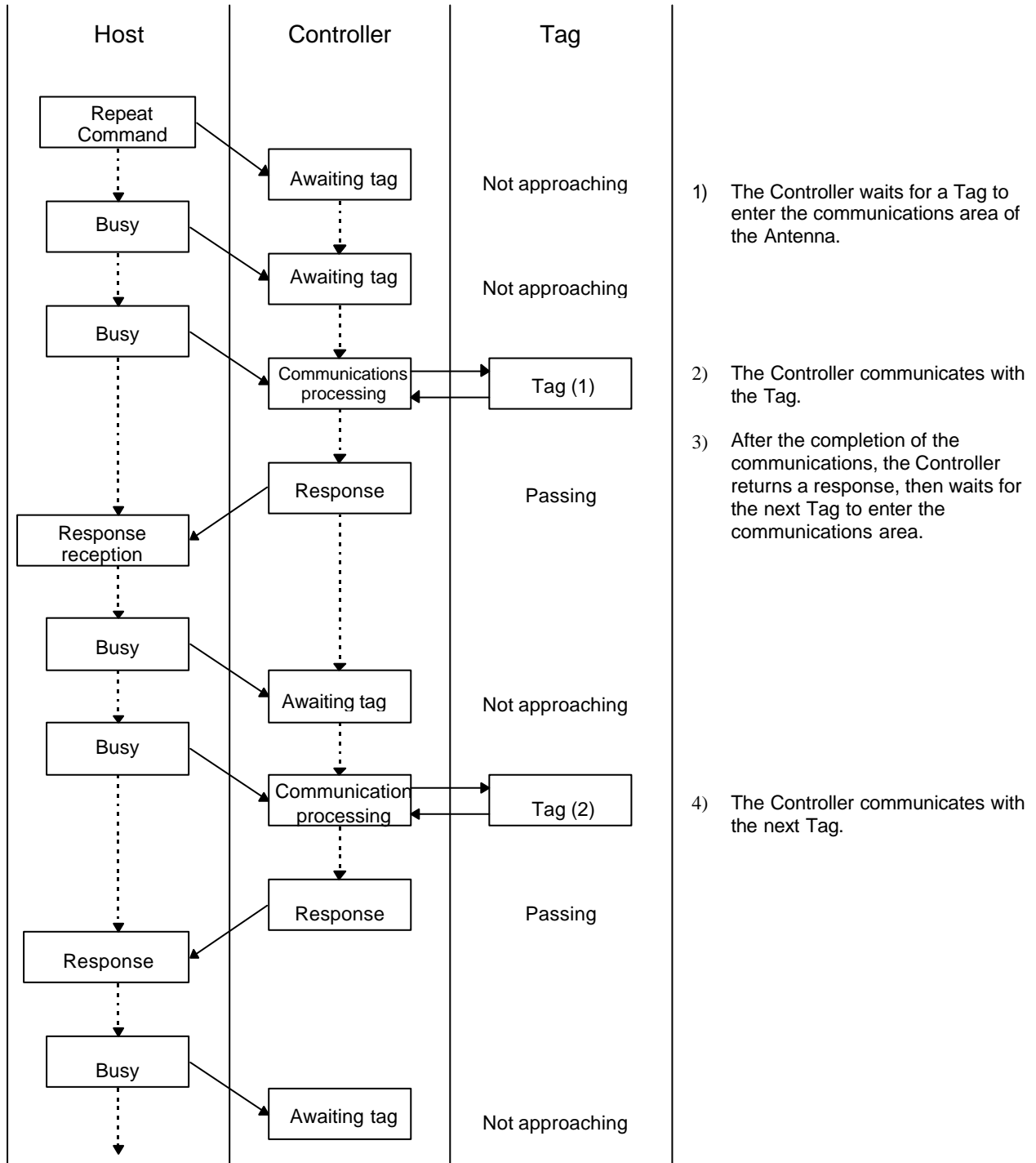
Host	Controller	Tag	
Auto Command			1) The Controller receives the command.
	Awaiting tag	Not approaching yet	2) The Controller waits for a Tag to enter the communications area of the Antenna.
Busy			
	Awaiting tag	Not approaching yet	
Busy			
	Communications processing	Tag	3) When the Tag enters the R/W Antenna's communications range, the Controller communicates with the Tag.
	Response	Passing	4) When communications have finished, the Controller returns a response to the host device.
Command end			

In Auto Mode, the communications path between the host device and the Controller is busy until a Tag approaches the Controller, so the host device cannot send the next command.
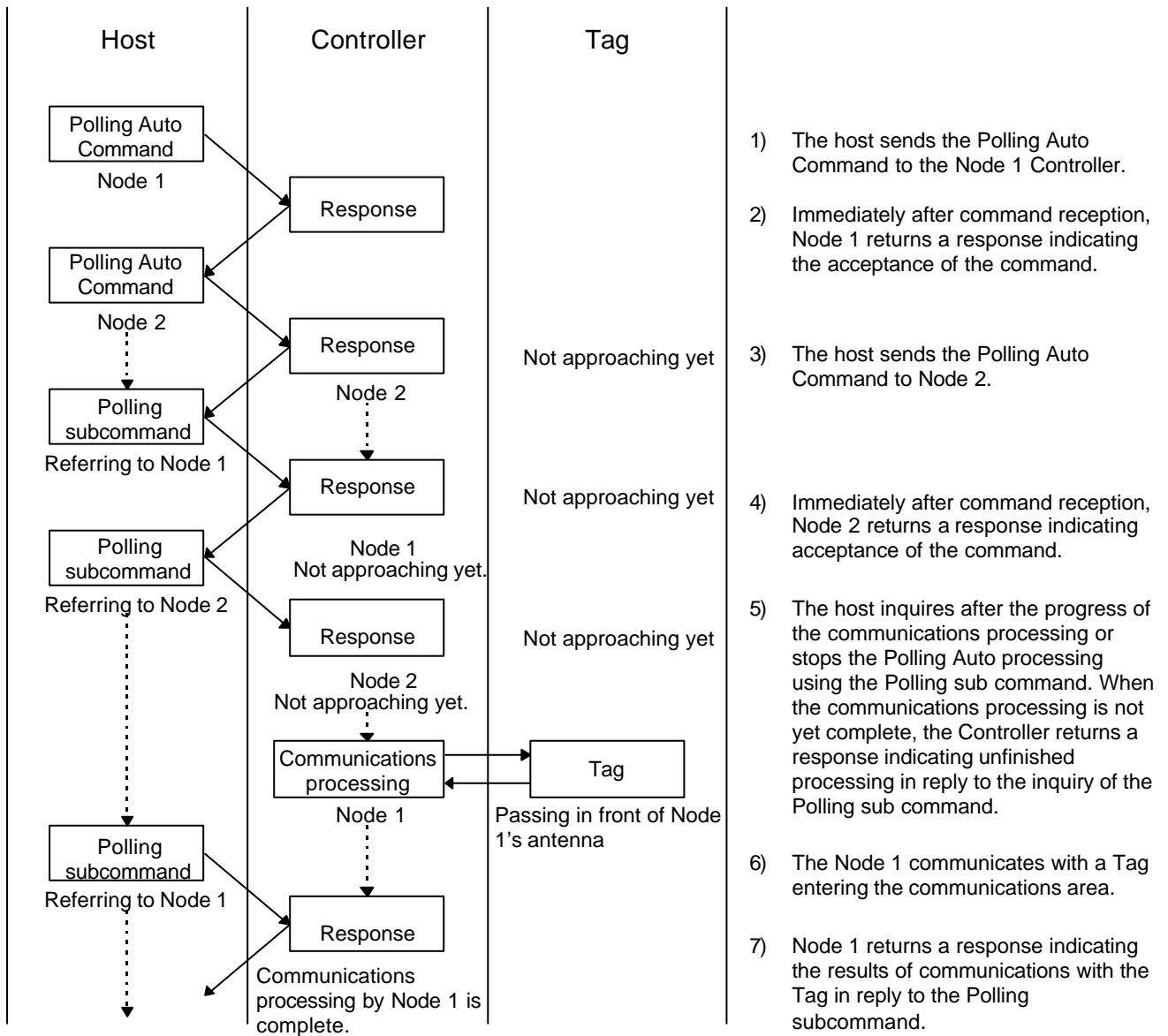
3) Repeat Mode

In repeat mode, every time an Tag enters the communications area, the Controller communicates with the Tag and returns a response. <u>It is not until communications are stopped by the Stop or Reset command that the Controller accepts the next command.</u>

Host	Controller	Tag	
Repeat Command			
	Awaiting tag	Not approaching	1) The Controller waits for a Tag to enter the communications area of the Antenna.
Busy			
	Awaiting tag	Not approaching	
Busy			
	Communications processing	Tag (1)	2) The Controller communicates with the Tag.
	Response	Passing	3) After the completion of the communications, the Controller returns a response, then waits for the next Tag to enter the communications area.
Response reception			
Busy			
	Awaiting tag	Not approaching	
Busy			
	Communication processing	Tag (2)	4) The Controller communicates with the next Tag.
	Response	Passing	
Response			
Busy			
	Awaiting tag	Not approaching	

To send another command from Repeat Mode, be sure to use either the stop command or reset command, and make sure that the Controller has finished processing commands and is in command waiting status before sending the new command.

4) Polling Auto Mode

If an Auto command is used when a single host controls more than one Controllers, the communications path between the host and one of the Controllers to which the command is sent becomes busy, disabling the host to control other Controllers. On the other hand, when a Polling Auto command is sent instead, the Controller returns a response in reply to a Polling subcommand, which allows the host to send a command to other Controllers. During the execution of the Polling Auto command, commands other than the Polling subcommand, Reset and Stop commands are not executed. The following flowchart shows the case where the Polling Auto Command is sent to 2 Controllers.

Host	Controller	Tag	
Polling Auto Command Node 1			1) The host sends the Polling Auto Command to the Node 1 Controller.
	Response		2) Immediately after command reception, Node 1 returns a response indicating the acceptance of the command.
Polling Auto Command Node 2			
	Response Node 2	Not approaching yet	3) The host sends the Polling Auto Command to Node 2.
Polling subcommand Referring to Node 1			
	Response	Not approaching yet	4) Immediately after command reception, Node 2 returns a response indicating acceptance of the command.
Polling subcommand Referring to Node 2	Node 1 Not approaching yet.		5) The host inquires after the progress of the communications processing or stops the Polling Auto processing using the Polling sub command. When the communications processing is not yet complete, the Controller returns a response indicating unfinished processing in reply to the inquiry of the Polling sub command.
	Response Node 2 Not approaching yet.	Not approaching yet	
	Communications processing Node 1	Tag Passing in front of Node 1's antenna	6) The Node 1 communicates with a Tag entering the communications area.
Polling subcommand Referring to Node 1	Response Communications processing by Node 1 is complete.		7) Node 1 returns a response indicating the results of communications with the Tag in reply to the Polling subcommand.

5-5-3 Table of Communications Methods

Name	Code	Description
Single Trigger	ST	Immediately after receiving a command, the Controller communicates with a Tag and returns a response. If the Tag is missing, an error is returned. During communications, only one Tag exists in the communications area of the Antenna.
Single Auto	SA	After receiving a command, the Controller waits for a Tag to enter the communications area. Next, the Controller communicates with the entering Tag and returns a response. During communications, only one Tag exists in the communications area.
Single Repeat	SR	The Controller waits for a Tag to enter the communications area and communicates with the entering Tag. After sending a response, the Controller is put into a Tag waiting state again and repeats this process until receiving the Stop or Reset Command. During communications, only one Tag exists in the communications area.
Multi-trigger	MT	Immediately after receiving a command, the Controller communicates with all of the Tags existing in the communications area and returns responses corresponding to each Tag. After sending the responses, the Controller enters a command waiting state.
Multi-repeat	MR	The Controller waits for Tags to enter the communications area. It communicates with all of the Tags existing in the communications area and returns responses corresponding to each Tag. After completing communications, the Controller disables the operation of the Tags. After sending the responses, the Controller is put into a Tag waiting state again and repeats this process until receiving the Stop or Reset Command.
FIFO Trigger	FT	Immediately after receiving a command, the Controller communicates with a Tag and returns a response. After completing communications, the Controller disables the operation of the Tag. After sending the response, the Controller will continue to operate until it receives a FIFO command, stop command, or reset command. During communications, only one Tag in the communications area is operable.
FIFO Auto	FA	After receiving a command, the Controller waits for a Tag to enter the communications area. Next, the Controller communicates with the entering Tag and returns a response. After sending the response, the Controller will continue to operate until it receives a FIFO command, stop command, or reset command. After sending the response, the Controller enters a command waiting state. During communications, only one Tag in the communications area is operable.
FIFO Repeat	FR	The Controller waits for a Tag to enter the communications area and communicates with the entering Tag. After completing communications, the Controller disables the operation of the Tag. After sending the response, the Controller enters a Tag waiting state again and repeats this process until receiving the Stop or Reset Command. During communications, only one Tag in the Communications area is operable.
Selective Access	LT or ? ?	A Tag selected from among multiple Tags in the communications area is accessed.

5-5-4 Table of Communications Methods for Commands

Command	Communications Method										
	Single			FIFO			Multi		Selective		Fast read
	Trigger	Auto	Repeat	Trigger	Auto	Repeat	Trigger	Repeat	Tag detec-tion	Tag speci-fication	
Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Write	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	–
Polling Read (see note 1)	–	✓	–	–	–	–	–	–	–	–	–
Polling Write (see note 1)	–	✓	–	–	–	–	–	–	–	–	–
Memory Check (see note 2)	✓	–	–	–	–	–	–	–	–	–	–
Memory Calculate (see note 2)	✓	–	–	–	–	–	–	–	–	–	–
Lock (see note 2)	✓	–	–	–	–	–	–	–	–	–	–

✓ :Able to select communications method

– :Not able to select communications method

Note 1: The specified communications mode is fixed as Single Auto. The user cannot specify another mode.

Note 2: The specified communications mode is fixed as Single Trigger. The user cannot specify another mode.

5-6 Data Type

Specify using the commands whether read/write data is to be handled as ASCII (or JIS8 code) character data, or as hexadecimal numerical data.

Name	Code	Description
ASCII data	A	A character of data occupies 1 byte (1 address) on a Tag as an ASCII code or a JIS 8 code.
HEX data	H	A character is handled as hexadecimal data. Therefore, only characters from "0" to "F" are accepted. Two characters of data occupy 1 byte (1 address) on a Tag.

- Example of ASCII Representation
  When writing "V720" to four bytes of memory of page 00 using ASCII data, the data will occupy the Tag's memory as follows:

	Byte 0		Byte 1		Byte 2		Byte 3	
Page 00h	5	6	3	7	3	2	3	0
Content	V		7		2		0	

- Example of Hexadecimal Representation
  When writing "12345678" to four bytes of memory of page 01h using hexadecimal data, the data will occupy the Tag's memory as follows:

	Byte 0		Byte 1		Byte 2		Byte 3	
Page 01h	1	2	3	4	5	6	7	8

5-7 Tag Number Setting

The timeslot setting is the setting in the command frame when communicating with multiple Tags simultaneously using Multi-system commands.

Tag Number Setting	Max. No. of Tags with which simultaneous communication is possible
1	2
2	4
3	8
4	16
5	32
6	64
7	128

Example: If the number of Tags is seven, select Tag Number setting 3.

Note 1: If more Tags than have been set using the timeslot setting enter the communications range, a "70" error may occur (e.g., if the timeslot setting is 2, and there are five Tags in the communications range). Select a suitable setting by referring to the above table.

Note 2: With the Special Read Command (refer to *5-3-7 General Commands and Responses*), because anti-collision processing is not performed, even if the number of Tags inside the communications area is greater than the Tag Number setting, read data is returned. Data is not returned, however, for Tags that collide.

Note 3: The higher the timeslot setting, the longer the communications time required. Consequently, setting a higher timeslot setting than required for the number of Tags in use unnecessarily lengthens communications time, so select a suitable setting.

5-8   Communications Phase

The following commands and responses can be made by specifying different command communications settings.
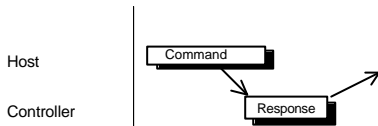
(1)   No Response

When the Controller receives the Reset Command, it is reset without returning a response and waits for the next command.
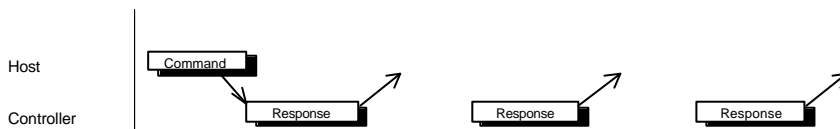
```
          ┌─────────┐
Host      │ Command │
          └────┬────┘
               │
Controller     └──▶ Reset
```
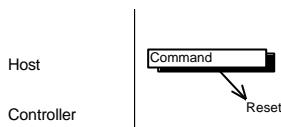
(2)   1-to-1

One response is sent per command with the following commands: Single Trigger, Single Auto, FIFO Trigger, FIFO Auto (commands that communicate with Tags) or commands that do not communicate with Tags.

```
          ┌─────────┐
Host      │ Command │
          └────┬────┘
               │   ┌──────────┐
Controller     └──▶│ Response │
                   └──────────┘
```

(3)   Multiple Response

Multiple responses are sent per command when the following commands have been specified: Single Repeat, FIFO Repeat, Multi-trigger, Multi-repeat, or Selective Access (for commands that communicate with Tags).

```
          ┌─────────┐
Host      │ Command │
          └────┬────┘
               │   ┌──────────┐        ┌──────────┐        ┌──────────┐
Controller     └──▶│ Response │        │ Response │        │ Response │
                   └──────────┘        └──────────┘        └──────────┘
```

5-9 ACK/NACK Control

5-9-1 Error Handling in ACK/NACK Control

When using ACK/NACK control, if the host does not receive a normal response, the Controller will resend the response by either (1) when the host sends a NACK command to the Controller or (2) when there is no response within a set period of time. Consequently, a response can be received without communicating with a Tag again. The host checks that responses have been received normally using the ACK/NACK commands, so response data can be communicated dependably.

Using ACK/NACK Control

If the host receives a normal response, it sends an ACK command to the Controller. The Controller judges that the host has received a normal response, and enters a command-waiting state. If, after the Controller has sent the response, an ACK is not received normally within the time set using the time out setting, or a NACK is received, the Retry Flag is set and the last response is sent again. The maximum number of response retries that can be made is nine.
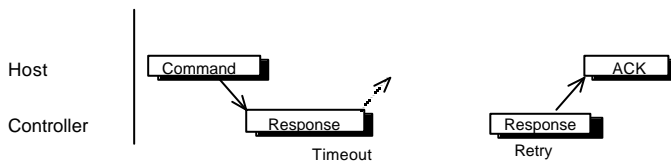
(1)   Host Receives a Normal Response and Sends ACK Command
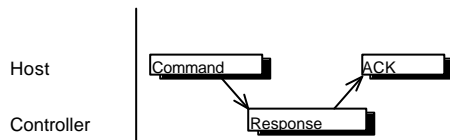
(2)   Host Cannot Receive a Normal Response and Sends a NACK Command
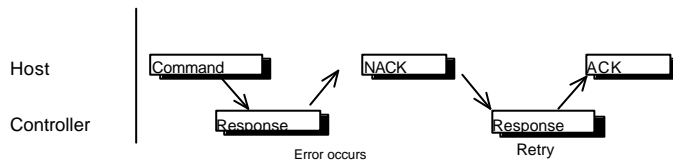
(3)   Host Did Not Send an ACK/NACK Command within the Timeout Period

5-10 Response Code List

Response codes in response frames are shown below.

Type	Response code	Name	Description
Normal end	00	Normal end	The received command ends normally with no error.
	72	Multi-processing end	Communications end response when a multi-trigger function is used
		Selective detection completion	Communications end response when a selective access/detection function is used.
	74	Polling command received	Polling commands are received normally, or polling occurs before communications with the Tags ends.
	75	Polling processing canceled	Polling processing is canceled before the completion of communications with an ID Tag.
		Data normal	Results of the memory calculation command (MK) check code verification are normal.
	76	Polling processing canceled	Polling processing is canceled after the start of communications with an ID Tag.
		Data error	Results of the memory calculation command (MK) check code verification show an error.
Host communications error	10	Parity error	A parity error occurs in one of the characters of the received command.
	11	Framing error	A framing error occurs in one of the characters of the received command.
	12	Overrun error	An overrun error occurs in one of the characters of the received command.
	13	BCC error	The received command has an incorrect BCC.
	14	Format error	The command format is incorrect. A stop command is received in command-waiting status. In Selective Access mode: 1) A temporary number not saved using the Tag detection command is specified; 2) A Tag detection command normal end is retried after is has been sent.
	18	Frame length error	ETX is not received in 151 characters or less after STX is received.
Communications error	70	Communications error	An error occurs during communications with an ID Tag, and communications cannot end normally. More Tags than have been specified in the timeslot setting have entered the communications range.
	71	Write process error	Tag is in an area that can be read, but not written to. You are trying to write to a locked page (i.e., write-protected). The correct data cannot be written to the Tag. An error was generated with read verification.
	72	No Tag error	No Tag is present in front of the Antenna when a Trigger command is executed. There are multiple Tags within the communications range when using Single Access mode.
	7C	Antenna error	Antenna is not connected, or is malfunctioning.
System error	93	Memory error	An error has occurred in the Controller memory.

5-10 Response Code List

This controller is added warning codes.

They are response code on the multi-read mode. The controller responds the read data and the following response code instead of error code "70", when the communication errors are occurred but some data can be read.

Type	Response code	Name	Description
Warning	"01"	Tag No. over	There are more tags than specified ones in the communication field. In the communications between tags and antenna, all communication procedures are successfully finished.
	"02"	Retry over	To read the all data in the communication area, retry were performed but not success.
	"04"	Communication error	Error was occurred while communication with tags, only some tags are achievable to read.
	"03"	Communication error (1)	Two of the errors "01","02" were occurred during communications procedures.
	"05"	Communication error(2)	Two of the errors "01","04" were occurred during communications procedures.
	"06"	Communication error(3)	Two of the errors "02","04" were occurred during communications procedures.
	"07"	Communication error(4)	All of the three errors "01","02","04" were occurred during communications procedures.