Cat. No. S921-E1-02

V720-series
Electromagnetic Inductive
RFID System

V720S-HMC73/V720S-HMC73T
PCB Read/Write Modules

User's Manual

OMRON

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

About this Manual:

This manual describes the installation and operation of the V720-series Electromagnetic Inductive RFID System (V720S-HMC73/ V720S-HMC73T) and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the System.

Section 1 provides the features of the V720S-HMC73/ V720S-HMC73T.

Section 2 provides the specifications and performance characteristics of the V720S-HMC73/ V720S-HMC73T.

Section 3 provides the functions and operations of the V720S-HMC73/ V720S-HMC73T..

Section 4 provides the communications functions and provides details on communications–related data and commands.

Section 5 provides the information of characteristics data.

⚠WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

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PRECAUTION

This user manual provides information on the functions, characteristics, and application methods required to use the V720S-HMC73 and V720S-HMC73T PCB Read/Write Modules.

In this manual, the PCB Read/Write Modules are referred to as simply "R/W Modules."

Be sure to observe the following precaution when using the V720 Series.

- You must read this manual and understand the information contained before attempting to set up or operate a V720-series Electromagnetic Inductive RFID System.
- Keep this manual close at hand for reference during operation.

1. Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing systems.
- Personnel in charge of designing systems.
- Personnel in charge of managing systems and facilities.

2. Regulations and Standards

The V720S-HMC73 and V720S-HMC73T R/W Modules are combined with user devices and equipment depending on the user application.
The user should check the conformity of devices with which the R/W Module has been combined with local laws and regulations.

3. Application Precautions

Before using the product under the following conditions and environments, make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, be sure to provide the systems, machines, and equipment with double safety mechanisms, and consult your OMRON representative.
(1) When using the product under conditions and in environments that are not described in the manual
(2) When using the product for nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment
(3) When using the product for applications that may have a serious influence on people's lives and property, especially those where safety is an issue.

⚠ **WARNING** Do not touch the PCB or any parts connected to the PCB while the power is bein supplied.Doing so may result in electric shock.
Do not attempt to take the product apart or insert or remove connectors while the power is being supplied. Doing so may result in electric shock.

4. Precautions

Be sure to observe the following precautions to ensure safety in installing or operating the System.

1. Do not use the System in an environment subject to flammable, explosive, or corrosive gases.
2. Do not attempt to take any Units apart, to repair any Units, or to modify any Units in any way.
3. Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals.
4. Be sure that the power supply voltage is within the rated range (5 VDC ± 10%).
5. Observe all warnings, cautions, and safety precautions specified in the manual.

5. Correct Use

1. Do not install the R/W Module in the following locations:
   - Locations subject to direct sunlight.
   - Locations subject to condensation as the result of high humidity.
   - Locations subject to shock or vibration.

2. Check the operating environment before use.
   The R/W Module communicates with the tags using a frequency of 13.56 MHz. Noise that affects communications with the tags may occur in transceivers, motors, monitor units, or power supplies (power supply IC). If using the R/W Module close to these sources, check beforehand that the R/W Module is not affected. Also, observe the following precautions to minimize the effects of noise.
   - Connect any metal devices installed nearby to a ground of 100 Ω or less.
   - Do not install wiring near high-voltage or high-current lines.

3. Handling
   The R/W Module is not equipped with a protective case to make it easier to use it with other devices. Consequently, observe the following precautions when handling.
   - Use a grounded conduction mat when removing the R/W Module.
   - Hold the tips of the PCB when handling the R/W Module.
   - Make sure the R/W Module is packaged during storage or carrying.
   - Do not remove the R/W Module other than when it is to be used. Never leave the R/W Module unpacked when not in use.
   - Do not touch the PCB parts (in particular the semiconductors) or the patterns.

- Never place the R/W Module in a polyethylene or plastic bag.
- Do not apply a voltage or current that exceeds specifications to the connector terminals.

• Configure the Electromagnetic Inductive RFID System so that the surge is absorbed by inserting a filter on the power supply side if there is extensive external surge.

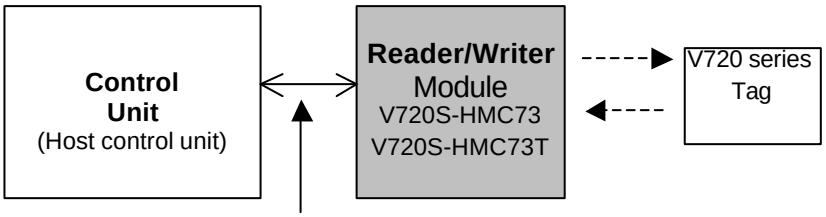
• Insert or remove connectors only during installation. Do not use the R/W Module for applications in which the connectors are inserted or removed frequently. Also, wire the cables so that strong force is not applied to the connectors.

SECTION 1
Product Outline

The R/W Module is designed to be combined with other devices, and is configured from an antenna PCB and a control PCB equipped with control functions and send-receive functions for communicating with OMRON V720-series Tags, which use two types of Phillips Semiconductor I-CODE chips (product name: SL1 ICS30 01, commonly known as "I-CODE1", and product name: SL2 ICS20, commonly known as I-CODE2). The SL2 ICS20 chip fully conforms to ISO/IEC15693.

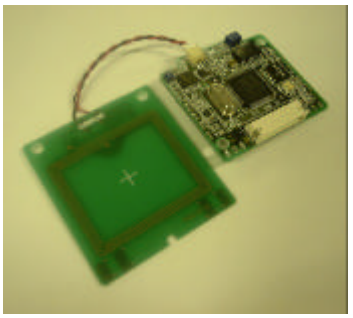
The V720S-HMC73 combines the control PCB and the antenna PCB in a compact Unit. The V720S-HMC73T provides the control PCB and the antenna PCB separately, and can be used in locations where mounting space is restricted. The V720S-HMC73T control PCB and antenna PCB are connected via a connector.

1-1 Features



Cable with housing
V700-A30 (manufactured by OMRON, sold separately)

V720S-HMC73



V720S-HMC73T

Compact, Low Power Consumption

- 40 x 44 x t14mm (V720S-HMC73)
- Operating: 5 V 70 mA, 90 mA (when the tag is contact with the antenna)

Slim (V720S-HMC73T)

- Max. width: approx. 10 mm (V720S-HMC73T control PCB)

Select Baud Rate and Communications Control Method to perform communications with the Host Control Unit

- Select 9,600 bps or 38,400 bps baud rate.
- Select CR control or number-of-characters control for communications control method.

User-friendly Command Structure

- Easy-to-understand command structure
- Built-in repetitive data write command (enabled when writing identical data to tag memory areas)
- Specify data code (hexadecimal or ASCII) using read/write command (CR control only)

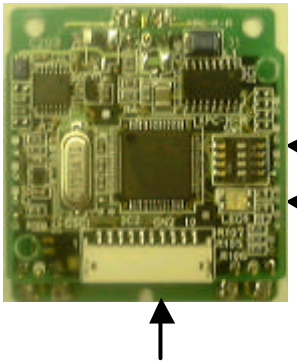
Many Operating Modes

- Supports two operating modes -- single access mode and FIFO access mode -- according to the status of the tags within the communications range.
- Supports four communications modes depending on the tag communications method. (Three communications modes when using single access mode.)

SECTION 2
Specifications and Performance

2-1 Nomenclature and Descriptions

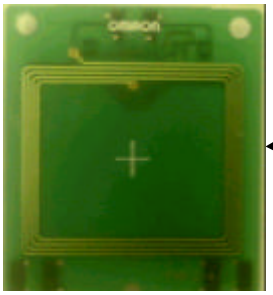
V720S-HMC73



Mode Switch

LED Indicator

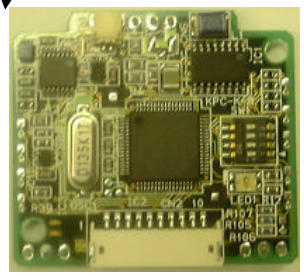
Host Interface Connector



Antenna (+ shows center of antenna surface)

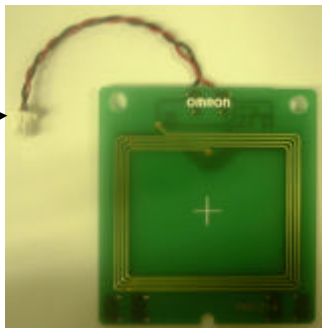
V720S-HMC73T

PCB connector (female)



Control PCB

PCB connector (male)



Antenna PCB

Component Descriptions

· **LED Indicator**

The LED indicator lights up to show the R/W Module operating status.

Color	Details
Green	Lit during communications with the tags.
Red	Lit when communications cannot be completed normally.

•Mode Switch

Set the R/W Module operating status using the DIP switch.

No.	Name	Details	
1	Baud rate setting	OFF: 9,600 bps	ON: 38,400 bps
2	Communications control mode setting	OFF: CR control	ON: Number-of-characters Control
3	Reserved for system use	Always OFF.	
4	Reserved for system use	Always OFF.	

Note All pins are turned OFF at the factory. Change the settings to those required for the user application.

· **Host Interface Connector**

Use this connector to connect to the host control unit.

· **Antenna**

Move the tags close to the antenna when communicating with the tags.

· **PCB Connectors (V720S-HMC73T)**

Use these connectors to connect the control PCB to the antenna PCB.

⚠ **Caution** The PCB and antenna connector is removed for the V720S-HMC73T at the factory. Be sure to connect the control PCB and antenna PCB before turning ON the power supply.

2-2 Specifications

2-2-1 General Specifications

Item	V720S-HMC73	V720S-HMC73T
Dimensions	40 × 44 × 14 mm (thickness)	40 × 44 × 10 mm (thickness) (control PCB) 40 × 44 × 2 mm (thickness) (antenna PCB)
Mounting method	3 x M2.3 screws	2 x M2 screws (control PCB) 3 x M2.3 screws (antenna PCB)
Power supply voltage	5 VDC ± 10%	
Current consumption	Approx. 90 mA max. (oscillating, when the tag is contact with the antenna), Approx. 70 mA max. (oscillating)	
Vibration resistance	Destruction: 10 to 150 Hz, 0.1-mm half amplitude at 15 m/s² in X, Y, and Z directions 10 times each for 8 minutes	
Shock resistance	Destruction: 150 m/s² three times each in 6 directions	
Ambient operating temperature	-10 to +55	
Ambient storage temperature	-25 to +65	
Ambient operating humidity	25% to 85% max. (with no condensation)	
Communications frequency	13.56 MHz	
Weight	Approx. 12 g	
Radio standards	Extremely low power radio station (Radio Law Article 4 Section 1 "radio stations that discharge extremely low electric waves and specified by the Ministry of Posts and Telecommunications") In accordance with Radio Law enforcement regulation Article 6 Section 1, the field intensity is 500μV/m or less at distance of 3 m (322 MHz or less).	

*1 For the information of communications distance and area, refer to the data in 5-1 and 5-2 of section 5.

2-2-2 Interface Specifications

Item	Details				
Connectors *2	S10B-ZR-SM3A-TF (JST Manufacturing Co., Ltd.)				
Communications method	2-wire half duplex serial (CMOS level)				
Synchronous method	Asynchronous mode or start-stop synchronous mode				
Communications control method *3	CR control/Number-of-characters control				
Baud rate *3	9,600 bps / 38,400 bps				
Character format	Start bits	Data bits	Parity	Stop bits	Total bits
1) CR control	1	8	Even	1	11
2) Number-of-characters control	1	8	None	1	10
Error detection method	Parity (CR control) or BCC (number-of-characters control)				
Bit send order	Least significant bit (LSB) first				

*2 To connect the R/W Module, use an OMRON V700-A30 Connecting Cable (sold separately), or perform wiring using the following housing and contacts.

- Housing: ZHR-10 (JST Manufacturing Co., Ltd.)
- Contacts: SZH-002T-P0.5 (JST Manufacturing Co., Ltd.), applicable wire sizes: AWG28 to AWG26
  SZH-003T-P0.5 (JST Manufacturing Co., Ltd.), applicable wire sizes: AWG32 to AWG28

⚠ **Caution** Use as short a connecting cable as possible (300 mm max.) to reduce noise.

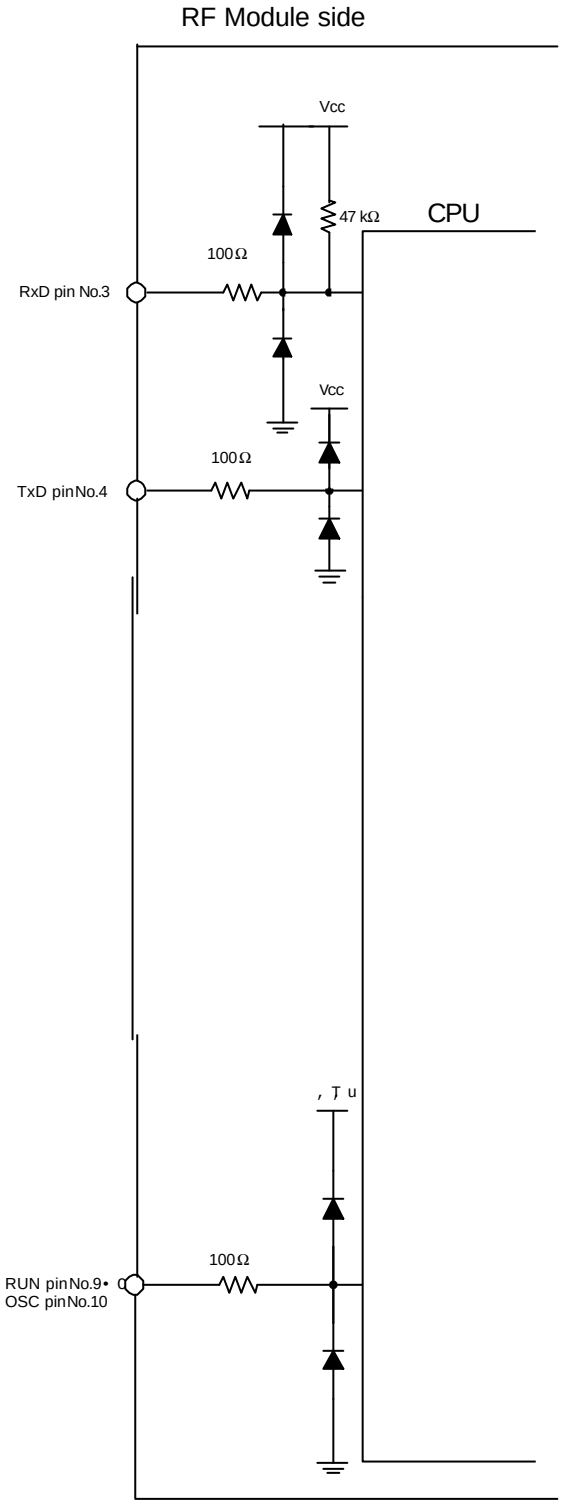
*3 Set using the DIP switch.

2-2-3 Interface Electrical Specifications

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>I/O</th><th>Function</th><th>Electrical characteristics</th></tr>
<tr><td>1</td><td>Vcc</td><td>.</td><td>5 V power supply</td><td>5 V ± 10%</td></tr>
<tr><td>2</td><td>GND</td><td>.</td><td>Ground</td><td>.</td></tr>
<tr><td>3</td><td>RxD</td><td>Input</td><td>Serial input</td><td>CMOS input with 47 kΩ pull-up, positive logic
<table><tr><th rowspan="2">Item</th><th colspan="2">Specified value</th></tr><tr><th>Min.</th><th>Max.</th></tr><tr><td>High level input voltage</td><td>Vcc x 0.7</td><td>Vcc + 0.3 V</td></tr><tr><td>Low level input voltage</td><td>-0.3 V</td><td>Vcc x 0.3</td></tr></table></td></tr>
<tr><td>4</td><td>TxD</td><td>Output</td><td>Serial output</td><td>CMOS output, positive logic
<table><tr><th rowspan="2">Item</th><th colspan="2">Specified value</th></tr><tr><th>Min.</th><th>Max.</th></tr><tr><td>High level output voltage</td><td>Vcc - 1.0 V (I_{OH} = -200 µA)</td><td>-----</td></tr><tr><td>Low level output voltage</td><td>-----</td><td>0.6 V (I_{OL} = 1.6 mA)</td></tr></table></td></tr>
<tr><td>5</td><td rowspan="2">GND</td><td rowspan="2">–</td><td rowspan="2">Ground</td><td rowspan="2">–</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>Reserved</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>8</td><td>-</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>9</td><td>RUN</td><td>Output</td><td>Output when Module is operating normally.</td><td>CMOS output, positive logic
<table><tr><th rowspan="2">Item</th><th colspan="2">Specified value</th></tr><tr><th>Min.</th><th>Max.</th></tr><tr><td>High level output voltage</td><td>Vcc - 1.0 V (I_{OH} = 1.5 mA)</td><td>-----</td></tr><tr><td>Low level output voltage</td><td>-----</td><td>0.6 V (I_{OL} = 1.6 mA)</td></tr></table></td></tr>
<tr><td>10</td><td>OSC</td><td>Output</td><td>Output during antenna oscillation.</td><td>CMOS output, positive logic
<table><tr><th rowspan="2">Item</th><th colspan="2">Specified value</th></tr><tr><th>Min.</th><th>Max.</th></tr><tr><td>High level output voltage</td><td>Vcc - 1.0 V (I_{OH} = -200 µA)</td><td>-----</td></tr><tr><td>Low l evel output voltage</td><td>-----</td><td>0.6 V (I_{OL} = 1.6 mA)</td></tr></table></td></tr>
</table>

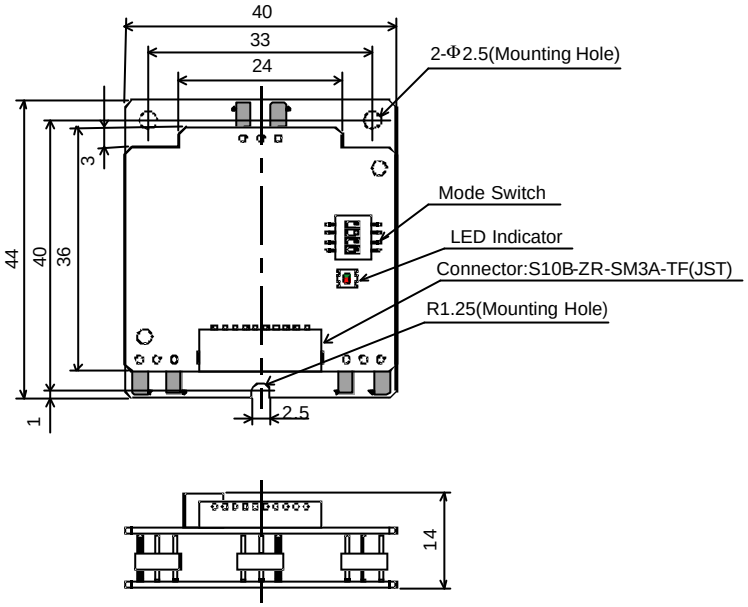
Note Do not connect unused signals.

2-2-4 Interface Circuit

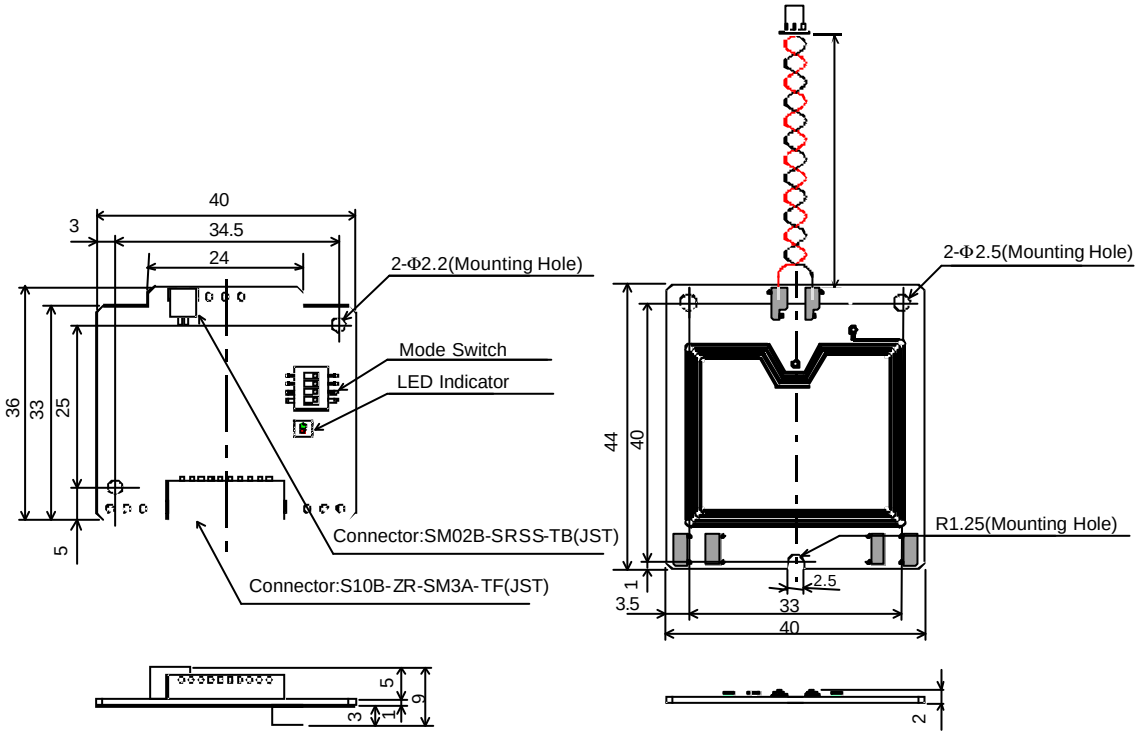


2-3 Dimensions

V720S-HMC73



V720S-HMC73T

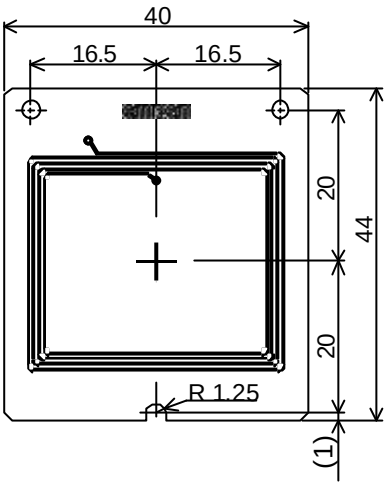


Control PCB Antenna PCB

⚠ **Caution** Use non-metal screws in the 2.2-diameter mounting holes on the V720S-HMC73T.

2-4 Antenna Center Position

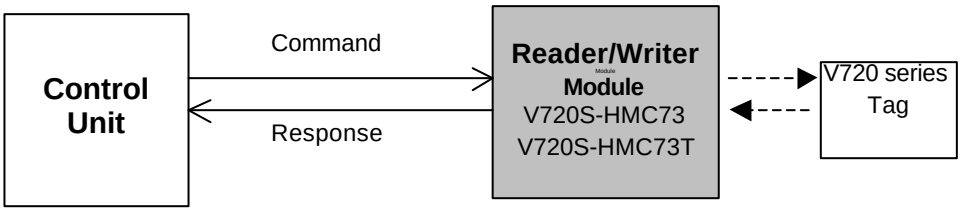
The center position of the antenna is shown by the silk (cross shape) on the antenna board. Relative to the mounting hole, this cross is positioned as illustrated below.



SECTION 3
R/W Module Operations

3-1 Outline of Operations

The R/W Module reads or writes to the tags using commands sent from the host control unit, and returns the processing responses to the host control unit.



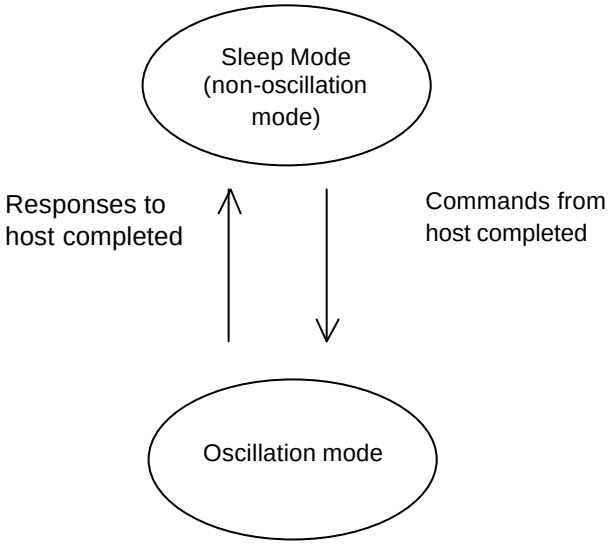
The R/W Module has two operating modes. The conditions for changing the mode are shown in the following diagram.

(1) Oscillation mode

This mode performs communications with the tags.
When using FIFO access mode, oscillation mode continues until a STOP command.

(2) Sleep Mode (Non-oscillation Mode)

This mode waits for commands from the host control unit.



3-2 Tag Access Functions

3-2-1 Memory Map of Tag

3-2-1-1 I-CODE1 Chip (Philips IC product name : SL1 ICS30 01, SL1 ICS31 01)

1) Memory Map of I-CODE1

These specifications describe a Tag incorporating an IC chip I- CODE1 Label IC from Philips, which is accessed by the system.
This chip consists of a 64-byte memory. The upper five blocks (Blocks 0 to 4) of the memory are used as a system area having functions that do not relate to user memory. OMRON offers special commands for accessing this area in order to ensure the great ease of these functions by the user.
Refer to Command List for details. OMRON defines the blocks below Block 5 as the user memory area. Block 5 is page 00h, and the subsequent blocks are allocated as shown below.
The memory is organized with four bytes as one page (4 bytes = 32 bits). One page is the minimum unit that can be read from and written to the memory.
The memory allocation described in this user's manual is in accordance with OMRON's memory allocation scheme.

OMRON						PHILIPS
Bank	Page	Byte 0	Byte 1	Byte 2	Byte 3	Block
00 Hex	B Hex	SNR				0
	C Hex	SNR				1
	D Hex	Write-protect				2
	E Hex	QUIET/EAS				3
	F Hex	Family code/application ID or user area				4
	0 Hex		User area			5
	1 Hex					6
	2 Hex					7
	3 Hex					8
	4 Hex					9
	5 Hex					10
	6 Hex					11
	7 Hex					12
	8 Hex					13
	9 Hex					14
	A Hex					15

Special Note Block 4 can be used as part of the user memory when the Distinguished Tag Read/Write function by family code (FC) or application ID (AI) is not used. If such use is preferred, define this page as F Hex to use it as part of the user memory. In this case, the user memory area becomes 12 pages long.

2) System Area of I-CODE1

The system area of I-CODE1 is mapped onto the memory. OMRON allocates the system area to pages B Hex to F Hex.

(1) SNR, pages C Hex, B Hex,

SNR is a tag-specific code and has been written into the memory during the chip production process.
The R/W Module is shipped with this page write-access inhibited (refer to page D Hex); there is no way of making this page rewritable by the user.

(2) Write-access conditions (page D Hex)

The pages are write-inhibited permanently if they are so indicated in the memory map. The factory settings are as follow. If the two bits of a particular page are 0.0, that page is write-protected.

Page D Hex	MSB							LSB
Byte 0	1	1	1	1	0	0	0	0
	Page E Hex		Page D Hex		Page C Hex		Page B Hex	
Byte 1	1	1	1	1	1	1	1	1
	Page 2 Hex		Page 1 Hex		Page 0 Hex		Page F Hex	
Byte 2	1	1	1	1	1	1	1	1
	Page 6 Hex		Page 5 Hex		Page 4 Hex		Page 3 Hex	
Byte 3	1	1	1	1	1	1	1	1
	Page A Hex		Page 9 Hex		Page 8 Hex		Page 7 Hex	

(3) QUIET/EAS (page E Hex)

QUIET mode: All the functions of a tag are suspended completely. Use Reset Quiet Bit to resume these functions. (q=0: QUIET mode disabled; q=1: QUIET mode enabled)
EAS mode: inhibition/permission of EAS function
(e=0: EAS mode disabled; e=1: EAS mode enabled)

Page Eh	MSB							LSB
Byte 0	x	x	x	x	q	q	e	e
Byte 1	x	x	x	x	x	x	x	x
Byte 2	x	x	x	x	x	x	x	x
Byte 3	x	x	x	x	x	x	x	x

The pages marked with "×" in the table above are reserved for future use.

(4) Family code/application ID (page F Hex)

Family code and application ID are special areas for enabling the user to identify an IC that is suitable to a specific user application.

Block Eh	MSB	LSB
Byte 0	Family code	
Byte 1	Application ID	
Byte 2	User area	
Byte 3	User area	

3-2-1-2 I-CODE2 Chip (Philips IC product name : SL2 ICS20)

In this module, processing is performed with the minimum access unit of one page (4 bytes), the maximum number of pages that can be processed simultaneously being one bank (16 pages), and up to a total of 16 banks (266 pages) being accessible.
The I-CODE 2 user memory area spans 112 bytes, or 28 pages, from page 00 Hex to page 1B Hex.

1) Max. address space of ISO/IEC15693 chip with a 4 Bytes/page organization

Bank	Page	Block	Byte 0	Byte 1	Byte 2	Byte 3
00 Hex	0 Hex	0				
	1 Hex	1				
	2 Hex	2				
	3 Hex					
	4 Hex					
	5 Hex					
	6 Hex					
	7 Hex					
	8 Hex					
	9 Hex					
	A Hex					
	F Hex	15				
01 Hex	0 Hex	16				
	1 Hex	17				
	B Hex	27				
	F	31				
0F Hex	0 Hex	240				
	1 Hex	241				
	F Hex	255				

I-CODE2
user memory area

Page 00 Hex to 1B Hex
(28 pages =112 bytes)

Caution The memory map above shows a memory area covered by the product. It complies with the ISO/IEC15693 standard.
Proper operation is ensured for our Tag, which incorporates Philips' IC product SL2ICS20 (known as "I-CODE2"), although this product incorporates a firmware allowing to access chips with a four bytes/page organization and fully compliant to ISO/IEC15693. Perform check test adequately when using other company's tag or tags that incorporate other ISO/IEC15693 chips.

2) System Area of I-CODE2

The I-CODE2 system area of is reserved in an area different from the user memory.
Special commands are used for accessing the system area.

Byte 0	Byte 1	Byte 2	Byte 3
UID			
UID			
EAS/AFI/DSFID			
Write-protect			

(1) UID

UID is a tag-specific code and has been written into the memory during the chip production process.
The R/W Module is shipped with this page write-access inhibited; there is no way of making this page rewritable by the user.

(2) EAS/AFI/DSFID

EAS mode: Inhibition/permission of EAS function
(e=0: EAS mode disabled; e=1: EAS mode enabled)

	MSB							LSB
Byte 1	x	x	x	x	x	x	x	e

The pages marked with "×" in the table above are reserved for future use.

(3) AFI

AFI is a special area for enabling the user to identify a tag that is suitable to a specific user application.

	MSB	LSB
Byte 2	AFI upper 4 bits	AFI lower 4 bits

AFI upper 4 bits	AFI lower 4 bits	Application area	Example/reference
0	0	All areas	Area not identified
X	0	X area	Selected extensively
X	Y	Y category of X area	
0	Y	Limited to Y category	
1	0,Y	Transportation	Mass-transit, bus, air plane
2	0,Y	Finance	Bank
3	0,Y	Recognition	Access control
4	0,Y	Telecommunication	Public telephone, CSM
5	0,Y	Medical care	
6	0,Y	Multimedia	Internet
7	0,Y	Game	
8	0,Y	Data storage	Portable file
9	0,Y	Logistics	
A	0,Y	Home delivery services	
B	0,Y	Mail	
C	0,Y	Airplane luggage	
D	0,Y	Reservation	
E	0,Y	Reservation	
F	0,Y	Reservation	

*Remarks: X=1 to F Y=1 to F

(4) DSFID

DSFID indicates how the data is configured in the memory.

	MSB							LSB
Byte 3	DSFID							

(5) Write-access conditions

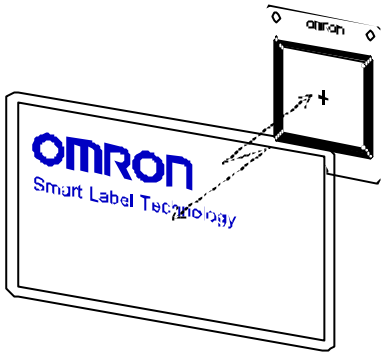
The pages are write-inhibited permanently if they are so indicated in the memory map. The factory settings are as follow. If the bit of a particular page is 1, that page is write-protected.

	MSB							LSB
Byte 0	0	0	0	0	0	0	0	0
	Page 03	Page 02	Page 01	Page 00				
Byte 1	0	0	0	0	0	0	0	0
	Page 0B	Page 0A	Page 09	Page 08	Page 07	Page 06	Page 05	Page 04
Byte 2	0	0	0	0	0	0	0	0
	Page 13	Page 12	Page 11	Page 10	Page 0F	Page 0E	Page 0D	Page 0C
Byte 3	0	0	0	0	0	0	0	0
	Page 1B	Page 1A	Page 19	Page 18	Page 17	Page 16	Page 15	Page 14

3-2-2 Single Access and FIFO Access Functions

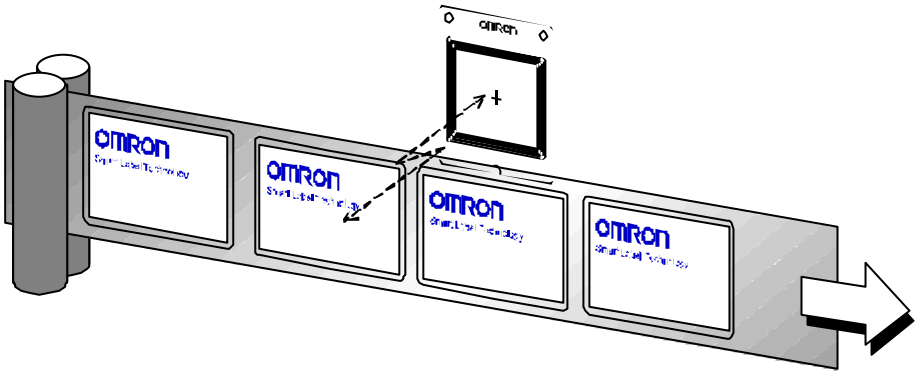
Single Access Mode

Use this mode to communicate with only one tag within the R/W Module communications area.
The time required for communications with the tag is shorter compared with FIFO access mode.



FIFO Access Mode

FIFO (First In First Out) access mode enables reading tags in order as they enter the antenna communications range. Tags with which communications have been completed are prohibited from being accessed again, so even if tags with which communications have been completed are still within range of the antenna, communications will be possible with new tags as they enter the communications range. When two or more tags enter the antenna communications range at the same time, a communications error will occur. When a tag to which access has been prohibited moves out of the communications area, communications with it will be possible again if it reenters the antenna communications range.



The above diagram shows an example of a tag inspection line.
When the distance between tags is small, two tags may enter the R/W Module communications range at the same time. If this happens when in Single Access Mode, a communications error will occur, or even if read/write appears to have been performed, there is no way to know which of the two tags was read. In FIFO Access Mode, tags entering communications range can be read or written to in order, so this mode is suited to applications such as a tag inspection line, in which the order of access is important.

3-2-3 Lock Function

The lock function is a protection function provided to prevent the loss of data by unintentionally overwriting fixed data stored on the tags. This function can be set using the lock command. This function can be set using the lock command.

There is a lock setting area in the tag system area, enabling user-defined areas to be write-protected one page at a time. If the write command is executed for a page that has been write-protected, a write processing error will occur.

Note The lock function used with the V720 Series cannot be canceled. Pages that have been write-protected cannot be written to again, so be careful when using this function.

3-2-4 Tag Identification Access Function

Only when the ID code stored on the tag and the ID code included in the command sent from the antenna match will the tag respond. This is called the tag identification access function.

Commands sent from the R/W Module respond without depending upon the ID code stored in the tags.

Reference Information for I-CODE1

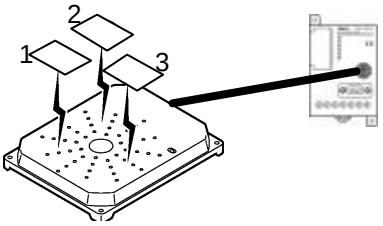
An example of using tag ID access using OMRON V720-H01 R/W Antenna and V720-CD1D is given below.

(1) The set values of the tag ID codes are given in the following table. These settings can be made using the R/W Module or the combined R/W Antenna and ID Controller.

	Tag No.1	Tag No.2	Tag No.3
Family Code	55 Hex	55 Hex	00 Hex
Application ID	AA Hex	11 Hex	00 Hex

(2) Tag ID Access Operation

•Not Using Tag ID Access

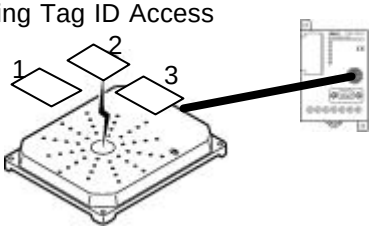


(1) Both the ID Controller family code and the application ID set value are taken to be 00 Hex. (Set at the factory.)

(2) Multiple tag access commands are executed.

(3) All tags within communications range respond. (The tag family codes and application IDs are not required.)

•Using Tag ID Access



(1) The set value of the ID Controller family code is 55 Hex, and the application ID is 11 Hex.

(2) Multiple tag access commands are executed.

(3) Only tags with the same ID code set in (1) and which are within communications range respond. In this example, only tag No. 2 responds.

SECTION 4
Controlling the R/W Module

Two methods of controlling the R/W Module from the host control unit are possible: CR control and number-of-characters control.

CR control — Data in the communications frame is handled as ASCII characters in 2-digit hexadecimal code (ASCII code). CR control simplifies operations with the host.

Number-of-characters Control — Data in the communications frame is handled as hexadecimal code, thus minimizing communications time with the host.

In this manual, the codes are displayed as follows:

ASCII characters: ' ×× '

Control code using ASCII characters: '<Control code>'

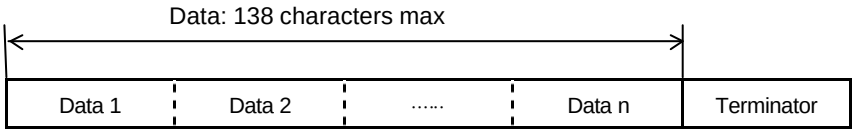
Displayed as hexadecimal code: ×× Hex

4-1 Communications Frames

4-1-1 CR control

The frame format consists of data in ASCII characters and a terminator. '<CR>' (ASCII: 0D Hex), the terminator, cannot be used in the data ASCII characters.

The CR control method is useful when the R/W Module is connected to a PC and the like.



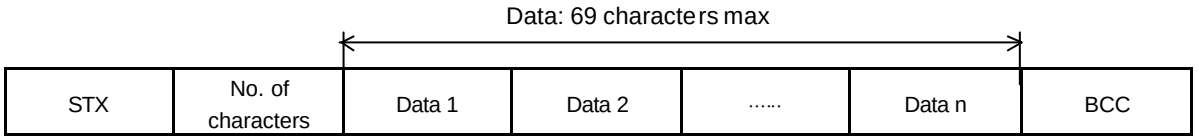
Data	No. of characters	Details
Data	1 to 138	Command parameters (ASCII characters)
Terminator	1	Code '<CR>' (0D Hex), which indicates end of communications frame

(Communications Control Procedure)

When a character is first received, reception starts, and when <CR> is received, the frame ends. If the interval between data is greater than 2 sec, a communications error occurs. If a communications error occurs, a frame error end code (Error code: '18') is sent as the response from the R/W Module to the host.

4-1-2 Number-of-characters Control

The frame format is given below, with '<STX>' (ASCII code: 02 Hex) as the beginning of the frame. The number-of-characters control method is useful when the R/W Module is directly connected to a microcomputer board, allowing communications time with the host device to be reduced.



Data	No. of characters	Details
STX	1	Code indicating start of communications frame (02 Hex).
No. of characters	1	Total number of data and BCC characters in hexadecimal.
Data	1.69	Command parameters (hexadecimal)
BCC	1	8-bit data taking the exclusive logical sum (ExOR) of the number of characters and the data characters (excluding STX). Example: Using STX 03 10 00 BCC BCC = (03 Hex) ExOR (10 Hex) ExOR (00 Hex) = 13 Hex

(Communications Control Procedure)

When character data has been received for the number of characters given at the beginning of the frame, the frame is assumed to have ended. If the interval between data is greater than 2 sec, processing of the reception is interrupted, and the sleep mode is engaged. If reception is stopped, responses are not returned from the R/W Module to the host.

4-2 Data Formats

The data in the communications frames used for commands and responses use the following formats.

■ **Command**

The command data consists of the command, communications options, and parameters. The communications options are added only to commands 01 to 03.

Command	Communications option	Parameter 1	.....	Parameter n

■ **Response**

The response data consists of an end code and parameters.

End code	Parameter 1	.....	Parameter n

4-2-1 Command Code List

Commands specify R/W Module processing. The commands are given in the following table.

1) General Commands (Commands sent to the RF Module)

Command name	No.	Details
Test	10	Sends the received data to the host device.
ACK	11	The host device received the data properly.
NACK	12	The host device did not receive the data properly.
STOP	13	Ends the command currently being executed. Stops antenna oscillation.

2) Commands Common to the I-CODE1 and the I-CODE2 Chips

Command name	No.	Details
Read	31	Reads tag memory data on a page basis.
Write	32	Writes data to tag memory on a page basis.
Write identical data	33	Writes identical data to tag memory on a page basis.
Read UID (SNR)	35	Reads tag serial numbers.
Set write-protection	39	Sets write-protection on a page basis

3) Commands Specific to the I-CODE2 Chip

Command name	No.	Details
Set AFI	36	Overwrites and locks tag AFI.
Set DSFID	37	Overwrites and locks tag DSFID.
Read Tag info	3A	Reads tag system information.
Read UID & data	41	Reads tag UID and memory data simultaneously.
EAS Alarm	42	Sends EAS Alarm to the tag.
Set EAS	43	Enables/disables and locks EAS.

4) Commands Specific to the I-CODE1 Chip

Command name	No.	Details
Read SNR	05	Reads tag serial numbers.
Read Family Code and Application ID	06	Reads tag family codes and application IDs.
Set Family Code and Application ID	07	Writes tag family codes and application IDs.
Set EAS	08	Permits/prohibits EAS commands to the tags.
EAS	24	Sends EAS commands to the tags.

5) Old Commands Specific to the I-CODE1 Chip (replaced by the Commands Common to the I-CODE1 and the I-CODE2 Chips)

Command name	No.	Details
Read	01	Reads tag memory data on a page basis.
Write	02	Writes data to tag memory on a page basis.
Write identical data	03	Writes identical data to tag memory on a page basis.
Set write-protection	09	Sets write-protection on a page basis.

Note These commands support the commands that are specific to I-CODE1 in the old RF module (V720-HMC73 and 73T).

4-2-2 Communications Options

The data code and communications mode can be specified as communications options. Data code specification is possible only when using CR control.

Bit	7	6	5	4	3	2	1	0
Setting details	0	0	Tag type	Data code	Communications mode			

*Bits 6 and 7 must be 0.

1) Specifying Tag Type

Setting	Value	Details
I.CODE1	0	When accessing a tag equipped with I-CODE1
ISO/IEC15693 (4byte/page type)	1	When accessing a tag equipped with I-CODE2 Addendum: when accessing the tag equipped with a chip with a four bytes/page organization and fully conforming to ISO/IEC15693

2) Specifying Data Code

■ **Using CR Control**

Specify the data code to perform read/write communications between the R/W Module and the host control unit. The specification concerns the data to be written/read to/from the user memory, as well as the test data.

Setting	Value	Details
Hex	0	Two-character data consisting of 0 to 9 and A to F is handled as 2-digit hexadecimal data. Two characters occupy one byte of tag memory. Example: When 12345678 is written to page 0, tag memory is used as shown below. Page 0 Byte 0: 12 Byte 1: 34 Byte 2: 56 Byte 3: 78
ASCII	1	One character of data occupies one byte of tag memory as ASCII or JIS8 unit code. Example: When 'ABCD' is written to page 0, tag memory is used as shown below. Byte 0: 41 Byte 1: 42 Byte 2: 43 Byte 3: 44

■ **Using Number-of-characters Control**

Only hexadecimal is handled; therefore, the data code must always be set to 0.

3) Specifying the Communications Mode

The following seven communications modes are supported for different processing procedures and execution timing.

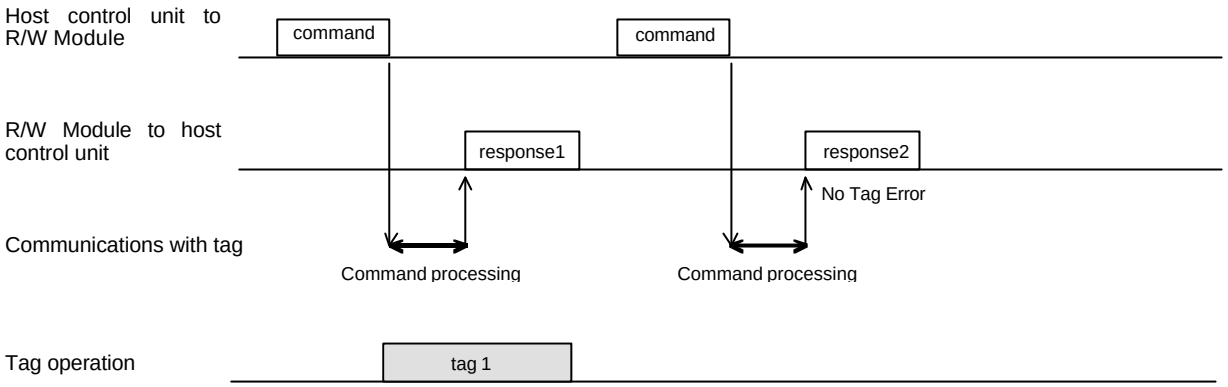
Communications mode	No.	Details
Single Trigger	0 Hex	After a command is received, communications with the tag is performed immediately and a response is sent. If there is no tag in communications range, a No Tag error is sent. After the response has been sent, the mode changes to sleep mode. Only one tag is permitted in communications range.
Single Auto	1 Hex	After a command is received, this mode waits for a tag to enter communications range, and then performs communications with the tag. After the response has been sent, the mode changes to sleep mode. If a STOP command is received while waiting for a tag, the command is ended. Only one tag is permitted in communications range.
Single Repeat	2 Hex	After a command is received, this mode waits for a tag to enter communications range, and then performs communications with the tag. If this mode has been specified, the command is repeated sequentially until a STOP command is received. This mode is enabled only for read commands. Only one tag is permitted in communications range.
FIFO Trigger	8 Hex	After a command is received, communications with the tag is performed immediately and a response is sent. If there is no tag in communications range, a No Tag error is sent. Access is prohibited to tags with which communications have been completed, and the R/W Module continues unmodulated oscillation. Tags with which communications have been completed do not respond to the next command. After the response has been sent, the mode changes to sleep mode. If a STOP command is received, oscillation stops.
FIFO Auto	9 Hex	After a command is received, this mode waits for a tag to enter communications range, and then performs communications with the tag. Access is prohibited to tags with which communications have been completed, and the R/W Module continues unmodulated oscillation. Tags with which communications have been completed do not respond to the next command. After the response has been sent, the mode changes to sleep mode. If a STOP command is received while waiting for a tag, the command is ended.
FIFO Continuous	A Hex	After a command is received, this mode waits for a tag to enter communications range, and then performs communications with the tag. Access is prohibited to tags with which communications have been completed, and the R/W Module continues unmodulated oscillation. Tags with which communications have been completed do not respond to the next command. After the response has been sent, when ACK is received, this mode again waits for a tag to enter communications range, and then performs communications with the tag. If a STOP command is received while waiting for a tag, the command is ended.
FIFO Repeat	B Hex	After a command is received, this mode waits for a tag to enter communications range, and then performs communications with the tag. Access is prohibited to tags with which communications have been completed. Tags with which communications have been completed do not respond to the next command. If this mode has been specified, the command is repeated sequentially until a STOP command is received.

Note Single repeat mode can only be specified for commands 01, 31, 35, 3A, 41, and 42.

4) Communications Modes Diagrams

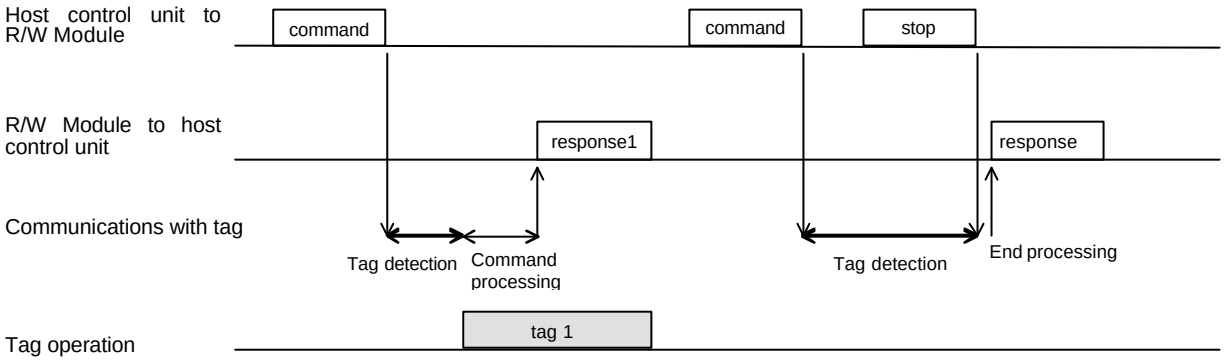
1) Single Trigger

■ **Operation Sequence**



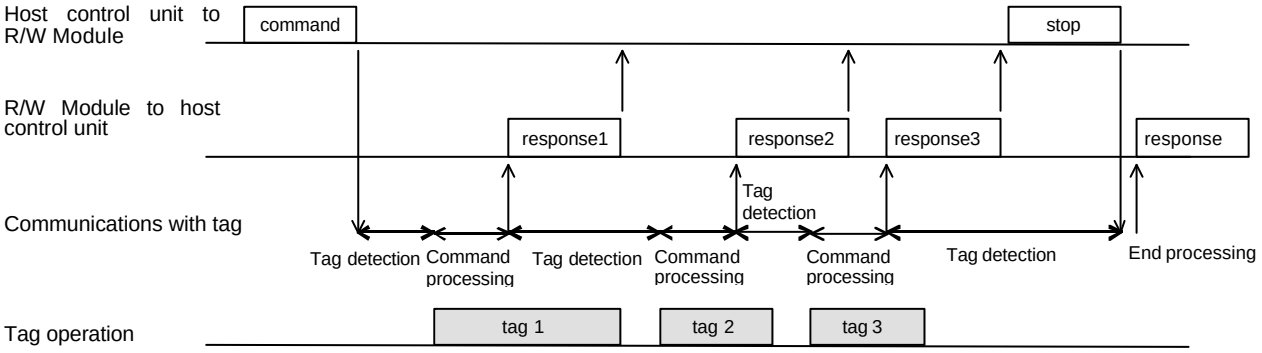
2) Single Auto

■ **Operation Sequence**



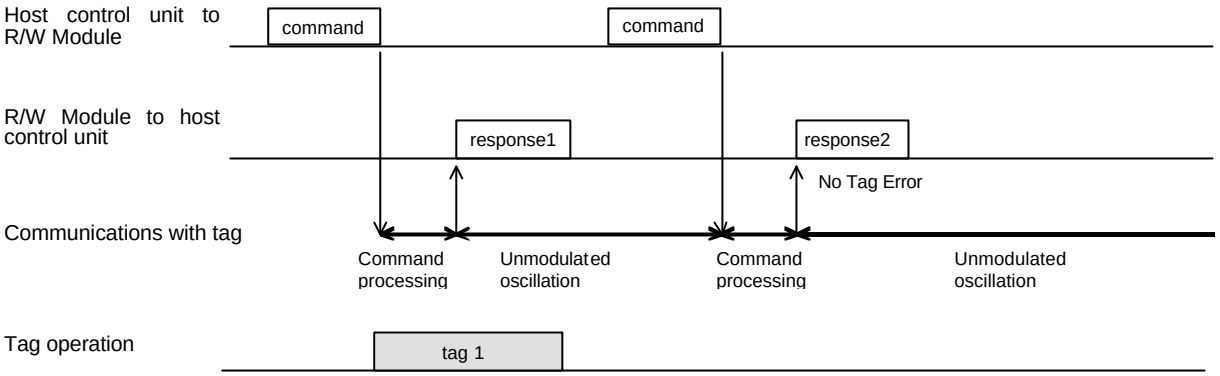
3) Single Repeat

■ **Operation Sequence**



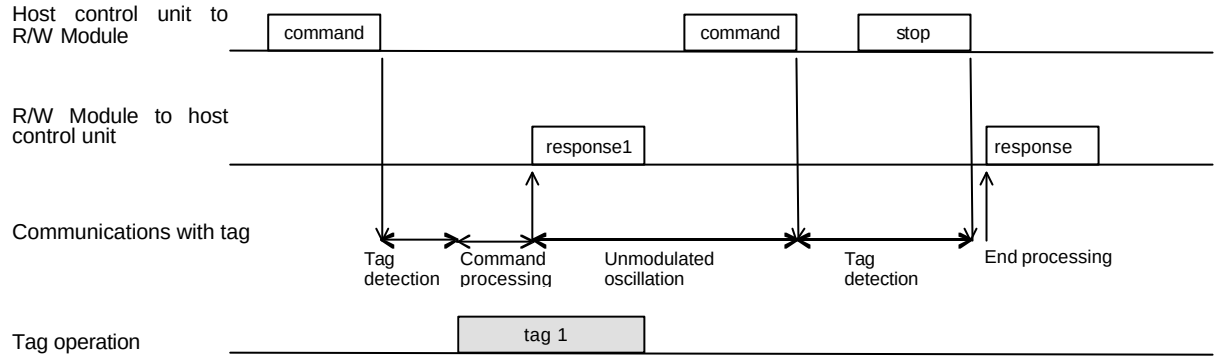
4) FIFO Trigger

■ Operation Sequence



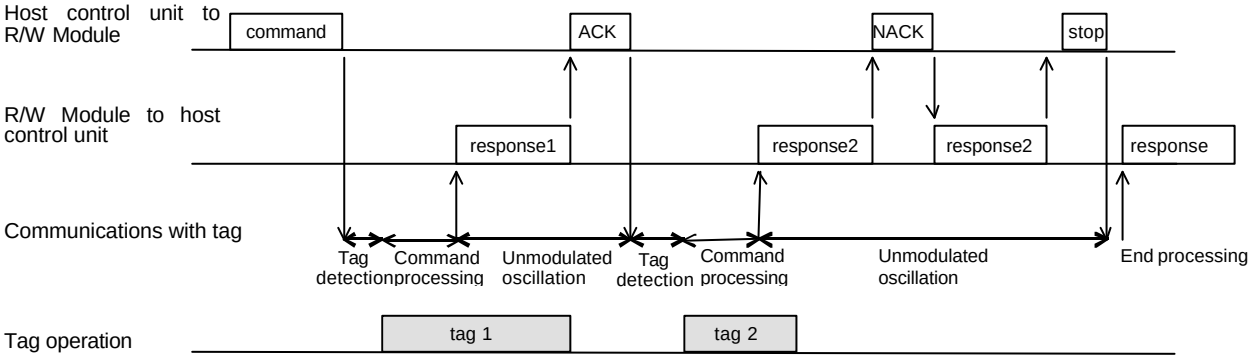
5) FIFO Auto

■ Operation Sequence



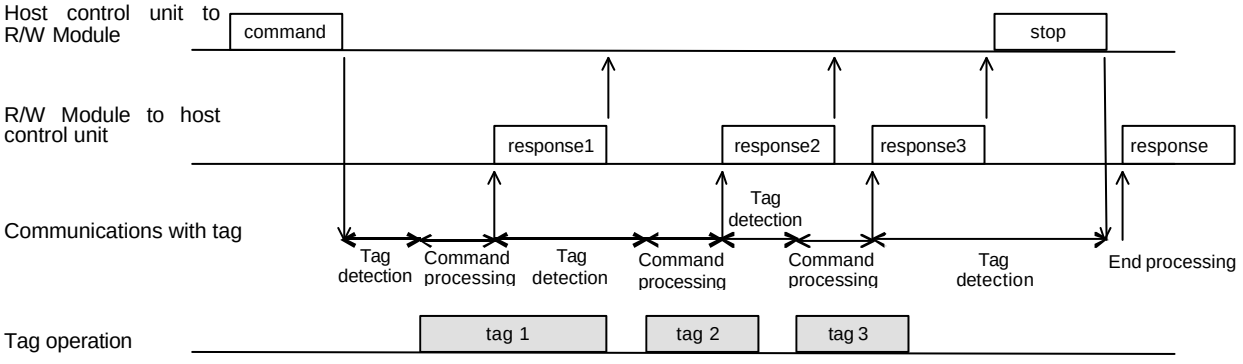
6) FIFO Continuous

■ Operation Sequence



7) FIFO Repeat

■ Operation Sequence



4-2-3 End Code List

■ Communications between Host Device and R/W Module

End code	Name	Details
10	Parity Error	• There is a character with a parity error in the command received. (CR control only).
11	Framing Error	• There is a character with a framing error in the command received.
12	Overrun Error	• There is a character with an overrun error in the command received.
13	BCC Error	• The BCC for the frame received is invalid (number-of-characters control only).
14	Format Error	• Command format does not match specifications. Examples: Command is not defined, page/address specifications are invalid, etc.
18	Frame Error	• Characters are received more than 2 sec apart (CR control only). • Frame received exceeds 140 (CR control only). • Frame received exceeds 73 bytes (number-of-characters control only).

■ Communications between R/W Module and Tags

End code	Name	Details
70	Communications Error	• Interference, such as noise, has occurred during communications with the tags, preventing normal completion.
71	Write Error	• Write command has been specified to a page that has been write-prohibited. • There is a tag area to which reading is possible, but writing is not possible. • Correct data cannot be written because the tag has exceeded its usable write life.
72	No Tag Error	• There was no tag in the communications area when the command was executed. • The specified pages do not exist (I-CODE2).
79	Command Error	• (see Comparison with ISO Error Code)
7A	Address Error	• The specified pages do not exist.

■ Comparison with ISO Error Code

When an ISO tag responds by returning an error, the module responds with the end code shown in the following table.

ISO code	Details	Module end code
01	Command not in use. Cannot recognize request command code.	79
02	Unrecognized command. Example: format error	79
03	Any unused command.	79
0F	Unknown or unused error code.	79
10	Specified block cannot be used (not present).	7A
11	Specified block cannot be re-locked because it has been already locked.	00
12	The contents of the specified block cannot be changed because it is locked.	71
13	Writing to the specified block did not end normally.	71
14	Locking of the specified block did not end normally.	71
Others	RFU	79

4-3 Commands and Responses during CR Control

4-3-1 General Commands (Commands sent to the RF Module)

1) Test

This command tests communications with the host. When this command is received, the R/W Module sends the same data to the host.

■ **Command**

Command		Test data		
'1'	'0'	Data 1	.....	Data n

■ **Response**

End code		Test data		
'0'	'0'	Data 1	.....	Data n

The test data returned is the same as the command data.

2) ACK

Use this command when the communications mode is FIFO Continuous Mode.

ACK is sent after the response has been received, and the next read operation is permitted.

■ **Command**

Command	
'1'	'1'

■ **Response**

There is no response to ACK.

3) NACK

If the host control unit does not receive a response normally, NACK is sent as a request to resend the response.

When the R/W Module receives the NACK command, it resends the immediately preceding response.

■ **Command**

Command	
'1'	'2'

■ **Response**

The immediately preceding response data is resent.

4) STOP

Use this command to stop the R/W Module processing. When this command is received, the R/W Module stops processing the current command and enters sleep mode. If the antenna is oscillating, the oscillation also stops.

■ **Command**

Command	
'1'	'3'

■ **Response**

End code	
'0'	'0'

4-3-2 Commands Common to the I-CODE1 and the I-CODE2 Chips

1) Read

Use this command to read data from the tags. Data can be read from a user-specified page.

■ **Command**

This command sends the pages to be read as command parameters. The page specification is as follows: The bits that correspond to the pages to be read are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The pages are specified by the user.

Command		Communications option		Bank specification		Page specification	
' 3'	' 1 '						

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	' 00 '	'00' to 'FF'								'00' to 'FF'							
ISO chip	'00' to '0F'	'00' to 'FF'								'00' to 'FF'							

■ **Response**

Returns the data read and the end code (normal end: '00'). The read data is returned sequentially in ascending order of the pages specified. If an error occurs, an error code is returned. In the case of a Tag equipped with I-CODE1, the read data is returned in the order: B⇒C⇒D⇒E⇒F⇒0⇒1⇒···⇒A.

End code		Read data *1		
' 0 '	' 0 '	Data 1	...	Data n

*1 Number of data n = Number of specified pages x 8 (hexadecimal)
Number of data n = Number of specified pages x 4 (ASCII)

Command Example

The following table gives the tag user memory details for the following example of commands and responses.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	54 Hex	55 Hex	56 Hex	57 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	62 Hex	63 Hex	64 Hex	65 Hex

(1) Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode with hexadecimal is as follows:
Command '01 00 006A<CR>'
Response '00 34353637 40414243 48494A4B 4C4D4E4F<CR>'

(2) Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode with ASCII is as follows:
Command '01 10 006A<CR>'
Response '00 4567 @ABC HIJK LMNO<CR>'

2) Write

Use this command to write tag data on a page basis. Data can be written to user-specified pages (except B Hex to E Hex for I-CODE1). The maximum number of pages which can be written to in a single operation is one bank, and writing to pages across banks is impossible. There is no need to perform the verify read process, since this command performs it as part of its execution.

■ **Command**

This command sends the data to be written as parameters. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. Specify the write data sequentially in ascending order of the specified page. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command		Communications option		Bank specification		Page specification		Write data *1		
‘ 3‘	‘ 2 ‘							Data 1	.	Data n

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	‘ 00 ‘		0	0	0	0											
ISO chip	‘00’ to ‘0F’	‘00’ to ‘FF’								‘00’ to ‘FF’							

*1 Number of data n = Number of specified pages x 8 (hexadecimal)
Number of data n = Number of specified pages x 4 (ASCII)

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘ 0 ‘	‘ 0 ‘

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	52 Hex	46 Hex	49 Hex	44 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	56 Hex	37 Hex	32 Hex	30 Hex

(1) Writing 52464944 hexadecimal to page 8, and 56373230 hexadecimal to page 10 using FIFO Repeat Mode, with hexadecimal:
Command ‘02 0B 0500 52464944 56373230<CR>‘
Response ‘00<CR>

(2) Writing ‘RFID’ hexadecimal to page 8, and ‘V720’ hexadecimal to page 10 using FIFO Repeat Mode, with ASCII:
Command ‘02 1B 0500 RFID V720<CR>‘
Response ‘00<CR>‘

Data written to tag memory is the same for both (1) and (2).

3) Write identical data

Use this command to write identical data to tags by the page. Data can be written to user-specified pages (except B Hex to E Hex for I-CODE1). This command is useful when writing the same data to multiple pages.

The maximum number of pages which can be written to in a single operation is one bank, and writing to pages across banks is impossible.

There is no need to perform the verify read process, since this command performs it as part of its execution.

■ **Command**

As parameters, the command sends specification of the pages to be written and the data to write to the specified pages one page at a time. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The write data is specified sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command		Communications option		Bank specification		Page specification		Write data *1		
‘ 3‘	‘ 3 ‘							Data 1	、	Data n

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	‘ 00 ‘		0	0	0	0											
ISO chip	‘00’ to ‘0F’	‘00’ to ‘FF’								‘00’ to ‘FF’							

*1 Number of data n = Number of specified pages x 8 (hexadecimal)
Number of data n = Number of specified pages x 4 (ASCII)

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘ 0 ‘	‘ 0 ‘

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	30 Hex	30 Hex	30 Hex	30 Hex
9	30 Hex	30 Hex	30 Hex	30 Hex
10	30 Hex	30 Hex	30 Hex	30 Hex

(1) Writing 30303030 hexadecimal to pages 8, 9, and 10 using FIFO Trigger Mode with hexadecimal:
Command ‘03 08 0700 30303030<CR>‘
Response ‘00<CR>

(2) Writing ‘0000’ to pages 8, 9, and 10 using FIFO Trigger Mode with ASCII:
Command ‘03 18 0700 0000<CR>‘
Response ‘00<CR>

Data written to tag memory is the same for both (1) and (2).

4) Read UID (SNR)

Use this command to read the serial numbers from the tags.

■ **Command**

Command		Communications option	
'3'	'5'		

■ **Response**

The response returns the UID (SNR) read and the end code (normal end: 00).

End code		UID (SNR)		
' 0 '	' 0 '	Data 1	...	Data 8

5) Set write-protection to Tag

Use this command to write-prohibit tags.

The maximum number of pages that can be write-protected in a single operation is one bank, and write-protecting pages across banks is impossible.

■ **Command**

This command sends the pages to be write-protected as command data. The page specification is achieved by setting the bit corresponding to each page to ON. When performing reading only, all the page specifications are set to OFF.

Command		Communications option		Bank specification		Page specification	
' 3 '	' 9 '						

Tag type	Bank	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I.CODE1	'00'				0	0											
ISO chip	'00' to '0F'	'00' to 'FF'								'00' to 'FF'							

■ **Response**

The response returns the setting status for write-protection and the end code (normal end: '00').

End code		Setting status		
		Bank specification	Page specification	
' 0 '	' 0 '			

4-3-3 Commands Specific to the I-CODE2 Chip

1) Write, Lock AFI

Use this command to change or lock tag AFI.

■ **Command**

Command		Communications option		Process option		Data	
‘3‘	‘6‘						

	Process option	Data
Write AFI	01 Hex	AFI = 00 to FF(Hex)
Lock AFI	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘0‘	‘0‘

2) Write, Lock DSFID

Use this command to change or lock tag DSFID.

■ **Command**

Command		Communications option		Process option		Data	
‘3‘	‘7‘						

	Process option	Data
Write DSFID	01 Hex	DSFID = 00 to FF(Hex)
Lock DSFID	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘0‘	‘0‘

3) Read Tag Info

Use this command to read tag system information.

■ **Command**

Command		Communications option	
‘3’	‘A’		

■ **Response**

The response returns the information flag, UID, the information data, and the end code (normal end: '00'). The data returned in the information data is changed with the information flag.

End code		Information flag		UID			Information		
‘0‘	‘0‘			Data 1	...	Data 8	Data 1	...	Data n

.Information flag

Bit	7	6	5	4	3	2	1	0
	0	0	0	0	IC information	Memory size	AFI	DSFID

.Information (variable data length)

DSFID	AFI	VICC memory size		IC information
		Number of blocks	Block length	

*Only information with the bit set by the information flag is stored.

*Number of blocks = 00h (1 block) to FFh (256 block)

*Block length = 00h (1 byte) to 1Fh (32 byte)

4) Read UID & Data

Use this command to read UID and data from the tags at the same time. Data can be read from a user-specified page.

The maximum number of pages that can be read in one operation is one bank (16 pages), and reading pages across banks is impossible.

■ **Command**

This command sends the pages to be read as command data. The page specification is achieved by setting the bit corresponding to each page to ON.

Command		Communications option		Bank specification		Page specification	
‘4‘	‘1‘						

Tag type	Bank	Page															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ISO chip	00 to 0F																

■ **Response**

The response returns the UID and data read and the end code (normal end: 00). The read data is returned sequentially in the order of the pages specified.

End code		UID			Read data*		
‘0‘	‘0‘	Data 1	...	Data 8	Data 1	...	Data n

* Number of read data n = Number of specified pages × page unit (4 bytes)

5) EAS Alarm Command

Requests EAS data to the tags.

■ **Command**

Command		Communications option	
‘4‘	‘2‘		

■ **Response**

The response returns the EAS data read and the end code (normal end: 00).

End code		EAS data
‘0‘	‘0‘	‘F4CD460EABE509FE178D011C4B81926E415B5961F6F5D10D8F398B48A54EECF7’

6) Set EAS

Enables/disables and locks EAS to the tags.

■ **Command**

Command		Communications option		Process option		Data	
‘4‘	‘3‘						

	Process option	Data
Enable EAS	01 HEX	00 HEX: disabled/01 HEX: enabled
Lock EAS	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘0‘	‘0‘

4-3-4 Commands Specific to the I-CODE1 Chip

1) Read Serial Nnumber

Use this command to read tag serial numbers.

■ **Command**

Command	
‘ 0 ‘	‘ 5 ‘

■ **Response**

The response returns the tag serial number read, and the end code (normal end: '00').

End code		Tag serial number		
‘ 0 ‘	‘ 0 ‘	Data 1	..	Data n

The tag serial number is 16 digits in hexadecimal code.

2) Read Family Code and Application ID

Use this command to read tag family codes and application IDs.

■ **Command**

Command	
‘ 0 ‘	‘ 6 ‘

■ **Response**

The response returns the tag family code, application ID read, and end code (normal end: '00').

End code		Family Code	Application ID
‘ 0 ‘	‘ 0 ‘	‘00’ to ‘FF’	‘00’ to ‘FF’

3) Write Family Code and Application ID

Use this command to set the tag family codes and application IDs.

■ **Command**

Command		Family Code	Application ID
‘ 0 ‘	‘ 7 ‘	‘00’ to ‘FF’	‘00’ to ‘FF’

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘ 0 ‘	‘ 0 ‘

4) Set EAS mode

Use this command to set whether to permit or prohibit tag EAS responses.

■ **Command**

Command		Set value	
‘ 0 ‘	‘ 8 ‘		

Set value: ’ 00 ‘ Permit
’ 01 ‘ Prohibit

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘ 0 ‘	‘ 0 ‘

5) EAS

Sends EAS commands to the tags. EAS data, which is the response from the tags, is fixed data, as shown below.

■ **Command**

Command	
‘ 2 ‘	‘ 4 ‘

■ **Response**

EAS data
‘ 2FB36270D5A7907FE8B18038D281497682DA9A866FAF8BB0F19CD112A57237EF ‘

Note If there is no tag in the communications area, undefined data of 64 characters will be returned.

4-3-5 Old Commands Specific to the I-CODE1 Chip

The command can be replaced by Section 4 "Commands Common to the I-CODE1 and the I-CODE2 Chips".

1) Read

Use this command to read data from the tags. Data can be read from a user-specified page.

■ **Command**

This command sends the pages to be read as command parameters. The page specification is as follows: The bits that correspond to the pages to be read are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The pages are specified by the user.

Command	Communications option	Page specification (4 characters)	
'0' '1'			

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	'00' to 'FF'								'00' to 'FF'							

■ **Response**

The response returns the data read and the end code (normal end: '00').The read data is returned sequentially in ascending order of the pages specified. If an error occurs, an error code is returned.In the case of a Tag equipped with I-CODE1, the read data is returned in the order:
B⇒C⇒D⇒E⇒F⇒0⇒1⇒···⇒A.

End code	Read data*1		
'0' '0'	Data 1	·····	Data n

*1 Number of data n = Number of specified pages x 8 (hexadecimal)

Number of data n = Number of specified pages x 4 (ASCII)

<Command Example>

The following table gives the tag user memory details for the following example of commands and responses.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	54 Hex	55 Hex	56 Hex	57 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	62 Hex	63 Hex	64 Hex	65 Hex

(1) Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode with hexadecimal is as follows:

Command '01 00 006A<CR>'
Response '00 34353637 40414243 48494A4B 4C4D4E4F<CR>'

(2) Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode with ASCII is as follows:

Command '01 10 006A<CR>'
Response '00 4567 @ABC HIJK LMNO<CR>'

2) Write

Use this command to write data to tags on a page basis. Data is written to user-specified pages.

There is no need to perform the verify read process, since this command performs it as part of its execution.

■ **Command**

This command sends the data to be written as parameters. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. Specify the write data sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command	Communications option	Page specification (4 characters)	Write data*1		
‘0‘ ‘2‘			Data 1	·····	Data n

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	‘00’ to ‘07‘ ‘10’ to ‘17‘								‘00’ to ‘FF’							

*1 Number of data n = Number of specified pages x 8 (hexadecimal)
Number of data n = Number of specified pages x 4 (ASCII)

■ **Response**

The response returns the end code (normal end: ‘00’).

End code	
‘0‘	‘0‘

<Command Example>

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	52 Hex	46 Hex	49 Hex	44 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	56 Hex	37 Hex	32 Hex	30 Hex

(1) Writing 52464944 hexadecimal to page 8, and 56373230 hexadecimal to page 10 using FIFO Repeat Mode, with hexadecimal:

Command ‘02 0B 0500 52464944 56373230<CR>‘
Response ‘00<CR>

(2) Writing ‘RFID’ hexadecimal to page 8, and ‘V720’ hexadecimal to page 10 using FIFO Repeat Mode, with ASCII:

Command ‘02 1B 0500 RFID V720<CR>‘
Response ‘00<CR>‘

Data written to tag memory is the same for both (1) and (2).

3) Write identical data

Use this command to write identical data to tags by the page. Data is written to user-specified pages. This command is useful when writing the same data to multiple pages (specification is required only once).

There is no need to perform the verify read process, since this command performs it as part of its execution.

■ Command

As parameters, the command sends specification of the pages to be written and the data to write to the specified pages one page at a time. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. Specify the write data sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒⋯⇒A.

Command	Communications option	Page specification (4 characters)		Write data*1		
‘0‘ ‘3‘				Data 1	.....	Data n

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	‘00’ to ‘07‘ ‘10’ to ‘17‘								‘00’ to ‘FF’							

*1 Number of data n = Number of specified pages x 8 (hexadecimal)
Number of data n = Number of specified pages x 4 (ASCII)

■ Response

The response returns the end code (normal end: ‘00’).

End code
‘0‘ ‘0‘

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	30 Hex	30 Hex	30 Hex	30 Hex
9	30 Hex	30 Hex	30 Hex	30 Hex
10	30 Hex	30 Hex	30 Hex	30 Hex

(1) Writing 30303030 hexadecimal to pages 8, 9, and 10 using FIFO Trigger Mode with hexadecimal:

Command ‘03 08 0700 30303030<CR>‘
Response ‘00<CR>

(2) Writing ‘0000’ to pages 8, 9, and 10 using FIFO Trigger Mode with ASCII:

Command ‘03 18 0700 0000<CR>‘
Response ‘00<CR>

Data written to tag memory is the same for both (1) and (2).

4) Set lock

Use this command to write-prohibit tags.

■ **Command**

This command sends the pages to be write-protected as command data. The page specification is as follows: The bits that correspond to the pages to be write-protected are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. To read the current write-prohibit settings, set the page specification to '0000'.

Command	Page specification (4 characters)			
‘0‘ ‘9‘				

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	Page B Hex and C Hex must be 0.								‘00’ to ‘FF’							

■ **Response**

The response returns the setting status for write-protection and the end code (normal end: '00'). The page specification is as follows: The bits that correspond to the write-protect pages are set to 1, and all other bits are set to 0.

End code	Setting status			
‘0‘ ‘0‘				

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	Page B Hex and C Hex are 0.								‘00’ to ‘FF’							

Note The lock function used with the V720 Series cannot be canceled. Pages that have been write-protected cannot be written to again, so be careful when using this function.

4-4 Commands and Responses during Number-of-characters Control

4-4-1 General Commands (Commands sent to the RF Module)

1) Test

This command tests communications with the host. When this command is received, the R/W Module sends the same data to the host.

■ **Command**

Command	Test data		
10 Hex	Data 1	·····	Data n

■ **Response**

End code	Test data		
00 Hex	Data 1	·····	Data n

The test data returned is the same as the command data.

2) ACK

Use this command when the communications mode is FIFO Continuous Mode.

ACK is sent after the response has been received, and the next read operation is permitted.

■ **Command**

Command
11 Hex

■ **Response**

There is no response to ACK.

3) NACK

If the host control unit does not receive a response normally, NACK is sent as a request to resend the response.

When the R/W Module receives the NACK command, it resends the immediately preceding response.

■ **Command**

Command
12 Hex

■ **Response**

The immediately preceding response data is resent.

4) STOP

Use this command to stop the R/W Module processing. When this command is received, the R/W Module stops processing the current command and enters sleep mode. If the antenna is oscillating, the oscillation also stops.

■ **Command**

Command
13 Hex

■ **Response**

End code
00 Hex

4-4-2 Commands Common to the I-CODE1 and the I-CODE2 Chips

1) Read

Use this command to read data from the tags. Data can be read from a user-specified page.

■ **Command**

This command sends the pages to be read as command parameters. The page specification is as follows: The bits that correspond to the pages to be read are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The pages are specified by the user.

Command	Communications option	Bank specification	Page specification	
31 Hex				

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	00 Hex	00 Hex to FF Hex								00 Hex to FF Hex							
ISO chip	00 Hex to FF Hex	00 Hex to FF Hex								00 Hex to FF Hex							

■ **Response**

The response returns the data read and the end code (normal end: '00').The read data is returned sequentially in ascending order of the pages specified. If an error occurs, an error code is returned. In the case of a Tag equipped with I-CODE1, the read data is returned in the order:
B⇒C⇒D⇒E⇒F⇒0⇒1⇒…⇒A.

End code	Read data[*1]		
00 Hex	Data 1	...	Data n

[*1] Number of data n = Number of specified pages x 8

<Command Example>

The following table gives the tag user memory details for the following example of commands and responses.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	54 Hex	55 Hex	56 Hex	57 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	62 Hex	63 Hex	64 Hex	65 Hex

Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode is as follows:

BCC

Command (02) 05 31 00 00 006A (5D) Hex

Response (02) 12 00 34353637 40414243 48494A4B 4C4D4E4F (12) Hex

BCC

STX

2) Write

Use this command to write data to tags on a page basis. Data can be written to user-specified pages (except B Hex to E Hex for I-CODE1). The maximum number of pages which can be written in one operation is one bank, and writing to pages across banks is impossible. There is no need to perform the verify read process, since this command performs it as part of its execution.

■ **Command**

This command sends the data to be written as parameters. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The write data is specified sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command	Communications option	Bank specification	Page specification		Write data *1		
32 Hex					Data 1	・	Data n

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	00 Hex		0	0	0	0											
ISO chip	00 Hex to 0F Hex	00 Hex to FF Hex								00 Hex to FF Hex							

*1 Number of data n = Number of specified pages x 8

■ **Response**

The response returns the end code (normal end: '00').

End code
00 Hex

<Command Example>

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	52 Hex	46 Hex	49 Hex	44 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	56 Hex	37 Hex	32 Hex	30 Hex

Writing 52464944 Hex to page 8, and 56373230 Hex to page 10 using FIFO repeat mode:

BCC

Command 02 0D 32 00 0B 0500 52464944 56373230 48 Hex

Response 02 02 00 02 Hex

BCC

STX

3) Write identical data

Use this command to write identical data to tags by the page. Data can be written to user-specified pages (except B Hex to E Hex for I-CODE1). This command is useful when writing the same data to multiple pages

The maximum number of pages which can be written to in one operation is one bank, and writing to pages across banks is impossible. There is no need to perform the verify read process, since this command performs it as part of its execution.

■ Command

As parameters, the command sends specification of the pages to be written and the data to write to the specified pages one page at a time. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The write data is specified sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command	Commu-nications option	Bank specification	Page specification		Write data *1		
33 Hex					Data 1	・	Data n

Tag type	Bank specification (Settable value)	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I-CODE1	00 Hex		0	0	0	0											
ISO chip	00 Hex to 0F Hex	00 Hex to FF Hex								00 Hex to FF Hex							

*1 Number of data n = Number of specified pages x 8

■ Response

The response returns the end code (normal end: '00').

End code
00 Hex

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	30 Hex	30 Hex	30 Hex	30 Hex
9	30 Hex	30 Hex	30 Hex	30 Hex
10	30 Hex	30 Hex	30 Hex	30 Hex

Writing 30303030 Hex to pages 8, 9, and 10 using FIFO Trigger Mode:

BCC

Command 02 09 33 00 08 0700 30303030 36 Hex

Response 02 02 00 02 Hex

BCC

STX

4) Read UID (SNR)

Use this command to read the serial numbers from the tags.

■ **Command**

Command	Communications option
35 Hex	

■ **Response**

The response returns the UID (SNR) read and the end code (normal end: 00).

End code	UID (SNR)		
00 Hex	Data 1	...	Data 8

5) Set write-protection to Tag

Use this command to write-protect tags.

The maximum number of pages which can be write-protected in one operation is one bank, and write-protecting pages across banks is impossible.

■ **Command**

This command sends the pages to be write-protected as command data. The page specification is achieved by setting the bit corresponding to each page to ON. When performing reading only, all the page specifications are set to OFF.

Command	Communications option	Bank specification	Page specification	
39 Hex				

Tag type	Bank	Page specification (settable value)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
I.CODE1	00 Hex				0	0											
ISO chip	00 Hex to 0F Hex	00 to FF Hex								00 Hex to FF Hex							

■ **Response**

The response returns the setting status for write-protection and the end code (normal end: '00').

End code	Setting status	
00 Hex	Bank specification	Page specification

4-4-3 Commands specific to the I-CODE2 Chip

1) Write, Lock AFI

Use this command to change or lock tag AFI.

■ **Command**

Command	Communications option	Process option	Data
36 Hex			

	Process option	Data
Write AFI	01 HEX	AFI = 00 to FF(Hex)
Lock AFI	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code
00 Hex

2) Write, Lock DSFID

Use this command to change or lock tag DSFID.

■ **Command**

Command	Communications option	Process option	Data
37 Hex			

	Process option	Data
Write DSFID	01 Hex	DSFID = 00 to FF(Hex)
Lock DSFID	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code
00 Hex

3) Read Tag Info

Use this command to read tag system information.

■ **Command**

Command	Communications option
3A Hex	

■ **Response**

The response returns the information flag, UID, the information data, and the end code (normal end: '00'). The data returned in the information data is changed with the information flag.

End code	Information flag	UID			Information		
00 Hex		Data 1	...	Data 8	Data 1	...	Data n

.Information flag

Bit	7	6	5	4	3	2	1	0
	0	0	0	0	IC information	Memory size	AFI	DSFID

.Information (variable data length)

DSFID	AFI	VICC memory size		IC information
		Number of blocks	Block length	

*Only information with the bit set by the information flag is stored.

*Number of blocks = 00h (1 block) to FFh (256 block)

*Block length = 00h (1 byte) to 1Fh (32 byte)

4) Read UID & Data

Use this command to read UID and data from the tags simultaneously. Data can be read from a user-specified page.

The maximum number of pages which can be read in one operation is one bank (16 pages), and reading pages across banks is impossible.

■ **Command**

This command sends the pages to be read as command data. The page specification is achieved by setting the bit corresponding to each page to ON.

Command	Communications option	Bank specification	Page specification	
41 Hex				

Tag type	Bank	Page															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ISO chip	00 to 0F																

■ **Response**

The response returns the UID and data read and the end code (normal end: 00). The read data is returned sequentially in the order of the pages specified.

End code	UID			Read data*		
00 Hex	Data 1	...	Data 8	Data 1	...	Data n

* Number of read data n = Number of specified pages × page unit (4 byte)

5) EAS Alarm Command

Use this command to request EAS data to the tags.

■ **Command**

Command	Communications option
42 Hex	

■ **Response**

The response returns the EAS data read and the end code (normal end: 00).

End code	EAS data
00 Hex	F4CD460EABE509FE178D011C4B81926E415B5961F6F5D10D8F398B48A54EECF7h

6) Set EAS Command

Use this command to enable/disable and lock EAS to the tags.

■ **Command**

Command	Communications option	Process option	Data
43 Hex			

	Process option	Data
Enable EAS	01 Hex	00 HEX: disabled/01 HEX: enabled
Lock EAS	02 Hex	00 Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code
00 Hex

4-4-4 Commands Specific to the I-CODE1 Chip

1) Read Serial Number

Use this command to read tag serial numbers.

■ **Command**

Command
05 Hex

■ **Response**

The response returns the tag serial number read, and the end code (normal end: '00').

End code	Tag serial number		
00 Hex	Data 1	..	Data n

The tag serial number is 16 digits in hexadecimal code.

2) Read Family Code and Application ID

Use this command to read tag family codes and application IDs.

■ **Command**

Command
06 Hex

■ **Response**

The response returns the tag family code, application ID read, and end code (normal end: '00').

End code	Family Code	Application ID
00 Hex	00 Hex to FF Hex	00 Hex to FF Hex

3) Write Family Code and Application ID

Use this command to set the tag family codes and application IDs.

■ **Command**

Command	Family Code	Application ID
07 Hex	00 Hex to FF Hex	00 Hex to FF Hex

■ **Response**

The response returns the end code (normal end: ‘00’).

End code
00 Hex

4) Set EAS mode

Use this command to set whether to permit or prohibit tag EAS responses.

■ **Command**

Command	Set value
08 Hex	

Set value: Permit
01 Hex Prohibit

■ **Response**

The response returns the end code (normal end: '00').

End code
00 Hex

5) EAS

Sends EAS commands to the tags. EAS data, which is the response from the tags, is fixed data, as shown below.

■ **Command**

Command
24 Hex

■ **Response**

EAS data
2FB36270D5A7907FE8B18038D281497682DA9A866FAF8BB0F19CD112A57237EFh

Note If there is no tag in the communications area, 32-byte undefined data will be returned.

4-4-5 Old Commands Specific to the I-CODE1 Chip

This command may be replaced by Commands Common to the I-CODE1 and the I-CODE2 Chips.

1) Read

Use this command to read data from the tags. Data can be read from a user-specified page.

■ Command

This command sends the pages to be read as command parameters. The page specification is as follows: The bits that correspond to the pages to be read are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The pages are specified by the user.

Command	Communications option	Page specification (2 characters)	
01 Hex			

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	'00' to 'FF'								00 Hex to FF Hex							

■ Response

The response returns the data read and the end code (normal end: 00 Hex). The read data is returned sequentially in ascending order of the pages specified. If an error occurs, an error code is returned. In the case of a Tag equipped with I-CODE1, the read data is returned in the order: B⇒C⇒D⇒E⇒F⇒0⇒1⇒···⇒A.

End code	Read data *1		
00 Hex	Data 1	·····	Data n

*1 Number of data n = Number of specified pages x 8

Command Example

The following table gives the tag user memory details for the following example of commands and responses.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	54 Hex	55 Hex	56 Hex	57 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	62 Hex	63 Hex	64 Hex	65 Hex

Reading the following four pages: 1, 3, 5, and 6, using Single Trigger Mode is as follows:

BCC

Command 02 05 01 00 006A(6E) Hex

Response 02 12 00 34353637 40414243 48494A4B 4C4D4E4F (12) Hex

BCC

STX

2) Write

Use this command to write data to tags on a page basis. Data is written to user-specified pages.

There is no need to perform the verify read process, since this command performs it as part of its execution.

■ **Command**

This command sends the data to be written as parameters. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The write data is specified sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A..

Command	Communications option	Page specification (2 characters)		Write data*1		
02 Hex				Data 1	·····	Data n

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	'00' to '07' '10' to '17'								00 Hex to FF Hex							

*1 Number of data n = Number of specified pages x 8

■ **Response**

The response returns the end code (normal end: 00 Hex).

End code
00 Hex

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	52 Hex	46 Hex	49 Hex	44 Hex
9	58 Hex	59 Hex	5A Hex	61 Hex
10	56 Hex	37 Hex	32 Hex	30 Hex

Writing 52464944 Hex to page 8, and 56373230 Hex to page 10 using FIFO repeat mode:

BCC

Command 02 0D 02 0B 0500 52464944 56373230 7B Hex

Response 02 02 00 02 Hex

BCC

STX

3) Write identical data

Use this command to write identical data to tags by the page. Data is written to user-specified pages. This command is useful when writing the same data to multiple pages (specification is required only once).

There is no need to perform the verify read process, since this command performs it as part of its execution.

■ Command

As parameters, the command sends specification of the pages to be written and the data to write to the specified pages one page at a time. The page specification is as follows: The bits that correspond to the pages to be written are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. The write data is specified sequentially in ascending order of the pages specified. In the case of a Tag equipped with I-CODE1, specify the write data in the order: F⇒0⇒1⇒···⇒A.

Command	Communications option	Page specification (2 characters)		Write data*1		
03 Hex				Data 1	·····	Data n

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	'00' to '07' '10' to '17'								00 Hex to FF Hex							

*1 Number of data n = Number of specified pages x 8

■ Response

The response returns the end code (normal end: 00 Hex).

End code
00 Hex

Command Example

The following table gives details of tag user memory when executing the following command.

Page	Byte 0	Byte 1	Byte 2	Byte 3
0	30 Hex	31 Hex	32 Hex	33 Hex
1	34 Hex	35 Hex	36 Hex	37 Hex
2	38 Hex	39 Hex	30 Hex	30 Hex
3	40 Hex	41 Hex	42 Hex	43 Hex
4	44 Hex	45 Hex	46 Hex	47 Hex
5	48 Hex	49 Hex	4A Hex	4B Hex
6	4C Hex	4D Hex	4E Hex	4F Hex
7	50 Hex	51 Hex	52 Hex	53 Hex
8	30 Hex	30 Hex	30 Hex	30 Hex
9	30 Hex	30 Hex	30 Hex	30 Hex
10	30 Hex	30 Hex	30 Hex	30 Hex

Writing 30303030 Hex to pages 8, 9, and 10 using FIFO Trigger Mode:

BCC

Command 02 09 03 08 0700 30303030 05 Hex

Response 02 02 00 02 Hex

BCC

STX

4) Set lock

Use this command to write-prohibit tags.

■ **Command**

This command sends the pages to be write-protected as command data. The page specification is as follows: The bits that correspond to the pages to be write-protected are set to 1, and all other bits are set to 0. This binary number is converted to hexadecimal and sent with the command. To read the current write-prohibit settings, set the page specification to '0000'.

Command	Page specification (2 characters)	
09 Hex		

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Settable Value	Page B Hex and C Hex must be 0.								00 Hex to FF Hex							

■ **Response**

The response returns the setting status for write-protection and the end code (normal end: 00 Hex). The page specification is as follows: The bits that correspond to the write-protect pages are set to 1, and all other bits are set to 0.

End code	Setting status	
00 Hex		

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Page	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	Page B Hex and C Hex are 0.								00 Hex to FF Hex							

Note The lock function used with the V720 Series cannot be canceled. Pages that have been write-protected cannot be written to again, so be careful when using this function.

SECTION 5
Characteristics Data (Reference)

5-1 Communications Distance (Reference)

The communications distance is given in the following table. The communications distance changes, however, depending on the tag inlet forming material, and the tag and R/W Module mounting conditions, so check the conditions of use beforehand.

1) I-CODE1 Tag Inlet and Tag

Model	Specifications	Shape	V720S-HMC73,73T
V720-D52P30	Laminate card	ISO card	0 to 45 mm
V720-D52P40	Plastic card	ISO card	0 to 40 mm
V720-D52P01	Inlet	ISO card 46x76	0 to 45 mm
V720-D52P02	Inlet	Half 46x43	0 to 45 mm
V720-D52P03	Inlet	Φ21	5 to 18 mm
V720-D52P04	Inlet	Rectangle 16.5x22	5 to 18 mm

2) I-CODE2 Tag Inlet and Tag (available soon)

Model	Specifications	Shape	V720S-HMC73,73T
V720S-D13P01	Inlet	ISO card 46 x 76	0 to 60 mm
V720S-D13P02	Inlet	Half 46 x 43	0 to 50 mm

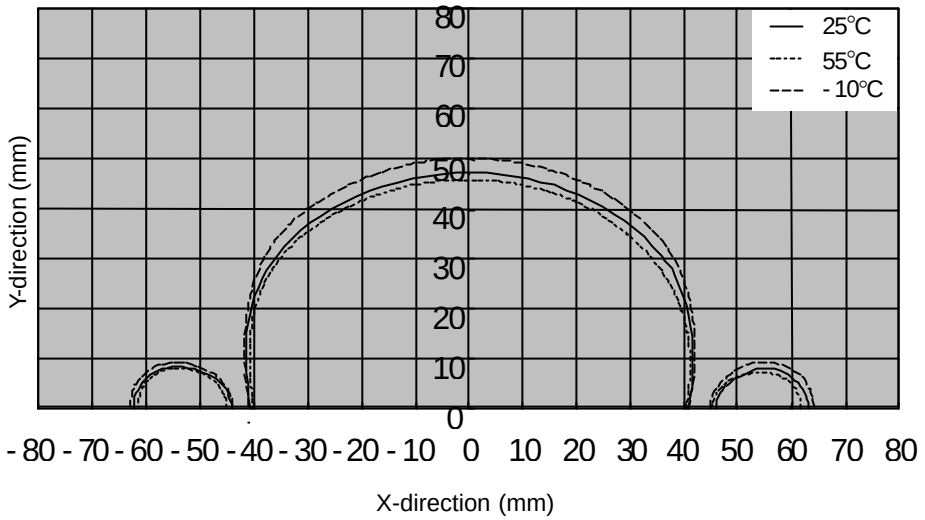
Note The communications distances shown above are based on the use of standard tags at a temperature of 25. and a supply voltage of 5.0 V.

5-2 Diagram of Communications Range (Reference)

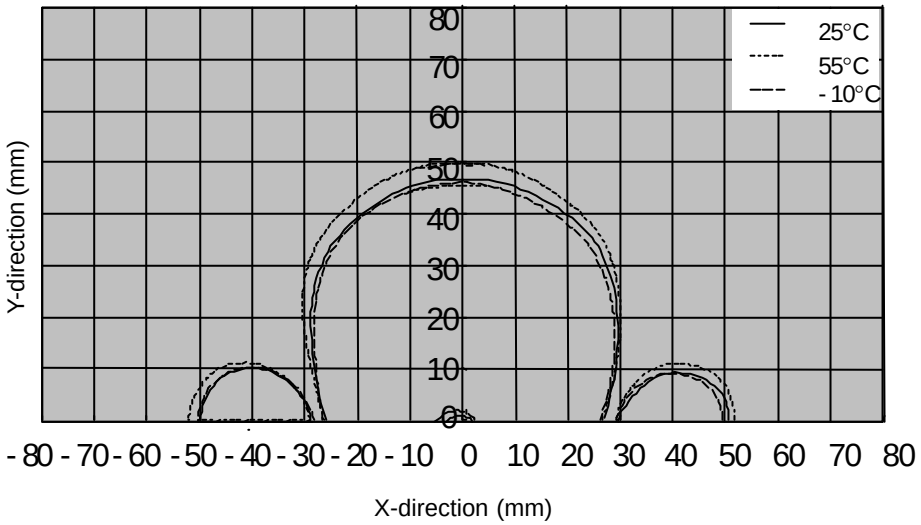
A diagram of the V720S-HMC73 communications range is given below. The communications range differs, however, depending on the mounting conditions and the environmental conditions.

1) I-CODE1 Tag

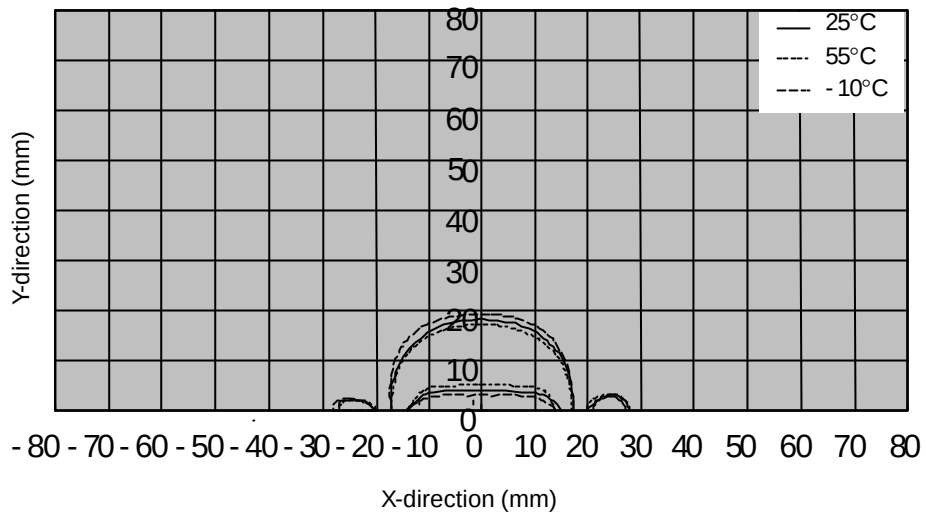
Tag: V720-D52P01



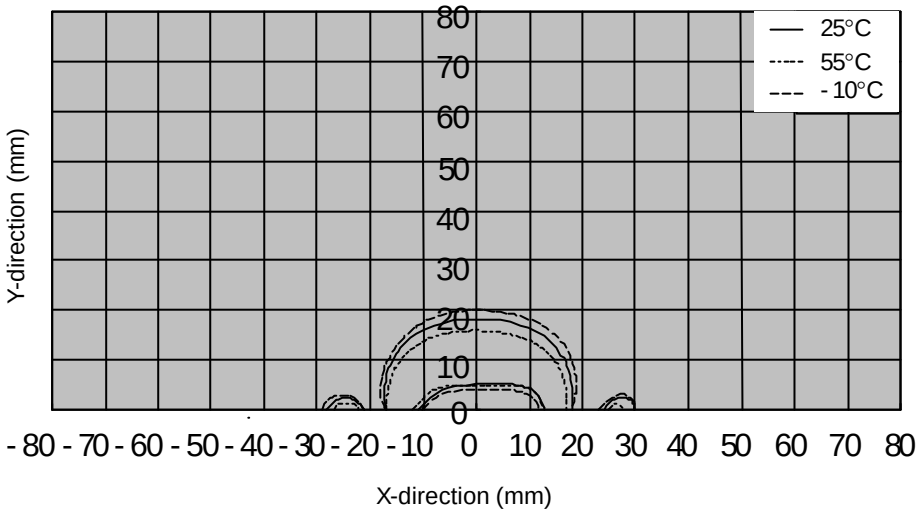
Tag: V720-D52P02



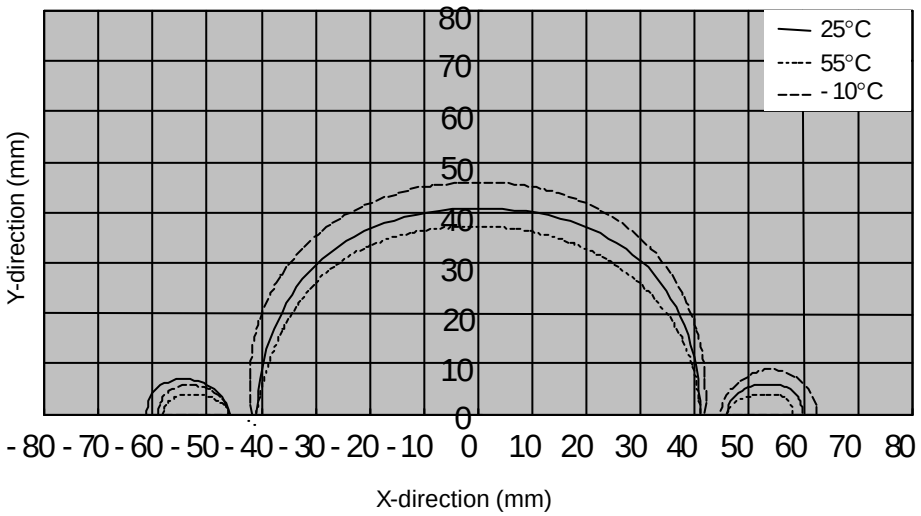
Tag: V720-D52P03



Tag: V720-D52P04

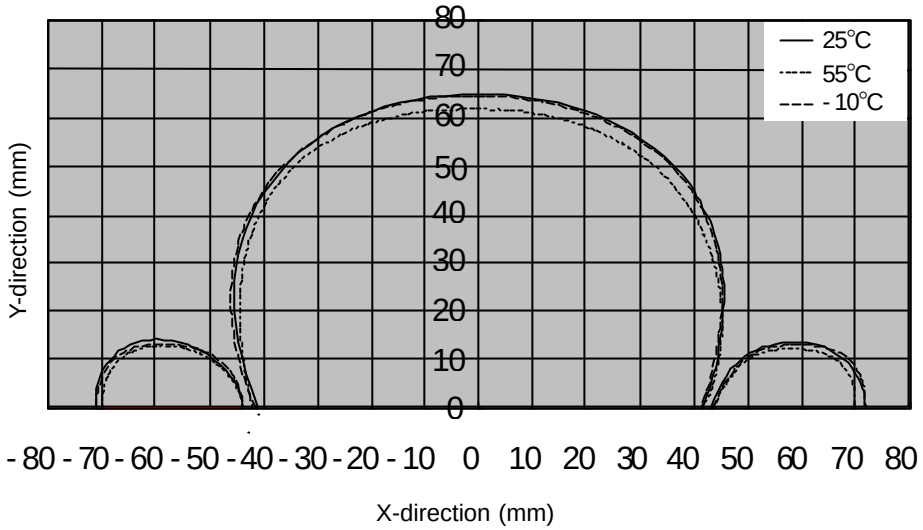


Tag: V720-D52P40

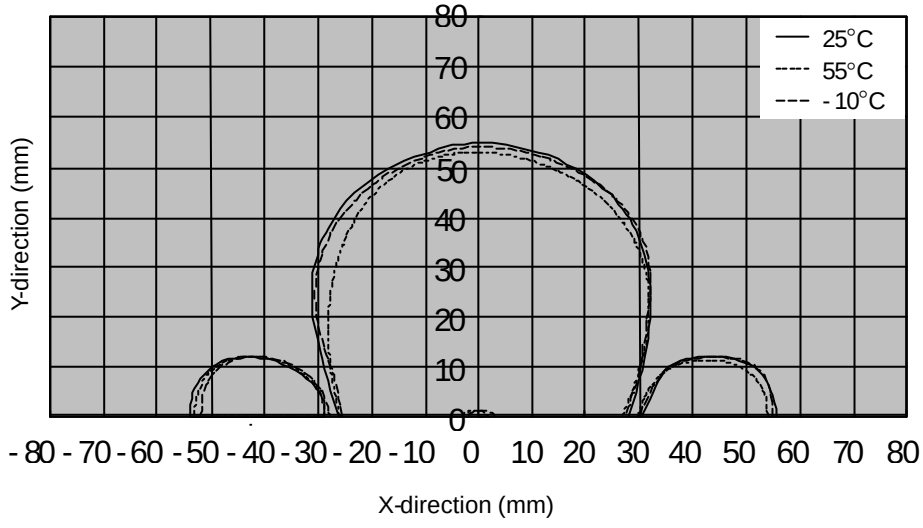


2) I-CODE2 Tag

Tag: V720S-D13P01 (available soon)

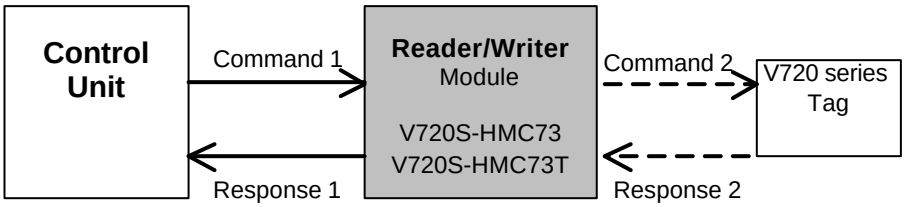


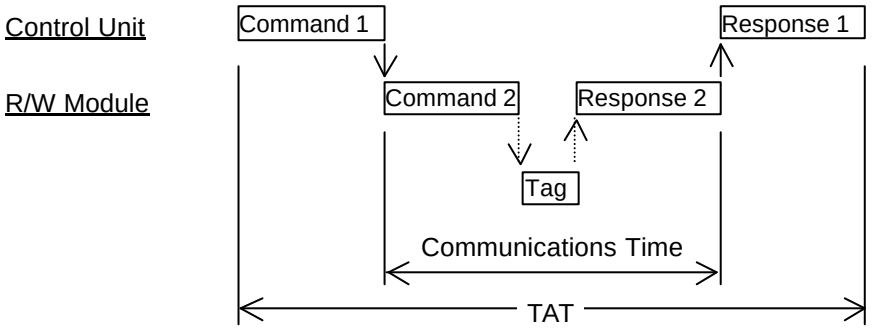
Tag: V720S-D13P02 (available soon)



5-3 Communications Time (Reference)

The communications time given below includes the communications time and TAT (Turn Around Time).





5-3-1 Communications time

The communications time is the communications processing time between the R/W Module and the tags. The communications time differs depending on the number of pages being written or read.

Specifying Number of Pages to Be Written/Read Continuously

Formulas

Command	Communications time (ms)	
	I-CODE1	I-CODE2
Read	T = 1.3N + 6.2	T = 1.3N + 6.0
Write	T = 13N + 13.5	T = 13.6N + 15.5

N: No. of pages processed

Not Specifying Number of Pages to Be Written/Read Continuously

Formulas

Command	Communications time (ms)	
	I-CODE1	I-CODE2
Read	$T = 1.3N_R + 6.2$	$T = 1.3N_R + 6.0$
Write	$T = 11.7N_W + 1.3N_R + 13.5$	$T = 12.3N_W + 1.3N_R + 15.5$

N_R = (Maximum number of specified pages – minimum number of specified pages) + 1

N_W = No. of pages written

Note When using I-CODE1 tags, convert the pages Bh through Fh in the system area as shown below:

Page B ⇒ Page -5
Page C ⇒ Page -4
Page D ⇒ Page -3
Page E ⇒ Page -2
Page F ⇒ Page -1

When using I-CODE2 tags, calculate the page numbers by converting them into decimal numbers.

Example: Reading data from pages 1, 5, and 9

T = 1.3 × (9 - 1 + 1) + 6.2 = 17.9 ms (for I-CODE1)

T = 1.3 × (9 - 1 + 1) + 6.0 = 17.7 ms (for I-CODE2)

Example: Reading data from pages C, 5, and 9

T = 1.3 × (9-(-4)+1) + 6.2 = 24.4ms (for I-CODE1)

T = 1.3 × (12-5+1) + 6.0 = 16.6ms (for I-CODE2)

Example: Writing data to pages 2, 4, 9, and 10

T = 11.7 × 4 + 1.3 × (10 - 2 + 1) + 13.5 = 72ms (for I-CODE1)

T = 12.3 × 4 + 1.3 × (10 - 2 + 1) + 15.5 = 76.4ms (for I-CODE2)

Communications Time Calculation Conditions

- Communications mode: Single Trigger Mode
- Communications errors must not occur, such as due to noises.

5-3-2 TAT (Turn Around Time)

The TAT is the time taken from when the host control unit sends a command to the R/W Module, to when a response is received and completed.

The time differs depending on the baud rate and the communications control method setting.

Example of TAT Calculation

Example: Reading from page 0 to page 4

I-CODE1	I-CODE2
(1)During command send 9[char.] × 11 [bits] / 9600[bps] × 1000[ms/s] ≈ 10.32ms (2)During communications 6.5 + 6.2 = 12.7ms (3)During reception of response 43[char.] × 11 [bits] / 9600[bps] × 1000[ms/s] ≈ 49.27ms The TAT in to the above example is (1) + (2) + (3) = 72.29 ms.	(1)During command send 11[char.] × 11 [bits] / 9600[bps] × 1000[ms/s] ≈ 12.61ms (2)During communications 6.5 + 6.0 = 12.5ms (3)During reception of response 43[char.] × 11 [bits] / 9600[bps] × 1000[ms/s] ≈ 49.27ms The TAT in to the above example is (1) + (2) + (3) = 74.38 ms.

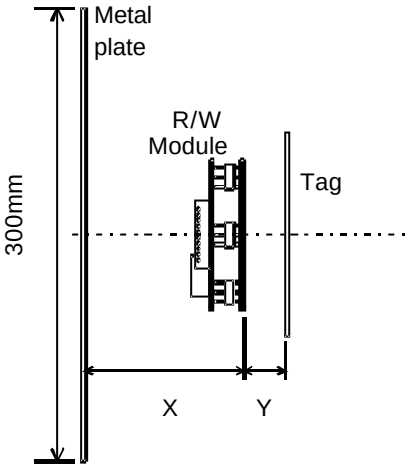
The calculations are performed according to the following conditions.

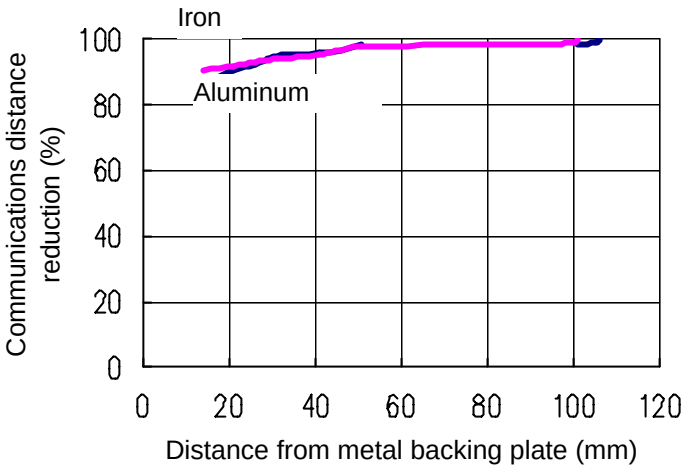
- Communications mode : Single Trigger Mode
- Communications control method : CR control
- Baud rate : 9,600 bps
- Data code specification : Hexadecimal
- Commands sent from the host control unit are sent continuously without spaces between the characters.
- Communications errors must not occur, such as due to noises.

5-4 Effects of Metal Backing Plate (Reference)

When there is a metal backing plate to the R/W Module, communications distance with the tags is reduced. The data given below is for aluminum and iron.

V720S-HMC73

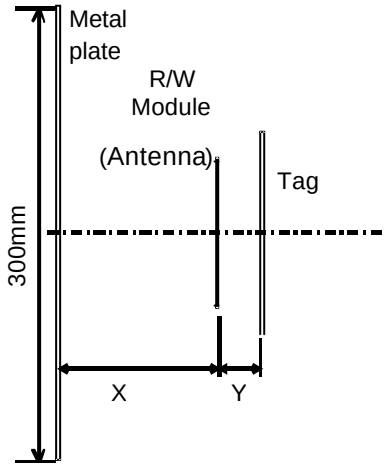


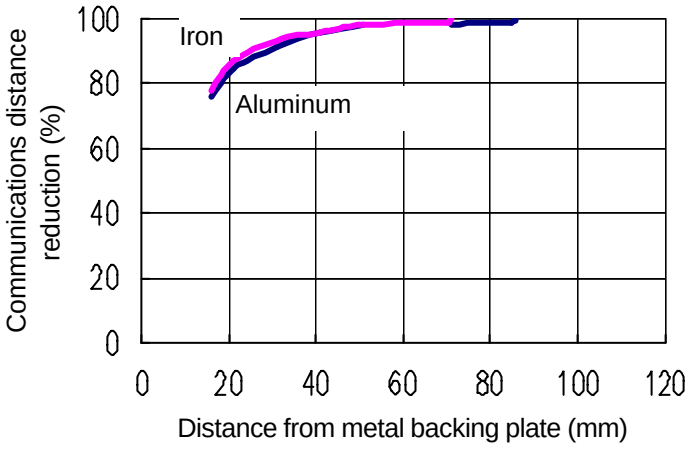


Measuring conditions
Aluminum: 300 × 300 × t1.5 mm
Iron: 300 × 300 × t1.0 mm

V720S-HMC73T

<Effects of Metal Backing Plate>



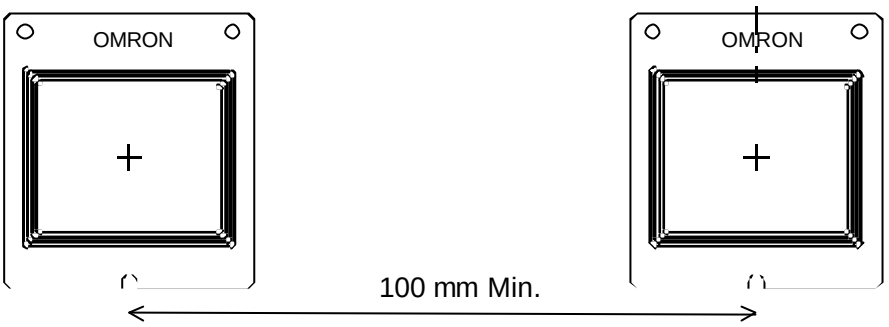


Measuring conditions
Aluminum: 300 × 300 × t1.5 mm
Iron: 300 × 300 × t1.0 mm

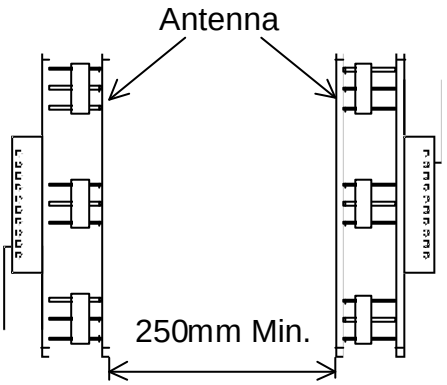
5-5 Mutual Interference (Reference)

If using multiple R/W Modules near to each other, space the Modules as shown below to prevent malfunction due to mutual interference. The following diagram shows the V720S-HMC73, but the distance for the V720-HMC73T is the same.

Parallel Antennas



Facing Antennas



Note Mutual interference depends on the operating environment of the R/W Module and tags, so be sure to check the environment before application.

5-6 Voltage Effects (Reference)

The R/W Module read/write communications distances depend on the value of the power supply voltage.

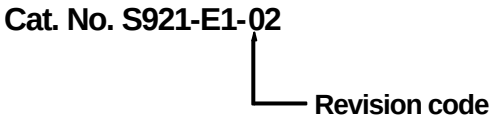
Refer to the following values when using the R/W Module. The fluctuation in the communications range is 100% at a distance corresponding to 5-V power supply.

· **V720S-HMC73, 73T**

Tag format	Rate of change in communications distance (%)		
	4.5V	5.0V	5.5V
V720-D52P01,02,30,40	92	100	104
V720-D52P03,04	85	100	104
V720S-D13P01,02 (I-CODE2 tag inlet) available soon	92	100	101

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	July, 2002	First Edition
2	March, 2003	Deleted the Standby Mode

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