V700 Series R/W Module

Model V700-HMC71
Model V700-HMC73

Functional Specifications

First Edition

This manual specifies the specifications and transmission format of the R/W Module Model V700-HMC71/Model V700-HMC73.

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Precautions upon Use

The R/W Module is a Board Type Module designed for the user to construct the device through connecting the Module to other such control units as CPUs. The Module is equipped with basic protection circuits for the input/output terminals, but as it is anticipated that insulation damage through unanticipated high voltage or thermal damage through excessive power surge is inevitable, please take note of the following precautions, and comply by them upon use.

1. When removing the Product from the box, please place it on an installed conducive mat.
2. When holding the board section of he Product, please be sure to hold the rims of the board. Please be sure not to put excessive pressure on the Product that may deform the exterior.
3. Please be sure to move and/or store the Product in its box, appropriately wrapped.
4. Please do not take the Product out of the box except when in use. Please do not leave the Product out by itself. It must be boxed.
5. Please do not touch the integrated circuit or patterns on the board.
6. Please do not put the Product in polyetherine or vinyl bags.
7. Please do not put voltage or currents exceeding the specified amount on the connector terminals. Please do not connect the output terminals directly into the power source.
8. If external surge is large upon constructing the device, please insert a filter or a device of similar function to absorb the excessive surge at the power source.
9. Please connect or disconnect the connector only upon installation. The Product is not suitable for applications where the connector is to be connected and disconnected repeatedly. Also, please be sure to structure the layout of cables so that excessive force will not be applied to the connector unit.

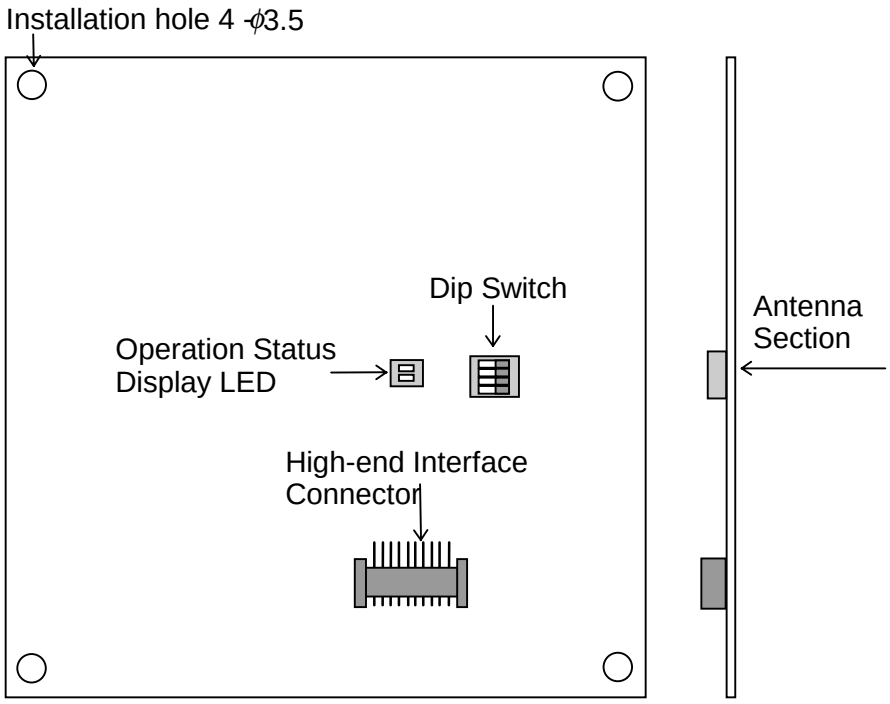
This Product uses a frequency of 125 kHz to communicate with tags. Some transceivers, motors, monitor units, and power (power IC) emit noise that adversely affects the communication with tags. If the R/W Module is to be used in an environment close to such devices, please check the effects of these devices prior to use.
To minimize the effect of noise, please earth any metal objects peripheral to the device with a class D grounding (class 3 grounding).

1. Product Outline

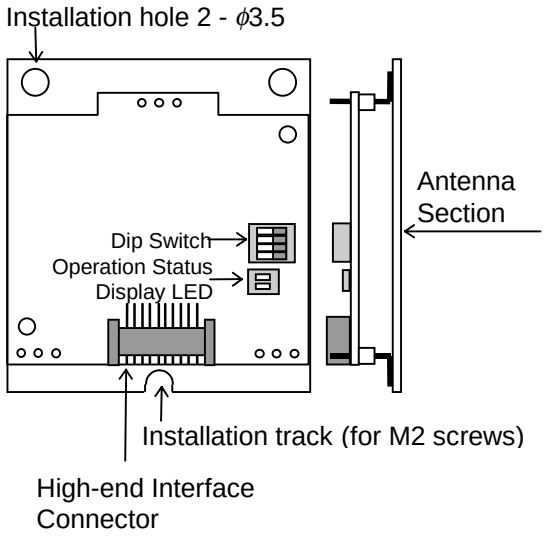
The R/W Module is an integrated unit of the transmission/receiving circuit and control function to communicate with the Model V700 Series Tag.

2. Specifications and Performance

(1) Shape

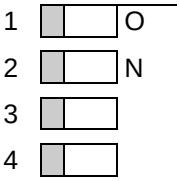


Model V700-HMC71



Model V700-HMC73

- Dip Switch
  By default, all DIP switches are set on OFF upon shipment.



No.	Name	Setting Range
1	Transmission speed setting	OFF: 9,600 / ON: 31,250 (bps)
2	Protocol setting	OFF: CR control / ON: restriction on number of characters
3	Unused	Please turn OFF
4	Unused	Please turn OFF

- Operating conditon displaying LED

LED Display	Detail
Green lights on	Lights on when communicating with the Tag
Red lights on	Lights on when communication process does not complete successfully.

- High-end Interface Connector
  This connector connects the Board to the High-end Device.
- Antenna Section
  When communicating with the tag, please bring tag close to the antenna.

(2) General Specifications

Item	Model V700-HMC71	Model V700-HMC73
External measurement	80 × 80 × 50 mm	40 × 44 × 10 mm
Installation	4 points Secured by M3 screws	Secured at 3 points, M2 or M2.3 screws
Electric current	5V ±10%	
Dissipation current	180 mA or less (while oscillating) 15 mA or less (no oscillation)	
Oscillation resistance (resistance)	10 ~ 150 Hz one-way swing radius 0.15 mm acceleration 20m/s2 3-directions 8 min 4x each	
Shock resistance (resistance)	200m/s2 6-directions 3x each	
Ambient temperature during use	-10 ~ +55°C	
Ambient temperature during storage	-25 ~ +65°C	
Ambient humidity during use	25 ~ 85% RH or less (with no condensation)	
Radio frequency	125 kHz	
Net weight	Approximately 18g	Approximately 11 g

(3) Electrical Specification

■ Absolute Maximum Ratings

Item	Symbol	Standard Value
Supply voltage	Vcc	-0.3V to +7.0V
Input voltage	Vin	-0.3V to Vcc+0.3V

■ DC Characteristics

I/O	Item	Symbol	Applicable Pins	Measuring Conditions	Standard Values		
					Min.	Typ.	Max.
Input	"H" level voltage	V_{IH}	All input pins	Vcc = 4.5 ~ 5.5V	0.7Vcc V	-	Vcc +0.3V
	"L" level voltage	V_{IL}	All input pins	Vcc = 4.5 ~ 5.5V	-0.3V	-	0.3VccV
	Leak currant	$\| I_{IL} \|$	All input pins except STOP	Vin = 0.5 ~ (Vcc-0.5) V	-	-	1.0uA
			STOP	Vin = 0.5 ~ (Vcc-0.5) V	-	-	20uA
Out put	"H" level voltage	V_{OH}	All output pins	$-I_{OH}$ = 1.5mA	Vcc - 1.0V	-	-
				$-I_{OH}$ = 0.1mA	Vcc - 0.5V	-	-
	"L" level voltage	V_{OL}	TXD	I_{OL} = 1.6mA	-	-	0.6V
				I_{OL} = 0.4mA	-	-	0.4V
			COMM,. NORM,. ERR,.RUN	I_{OL} = 10.0mA	-	-	1.0V
				I_{OL} = 1.6mA	-	-	0.4V
	"H" level allowable current (per pin)	$-I_{OH}$	All output pins	-	-	-	2mA
	"L" level allowable current (per pin)	I_{OL}	TXD,. COMM,. NORM,. ERR,.RUN	-	-	-	2mA 10mA

(4) High-end Interface Specifications

Item	Specifications				
Connector specifications	S10B-ZR-SM3A-TF (manufactured by Japan Crimp Contacts Mfg. Co. Ltd.)				
Transmission format	2 wire system semi-double serial (CMOS level)				
Synchronization format	Asynchronous mode; start-stop system				
Transmission control format	Transmission control format Cr control/number of characters control*				
Transmission speed	9600/31250 bps*				
Character format (fixed)	Start bit	Data bit	Parity bit	Stop bit	Total
When on CR control	1	8	Even number of digits	1	11
When on Number of characters control	1	8	None	1	10
Error detection format	Parity (Cr control)/BCC (number of characters control)				
Bit transmission order	Low order first (from LSB)				

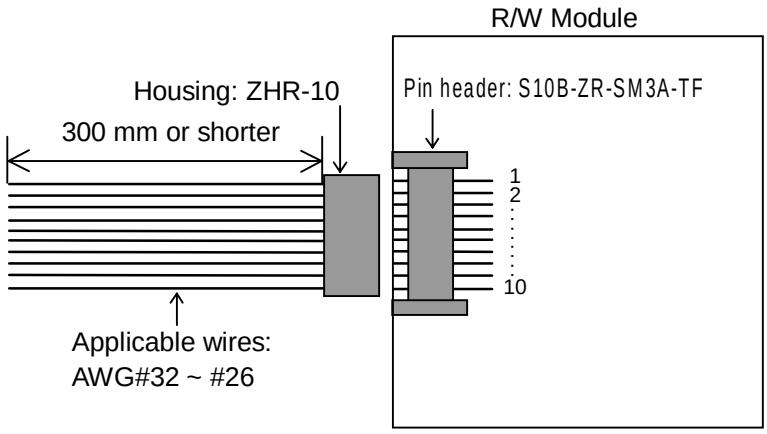
*Set using Dip-SW.

■ Pin Layout and Connection with High-end Devices

When connecting the R/W Module to a high-end device, please use the connection cable Model V700-A30 (optional) or the below-indicated cable and socket. The length of the cable should be as short as possible (less than 300 mm) with considerations to noise resistance.

Manufactured by Japan Crimp Contacts Mfg. Co. Ltd.

Socket housing: ZHR-10
Socket contact: SZH-002T-P0.5 or SZH-003T-P0.5

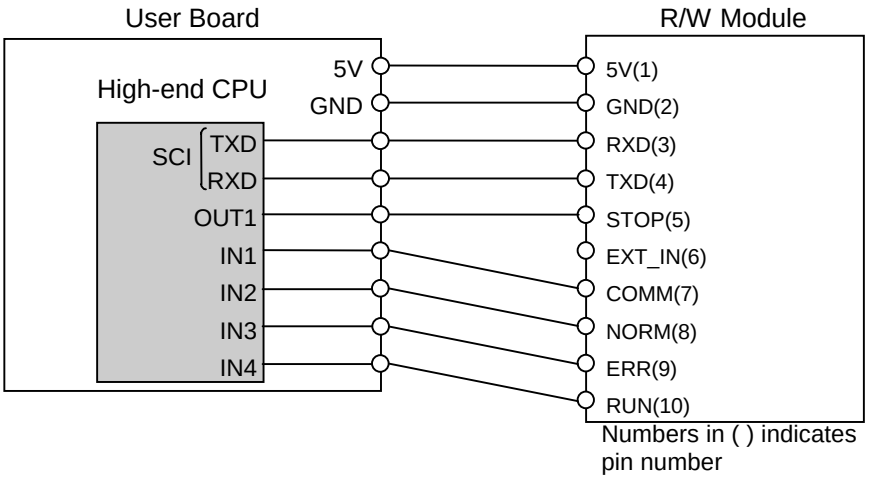


■ **Names of Signals and Functions**

No.	Codes	I/O	Function	Performance	Signal Logic
1	5V	-	Power	5V ±10%	-
2	GND	-	Ground	-	-
3	RXD	Input	Serial input CMOS	CMOS input 47 kΩ pull up	0:0V, 1:5V (positive logic)
4	TXD	Output	Serial output	CMOS output I_{OL}=2mA, I_{OH}=2mA	5V 0V S Data section E
5	STOP	Input	Receive process of command being executed / command execution will be aborted and after STOP is input, will be on stand by for command	CMOS input 47 kΩ pull up	L active
6	EXT_IN	Input	(unused)	CMOS input 47 kΩ pull up	-
7	COMM	Output	Will be output while communication is occurring between tag	CMOS output	H active
8	NORM	Output	Will be output after transmission with tag is successfully completed	CMOS output	H active
9	ERR	Output	Will be output when transmission with tag was unsuccessful	CMOS output	H active
10	RUN	Output	Will be output when Module is operating normally. This is OFF when STOP signal is being input.	CMOS output	H active

■ **Example of Connection with High-end Device**

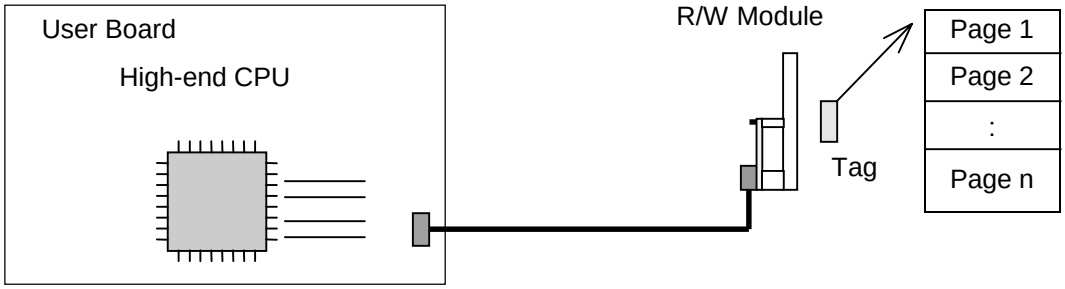
Please refer to the below-indicated connection for connecting the Module to High-end devices. Any signals that will be unused should not be connected.



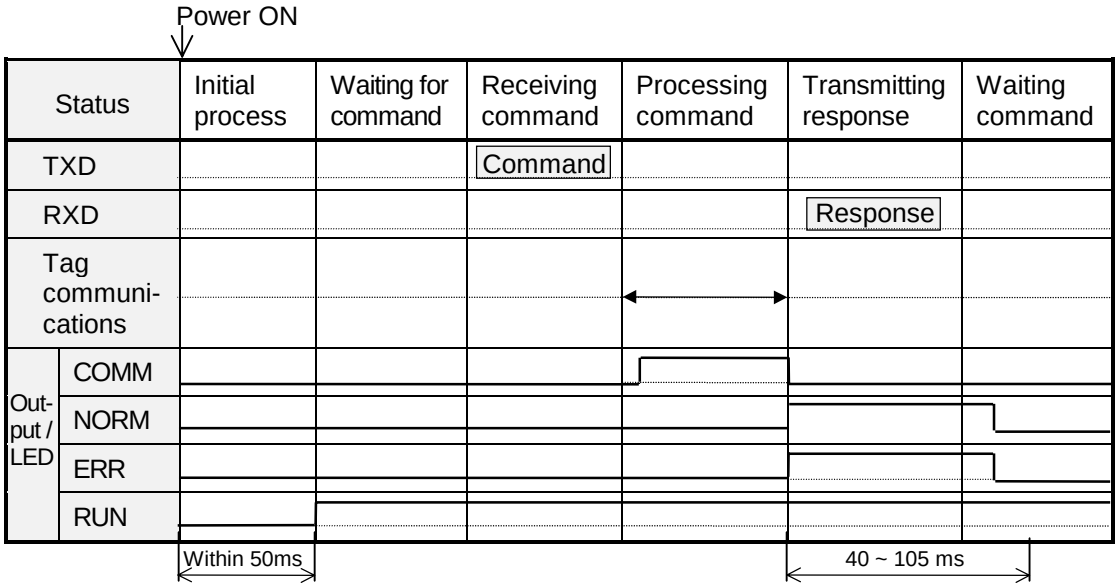
3. Operations of the R/W Module

3.1 Outline of operations

The R/W Module receives commands from the High-end device, executes read / write processes on the Tag, and returns a response of the results of the process to the High-end device. The status of the R/W Module operations will be reflected on the Output / LED.



■ **Operations Timing Chart**



3.2 Oscillation Control

The R/W Module supplies power to the Tag by oscillating the antenna, and thus conducts communication with the Tag. The Module may be set on either the “Oscillate Mode” “Stop Mode” depending on whether the Module should oscillate while not in communication with the Tag. The “Stop Mode” conserves dissipation power, and enables the R/W Module antenna to be installed close to the Tag to conduct communications on a time sharing basis. The “Oscillate Mode” allows the Module to constantly supply power to the Tag for FIFO processing.

Oscillation Status	Operation	Mode Switching Conditions
Stop Mode (conserves dissipation power)	The antenna stops oscillating while not processing commands	• Mode switching conditions at start-up • When oscillation OFF command is active
Oscillation Mode (enables high-speed processing)	The antenna is constantly oscillating	• When oscillation ON command is active • When option is active in FIFO Trigger / FIFO Auto Command

3.3 Input STOP

When a STOP signal is input to the R/W Module, receiving and processing of commands / command processing / response reply process will stop and then, after the STOP command is deactivated, the Module will be on stand by for new commands. When the STOP signal is input, oscillation will stop and RUN output will be turned OFF regardless of the setting of the oscillation control mode.
If a STOP signal is input more than 50 msec prior to shut down, writing of unstable data to the Tag may be prevented. However, if writing of the command in process requires more than one page, not all pages may be completely rewritten.

3.4 Memory Management on Tag

There are two types of the memory capacity of the tag: 128 bytes (user area 112 bytes) and 256 bytes (user area 240 bytes). The memory area recognizes every 8 bytes as one page, distinguished by such addresses as 00h ~ 07h, 08h ~0Fh, and so on.

■ **Memory Map (00h ~ EFh indicates to address)**

Page	8 bytes / page							
1	00h	01h	02h	03h	04h	05h	06h	07h
2	08h	09h	0Ah	0Bh	0Ch	0Dh	0Eh	0Fh
3	10h	11h	12h		...	...		17h
4	18h	19h	1Ah		...	...		1Fh
5	20h							27h
6	28h							2Fh
7	30h							37h
8								
9								
10	:							:
11	:							:
12								
13								
14	68h				...	...		6Fh
15	70h				...	...		77h
16	78h				...	...		7Fh
:	:							:
:	:							:
29	E0h	E1h			...	...		E7h
30	E8h	E9h			...	...		EFh

112 bytes

240 bytes

3.5 Processing Tag Memory

(1) Process Contents

The following three processes may be executed on the Tag Memory

1) Read

Reading data from Tag Memory in units of pages. The area to execute the Read command may be selected at random up to 16 pages (CR control) / 28 pages (Number of characters control).

2) Write

Writing data onto Tag Memory. The area to execute the Write command may be selected at random up to 16 pages (CR control) / 28 pages (Number of characters control). When writing the same data onto all pages (multiple write), there is no limitation on the number of pages. Certain data may be selected in units of bytes to be written onto the Tag Memory (byte write).

3) Write Protection Set/OFF

Write protection may be set on the selected pages of Tag Memory. When write protection is set, the data may be read, but not re-written. Write protection may be set on any of the pages. Write protection may be set or turned off by commands. Set / Clear is conducted by using the write protect command (08).

(2) Communication Operations

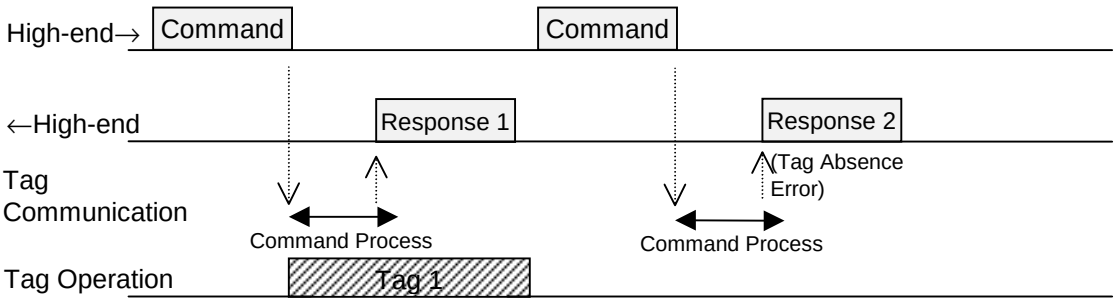
The following 6 communications operation may be executed by changing the process procedure and execution timing. Communication operations may be specified by commands during command transmission.

1) Single Trigger

Communication with Tag will be executed immediately after receiving command and a response will be transmitted. After response is transmitted, the Module will be on stand by for new commands. During communication with the Tag, there may only be one Tag within the communication area.

♦ Operation Sequence

Processing will be executed once only after receiving command. If there is no Tag, a Tag absent error message will be transmitted.

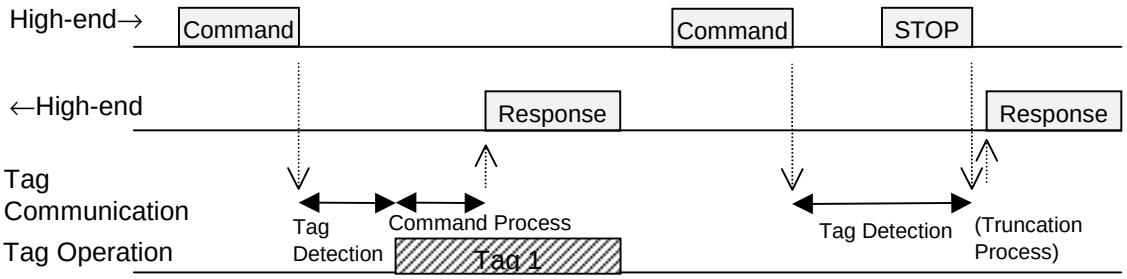


2) Single Auto

After receiving command, the Module waits for the Tag to approach, communicates with the Tag, and then transmits a response. Once the response is transmitted, Module will be on stand by for new commands. During communication with the Tag, there must be one Tag within the communication area.

♦ Operation Sequence

After receiving command, the Module waits for the Tag to approach, then executes process once only after Tag is detected. When Module receives a STOP command, the command will be completed.

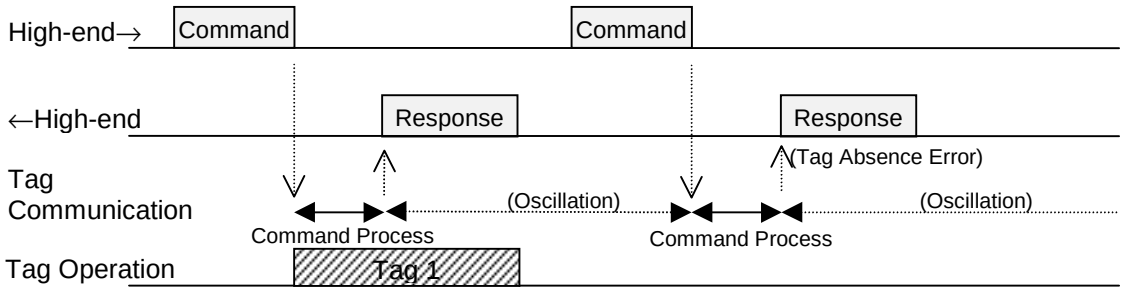


3) FIFO Trigger

Module will communicate with Tag immediately after receiving command and transmit response. After communication is completed, Module will prohibit Tag from operating. Module will be on stand by for commands after response is transmitted. During communication with Tag, there MUST BE AN OPERATIONAL TAG (A TAG THAT IS NOT PROHIBITED FROM OPERATION) within the communication area. When this command is executed, Module automatically activates “Oscillation Mode”

♦ Operation Sequence

Upon receiving command, Module will execute process once only. If there is no Tag, a Tag absence error will be transmitted. During processing of the command, Tag will become inoperative, and thus Tags that have completed communications will not respond to the next command. Oscillation will continue after command is processed.

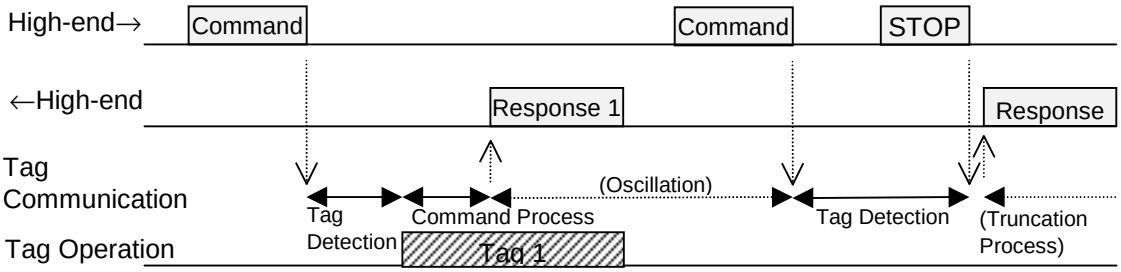


4) FIFO Auto

Module will await Tag to approach after receiving command, then communicate with Tag and transmit response. After communication is completed, Module will prohibit Tag from operating. Module will be on stand by after response transmission is completed. During communication with the Tag, there MUST BE AN OPERATIONAL TAG (A TAG THAT IS NOT PROHIBITED FROM OPERATION) within the communication area. When this command is executed, Module automatically activates “Oscillation Mode.”

♦ Operation Sequence

After receiving command, the Module waits for the Tag to approach, then executes process once only after Tag is detected. During processing of the command, Tag will become inoperative, and thus Tags that have completed communications will not respond to the next command. Oscillation will continue after command is processed. When Module receives a STOP command, the command will be completed. However, oscillation after completion of command continues.

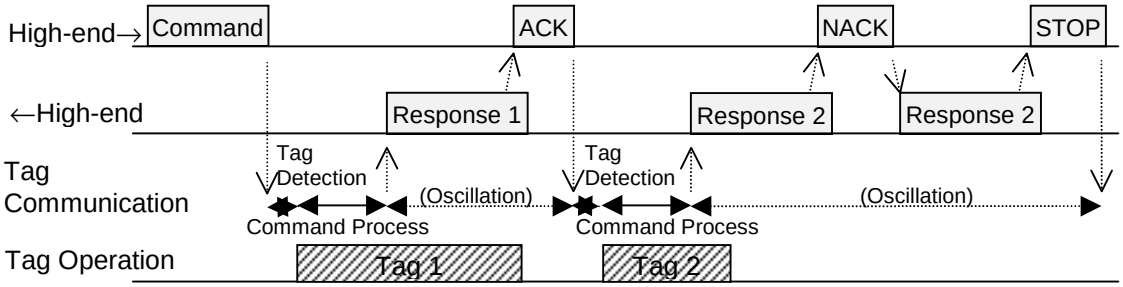


5) FIFO Continue

After receiving command, the Module waits for the Tag to approach, then communicates with the Tag and transmits a response. After communication is completed, Tag will become inoperative. After transmitting a response, Module will await Tag to approach again if it receives [ACK], and CONTINUE UNTIL MODULE RECEIVES A STOP COMMAND. When communicating with the Tag, THERE MUST ONLY BE ONE ACTIVE TAG within the communication area.

♦ Operation Sequence

Upon receiving the command, Module awaits Tag to approach. When Tag is detected, Module executes command and transmits a response. Afterwards, when [ACK] is received, Module repeats the same operation. Once process is executed on a Tag, the Tag becomes inoperative, and thus a Tag will only beprocessed once. When Module receives a STOP command, processing will stop.

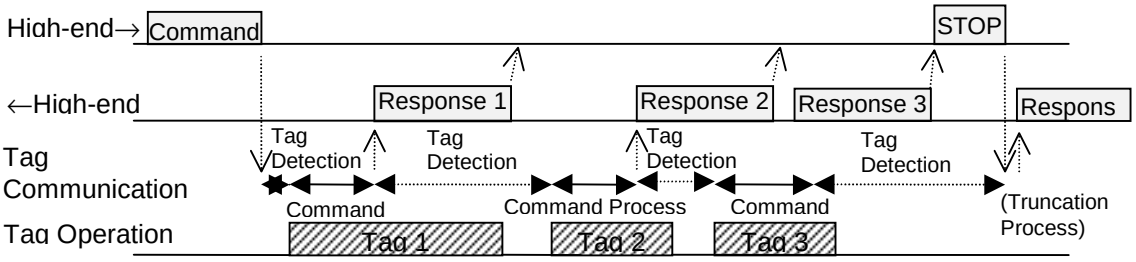


6) FIFO Repeat

After receiving command, the Module waits for the Tag to approach, then communicates with the Tag and transmits a response. After communication is completed, Tag will become inoperative. MODULE WILL CONTINUE PROCESS UNTIL IT RECEIVES A STOP COMMAND. When communicating with the Tag, THERE MUST ONLY BE ONE ACTIVE TAG (A TAG THAT IS NOT PROHIBITED FROM OPERATION) within the communication area.

♦ Operation Sequence

Upon receiving the command, Module awaits Tag to approach. When Tag is detected, Module executes command and transmits a response. Afterwards, Module repeats the same operation. Once process is executed on a Tag, the Tag becomes inoperative, and thus a Tag will only be processed once. When Module receives a STOP command, processing will stop.



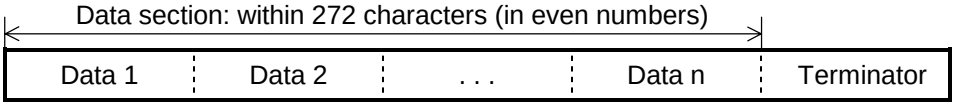
4. Controlling the Module from High-end Devices

There are two ways of controlling the R/W Module from the high-end unit: CR Control and Number of characters control. CR control enables simplification of control from the high-end unit, and the Number of characters control enables minimization of communication time between the high-end unit and the Module.

4.1 Communication Frame

(1) CR Control

Frame format consists of 16 different types of data, “0” ~ “F,” in units of even-number characters and a terminator [CR] (ASCII Code: 0Dh).

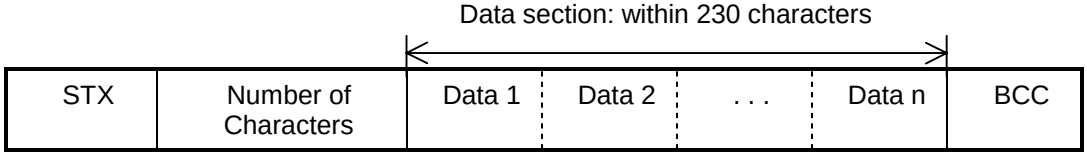


Data	Number of characters	Details
Text	0 ~ 260	Parameters of each command (“0” ~ “F”)
Terminator	1	Code (0Dh) indicating the completion of transmission frame

(Transmission Control Procedure)
Receipt commences when a character is received first, and when [Cr] is received, the frame is recognized as finished. If the interval between data exceeds 2 seconds, a transmission error will be recognized. A frame error completion code (error code: 18) is sent as a response to the high-end unit from the R/W Module.

(2) Number of Characters Control

The frame format is constructed as follows, with the [STX] (ASCII Code: 02h) at the beginning of the frame:



Data	Number of Characters	Details
STX	1	This code indicates the beginning of a communication frame (02h)
Number of Characters	1	A hexadecimal, which is the total of the number of characters in the data section and the BCC
Data Section	1-230	Parameters for each command
BCC	1	8-bit data, which is the discriminative logical sum (ExOR) of each of the characters in the number of characters and data sections Ex: in the case of STX 03 10 00 (BCC)

(Communications Control Instructions)
The first character received is considered the total number of characters received, and the frame is completed as soon as data for as many characters as indicated in the first character is received. When the idle time between data exceeds 2 sec, the receiving process will cease. There will be no response from the R/W Module to the high-end unit.

4.2 Command/Response Format

The communication frame Data Section for Command / Response will be in the following format:

■ Command

The data section consists of command, communication option, and parameters. The communication option can only be attached to commands 01 ~ 08.

Command	Communication option	Parameter 1	. . .	Parameter n

■ Response

The data section consists of a completion code and parameters.

Completion code	Parameter 1	. . .	Parameter n

Types of Commands

Specifies the process of the R/W Module

Command Name	Number	Details
Read	01	Reads Tag Memory data in units of pages
Write	02	Writes data onto Tag Memory in units of pages
Multiple Write	03	Writes the same data onto Tag Memory in units of pages
Byte Write	04	Writes data onto Tag Memory in units of bytes
Write Protection	08	Specifies setting or to undo write protection per page
ACK	11	Is sent when High-end device successfully receives data
NACK	12	Is sent when High-end device does not receive data successfully
STOP	13	Stops processing of command being executed
Oscillation ON	14	Activates Oscillation Mode on Module Antenna
Oscillation Off	15	Stops Oscillation Mode on Module Antenna
Test	10	Transmits data received directly back to High-end device

(2) Communication Option

Data code specification (for CR Control only) and communication operations specification are conducted in the Communication Option.

Communication Option	
Data code specification	Communication operation specification

1) Code Specification for Data

When conducting CR Control and when using commands 01 through 08, what kind of code communication will be conducted between the high-end unit and the R/W Module for reading or writing data must be specified.

When using the write protection command (08), please specify code as HEX code (“0”). If the ASCII Code (“1”) is specified, a format error (error code: 14) will occur.

- HEX Code Specification: “0”

  Data code within Tag is transformed into a 2-digit hexadecimal upon communication. The types of characters uses will be “0” ~ “F,” one of the 16 different types.

  Ex) When Tag data is 4Fh (“0”)

  34h (“4”) and 46h (“F”) are communicated.

- ASCII Code Specification: “1”

  Data code within Tag is communicated as is. However, the control code (CR) 0Dh cannot be used for read or write data.

  Ex) When Tag data is 4Fh (“0”)

  4Fh (“0”) is communicated.

When using the Number of Characters Control, please specify code specification as 0.

2) Specifying Communications Operations

Specifies communication operations when command is one of 01 through 08.

Option	Number	Details
Single Trigger	0	Conducts communication with Tag on Single Trigger Mode
Single Auto	1	Conducts communication with Tag on Single Auto Mode
FIFO Trigger	8	Conducts communication with Tag on FIFO Trigger Mode
FIFO Auto	9	Conducts communication with Tag on FIFO Auto Mode
FIFO Continue	A	Conducts communication with Tag on FIFO Continue Mode
FIFO Repeat	B	Conducts communication with Tag on FIFO Repeat Mode

(3) Completion Code

The R/W Module will reply to the high-end unit by transmitting a completion code. The definitions of the completion codes are as follows:

Class	Completion Code	Name	Details
Normal end	00	Normal end	Normal operations completed.
Communication Error between high-end unit and R/W Module	10	Parity error	There is a parity error in one of the characters among the command received.
	12	Overrun error	There is an overrun error in one of the characters among the command received.
	13	BCC Error	The BCC on the received frame is incorrect (for Number of Characters Control only).
	14	Format error	The command format is not suitable for the specification. Ex) Command section is not specified; page specification is incorrect, etc.
	18	Frame length error	When the receiving frame exceeds 273 characters (CR Control) / 233 characters (Number of Characters Control). When the intervals between the characters being received exceeded 2 sec. (CR Control only).
Communication Error between R/W Module and Tag	70	Transmission error	Noise or other disruption occurred during communication with Tag and command cannot be executed properly.
	71	Verification error	Tag is dated or incapable of being written correctly for physical reasons.
	72	Tag absence error	Tag is not present near antenna at time of Trigger commands execution.
	7A	Address specification error	Page specification is incorrect.
	7B	Outside of write area error	There is a Tag in the area where reading is possible but writing is not.
	7D	Write protection error	Write command was executed on a page specified with write protection.
	7F	ID system error	The Tag used is not to specification of system.
Hardware Error	7C	Antenna hardware error	There is a hardware problem on the antenna.

4.3 Types of Commands and Responses

4.3.1 CR Control

(1) Read

Read is used when data is to be read from the Tag. Data for any specified page may be read. The maximum number of pages that may be read at one time is 16.

■ Command

The pages to be read will be transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Pages can be specified at random.

Command		Communication Option		Page specification (8 characters)							
“0”	“1”										

Bit	7	6	5	~	1	0	7	6	~	1	0	7	6	~	1	0	7	6	~	2	1	0
Page	30	29	28	~	24	23	22	21	~	16	15	14	13	~	8	7	6	5	~	1	*	*
Value	“00” ~ “FF”						“00” ~ “FF”					“00” ~ “FF”					“00” ~ “FC”					

*0,1 bytes should be specified as “0”. When “1” is specified, it will register as an error (error code 14).

■ Response

The completion code (“00”when successful) and read data will be transmitted. The read data will be transmitted continuously according to the order of page specification. When an error occurs, the error code is transmitted as a completion code for the reply.

Completion code		Read data*		
“0”	“0”	(Data 1)	. .	(Data n)

*Data number n = specified page x 8 (For HEX specifications, this is in units of 2 characters; ASCII requires only one character)

<Command Example>

When reading all 6 pages from pages 1, 3, 5 ~ 8 using the single trigger mode with HEX specification:

0100000003D4 [CR]

(000000000000000000000001111010100b)

(2) Write

The Write command is used when data is to be written onto the Tag Memory in units of pages. Data can be written on any specified page. The maximum number of pages onto which data may be written at one time is 16.

■ Command

The pages to be written on and the data to be written onto each page will be transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Data to be written should be specified in the order of specification of the designated pages.

Command		Option		Page specification (8 characters)								Data to be written*					
“0”	“2”											(Data 1)	· · ·	(Data n)			

Bit	7	6	5			1	0	7	6		1	0	7	6		1	0	7	6		2	1	0
Page	30	29	28	~	~	24	23	22	21	~	16	15	14	13	~	8	7	6	5	~	1	**	**
Value	“00” ~ “FF”							“00” ~ “FF”					“00” ~ “FF”					“00” ~ “FC”					

* Data number n = specified page x 8
** Data number n = specified page x 8 (For HEX specifications, this is in units of 2 characters; ASCII requires only one character)

■ Response

The completion code (“00” when successful) will be transmitted.

Completion code	
“0”	“0”

<Command Example>

When writing 2 pages of data onto pages 8 and 9 using the FIFO repeat mode with ASCII specification:

021B00000600 (Data on page 8) (Data on page 9) [CR]

(00000000000000000000011000000000b)

(3) Multiple Write

The Multiple Write command is used when the same data is written in units of pages. Pages may be specified at random. There is no limit on the number of pages that may be written at one time.

■ Command

The designated pages to be written and the data to be written onto each page is transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Data to be written should be specified in the order of specification of the designated pages.

Command		Option	Page specification						Data to be written*		
“0”	“3”								(Data 1)	. . .	(Data n)

Bit	7	6	5		1	0	7	6		1	0	7	6		1	0	7	6		2	1	0
Page	30	29	28	~	24	23	22	21	~	16	15	14	13	~	8	7	6	5	~	1	**	**
Value	“00” ~ “FF”						“00” ~ “FF”					“00” ~ “FF”					“00” ~ “FC”					

* Data number n = 8
** Data number n = 8 (For HEX specifications, this is in units of 2 characters; ASCII requires only one character)

■ Response

The completion code (“00” when successful) will be transmitted.

Completion code	
“0”	“0”

(4) Byte Write

The Byte Write command is used when data is to be written onto the Tag Memory in Units of Bytes. Data of any bytes can be written from the specified address. An area spanning over more than one page may be specified, but a maximum limit of 16 pages applies.

■ Command

The area’s leading address and the data to be written will be transmitted as parameters. The address may be specified within the range of 00h ~ EFh. The data to be written is to be specified in ascending order from the specified address.

Command		Option	Designated Address	Data to be written*			
“0”	“4”			(Data 1)	. . .		(Data n)

* Data number n = number of bytes to be written (For HEX specifications, this is in units of 2 characters; ASCII requires only one character.)

■ Response
The completion code (“00” when successful) will be transmitted.

Completion code	
“0”	“0”

(5) Write Protection

The Write Protection command is used to set or turn off write protection on Tag.

■ **Command**

The pages to set or turn off write protection on will be transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. If set and turn off were specified for the same page, the set command will have priority.
The only communication operation that may be specified as options are 0 (single trigger) and 8 (FIFO trigger).

Command		Option	Setting specification (8 characters)				Turn off specification (8 characters)			
“0”	“8”		(Data 1)	(Data 2)	(Data 3)	(Data 4)	(Data 5)	(Data 6)	(Data 7)	(Data 8)

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 * *
Value	“00” ~ “FF”	“00” ~ “FF”	“00” ~ “FF”	“00” ~ “FC”

* 0,1 bytes should be specified as “0”. When “1” is specified, it will register as an error (error code 14).

■ **Response**

The completion code (“00” when successful) and write protection status information will be transmitted.

Command		Setting specification (8 characters)			
“0”	“8”	(Data 1)	(Data 2)	(Data 3)	(Data 4)

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 * *
Value	“00” ~ “FF”	“00” ~ “FF”	“00” ~ “FF”	“00” ~ “FC”

* 0, 1 bytes are indicated as “0”.

(6) ACK

ACK is transmitted after FIFO Continue is operated and the response is received to allow reading of the following:

■ **Command**

Command	
“1”	“1”

■ **Response**

There is no response.

(7) NACK

When the High-end device was not able to receive a response correctly, NACK is transmitted to demand that the response to be transmitted again. When the R/w Module receives this command, the most recent response will be transmitted again.

■ **Command**

Command	
“1”	“2”

■ **Response**

The most recent response will be transmitted again.

(8) STOP

The STOP command is used to stop the R/W Module from executing a command. When the R/W Module receives this command, it immediately stops the execution of the current command and sets on stand by mode for a new command.

■ **Command**

Command	
“1”	“3”

■ **Response**

Completion Code	
“0”	“0”

(9) Oscillation ON / OFF

The Oscillation ON / OFF command specifies the oscillation of the antenna.

■ **Command**

Oscillation ON

Command	
“1”	“4”

scillation OFF

Command	
“1”	“5”

■ Response

Completion Code	
“0”	“0”

(10) Test

The Test command is to conduct transmission tests on the transmission to the High-end device. When the R/W Module receives this command, it transmits the same command to the High-end device.

■ **Command**

Command		Test Data		
“1”	“0”	(Data 1)	· · ·	(Data n)

■ **Response**

Completion code		Test Data (Same data as the command)		
“0”	“0”	(Data 1)	· · ·	(Data n)

4.3.2 Number of Characters Control

(1) Read

Read is used when data is to be read from the Tag. Data for any specified page may be read. The maximum number of pages that may be read at one time is 28.

■ **Command**

The pages to be read will be transmitted as parameters of command. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Pages can be specified at random.

Command	Communication Option	Page specification (8 characters)			
01h					

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 * *
Value	00h ~ FFh	00h ~ FFh	00h ~ FFh	00h ~ FCh

*0,1 bytes should be specified as “0”. When “1” is specified, it will register as an error (error code 14).

■ **Response**

The completion code (“00h” when successful) and read data will be transmitted. The read data will be transmitted continuously according to the order of page specification. When an error occurs, the error code is transmitted as a completion code for the reply.

Completion code	Read data*		
00h		. . .	

*Data number n = specified page x 8

<Command Example>

When reading all three pages of pages 2 ~ 4 using the single auto mode:

[STX] 070101000000383F

(00000000000000000000000000111000b)

(2) Write

The Write command is used when data is to be written onto the Tag Memory in units of pages. Data can be written on any specified page. The maximum number of pages onto which data may be written at one time is 28.

■ Command

The pages to be written on and the data to be written onto each page will be transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Data to be written should be specified in the order of specification of the designated pages.

Command	Option	Page specification (4 characters)				Data to be written*		
02h						(Data 1)	…	(Data n)

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 ** **
Value	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FCh”

* 0,1 bytes should be specified as “0”When is specified, it will register as an error (error code 14).
* Data number n = specified page x 8

■ Response

The completion code (00h when successful) will be transmitted.

Completion code
00h

<Command Examples>

When writing data onto page 12 using the FIFO trigger mode:
(data on page 12) (BCC)

[STX] 0F0208<u>00002000</u> (Data on page 12) (BCC)

(00000000000000000010000000000000b)

(3) Multiple Write

The Multiple Write command is used when the same data is written in units of pages. Pages may be specified at random. There is no limit on the number of pages that may be written at one time.

■ Command

The designated pages to be written and the data to be written onto each page (for one page) is transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. Data to be written should be specified in the order of specification of the designated pages.

Command	Option	Page specification (4 characters)				Data to be written*		
03h						(Data 1)	. . .	(Data n)

Bit	7 6 5 ~ ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 ** **
Value	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FCh”

* 0,1 bytes should be specified as 0 When “1” is specified, it will register as an error (error code 14).
* Data number n = 8

■ Response

The completion code (“00” when successful) will be transmitted.

Completion code
00h

(4) Byte Write

The Byte Write command is used when data is to be written onto the Tag Memory in Units of Bytes. Data of any bytes can be written from the specified address. An area spanning over more than one page may be specified, but a maximum limit of 28 pages applies.

■ Command

The pages to be written on and the data to be written onto each page will be transmitted as parameters. The address may be specified within the range of 00h ~ EFh. The data to be written is to be specified in ascending order from the specified address.

Command	Option	Designated Address	Data to be written*			
04h			(Data 1)		. . .	(Data n)

* Data number n = number of bytes to be written

■ Response

The completion code (“00h” when successful) will be transmitted.

Completion code
00h

(5) Write Protection

The Write Protection command is used to set or turn off write protection on Tag.

■ Command

The pages to set or turn off write protection on will be transmitted as parameters. Page specifications shall be made by specifying the bit indicating the page as “1” and the other bytes as “0”. This binary is converted to a hexadecimal and transmitted as a command. If set and turn off were specified for the same page, the set command will have priority.
The only communication operation that may be specified as options are 0 (single trigger) and 8 (FIFO trigger).

Command	Option	Page specification (4 characters)				Turn off specification (4 characters)			
08h		(Data 1)	(Data 2)	(Data 3)	(Data 4)	(Data 1)	(Data 2)	(Data 3)	(Data 4)

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 ** **
Value	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FCh”

* 0,1 bytes should be specified as “0” When “1” is specified, it will register as an error (error code 14).

■ Response

The completion code (“00h” when successful) and write protection status information will be transmitted.

Command	Status Indication (4 characters)			
00h	(Data 1)	(Data 2)	(Data 3)	(Data 4)

Bit	7 6 5 ~ 1 0	7 6 ~ 1 0	7 6 ~ 1 0	7 6 ~ 2 1 0
Page	30 29 28 ~ 24 23	22 21 ~ 16 15	14 13 ~ 8 7	6 5 ~ 1 ** **
Value	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FFh”	“00” ~ “FCh”

* 0, 1 bytes are indicated as “0”.

(6) ACK

ACK is transmitted after FIFO Continue is operated and the response is received to allow reading of the following:

■ Command

Command
11h

■ Response

There is no response.

(7) NACK

When the High-end device was not able to receive a response correctly, NACK is transmitted to demand that the response to be transmitted again. When the R/w Module receives this command, the most recent response will be transmitted again.

■ Command

Command
12h

■ Response

The most recent response will be transmitted again.

(8) STOP

The STOP command is used to stop the R/W Module from executing a command. When the R/W Module receives this command, it immediately stops the execution of the current command and sets on stand by mode for a new command.

■ Command

Command
13h

■ Response

Completion Code
00h

(9) Oscillation ON / OFF

The Oscillation ON / OFF command specifies the oscillation of the antenna.

■ Command

Oscillation ON

Command
14h

Oscillation OFF

Command
15h

■ Response

Completion Code
00h

(10) Test

The Test command is to conduct transmission tests on the transmission to the High-end device. When the R/W Module receives this command, it transmits the same command to the High-end device.

■ Command

Command	Test Data		
10h	(Data 1)	...	(Data n)

■ Response

Command	Test Data (Same data as the command)		
00h	(Data 1)	...	(Data n)

5. Communications Specification (Indicative Values)

5.1 Communication Distance

The communication distance specifications are as follows. Please take note that communication distance is subject to change, depending on installation requirements. Please refer to “6. The Influence of Requirements of Use on Communication Distance.”

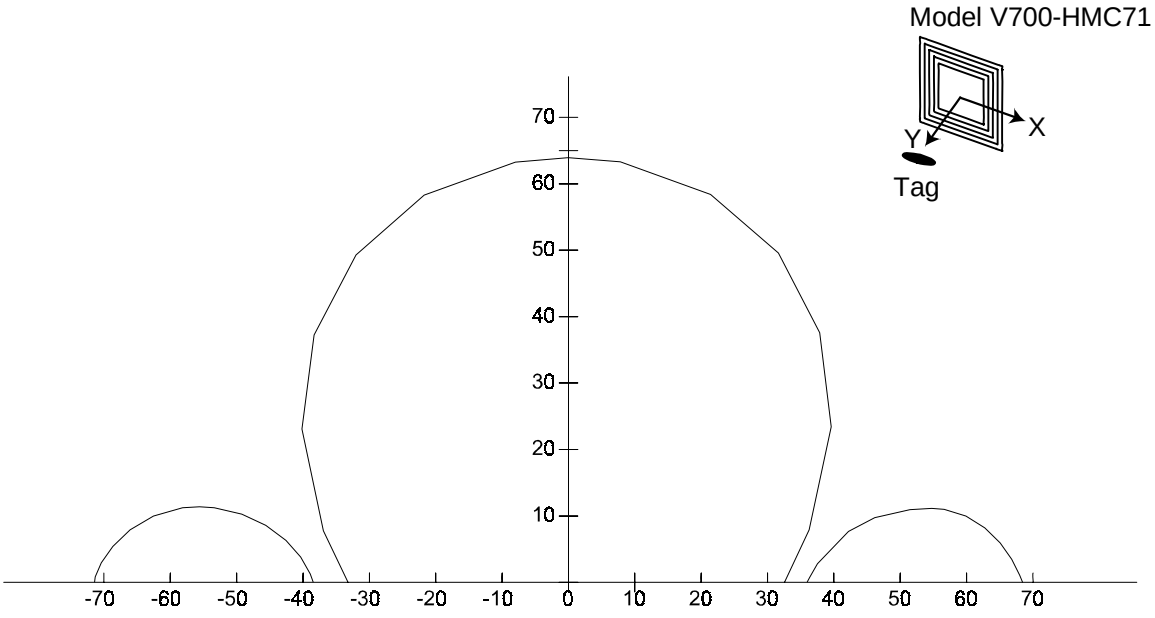
Tag		Model V700HMC71	Model V700HMC73
Model V700-D13P31	Still	5 ~ 65 mm	10 ~ 40 mm
	In operation	18 ~ 65 mm	15 ~ 40 mm
Model V700-D13P21	Still	5 ~ 65 mm	10 ~ 40 mm
	In operation	18 ~ 65 mm	15 ~ 40 mm

Note **1**. The read distance and write distance are the same
2. The values indicated above are based on the assumption that there is no axis variation.

5.2 Communication Area

- R/W Module: Model V700-HMC71
- Tag: Model V700-D13P31 / Model V700-D13P21

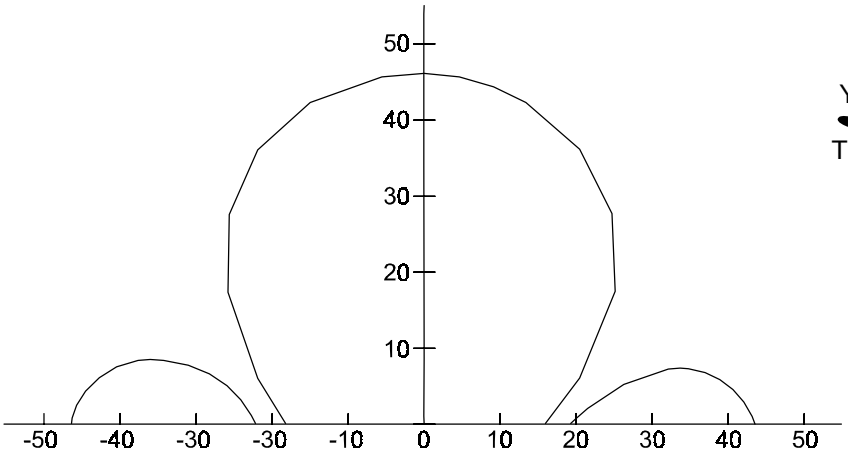
The communication area diagram going through the center of the antenna and indicated on a flat surface vertical to the antenna surface is as indicated below. Read / write are the same area.

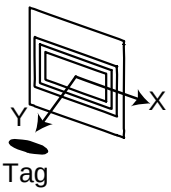


- R/W Module: Model V700-HMC73
- Tag: Model V700-D13P31 / Model V700-D13P21

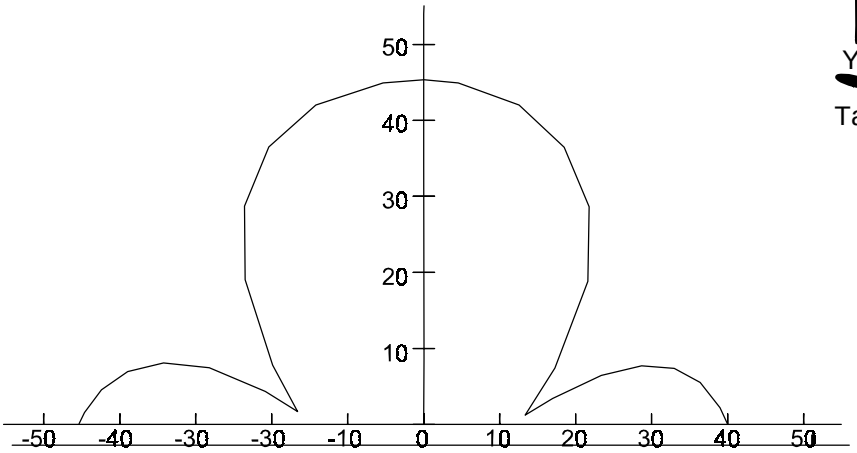
The communication area diagram going through the center of the antenna and indicated on a flat surface vertical to the antenna surface is as indicated below. Read / write are the same area.

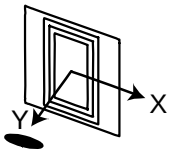
Model V700-HMC73





Model V700-HMC73



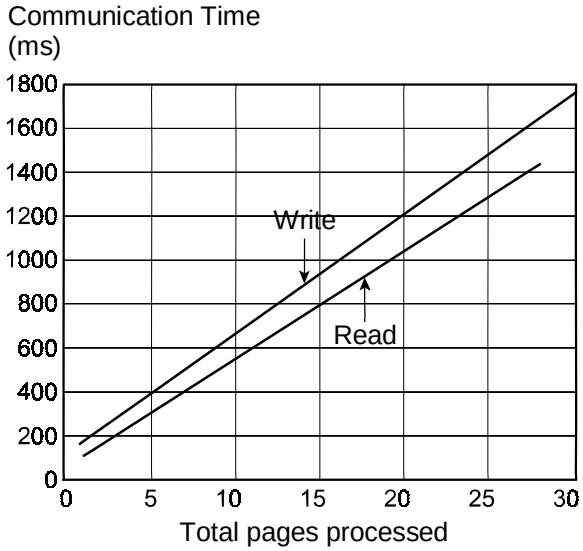


5.3 Communication Time

The Model V700 Series has two transmission times: the communication time and the TAT (Turn Around Time).

(1) Communication Time

This is the communication processing time between the R/W Module and the Tags. This time changes in accordance with the number of pages to be read / written.
The communication time values are as indicated below. This value is estimated based on the assumption that the communication operation is on trigger mode and that there is no interference in communication due to noise and other causes.



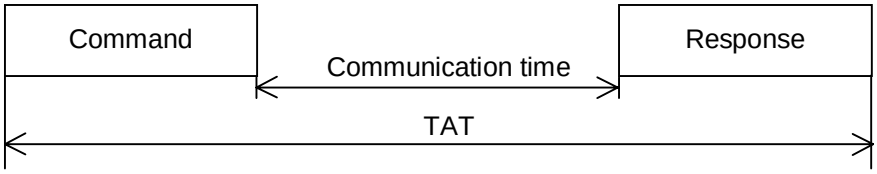
Communication Time Calculation Formula

	Communication Time (msec)
Read	T=48N+66
Write	T=55N+120

N: pages to be processed

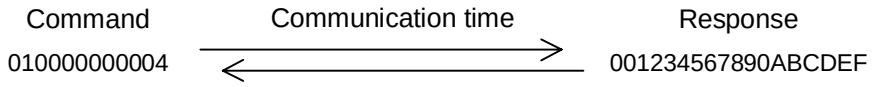
(2) TAT

This is the time required for the high-end unit to transmit a command to the R/W Module, and to complete receipt of a response. This time changes in accordance with the transmission speed and the communication control mode.



<Example of TAT Calculation>

- Read 1 page



$$\frac{1}{9600}(\text{sec})\times 11(bits)\times 13(characters)+114(m\text{sec})+\frac{1}{9600}(\text{sec})\times 11(bits)\times 19(characters)=151(m\text{sec})$$

(bit time) (number of bits per character) (number of characters transmitted)

Prerequisites: 1 CR Control, HEX code specification
2 No spaces between characters; all data sent consecutively

6. The Influence of Requirements of Use on Communication Distance (Indicative Values)

When using the R/W Module, communication distance changes in accordance with the requirements of use (the existence / non-existence of metal objects in the vicinity, the use /non-use of multiple R/W Modules, power voltage value, etc.). This section indicates how such requirements and changes in them affect communication distance. Please use the following figures for your reference. Note that all values indicated in this section are indicative.

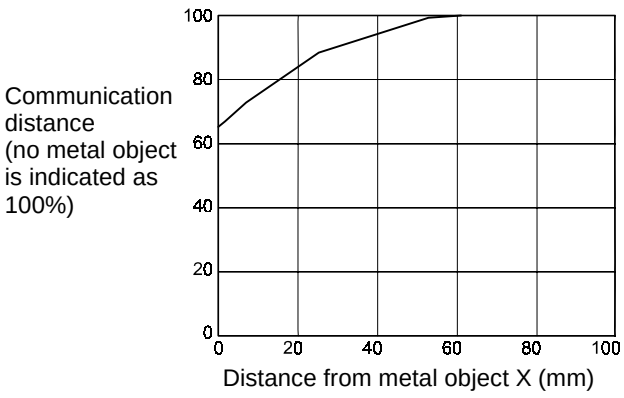
6.1 Effects of Peripheral Metal Objects and Metal Objects Behind the device

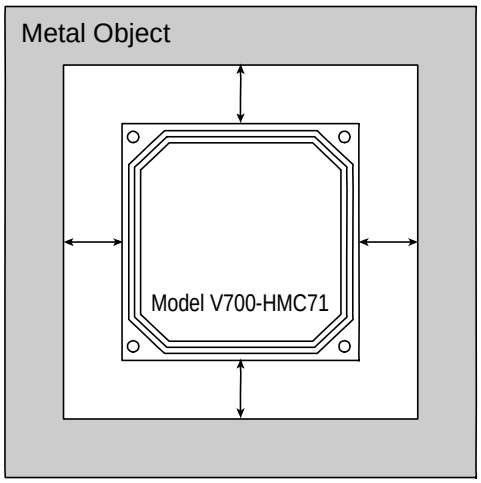
When metal objects are around or behind the R/W Module, communication distance deteriorates. Please take note of the distance between the metal objects and the R/W Module as per below when using the R/W Module.

(1) Model V700-HMC71

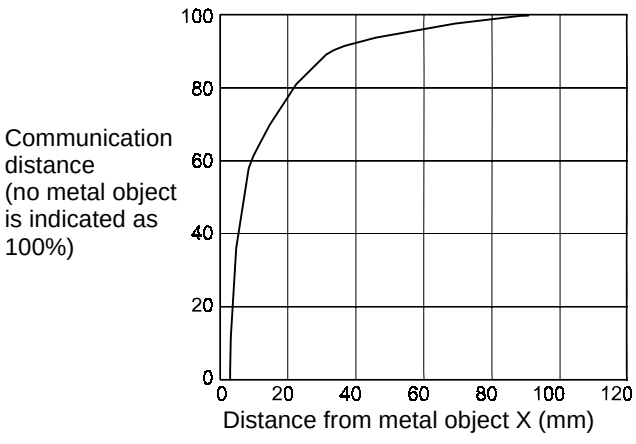
When the metal object is steel, the relationship between the distance of the metal objects around and behind the Model V700-HMC71 from the device and the communication distance (read / write) is indicated below. The following values were obtained by using Tags Model V700-D13P31 / Model V700-D13P21 with an axis variation of +- 0 mm.

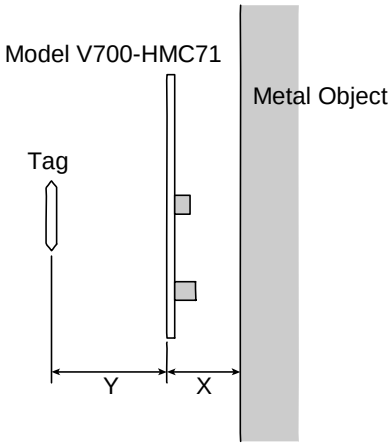
■ Peripheral Metal Objects





■ Metal Object Behind the Module

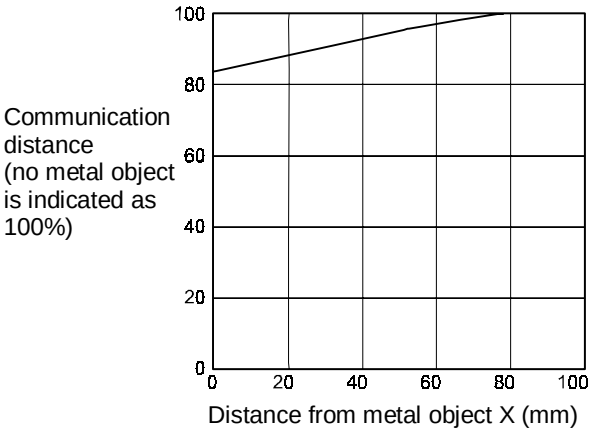


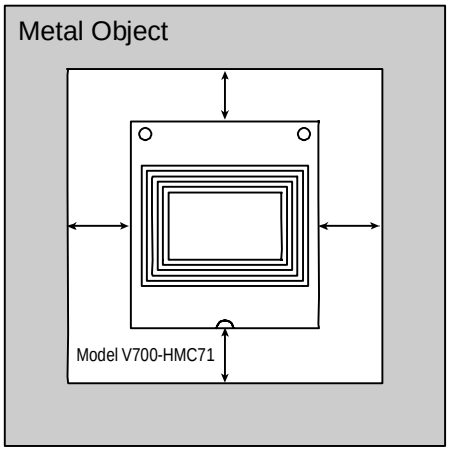


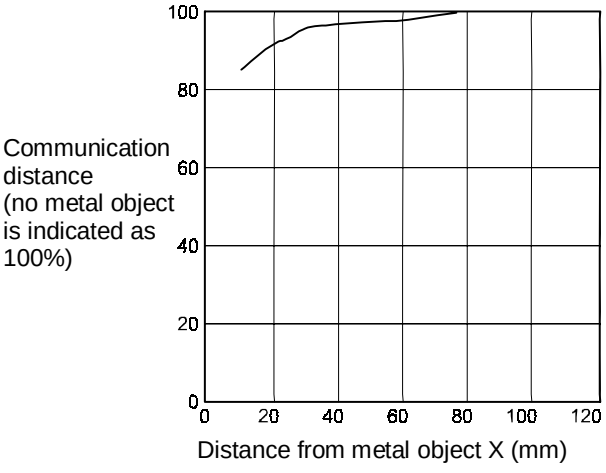
(2) Model V700-HMC73

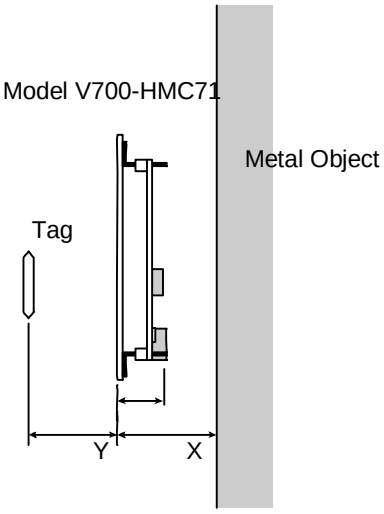
When the metal object is steel, the relationship between the distance of the metal objects around and behind the Model V700-HMC73 from the device and the communication distance (read / write) is indicated below. The following values were obtained by using Tags Model V700-D13P31 / Model V700-D13P21 with an axis variation of +- 0 mm.

■ Peripheral Metal Objects







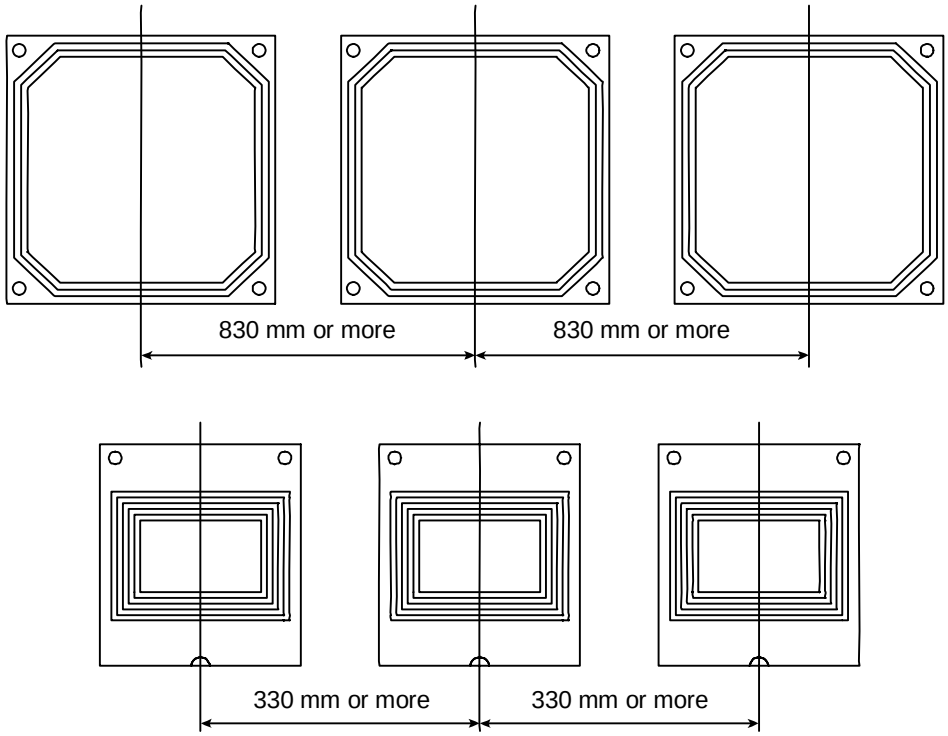


6.2 Interference among Modules

When using more than one R/W Module, to prevent erroneous operations due to interference from other Modules, please be sure to check that the below-indicated distance between Modules is secured.

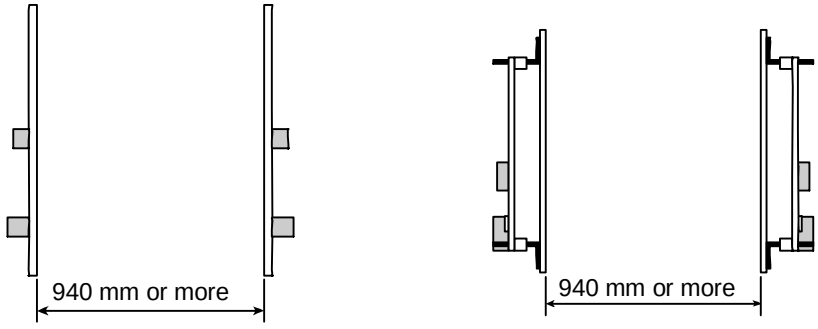
■ When Using Multiple Modules in a Line

Model V700-HMC71: 830 mm or more
Model V700-HMC73: 330 mm or more



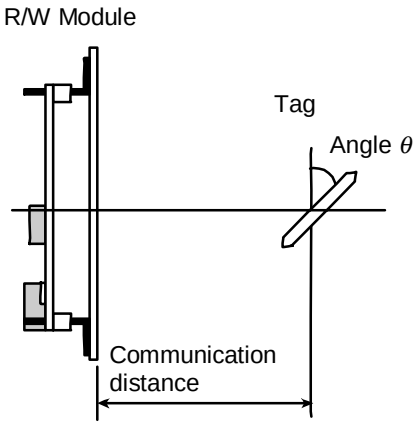
■ When Using the Modules Facing Each Other

Model V700-HMC71: 940 mm or more
Model V700-HMC73: 340 mm or more



6.3 Effects of Angled Installation

Please install the R/W Module and Tags so that they are parallel to each other whenever possible. The R/W Module and Tags can communicate when installed on angles, but the communication distance will be shorter. The relationship between angles and communication distance is as indicated below. The following values were obtained by using Tags Model V700-D13P31 / Model V700-D13P21.

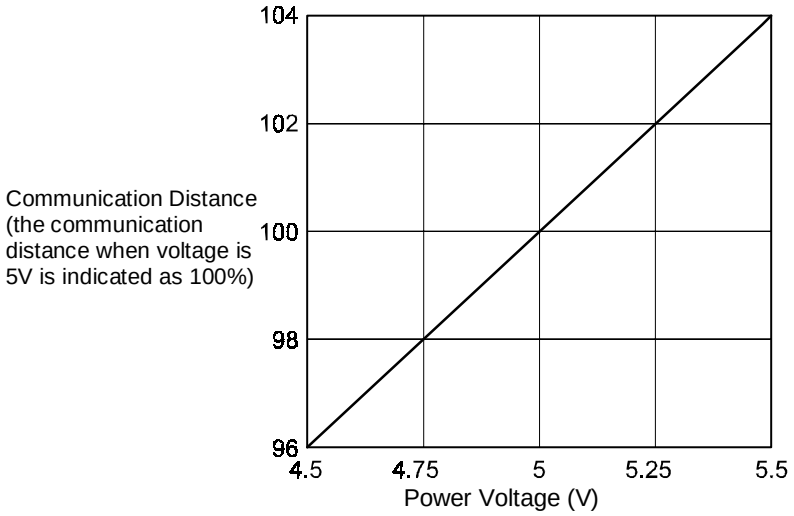


Communication Distance (The distance when angle is 0 degrees is indicated as 100%)

R/W Module	Angle of Tag θ (degrees)		
	0	30	45
Model V700-HMC71	100%	95%	83%
Model V700-HMC73	100%	99%	88%

6.4 Effect of Voltage

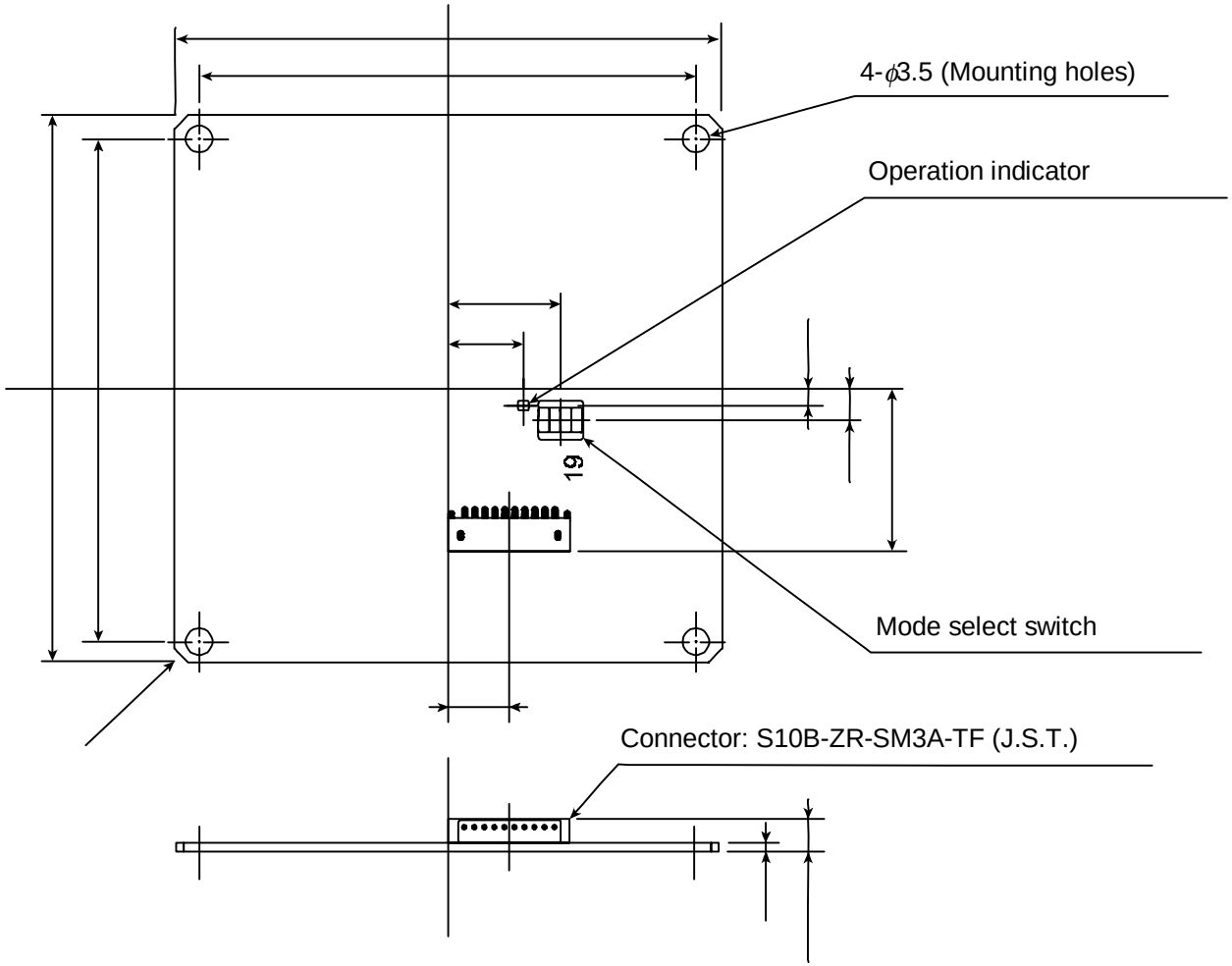
The Communication Distance (read / write) for the R/W Module changes in accordance with the power voltage applied. Please refer to the following values. (For both Model V700-HMC71 and Model V700-HMC73.)



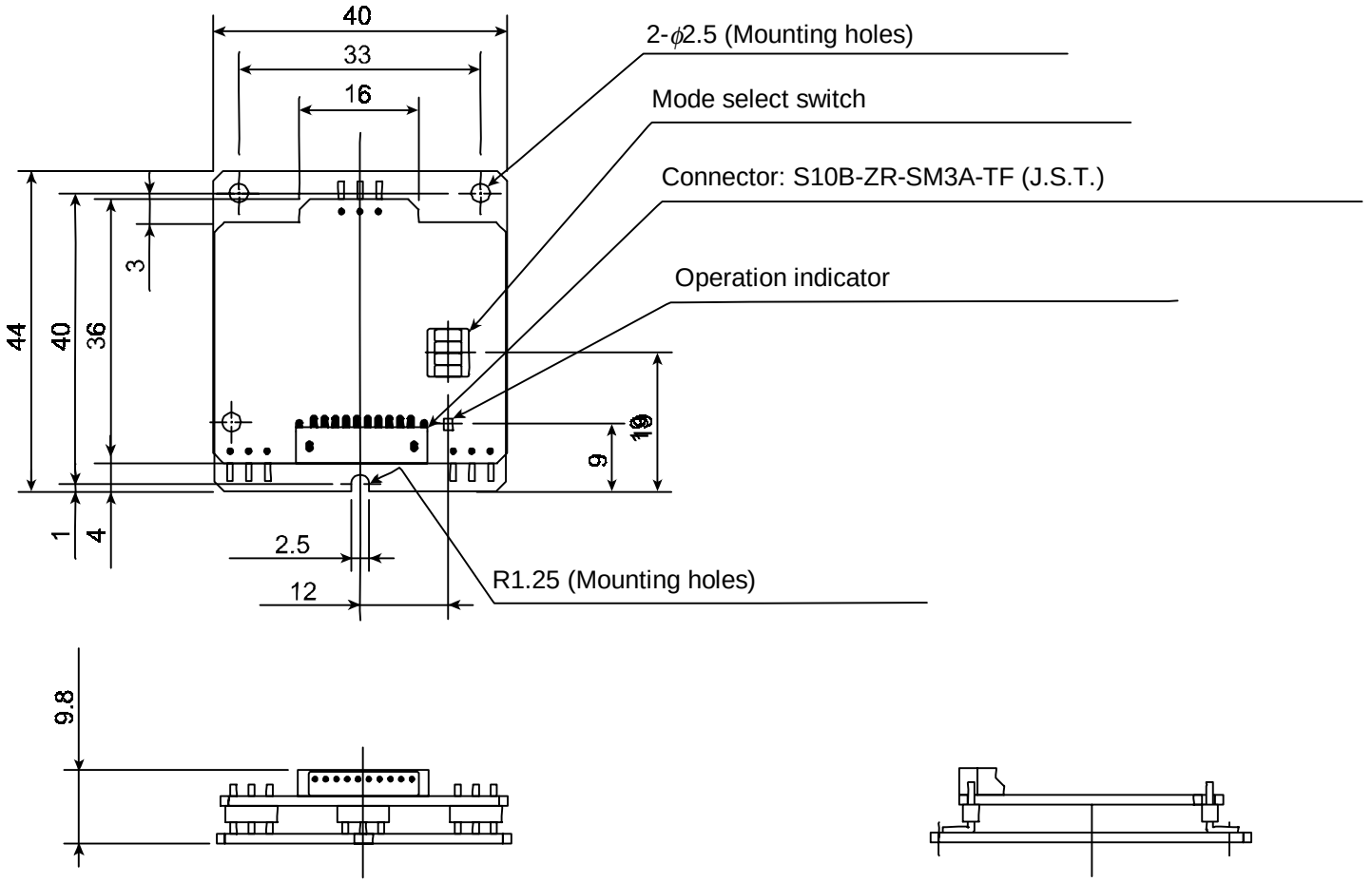
7. Appendix

7.1 Revision History

Date of revision	Revision Details	Notes
July 1998	First version	



RWH/ID System outline drawing



RWH/ID System outline drawing