Electromagnetic Inductive RFID System

V720-series

User's Manual

PCB Read/ Write Modules

V720S-HMC75

Omron Corporation

Manual Number SRFM-014A

About this Manual:

This manual describes the installation and operation of the V720-series Electromagnetic Inductive RFID System (V720S-HMC75) 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-HMC75.

Section 2 provides the specifications and performance characteristics of the V720S-HMC75.

Section 3 provides the functions and operations of the V720S-HMC75.

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

Section 5 provides the information of characteristics data.

Precautions

Read and Understand this Manual

Please read and understand this manual before using the products. Please consult your OMRON representative if you have any questions or comments.

Warranty, Limitations of Liability

< WARRANTY >

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

< LIMITATIONS OF LIABILITY >

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

< SUITABILITY FOR USE >

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

< PROGRAMMABLE PRODUCTS >

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

< PERFORMANCE DATA >

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

< CHANGE IN SPECIFICATIONS >

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

< DIMENSIONS AND WEIGHTS >

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

< ERRORS AND OMISSIONS >

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

This chapter provides important information for the safe use of this product.
Ensure to read the information carefully before use.

In the safety precautions below, severity is categorized as either “WARNING” or “CAUTION”.

⚠ 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. Property damage refers to extended damage caused to house/household goods or livestock/pets.

●Description of Symbols

Prohibition
Indicates an action or activity not permitted.

Observe strictly
Indicates the need to ensure the safe use of the product.

Ensure to establish a solid grounding
A label indicating that a device with a grounding terminal should always be grounded.

Electric shock hazard
A notification that alerts the possibility of electric shock under certain conditions.

Do not disassemble
A notification that prohibits disassembly when injuries caused by electric shocks may result.

Please ensure that all cautions and prohibitions are adhered to, since non-compliance may lead to serious injury or damage, in certain circumstances.

⚠ WARNING

Never disassemble, repair, or modify the main unit and cables.

- Do not disassemble, repair, or modify this product. Doing so may result in electric shock, fire, or personal injury.

Do not handle the device with wet hands. Do not touch the terminals while the device is connected to the power supply.

- Electric shock hazard.

Do not allow the cables to be in contact with heaters.

- The cable sheaths may melt and the exposed wire may cause electric shock or fire.

⚠ Caution

Do not drop the device or apply physical shock.

- Doing so may result in personal injury or device damage.

Do not apply strong force to, or place heavy items on the device or cables.

- Doing so may deform or damage the device, resulting in electric shock or fire.

Use and store the product in an environment that is specified in the catalog or operation manual.

- Failure to do so may cause failure of the device, electric shock, or fire. Do not use or store the device in the following locations:
  - Locations that do not satisfy the specified operating conditions (-10°C to +55°C, 25%RH to 85%RH,non-condensing).
  - Locations that do not satisfy the specified storage conditions (-25°C to +65°C, 25%RH to 85%RH,non-condensing).
  - Locations where the Reader/Writer is exposed to direct sunlight.
  - Locations where the Reader/Writer is exposed to dust, corrosive gas, saline, or flammable gas.
  - Locations where the Reader/Writer is exposed to direct heat.
  - Locations subject to condensation due to high humidity.
  - Locations subject to vibration or impact that exceed the limits outlined in the specifications.
  - Locations where the device may be exposed to water, oil, or chemical agents. (This applies to the models other than waterproof types.)
  - Outdoor
- Store and carry the product in packed state.

Do not allow the device or cables to be soused or exposed to water.

Doing so may result in electric shock, fire or failure of non-waterproof devices or cables.

To avoid interferences with other systems, adhere to the following items and check them before using the product.

- **The product uses a publicly available ISM frequency band of 13.56 MHz to communicate with Tags. Some transceivers, motors, monitoring devices, power supplies (power supply ICs), and other similar RFID systems may generate noise, which cause radio interference and may affect communication with Tags. If the product is required in the vicinity of these items, check for any interferences prior to use.**
- **On the contrary, the system itself may affect radio station transmissions or medical devices. Be cautious when using the system in the environments where such effects might occur.**
- **To minimize noise effects, adhere to the following:**
  • Establish a Class D grounding (former Class 3 grounding) for metal objects placed in the vicinity of the system.
  • Keep cables away from those with high voltages or heavy currents.

Adhere to the following precautions:

- When the product is unpacked, handle it on a conductive mat taking countermeasures against static electricity by wearing earth band or anti-static gloves.
- When treat the PCB by hand, grab the edge of the PCB.
- Store and carry the product in packed state.
- Do not remove the product from its packaging until it is time to use it. Do not leave unpackaged product exposed.
- Do not touch the semiconductors or patterns on the PCB.
- Never put the product into the polyethylene or vinyl bag.
- Do not apply more voltage or current to the connector terminals than the specified values. Do not connect the output terminals to a power supply directly.
- If an excessive external surge is supplied for your component, insert a filter or take other countermeasures to absorb the surge at the power supply portion.
- Attach or remove connectors only when the product is installed. This product is not suitable for application that requires frequent removal or attachment of the connectors. Wire cables carefully so that no force is applied to the connectors.

If the device fails or is exposed to water (non-waterproof devices or parts), or an unusual smell, smoke, or sparks are detected, immediately refrain from using the device and contact OMRON or a sales representative for service and repair.

- **Continued use of the failed device may result in electric shock or fire.**

Precautions

This chapter provides important information for international standards and copyright.
Ensure to read the information carefully before use.

Declarations

The V720S-HMC75 R/W Module conforms to the following laws and standards.

1) US standards

FCC Part 15 Subpart C: 2006

FCC ID: OZGV720SHMC75

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTICE: This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

In accordance with FCC Part 15, this module is listed as a Limited Modular Transmitter device.
In support of the Modular Transmitter Approval, the following is stated:

The module does have buffered modulation / data inputs.
The module does have a permanently attached antenna.
The module is labeled with the proper FCC ID, and labeling instructions are provided to OEM end users for external product labels.
The module does have instruction for proper use.
The module does meet the FCC RF regulations.

Limited Modular Transmitter Approval, is granted, instead of Modular Transmitter Approval, because the following condition is not met:

The module does not have its own RF shielding.
The module does not regulate its own power supply.
The module can not be tested as a stand-alone device.

In accordance with FCC document, DA 00-1407, all final usage by OEMs of this device, (1) Must be approved by the module's manufacturer, OMRON, (2) final installation must follow the instructions in this user's manual, (3) a written agreement with the OEM will detail which products are approved for this module's final installation to control its end usage and ensure FCC Part 15 compliance.

2) Canadian standards

RSS-Gen Issue 1: September 2005

RSS-210 Issue 6: September 2005

IC Number: 850L-72HMC75

NOTICE: Operation is subject to the following two conditions: (1) this device may not cause, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

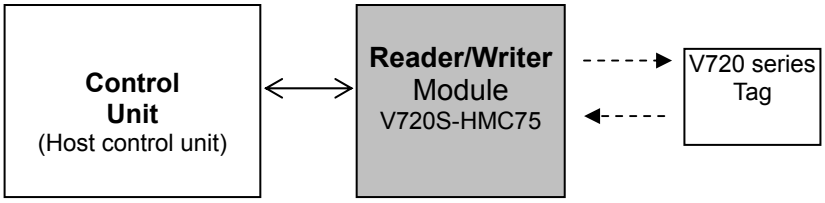
TABLE OF CONTENTS

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: SL2 ICS20, commonly known as I-CODE SLI). The SL2 ICS20 chip fully conforms to ISO/IEC15693.

The V720S-HMC75 combines the control PCB and the antenna PCB in a compact Unit.

1-1 Features



V720S-HMC75

Compact, Low Power Consumption

- 40 x 47 x t6mm
- Operating: 5V 40mA (when the tag is contact with the antenna)

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)

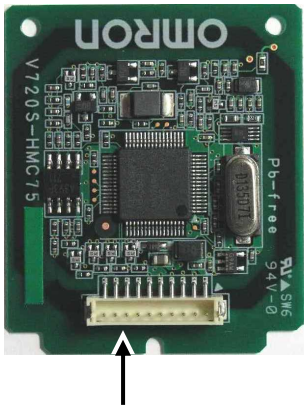
Many Operating Modes

- 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.)

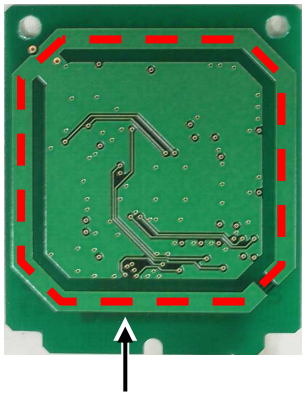
SECTION 2
Specifications and Performance

2-1 Nomenclature and Descriptions

V720S-HMC75



Host Interface Connector



Antenna
(Broken-lined area)

Component Descriptions

- **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.

2-2 Specifications

2-2-1 General Specifications

Item	V720S-HMC75
Dimensions	40 × 47 × 6 mm (thickness)
Mounting method	3 x M2.3 screws (resin screw) Torque : 0.15N-m or less
Power supply voltage	5 VDC ± 10%
Current consumption	Approx. 40 mA max. (oscillating) Approx. 20 mA max. (not 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. 6 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-SM4A-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	Number-of-characters control				
Baud rate *3	9,600 bps				
Character format (Number-of-characters control)	Start bits	Data bits	Parity	Stop bits	Total bits
	1	8	None	1	10
Error detection method	BCC (number-of-characters control)				
Bit send order	Least significant bit (LSB) first				

*2 To connect the R/W Module, 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

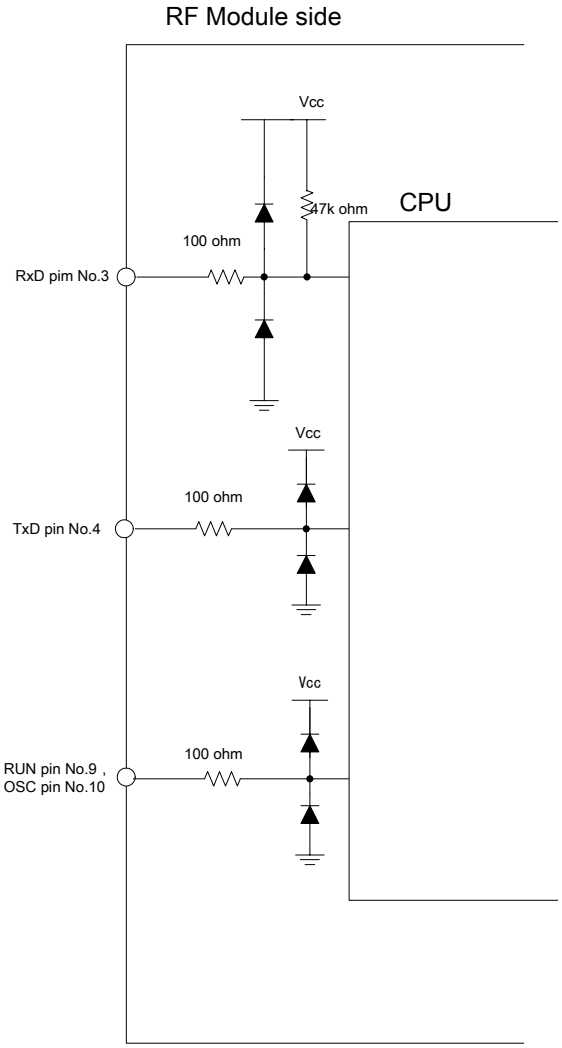
⚠ **Caution** Use as short a connecting cable as possible (300 mm max.) to reduce noise.

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>Reserved</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 level output voltage</td><td>-----</td><td>0.6 V (I_{OL} = 1.6 mA)</td></tr></table></td></tr>
</table>

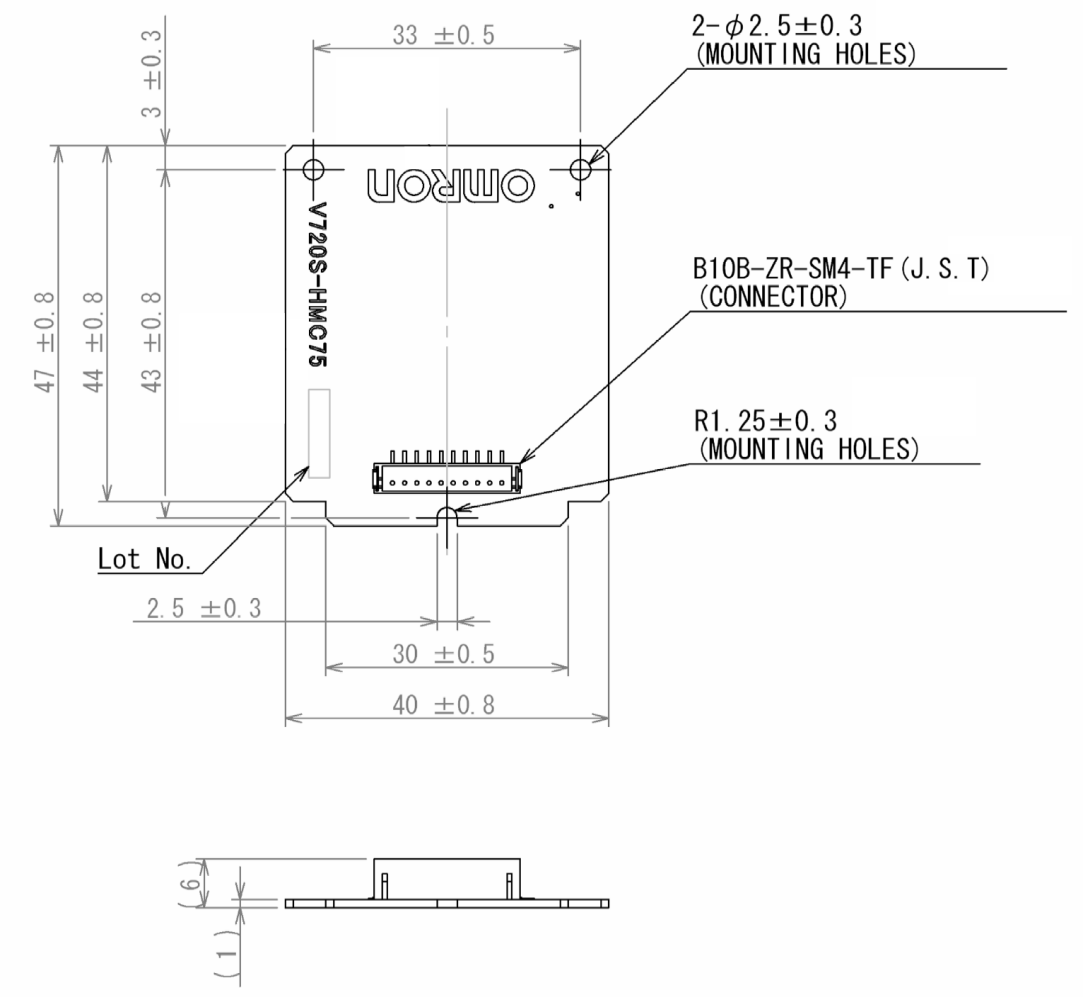
Note Do not connect unused signals.

2-2-4 Interface Circuit



2-3 Dimensions

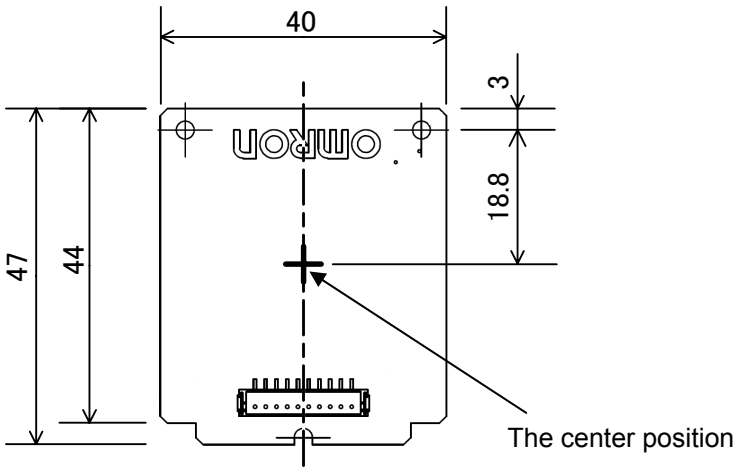
V720S-HMC75



⚠ **Caution** Use non-metal screws for attachment.
Fasten the screw at specified torque (0.15N-m or less).

2-4 Antenna Center Position

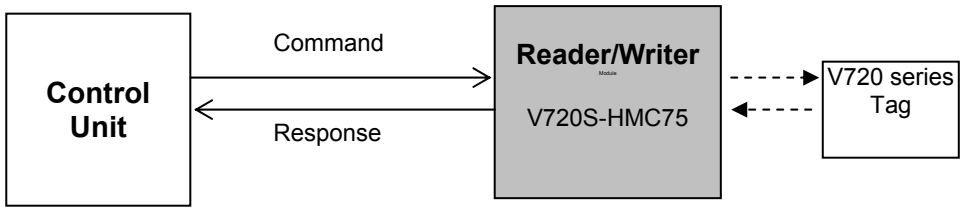
The center position of the antenna is + marked point shown by the following figure, which can be measured from the mounting holes.
(There is no actual mark for this center position on the R/W module.)



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.



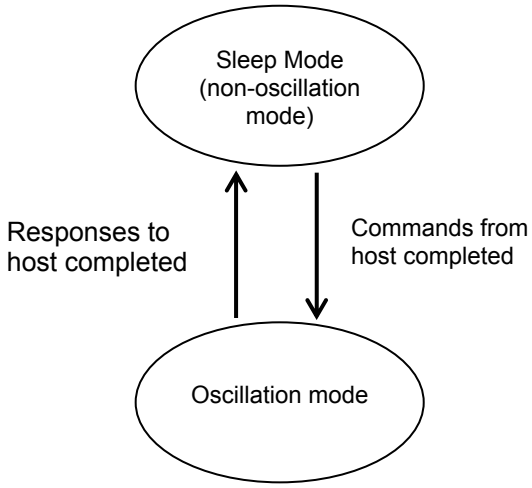
The R/W Module has three operating modes. The conditions for changing the mode are shown in the following diagram.

(1) Oscillation mode

This mode performs communications with the tags.
In FIFO access mode, oscillation mode continues until it receives 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-CODE SLI 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 SLI 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-CODE SLI
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-CODE SLI"), 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-CODE SLI

The I-CODE SLI 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	×	×	×	×	×	×	×	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

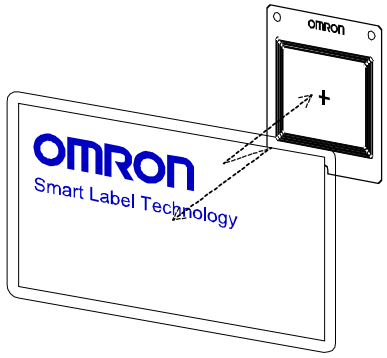
The pages are write-inhibited permanently if they are so indicated in the memory map. The factory settings are as follow. If the bit of a particular page is 1, that page is write-protected.

	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

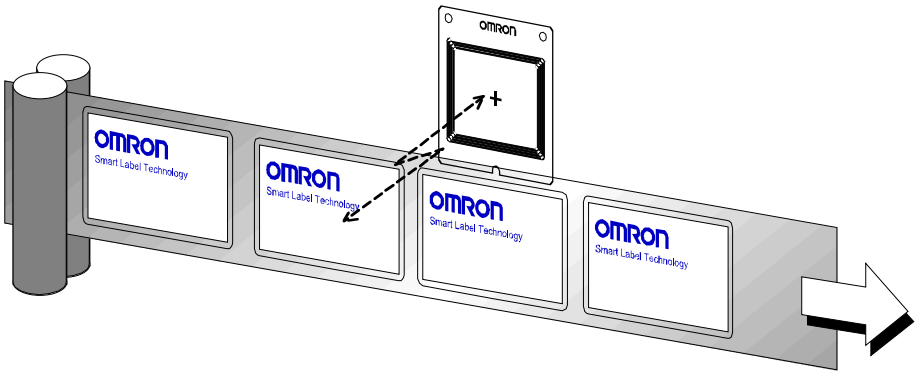
Single Access Mode

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-CODE SLI

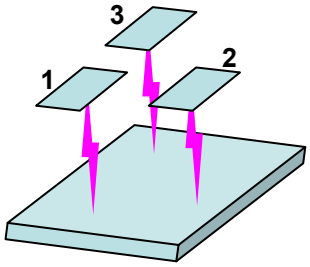
Followings are examples of tag identification access function using OMRON's antenna and reader such as V720-H04 and V720S-BC5D4A.

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

	Tag No.1	Tag No.2	Tag No.3
AFI	11 Hex	22 Hex	33 Hex

(2) Tag ID Access Operation

•Not Using Tag ID Access

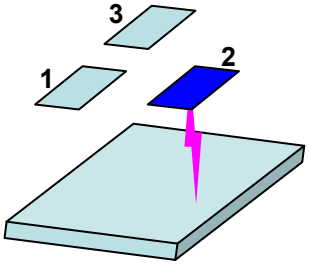


(1) The reader's AFI set value is taken to be 00 Hex. (Set at the factory.)

(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 reader's AFI is 22 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

⚠ **Caution:**
There are two methods to control an R/W module from the host control unit; the CR control and number-of-characters control.
OMRON's existing product (V720S-HMC73/HMC73T) allows user to use either methods but this product (V720S-HMC75) introduces only the number-of-characters control method.

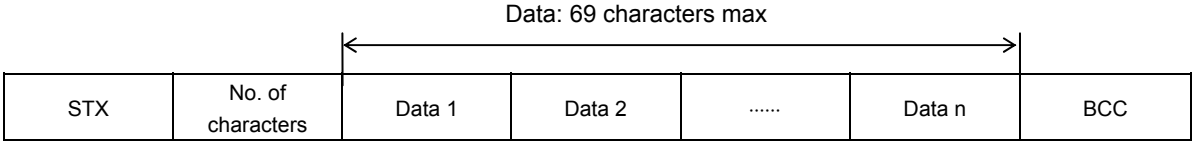
CR control	Data in the communications frame is handled as ASCII characters in 2-digit hexadecimal code (ASCII code). CR control simplifies operations with the host.
Number-of-characters Control	Data in the communications frame is handled as hexadecimal code, thus minimizing communications time with the 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 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 Specific to the I-CODE SLI Chip

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 AFI	36	Overwrites and locks tag AFI.
Set DSFID	37	Overwrites and locks tag DSFID.
Set write-protection	39	Sets write-protection on a page basis
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.

4-2-2 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	1	0	Communications mode			

*Bits 4, 6 and 7 must be 0.

*Bit 5 must be 1.

1) Specifying the Communications Mode

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

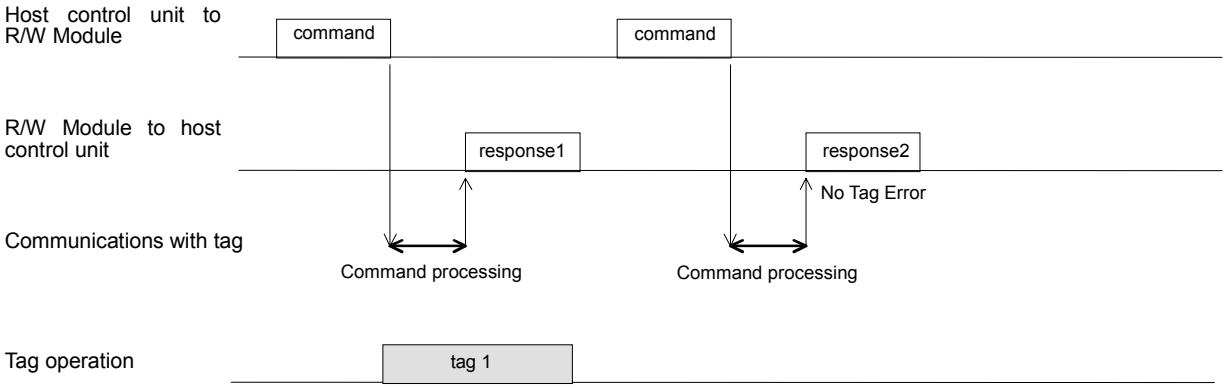
Communications mode	No.	Details
Single Trigger	0 Hex	After a command is received, communications with the tag is performed immediately and a response is sent. If there is no tag in communications range, a No Tag error is sent. After the response has been sent, the mode changes to sleep mode. Only one 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 31, 35, 3A, 41, and 42.

2) Communications Modes Diagrams

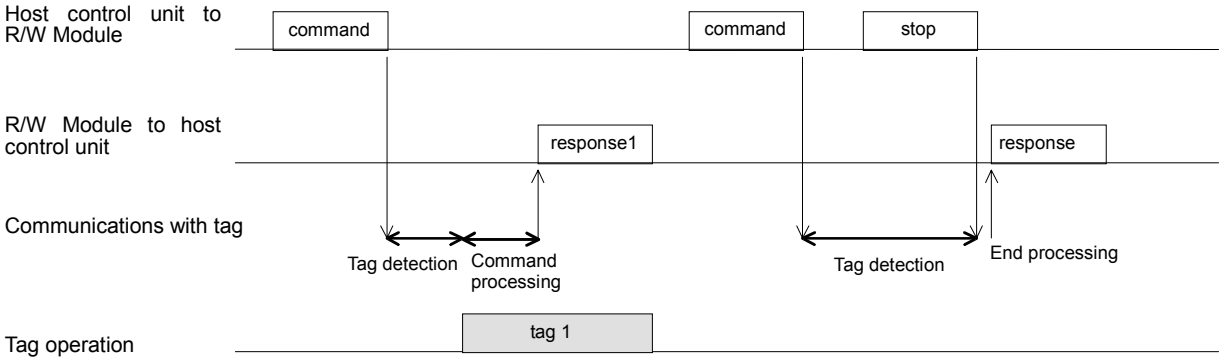
1) Single Trigger

■ **Operation Sequence**



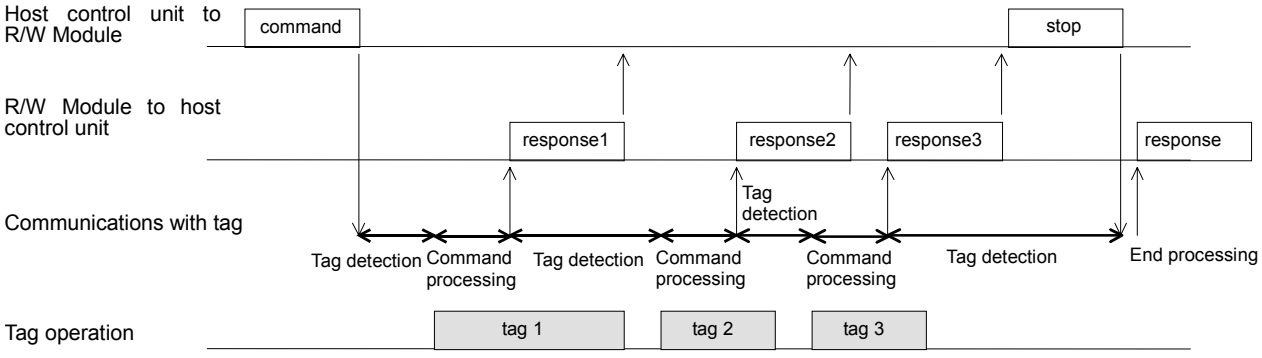
2) Single Auto

■ **Operation Sequence**



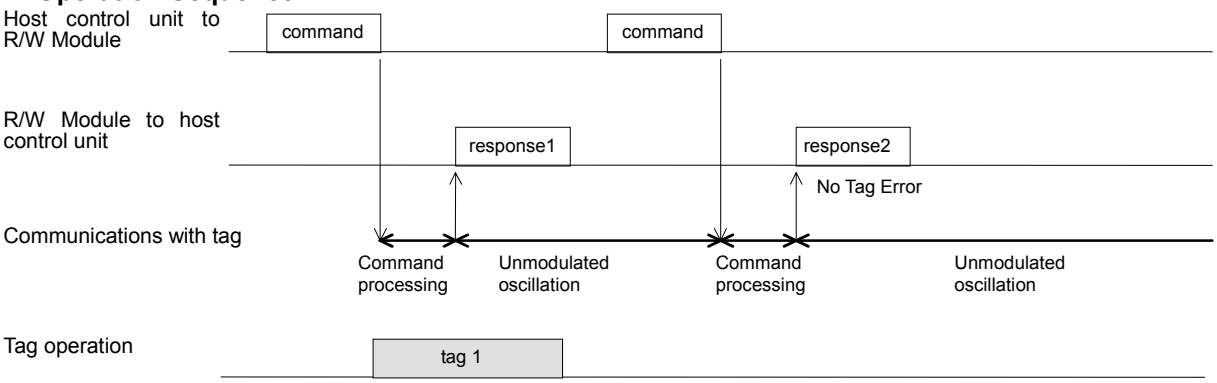
3) Single Repeat

■ **Operation Sequence**



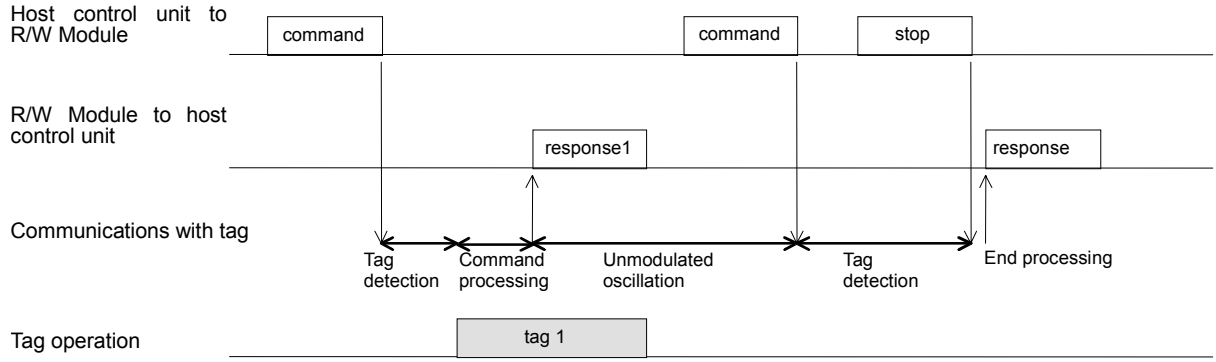
4) FIFO Trigger

■ **Operation Sequence**



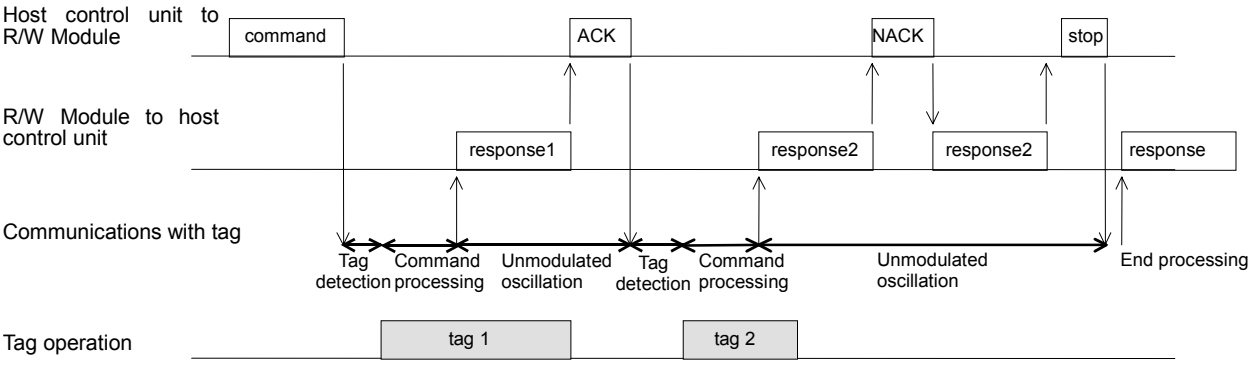
5) FIFO Auto

■ **Operation Sequence**



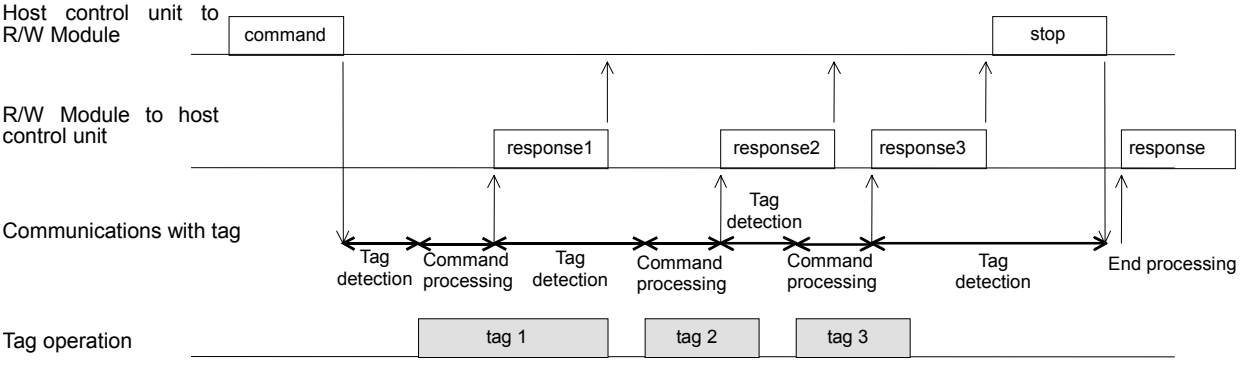
6) FIFO Continuous

■ **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.
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.
14	Format Error	• Command format does not match specifications. Examples: Command is not defined, page/address specifications are invalid, etc.
18	Frame Error	• Frame received exceeds 73 bytes.

■ **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.
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

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		
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

4-3-2 Commands Specific to the I-CODE SLI 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	Communi-cations option	Bank specifica-tion	Page specification	
31 Hex				

Bank specification (Settable value)	Page specification (settable value)															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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

STX BCC

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

Bank specification (Settable value)	Page specification (settable value)															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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

STX BCC

3) Write identical data

Use this command to write identical data to tags by the page. Data can be written to user-specified pages. 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

Bank specification (Settable value)	Page specification (settable value)															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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				

Bank	Page specification (settable value)															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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

6) Write, Lock AFI

Use this command to change or lock tag AFI.

■ **Command**

Command	Communica-tions 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

7) Write, Lock DSFID

Use this command to change or lock tag DSFID.

■ **Command**

Command	Communica-tions option	Process option	Data
37 Hex			

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

■ **Response**

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

End code
00 Hex

8) 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)

9) 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			

Bank	Page															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
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)

10) EAS Alarm Command

Use this command to request EAS data to the tags.

■ **Command**

Command	Communica-tions 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

11) Set EAS Command

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

■ **Command**

Command	Communica-tions 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

MEMO

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-CODE SLI Tag Inlet and Tag

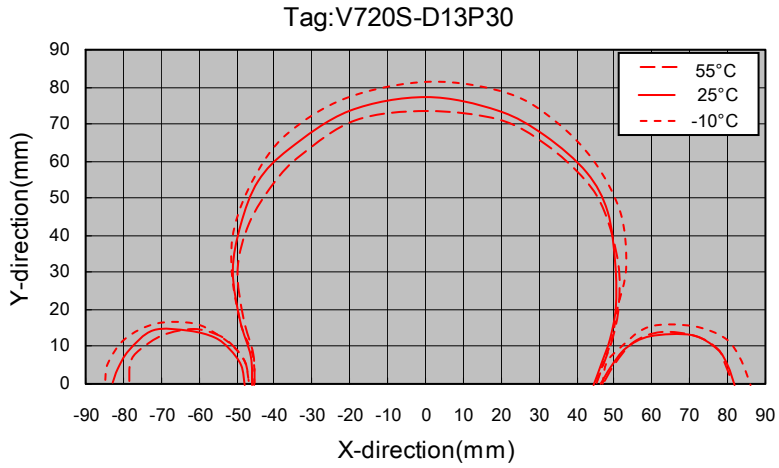
Model	Specifications	Shape	V720S-HMC75
V720S-D13P30	Laminate card	86 × 55mm	0 to 65 mm
V720S-D13P40	Plastic card	ISO card 86 × 55mm	0 to 45 mm

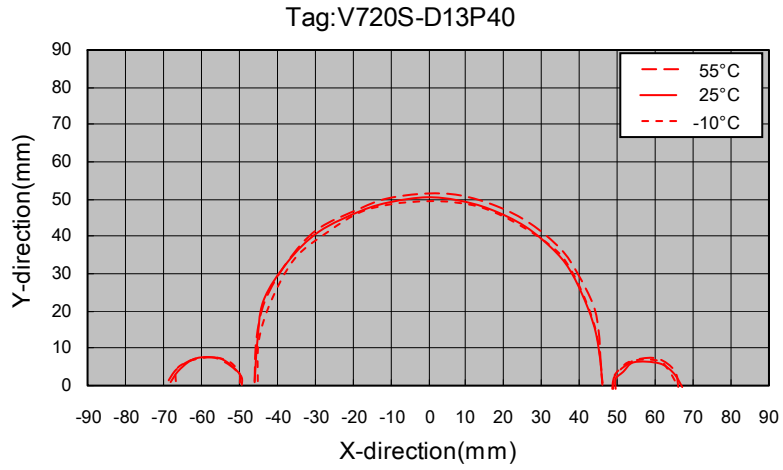
Note The communications distances shown above are based on the use of standard tags at a temperature of 25°C and a supply voltage of 5.0 V.

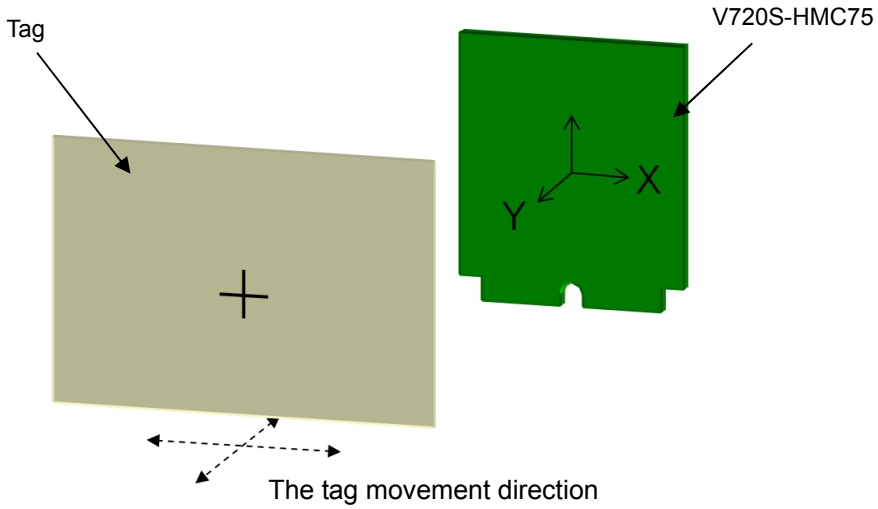
5-2 Diagram of Communications Range (Reference)

A diagram of the V720S-HMC75 communications range is given below. The communications range differs, however, depending on the mounting conditions and the environmental conditions.

1) I-CODE SLI Tag

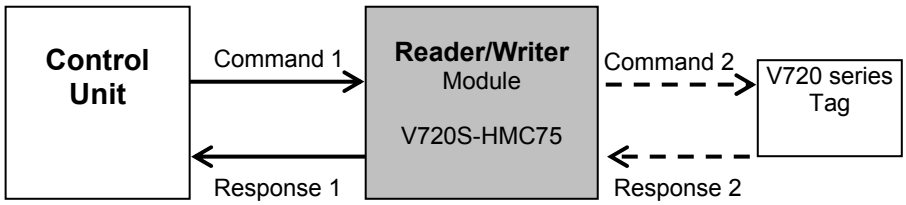


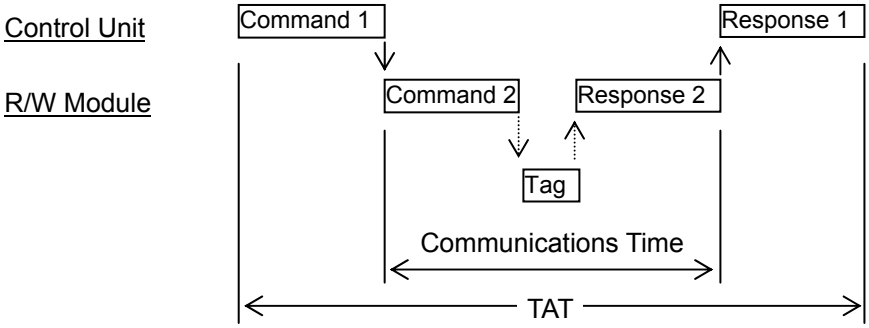




5-3 Communications Time (Reference)

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)
Read	T = 1.3N + 6.0
Write	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)
Read	$T = 1.3N_R + 6.0$
Write	$T = 12.3N_W + 1.3N_R + 15.5$

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

N_W = No. of pages written

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

T = 1.3 × (9 - 1 + 1) + 6.0 = 17.7 ms

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

T = 1.3 × (12-5+1) + 6.0 = 16.6ms

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

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

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-CODE SLI
(1)During command send 8 [byte] × 10 [bits] / 9600 [bps] × 1000 [ms/s] ≈ 8.33ms (2)During communications 6.5 + 6.0 = 12.5ms (3)During reception of response 24 [byte] × 10 [bits] / 9600 [bps] × 1000 [ms/s] = 25ms The TAT in to the above example is (1) + (2) + (3) = 45.83 ms.

The calculations are performed according to the following conditions.

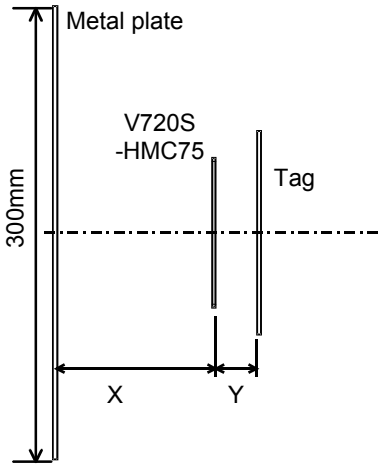
- Communications mode : Single Trigger Mode
- Baud rate : 9,600 bps
- Commands sent from the host control unit are sent continuously without spaces between the characters.
- Communications errors must not occur, such as due to noises.

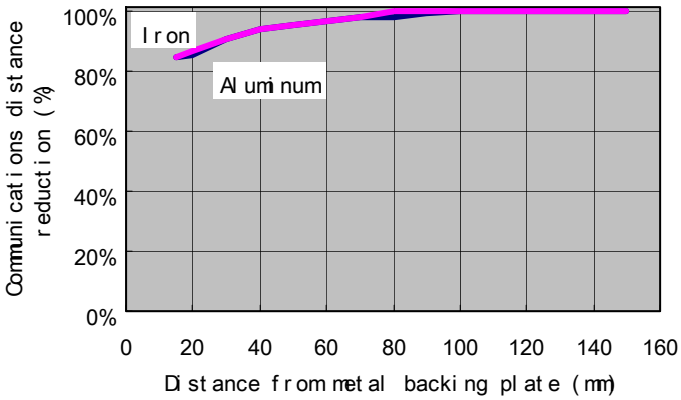
5-4 Effects of Metal Backing Plate (Reference)

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-HMC75

<Effects of Metal Backing Plate>



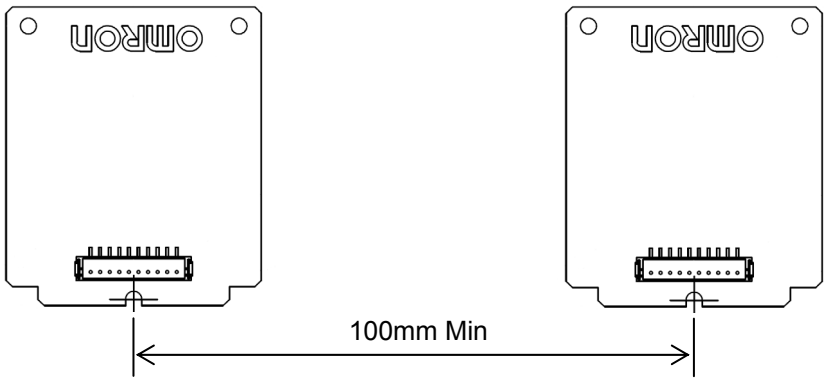


Measuring conditions
Aluminum: 300 × 300 × t1.5 mm
Iron: 300 × 300 × t1.0 mm

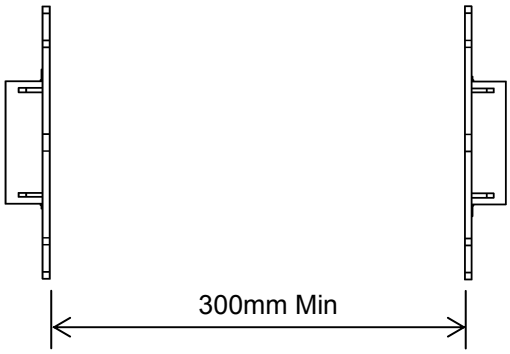
5-5 Mutual Interference (Reference)

If using multiple R/W Modules near to each other, space the Modules as shown below to prevent malfunction due to mutual interference.

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.

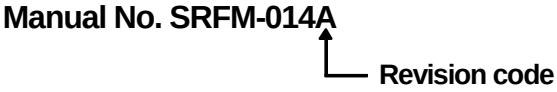
Refer to the following values when using the R/W Module. The fluctuation in the communications range is 100% at a distance corresponding to 5-V power supply.

- **V720S-HMC75**

Tag format	Rate of change in communications distance (%)		
	4.5V	5.0V	5.5V
V720S-D13P30	96	100	104
V720S-D13P40	94	100	106

Revision History

A manual revision code appears as a suffix to the manual 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
A	December, 2008	The first edition

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