

**OMRON**



**Preliminary**

**Electromagnetic Inductive  
RFID System**

**V720-series**

**User's Manual**

**OMRON Corporation**

**Long-Range Reader/ Writer**

**V720S-BC5D4A**

**V720S-BC5D4A-US**

## About this Manual:

Thank you for purchasing our V720-series Electromagnetic Inductive RFID System.

The V720-series is a family of products that were developed by fully utilizing our high technology and broad experience.

This User's Manual provides various information that will be necessary when using the Reader/Writer model V720S-BC5D4A / BC5D4A-US (hereinafter called the "Reader/Writer" or "R/W"), including the functions and performance of the Reader/Writer and how to use it.

When you actually use the V720-series product, please make sure to follow the recommendations below:

- Read this manual carefully to understand the product fully, and ensure proper use when you actually use the product.
- Keep this manual in a safe place where you can access it any time for immediate reference.

## Precautions

<b>Read and Understand this Manual</b>
Please read and understand this manual before using the products. Please consult your OMRON representative if you have any questions or comments.
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## Application Considerations

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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.

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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.


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# 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".

 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
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 <b>Caution</b>	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.
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## 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.



**Be sure a solid grounding is established for the device.**

- Electric shock hazard.

## 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 to +50 °C, 35%RH to 85%RH, non-condensing).
  - Locations that do not satisfy the specified storage conditions (-25 to +65 °C, 35%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



**Be sure to tighten the base-mounting and terminal-block screws securely.**

- Failure to do so may result in personal injury or device damage.



**Use the specified-sized distribution cables.**

- Failure to do so may cause failure of the device, electric shock, or fire.



**Cables with locking attachments must be secured before use.**

- Failure to do so may damage the device.



**The specifications of the DC power unit used must satisfy all of the following conditions:**

- The power unit must be connected to the V720-series system and must not be connected to any other devices.
- The supply voltage for the power unit must be within the range specified in this document (within the range of DC24V + 10% and – 10%).
- Observe correct polarity when connecting the power unit.
- Be sure a solid Class D grounding is established (former Class 3 grounding).



**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.



**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.



**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.



**Do not use damaged cables.**

- Continued use of the damaged cables may result in electric shock or fire.

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# Precautions

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

## Declarations

V720-BC5D4A and V720-BC5D4A-US conform to the following laws and standards. This conformity is effective only if V720-BC5D4A or V720-BC5D4A-US is used with the designated antenna, V720-HS04.

1) European Standards (R&TTE Directive)

This product will conform to the R&TTE Directive (Radio Equipment and Telecommunication Terminal Equipment Directive) as a set of the antenna, V720-HS04 (in October 2006).

Radio : EN 300 330

EMC : EN 301 489-1(EN55024, EN61000-4-2,3,4,6)

Safety : EN61010 or 60950

2) FCC(USA):

This product conforms to FCC Part 15 Subpart C.

FCC ID: OZGV720SBC5D4A-US (V720S-BC5D4A-US only).

### 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 has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

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.

### NOTICE

Attach the accompanying ferrite core to the cable of DC power supply at the side of AC Mains connected with AC input and Ground terminal in order to meet FCC emission limits.

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# SECTION 1

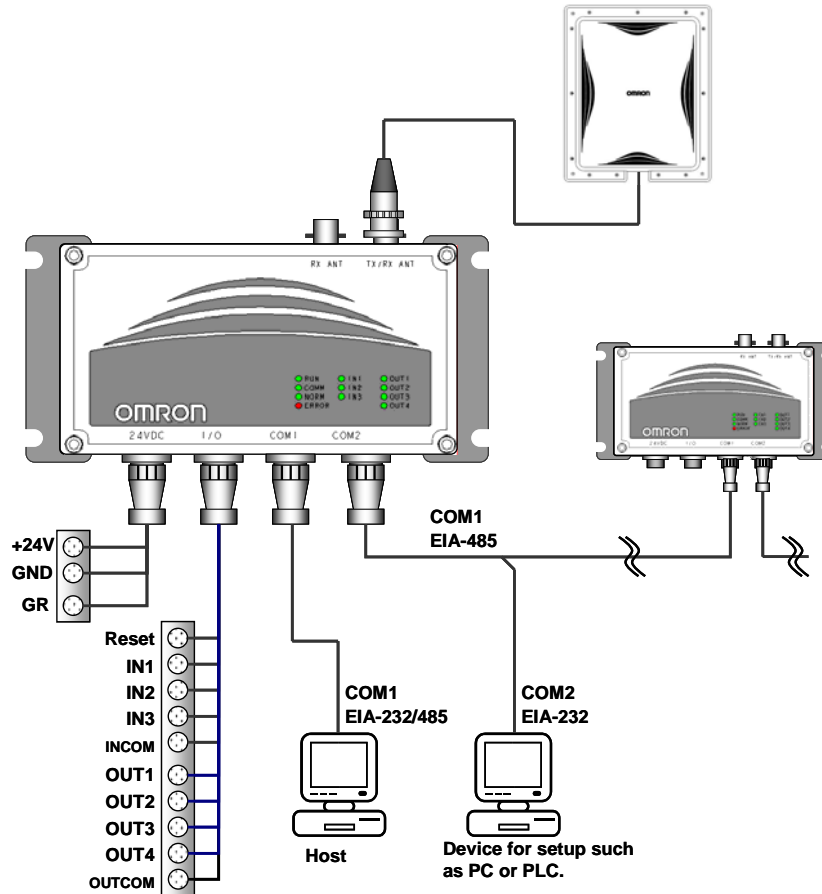
## Features and System Configuration

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The V720-series Electromagnetic Inductive RFID System is ideal for the construction of highly functional, long-distance wireless ID systems for material control and logistics.

V720S-BC5D4A (hereinafter called “Reader/Writer”) is the device to communicate with Tag (manufactured by OMRON) of the V720-series that use two kinds of I-CODE chips manufactured by Philips Semiconductor (Product name: SL1 ICS30 01, Common name: I.CODE1; and Product name: SL2 ICS20, Common name: I.CODE2). The chip SL2 ICS 20 is fully conforming to ISO/EC15693.

The Reader/Writer can be connected to personal computers (PCs) and Programmable Logic Controllers (PLCs) to process large amounts of data flexibly with simple commands.



**Highly Functional RFID System**

In addition to 1-to-1 communication between a Tag and an antenna, the RFID System operates in either multiple simultaneous access mode, selective access mode, or FIFO (first-in, first-out) read/write mode. In multiple simultaneous access mode, if there is more than one Tag in the communications area, the RFID System reads and writes data from and to all the Tags at one time. In selective access mode, the user can specify the Tags from and to which data is read and written. In FIFO read/write mode, the RFID System reads and writes data to one Tag after another as they come into the communications area.

**Support of off-line EAS Mode**

The Reader/Writer can operate in EAS mode (see 3-7 in Section 3) as a standalone device, with no need to connect with the host.

**I/O function**

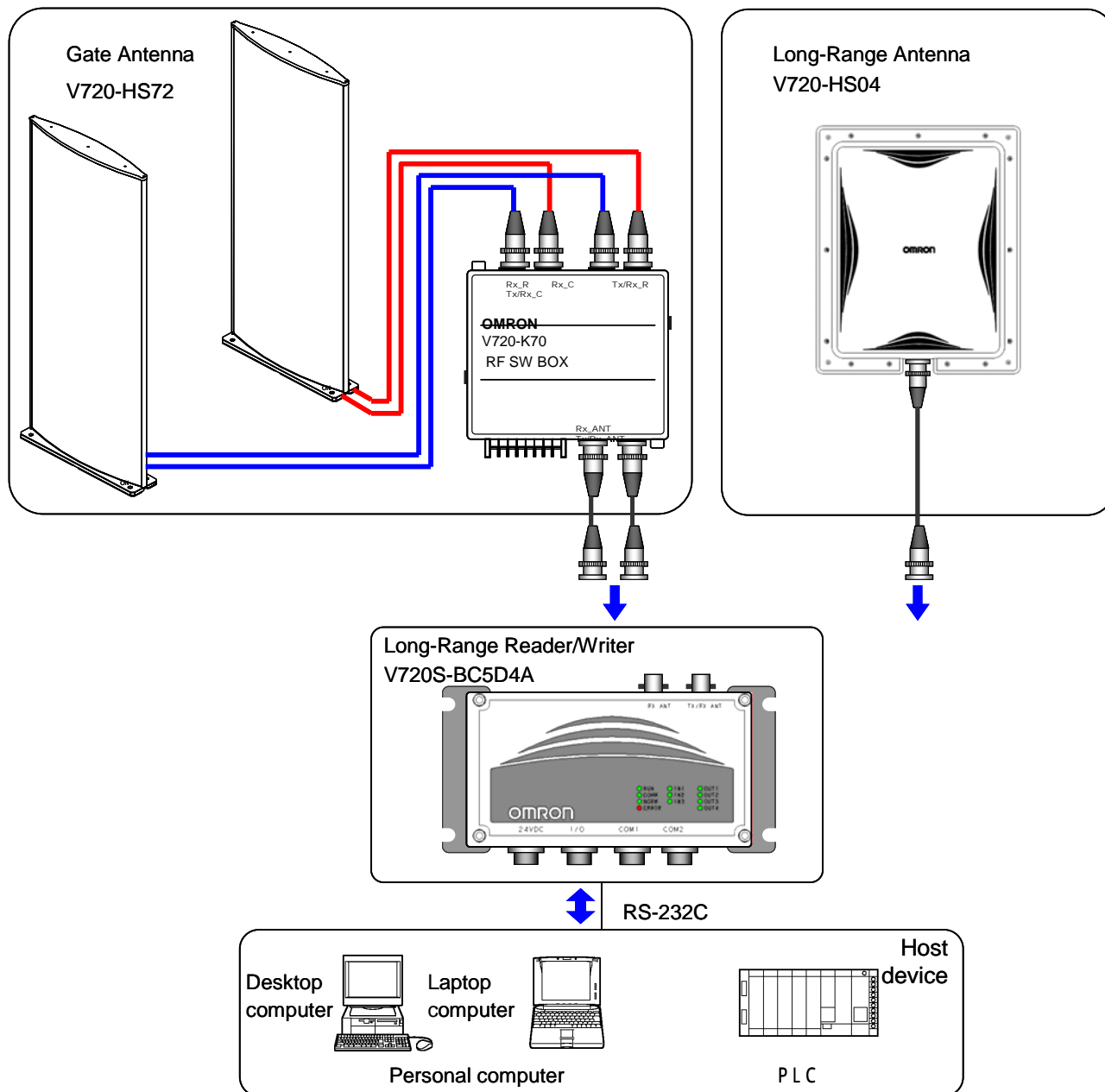
By issuing commands from the host, the user can operate three input points and four output points.

**Protection Construction**

The protection construction IP60 has been achieved in the Reader/Writer.

## 1-2-1 Example of 1-to-1 System Configuration

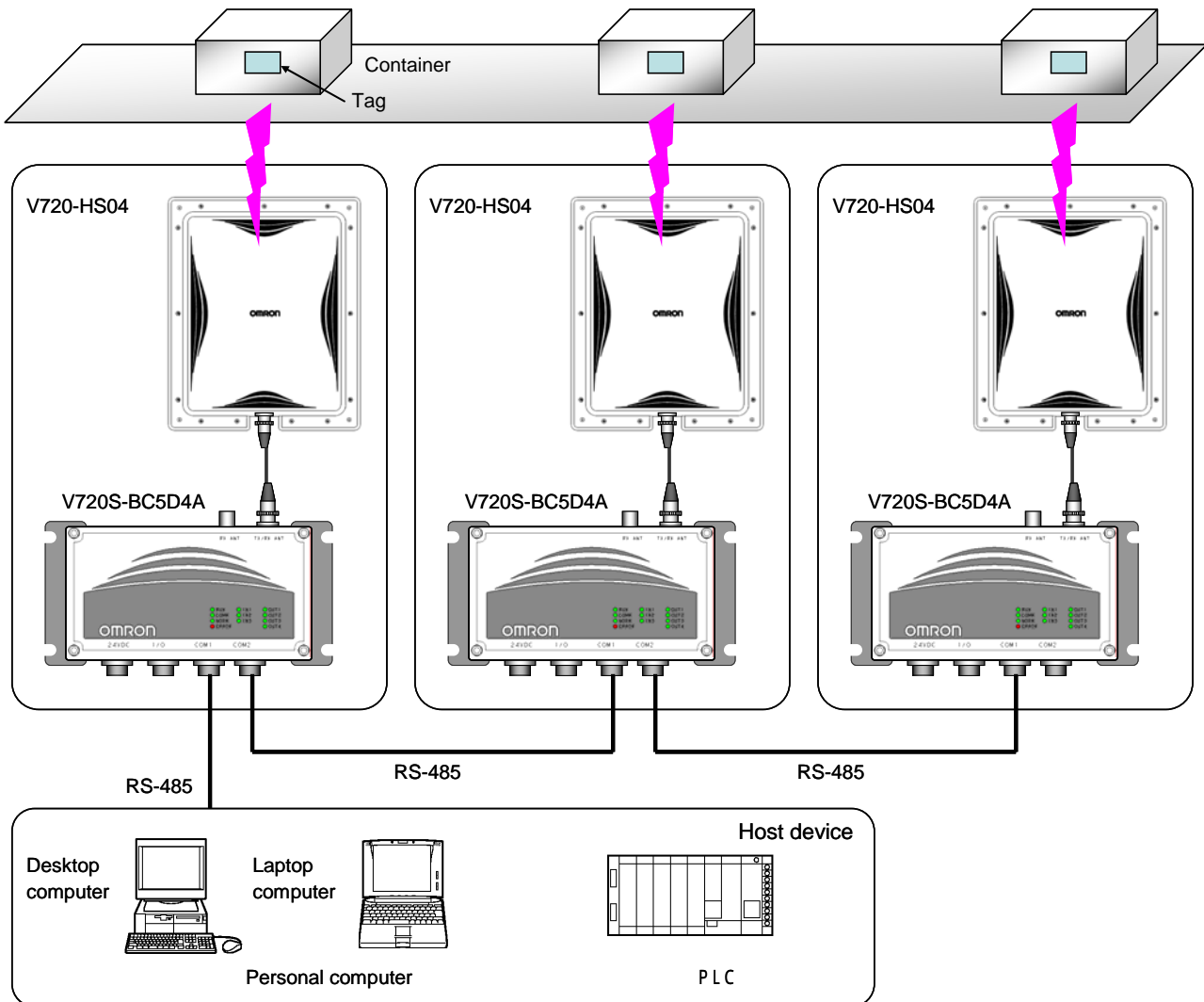
The V720S-BC5D4A has a built-in serial interface conforming to RS-232C and RS-485, thus making it possible to communicate with personal computers and PLCs. All the ordinary communication processes take place via commands from the host.



## 1-2-2 Example of 1-to-N System Configuration

The unit has a built-in RS-485 interface that enables multi-drop connection of up to 31 Reader/Writer units per host such as a mainframe or PLC.

The cable for RS-485 can be extended to a total maximum length of 300 meters.



**NOTE** : The models shown in the diagram are for example purposes only

**Note:**

In the configuration, where multiple Reader/Writers are connected via an RS-485 interface, the commands in a Communication Mode by which responses are returned at the Tag's entry into the communication area, such as those in the Auto or Repeat Modes, cannot be executed simultaneously. The responses from the Reader/Writer will collide, preventing the host from receiving them normally. Such commands must be executed from the Polling Command, or by the time-shared processing performed by the host.

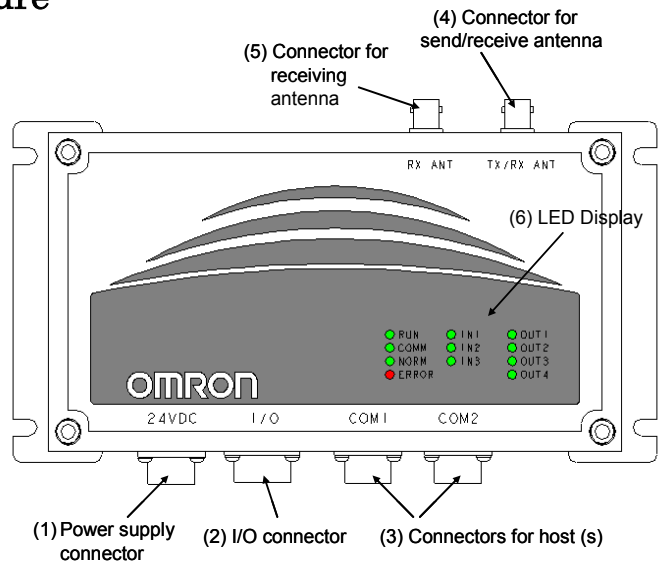


# SECTION 2

## Specifications and Performance

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2-1-1 Nomenclature



No.	Name	Function/description	
1	Power connector	Connects 24 VDC.	
2	Input/Output connector	This connector can connect the following signals: <ul style="list-style-type: none"> <li>● External RESET signal input (1 point)</li> <li>● User input readable via command (3 points)</li> <li>● User output operable via command (4 points)</li> </ul> * For the application of specialized antennas, some outputs are reserved for exclusive use. For the connection in such cases, refer to the respective Antenna Manual.	
3	Host communication connector	Connects a PLC, PC, or the like to transmit commands to and receives responses from the Reader/Writer.	
	COM1	This is a host port used for ordinary communication. The interface conforms to RS-232C and RS-485, either of which is used selectively as appropriate.	
	COM2	This port conforms to RS-232C and is solely used for setup. The RS-232C interface of this port operates independent of the RS-232C interface of COM1. The RS-485 pin is provided for extension when multi-dropped connection is used.	
4	Transmitting/receiving antenna connector (TX/RX ANT)	Connects an antenna (the V720-HS04 or the like).	
5	Receiving antenna connector (RX ANT)	A receive-only antenna can be connected to this connector. This connector is provided for special applications, e.g., connection with a gate antenna. Leave this connector unconnected in normal use.	
6	Indicators	The indicators shows the state of operation, as shown below:	
	RUN	Green	Turns on when the Reader/Writer is operating normally.
	COMM	Green	Turns on when the Reader/Writer is in communications with the Tag.
	NORM	Green	Turns on when communication has completed normally.
	ERROR	Red	<ul style="list-style-type: none"> <li>● Turns on when a communication error has occurred.</li> <li>● Turns on when a system error has occurred.</li> </ul>
	IN1 - IN3	Green	Turns on when the input signal is on.
OUT1 - OUT4	Green	Turns on when the output signal is on.	

**Note**

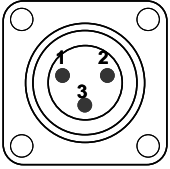
Do not connect antennas other than those recommended by OMRON.

When connecting a Receive-only Antenna, enable the Receive-only Antenna Mode with the Antenna Changeover Command (AC).

2-1-2 Names of Connector Terminals

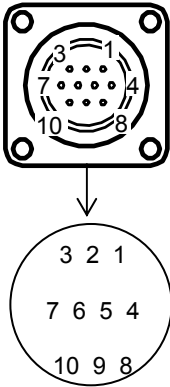
Each connector shows pin numbers ,which are viewed from the outside of the Reader/Writer.

1. Power connector

Shape of connector	Pin number	Name	Description
	1	GND	Connects 0V.
	2	+ 24 VDC	Connects the + side of 24 VDC.
	3	GR	Connecting to a ground of 100 Ω or less


2. Input/Output connector

Signals have been insulated from one another. The input and output signals are connected in a pair to INCOM and OUTCOM, respectively.

Shape of connector	Pin number	Name	Description
	1	RST	RESET signal input
	2	IN1	External input signal 1
	3	IN2	External input signal 2
	4	IN3	External input signal 3
	5	INCOM	Common terminal for common use by external input signals
	6	OUT1	External output signal 1
	7	OUT2	External output signal 2
	8	OUT3	External output signal 3
	9	OUT4	External output signal 4
	10	OUTCOM	Common terminal for common use by external output signals

3. Host communication connector


COM1 and COM2 are set commonly, as shown below.

Shape of connector	Pin number	Name	Description
	1	RD	Receive data (RS-2332C)
	2	SD	Transmit data (RS-2332C)
	3	SG	Grounding for signals (RS-232C)
	4	+	+ (RS-485)
	5	-	- (RS-485)

## 2-2-1 General Specifications

Item	Specifications
Supply voltage	24VDC $\pm$ 10%
Power consumption	27 W or less
Ambient operating temperature	-10 to 50 (with no icing)
Ambient operating humidity	35% to 85% RH (with no condensation)
Ambient storage temperature	-25 to 65 (with no icing)
Insulation resistance	20 M $\Omega$ min. (by a 100 VDC mega) between both I/O terminals and both power supply terminals, between both COM terminals, and between both ANT terminals
Dielectric strength	Leakage current of 10 mA max. at 1000 VAC (50/60 Hz) for 1 minute in any of the above combinations
Vibration resistance	No abnormal condition after applying 10 sweeps of a vibration of 10 to 150 Hz and 0.2mm double amplitude in X, Y, and Z directions for eight minutes
Shock resistance	No abnormal condition after giving an impact of 150 m/s <sup>2</sup> three times each in X, Y, and Z directions, i.e., 18 times in total
Grounding	Connecting to a ground of 100 $\Omega$ or less
Dimensions	247 x 84 x 128 mm (W×H×D)
Protective construction	IP60 (IEC60529 Standard)
Number of terminals for antenna connection	Transmitting/receiving antenna: 1 Receive-only antenna: 1
Material	Aluminum die casting
Mounting method	Fastening with M6 screws
Standby time * 1	15 min
Weight	Approx. 1.6 kg

**NOTE**

 : (\*1) The time that elapses after turning power ON to getting stable for communication.

## 2-2-2 Performance Specifications

Item	Specifications
Self-diagnostics	CPU Error, System Error, Host communication Error, Tag Communication Error.

**Initialization process at power-on**

During the initialization process after power-on, four LED indicators: RUN, COMM, NORM, and ERROR light up. No commands are accepted during the initialization process (approximately 2.5 seconds).

## 2-2-3 Reader/Writer Communications Specifications

## 1. Transmission specifications

Item	Specifications
Central carrier frequency	13.56 MHz $\pm$ 7 kHz
Antenna output	V720S-BC5D4: 4.0 W or less Output impedance: 50
Modulation method	ASK
Degree of modulation	10% to 20%
Coding method	Fast mode: RZ/1 out of 4 Standard mode: 1 out of 256
Baud rate	Fast mode: 26.5 kbps Standard mode: 1.65 kbps

## 2. Receipt specifications

Item	Specifications
Central carrier frequency	13.56 MHz $\pm$ 7 kHz
Sub-carrier	424 kHz
Modulation method	ASK modulation on sub-carrier
Coding method	Manchester encoding
Baud rate	26.5 kbps

Note
------

The Standard Mode and Fast Mode are specified by the Tag Communications Mode Setting Command (CM). It should be noted that the factory default setting is the Fast Mode.
--

## 2-2-4 I/O Specifications

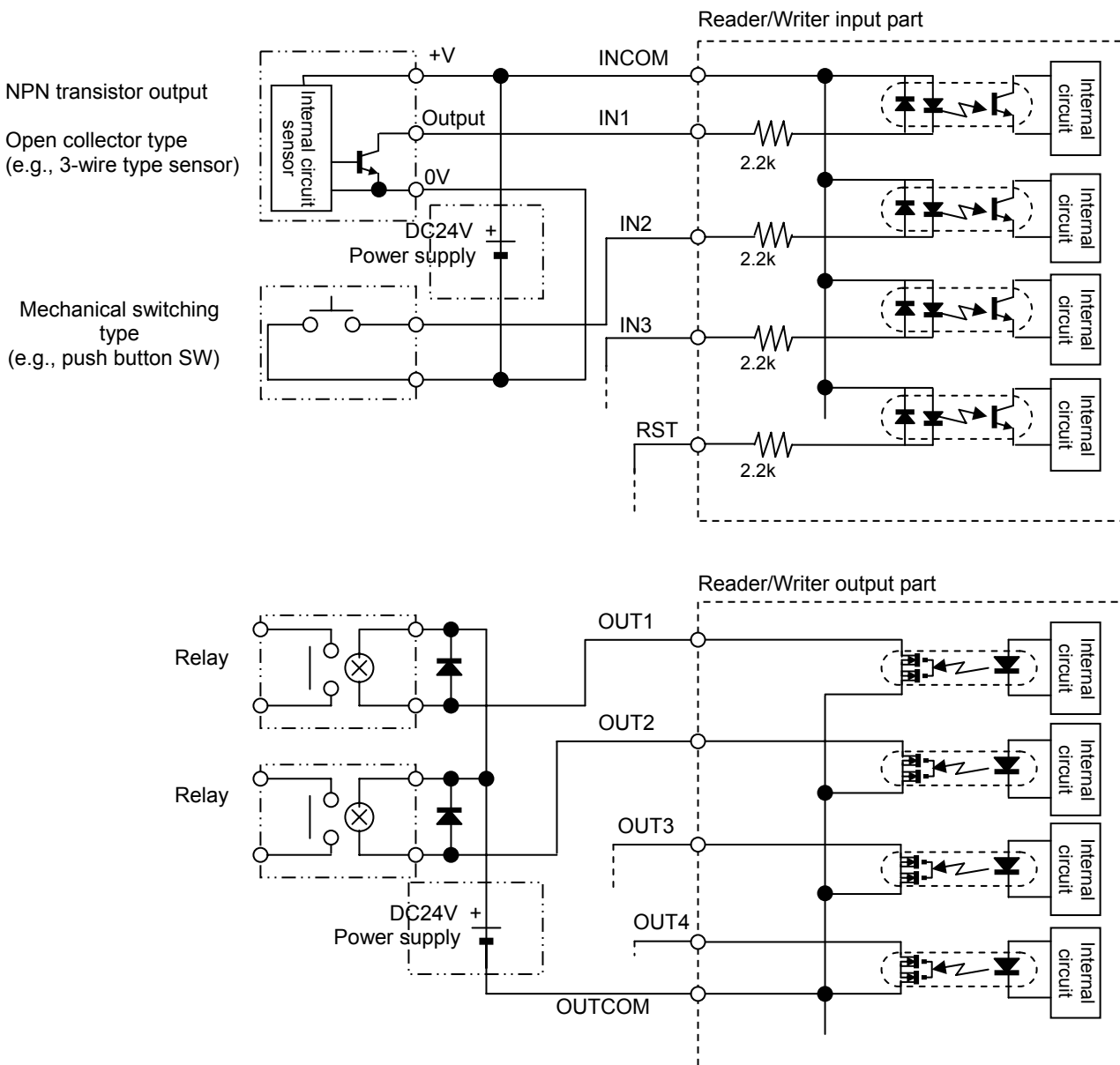
### ■ Input specifications (RST, IN1, IN2, and IN3)

Item	Specifications
Input voltage	24VDC ± 10% (including ripples)
Input impedance	2.2 k
Input current	10mA TYP (24 VDC)
ON voltage	19 V min.
OFF voltage	5 V max.
Input response time	70 ms max.

### ■ Output specifications (OUT1, OUT2, OUT3, and OUT4)

Item	Specifications
Max. opening and closing capacity	24VDC ± 10%, 50mA (including ripples)

### ■ Wiring with I/O equipment (Ex.)



### 2-2-5 Host Communications Specifications

The RS-232C interfaces for COM1 and COM2 have separate communication ports, and thus it is possible for these interfaces to have different communication settings. COM1 can be communicated via RS-232C or RS485 interfaces. RS-232C for COM2 is primarily used for Reader/Writer setup, whereas RS-485 pin at COM2 is used for multi-drop connection to other Reader/Writer devices.

#### ■COM1 connector

Item	Description
Conforming standard	RS-232C or RS-485
Communications method	EIA/TIA-232-E half duplex or EIA/TIA-485 half duplex
Baud rate	9600 bps, 19200 bps, 38400 bps, 115200 bps
Sync	Start-stop synchronization (stop bit: 1 or 2)
Transmission code	ASCII7 or JIS8 unit symbols
Max. number of connections	31 (for connection via RS-485 Interfaces)
Error control	Vertical parity (select from even, odd, or none) For BCC, use or non-use of horizontal parity can be selected.
Line length <sup>4)</sup>	15 m (when RS-232C is selected) 300 m in total (when RS-485 is selected)

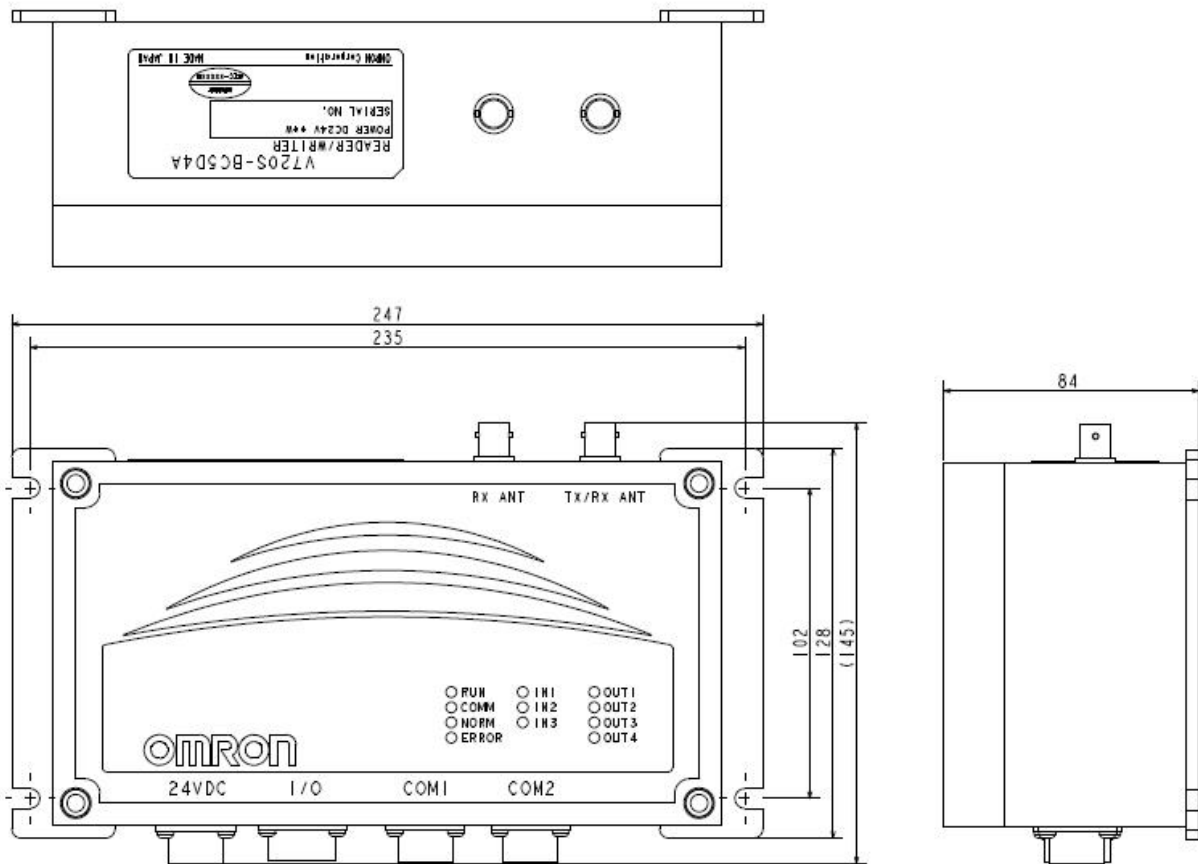
#### ■COM2 connector

Item	Description	Initial value (after resetting power supply)
Conforming standard	RS-232C	-
Communications method	EIA/TIA-232-E half duplex	-
Baud rate	9600 bps, 19200 bps, 38400 bps, 115200 bps	9600 bps
Sync	Start-stop synchronization (stop bit: 1 or 2)	Stop bit 2
Transmission code	ASCII7 or JIS8 unit symbols	ASCII 7
Error control	Vertical parity (select from even, odd, or none) For BCC, use or non-use of horizontal parity can be selected.	<ul style="list-style-type: none"> <li>• even</li> <li>• Use for BCC</li> </ul>
Line length <sup>4)</sup>	smaller than or equal to 15 m	-

### Communication Settings

- 1) Either RS-232C or RS-485 interfaces must be selected for COM1.
- 2) The Communication Settings for COM1/COM2 are set using Communications Port Setting Command (CP).
- 3) The COM2 Communication Settings are reset to the initial values at power reset.  
(The settings are maintained when reset with Reset Command) (XZ).
- 4) The line length may be shorter depending on the transmission rate applied, be sure to confirm the length in advance.

## 2-2-6 Dimensions





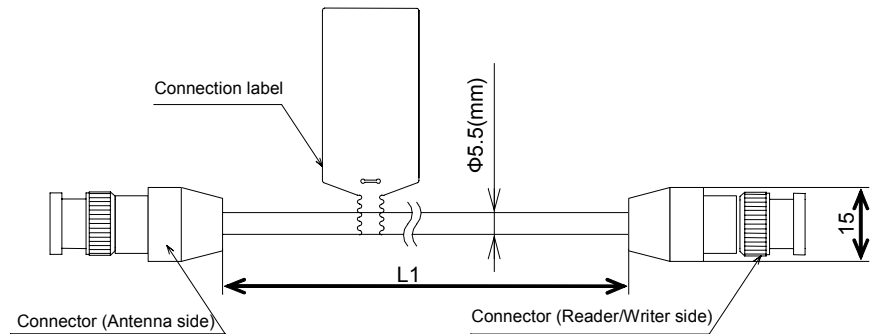
2-3-1 General Specifications

Item \ Model	V720-A 41 Antenna cable	V720-A 51 Power cable	V720-A 62 RS-232C cable
Cable type	Coaxial cable	-	-
Number of conductors	2 (shield)	3	6
Insulation resistance	10 M min. (at 250 VDC) between conductor and shield	5 MΩ min. (at 250 VDC) between conductor and shield	10 M min. (at 250 VDC) between conductor and shield
Dielectric strength	Leakage current of 1mA max. at 300VAC	Leakage current of 1mA max. at 300VAC	Leakage current of 1mA max. at 300VAC
Cladding material	PVC	PVC	PVC

2-3-2 Dimensions

Antenna cable: V720-A41

Item \ Model	V720-A41 3.35M	V720-A41 10.33M
Length	3350 +20-30 (mm)	10330+20-30 (mm)



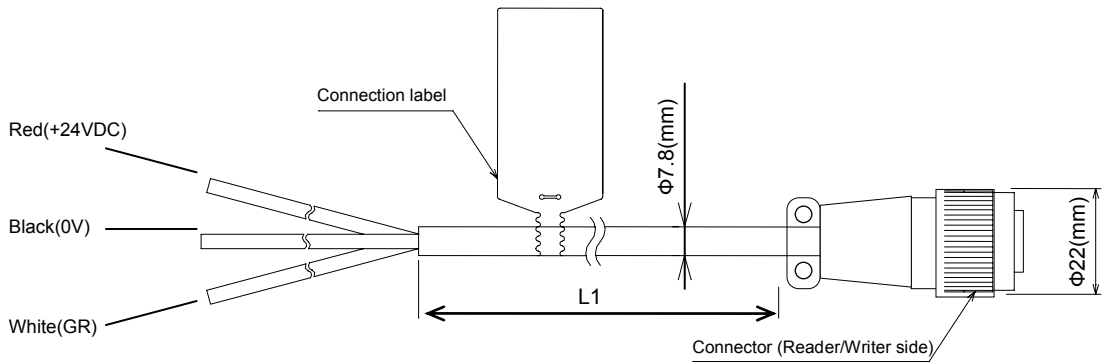
Antenna Cable Wiring

Be sure to use V720-A41 3.35M or V720-A41 10.33M for the antenna cable. Using other cables may affect communication performance.

Do not change the cable length. Doing so may affect communication performance.

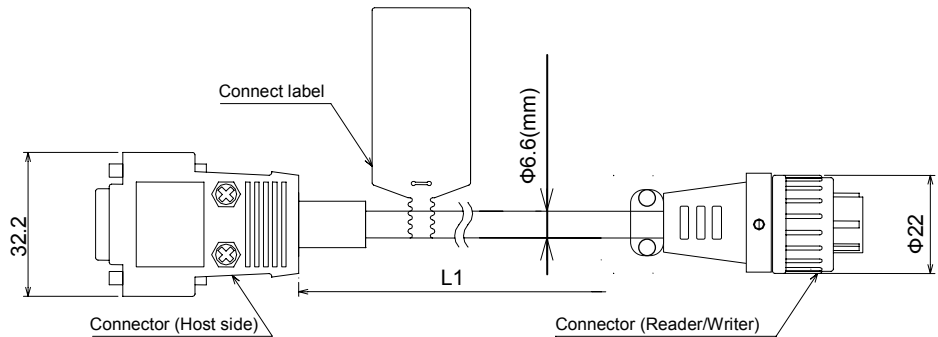
Power cable: V720-A51

Item	Model	V720-A51
Length (L1)		3000+10-20(mm)



Cable for RS-232C: V720-A62(For DOS/V PCs)

Item	Model	V720-A62 3M	V720-A62 15M
Length (L1)		3000+50-0 (mm)	15000+50-0 (mm)



**NOTE** : The D-sub connector is an inch screw thread (M2.54) type.

D-sub connector		Reader/Writer-side connector	
2 pin	RD	1 pin	RD
3 pin	SD	2 pin	SD
5 pin	SG	3 pin	SG
Housing	Shield		

**NOTE** : Connect the shield wire to the connector cover on the PC side.

**Installation/Operation Precautions**

The cable must be laid in a particular manner so that no mechanical stress is applied to the cable.  
 The cable should not be repeatedly bent or pulled in an axial direction.

### 2-4-1 I.CODE SLI Chip (Philips Semiconductor IC, product name: SL2 ICS20)

This section describes a Tag incorporating a Philips Semiconductor IC chip SL2 ICS20 Label IC (hereinafter called “I.CODE SLI chip”), which is accessed by the system.

This chip is in conformity with international standards or ISO/IEC15693. The user memory area of I.CODE2 chip consists of 28 pages (00h through 1Bh page) or 112 bytes.

This Reader/Writer is organized with one page (4 bytes) as the minimum access unit of its memory block, and can be accessed up to the maximum address space defined in ISO/IEC15693. 1) shows an example of a Memory Map of an IC (hereinafter called “ISO/IEC chip”) in accordance with ISO/IEC15693.

#### 1) Maximum address space of ISO/IEC15693 chip organized with 4 bytes/page

Page	Block	Byte0	Byte1	Byte2	Byte3
00h	0				
01h	1				
02h	2				
03h					
04h					
05h					
06h					
07h					
08h					
09h					
0Ah					
⋮	⋮				
0Fh	15				
10h	16				
11h	17				
⋮	⋮				
1Bh	27				
⋮	⋮				
1F	31				
⋮	⋮				
F0h	240				
F1h	241				
⋮	⋮				
FFh	255				

User memory area of I·CODE2  
Page 00h through 1Bh  
(28 page = 112 Byte)

Accessible Tags
<p>This product incorporates the firmware, which can access the 4-byte/page chip that conforms to ISO/IEC 15693. However, the operation is guaranteed for OMRON Tags that use the Philips Semiconductor IC, SL2ICS20 (commonly called I.CODE SLI) only. The Tags by other manufactures, or those with other ISO/IEC15693 Chips should be thoroughly tested by each user.</p>

2) System area of I.CODE2 chip

This section describes a system area of I.CODE SLI chip. The system area of I-CODE SLI chip is allocated in the other area rather than user memory area.

Execute a specific command to access to the system area.

The processes in the system area are done by specific commands instead of page number allocations.

Byte0	Byte1	Byte2	Byte3
UID			
UID			
EAS/AFI/DSFID			
Write-protected			

(1) UID

UID is a Tag-specific code and has been written into the memory during the chip production process.

The IC is shipped with this page write-access inhibited; there is no way of making this page rewritable by the user.

(2) EAS

EAS mode: Inhibition/permission of EAS function

(e=0: EAS mode is disable; e=1: EAS mode is enable)

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

The pages marked with “X” in the table above are reserved for future use.

(3) AFI

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

Byte 2	MSB							LSB
	AFI higher-order 4bits				AFI lower-order 4bits			

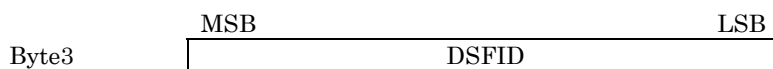
**Definitions by ISO/IEC15693**

AFI higher-order 4 bits	AFI lower-order 4 bits	Applications	Example
0	0	All applications	None specified applications
X	0	X applications	Select extensively
X	Y	Y sub classification of X application	
0	Y	Limited applications to Y sub classification	
1	0,Y	Transportation	Mass transportation, bus, airplane
2	0,Y	Finance	Banks
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	Physical distribution management	
A	0,Y	Package delivery	
B	0,Y	Postal mail	
C	0,Y	Air hand baggage	
D	0,Y	Hold	
E	0,Y	Hold	
F	0,Y	Hold	

\*Note: X=1 through F                      Y=1 through F

(4) DSFID

DSFID indicates how data are organized in a memory.



(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
Byte0	0	0	0	0	0	0	0	0
	Page 03	Page 02	Page 01	Page 00				
Byte1	0	0	0	0	0	0	0	0
	Page 0B	Page 0A	Page 09	Page 08	Page 07	Page 06	Page 05	Page 04
Byte2	0	0	0	0	0	0	0	0
	Page 13	Page 12	Page 11	Page 10	Page 0F	Page 0E	Page 0D	Page 0C
Byte3	0	0	0	0	0	0	0	0
	Page 1B	Page 1A	Page 19	Page 18	Page 17	Page 16	Page 15	Page 14

## 2-4-2 I.CODE1Chip (Philips Semiconductor IC, product name: SL1 ICS30 01, SL ICS31 01)

These specifications describe a Tag incorporating an IC chip I- CODE1 Label IC (product name: SL1 ICS30 01) 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.

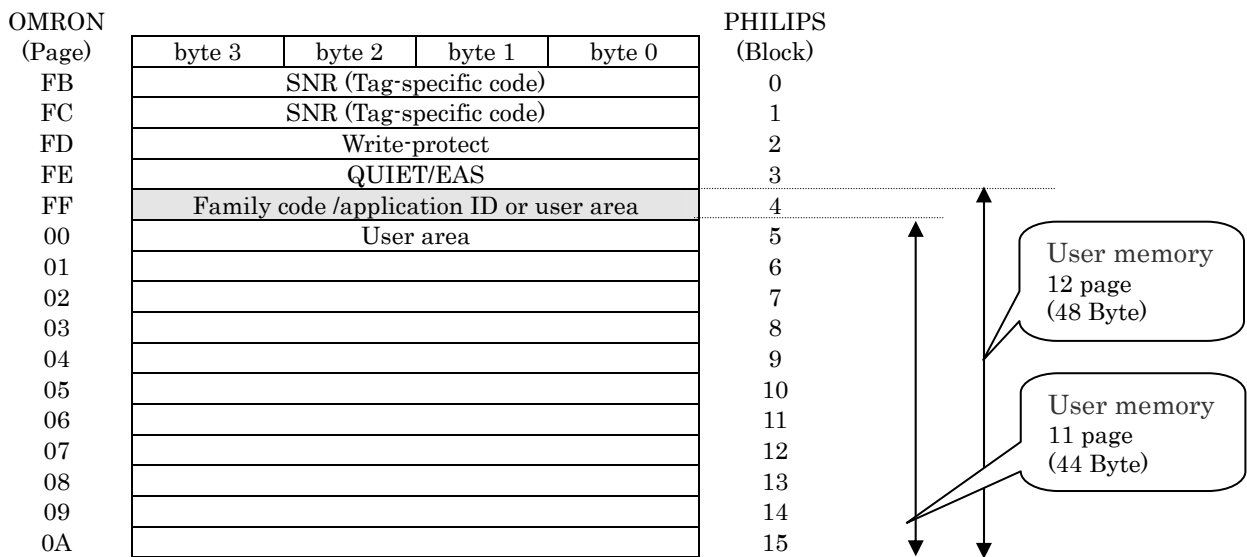
Refer to 5-5 "System commands" for details. OMRON defines the blocks below Block 5 as the user memory area. Block 5 is page 00, and the subsequent blocks are allocated as shown below.

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 these specifications is in accordance with OMRON's memory allocation scheme.

### 1)Memory map of I.CODE1Chip



### Page FF (Block 4)

Page FF (Block 4) can be used as user memory when Tag-discriminating access by Family Code (FC) or Application ID (AI) is not performed. In this case, specify FF for the page to use it as user memory. The user memory contains 12 pages.

## 2) System area of I.CODE2 chip

### 1 ) SNR (pages FB and FC)

SNR is a Tag-specific code and has been written into the memory during the chip production process.

The IC is shipped with this page write-access inhibited (refer to page FD); there is no way of making this page rewritable by the user.

### 2 ) Write-access conditions (page FD)

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 FD	MSB								LSB							
Byte 0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	0	0
Byte 1	Page FE				Page FD				Page FC				Page FB			
Byte 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Byte 3	Page 02				Page 01				Page 00				Page FF			
Byte 0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Byte 1	Page 06				Page 05				Page 04				Page 03			
Byte 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Byte 3	Page 0A				Page 09				Page 08				Page 07			

### 3 ) QUIET/EAS (page FE)

QUIET mode : All the functions of a tag are suspended completely. Use Reset Quiet Bit to resume these functions.

(q=0: QUIET mode is disabled; q=1: QUIET mode is enabled)

EAS mode : Inhibition/permission of EAS function

(e=0: EAS mode is disabled; e=1: EAS mode is enabled)

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

\*The pages marked with "x" in the table above are reserved for future use.

### 4 ) Family code/application ID (page FF)

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

# SECTION 3

## Functions

<b>3-1</b>	<b>Operating Mode</b> .....	<b>3-2</b>
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<b>3-8</b>	<b>Duplicate Communication Protecting Function [Ver1.20 or higher]</b> .....	<b>3-11</b>



## 3-1-1 Chip Operating Mode

This Reader/Writer has two Chip-Operating Modes for different types of Tags (and its IC Chips.) You have to set either of the Chip Operating Modes in accordance with the Tag you choose. The functions or command types/formats vary, depending on the Chip Operating Mode. The factory default is ISO Mode (I.CODE 1 Mode for Ver1.10 and lower).

The mode is set by the Chip Operating Mode Switch Command (TY).

Operating Mode	Operation
ISO Moed	Processes the Tags with ISO/IEC15693 Standard Chips (I.CODE SLI). I.CODE1-Mode specific functions or commands are disabled.
I.CODE 1 Mode	Processes the Tags with I.CODE1 Chips. ISO-Mode specific functions or commands are disabled.

## 3-1-2 Online Mode /Offline Mode

The Reader/Writer operates in either Online Mode, in which commands are given by the host, or in Offline Mode, in which the EAS function (refer to SECTION 3-7) performs the configuration, when the host is disconnected and the communication test between the antenna, the Reader/Writer and the Tags.

The factory default is set to Offline mode. To change the mode to the Online Mode, connect the host and execute the Stop Command (ST). To always start the Reader/Writer in the Online Mode, the default mode is disabled using the Offline Mode Setting Command (FL).

When the Reader/Writer is turned on in Online Mode, it remains in a stand-by state, until commands from the host are received.

In the Offline Mode, the Reader/Writer starts detecting the EAS-enabled Tags (the EAS function mounted on the Tags is not disabled) from the moment it is turned on in this mode the COMM LED remains flashing. At the entrance of an EAS-enabled Tag into the antenna communication area, the external output turns ON for the specified time. The OUT1 LED light indicates normal communication between the Reader/Writer and the Tags .

To check the communication status in the Offline Mode, the EAS on the Tags must be enabled in advance.

**Note:**

If the type of Tags used and the chip operating mode setting do not match, the Reader/Writer will not respond to the Tags. The No Tag Error ( code: 72 ) results.

Specifying the commands or functions unavailable in the specified Chip Operation Mode will result in a Format Error (code: 14).

The communication test in Offline Mode is performed with the EAS on the Tags enabled. The communication by the EAS function takes longer compared to Read/Write operations performed by other functions. The communication distance in the Online Mode should be checked using the actual commands.

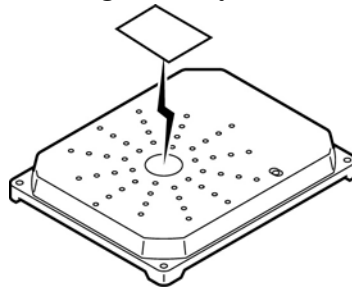
This Reader/Writer has five communication modes to be selected by each command corresponding to the number and/or state of Tags in the communication area.

Each mode is activated by specifying the communication in the command data.


### 3-2-1 Single Access

Single Access is used to read data from or write data on the only Tag that exists in the Antenna Communication Area. The execution timing can be selected from Trigger, which executes immediately, Auto, which waits for the Tag to enter the communication area and executes, or Repeat, which repeats the execution for the Tag in the communication area.

Be sure to have only one Tag in the communication area. Multiple Tags in the Antenna Communication Area prevents the antenna from communicating normally.



#### NOTE

 : In the I.CODE1 Mode, the Tag is processed only once at the entry into the communication area. It can be reprocessed once it is outside the area again.

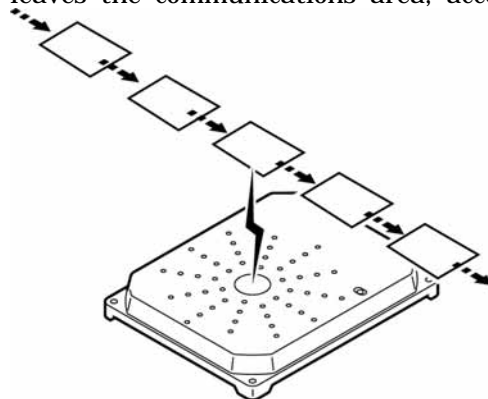
### 3-2-2 FIFO Access

FIFO Access is used to read data from or write data on the Tags sequentially in the same order they entered the antenna communication area. (FIFO First In First Out).

The execution timing can be selected from Trigger, which executes immediately, Auto, which waits for the Tags to enter the communication area and executes, or Repeat, which continues to wait for the Tags to enter the communication area.

Since every Tag finished with communications is set to access prohibit, communications will be possible if only one Tag newly arrives in the communication area of the Antenna where more than one Tag exists.

An error results, however, if two or more Tags arrive in the communications area simultaneously. Once an access-prohibited Tag leaves the communications area, access to the Tag is enabled again.

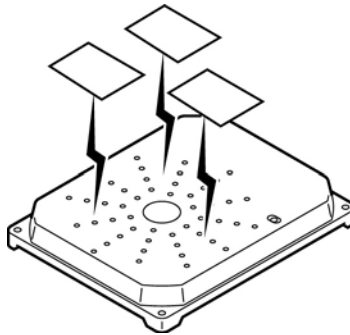


### 3-2-3 Multiple Access

Multiple Access is used to read data from or write data on the Multiple Tags in the Antenna Communication area simultaneously. Communications with Multiple Tags in the communications area is available. (This function is also called 1:N Access or Multiple Tag Simultaneous Access). The execution timing can be selected from Trigger, which executes immediately, or Repeat, which continues to wait for the Tags to enter the communication area.

In I.CODE1 Mode, specify the appropriate tag-number code in command data according to the number of Tags that exist in the communication area (refer to SECTION 5-2-5).

The Duplicate Communication Protecting Function is useful for unstable Tags in the Antenna Communication Area (refer to SECTION 3-8 for details).

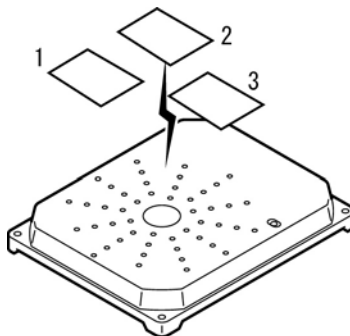


### 3-2-4 Selective Access

Selective Access is used to read or write data on specified Tags among the multiple Tags in the communication area.

In ISO Mode, communication with specific Tags is achieved by first reading the Tag UIDs (unique codes) in Multiple Access Mode and then by specifying them. It is recommended that the UID/SNR addition option of the Command Processing Procedure Setting should be used. It is especially convenient since data readouts and UID acquisitions are performed by a single command.

In I.CODE1 Mode, the Tag Detection Command that assigns numbers to the Tags in the communication area in Multi Access Mode is performed first, and then the Tag Designation Command that specifies the assigned numbers is performed to launch the communication with the specific Tags.



### 3-2-5 Fast Read Access: I.CODE1 Mode Only

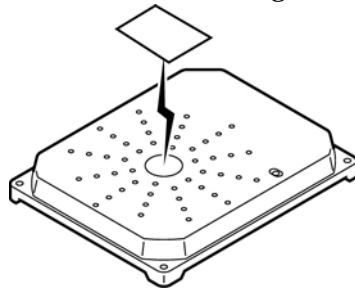
The Fast Read Access speeds up the data readout in I.CODE1 Mode. The execution timing can be selected from Trigger, which executes immediately, Auto, which waits for the Tag to enter the communication area and executes, or Repeat, which repeats the execution for the Tag in the communication area.

The function operates the same way as in Single Access mode when the Tag number code is set to 0; in other cases it is the same as in Multiple Access Mode.

#### [When the Tag number code is set to 0 (Single Access Mode)]

By selecting the Trigger or Auto execution timing, the function executes the same operation as that in normal single access mode but in a shorter period of time.

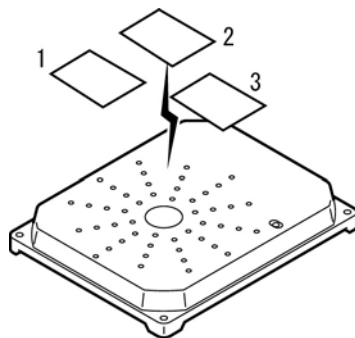
When the Repeat execution timing is selected, the function continuously returns data while the Tags are present in the communication area, this is useful in confirming the communication area.



#### [When the Tag number code is set to those other than 0 (Multiple Access Mode)]

The only execution timing available is Repeat, since the function employs a simple version of the communication sequence, some Tag data may be unreadable under the condition where the responses from the Tags collide frequently. In addition, the function processes and responds to the same Tags repeatedly while they are present in the communication area.

This function should be used when there is a low number of Tags in the communication area. When there are a greater number of Tags, the Multiple Access Mode should be used. The Duplicate Communication Protecting Function is useful to avoid multiple responses returned to the same Tag. (Refer to SECTION 3-8).



#### Note:

For the I.CODE1 Communication Modes used under the conditions, where Multiple Tags exit in the Antenna Communication Area (Multiple Access, Selective Access, or Fast Read Modes), the Tag Number Code must be specified. The maximum number of Tags allowed in the communications area is set previously. (Refer to SECTION 5-2-5 for details).

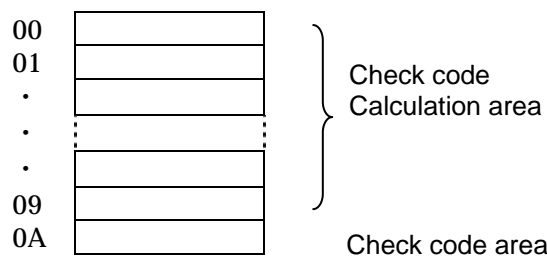
By adding a check code to the data in the Tag, you can detect data errors due to the Tag memory (EEPROM) being overwritten, service life, and unforeseen factors.

The check code uses the CRC code of the generating polynomial  $X^{16} + X^{12} + X^5 + 1$ .

A memory check is performed using the Memory Check Command (MC), which writes the check code, and the Memory Calculation Command (MK), which verifies the check code. In the check block defined using the header page and the number of pages, the target calculation area is the area except for the last page of the block, and the last page is the check code area. The check code uses two bytes in the check code area.

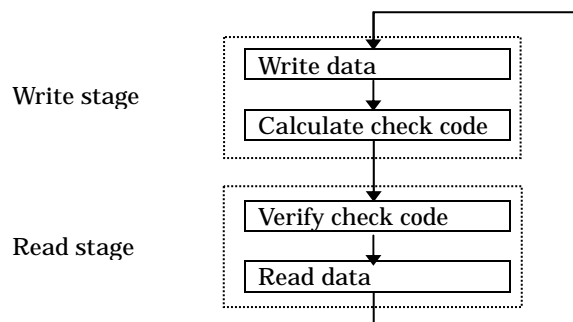
When a check code write command is sent, the CRC code for the data in the target calculation area is calculated, and written to the check code area. When the data verification command is sent, the CRC code for the data in the target calculation area is calculated, and compared with the data in the check code area. If these match, the number 75 is returned in the response code to show that the data is normal. If they do not match, the number 76 is returned to show that there is a data error.


Example: Memory check is performed when check block header page is 00 and the number of check blocks is 0B.



#### 3-3-1 Usage

After writing the data, calculate and write the check code using the Memory Check Command (MC), and before reading the data, verify the check code using the Memory Calculation Command (MK). You can detect data corruption in advance within the Tags that are not being accessed.



**NOTE**  : This Command is for I.CODE1 Mode Only. The command is not available in ISO mode:

The Lock function protects data from being erased due to unintentional overwriting on the fixed data in the Tags.

### Lock setting in ISO mode

For the lock setting in ISO mode, you can write-protect any given areas by the page of Tag memory.

If you execute Write command on a write-protect page, a write processing error (code:79) will occur. You can make the lock setting by executing the Lock command (LK) that enables access to the lock setting area.

For the details, see 5-4-7 “Lock Setting: ISO Mode.”

### Lock setting in I.CODE1 mode

There is a lock setting area in the system area of I.CODE1 chip, and you can write-protect any given areas by page.

If you execute Write command on the write-protect page, the write processing error (code:71) will occur.

The lock setting consists of 12 bits of data in total, giving one bit to each page. Lock setting can be made by using the Lock command (LK).

For the details, see 5-5-9 “Lock Setting: I.CODE1 Mode.”

### Lock setting area of I.CODE1 chip: “FDh page”

Lock Setting Area															
1 byte								1 byte							
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
Page 10	Page 09	Page 08	Page 07	Page 06	Page 05	Page 04	Page 03	Page 02	Page 01	Page 00	ID code, Family application	QU IET EAS	Write Protect	SNR	SNR

### Note:

The write protection cannot be canceled by the V720-series lock function. Data can never be re-written into write-protected pages; be careful in setting write protection.

Be extremely careful when setting write protection in the system area.

Tag-specific codes (UID on I.CODE SLI/SNR on I.CODE1) are write-protected when manufactured.

The ID codes set in the Tags are utilized in identifying the target chips in the antenna's application fields. Responses are returned only when the ID code in the command from the antenna and the ID code on the Tag are matched.

The factory default of the Reader/Writer ID codes are all set to 00h, which means communications are available regardless of ID codes on the Tags.

### I.CODE1 mode

The I.CODE1 chip has two kinds of one-byte ID codes called the Family Code and Application ID. The Tag ID code can be set/modified by the Write Command (WT) with the Family Code/Application ID area (FF page) specified.

The ID codes for the Reader/Writer can be set/modified by the Reader/Writer Family Code Setting (FC)/Reader/Writer Application ID Setting (AI) Command.

#### In I.CODE1 mode

No.	Reader/Writer set value		No.	Tag set value	
	Family code	Application ID		Family code	Application ID
(1)	00h	00h	A	55h	AAh
(2)	55h	00h	B	55h	11h
(3)	55h	AAh	C	00h	00h

#### Reader/writer setting (1)

This setting enables communication with Tag A, B, and C, as both of the family code and application ID are set to "00h."

#### Reader/writer setting (2)

This setting enables communications with Tag A and B as their family codes match. Communication with Tag C is not possible. This identification code has nothing to do with identifying Tags as the application ID is "00h."

#### Reader/writer setting (3)

The communication with Tag "A" is possible as the family code and application ID match. The communication with Tag B and C are not possible.

### ISO Mode

Both the I.CODE SLI and ISO/IEC Chips have a one-byte ID code called AFI (Address Family Identifier). To use this function, the AFI's must be set for the Reader/Writer and Tags, and the function must be enabled on the Reader/Writer as well. The Tag ID codes are set/modified using the System Write (SW) Command. The ID codes for the Reader/Writer are set by the Reader/Writer AFI Enable/Disable Changeover (AE) Command or the Reader/Writer AFI Value Setting (AF) Command.

#### In ISO mode

No.	Reader/Writer AFI set value	No.	Tag AFI set value
(1)	00h	A	5Ah
(2)	0Ah	B	0Ah
(3)	5Ah	C	00h

#### Reader/writer setting (1)

This setting enables communication with Tag A, B, and C as AFI is set to "00h."

#### Reader/writer setting (2)

This setting enables communication with Tag A and B of which the AFI's 4 least significant bits "Ah" match. As the 4 most significant bits are "0h," the part of this identification code has nothing to do with identifying a Tag.

#### Reader/writer setting (3)

The communication with Tag "A" is possible as AFI matches.

The I/O connector has three external input ports and four external output ports to which such devices as sensors or actuators are connected to build a more efficient system.

The external output may be dedicated to the antenna control, depending on the Reader/Writer settings.

### **3-6-1 External Input**

#### **[Online Mode]**

The status can be obtained by the I/O Control Command (CC). Sequenced operations such as those for starting and terminating the communication with Tags by external triggers are available.

#### **[Offline Mode]**

Not available. The I/O Control Command (CC) is rejected. To perform the function, the mode must be switched to the Online Mode by the Stop Command (ST).

### **3-6-2 External Output**

#### **[Online Mode]**

The output status can be modified or read-out by the I/O Control Command (CC.) Read-out data can be evaluated by the host and output as a control signal for Lamps or sounds.

When the I/O Automatic Changeover Setting is enabled, the external outputs 3 (OUT3) and 4 (OUT4) are dedicated to the antenna control and thus unmodifiable. However, the output status can be read-out.

#### **[Offline Mode]**

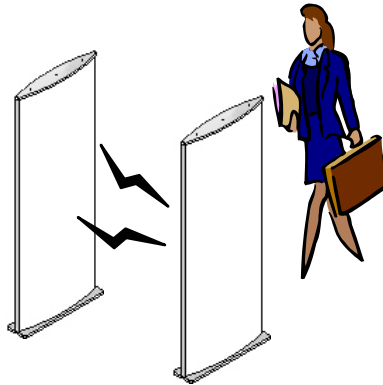
The external output is dedicated to the control from the Reader/Writer in this mode. Modification/Reading out of the output status by the I/O Control Command (CC) is unavailable.

The external output 1 (OUT1) is turned ON for a specified period of time (modifiable) when Tags with the uncanceled EAS is detected. The external outputs 3 (OUT3) and 4 (OUT4) are dedicated to antenna control when the I/O Automatic Changeover setting is enabled.



The Reader/Writer supports the EAS (Electronic Article Surveillance) system applied for anti-theft and other devices. The Reader/Writer identifies the unique data string returned by the EAS-bit enabled Tags and detects the existence of the Tags in the communication area. Multiple EAS-bit enabled Tags that exist simultaneously can also be detected. The Reader/Writer stops detecting the Tags by disabling the EAS bit on the Tags. This is useful in preventing unauthorized removal of properties or giving caution.

The function operates in either Online Mode, where the function is executed by the commands issued by the connected host, or Offline Mode where the function is executed by the Reader/Writer alone.



#### [Offline Mode]

In the Offline Mode, the EAS-bit enabled (non-disabled) Tags are continuously detected. When the EAS-bit enabled Tags enter the Antenna Communication Area and their EAS-response concordance rate exceeds the specified value (=EAS threshold), the external output 1 (OUT1) will turn ON for the specified time. The operation state is visibly identified by the OUT1 LED light. The EAS threshold and external output time are specified by the Offline Mode Setting (FL) Command.

##### EAS threshold

The Tags return 256-bit fixed data. The concordance rate at which the Tag is recognized as one with non-disabled EAS (EAS-bit disable processing is not performed) is specified by a percentage. The smaller the concordance rate, the more lax the criteria becomes. The initial threshold is 75%.

##### The ON-time of the external output 1 (OUT1)

The ON-time is specified according to the output time of the lamp or buzzer. The initial output time is 500ms.

#### [Online Mode]

The EAS Check (EA) Command is executed from the host. (Refer to SECTION 5-5-10). The EAS-response concordance rate is returned, which is compared to the threshold in the host and evaluated for the existence of the EAS-enabled Tags.

#### EAS Setting for the Tag

The EAS on the Tag is enabled by a specific command that enables EAS-bit. For the ISO/IEC chip (I.CODE SLI chip), it is done by the System Write (SW) Command and for I.CODE1 chip, it is done by the EAS Setting (ES) Command.

The Duplicate Communication Protecting Function prevents the command that processes multiple Tags serially from performing multiple Read/Write processing for each Tag. This function controls the command so that it performs the processing only once per Tag and returns a single response, even in situations where a Tag is recognized more than once as shown below. The processing load is reduced because the response receiving or duplication check by the host is unnecessary. The communication performance speed is also improved since unnecessary processing is eliminated in the following:

1. The situation where the Tag enters the Antenna Communication Area several times due to its vibration, irregular operation, or stop on the boundary, or because the Tag is in the antenna's side lobe area.
2. The situation where the Tag is stopped in the boundary zone or enters the Antenna Communication Area several times because of the moved antenna.
3. The situation where the Tag passes an antenna with a discontinuous communication area such as the gate antenna.

The enabled function is activated when the commands using the following communication modes are executed:

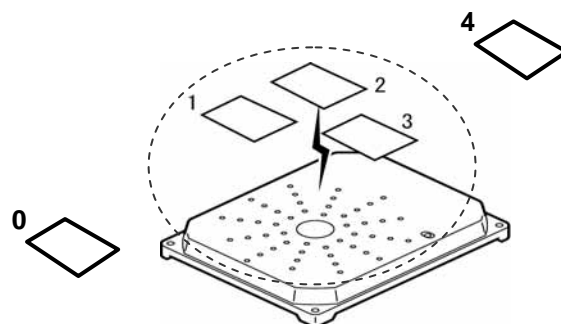
- FIFO Repeat Mode (FR)
- Multiple Trigger Mode (MT)
- Multiple Repeat Mode (MR, UR[I.CODE1 Only]\*)

When the function is enabled, the unique number (UID/SNR) given to the processed Tag is recorded in the table of the processed Tags after the command has been executed. When a new Tag is detected and its UID/SNR is obtained, the system refers to the table and processes the Tag only when the UID/SNR is not found in the table. After the Tag has been processed normally, the system records the UID/SNR in the table. The table is initialized at the start of command.

\* As to UR, the page on which the processing is started must be FB, and the pages must be 2 and more.

The function is set by the Duplicate Communication Protecting Function Setting (MX) Command (disabled by factory default.) To enable the function, specify the maximum number of UID/SNRs recorded in the table of the processed Tags. The number of tables can be selected from 1, 4, 8, 16, 64, 128, or 256. Usually, the closest number above the maximum number of Tags that can co-exist in the communication area of the antenna being used is specified.

Example) When the maximum number of the co-existing Tags are 6: The number of tables = 8



The table of the processed Tags:

1: Tag 0
2: Tag 1
3: Tag 2
4: Tag 3
5: (Vacant)
6: (Vacant)
7: (Vacant)
8: (Vacant)



In this case, Tag 0 is not processed for re-entry in the communication area. When the Tag 4 enters the area it is processed and recorded in row 5: of the table.

# SECTION 4

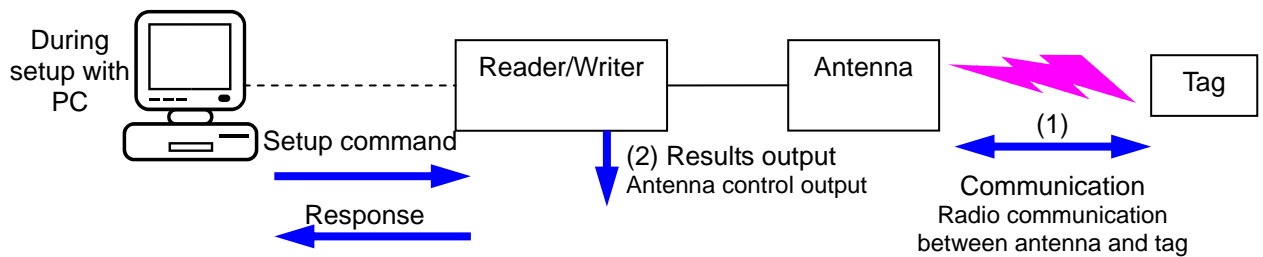
## From Start-up to Operation

<b>4-1</b>	<b>Operation of Reader/Writer .....</b>	<b>4-2</b>
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The V720-series RFID system has two operation modes: Offline Mode and Online Mode. The functions and control methods by the host vary, depending on the Operation Mode. One of the two modes must be selected at system setup.

## 4-1-1 Offline Mode

In the Offline Mode, the EAS-enabled Tags (the EAS function mounted on the Tags is not disabled) are always detected (1). When the EAS-enabled Tags enter the antenna communication area, the output results (OUT1) turns ON for the specified time (2). The control from the host is unnecessary. The PCs used for setup are connected as needed when the operating conditions must be specified. Some outputs are exclusively used for antenna control, depending on the settings.



### Detecting Tags

In the state where the EAS-enabled Tags (the EAS function mounted on the Tags is not disabled), are being detected, the COMM LED flashes in this state.

### Detection of the EAS-enabled Tags

In the state where the EAS-enabled Tags are present in the Antenna Communication Area. OUT1 turns ON for the specified time. OUT1 stays ON while the Tags are present in the area.

### LED/Output state in each operating status

Item	LED state				Output
	RUN	COMM	NORM	ERROR	OUT1
Detecting Tags (EAS)		●			OFF
Detection of the EAS-enabled Tags		●			ON

:ON, :OFF, ●:Flashing

**NOTE** If an error occurs to the value specified in the EEPROM at power-ON, the status enters the specified-value error state. When this occurs, the factory default value is employed.

### Note:

The factory default is Offline Mode.

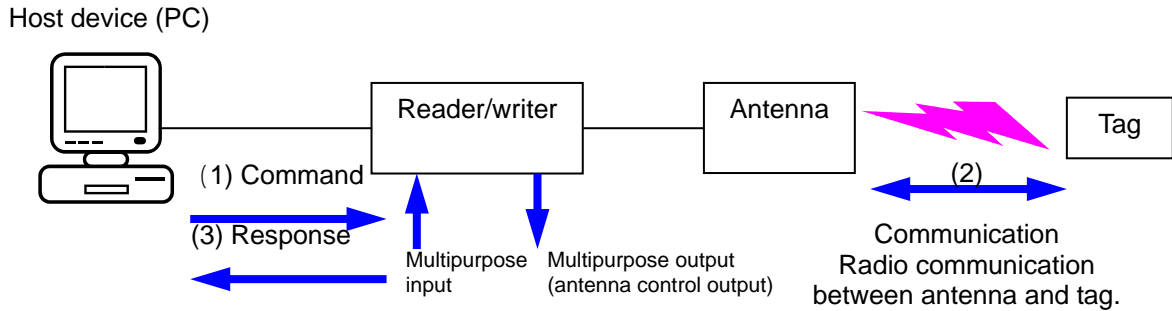
To specify Offline Mode operations (Chip Operation Mode, EAS threshold, OUT1 output time, receiving antenna settings, antenna control settings, I/O automatic changeover, etc.), the mode must be switched to Online Mode.

To switch the Offline Mode to Online Mode, connect the host and execute the Stop Command (ST).

To switch the operation mode at power-ON, disable the mode by the Offline Mode Setting Command (FL).

## 4-1-2 Online Mode

Communication with Tags (2) is performed according to the command (1) from the connected host. The result is returned to the host as a response (3). The I/O can be read or controlled using commands. The input can be used as a command execution trigger, and the output can be used as a result-based control signal for peripherals. Some outputs are exclusively used for antenna control, depending on the settings.



### Command Standby State

The Command Standby State is where the Reader/Writer is not processing but can accept any command other than AK or NK, which are used for ACK/NACK control. When the Reader/Writer accepts a command, it enters the command processing state.

### Command Processing State

When a command is accepted, other commands are ignored until the accepted command has been processed. However, the Stop (ST) and Reset (XZ) Commands are always accepted. When a command that performs continuous processing is executed, the processing state continues until completed or stopped.

The COMM LED is lit (flashed) while communication with the Tags is in progress.

The Reader/Writer enters a special command processing state in the following situations, although it is not actually communicating with the Tags. The COMM LED is not lit in these cases.

- After the commands have been executed in FIFO trigger or FIFO auto mode  
FIFO continuation state where the antenna oscillates continuously: Only the FIFO access commands are accepted.
- After the Tag Detection Command has been executed (I.CODE1 Mode only).  
Selective state where the simplified numbers of Tags are stored, only the Tag specification commands are accepted.

### Normal/abnormal completion of command processes

The NORM LED is turned on when the command from the host has been completed normally, and ERROR LED is turned on if the command has been completed abnormally, for a short period of time at the returning of the response.

#### LED/Output state in each operating status

Operation state	LED state				Output
	RUN	COMM	NORM	ERROR	OUT1
Command standby					(command)*1
Processing with Tags					-
Normal completion of command processing		/ *2			-
Abnormal completion of command processing		/ *2			-

: ON, :OFF, ●: Flashing, - : Unchanged

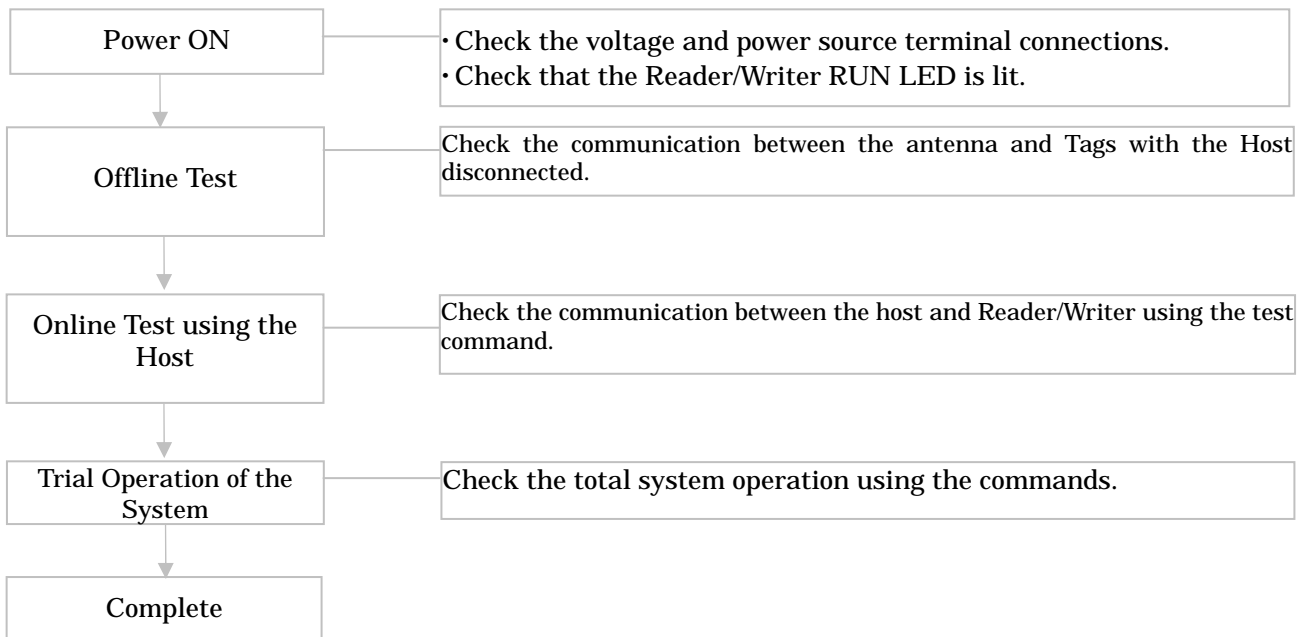
\*1 Specified by I/O Control Command (CC.)

\*2 Stays lit (flashed) when the communication with Tags is continued.

**Checkpoints** Check the following points before starting Trial Operation

No .	Checkpoint	Description	Section-Item
1	Are the power supply and I/O lines connected	Wired properly? Are the terminal screws properly tightened?	SECTION 4-6
2	Antenna connection	Is the Antenna connected properly?	-
3	Connection to the host	Are the RS-232C and RS485 connectors connected properly?	SECTION 4-6
4	Antenna and Tag layout	Are the Antenna and Tag located properly?	Refer to the Instruction Manual for your antenna.

### Procedure for Trial Operation



**Offline test** Offline Mode is set by the Offline Mode Setting Command (FL). The default mode is set for Offline Mode.

By setting the Test Mode, the communications between the Antenna and Tag can be tested without connecting the host. You can exit the Offline Mode by connecting to the host and sending a Stop Command (ST)


**Communication test between the Reader/Writer and the host** By using Test Commands(TS), the communications between the Reader/Writer and host can be tested. This test allows the checking of the cable connection and the processing operation of communications before the trial operation of the whole system. It is recommended that RS-232C be connected to COM2 where the communication condition is fixed.

- Prepare a simple communications program on the host and transmit Test Commands.

- If the communications line is normal, the Reader/Writer returns the data received.

**Trial Operation of the System** Check the operation on the real system using the setting commands under the actual operating conditions defined by the system design. When using COM1, the RS-232C cable connection must be modified.

**NOTE**

 Conduct the test of the final installation positions of both the antenna and Tag after the lapse of standby time (15 minutes). Standby time means the time that elapses after turning the power on to getting the product ready for stable communications

The Reader/Writer has been designed for the user to make all the settings by issuing commands from the host. The user can use either the COM1 or COM2 port to make settings. However, we recommend use of the COM2 port because its communications settings have been fixed at factory to survive a power reset.


In order to fix the information set for the Reader/Writer to survive a power reset, it is necessary for the user to execute the setting write command (EW) (refer to 10) in 5- 7 -14 of Section 5). (This does not apply to the communications settings for the COM2 port).

### 4-3-1 Host Communications Setting (COM Port Setting)

Make settings for host communications by using the communications port setting command (CP)

Setting name (command name)	Port	Default set value	Setting range	Description
Baud rate setting *1 (CP command)	COM1	38400 bps	9600 bps 19200 bps 38400 bps 115200 bps	This command sets the baud rate for use in communications with the host.
	COM2	9600 bps		
Data length setting *1 (CP command)	COM1	7bits	7 bits 8 bits	This command sets the data length for use in communications with the host.
	COM2	7 bits		
Parity bit setting *1 (CP command)	COM1	Even	None Odd Even	This command sets the parity bit for use in communications with the host.
	COM2	Even		
Stop bit setting *1 (CP command)	COM1	2bits	1bit, 2 bits	This command sets the stop bit for use in communications with the host.
	COM2	2 bits		
BCC bit setting *1 (CP command)	COM1	Enabled	Disabled Enabled	This command sets whether the BCC for command frames and response frames for communications with the host will be enabled or disabled. Using the BCC is referred to as "BCC enabled."
	COM2	Enabled		
ACK/NACK setting *1 (CP command)	COM1	No	No Yes	This command sets whether or not ACK/NACK control is performed between the host and the Reader/Writer. If this control is not performed, it is referred to as "no ACK/NACK control."
	COM2	No		
Timeout setting *1 (CP command)	COM1	0.5 sec.	0.5 sec. 5 sec.	This command sets the timeout period for ACK/NACK control. This setting will be meaningless unless this command (ACK/NACK control) is set to ON.
	COM2	0.5 sec.		

#### NOTE

 : (\*1) The communications settings for the COM2 port can also be changed but will return to the Default set values on resetting the power of the Reader/Writer.

## 1) Communications type setting for COM1 port

Set whether COM1 will be used as RS-232C or RS-485 by using the communications type setting command (CT)


Setting name (command name)	Default set value	Setting range
Communications type setting *1 (CT command)	RS-232C	RS-232C RS-485

## 2) Node No. setting

If more than one Reader/Writer is connected to a single host, each Reader/Writer needs an ID number so that the host can discriminate one Reader/Writer from another. Such an ID number is called node number. Each Reader/Writer must be assigned a unique node number. Each command or response includes the node number of the Reader/Writer. Communications will not be possible if the node number is wrong. The setting can be saved by executing the setting write command. Use the node number setting command (NM) to set a node number.

Setting name (command name)	Default set value	Setting range
Node No. setting (NM command)	00	00 ~ 31

**NOTE**

 : Communications through COM2 are possible regardless of the node number setting.

## 3) Terminal resistance setting

This setting is necessary when COM1 is used as RS-485.

If more than one Reader/Writer is connected to a single host, terminal resistance must be turned on for both the host and the Reader/Writer connected to either end of the host in order to ensure stable operation. The setting can be saved by executing the setting write command.

Use the terminal resistance setting command (TM) to set the terminal resistance.

Setting name (command name)	Default set value	Setting range
Terminal resistance setting (TM command)	OFF	ON/OFF

**NOTE**

 : For more information, refer to 4-6-2-2 RS-485 Interface Cabling.

## 4-3-2 Chip Operating Mode Setting

This Reader/Writer consists of 2 types of operating modes (hereinafter called: Operating Mode) in accordance with a type of the Tag (an incorporated IC chip). Both operating modes must be set in accordance with the Tag you choose. Execute the Operating Mode Switch Setting Command (TY).

Setting name (command name)	Default set value	Setting range	Remarks
Operating Mode Switch Setting Command (TY)	ISO Mode [1.20 - ]* I.CODE1 Mode [ - 1.10]	ISO Mode	Conformed to the ISO/IEC15693 standard (I.CODE SLI Chip)
		I.CODE1 Mode	I.CODE1 Chip supported



4-3-3 Command Processing Procedure Setting


1)UID/SNR Addition Setting

For the Read command response in I.CODE1 Mode or the Read/Write command response in ISO Mode, whether to add the UID/SNR (a serial number which is a unique ID given to a Tag) must be selected. When enabled, this command makes association of data contained in a Tag to the serial number of that Tag considerably easier.

Make this setting by using the UID/SNR Addition Command (SN)

Setting name (command name)	Default set value	Setting range
UID/ SNR addition setting(SN command )	Disable (do not add)	Enabled, Disabled

**NOTE**

 Note Using Selective Access in ISO Mode when communicating with specific Tags among the multiple Tags in the communication area is extremely useful, because data reading and UID acquisition can be processed by a single command.

2)Discriminating Access to Tag Setting

The discriminating access to the Tags is set using the AFI (ISO Mode) on the Tags or the Family Code/Application ID (I.CODE1 Mode.) Refer to SECTION 3-5 for the details of the function.

The settings are done using the specific setting command of each operating-mode.

Operating mode	Setting name (command name)	Default set value	Setting range
ISO	Reader/Writer AFI Enable/Disable Changeover (AE Command)	Disabled	Enabled, Disabled
	Reader/Writer AFI Value Setting (AF Command)	00	00 ~ FFh
I.CODE1	Reader/Writer Family Code Setting (FC Command)	00	00 ~ FFh
	Reader/Writer Application ID setting (AI Command)	00	00 ~ FFh

3)Duplicate Communication Protecting Function

In executing the commands with the options that specify the serial processing of multiple Tags (FR, MT, MR, and UR [I.CODE1 Mode]), the function controls the condition so that the Tags with the same UID/SNR are processed only once. This function is enabled by specifying the maximum number for the table of the processed Tags. Refer to SECTION 3-8 for the details of the function. This function is specified by the Duplicate Communication Protecting Function Setting Command (MX.)

Setting name (command name)	Default set value	Setting range
Mask Setting (MX Command)	Disabled	Enabled (The number of tables: 1, 4, 8, 16, 32, 64, 128, 256), Disabled

### 4-3-4 Antenna and Tag Communications Setting

Set how communications should take place between the Reader/Writer and a Tag.

#### 1) Reader/Writer-Tag communications speed setting

Set the speed of communications between the Reader/Writer and a Tag (baud rate from the Reader/Writer to a Tag). The baud rate from a Tag to the Reader/Writer is fixed (26.5kbps).

This setting can be made by using the Tag Communications mode Setting Command (CM).

Setting name (command name)	Default set value	Setting range
Communications speed setting(CM command)	Fast mode	Standard mode
		Fast mode

**NOTE** :The Fast mode, the factory default, is highly recommended because it provides fast transmission speed for normal use. Its communication distance, area, and other performance conditions are same as those in Standard Mode.

#### 2) Receiving antenna setting

This is enabled when using the receiving antenna. The antenna is used for some specific configurations such as those for the gate antennas. Set the function according to the respective antenna operation guide. The function must be disabled for the configurations where the antenna is not used.

This can be done by using the Receiving Antenna Changeover Command (AC).

Setting name (command name)	Default set value	Setting range
Receiving antenna setting (AC command)	Disable (the receiving antenna will not operate)	Enabled, Disabled

#### 3) I/O Automatic Changeover setting

When the I/O Automatic Changeover Function is enabled, the antenna is controlled by the I/O Automatic Changeover (OUT3 and OUT4) for Multiple Repeat (MR) reading, Fast Read Repeat (UR) (I.CODE1 Mode only), and EAS Check Command (EA) This function should only be enabled for antennas requiring the I/O automatic changeover. The function must be disabled for the configurations where the antenna is not used.

The function is set by the I/O Automatic Changeover Setting Command (CA)

Setting name (command name)	Default set value	Setting range
I/O Automatic Changeover Setting Command (CA.)	Disabled (NotAutomatic Changeover setting )	Enabled, Disabled

**NOTE** : The Operation Manual describes what type of antennas require the receiving antenna settings or I/O automatic changeover settings. Follow the respective instructions in setting these functions.

### 4-3-5 Offline Mode Setting

Set whether the Reader/Writer will start in offline mode or online mode. This setting can be made by using the offline mode setting command (FL)

Setting name (command name)	Default set value	Setting range
Offline Mode Setting (FL command)	Enable (offline mode)	Enabled, Disabled
EAS threshold	75%(4Bh) 25%(19h)	0-100% (00h ~ 64h)
OUT1 output time	500 ms (05 h)	100ms-22.5 s (01h ~ FFh)

### 4-3-6 Initialization of settings

If necessary, you can return all the settings to their default set values.

Use the initialize settings command (IS) to return your settings to their default set values

Setting name (command name)
Initialize settings (IS command)

### 4-3-7 Fixing of Settings

By fixing the settings that you have made using various setting commands, you can write them into the EEPROM (nonvolatile memory) so that they will survive a power reset of the Reader/Writer.

Use the EEPROM write command (EW) to fix your setting

Setting name (command name)
EEPROM write (EW command)

### Precautions on setting modifications

The execution of the setting commands only modifies the S-RAM (volatile memory) on the Reader/Writer. The modifications are not reflected immediately; they are reflected only after the Reset Command (XZ) has been executed.

To apply the modified settings at the next startup, fix the settings and reset the power supply. If the settings are not fixed, the modifications will be reset to the original status after the power supply reset. This does not apply to the communication settings for COM2.

If Reset Command (XZ) is executed without fixing the settings, the settings are reset to original status after the power supply reset.

The default mode is Offline mode. To change the settings, the mode must be switched to Online mode. Connect the host and execute Stop Command (ST.)

The V720S-BC5D4 Reader/Writer is a highly reliable control device withstanding tough environments. In order to ensure the full, reliable performance of the RFID system, however, observe the following.

### 4-4-1 Installation

Do not install the Controller under the following conditions.

- The ambient temperature is not within a range between -10 and 50 or there are radical temperature changes resulting in condensation.
- The humidity is not within a range between 35% and 85%.
- There is corrosive gas, flammable gas, dust, salt, or metal powder.
- The Reader/Writer is affected by direct vibration or shock.
- The Reader/Writer is exposed to direct sunlight.
- Oil, or chemical is sprayed onto the Controller.
- Do not install the Reader/Writer close to heaters, transformers, or resistors that radiate excessive heat.
- If power lines or high-tension lines with large currents are located close to the Reader/Writer, be sure to test the Reader/Writer carefully and make sure that wires connected to the Reader/Writer are not affected by the noise of power lines or high-tension lines.

#### Note

Be sure to abide by the above before installing the Reader/Writer and carefully test the Reader/Writer.

Be sure to wire antenna cables separately from other cables. For the antenna cable, be sure to use V720-A41 3.35M or V720-A41 10.33M that is specially designed for this product. Using any other cable may affect adversely the communications performance, waterproof performance, etc.

For wire power and I/O cables as well, wire them separately wherever possible in order to avoid malfunctions.

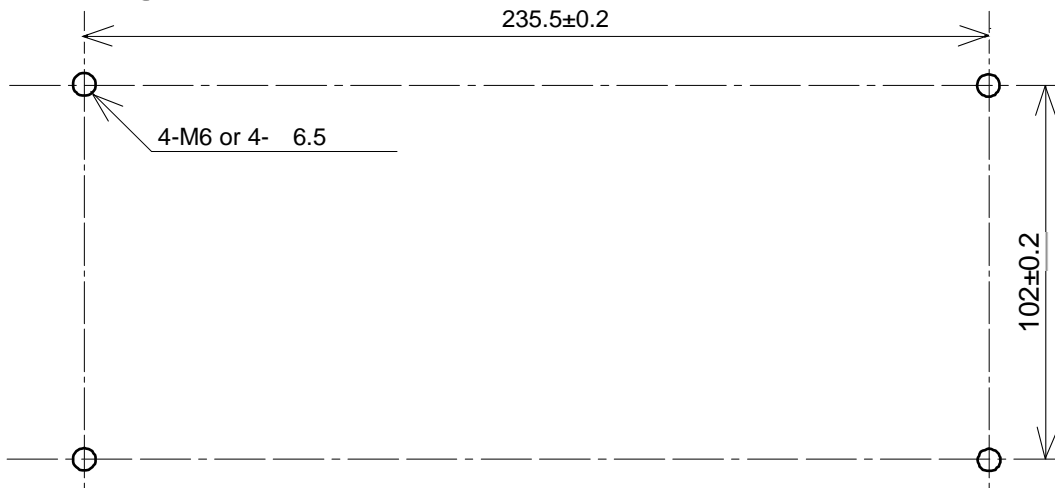
#### Caution

Ensure that a solid (Class D) grounding is established for the "GR" on the Reader/Writer power connector.

The Reader/Writer must be mounted using a mounting plate. When mounting, be sure to secure it onto the mounting plate with M6 screws, spring washers and flat washers.

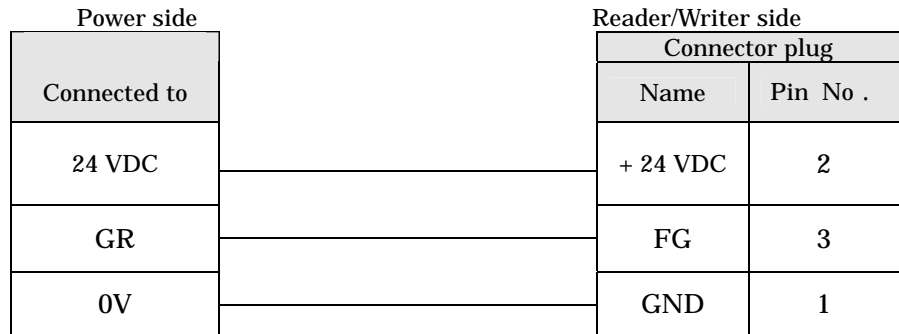
Do not apply organic solvent, e.g., screw lock solvent, to the screws to secure the Reader/Writer. If you do, the Reader/Writer body and the mounting plate may be damaged.

### 4-5-1 Mounting Dimensional Drawing



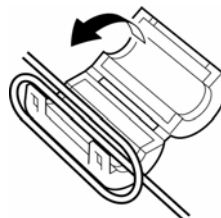
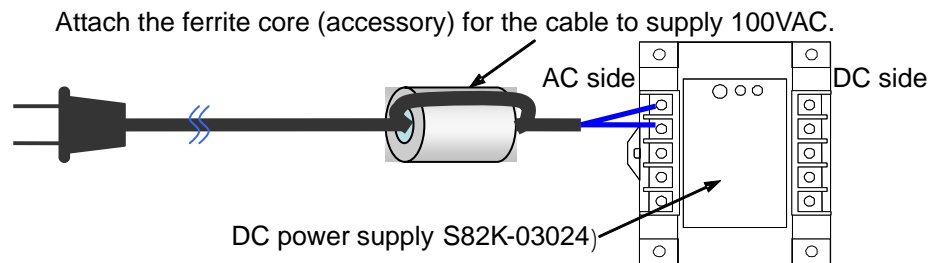
## 4-6-1 Power Supply and Grounding Wires

### Power cable



### Recommended Compact DC Power Supply (OMRON)

Model	Output capacitance	Input voltage
S82K-03024	24VDC at 1.3A	100/200V



How to attach ferrite core:  
 Open the ferrite core. Put the cable inside and roll one time as shown in the figure. Close the core in the direction of the arrow and make sure it locked. Set the core near the DC power supply side.

### Note

Use 24 VDC to supply power to the Reader/Writer. When you use the recommended power supply, S82K-03024, and a cable with a thickness of AWG16, the cable can be extended to 7 meters at maximum. If a longer power wire is desirable, use a power supply with remote sensing function.

The maximum power consumption of the Reader/Writer is 25 W. An inrush current of approximately 30 A at 24 VDC, however, flows when the Reader/Writer is turned ON. Take this into consideration when preparing the power supply.

Provide a power wire with a thickness of AWG16 in order to prevent the dropping of voltage. It is recommended that twisted-pair wire be used for the power line. The thickness of AWG16 is the maximum wire diameter that can be used with the power connector of the Reader/Writer.

Use Class D grounding (previous Class 3 grounding) for the Reader/Writer for improved noise resistance.

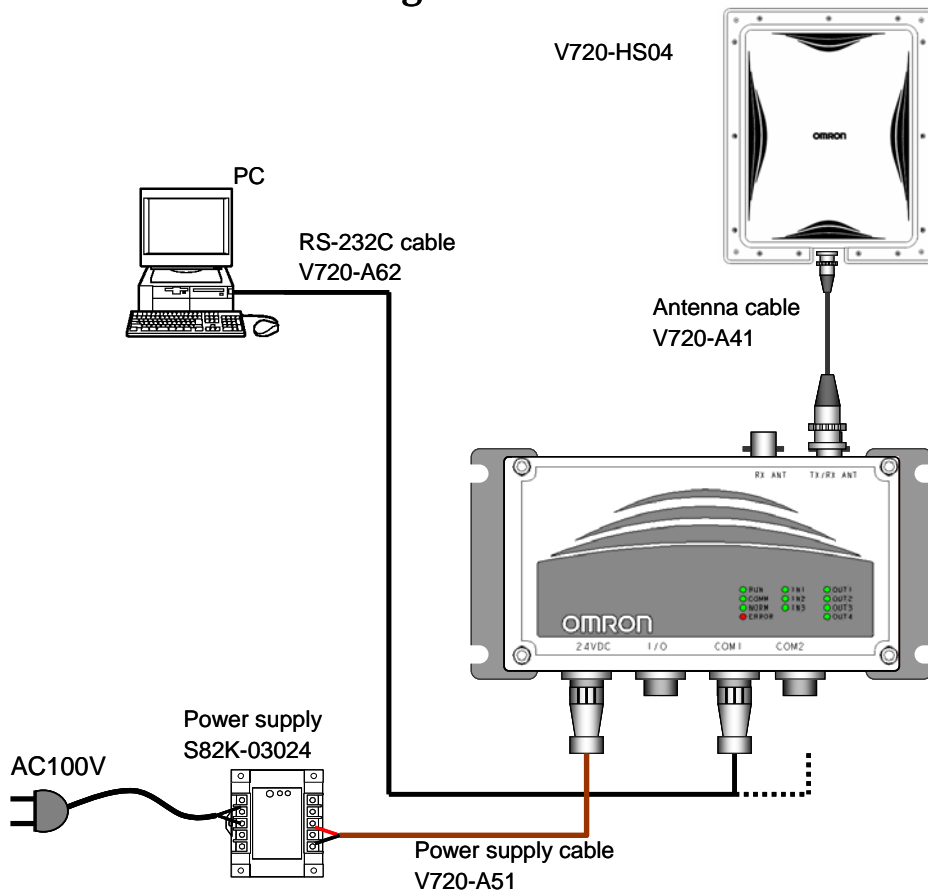
Use the ferrite core enclosed to the Reader/Writer for the 100VAC side of the recommended compact DC power supply S82K-03024.

### ⚠ WARNING

Be sure to connect to a power supply with a maximum power supply capacity of 24V 4.2A (100 W) or less. In case a short-circuit failure should occur within the Reader/Writer, a burnout in the power cable may result.

4-6-2 Host Communications Cabling

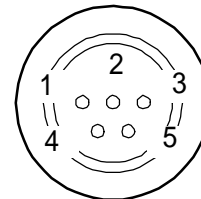
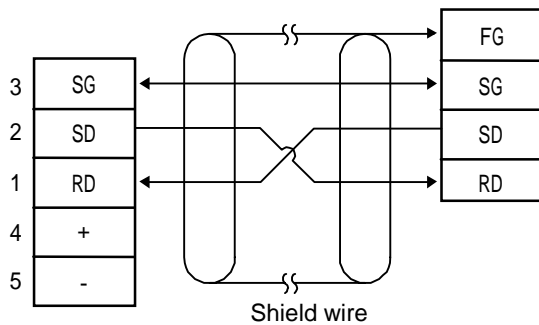
4-6-2-1 RS-232C Interface Cabling



Reader/Writer  
(COM1, COM2)

Host computer

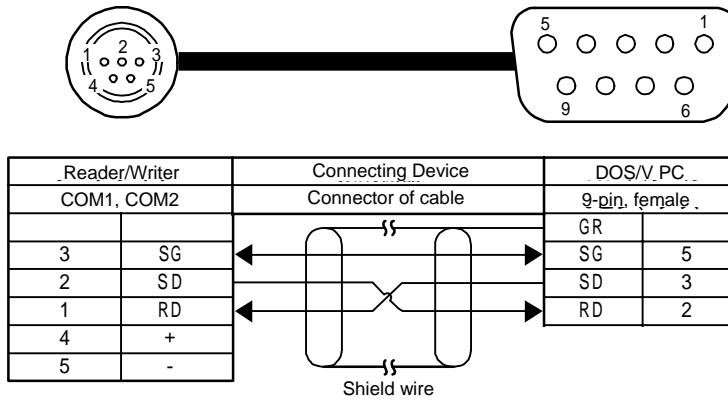
Pin layout when cable connector on  
Reader/Writer is viewed from engaging face



**Caution**

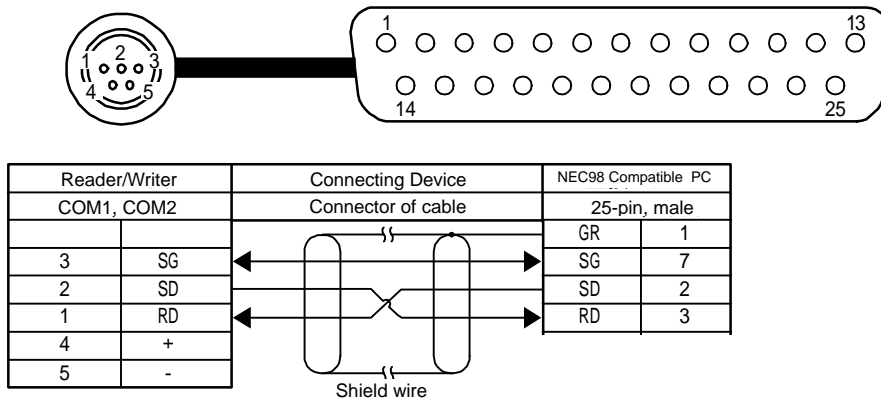
The shield wire must always be grounded on the host side.  
Leave the pin for RS-485 unconnected.  
Cables must not be longer than 15 meters.

## 1) Connection to a DOS/V Host with 9-pin Port (Pin layout when cable connector is viewed from engaging face)

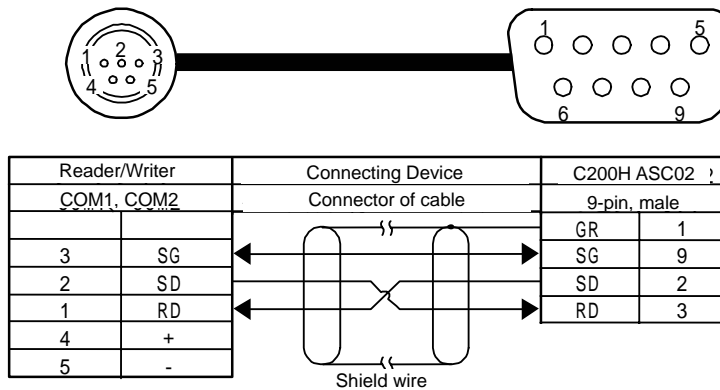


**NOTE** : Connect the shield wire to the connector cover on the PC side.

## 2) Connection to Host through NEC 98 or Compatible Computer, 25-pin Port (Pin layout when cable connector is viewed from engaging face)

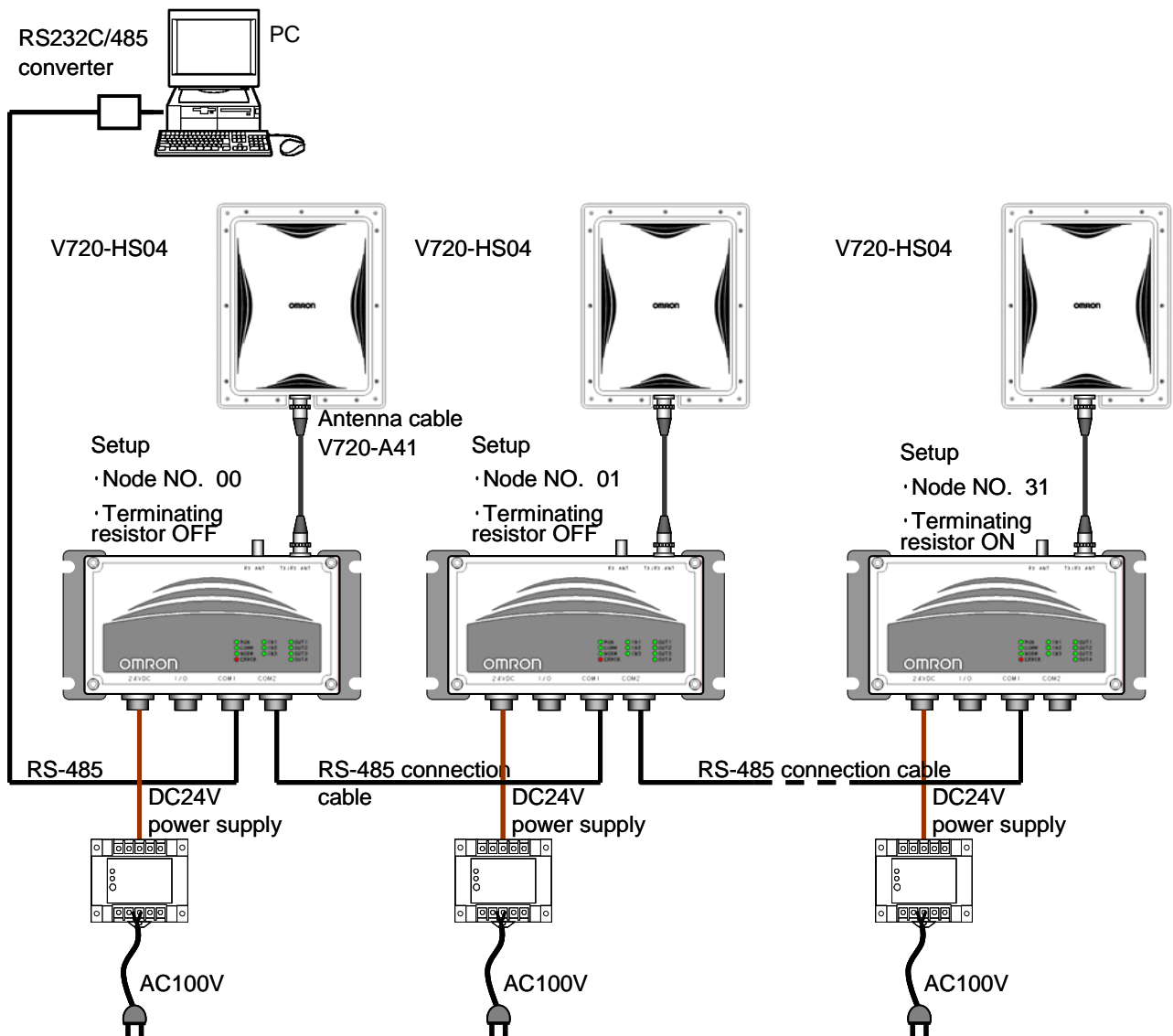


## 3) Connection to OMRON C200H PLC (Pin layout when cable connector is viewed from engaging face)



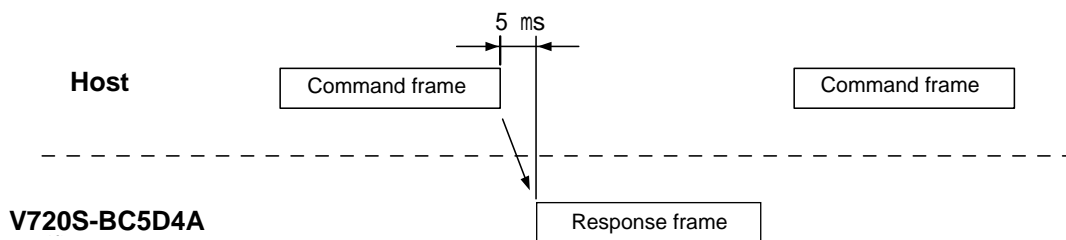


## 4-6-2-2 RS-485 Interface Cabling

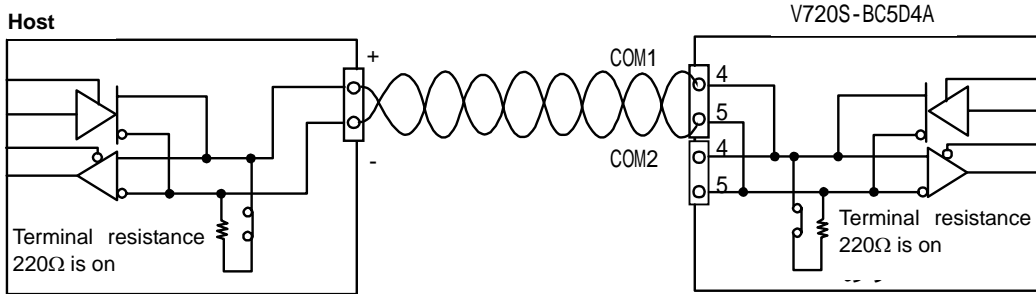


### Note

On the host side, send the following commands after confirming that the Reader/Writer responds normally. Do not begin sending commands until the host is completely ready for transmission. Switch the host to receive mode within 5 ms after completion of transmission of commands. If you fail to do this, the host may not be able to communicate with the Reader/Writer.



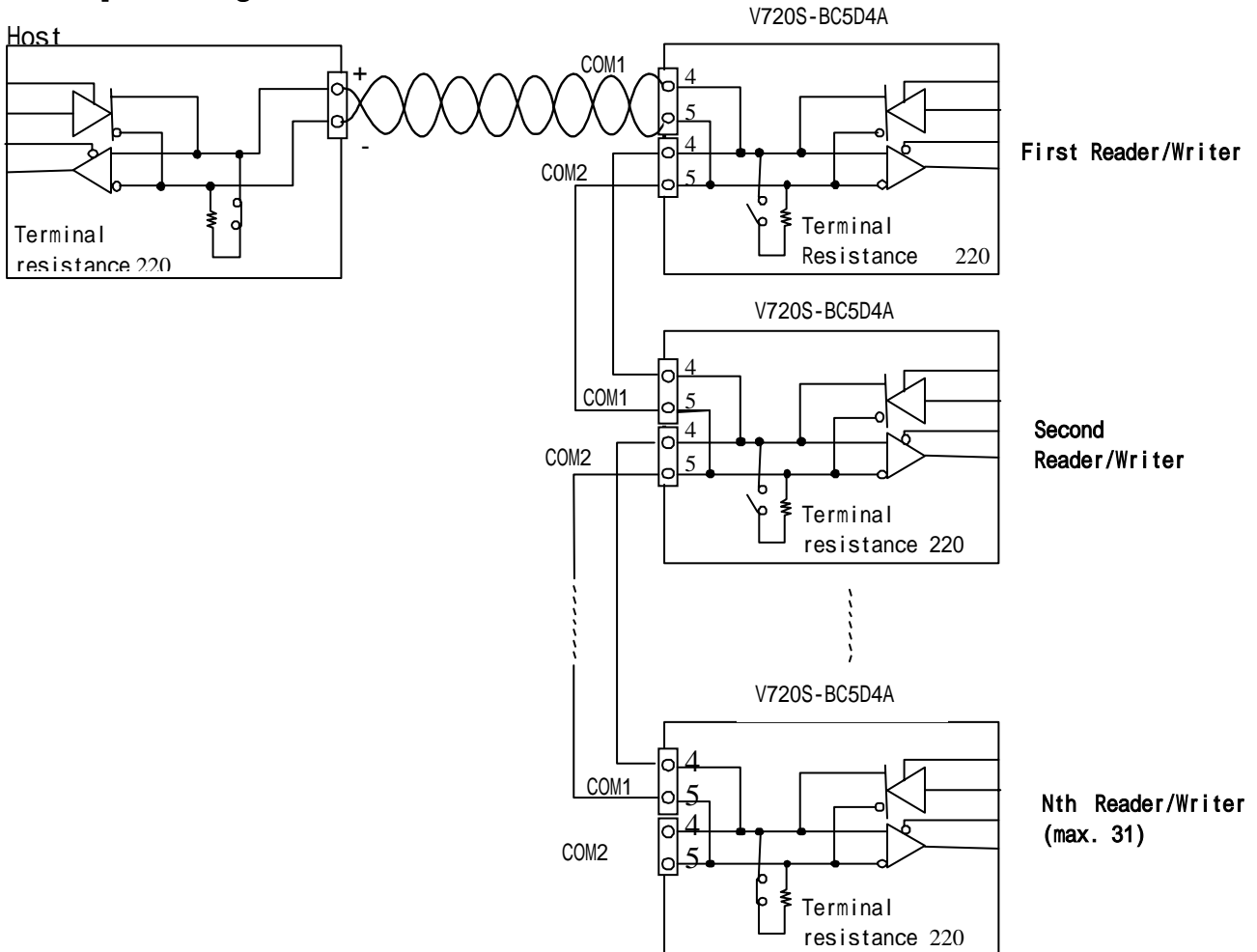
## 1) Example of wiring for 1-to-1 connection



**Note**

Be sure to turn on the terminal resistance on both the host and Reader/Writer sides.

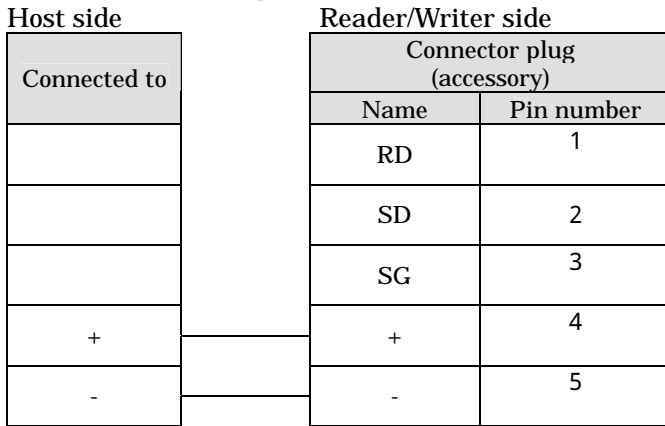
## 2) Example of wiring for 1-to-N connection



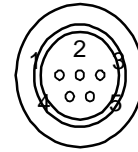
**Terminal resistance setting**

When you connect more than one Reader/Writer, turn on the terminal resistance for the Reader/Writer that is located farthest from the host and the terminal resistance for the host. The terminal resistance for all the other Reader/Writers must be off.

### Example of wiring between host and Reader/Writer



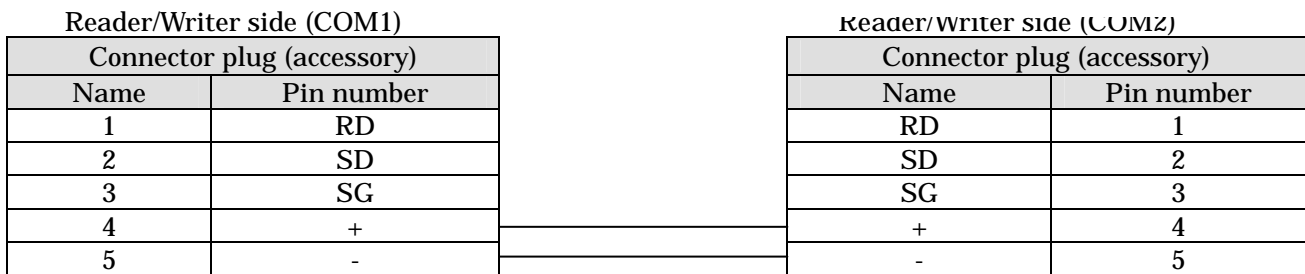
Pin layout when cable connector on Reader/Writer is viewed from engaging face



Port	COM1		COM2	
Terminal No.	4	5	4	5
Polarity.	+	-	+	-

\* Short circuits have been established within RS-485 between Pin 4 of COM1 and Pin 4 of COM 2 and between Pin 5 of COM2 and Pin 5 of COM1.

### Example of cabling between Reader/Writers



### Note

- Leave the pin for RS-232 unconnected.
- Be sure to use a twisted-pair wire for the signal line.
- Be sure to use a wire with a thickness of AWG20 for the signal line.
- When you use a shielded cable, be sure to ground on the host side.
- Make sure that the total cable length for 1-to-1 and 1-to-N connection is not longer than 300 m.

### Note

When you connect more than one Reader/Writer, give special attention to communications timing between Reader/Writers. To ensure proper timing, you will need to perform both theoretical calculation of timing and verification of communications on real machines.

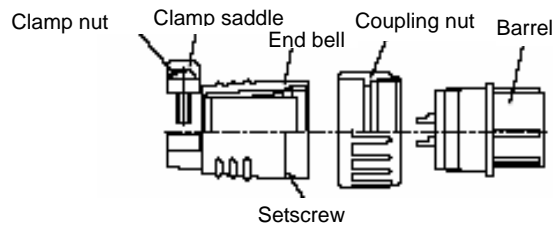
- 1) The Reader/Writers cannot operate simultaneously except through polling-related commands. This means that, even when you connect more than one Reader/Writer, only one Reader/Writer can communicate with the host at a time. Multiple Reader/Writers can access the host only in a time-phased manner.
- 2) When you use an Auto command, the Reader/Writer will not return a response but continue to wait if there are no Tags in the communications area. In this state, if you send a command to another Reader/Writer, no command will be accepted until a response is returned. To avoid this, you must abort the Auto command using the STOP command before sending any command.
- 3) Polling-related commands do not support any commands but Auto commands. These commands are not available in Multiple Access Mode (which permits access to multiple Tags) to avoid processing complexities.

## 4-6-3 Assembly of Connector

### 4-6-3-1 Assembly of Host Communications Connector and I/O Connector

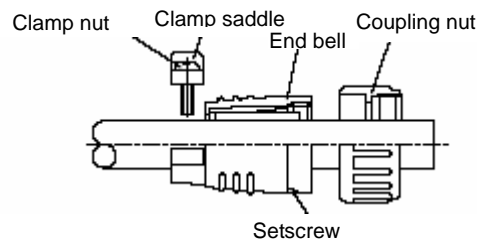
1) Disassemble the connector as follows:

- (1) Loosen the set screw and remove the barrel from the end bell (by turning it counterclockwise).
- (2) Loosen the clamp screw, remove the clamp saddle from the end bell.

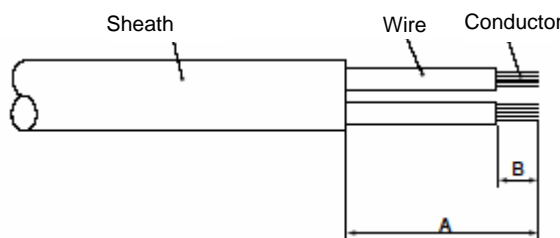


2) Draw the cable through the disassembled parts in the order shown below.

- Make sure that the parts are in the correct order and orientation.



3) Strip a part of the sheath and insulator of each cable to be used according to the measurements specified in the table below.



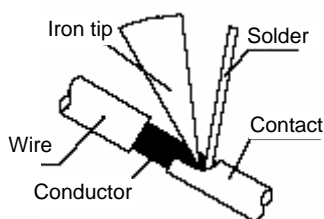
• Cable terminal treatment measurement table

Usage	Connector name	Mesurement A (mm)	Mesurement B (mm)	Conductor cross-sectional area (mm <sup>2</sup> )	Iron tip temperature(%)
Host communications/IO	NJC-165 - PF, PM, A d F	16	3.2	0.5	280
Power supply	NJC-2010 - PF, PM, A d F	18			350

4) Pre-solder the conductors complete with terminal treatment.

**NOTE** :

- Be careful not to pre-solder the cable cladding.
- When finished, the pre-soldered part should be smaller in diameter than the contact hole and have no uneven portion on the entire surface.



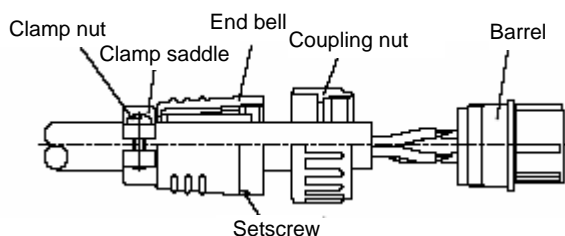
### 5) Soldering

- (1) Insert the pre-soldered wire into the solder pot of the contact.
- (2) Heat the contact and the conductors with a soldering iron.
- (3) Pour solder to fill the opening between the contact and the conductors.

Soldering iron to use	Conductor cross-sectional area (mm <sup>2</sup> )
30W	0.5

### 6) Reassemble the connector as follows.

- (1) Put the coupling nut with directing its thread to the connecting side over the barrel.
- (2) Screw the end bell and torque it to the specified values.
- (3) Tighten the setscrew to the specified torque value.
- (4) Tighten the clamp nut to the specified torques value and attach the clamp saddle to the end bell.



• Tightening torque for screws

Unit:N•m

End bell	1.0 - 1.5
Clamp nut	0.4 - 0.6
Set Screw	0.2 - 0.3

## Connector models

Model name of connector plug for host communications: NJC-165-PM from Nanaboshi Electric Mfg. Co., Ltd.  
 Model name of I/O connector plug: NJC-2010-PM from Nanaboshi Electric Mfg. Co., Ltd.

Before use, be sure to check for the proper torques of the cable of your choice. OMRON does not offer any guarantee for customer-made cables. Please inquire to the manufacturer for details of these connectors.

# SECTION 5

## Control from Host

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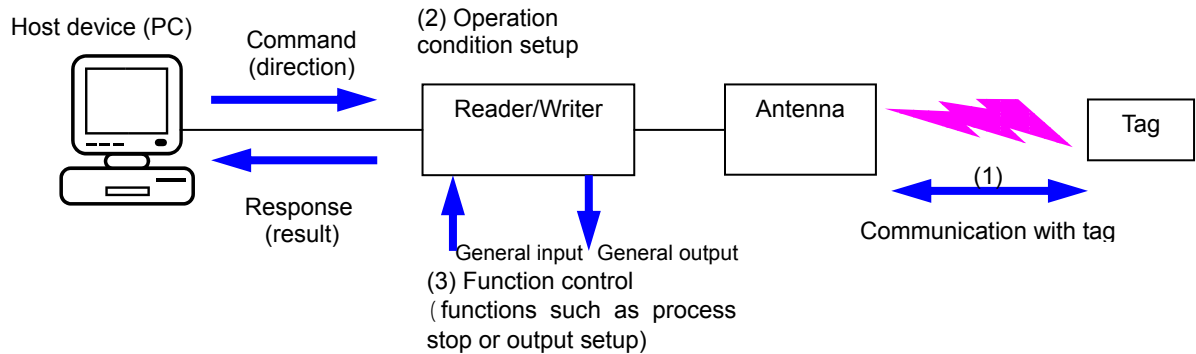
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5-1-1 Control by Commands

The Reader/Writer operation is controlled by the commands from the connected host. The result of the command execution is returned as a response.

In Online Mode, all the operations, such as Tag-data Reading/Writing, Tag-function setting, operating condition setting, or Reader/Writer function control, are controlled by the commands.

In Offline Mode, the Reader/Writer functions controlled by the commands are restricted to those controlled by Stop and Reset commands. The operating conditions for Offline Mode are set in Online Mode.

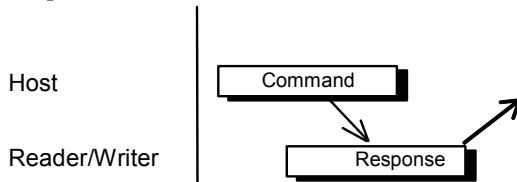


5-1-2 Command-Response Flow

In Online Mode, the host sends an instruction command and the Reader/Writer returns the result as a response. The command-response flows vary, depending on the types of commands and specified communications, as shown below.

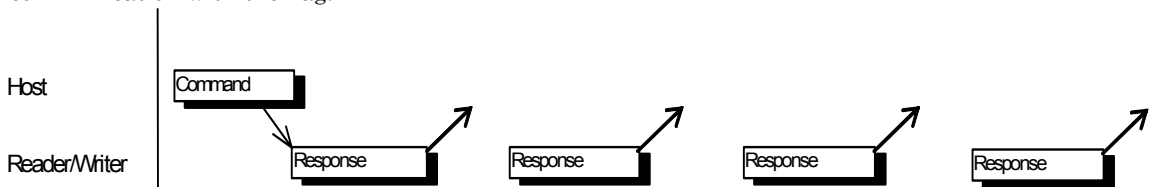
1-to-1 Response

One response is returned per command for Single Trigger (ST), Single Auto (SA), FIFO Trigger (FT), FIFO Auto (FA), UID Select (SL), or Tag Designation is specified for the command that performs the communication with the Tag, or when a command that does not perform the communication with the Tag is specified.



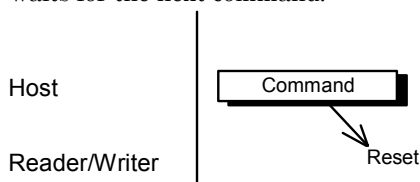
Multiple Response

Multiple Responses are returned per command for Single Repeat (SR), FIFO Repeat (FR), Multiple Trigger (MT), Multiple Repeat (MR), or Tag Detection (LT) is specified for the command that performs the communication with the Tag.



No response

When the Reader/Writer receives the Reset Command(XZ), it is reset without returning a response and waits for the next command.





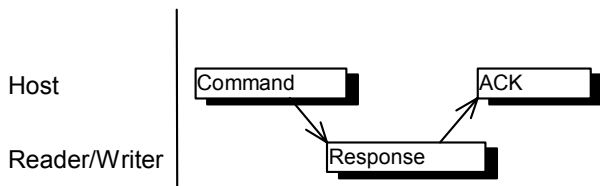
### 5-1-3 ACK/NACK Control

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

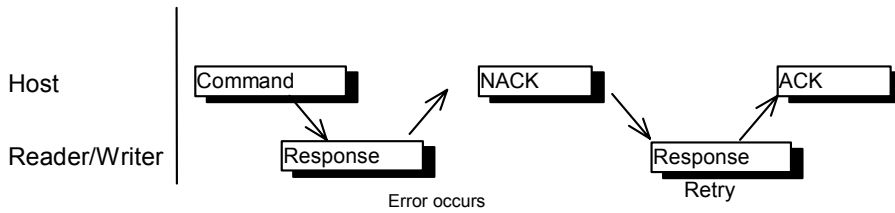
#### Using ACK/NACK Control

If the host receives a normal response, it sends an ACK command to the Reader/Writer. The Reader/Writer judges that the host has received a normal response, and enters a command-waiting state. If, after the Reader/Writer has sent the response, an ACK is not received normally within the time set using the time out setting, or a NACK is received, the Retry Flag is set and the last response is sent again. The maximum number of response retries that can be made is nine.

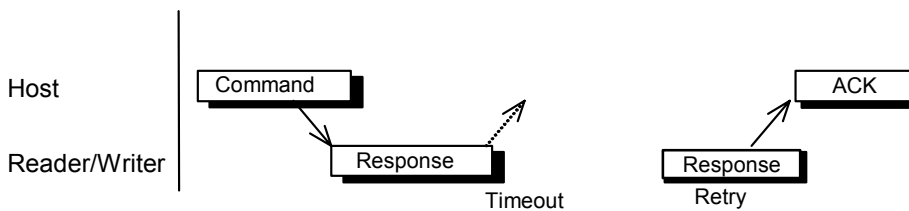
#### Host Receives a Normal Response and Sends ACK Command



#### Host Cannot Receive a Normal Response and Sends a NACK Command



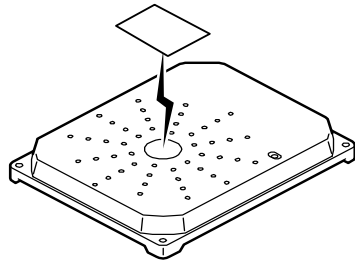
#### Host Did Not Send an ACK/NACK Command within the Timeout Period



The operating sequences including the communication with the Tag or timing for returning the response vary, depending on the communication mode. The communication mode is set by specifying the communication mode in the command data. The access and mode specified as the communication settings must be those specifiable for each Tag status in the specified antenna's communication area or the connection topology with the host. This section describes these access and mode settings.

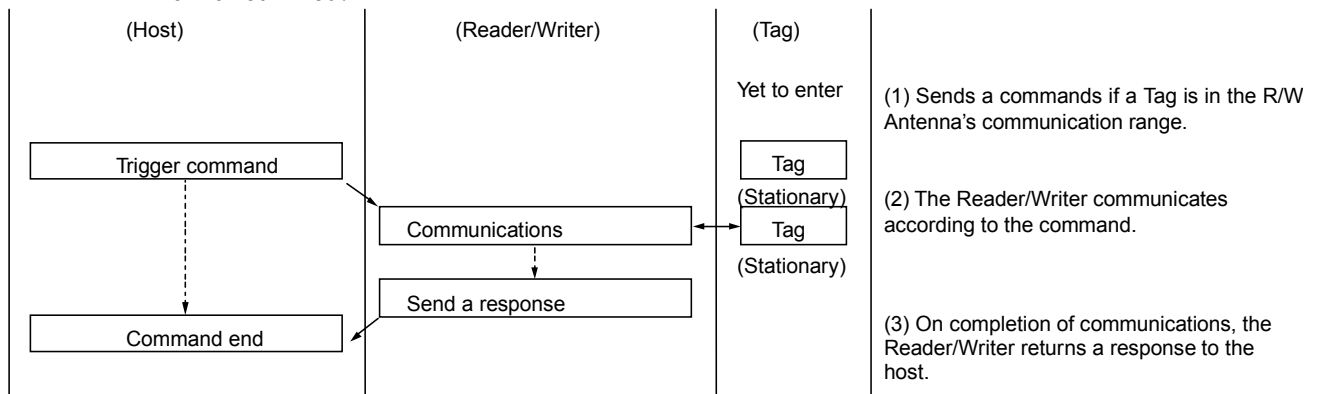
## 5-2-1 Single Access

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



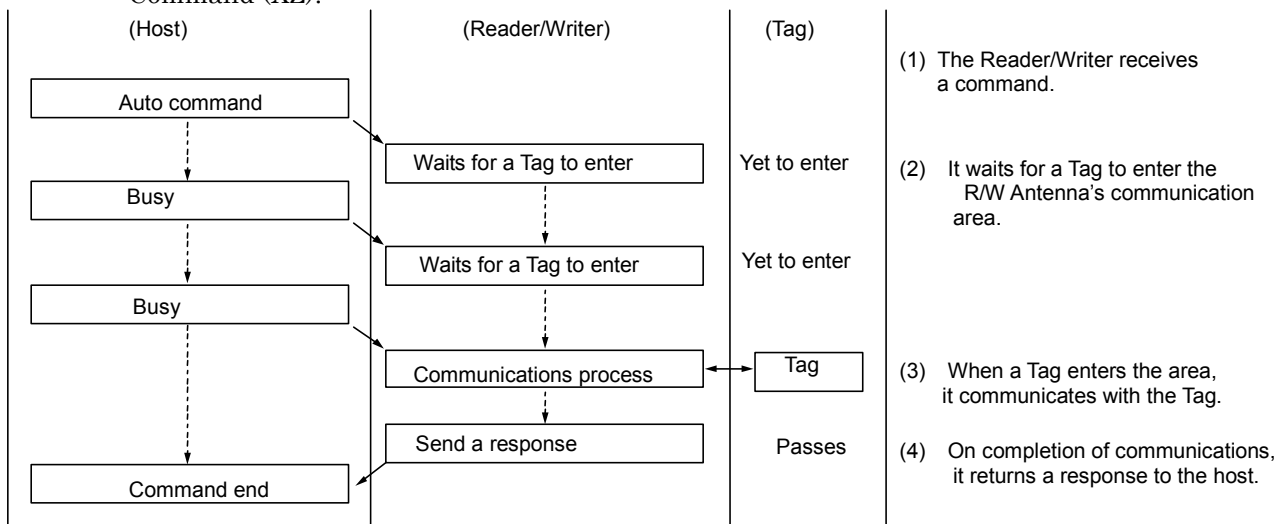
### 5-2-1-1 Single Trigger mode

Single Trigger mode is used when a single Tag is present in a resting condition in the antenna communication area. If the Tag does not exist in the antenna communication area, No Tag Error is returned.



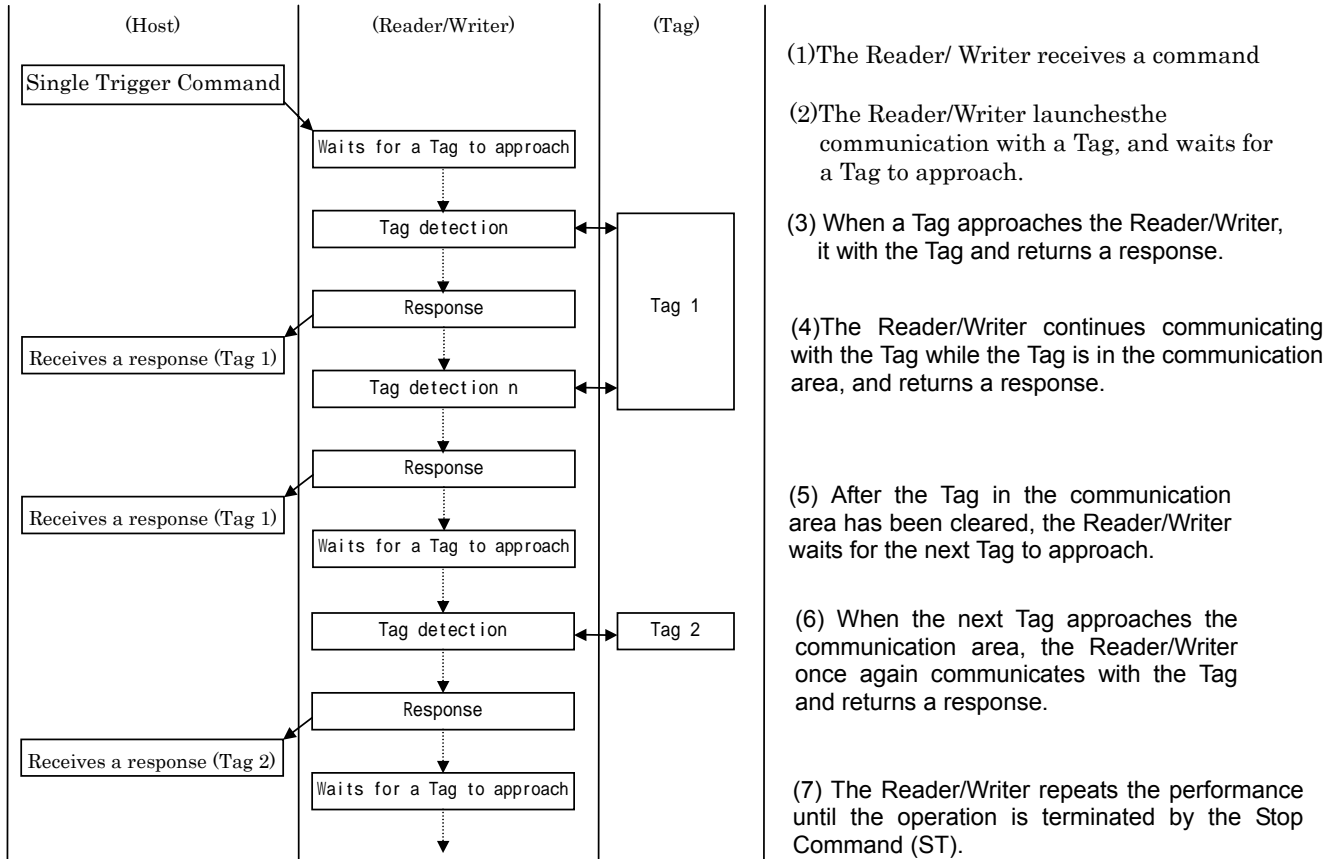
### 5-2-1-2 Single Auto Mode

The Reader/Writer waits until the Tag has entered the antenna communication area and executes the command it received from the host. When the Reader/Writer receives Auto Command, it enters the busy state until the communication with the Tag has been completed, during which it does not accept any commands other than Stop Command (ST) and Reset Command (XZ).



5-2-1-3 Single Repeat Mode: ISO Mode

The Reader/Writer waits for a Tag to enter the R/W Antenna’s communications area. Every time a Tag enters the communications area, the Reader/Writer communicates with the Tag and returns a response. It is not until communications are stopped by the Stop(ST) or Reset(XZ) command that the Reader/Writer accepts the next command.



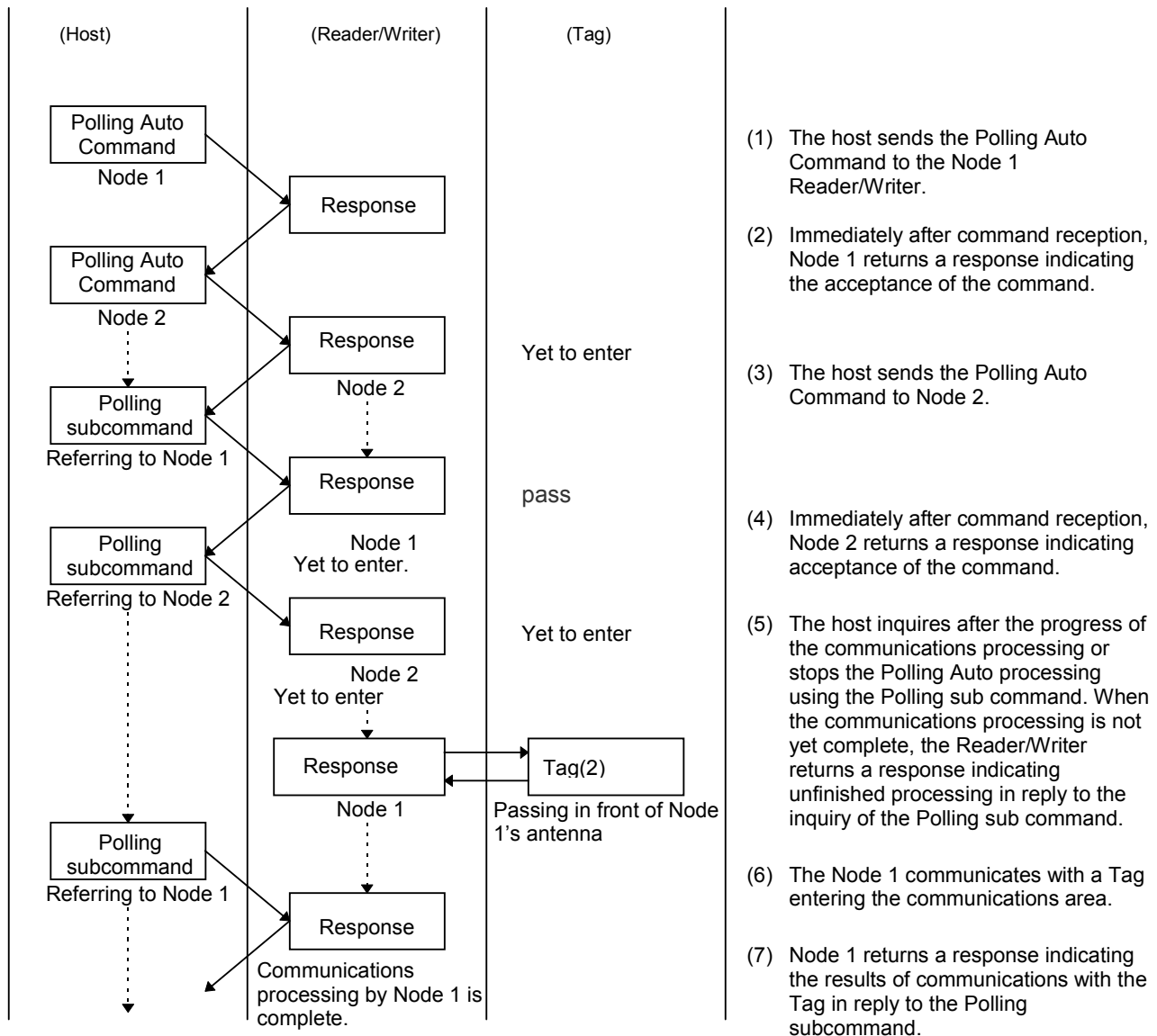
**Operation in I.CODE1 mode**

Do not operate the function in I.CODE1 mode. If a function equivalent to ISO mode, i.e., a function that always returns a response, is required for the area confirmation and other purposes, a single command (Tag code = 0) by Fast Read Access should be used.

(If the function is executed in I.CODE1 mode, the Reader/Writer will perform the process only once at the Tag’s entry to the communication area and return a response. Multiple Tags in the communication area may result in a response with abnormal read data).

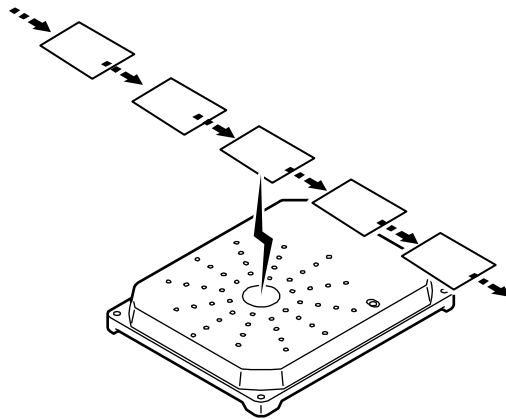
5-2-1-4 Polling Auto Read

If an Auto command is used when a single host controls more than one Reader/Writer, the communications path between the host and one of the Reader/Writers to which the command is sent becomes busy, disabling the host to control other Reader/Writers. On the other hand, when a Polling Auto command is sent instead, the Reader/Writer returns a response according to the request from the host. The communications line with the host will not remain busy, allowing the host to send a command to other Reader/Writers. When Polling Auto command is executing, the only commands accepted and executed are Polling Check (PC), Polling End (PE), Reset Command (XZ), and Stop Command (ST). An example of Polling Auto Command executed for two Reader/Writer devices are shown below.



5-2-2 FIFO Access

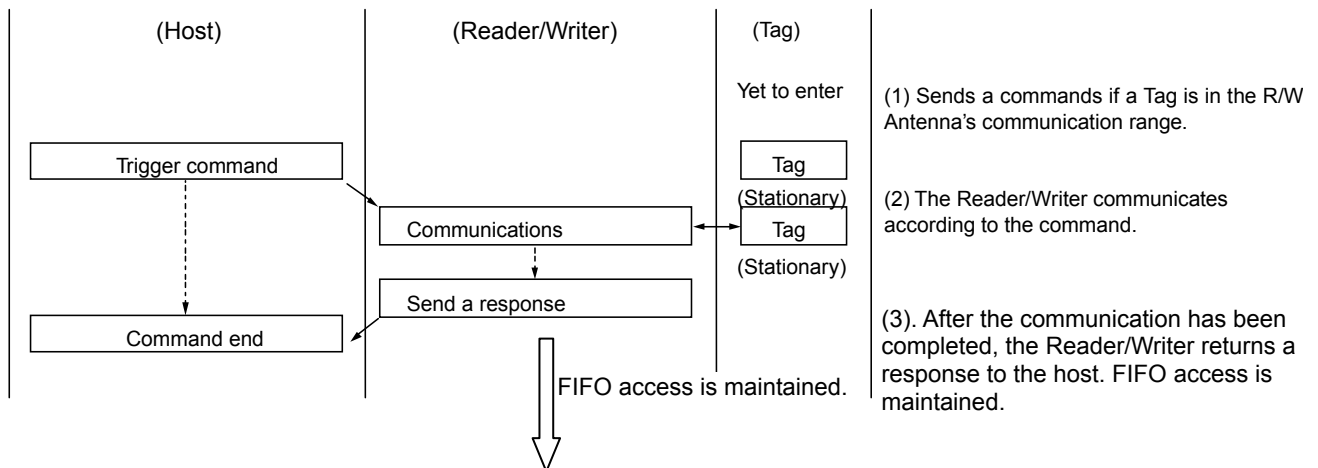
In FIFO (first-in, first-out) access, communications with Tags entering the communications area one after another are carried out in sequence. Once communications with Tags are completed, access to them is prohibited. Consequently, even if Tags with which communications are already completed exist in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



5-2-2-1 FIFO Trigger Mode

FIFO Trigger Mode is used for communications when the Tag is present in a resting condition in the antenna communication area. The Reader/Writer prohibits access to the Tag after the communication has been completed, and keeps the antenna oscillated to maintain the FIFO access. Under such conditions, the Reader/Writer can issue another FIFO command and communicate with the next Tag that enters the communication area, where the previous Tag with which the communication has been completed is still present. (The commands other than FIFO Access are rejected).

When there are no accessible Tags in the antenna communication area, the No Tag Error is returned. To exit the FIFO state, execute Stop Command (ST).

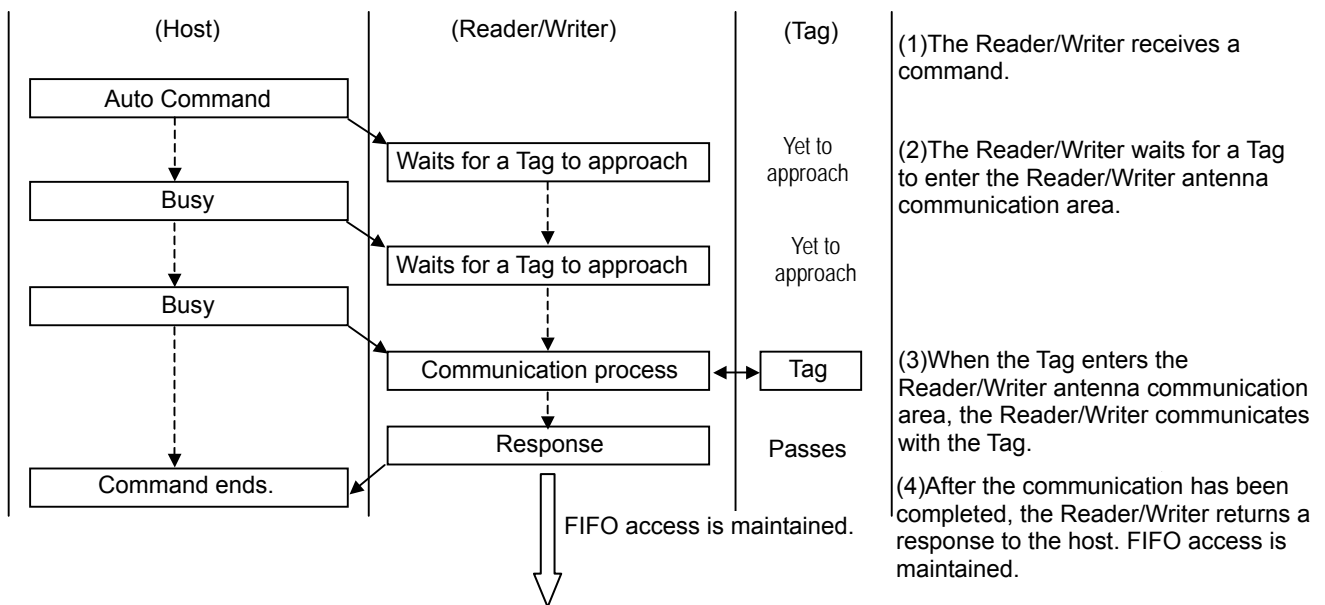


**Note:**  
Before entering Trigger mode, make sure the Tag is in a resting condition in the antenna communication area.

5-2-2-2 FIFO Auto Mode

The Reader/Writer waits until the Tag has entered the antenna communication area and executes the command it received from the host. The Reader/Writer prohibits access to the Tag after the communication has been completed, and keeps the antenna oscillated to maintain the FIFO access. Under such conditions, the Reader/Writer can issue another FIFO command and communicate with the next Tag that entered the communication area where the previous Tag with which the communication has been completed is still present. (The commands other than FIFO Access are rejected).

When the Reader/Writer receives Auto Command, it enters the busy state until the communication with the Tag has been completed, during which it does not accept any commands other than Stop Command (ST) and Reset Command (XZ). To exit the FIFO state, execute Stop Command (ST).



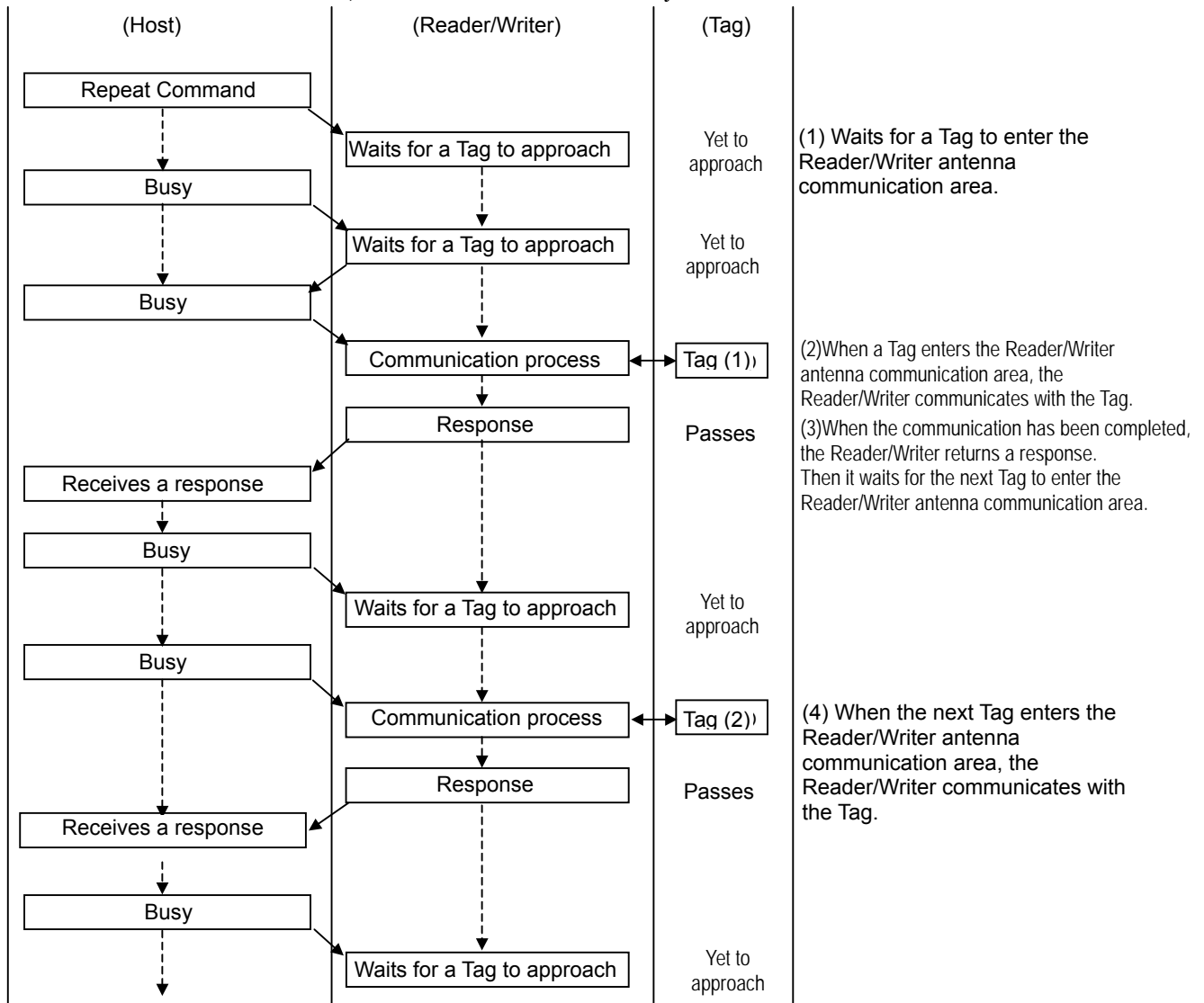
**Note:**

Note, that in Auto mode, the communication path between the Reader/Writer and the host are busy until the Tag is close to the area; the host cannot send the next command under such conditions.

5-2-2-3 FIFO Repeat Mode

The Reader/Writer waits until the Tag has entered the antenna communication area and starts communicating. It communicates with the Tags serially as they enter the antenna communication area, and returns the responses. When the communication has been completed, the Reader/Writer makes the Tag inaccessible, so that it can communicate with the next Tag that entered the area although the Tags with which the Reader/Writer has completed the communication are still present in the same area.

This state continues until the communication has been terminated by Stop Command (ST), or Reset Command (XZ), and other commands are rejected.



When the Tag is on the boundary of the communication area or enters the communication area more than once because of swing, the Tag may be processed more than once, or some Tags may not be processed.

In this case, enable the Duplicate Communication Protecting Function (Table number = 1). The function will prevent the Reader/Writer from communicating with the Tags already communicated with, and allows proper and sequential Tag processing. [ Software Ver 1.20 and higher only ]

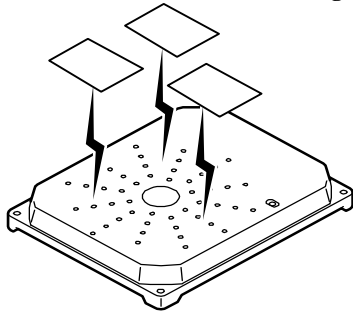
**Note**

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

### 5-2-3 Multiple Access

In Multiple Access, the Reader/Writer can communicate with all of the multiple Tags present in the antenna communication area. In I.CODE1 Mode, the Tag code corresponding to the number of Tags present in the communication area must be specified. For the Tag number specifications, refer to SECTION 5-2-5.

When the Tag is on the boundary of the communication area or enters the communication area more than once because of swing, the normal operation may be interrupted because the Tags are processed more than once. In this case, it is recommended that UID/SNR addition setting be enabled to evaluate the Tags on the host side. In addition, one processing per Tag is available by enabling the Duplicate Communication Protecting Function. For Duplicate Communication Protecting Function,, refer to SECTION 3-8.

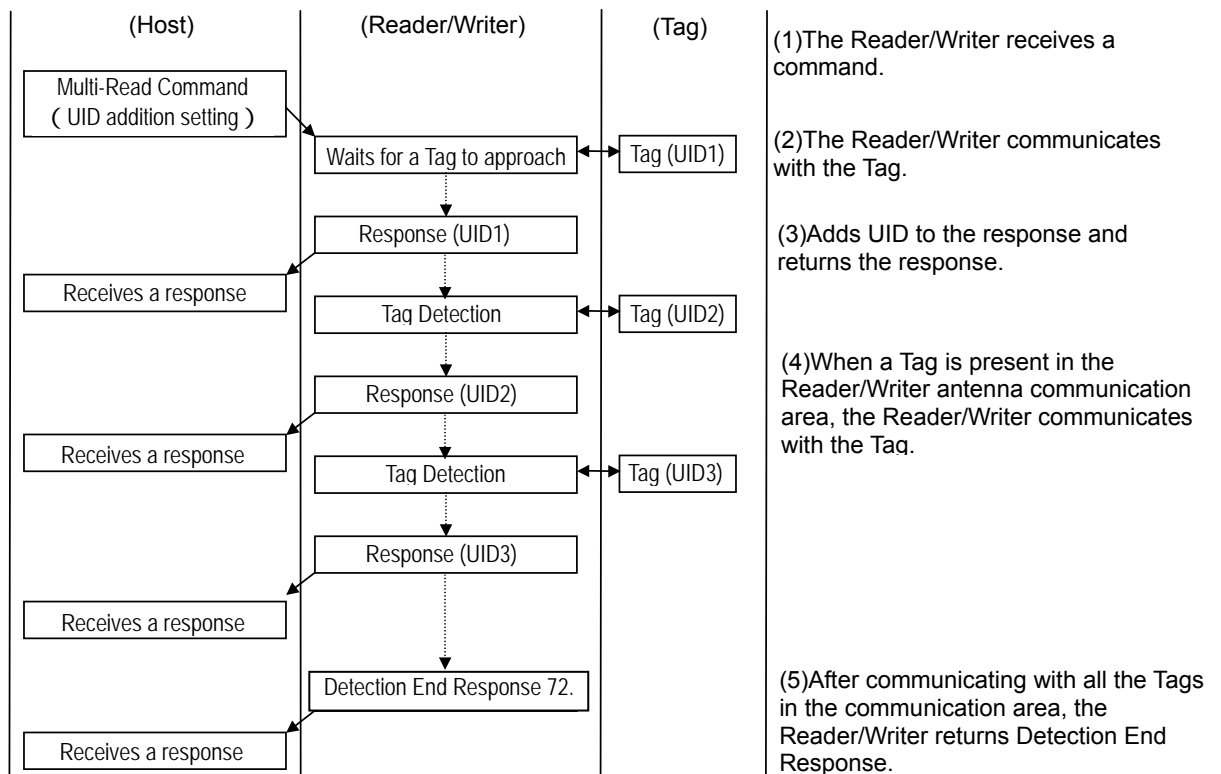


#### 5-2-3-1 Multiple Trigger Mode

**Read Command (RD)**

**Write Command (WT) with UID/SNR addition setting enabled (Excluding I.CODE1 Mode).**

At the reception of the command, the Reader/Writer communicates with all the Tags in the communication area and returns communication results with each Tag, as responses. After communicating with all the Tags, it returns Detection End Response (Response Code: 72). When no Tag is present in the communication area, it returns to Detection End Response (Response Code: 72).

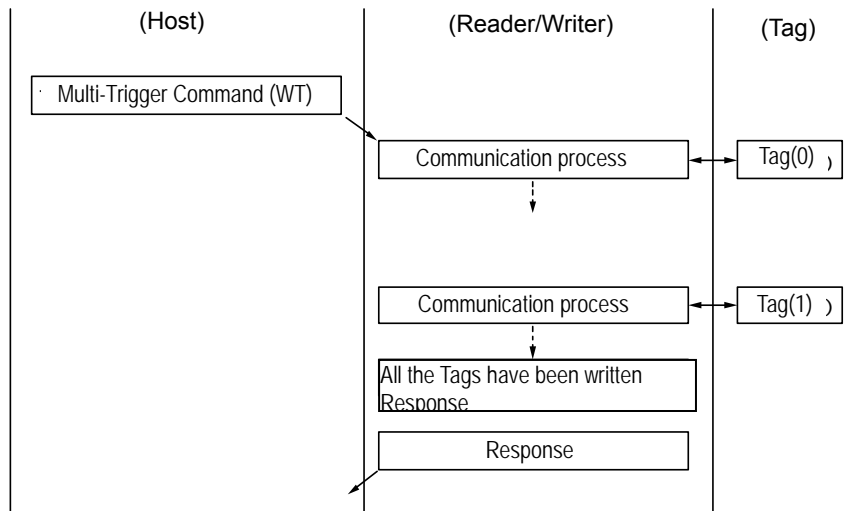


In I.CODE1 Mode, when the Reader/Writer could not communicate with all of the detected tags or when it detected non-processable Tags during the processing sequence, it returns a warning code (Code: 0 ) as Response Code. (Refer to SECTION 5-3-7-2).



**In Write Command (WT) with UID/SNR addition setting disabled (in I.CODE1 Mode, the command with UID/SNR addition setting eabled is also covered),**

the Reader/Writer communicates with all the Tags in the communication area on receiving the command, and returns the results of the communications with each tag as a response. At the completion of communicating with all the Tags, it returns Detection End Response (Response Code: 00) once. The number of Tags with which the communication has been normally completed is added to Detection End Response. When no Tag is present in the communication area, it returns Detection End Response (Response Code: 72).



In ISO Mode, if the communication with the detected Tag failed, the Reader/Writer returns an error response immediately and moves on to process another Tag. At the completion of communicating with all the detected Tags, it returns the Detection End Response and terminates the command processing.

In I.CODE1 Mode, the Response Code is set to 00 only after the communications with all the detected Tags have been completed successfully. When the number of Tags detected exceeds the number specified by the Tag code in command data, the Response Code is replaced with a warning code (Code: 0 ), (Refer to SECTION 5-3-7).

If data writing process in even one Tag has failed, the Reader/Writer returns to Write Process Error (Response code: 71), and terminates the command processing.

**Note:**

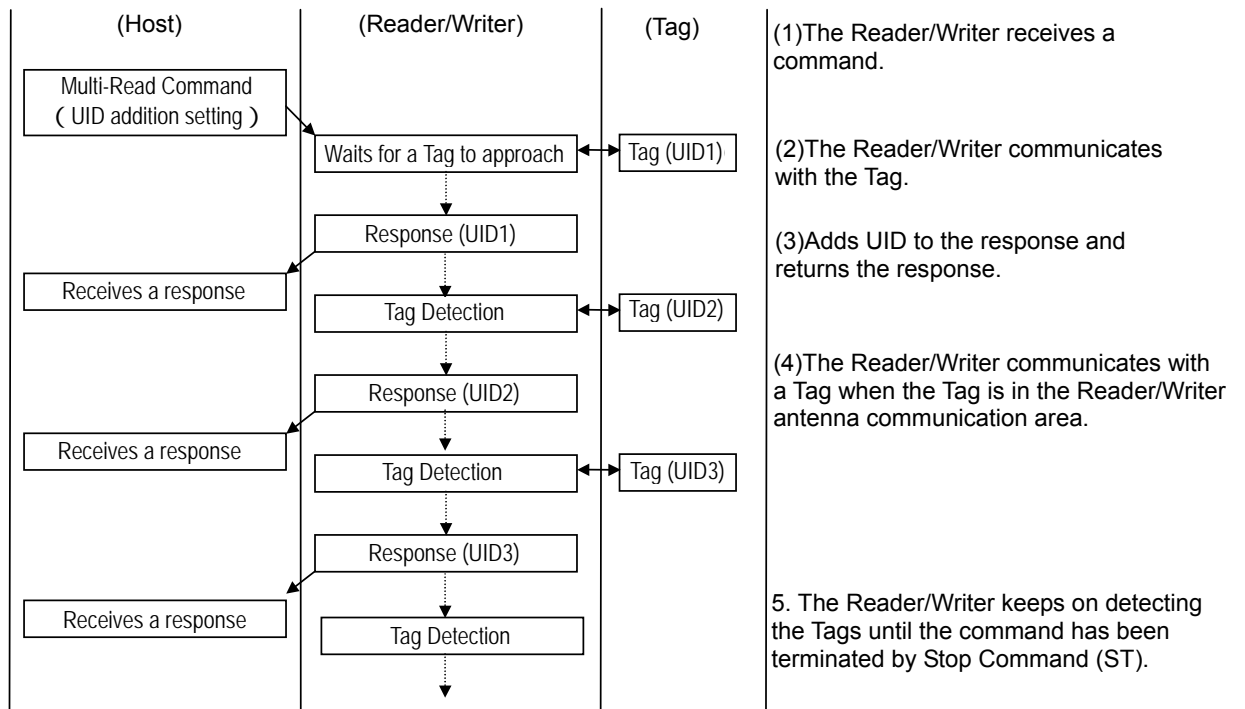
In processing Multi-Trigger Command, some Tags may not be processed due to their conditions (including the distances between the antenna and Tag, or those between the Tag and another Tag). The operating system must be configured to check the number of processed Tags based on the number of returned responses or normally processed Tags, and match them against the actual number of the Tags.

5-2-3-2 Multiple Repeat Mode

Read Command (RD)

Write Command (WT) with UID/SNR addition setting enabled (Excluding I.CODE1 Mode).

The Reader/Writer continues to return a response every time it has communicated with a Tag in the communication area. This operation continues until the Stop Command (ST) or Reset Command (XZ) has been executed. Other commands are rejected in this state.



Write Command (WT) with UID/SNR addition setting disabled (In I.CODE1 Mode, the command with UID/SNR addition setting enabled is also covered).

In this case, do not execute the commands in Multiple Repeat Mode. Basically, the operation in Multiple Trigger Mode is performed repeatedly.

However, the operation may become highly complicated, depending on the Tag status.

### 5-2-4 Selective Access

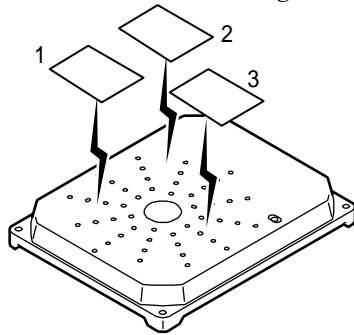
Selective Access is a function to communicate with the specified Tags among multiple Tags in the antenna communication area. The processes vary depending on the Reader/Writer's mode.

#### 5-2-4-1 ISO Mode

First, the Reader/Writer reads out the UID of the Tag in the communication area using Read Command (in multiple processing modes). The UID is readable when UID/SNR addition setting option is enabled in advance using the respective command (SN). When the UID is already identified, the execution of Read Command can be skipped. Then, the Reader/Writer communicates with the specified Tag based on the obtained UID.

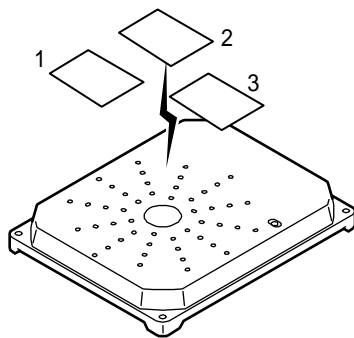
**(1) The Reader/Writer reads the UID of the Tag using Read Command.**

It reads out UID data of the Tag by executing a Multiple Trigger Mode command with its UID/SNR addition setting enabled.



**(2) The Reader/Writer communicates with the specified Tag (No. 2 in the figure below) by specifying the UID obtained in 1 using UID Select Read/Write command.**

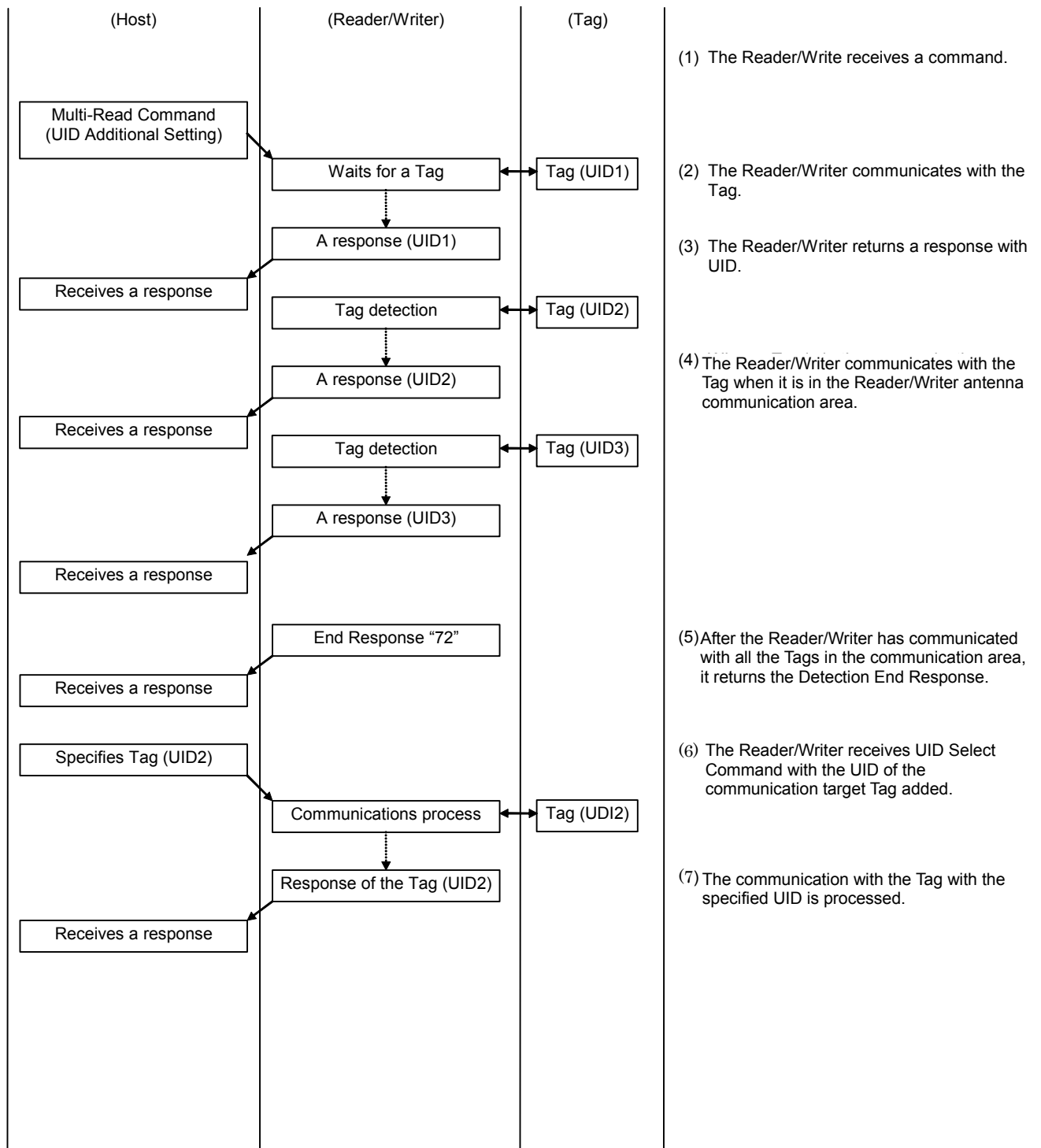
The Reader/Writer communicates with the Tag specified by the UID. For UID Select Command, specify SL for the communication, and specify the UID of the communication target Tag in the UID area in hex number, 123.



**Note:**

Some Tags detected by UID read (Tag detection) may not be communicated with Selective Access mode using UID Select (Tag designation) command, depending on the Tag conditions (the distances between the antenna and tag, or those between the Tag and another Tag). This is especially true when the Tag exists in the boundary area of the communication area. The operating system must be configured to check the number of detected Tags against the number of Tags the Reader/Writer communicated with (or the number of the actual Tags).

Selective Access Operation: In ISO Mode



**Exceptions**

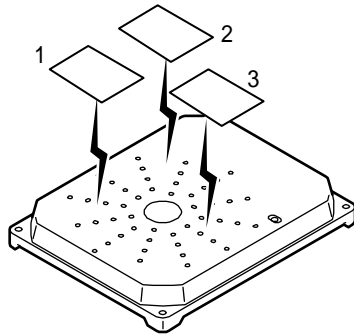
(1) When the Tag with the UID specified by UID Select Command does not exist in the communication area, the Reader/Writer returns No Tag error (Response Code:72) to the host.

### 5-2-4-2 I.CODE1Moed

After allocating the Temporary numbers to the Tags in the communication area using Tag Detection Command, the Reader/Writer communicates with the Tags based on the allocated numbers. The Tag code must be specified as command data according to the numbers of the Tags present in the communication area. For Tag number specifications, refer to SECTION 5-2-5.

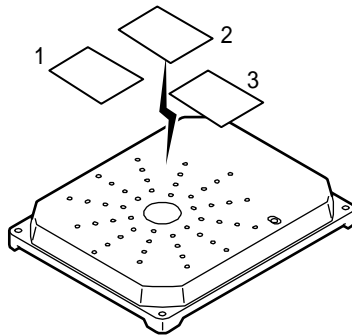
#### 1. Numbers are allocated to the Tags by Tag Detection Command.

Tag Detection Command, the state enters the Select State, where the mapping of the Tags in the antenna communication area and their Temporary numbers are stored. In Select State, all the commands are rejected except the Tag Designation Command. The Select State is valid until Stop Command (ST) has been executed.



#### 2. After allocating the numbers to the Tags, the Reader/Writer communicates with the specified Tag (No.2 in the figure below) using Tag Designation Command.

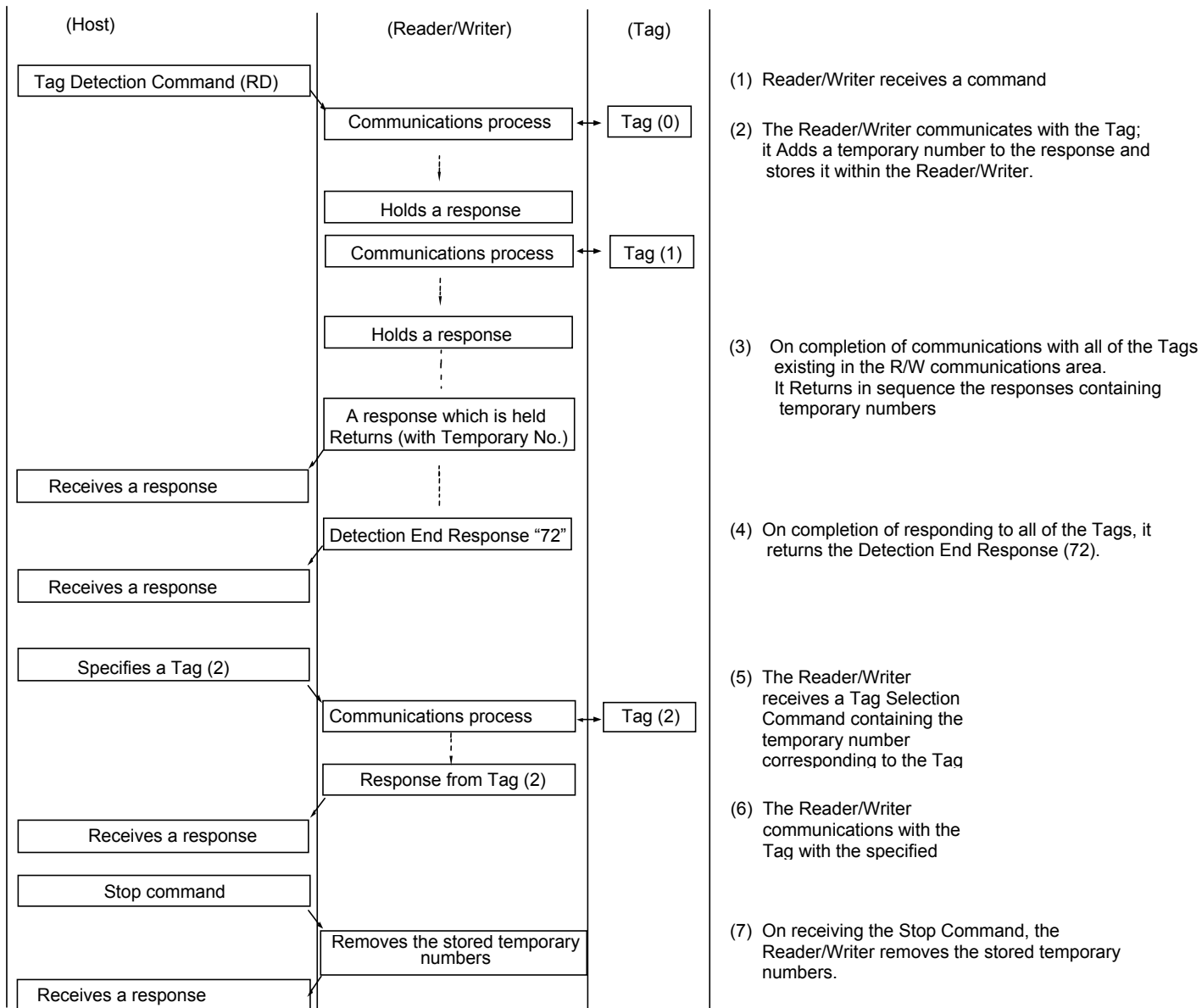
The Reader/Writer communicates with the Tag specified by the Temporary number. It can communicate with the Tags repeatedly in the Select State.



### Tag Detection Command/Tag Designation Command

For Tag Detection Command, specify LT as the communication method of the command. For Tag Designation Command, specify 00 to 7F as the communication method of the command. (To specify the Tag with Temporary number 1, specify 01).

## Selective Access Operation: In I.CODE1 Mode



### Exception ( In I.CODE1 Mode )

- 1) When the Tags with the temporary numbers selected by the Tag Selection Command are not present, the Reader/Writer returns a communications error (Response Code:72) to the host.
- 2) When the Tag Selection Command selects temporary numbers other than those stored by the Reader/Writer by the Tag Detection Command, the Reader/Writer returns a format error (Response Code:14) to the host.
- 3) The Reader/Writer cannot communicate with the tag which a Temporary number is assigned by the host, once the Tag goes out of communication area while the Reader/Writer selecting the tag to be read, even if the Tag exists in the communication area, Then the Reader/Writer sends back to "No Tag error command (Response Code72)"to the host.

**5-2-5 Specifying a Tag Code: I.CODE1 Mode**

The timeslot setting is the setting in the command frame when communicating with multiple Tags simultaneously using Multi-system commands. This setting must be set according to the number of Tags with which to communicate simultaneously. Refer to the table below for the relationship between the number of Tags and this setting.

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

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

**Note:**

For the Multi Trigger(MT) and the Multi Read(MR), if more Tags than have been set using the timeslot setting enter the communications range, a "70" error (warning) may occur. (e.g., When the timeslot setting is "2" and there are five Tags in the communications area.)

For the Special Read (refer to 5-2-1-6) command, the anti-collision process is not performed. Therefore, read data will be returned even if there are more Tags than the timeslot setting in the communications area. If a collision occurs, such data will not be returned.

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


### 5-3-1 Command Frame Structure

The Reader/Writer continuously receives signals from STX through ETX, and executes the command when the correct node number is received (\*1). If, after receiving an STX signal, another STX signal is received before an ETX signal is received, the second STX signal is given command priority.

	Node No.	Command Code	Option	ETX	BCC
STX	"□□"	"□□"		ETX	
1	2	2		1	1

Name	Description
STX	Indicates the beginning of a communication frame (text). Expressed by ASCII code 02h.
Node No.	Indicates the Reader/Writer to communicate with by its node No. This number can be set within the range between 00 and 31 decimal.(*1)
Command Code	Indicates the command that the Reader/Writer executes. For the command codes that are available, refer to Command Code List in 5-3-3.
Option	Makes specified optional settings or specifies read/write data. For details, refer to the format of the appropriate command.
ETX	Indicates the end of a communication frame (text) Expressed by ASCII code 03h.
BCC	Stands for Block Check Character (hereinafter referred to as "BCC"). The result of the horizontal parity calculation from immediately after STX through ETX is expressed using one character. You can enable or disable the BCC command using the communications port setting command. For BCC calculation method, refer to 5-3-8 Example BCC Calculation.

#### NOTE

 : COM2 is a port for setup and can communicate without depending on a node No.

### 5-3-2 Response Frame Structure

	Node No.	Retry Flag	Command Code	Response code	Text data	ETX	BCC
STX	"□□"	"□"	"□□"	"□□"		ETX	
1	2	1	2	2		1	1

Name	Description
Node No.	Indicates the node No. that has been assigned to the Reader/Writer.
Retry Flag	This flag will be set to "0" when ACK/NACK control has been disabled. In ACK/NACK control, a response will be re-transmitted with the retry flag set to "1" if, after returning a response, ACK has not been received within a pre-determined period of time or if NACK has been received.
Command code	Indicates the code of the command that the Reader/Writer executed.
Response Code	Indicates the result of command execution. Refer to 5-3-7 Response Code List for different response codes.
Text data	Sent in response to specific commands. For the content, refer to the frame structure of each command.

#### NOTE

 : The contents of STX, ETX, and BCC are the same as those in command frames.



### 5-3-3 Command Code List

The command type is set by specifying the following command types as a command code: There are four major types of commands.

(1) Communications command

This command communicates with a Tag.

(2) System command

This command accesses to the system area of a Tag.

(3) Reader/Writer control command

This command controls the Reader/Writer, e.g. stopping a command in process, and/or resetting.

(4) Setting command

This command sets the system of the Reader/Writer.

Command type	Command code	Command name	Description	Remarks
Communications Command	RD	Read	Reads data from the Tag memory. This is also used for some system areas.	
	WT	Write	Writes data to the Tag memory. This is also used for some system areas.	
	PR	Polling Read	Executes a Single Auto Read through Polling processing.	
	PW	Polling Write	Executes a Single Auto Write through Polling processing.	
	PC	Polling Check	Inquires the Reader/Writer under Polling processing.	
	PE	Polling Cancel	Cancels Polling processing.	
	MC	Memory Check	Compares check codes in Tag memory.	I.CODE1 Mode Only
	MK	Memory Calculation	Calculates check codes in Tag memory.	I.CODE1 Mode Only
System Command	SR	System Read	Reads system information of a Tag.	ISO Mode Only
	SW	System Write	Sets AFL, DSFID and EAS of a Tag.	ISO Mode Only
	SL	System Lock	Locks AFL, DSFID and EAS of a Tag.	ISO Mode Only
	ES	EAS Setting	Enables or disables the EAS command.	I.CODE1 Mode Only
	QB	QuietBit Setting	Sets QuietBit	I.CODE1 Mode Only
	LK	Lock	Locks the Tag memory by page.	
	L R	Lock Setting Read	Reads lock setting data of the Tag. ISO Mode only.	ISO Mode Only
	EA	EAS Check	Checks EAS.	
Reader/Writer Control Command	ST	Stop	Stops the communications with a Tag.	
	XZ	Reset	Resets the Reader/Writer after receiving a command.	
	AK	ACK	In a case where the system under ACK/NACK control cannot receive a response properly, send this command to the Reader/Writer.	
	NK	NACK	In a case where the system under ACK/NACK control cannot receive a response properly, send this command to the Reader/Writer.	
	CC	I/O Control	Changes and reads user input and output.	
	TS	Test	Sends the data received from the host back to the host.	
	VS	Version	Reads the software version of the Reader/Writer.	
Setting Command	AE	AFI Enable/disable Changeover	Sets whether AFI is used or not when communicating with a Tag.	ISO Mode Only
	AF	AFI Reading	Sets AFI in the Reader/Writer.	ISO Mode Only
	FC	Family Code Setting	Sets a Family Code in the Reader/Writer.	I.CODE1 Mode Only
	AI	Application ID Setting	Sets an Application ID in the Reader/Writer.	I.CODE1 Mode Only
	SN	UID (SNR) Additional Setting	Sets whether or not UID (SNR) will be added to a read response.	
	NN	Node No.	Sets the node number in the Reader/Writer.	
	CP	Communications Port Setting	Sets the baud rate, data length, parity bit, stop bit, ACAK/NAK control, timeout period, BCC addition, etc, in the Reader/Writer.	
	CT	Communications Type Setting	Sets the communications type in the Reader/Writer.	
	CM	Tag Communications Mode	Set the Tag communications mode in the Reader/Writer.	

AC	Antenna Changeover	Sets the antenna changeover in the Reader/Writer.	
TM	Terminal Resistance	Sets the terminal resistance for RS485 in the Reader/Writer.	
FL	Offline Mode Setting	Sets which mode the Reader/Writer will start online or offline.	
IS	Initialization of Setting	Reset the Reader/Writer to the factory settings.	
EW	Set Value Writing	Stores the Reader/Writer set value on the EEPROM	
TY	Chip Operating Mode Switch	Switches I.CODE1/I.CODE SLI modes	
MX	Duplicate Communication Protecting Setting	Enables/Disables Duplicate Communication Protecting Function sets the number of the tables.	
CA	I/O Automatic Changeover setting	Enables/Disables I/O Automatic Changeover setting.	

\* In Offline Mode, the only commands accepted are Stop Command (ST) or Reset Command(XZ).

### 5-3-4 Communication Method List

The communication mode is set by specifying the following communication code as the command-data option. The available communication modes vary, depending on the commands or operation modes.

Name	Code	Description
Single Trigger	ST	Immediately after receiving a command, the Reader/Writer communicates with a Tag and returns a response. If the Tag is missing, an error (Code:72) is returned. During communications, only one Tag should exist in the communications area.
Single Auto	SA	After receiving a command, the Reader/Writer waits for a Tag to enter the communications area. Next, the Reader/Writer communicates with the entering Tag and returns a response. During communications, only one Tag exists in the communications area.
Single Repeat (ISO mode)	SR	After receiving a command, the Reader/Writer waits for a Tag to enter the communications area. Next, the Reader/Writer communicates with the entering Tag and returns a response. After sending the response, the Reader/Writer enters a Tag waiting state again <u>and repeats this process until receiving the Stop(ST) or Reset Command(XZ).</u> During communications, only one Tag should exist in the communications area. This method is for ISO mode only. Do not specify this method in I.CODE1 mode.
Multi-trigger	MT	Immediately after receiving a command, the Reader/Writer communicates with all of the Tags existing in the communications area and returns responses corresponding to each Tag. If the Tag is missing, an error (Code:72) is returned.
Multi-repeat	MR	The Reader/Writer waits for Tags to enter the communications area. It communicates with all of the Tags existing in the communications area and returns responses corresponding to each Tag. After completing communications, the Reader/Writer disables the operation of the Tag. After sending the response, the Reader/Writer enters a Tag waiting state again and <u>repeats this process until receiving the Stop(ST) or Reset Command(XZ).</u>
FIFO Trigger	FT	Immediately after receiving a command, the Reader/Writer communicates with a Tag and returns a response. After completing communications, the Reader/Writer disables the operation of the Tag. After sending the response, the Reader/Writer will <u>continue to operate until it receives a FIFO command, Stop(ST) command, or Reset command(XZ).</u> During communications, only one Tag in the Communications area is operable.
FIFO Auto	FA	After receiving a command, the Reader/Writer waits for a Tag to enter the communications area. Next, the Reader/Writer

		<p>communicates with the entering Tag and returns a response. After sending the response, the Reader/Writer will <u>continue to operate until it receives a FIFO command, Stop command (ST), or Reset command(XZ).</u></p> <p>After sending the response, the Reader/Writer enters a command waiting state. During communications, only one Tag in the Communications area is operable.</p>
FIFO Repeat	FR	<p>The Reader/Writer waits for a Tag to enter the communications area and communicates with the entering Tag. After completing communications, the Reader/Writer disables the operation of the Tag. After sending the response, the Reader/Writer enters a Tag waiting state again and <u>repeats this process until receiving the Stop (ST) or Reset Command(XZ).</u> During communications, only one Tag in the Communications area is operable.</p>
UID Select (ISO Mode)	SL	<p>Communicates with the Tags specified by UID among the Tags in the SL communication area. If the specified Tag does not exist, the No Tag Error (Code: 72) is returned.</p>
Tag Detection, Tag Designation (I.CODE1 Mode)	LT, □□	<p>Communicates with multiple Tags in the communication area specified by the allocation of the Temporary number (Tag Detection) and by the Temporary number (Tag Designation). Selective access is performed by specifying the two communication settings as a unit.</p>
Fast Read Access (I.CODE1 mode)	UT, UA, UR	<p>Fast data reading performed by the I.CODE1-specific sequence. Both Single and Multi Accesses are available by setting the corresponding Tag codes.</p>

### 5-3-5 Command-by-Command Communication Method List

The communication modes specifiable as a communications method vary, depending on the command. Communications method options are not provided for some commands, their communication methods are determined by specifying the command types.

Communications Method Command	Single			FIFO			Multiple		Selective		Fast Read (I.CO DE1 mode)
	Trigger	Auto	Repeat	Trigger	Auto	Repeat	Trigger	Repeat	Tag Detection	Tag Selection	
Read	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Note	✓	✓	-	✓	✓	✓	✓	✓	-	✓	-
Polling Read *1	-	(✓)	-	-	-	-	-	-	-	-	-
Polling Write *1	-	(✓)	-	-	-	-	-	-	-	-	-
Memory Check *2	(✓)	-	-	-	-	-	-	-	-	-	-
Memory Calculation *2	(✓)	-	-	-	-	-	-	-	-	-	-
System Read *2	(✓)	-	-	-	-	-	-	-	-	-	-
System Write	✓	-	-	-	-	-	-	-	-	✓*3	-
System Lock	✓	-	-	-	-	-	-	-	-	✓*3	-
EAS Setting *2	(✓)	-	-	-	-	-	-	-	-	-	-
QuitBit Setting *2	(✓)	-	-	-	-	-	-	-	-	-	-
Lock Setting *2	(✓)	-	-	-	-	-	-	-	-	-	-
Lock Setting Read *2	(✓)	-	-	-	-	-	-	-	-	-	-
EAS Check *4	-	-	-	-	-	-	-	(✓)	-	-	-

✓ : Able to select communications method

- : Not able to select communications method

\*1 The communication is fixed to Single Auto. The communication method cannot be specified by users.

\*2 The communication is fixed to Single Trigger. The communication method cannot be specified by users.

\*3 Specifies the communication method by system designation in command data. Selective/UID Select can be specified for EAS only. Settings for other system data is fixed to Single Trigger.

\*4 The communication is fixed to Multiple Repeat. The communication method cannot be specified by users.

5-3-6 Specifying a Data Code

In the Command code area of the command data, whether the Reader/Writer reads or writes data as ASCII code (or JIS8 code) or HEX code numeric data is specified.

Name	Code	Description
ASCII Code	A	A character of data occupies 1 byte (1 address) on a Tag as an ASCII code or a JIS 8 code. Control codes 02 (STX) and 03 (ETX) cannot be used.
HEX code	H	A character is handled as hexadecimal data. Therefore, only characters from 0 to F are accepted. Two characters of data occupy 1 byte (1 address) on a Tag.

- Example of ASCII Representation

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

	byte 0	byte 1	byte 2	byte 3
page 00h	5 6	3 7	3 2	3 0
	V	7	2	0

- Example of Hexadecimal Representation

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

	byte 0	byte 1	byte 2	byte 3
page 00h	1 2	3 4	5 6	7 8

## 5-3-7 Response Code List

## 5-3-7-1 ISO Mode

Type	Response Code	Name	Description
Normal completion	"00"	Normal completion	The received command ends normally with no error.
	"72"	Multi-processing end	Communications end response when a multi-trigger function is used.
	"74"	Polling command received	<ul style="list-style-type: none"> <li>• Polling command has been received normally.</li> <li>• Polling Check is received before the completion of communications with a Tag.</li> </ul>
	"75"	Polling processing canceled	Polling processing is canceled before the completion of communications with a Tag.
	"76"	Polling processing canceled	Polling processing is canceled after the start of communications with a Tag.
Host communications error	"10"	Parity error	A parity error occurs in one of the characters of the received command.
	"11"	Framing error	A framing error occurs in one of the characters of the received command.
	"12"	Overrun error	An overrun error occurs in one of the characters of the received command.
	"13"	BCC error	The received command has an incorrect BCC.
	"14"	Format error	<ul style="list-style-type: none"> <li>• The command format is incorrect.</li> <li>• A stop command is received in command-waiting status.</li> <li>• An I.CODE1-mode specific command/function is executed.</li> </ul>
Communications error	"18"	Frame length error	• ETX is not received in 289 characters or less after STX is received.
	"70"	Communications error	• An error occurs during the communications with a Tag, and communications cannot end normally.
	"71"	Write process error	<ul style="list-style-type: none"> <li>• Failed to write correct data onto a Tag. (Verification error)</li> <li>• An error occurred in the data writing process between a Tag, preventing the process from being completed normally.</li> </ul>
	"72"	No Tag error	<ul style="list-style-type: none"> <li>• No Tag is present in front of Antenna when a Trigger command is executed.</li> <li>• There are multiple Tags within the communications area when using Single Access mode.</li> </ul>
	"79"	Command error	• Refer to the correlation table of ISO/IEC Error Codes.
	"7A"	Address error	<ul style="list-style-type: none"> <li>• Unavailable pages. (ISO/IEC standard error code 10)</li> <li>*Results in 79 error on I.CODE SLIs because the Tag is not supported.</li> </ul>
System error	"7E"	Lock error [ver1.20 and higher]	• Writing onto a locked page. (ISO/IEC standard error code 12) *Results in 79 error on I.CODE SLIs because the Tag is not supported.
	"7C"	Communication circuit error	• An error occurred in the Reader/Writer communication circuit.
	"93"	Memory error	• The EEPROM for the operating condition setting cannot be re-written normally.

**Correlation table of ISO/IEC Error Codes**


When a Tag incorporating ISO/IEC chip (including I.CODE SLI chip) returns an error response, the Reader/Writer responses a Response Code shown in the table below.

ISO code	Description	Response code of module
01	An unadopted command. No request command can be recognized.	79
02	An unrecognizable command. ex. format error.	79
03	An unadopted arbitrary command	79
0F	An unaccountable error or unadopted error code.	79
10	A specific block cannot be use. (There is none)	7A
11	A specific block cannot be relocked since the block has been already locked.	00
12	A specific block cannot be rewritten since it is locked.	71/7E
13	A specific block has not completed writing correctly.	71
14	A specific block has not completed locking correctly.	71
Others	RFU	79

## 5-3-7-2 I.CODE1 Mode

Type	Response Code	Name	Description
Normal completion	"00"	Normal completion	The received command ends normally with no error.
	"72"	Multi-processing end	Communications end response when a multi-trigger function is used.
		Selective detection completion	Communications end response when a selective access/detection function is used.
	"74"	Polling command received	<ul style="list-style-type: none"> <li>• Polling command has been received normally.</li> <li>• Polling Check is received before the completion of communications with a Tag.</li> </ul>
	"75"	Polling processing canceled	Polling processing is canceled before the completion of communications with a Tag.
		Data normal	Results of the memory calculation command (MK) check code verification are normal.
"76"	Polling processing canceled	Polling processing is canceled after the start of communications with a Tag.	
	Data error	Results of the memory calculation command (MK) check code verification show an error.	
Host communications error	"10"	Parity error	A parity error occurs in one of the characters of the received command.
	"11"	Framing error	A framing error occurs in one of the characters of the received command.
	"12"	Overrun error	An overrun error occurs in one of the characters of the received command.
	"13"	BCC error	The received command has an incorrect BCC.
	"14"	Format error	<ul style="list-style-type: none"> <li>• The command format is incorrect.</li> <li>• A stop command is received in command-waiting status.</li> </ul> In Selective Access mode; <ol style="list-style-type: none"> <li>1) A temporary number not saved using the Tag detection command is specified.</li> <li>2) A tag detection command normal end is retried after it has been sent.</li> </ol> <ul style="list-style-type: none"> <li>• The specified, Temporary number is not saved by Tag Detection Command.</li> <li>• An ISO-mode specific command/function is executed.</li> </ul>
<ul style="list-style-type: none"> <li>• ETX is not received in 289 characters or less after STX is received.</li> </ul>			
Communication s error	"70"	Communications error	<ul style="list-style-type: none"> <li>• An error occurs during the communications with a Tag, and communications cannot end normally.</li> </ul>
	"71"	Write process error	<ul style="list-style-type: none"> <li>• Tag is in an area that can be read, but not written to.</li> <li>• You are trying to write to a locked page (i.e., write-protected).</li> <li>• The correct data cannot be written to the Tag.</li> <li>• Verify read results in an error.</li> </ul>
	"72"	No Tag error	<ul style="list-style-type: none"> <li>• No Tag is present in front of Antenna when a Trigger command is executed.</li> <li>• There are multiple Tags within the communications area when using Single Access mode.</li> </ul>
System error	"7C"	Communication circuit error	<ul style="list-style-type: none"> <li>• An error occurred in the Reader/Writer communication circuit.</li> </ul>
	"93"	Memory error	<ul style="list-style-type: none"> <li>• The EEPROM for the operating condition setting cannot be re-written normally.</li> </ul>
Warning	"01"	Specified No. of Tags exceeded	<ul style="list-style-type: none"> <li>• More Tags than have been specified in the Tag No. setting have entered the communications area.</li> </ul>
	"02"	Specified No. of retries exceeded	<ul style="list-style-type: none"> <li>• Tag detection has been retried the specified number of times to find all the Tags in the communications area, but some Tags have not been detected.</li> </ul>
	"03"	No. of Tags exceeded No. of retries exceeded	<ul style="list-style-type: none"> <li>• Two of the warning, "01" and "02," have occurred.</li> </ul>
	"04"	Communications error	<ul style="list-style-type: none"> <li>• An error occurs during communicating with Tags, resulting in successful communications with only some of the Tags.</li> </ul>
	"05"	Specified No. of Tags exceeded Communications error	<ul style="list-style-type: none"> <li>• Two of the warnings, "01" and "04," have occurred.</li> </ul>
	"06"	No. of Tags exceeded Communications error	<ul style="list-style-type: none"> <li>• Two of the warnings, "02" and "04," have occurred.</li> </ul>
	"07"	No. of Tags exceeded No. of retries exceeded Communications error	<ul style="list-style-type: none"> <li>• All the three warnings, "01," "02," and "04," have occurred.</li> </ul>

**NOTE**

 : The warning code is issued for Multiple Trigger(MT) and Multiple Repeat(MR) Modes only.

5-3-8 Example BCC Calculation

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

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

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

**Precautions on the communication-control software programming:**

The BCC is a character representing the result of the horizontal parity check performed for data and ETX. The BCC could be any code from 00h to FFh. (From 00h to 7Fh for 7-bit data). The communication control program that runs on the host must be designed assuming the case where BCC is not defined as STX/ETX control character or other characters.

\* Some characters may not be available, depending on the program development environment or coding method. Check the restrictions of the development environment of your choice.



5-4-1 Read (RD)

This command reads data from a Tag in the communications area. This is also used to read some system areas in I.CODE1.

<Command Format>

STX	Node No..	Command Code "RD"	Communications method	Data type	Tag type	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications method	Specifies a communications method ST: Single Trigger                      FA: FIFO Auto SA: Single Auto                         FR: FIFO Repeat SR: Single Repeat                      MT: Multi Trigger FT: FIFO Trigger                        MR: Multi Repeat *Refer to SECTION 5-3-4 Communication Mode List for details.
Data type	Specifies whether the read data is represented in ASCII or HEX. A : ASCII code H : HEX code *Refer to SECTION 5-3-6 Specifying a Data Code for details.
Tag type	Specifies the Tag type. A: I.CODE SLI chip
In ISO mode	Set the number of Tags which communicate simultaneously. 0 : when executing single or FIFO communications "1 to 7" : when executing multi-communications *Refer to SECTION 5-2-5 Specifying a Tag Code for details.
In I.CODE1 mode (Tag No. setting)	
First read page	Specifies the first page in hexadecimal to read from the Tags. Specification range: 00 to FFh (in ISO mode: 00 to 1Bh for I.CODE SLI chip) Specification range: FB to 0Ah (in I.CODE1 mode) *Refer to SECTION 2-4 Memory Map of Tag for details.
No. of read pages	Specifies the number of pages in hexadecimal to read from the Tags. Specification range: 01 to FFh (in ISO mode: 01 to 1Ch for I.CODE SLI) Specification range: 01 to 10h (in I.CODE1 mode)

\*The setting number of each Tag type is valid only when it is within the range of each operating mode in Reader/Writer.

<Response Format>

(1) Read data: there are responses according to the number of Tags in its communications area when multi-communications method is executed.

STX	Node No.	Retry Flag	Command Code "RD"	Response Code "00"	UID(SNR)	Read data	ETX	BCC
1	2	1	2	2	16	As specified	1	1

(2) Completion of communications (Multi/Trigger only): When the communications with all tags in communications area is completed.

STX	Node No.	Retry Flag	Command Code "RD"	Response Code "72"	ETX	BCC
1	2	1	2	2	1	1

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
UID (SNR)	Indicates UID (SNR) having been read from a Tag. When UID (SNR) (Tag-specific code) additional setting is valid, read data will be preceded by UID. UID(SNR)
Read Data	Indicates the data having been read from a Tag. The number of characters of data is as follows. ASCII code: No. of read pages x 4 HEX code: No. of read pages x 8

5-4-2 Write (WT)

Writes data to the Tag in the communication area. Also used to write data to some system areas in I.CODE1.

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

<Command Format>

STX	Node No.	Command code "WT"	Communi- cations method	Data type	Tag type	First write page	No. of write pages	Write data	ETX	BCC
1	2	2	2	1	1	2	2	As specified	1	1

Communications method	Specifies the communications method with a Tag. ST: Single Trigger      FR: FIFO Repeat SA: Single Auto        MT: Multi Trigger FT: FIFO Trigger       MR: Multi Repeat FA: FIFO Auto *Refer to SECTION 5-3-4 Communication Mode List for details.	
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code **Refer to SECTION 5-3-6 Specifying a Data Code for details.	
Tag type	In ISO mode	Specifies the Tag type. A: I.CODE SLI chip
	In I.CODE1 mode (Tag No. setting)	Set the value with accordance with the number of Tags communicating simultaneously. 0 : when performing Single or FIFO communications method "1 to 7": when performing multi communications method *Refer to SECTION 5-2-5 Specifying a Tag Code for details.
First write page	Specifies the first page in hexadecimal to write to the Tags. Specification range: 00 to FFh (in ISO mode: 00 to 1Bh for I.CODE SLI chip) Specification range: FD to 0Ah (in I.CODE1 mode: the range of the writable user area is FF page to 0A page) *Refer to SECTION 2-4 Memory Map of Tag for details.	
No. of write pages	Specifies the number of pages to which data is written to Tags in hexadecimal. Specification range: 01 to FFh (in ISO mode: 01 to 1Ch for I.CODE SLI) Specification range: 01 to 0Eh (in I.CODE1 mode)	
Write data	Indicates data to be written to the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8	

\* Setting values of each Tag type is valid in the operating mode setting range in Reader/Writer.

I.CODE1 System Area
<p>From Page FD to Page FF is a system area for write-protect and QUIET/EAS settings. Depending on the content of write data, a Tag may become write-protected or inaccessible, so be sure to understand these pages fully before use.</p> <p>It is strongly recommended that data be re-written using a command dedicated to system area re-writing rather than Write Command (Refer to SECTION 5-5). Re-writing data when the Tag is in an unstable communication area may destroy data in the system area, interrupting the communication with the Tag. Be sure to re-write data while the Tag is in a stable communication area.</p>

<Response Format>

(1)In ISO mode

1) The completion of write (In a case where UID (SNR) additional setting is invalid)

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

As specified

2)The completion of write (In a case where UID (SNR) additional setting is valid)

There are responses according to the number of Tags in communications area when multi-communications method is preferred.

STX	Node No.	Retry flag	Command code "WT"	Response code "00"	UID(SNR)	ETX	BCC
1	2	1	2	2	16	1	1

3)The completion of communications (In a case where multi-trigger and UID (SNR) additional setting is invalid.)

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

(2)In I.CODE1 mode

1)The completion of write

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

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
No. of write pages	Returns the number of pages which data is written normally. Does not return a response except that it completes normally. Does not add during Single and FIFO communications.
UID(SNR)	Indicates UID (SNR) having read from written Tags. UID (SNR) (Tag-specified code) additional setting is added when it is valid.

5-4-3 Read (RD)-Tag Detection: I.CODE1 Mode only

This command assigns temporary Tag numbers to each of multiple Tags that are present in the communications area. This command is available only when the system is in I.CODE1 mode. In ISO mode, you must enable UID (SNR) additional setting, execute 5-3-1 Read Command (RD), and get UID since the system uses UID (SNR) data as a temporary number.

<Command Format>

STX	Node No.	Command code "RD"	Communications method	Data type	Tag number setting	First read page	No. of read page	ETX	BCC
1	2	2	2	1	1	2	2	1	1

Communications method	Specifies a communications method with a Tag. LT: Tag Detection * For details, refer to 5-3-4 Communications Methods.
Data type	Specifies whether the read data is represented in ASCII or HEX. A : ASCII code H : HEX code * For details, refer to 5-3-6 Data Type
Tag No. setting	Set the value with accordance with the number of Tags communicating simultaneously. Specification range: 1 to 7 * For details refer to 5-2-5 Tag No. setting.
First read page	Specifies the first page in hexadecimal to read from the Tags. Specification range: FB to 0Ah (when Block 4 for a Philips product is used as the user memory,, refer to 2-4 of Section 2 Memory Map of Tag)
No. of read pages	Specifies the number of pages from which data is read in hexadecimal. Specification range: 01 to 10h

<Response Format>

(1) There will be as many responses as the number of Tags that are present in the communications area.

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

(2) Tag detection end response

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

Response code	01: Normal completion 72: The completion of Tag detection For other response codes, refer to 5-3-7 Response code List.
Read data	Indicates the data having been read from a Tag. The number of characters of the data is as follows. ASCII code : No. of read pages x 4 HEX code : No. of read pages x 8
UID (SNR)	Indicates UID (SNR) having been read from a Tag. When UID (SNR) (Tag-specific code) additional setting is valid, read data will be preceded by UID. UID(SNR)
Temporary No.	The Temporary Number 00 to 7F are returned under normal conditions.

**NOTE**  
 : This command works in I.CODE1 mode only. ISO mode is not available.

5-4-4 Read (RD)-UID Select/Specified Tag

In ISO mode, this command reads data from the Tag in communications area by specifying UID (SNR).  
 In I.CODE1 mode, this command reads data from the Tag which is specified by the Temporary Number.

<Command Format>

STX	Node No.	Command code "RD"	Communications method	Data type	Tag type	First read page	No. of read pages	UID(SNR)	ETX	BCC
1	2	2	2	1	1	2	2	16	1	1

Communications method	In ISO mode	Specifies the communications method with a Tag. SL: UID (SNR) select * For details, refer to 5-3-4 Communications Methods
	In I.CODE1 mode	Specifies the temporary No. in hexadecimal to read from the Tags. □□: Temporary No. (The value of □□ should be within the range of 00h to 7Fh) * For details, refer to 5-3-4 Communications Methods.
Data type		Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code For details, refer to 5-3-6 Data type.
Tag type *	In ISO mode	Specify the Tag type. A: I.CODE SLI chip
	In I.CODE1 mode	"0" fixed.
First read page		Specifies the first page in hexadecimal to read from the Tags. Specification range: 00 to FFh (In ISO Mode: I.CODE SLI chip should be from 00 to 1Bh) Specification range: FB to 0Ah (In I.CODE1 Mode) * For details, refer to 2-4 Memory Map of Tag.
No. of read pages		Specifies the number of the pages in hexadecimal to read from the Tags. Specification range: 01 to FFh (In ISO Mode: I.CODE SLI chip should be 01 to 1Ch) Specification range: 01 to 10h (In I.CODE1 Mode)
UID (SNR)	In ISO Mode	Specifies UID (SNR) in hexadecimal to read from the Tags.
	In I.CODE1 mode	Not added.

\* Tag Type Setting is valid in the operating mode setting range of Reader/Writer.

<Response Format>

STX	Node No.	Retry flag	Command code "RD"	Response code "00"	Temporary No.	UID(SNR)	Read data	ETX	BCC
1	2	1	2	2	2	16	As specified	1	1

Response code	00: normal completion For other response codes, refer to 5-3-7 Response code List.
Temporary number (I.CODE1 Mode only)	Returns the Temporary numbers from 00 to 7F in the normal state.
UID/SNR (ISO Mode only)*	UID/SNR is added at the top of read data when UID/SNR addition setting is enabled.
Read data	Indicates data having read from the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8

\* UID/SNR is not added in I.CODE1 Mode regardless of the UID/SNR addition setting status.

5-4-5 Write (WT)-UID Select/Specified Tag

This command writes data to the Tag of either UID (SNR) (in ISO mode) or Temporary Number (in I.CODE1 mode).

<Command Format>

STX	Node No..	Command code "WT"	Communications method	Data type	Tag type	First write page	First write page	UID(SNR)	Write data	ETX	BCC
1	2	2	2	1	1	2	2	16	As specified	1	1

Communications method	In ISO mode	Specifies the communications method with a Tag. SL: UID (SNR) select * Refer to SECTION 5-3-4 Communication Mode List for details.
	In I.CODE1 mode	Specifies the temporary No. in hexadecimal to write to the Tags. □□: Temporary No. (The value of □□ should be within the range of 00h to 7Fh) * Refer to SECTION 5-3-4 Communication Mode List for details.
Data type		Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code *Refer to SECTION 5-3-6 Specifying a Data Code for details.
Tag type *	In ISO mode	Specify the Tag type. A: I.CODE SLI chip
	In I.CODE1 mode	"0" fixed.
First write page		Specifies the first page in hexadecimal to write to the Tags. Specification range: 00 to FFh In ISO mode: I.CODE SLI chip should be between 00 to 1Bh Specification range: FB to 0Ah (In I.CODE1 mode: The available user area should be between FF page and 0A page) *Refer to SECTION 2-4 Memory Map of Tag for details.
No. of read pages		Specifies the number of the pages in hexadecimal to write to the Tags. Specification range: 01 to FFh (In ISO Mode: I.CODE SLI chip should be from 01 to 1Ch) Specification range: 01 to 0Eh (In I.CODE1 Mode)
UID (SNR)	In ISO mode	Specifies UID (SNR) in hexadecimal to write to the Tags.
	In I.CODE1 mode	Not added.
Write data		Indicates data to write to the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8

\* Tag Type Setting is valid in the operating mode setting range of Reader/Writer.

<Response Format>

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

Response code	00:normal completion For other response codes, refer to 5-3-7 Response code List.
Temporary number (I.CODE1 Mode only)	Returns the Temporary numbers from 00 to 7F in the normal state.
UID/SNR (ISO Mode only)*	UID/SNR is added at the top of read data when UID/SNR addition setting is enabled.

\* UID/SNR is not added in I.CODE1 mode regardless of the UID/SNR addition setting status.

I.CODE1 SYSTEM AREA

From Page FD to Page FF is a system area for write-protect and QUIET/EAS settings. Depending on the content of write data, a Tag may become write-protected or inaccessible, so be sure to understand these pages fully before use.It is strongly recommended that you use a system command to write in these pages (refer to 5-5) rather than using the write command.

### 5-4-6 Read (RD)-Fast Read Access: I.CODE1 Mode only

When there is only a single Tag in the communications area, this command enables to read data from the Tag faster than a usual Read.

#### <Command Format>

STX	Node No..	Command code "RD"	Communications method	Data type	Setting Tag No.	First read page	No. of read pages	ETX	BCC
1	2	2	2	1	1	2	2	1	1


Communications method	Specifies the communications method with a Tag. UT: Special Read Trigger UA: Special Read Auto UR: Special Read Repeat * Refer to SECTION 5-3-4 Communication Mode List for details.
Data type	Specifies whether the read data is represented in ASCII or HEX. A: ASCII code H: HEX code * Refer to SECTION 5-3-6 Specifying a Data Code for details.
Tag No. setting	Set the number of Tags which communicate simultaneously. * Refer to SECTION 5-2-5 Specifying a Tag Code: I.CODE1 for details. Specification range: 0 to 7
First read page	Specifies the first page in hexadecimal to read from the Tags. Specification range: FB to 0A (when Block 4 for a Philips product is used as the user memory, refer to 2-4 of Section 2 Memory Map of Tag)
No. of read pages	Specifies the number of pages from which data is read in hexadecimal. Specification range: 01 to 10

#### <Response Format>

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Read data	Indicates data having read from the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8

#### NOTE

 : In Fast Read Access, multiple Tags can be read in the same way as in Multiple Repeat mode by setting the Tag code other than 0 and specifying UR as the communication method. However, data is repeatedly read while the Tag is in the communication area. (Refer to SECTION 3-2-5).

When UT or UA is specified as the communication method, the anti-collision processing (the operation to prevent the collision of the response returned by the Tag), it is not performed even if a number other than 0 is specified as the Tag code. Therefore, if a collision (of the response) takes place, its Tag data cannot be read. It is recommended that the command be used in Multiple Access mode (MT/MR). The command is available in I.CODE1 Mode only; it is not available in ISO Mode.

5-4-7 Polling Single Auto Read (PR)

Immediately after receiving the Polling Single Auto Read Command, the Reader/Writer returns a response indicating the acceptance of the command, and waits for a Tag to enter the communications area of the Antenna. Then it reads the data of the entering Tag. The host can inquire of the Reader/Writer about the results of communications processing using the Polling Check (PC) command.

<Command Format>

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

Data type	Specifies whether the read data is represented in ASCII or HEX. A : ASCII code H : HEX code * Refer to SECTION 5-3-6 Specifying a Data Code for details.	
Tag type *	In ISO mode	Specify the Tag type. A: I.CODE SLI chip
	In I.CODE1 mode	Not added.
First read page	Specifies the first page in hexadecimal to read data from the Tags. Specification range: 00 to FFh (In ISO mode: I.CODE SLI chip should be from 00 to 1Bh) Specification range: FB to 0Ah (In I.CODE1 mode) * Refer to SECTION 2-4 Memory Map of Tag for details.	
No. of read pages	Specifies the number of the pages in hexadecimal to read data from the Tags. Specification range: 01 to FFh (In ISO mode: I.CODE SLI chip should be from 01 to 1Ch) Specification range: 01 to 10h (In I.CODE1 mode)	

\* Tag Type Setting is valid in the operating mode setting range of Reader/Writer.

<Response Format>

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

Response code	74: Command acceptance For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--



5-4-8 Polling Single Auto Write (PW)

Immediately after receiving the Polling Single Auto Write Command, the Reader/Writer returns a response indicating the acceptance of the command and waits for a Tag to enter the communications area of the Antenna. Then it writes data to the entering Tag. The host can inquire of the Reader/Writer about the results of communications processing using the Polling Check (PC) command.

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

<Command Format>

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

Data type	Specifies whether the write data is represented in ASCII or HEX. A : ASCII code H : HEX code * Refer to SECTION 5-3-6 Specifying a Data Code for details.	
Tag type *	In ISO mode	Specify the Tag type. A: I.CODE SLI chip
	In I.CODE1 mode	Not added.
First write page	Specifies the first page in hexadecimal to write data to the Tags. Specification range: 00 to FFh (In ISO mode: I.CODE SLI chip should be from 00 to 1Bh) Specification range: FB to 0Ah (In I.CODE1 mode: the range of the writable user area is FF page to 0A page) * Refer to SECTION 2-4 Memory Map of Tag for details.	
No. of read pages	Specifies the number of the pages in hexadecimal to write data to the Tags. Specification range: 01 to FFh (In ISO Mode: I.CODE SLI chip should be from 01 to 1Ch) Specification range: 01 to 0Eh (In I.CODE1 Mode)	
Write data	Indicates data to write to the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8	

\* Tag Type Setting is valid in the operating mode setting range of Reader/Writer.

<Response Format>

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

Response code	74: Command acceptance For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

I.CODE1 SYSTEM AREA

The pages from FD to FF on the I.CODE1 Chip are system areas for setting write access conditions, QUIET/EAS, family code/application ID. Users must understand thoroughly how the function works because the Tag may be locked or access may be disabled depending on data written to the area. It is strongly recommended that data be re-written using a command dedicated to system area writing rather than Write Command (Refer to SECTION 5-5).

5-4-9 Polling Check (PC)

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

<Command Format>

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

<Response Format>

(1) Response to Polling Single Auto Read Command (PR)

STX	Node No..	Retry flag	Command code "PR"	Response code "00"	UID(SNR)	Read data	ETX	BCC
1	2	1	2	2	16	As specified	1	1

(2) Response to Polling Single Auto Write Command (PW)

STX	Node No..	Retry flag	Command code "PW"	Response code "00"	UID(SNR)	ETX	BCC
1	2	1	2	2	16	1	1

(3) Response when a Tag is not detected

A response when Polling Check Command is received before the communications with a Tag is completed.

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

Response code	00:normal completion 74: In a case before the communications with a Tag is completed. For other Response Codes, refer to SECTION 5-3-7 Response Code List.
UID (SNR)	Indicates UID (SNR) data having read from a tag. UID (SNR) (Tag-specified code) additional setting (refer to 5-6-5 SN Command) is added when it is valid as follow <ul style="list-style-type: none"> <li>• Polling Single Auto Read: UID (SNR) is added before Read data.</li> <li>• Polling Single Auto Write: When it is in ISO mode, UID (SNR) is added after the Response code "00."</li> </ul>
Read data	Indicates data to read from the Tag. The number of characters of the data is as follows. ASCII Code: No. of write pages x 4 HEX code: No. of write pages x 8

5-4-10 Polling End (PE)

This command aborts the execution of Polling commands. It is used after a Polling command is sent.

<Command Format>

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

<Response Format>

(1) Before the completion of communications with a Tag

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

(2) After the completion of communications with a Tag

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

Response code	75:Before the completion of communications with a Tag 76:After the completion of communications with a Tag For other response codes, refer to 5-3-7 Response code List.
---------------	---

### 5-4-11 Memory Check (MC): I.CODE1 Mode only

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

**<Command Format>**

STX	Node No..	Command code "MC"	Check block. header page	Check block No. of pages	ETX	BCC
1	2	2	2	2	1	1

Check block Header page	Specifies the header page of check block in hexadecimal. Specify the top page of the check block in hex number. Specification range: FF to 09 (When using the Philips block 4 as the user memory, refer to SECTION 2-4).
Check block No. of pages	Specifies the number of the pages of check block in hexadecimal. Specification range: 02 to 0C

**<Response Format>**

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

Response code	75: When the check results are correct 76: When the check results are incorrect For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**NOTE**

 : This command is for I.CODE1 Mode Only. The command is not available in ISO mode.

### 5-4-12 Memory Calculation (MK): I.CODE1 Mode only

This command uses the generating polynomial,  $X^{16} + X^{12} + X^5 + 1$  to calculate the range of the check block designated by a user and writes the check code to the last page of the check block.

**<Command Format>**

STX	Node No..	Command code "MK"	Check block. header page	Check block No. of pages	ETX	BCC
1	2	2	2	2	1	1


Check block header page	Specifies the header page of check block in hexadecimal. Specify the top page of the check block in hex number. Specification range: FF to 09 (When using the Philips block 4 as the user memory, refer to Chapter 2, SECTION 2-4 Memory Map of Tag).
Check block No. of pages	Specifies the number of the pages of check block in hexadecimal. Specification range: 02 to 0C

**<Response Format>**

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**NOTE**

 : This command is for I.CODE1 Mode Only. The command is not available in ISO mode.

5-5-1 System Read (SR): ISO Mode only

This command read system information in the system area of the Tag.

<Command Format>

STX	Node No..	Command code "SR"	Tag type	System method "00"	ET X	BC C
1	2	2	1	2	1	1

Tag type	Specified a Tag type A: I.CODE SLI chip
System method	Specified the kind of system information. "00" fixed.

<Response Format>

STX	Node No..	Retry flag	Command code "SR"	Response code "00"	Information flag	UID(SNR)	Information field	ETX	BCC
1	2	1	2	2	2	16	2to10	1	1

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.												
Information flag	Indicates information in the Information field with a flag. <table border="1" style="margin-left: 40px;"> <tr><th>Bit</th><th>Information</th></tr> <tr><td>0</td><td>DSFID</td></tr> <tr><td>1</td><td>AFI</td></tr> <tr><td>2</td><td>VICC memory size</td></tr> <tr><td>3</td><td>IC reference information</td></tr> <tr><td>4 to 7</td><td>For future use</td></tr> </table> * Information field is stored in order of bit when the bit above is 1. * For the contents of information flag, refer to 2-4 Memory Map.	Bit	Information	0	DSFID	1	AFI	2	VICC memory size	3	IC reference information	4 to 7	For future use
Bit	Information												
0	DSFID												
1	AFI												
2	VICC memory size												
3	IC reference information												
4 to 7	For future use												
UID(SNR)	Indicates UID (SNR) data having read from a Tag.												
Information field	DSFID	DSFID of a Tag											
	AFI	AFI of a Tag											
	VICC memory size	Defines the memory and block sizes of a Tag. <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">MSB</td> <td style="text-align: center;">LSB</td> </tr> <tr> <td style="text-align: center;">15 13 12</td> <td style="text-align: center;">8 7 0</td> </tr> <tr> <td style="text-align: center;">Un- assigned</td> <td style="text-align: center;">Block size      Block length</td> </tr> </table> * Block length: the number of blocks of a Tag ( 00h to FFh = 1 to 256 ) * Block size: the number of bytes per one block ( 00h to 1Fh = 1 to 32 )  <As for I.CODE SLI chip: "1B03"> Block length: "1B" = 28 blocks Block size: "03" = 4 bytes	MSB	LSB	15 13 12	8 7 0	Un- assigned	Block size      Block length					
	MSB	LSB											
15 13 12	8 7 0												
Un- assigned	Block size      Block length												
IC reference information	IC reference Information of Tag * IC reference Information is a form of data defined by IC manufacturer.												

**NOTE**

: This command is in ISO Mode Only. The command is not available for I.CODE1 mode.

5-5-2 System Write (SW): ISO Mode only

This command writes the settings of AFI, DSFID, and EAS to a Tag.

<Command Format>

(1) For normal write

STX	Node No..	Command code "SW"	Tag type	System method	data	ETX	BCC
1	2	2	1	2	2	1	1

(2) When UID of a Tag is specified

STX	Node No..	Command code "SW"	Tag type	System method	UID	data	ETX	BC
1	2	2	1	2	16	2	1	1


Tag type	Specifies the Tag type. A: I.CODE SLI chip	
System method	Specifies the kind of system information to write to. 01: AFI 02: DSFID 03: EAS (For normal write) 83: Select EAS (When specifying UID of a Tag)	
UID	Specifies UID of a Tag in hexadecimal to write to.	
Data	AFI	Specifies UID of a Tag in hexadecimal to write to. Specification range: 00 to FFh
	DSFID	Specifies UID of a Tag in hexadecimal to write to. Specification range: 00 to FFh
	EAS setting	00: Enables EAS setting 01: Disables EAS setting

<Response Format>

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**NOTE**

 : This command is in ISO Mode Only. The command is not available for I.CODE1 mode.

5-5-3 System Lock (SL): ISO Mode only

This command locks (write-inhibit) to write to system area information of a Tag.

<Command Format>

(1) Normal lock

STX	Node No..	Command code "SL"	Tag type	System method	ETX	BCC
1	2	2	1	2	1	1

(2) In a case where UID of a Tag is specified

STX	Node No..	Command code "SL"	Tag type	System method	UID	ETX	BCC
1	2	2	1	2	16	1	1

Tag type	Specifies the Tag type. A: I.CODE SLI chip
System method	Specifies the system information to lock. 01:AFI 02:DSFID 03:EAS (normal lock) 83: Select EAS (In a case where UID of a Tag is specified and locked)
UID	Specifies the UID of a Tag to lock in hexadecimal.

<Response Format>


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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**(Important) Precautions on the Lock function**

Be careful that once system information has been locked, the lock cannot be cleared.

**NOTE**

 : This command is in ISO mode Only. The command is not available for I.CODE1 mode.

5-5-4 Read (RD)-SNR Read: I.CODE1 Mode only

This command read SNR (Tag-specified code) which incorporates I.CODE1 chip. Refer to 2-4 of Section 2 Memory Map of Tag.

<Command Format>

STX	Node No..	Command code "RD"	Communications method	Data type	Tag No. setting	Fixed value "**"	Fixed value "("	ETX	BC C
1	2	2	2	1	1	2	2	1	1

Communications method	Specifies the communications method with a Tag. ST: Single Trigger SA: Single Auto SR: Single Repeat FT: FIFO Trigger FR: FIFO Repeat	MT: Multi-trigger MR: Multi-repeat LT: Selective Access (Tag detection) □□: Selective Access (Read) (For □□, the values from 00h to 7Fh are available.) UT: Special Read Trigger UA:: Special Read Auto UR: Special Read Repeat Refer to SECTION 5-3-4 Communication Mode List for details.
Data type	"H" fixed (HEX code)	
Tag No. setting	For Single/FIFO/Selective Access (Read) Set the number of Tags "0." For Multi/Selective Access (Tag detection command) Reads SNR (unique code of the Tag) on the Tags with an I.CODE1 Chip. Refer to SECTION 5-2-5, Specifying a Tag Code. Specification range: 1 to 7	

<Response Format>

(1) For Single/FIFO/Multi (except for the response of the completion of communications)


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

(2) For Selective Access (except for the response of the completion of Tag detection)

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Serial No.	Indicates serial number written to a Tag in advance. You cannot rewrite the number.

**NOTE**

 : This command is for I.CODE1 Mode Only. The command is not available in ISO mode:



**5-5-5 EAS Setting (ES): I.CODE1 Mode only**

This command sets the EASBit of a Tag incorporating I.CODE1 chip. When the EASBit is disabled, the Reader/Writer will not return a response to the EAS Check Command (EA).

**<Command Format>**

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


Setting	Specification range : 00to01 00:EAS enabled 01:EASdisabled
---------	--

**<Response Format>**

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**NOTE**

 : The relative commands are set in offline mode (refer to 5-7-12 FL Command). This command is for I.CODE1 mode Only. The command is not available in ISO mode.

**5-5-6 QuietBit Setting (QB): I.CODE1 Mode only**

This command sets QuietBit of a Tag incorporating I.CODE1 chip. If you enable this bit, a Tag ceases to return a response to any command (excluding the EAS Command).

**<Command Format>**

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


Setting	Specification range:00h to 01h 00: Disable QuietBit 01: Enable QuietBit
---------	---

**<Response Format>**

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	--

**NOTE**

 : This command is for I.CODE1 Mode Only. The command is not available in ISO mode.

5-5-7 Lock Setting (LK): ISO Mode

This command is used to set and check the write-protection of Tags incorporating I.CODE1 chip. A Tag can be locked (or write-protected) by memory page.

<Command Format>

STX	Node No..	Command code "LK"	Tag type	First lock page	lock No. of pages	ETX	BCC
1	2	2	1	2	2	1	1

Tag type	Specifies Tag type. A: I.CODE SLI chip
First lock page	Specifies the first page to be locked in hexadecimal. Specification range: 00 to FFh * For details, refer to 2-4 Memory Map of Tag.
No. of lock pages	Specifies the first lock page t in hexadecimal. Specification range: 01h to 1Ch


<Response Format>

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

Response code	00:normal completion For other response codes, refer to 5-3-7 Response code List.
---------------	--

**(Important) Precautions on the Lock function**

Be careful that once a lock is set, the lock cannot be cleared.

**NOTE**  : This command is for ISO mode Only. The command is not available in I.CODE1 mode, refer to 5-5-9.

5-5-8 Lock Setting Read (LR): ISO Mode only

This command reads lock setting information of a Tag incorporating I.CODE SLI chip.

<Command Format>

STX	Node No..	Command code "LR"	Tag type	First lock page	No. of lock pages	ETX	BCC
1	2	2	1	2	2	1	1


Tag type	Specifies Tag type. A: I.CODE SLI chip
First lock page	Specifies the first page, which reads lock information, in hexadecimal. Specification range: 00 to FFh ( I.CODE SLI chip: 00 to 1Bh ) *Refer to SECTION 2-4 Memory Map of Tag for details.
No. of lock pages	Specifies the number of pages, from which reads lock information, in hexadecimal. Specification range: 01h to FFh ( I.CODE SLI chip: 01 to 1Ch )

<Response Format>

STX	Node No..	Retry flag	Command code "LR"	Respon s code "00"	Lock Information	ETX	BCC
1	2	1	2	2	No. of lock pages	1	1

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Lock information	Indicates lock information having read from Tag. Locked:"01" Not locked : "00" The number of characters of the data: "read pages x 2.

**NOTE**

 : This command is for ISO Mode Only. The command is not available in I.CODE1mode.

5-5-9 Lock Setting (LK): I.CODE1 Mode

This command is used to set and check the lock (write-protection) of Tags incorporating I.CODE1 chip. A Tag can be locked (or write-protected) by memory page. To read lock information set in a Tag, set all lock information in the commands to 0.

<Command Format>

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

Lock setting	Set the bit corresponding to the page you want to lock to 1. *See the table below.  <Lock setting check> Set all lock settings to 0 to read the lock information in a Tag.
--------------	---

\* The lock information for each page is represented by a 1-bit datum.

Lock setting															
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
Page 10	Page 9	Page 8	Page 7	Page 6	Page 5	Page 4	Page 3	Page 2	Page 1	Page 0	A I F C	E Q A U S I E T	Write - protect	S N R	S N R

AI: Application ID

FC: Family Code

<Response Format>

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


Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Lock setting Information	Indicates lock information set in a Tag.

**Description:** This is an example of command and response when locking pages 1, 3, 7, and 8 in a Tag in which page 10 has already been locked. This example does not include STX, ETX, BCC, and the node number. The lock setting in the response included information concerning the pages that have already been locked.

Command: LK3140

Response: LK00B143


**NOTE**

 : SNR (Tag-specific code) is locked at factory. SNR 2 bit in the lock setting in the response is always on.

**(Important) Precautions on the Lock function**

Use utmost care when using the LK Command because once a page has been locked, it cannot be unlocked. It is strongly recommended that you use a system command to lock a page rather than using this command.

**NOTE**

 : This command is for I.CODE1 Mode Only. The command is not available in ISO mode, refer to 5-5-7.

5-5-10 EAS Check (EA)

This command transmits the EAS command continuously and returns the percentage of data that matches the EAS response code.

<Command Format>

1) In ISO mode

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

2) In I.CODE1 mode

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

Tag type ( ISO mode )	Specifies Tag type. A: I.CODE SLI chip * Not added in I.CODE1 mode.
--------------------------	---

<Response Format>

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Ratio	Indicates the ratio of data that matches the EAS response code in hexadecimal. (00h to 64h[%])

**How to use properly**

- 1) In some cases, this command will not indicate 0% even though there are no Tags. Be sure take this into account when determining the presence or absence of Tags.
- 2) The EAS Check Command works as a repeat command. After this command is sent once, only a response will be returned. To discontinue transmission of this command, you need to use the Stop Command (refer to ST Command in 5-6-1).

5-6-1 Stop (ST)

Stop (ST) Stop command terminates Auto mode, Repeat mode, EAS check and other command processings, as well as continued FIFO state after FIFO Access, or Select state after executing Detection command, returning to the Reader/Writer to a stand-by status to wait for commands.

<Command Format>

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

<Response Format>

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

Response code	00: Normal completion For other response codes, refer to 5-3-7Response Code List.
---------------	--

5-6-2 Reset (XZ)

Reset Command resets the Reader/Writer software. No response is returned for this command. Other commands are rejected during the software reset process (approximately 2.5 seconds).

<Command Format>

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

5-6-3 ACK(AK)

This command is used during ACK/NACK control to inform the Reader/Writer that the host device normally received a response from the Reader/Writer. There is no response if this command is used in ACK/NACK control, but if the Reader/Writer is not waiting to receive ACK/NACK signals, an error will occur when the command is received. Refer to SECTION 5-1-3 ACK/NACK Control for details.

<Command Format>

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

5-6-4 NACK(NK)

This command is used during ACK/NACK control to inform the Reader/Writer that the host device did not normally receive a response from the Reader/Writer. When the Reader/Writer receives a NACK command, the previous response is retried provided that the maximum number of retries (9) has not been exceeded.

If the Reader/Writer is not waiting to receive ACK/NACK signals, an error will occur when the command is received. Refer to SECTION 5-1-3 ACK/NACK Control for details.

<Command Format>

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

5-6-5 I/O Control Command (CC)

This command changes the state of the user output terminals (OUT1 to OUT4) and reads the state of the user input terminals (IN1 to IN3).

<Command Format>

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

OUT1to OUT4	The state of an output is designated in hexadecimal. Specification range: 0 to 1 (1: ON / 0: OFF) When * is specified, the Reader/Writer reads the state of a terminal.
-------------	---

<Response Format>

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

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
OUT1 to OUT4	Indicates the state of the output. 1: ON, 0: OFF
IN1 to IN3	Indicates the state of the input. 1: ON, 0: OFF

5-6-6 Test (TS)

This command returns test messages sent from the host with no change made. The test command is used for testing communications between the host and the Reader/Writer and other purposes.

<Command Format>

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

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

<Response Format>

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

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Test message	Returns the test message received using commands.

5-6-7 Version (VS)

This command reads the software version for the Reader/Writer.

**<Command Format>**

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

**<Response Format>**

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

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
---------------	---



### 5-7-1 Reader/Writer AFI Enable/Disable Changeover (AE): ISO Mode only

In ISO mode, you must set AFI of the Reader/Writer either enable or disable when communicating with a Tag. If you set AFI enable, only Tags, which has the same AFI, can be communicated. When you set AFI disable, the communications are enabled no matter AFI in Reader/Writer is set or not.

**<Command Format>**

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

AFI enable/disable	Specifies either valid or invalid of AFI setting in Reader/Writer. 0: disabled (factory setting) 1: enabled For "**", the Reader/Writer reads and writes current settings.
--------------------	---

**<Response Format>**

STX	Node No.	Retry flag	Command code "AE"	Response code "00"	AFI Setting	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
AFI valid/invalid	Indicates valid/invalid of AFI in hexadecimal.

**NOTE**

- A setting becomes valid after executing Reset Command(XZ). To keep the setting valid next startup, you need to save with Setting Write Command(EW).
- This command is for ISO Mode Only. The command is not available in I.CODE1 mode.

### 5-7-2 Reader/Writer AFI Value setting (AF): ISO Mode only

In ISO mode, you must set and read AFI of the Reader/Writer. When you set AFI enable, only Tags, which has the same AFI, can be communicated. When the setting is "00", the communications are enabled.

**<Command Format>**

STX	Node No.	Command code "AF"	AFI	ETX	BCC
1	2	2	1	1	1

FI	Specifies AFI in hexadecimal. Specification range:00h to FFh (factory setting "00") For "**", the Reader/Writer reads and writes current setting of AFI.
----	--

**<Response Format>**

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

Response code	00: normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
AFI	Specifies AFI in hexadecimal.

**NOTE**

- A setting becomes valid after executing Reset Command. To keep the setting valid next startup, you need to save with Setting Write Command (EW).
- This command is for ISO Mode Only. The command is not available in I.CODE1 mode.

### 5-7-3 Reader/Writer Family Code Setting (FC): I.CODE1 Mode

The FC Command is used to set or read the Family Code in the Reader/Writer. Only Tags that have the same Family Code as the one set by this command can perform communications. If this Family Code is set to 00, communications will be possible with all Tags. The default set value of the Reader/Writer is 00.

**<Command Format>**

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


Family Code	The Family Code is designated in hexadecimal. Specification range: 00h to FFh (factory setting: "00") When the Family Code set to "**," the Family Code currently set in the Reader/Writer will be read.
-------------	--

**<Response Format>**

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Family Code	Indicates current Family Code in hexadecimal.

**NOTE**

-  : • A setting becomes valid after executing Reset Command(XZ). To keep the setting valid next startup, you need to save with Setting Write Command (EW).
- This command is for I.CODE1 Mode Only. The command is not available in ISO mode.

### 5-7-4 Reader/Writer Application ID Setting (AI): I.CODE1 Mode

This Command is used to set or read and read the application ID in the Reader/Writer in 1.CODE1 Mode Only Tags that have the same application ID as the one set by this command can perform communications. If the application ID in the Reader/Writer is set to 00, communications will be possible with all Tags.

**<Command Format>**

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


Application ID	The application ID is designated in hexadecimal. Specification range: 00h to FFh When the application ID is set to "**," the application ID currently set in the Reader/Writer will be read.
----------------	--

**<Response Format>**

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

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Application ID	Indicates current Application I in hexadecimal.

**NOTE**

-  : • A setting becomes valid after executing Reset Command(XZ). To keep the setting valid next startup, you need to save with Setting Write Command(EW).
- This command is for I.CODE1 Mode Only. The command is not available in ISO mode.

5-7-5 UID/SNR Addition Setting (SN)

This command selects whether SNR will be added to a response to a Read Command (excluding Special Read).

<Command Format>

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

Addition mode	Specify whether SNR will be added to a response. Setting range: 0 to 1, or * When * is specified, the Reader/Writer reads the number that is currently set.			
	Specification number	0	1	*
	UID(SNR) addition mode	Disabled	Enabled	-

<Response Format>

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

Response code:	00: Normal completion For other response codes, refer to 5-3-7 Response Code List.
addition mode	Indicates the number corresponding to the specified addition mode.

<Response when setting is invalid>

STX	Node No.	Retry flag	Command code "RD"	Response code: "00"	Read data	ETX	BCC
1	2	1	2	2	As specified	1	1

<Response when setting is valid>

STX	Node No.	Retry flag	Command code "RD"	Response code: "00"	UID(SNR)	Read data	ETX	BCC
1	2	1	2	2	16	As specified	1	1

Response code:	00: Normal completion For other response codes, refer to 5-3-7 Response Code List.
UID(SNR)	Indicates the UID(SNR) read from the Tag.
Read data	Indicates the data read from the Tag.

**Precautions on using the command in I.CODE1 mode**

- SNR is not added to the response for Fast Read Access (U ) even though UID/SNR addition setting is enabled.
- The correct SNR value is not returned as a response by the Tag Designation Command even though UID/SNR addition setting is enabled. The setting must be disabled or data in SNR area must be ignored.

**NOTE**

✂ : • The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-6 Node Number Setting(NN)

This command sets and reads the node number of the Reader/Writer.

**<Command Format>**

STX	Node No.	Command code "NN"	Node number change specification	ETX	BCC
1	2	2	2	1	1


Node number change specification	Specifies the node number in decimal that you want to change. Specification range: 00 to 31, ** When "***" is specified, the Reader/Writer reads the current setting.
----------------------------------	---

**<Response Format>**

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

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Node number	Indicates the specified node number in decimal.

**NOTE**

 : • The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-7 Communications Port Setting(CP)

This command sets the baud rate for the communications port (Com Port), data length, parity bit, and stop bit for use in communications with the host.

**<Command Format>**

STX	Node No.	Command code "CP"	Port No.	Baud rate	Data length	Parity bit	Stop bit	BCC Enabled/Disabled	ACK NACK	time out	ETX	BCC
1	2	2	1	1	1	1	1	1	1	1	1	1


Port No.	Specify the port number that you want to change in decimal. Specification range: 1 or 2				
	Specification number	1		2	
	Port	COM1		COM2	
Baud rate	Specify the number corresponding to the baud rate that you want to change. Specification range: 0 to 3, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specified number	0	1	2	3
Baud rate	9600 bps	19200 bps	38400 bps	115200 bps	-
Data length	Specify the number corresponding to the data length that you want to change. Specification range: 0, 1, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0		1	
Data length	7Bit		8Bit		-
Parity bit	Specify the number corresponding to the parity bit that you want to change. Specification range: 0, 1, 2, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0	1	2	*
Parity	No	Odd	Even	-	
Stop bit	Specify the number corresponding to the stop bit that you want to change. Specification range: 0, 1, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0		1	
Stop bit	1 bit		2 bits		-
BCC Enabled/Disabled	Specify the number corresponding to the BCC setting that you want to change. Specification range: 0, 1, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0		1	
BCC	Disabled		Enabled		-
ACK/NACK	Specify the number corresponding to the communications mode that you want to change. Specification range: 0, 1, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0		1	
ACK/NACK Control	Disabled		Enabled		-
ACK/NACK timeout period setting	Specify the number corresponding to the timeout period that you want to change. Specification range: 0, 1, *				
	When * is specified, the Reader/Writer reads the current setting.				
	Specification number	0		1	
Timeout period	0.5 sec		5 sec		-

**<Response Format>**

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

Response code:	00: Normal completion For other Response Codes, refer to Response Code List.
Port No.	Indicates the number corresponding to the specified terminal resistance.
Baud rate	Indicates the number corresponding to the specified baud rate.
Data length	Indicates the number corresponding to the specified data length.
Parity bit	Indicates the number corresponding to the specified parity bit.
Stop bit	Indicates the number corresponding to the specified stop bit.
BCC Enabled/Disabled	Indicates the number corresponding to the specified BCC setting.
ACK/NACK	Indicates the number corresponding to the specified control mode.
Timeout	Indicates the number corresponding to the specified timeout period.

**NOTE**

 : • The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-8 Communications Type Setting (CT)

This command selects whether COM1 will be used as RS-232C or RS-485.

**<Command Format>**

STX	Node No.	Command code "CT"	Communications type	ETX	BCC
1	2	2	1	1	1


Communications type	Specify the number corresponding to the communications type that you want to select. Specification range: 0, 1, * When "*" is specified, the Reader/Writer reads the current setting.			
	Specification number	0	1	*
	Communications type	RS-232C	RS4-85	-

**<Response Format>**

STX	Node No.	Retry flag	Command code "CT"	Response code: "00"	Communications type	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Terminal setting	Indicates the number corresponding to the specified terminal resistance.

**NOTE**

 : The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-9 Tag Communications Mode Setting(CM)

This command sets and reads the communications mode for use in communications with Tags.

**<Command Format>**

STX	Node No.	Command code "CM"	Communications mode	ETX	BCC
1	2	2	1	1	1


Communications mode	Specify the number corresponding to the communications mode that you want to select for communications with Tags. Specification range: 0, 1, * When "*" is specified, the Reader/Writer reads the current setting.			
	Specification number	0	1	*
	Tag communications mode	Standard Mode	Fast Mode	-

**<Response Format>**

STX	Node No.	Retry flag	Command code "CM"	Response code: "00"	Communications mode	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Communications mode	Indicates the number corresponding to the specified terminal resistance.

**NOTE**

 : The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-10 Antenna Changeover(AC)

This command selects whether the receiving function of each antenna will be enabled or disabled.

**<Command Format>**

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


Antenna selection	Specify the number corresponding to how TX/RX ANT and RX ANT will be used. Setting range: 0 to 3, or * When "*" is specified, the Reader/Writer reads the current setting.					
	Setting	0	1	2	3	*
	TX/RX ANT	Disabled	Enabled	Disabled	Enabled	-
	RX ANT	Disabled	Disabled	Enabled	Enabled	-

**<Response Format>**

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

Response code:	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Antenna selection	Indicates the number corresponding to the specified antenna selection.

**NOTE**

-  : • The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).
- This setting enables or disables the receiving circuit of each antenna. Therefore, if TX/RX ANT (transmitting/receiving antenna) is disabled by this setting, the antenna can perform transmission only.

### 5-7-11 Terminal Resistance Setting (TM)

This command sets and reads the terminal resistance (for RS-485).

**<Command Format>**

STX	Node No.	Command code "TM"	Terminal specification	ETX	BCC
1	2	2	1	1	1


Terminal specification	Specify the value, 0 or 1, that corresponds to the terminal resistance that you want to change. Specification range: 0, 1, or * When "*" is specified, the Reader/Writer reads the current setting.					
	Specification number		0	1	*	
			OFF	ON	-	

**<Response Format>**

STX	Node No.	Retry flag	Command code "TM"	Response code: "00"	Terminal setting	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Terminal setting	Indicates the setting corresponding to the specified terminal resistance in decimal.

**NOTE**

-  : • The setting is enabled after reset by the Reset Command(XZ). To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).



## 5-7-12 Offline Mode Setting (FL)

This command selects whether the Reader/Writer will start in online mode or offline mode.

When offline mode is selected, the Reader/Writer will perform EAS check independent of the host, and output a signal from the output port (OUT1) if the result exceeds the specified criterion.

## &lt;Command Format&gt;

STX	Node No.	Command code "FL"	On/OFF mode	Time	Threshold	ETX	BCC
1	2	2	1	2	2	1	1

On/OFF mode	Specify the number corresponding to the mode in which the Reader/Writer will start. Specification range: 0, 1, * When "*" is specified, the Reader/Writer reads the current setting.			
	Specification number	0	1	*
	On/OFF mode	Online mode	Offline mode	-
Time (*100ms)	Specify the length of time in HEX for which the signal will be output to OUT1 in offline mode. Specification range: 01 to FFh (100ms to 22.5s) When "***" is specified, the Reader/Writer reads the current setting.			
Threshold (%)	Specify the threshold in HEX to be output to OUT1 in offline mode. Specification range: 00h to 64h (%) (Refer to EAS Check Command.) When "***" is specified, the Reader/Writer reads the current setting.			

## &lt;Response Format&gt;

STX	Node No.	Retry flag	Command code "FL"	Response code: "00"	On/OFF mode	Time	Threshold	ETX	BCC
1	2	1	2	2	1	2	2	1	1

Response code:	00: Normal completion For other response codes, refer to 5-3-7 Response Code List.
On/OFF mode	Indicates the number corresponding to the specified On/Off mode.
Time	Indicates the time corresponding to the specified On/Off mode.
Threshold	Indicates the criterion corresponding to the specified On/Off mode.

## Notes on the execution of Offline Mode Setting Command

The setting is enabled after reset by Reset Command (XZ).

To enable the setting at the next startup, the setting must be saved in the non-volatile memory (EEPROM) on the Reader/Writer using Set Value Writing (EW).

To enable EAS on the Tag, use System Write (SW) in ISO Mode, or EAS Setting (ES) in I.CODE1 Mode. The command related to this is the EAS Setting(ES) and EAS Check(EA).

### 5-7-13 Set Value Initialization (IS)

If necessary, you can return all the settings to their factory settings.

**<Command Format>**

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

**<Response Format>**

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

Response code:	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
----------------	---

**NOTE**

- The factory defaults vary, depending on the software version. The difference must be taken into account when executing the command.
- The factory defaults vary, depending on the software version. The difference must be taken into account when executing the command.

### 5-7-14 Set Value Writing (EW)

This command is executed to keep the settings made by the commands after recovering the power of the Reader/Writer.

**<Command Format>**

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

**<Response Format>**

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

Response code:	00: Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
----------------	---

**NOTE**

- On successful completion of this command, the settings are written to the nonvolatile memory (EEPROM) of the Reader/Writer. Once the EW command has been executed, all the settings made up to this point in time are written to the nonvolatile memory, thereby eliminating the need to execute this command every time you make a setting.
- If Set Value Writing (EW) is not executed, the value specified will be reset to original value at the next start-up.

### 5-7-15 Chip Operating Mode Switch (TY)

This command changes the operating mode (ISO/I.CODE1) of the Reader/Writer.

**<Command Format>**

STX	Node No..	Command code "TY"	Tag type	ETX	BCC
1	2	2	1	1	1


Tag type	Specifies the mode. 0: I.CODE1 mode 1: ISO mode When the Operating Mode is set to "**," the Operating Mode currently set in the Reader/Writer will be read.
----------	--

**<Response Format>**

STX	Node No..	Retry flag	Command code "TY"	Response code "00"	Tag type	ETX	BCC
1	2	1	2	2	1	1	1

Response code	00:normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Tag type	Specifies the mode.

**NOTE**

 : The setting is enabled after reset by the Reset Command. To enable the setting for the next start-up, the setting must be saved by Set Value Writing (EW).

### 5-7-16 Duplicate Communication Protecting Function setting (MX)

This command specifies the enabled/disabled state of the duplicate communication protecting function and the number of tables in the enabled state. When the function is enabled, the Tag is read only once at the execution of a command with FIFO Repeat (FR), Multiple Trigger, or Multiple Repeat (MR, UR [I.CODE1 mode]) options. Refer to SECTION 3-8 for the details of the function.

**<Command format>**

STX	Node No.	Command code "MX"	Number of tables	Extension "0"	ETX	BCC
1	2	2	1	1	1	1

Number of tables	Specifies the enabled/disabled state of the duplicate communication protecting function and the number of tables used to record UID/SNR in the enabled state. Specifying 0 for the number of tables disables the function. Specification range: 0 to 8 (Factory default: 0 - disabled)									
	When * is specified, the currently specified value is read.									
	Value	"0"	"1"	"2"	"3"	"4"	"5"	"6"	"7"	"8"
Specified number	Disa bled	1	4	8	16	32	64	128	256	
Extension	The number specified for an extension, always specify 0.									

**<Response Format>**

STX	Node No.	Retry Flag	Command code "MX"	Response Code "00"	Number of tables	Extension "0"	ETX	BCC
1	2	1	2	2	1	1	1	1

Response Code	00:Normal completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Number of tables	Number of tables specified extension.
Extension	The Extension number specified 0 is always returned.

**NOTE**

- The setting is enabled after reset by the Reset Command. To enable the setting at the next start-up, the setting must be saved by Set Value Writing command (EW).
  - For the number of tables, specify the closest number above the maximum number of Tags that coexist in the communication area of the antenna used.
  - In executing the command in I.CODE1 Mode with UR option, **fix FB for the start page, and specify the number 2 and greater for the number of pages.** Specifying other than these values results in command error (Code: 14).
- Example: To read the pages from FB to 01, [STX]00RDURH2FB07[ETX][BCC]

### 5-7-17 I/O Automatic Changeover setting (CA)

This function alternately turns the output terminals (OUT3 and OUT4) ON and OFF for Multiple Repeat and EAS. Check commands every time the command is issued. This is used to switch multiple antennas automatically.

Enable the function when a special antenna that requires this function is used. Otherwise, disable the function.

#### <Command Format>

STX	Node No.	Command code "CA"	Output	ETX	BCC
1	2	2	1	1	1

Output	Specifies the enabled/disabled state of the output signal. Specification range: 0,1, (Factory default: 0) When * is specified, the currently specified value is read.			
	Specified number	0	1	*
		Disabled	Enabled	-

#### <Response Format>

STX	Node No.	Retry flag	Command code "CA"	Response Code "00"	Output	ETX	BCC
1	2	1	2	2	1	1	1

Response Code	00:Normal Completion For other Response Codes, refer to SECTION 5-3-7 Response Code List.
Output	Output value Displays the specified output value.

#### NOTE

- The setting is enabled after reset by the Reset Command. To enable the setting at the next start-up, the setting must be saved by Set Value Writing (EW).
- Alternately, the OUT3 and OUT4 on the Reader/Writer are turned ON and OFF.
- This function is applied only for Multiple Repeat read and EAS check (and offline EAS check) command in ISO mode, and EAS check (and offline EAS check) command in I.CODE1 Mode. The function is not activated by other commands.
- When the function is enabled, the control of OUT3 and OUT4 by I/O Control Command (CC) is unavailable. To control OUT1 and OUT2, specify \* for the OUT3 and OUT4 values. Example) When OUT1:ON, OUT2:OFF, Note No. 00 [STX]00CC10\*\*[ETX][BCC]

**5-8-1 Command Undefined Response**

When the Reader/Writer receives a command code which is not on the command list, the Reader/Writer returns the Command Undefined Response.

**<Response Format>**

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

This Command Connection works in I.CODE1 Mode Only, and does not support ISO Mode.

A command connection function allows the Reader/Writer to perform a pair of read and write operations at a time by sending a command only once.

Any of the following six commands can be paired.

- Read (RD) This excludes Special Read.
- Write (WT)
- Polling Single Auto Read (PR)
- Polling Single Auto Write (PW)
- Memory Check (MC)
- Memory Calculation (MK)

Example of command connection

In a command connection function, a single STX, Node No., BCC and ETX are shared each, and connected to each other using "+."

**<Command Format>**

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

**<Response Format>**

(1) When completed successfully

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

(2) When completed unsuccessfully

When a command has not completed successfully, the command code of the command (1) and a response code are returned.

STX	Node No..	Retry flag	Command (1) Code	Response code	ETX	BCC
1	2	1	2	2	1	1

The Following Combinations of Command Connections Are Possible.

		Command (1)					
		Read (RD)	Write (WT)	Memory Calculation (MK)	Memory check (MC)	Polling read (PR)	Polling write (PW)
Command (2)	Read (RD)	✓	✓	-	-	-	-
	Write (WT)	✓	✓	-	-	-	-
	Memory Calculation (MK)	-	✓	-	-	-	-
	Memory check (MC)	✓	-	-	-	-	-
	Polling read (PR)	-	-	-	-	✓	✓
	Polling write (PW)	-	-	-	-	✓	✓

(: Command connection is possible; ( : Command connection is not possible

<b>Note</b>
<p>1. Communications method The communications method specified using command (1) is given priority. Single Auto is specified for Polling commands, and Single Trigger is specified for the memory check and memory calculations.</p> <p>2. Polling process If a Polling command is specified as command (1), the Reader/Writer will perform Polling.</p> <p>3. Tag No. setting The number of Tag No. setting made using command 1 is given priority.</p>



# SECTION 6

## Startup and Full Operation

<b>6-1</b>	<b>Error Types and Diagnostic Functions .....</b>	<b>6-2</b>
<b>6-2</b>	<b>Errors and Remedies .....</b>	<b>6-3</b>
<b>6-3</b>	<b>Maintenance and Inspection .....</b>	<b>6-4</b>
<b>6-4</b>	<b>Troubleshooting .....</b>	<b>6-6</b>
6-4-1	Check Flowchart .....	6-6
6-4-2	Check Items for Each Response Code .....	6-10

The Reader/Writer performs a variety of self-diagnostic functions to reduce system downtime in case of an error. The errors detected by the Reader/Writer are categorized into fatal errors and nonfatal errors.

**Fatal Error** If the Reader/Writer main unit or hardware fails, the CPU operation is interrupted and the ERROR LED is turned on or flashed.

CPU error

Detects the CPU operation error using the watch dog timer (W.D.T.)

Memory error

Checks if data is read from or written onto the internal memory normally when the power is on.

**Nonfatal error** When an error occurs during communications between the Reader/Writer and the host, or the antenna and Tag, the ERROR LED is turned on.

Communication error

Checks for the errors in the communication processing sequence, frame, check code, and data at the execution of a command. The error code corresponding to each error, is returned to the host as the response. (Error code:1 )

Host communication error

Checks for the errors in the communication processing sequence of the command data, frame, check code, and data at the reception of a command. The error code corresponding to each error is returned to the host as the response. (Error code:7 )

System error

Checks that the command processing functions (EEPROM, communication circuit, etc.) are normal at the execution of a command. The error code corresponding to each error is returned to the host as the response. If the error occurs repeatedly, the device needs repair. (Error code:7C, 93)

Set value error

Checks that set data concerning the operating environment on the EEPROM in the main unit is not corrupted.. Checks for errors at power on, and if the error(s) are detected, operates in Online Mode with the factory default settings. The operating environment is regained by setting the operating conditions once again.

### LED states in each condition

	Item	Indicator			
		RUN	COMM	NORM	ERROR
Normal operation	Awaiting command				
	Communicating with Tag/ Offline mode		/ ●		
	Normal completion of communications with Tag				
Fatal error	CPU error				
	Memory error				●
Nonfatal error	Communications error				
	Host communications error				
	System error				
	Setting error				●

: ON, : OFF, ● : Flashing

\* The LED-lit state for the set value error is retained until the next command has been executed.

**NOTE** : During the communication with Tags in Online Mode, the COMM LED is lit in the software versions 1.20 and higher, or flashes in versions 1.10 and lower.

The following are considered to be main causes of system breakdowns.

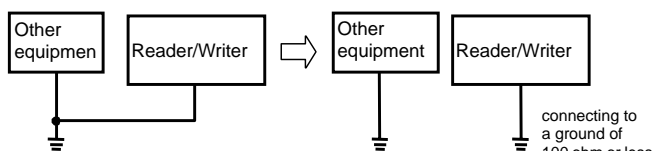
- Noise Interference..... Take appropriate countermeasures against noise.
  - Failures in any of the external devices
  - Failures in the Reader/Writer
  - Failures in the Antenna
  - Failures in the cable
  - Failures in any of the Tags
  - Others
- } Repairs are required.

**Noise Interference**

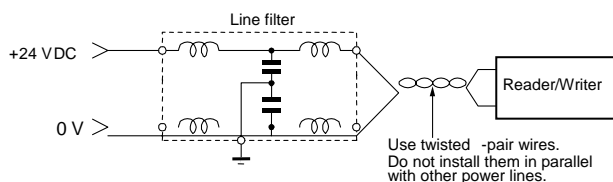
If the system malfunctions due to noise, refer to the following and take appropriate countermeasures.

No.	Circumstance of failure	Probably cause	Remedy
1	Occurs when a heavy-duty motor, transformer, or capacitor is turned ON.	An instantaneous voltage drop due to inrush current to the heavy load.	Increase the capacity of the power supply and that of the power cable.
		Common mode noise caused by the above cause.	Provide the power through a 1-to-1 non-grounded insulating transformer. Independently ground the Reader/Writer at a resistance less than 100 ohm.
2	Occurs irregularly	Noise on power line	Provide the power through a 1-to-1 non-grounded insulating transformer or noise filter. Independently ground the Reader/Writer at a resistance less than 100 ohm.
		Noise propagated through space 1. When a power circuit, power wire, or other signal wires for the devices are located near the antenna. 2. When a driving system such as an inverter or motor is located nearby. 3. When a power unit such as a switching power source is located nearby.	1. Place the power circuit, power wire, or other signal wires for the devices as far away from the antenna as possible. Be sure to wire antenna cables separately from other cables. Shield the power circuit, power wire, or signal wires for other devices. 2. Be sure to ground the unit of the driving system. Place the unit as far away from the antenna as possible. 3. Be sure to ground the power unit. Place the unit as far away from the antenna as possible.
		More than one V720-series Antenna	When operating more than one V720-series Antenna, provide a sufficient clearance between the Antennas. Refer to the instruction manual for your antenna for details.

Improvement of grounding



Remedy for power noise



The V720 Series must be inspected on a daily or regular basis so that the functions of the V720 Series can be used in good condition.

The V720 Series consists of semiconductors that last almost indefinitely. The following malfunctions may, however, result due to the operating environment and conditions.

- (1) Element deterioration due to overvoltage or overcurrent.
- (2) Element deterioration due to continuous stress caused by high ambient temperature.
- (3) Connector contact faults or insulation deterioration due to humidity and dust.
- (4) Connector contact faults or element corrosion due to corrosive gas.

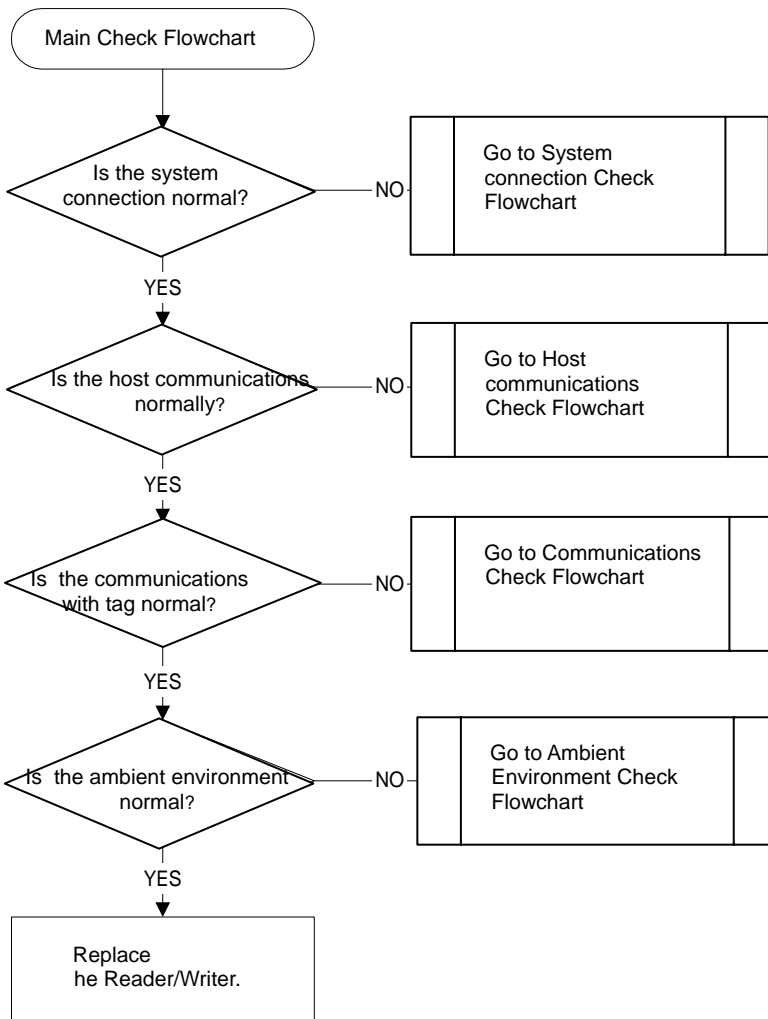
**Item**

No	Item	Detail	Criteria	Remarks
1	Supply voltage fluctuation	(1) Check that the supply voltage fluctuation at the power supply terminal block is within the permissible range.	Supply voltage rating	Voltage tester
		(2) Check that there is no frequent instantaneous power failures or radical voltage drops.	Within permissible voltage fluctuation range	Power supply analyzer
2	Environment a. Ambient temperature b. Ambient humidity c. Vibration and shock d. Dust e. Corrosive gas	a. Check that the ambient temperature is within the specified range. b. Check that the humidity is within the specified range. c. Check that no vibration or shock is transmitted from any machines. d. Check that the system is free of adherence or accumulation of dust or foreign matter. e. Check that no metal part of the system is discolored or corroded.	a. Check that the ambient temperature is within the specified range. b. Check that the humidity is within the specified range. c. Check that the ambient temperature and humidity are within the specified ranges. d. Check that there is no dust or foreign matter. e. Check that there is no discoloration or corrosion.	Maximum and minimum thermometer Hygrometer
3	Panel condition a. Ventilation b. Packing for any enclosed construction	a. Check that the system is ventilated properly with natural ventilation, forced ventilation, or cooling air. b. Check that the packing is properly attached with no damage.	a. The interior temperature must be within a range between -10°C and 50°C with proper ventilation. b. The packing has no damage.	
4	I/O power supply a. Voltage fluctuation b. Ripple	Check on the I/O terminal block that the voltage fluctuation and ripple are within the permissible ranges.	The voltage fluctuation and ripple must be within the specified range.	Voltage tester Oscilloscope
5	Mounting condition	(1) Check that each device is securely mounted.	There must be no loose screws.	
		(2) Check that each connector is securely connected.	Each connector is locked or securely tightened with screws	
		(3) Check that no screw of the terminal block is loosened.	There must be no loose screws.	
		(4) Check that no wire is broken or nearly broken.	There must be no wire that is broken or nearly broken.	
		(5) Check that the distance between the Tag and Antenna is within the specified range.	The distance between the Tag and Antenna must be within the specified range.	
		(6) Check that the GR terminal is grounded.	The terminal must be grounded to a resistance of 100 ohm or less.	

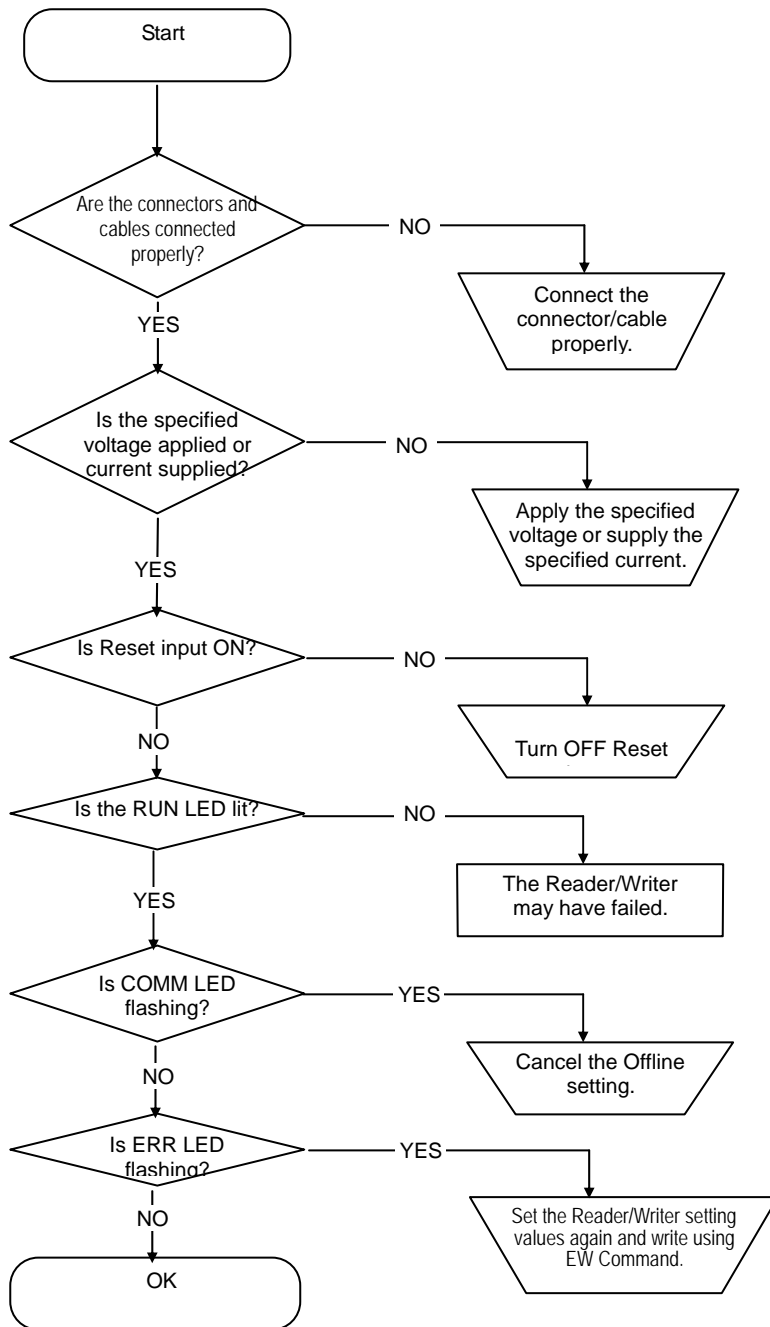
### 6-4-1 Check Flowchart

Use the following main check flowchart to determine the cause of the error.

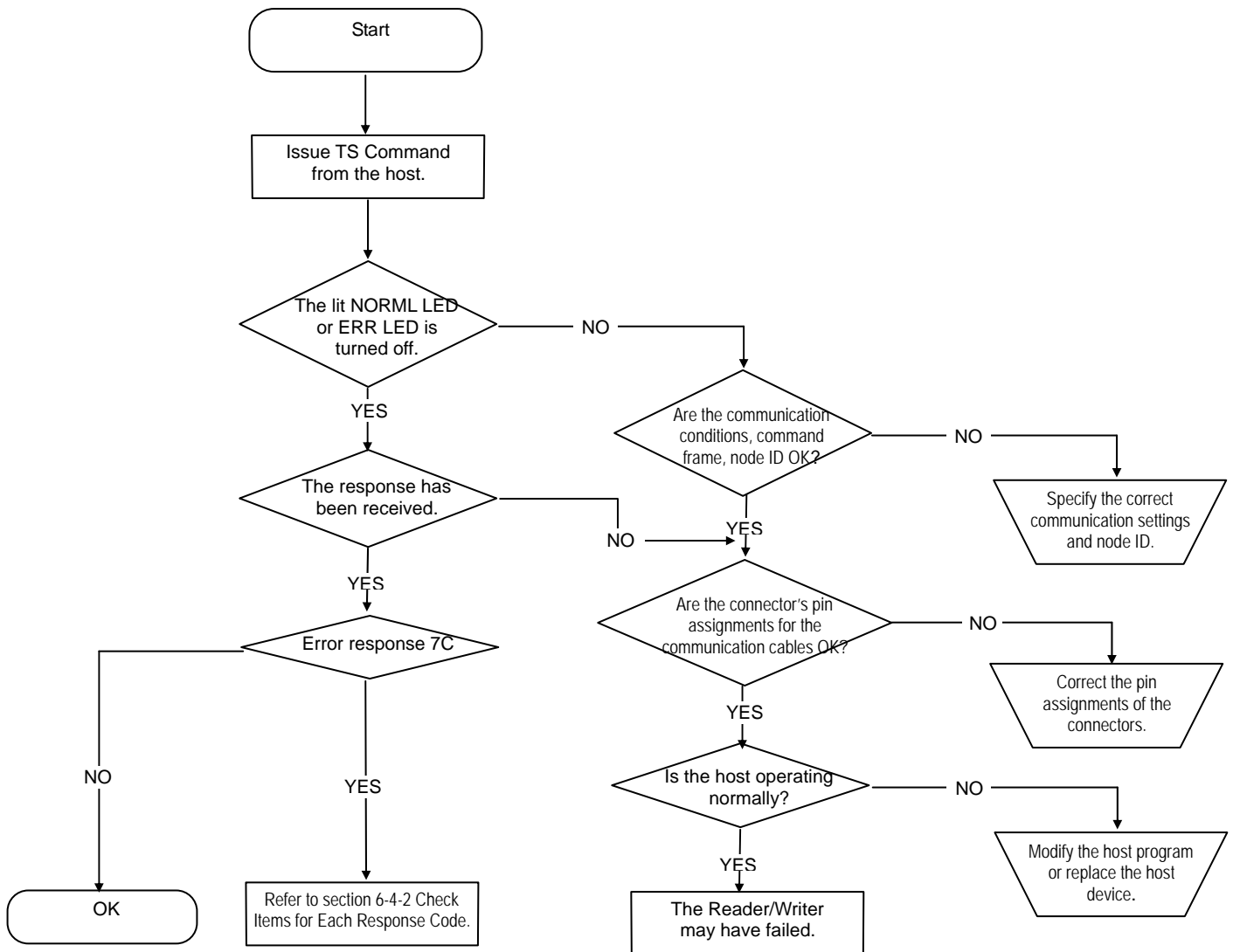
#### Main Check Flowchart



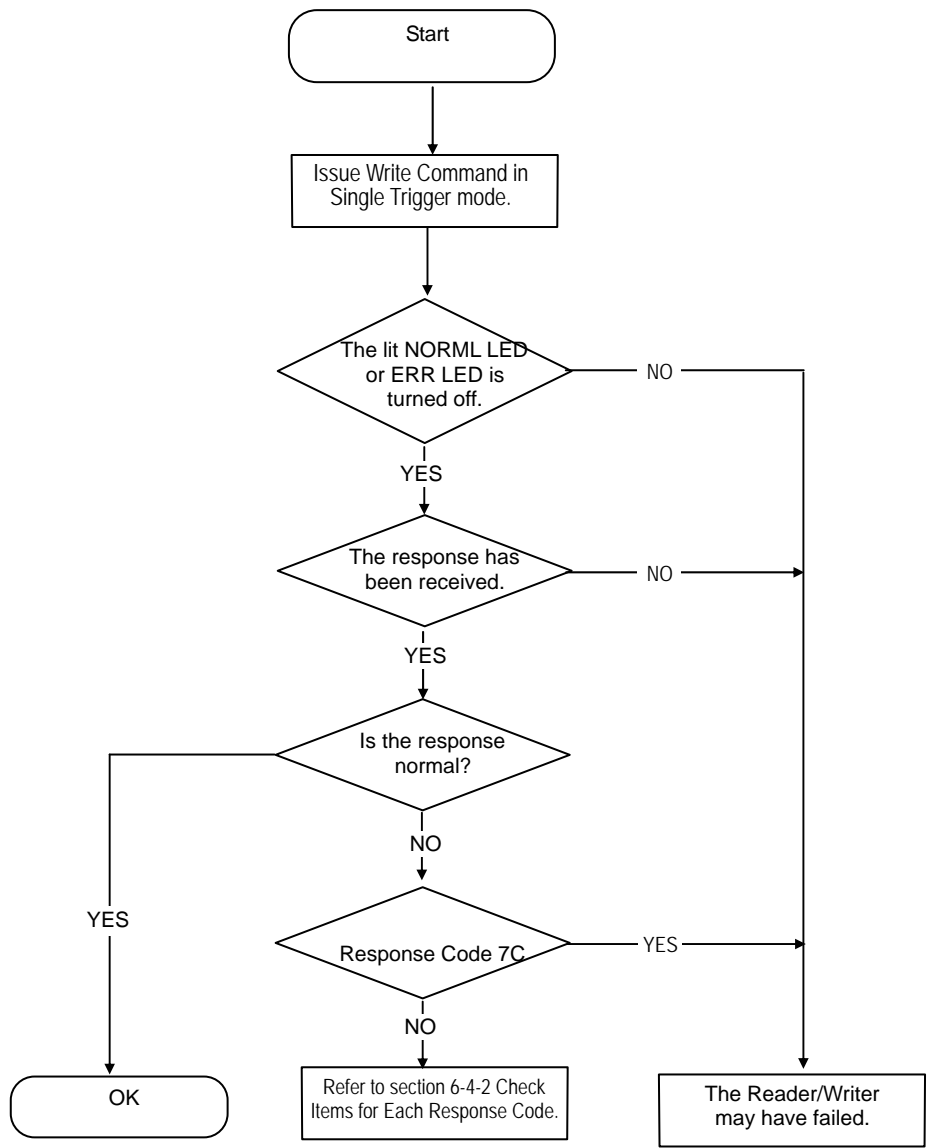
System connections check flowchart



Host communications Check Flowchart

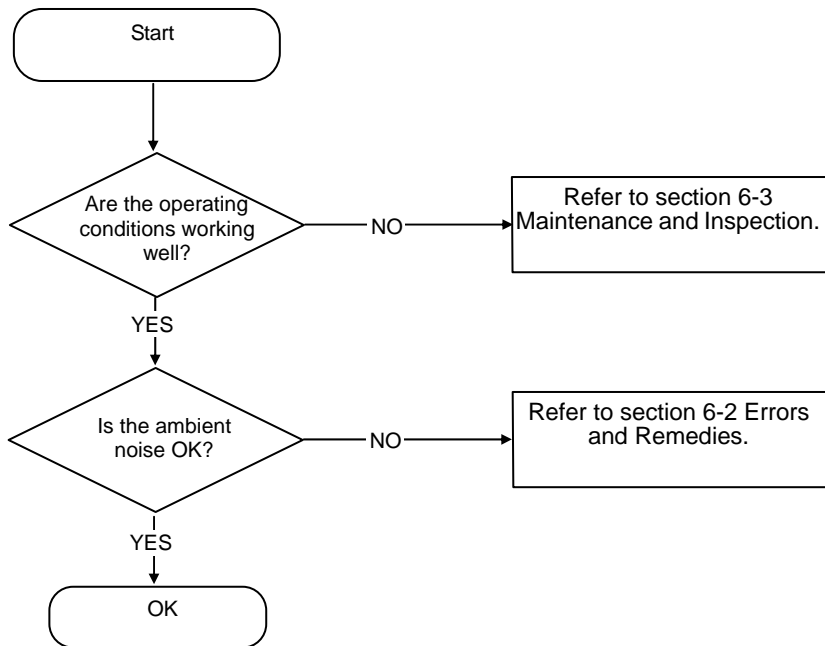


Communications Check Flowchart





External Environment Check Flowchart



## 6-4-2 Check Items for Each Response Code

Response Code	Primary check items
(Nonresponding state)	<ul style="list-style-type: none"> <li>• Are the communication conditions set for the host and the Reader/Writer matched? Transmission rate, data length, stop bit length, parity (even, odd, none)</li> <li>• Is the control code (STX/ETX) transmitted properly?</li> <li>• Are the command node No. and Reader/Writer node No. setting matched?</li> <li>• Is the Reader/Writer set to Offline mode?</li> <li>• Is the command issued by the Reader/Writer executable in the state? Offline mode: Commands are not accepted. Communication with the Tag in progress: Commands are not accepted. FIFO mode: Only FIFO Access command is accepted. Select state: Only Tag Designation command is accepted.</li> <li>• *Stop Command (ST) and Reset Command (XZ) are always executable.</li> <li>• Is the command issued during the initialization (approximately 2.5 seconds) that follows power ON or Reset Command execution?</li> </ul>
" 10 "	<ul style="list-style-type: none"> <li>• Are the communication conditions set for the host and the Reader/Writer matched?</li> </ul>
" 11 "	<ul style="list-style-type: none"> <li>• Transmission rate, data length, stop bit length, parity (even, odd, none)</li> </ul>
" 12 "	<ul style="list-style-type: none"> <li>• Is there a noise source near the communication cables?</li> </ul>
" 13 "	<ul style="list-style-type: none"> <li>• Is the added BCC correct? Calculation method, Format (Binary, 1byte)</li> </ul>
" 14 "	<ul style="list-style-type: none"> <li>• Is data for each command field correct? Communication method specified (Types, combination with the commands), specified data, Tag types, page, written data</li> <li>• Is the command executable with the Reader/Writer's chip operating mode (I.CODE1/ISO) settings?</li> <li>• Is the simplified number already assigned using Tag designation command? [I.CODE1 Mode]</li> </ul>
" 18 "	<ul style="list-style-type: none"> <li>• Is the command to be issued correct?</li> <li>• Is the control code (STX/ETX) transmitted correctly?</li> </ul>
" 70 "	<ul style="list-style-type: none"> <li>• Aren't there multiple Tags present in the communication area? [In Single Access mode]</li> <li>• Is there any antennas other than the one communicating, nearby?</li> <li>• Are there any devices or cables that could be a source of noise nearby?</li> <li>• Is the Tag in the stable communication area?</li> <li>• Does the Tag stay for a short time in the communication area? (Is it moving fast enough?)</li> <li>• Is the specified page within the Tag's memory range?</li> <li>• Does the Reader/Writer support the Tag?</li> </ul>
" 71 "	<ul style="list-style-type: none"> <li>• Is the Tag re-written exceeding its rewrite cycle?</li> <li>• Is the write target page locked? [In ICODE1 Mode]</li> <li>• Does the Reader/Writer support the Tag?</li> </ul>
" 72 "	<ul style="list-style-type: none"> <li>• Is the communication distance between the antenna and Tag appropriate?</li> <li>• Are there multiple Tags present in the communication area?</li> <li>• Are chip operating mode and the type of Tag used matched?</li> <li>• Does the Reader/Writer support the Tag?</li> </ul>
" 79 "	<ul style="list-style-type: none"> <li>• Is the specified page within the Tag's memory range? [ISO mode - I.CODE SLI]</li> <li>• Is the write target page locked? [ISO Mode - I.CODE SLI]</li> </ul>
" 7A "	<ul style="list-style-type: none"> <li>• Is the specified page within the Tag's memory range? [ISO mode]</li> </ul>
" 7C "	<ul style="list-style-type: none"> <li>• If this occurs continuously, the Reader/Writer may fail.</li> </ul>
" 7E "	<ul style="list-style-type: none"> <li>• Is the specified page locked? [ISO Mode]</li> </ul>
( " IC " )	<ul style="list-style-type: none"> <li>• The command code for the command is incorrect.</li> </ul>

# SECTION 7

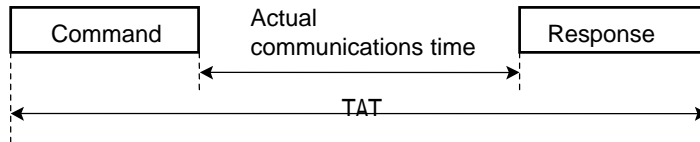
## Reference Data

<b>7-1</b>	<b>Turn Around Time and Communication Time.....</b>	<b>7-2</b>
7-1-1	Communication time in I.CODE1 mode.....	7-2
7-1-2	ISO mode - Communication time of I.CODE SLI chip .....	7-4
7-1-3	Turn Around Time (TAT) Calculation Method .....	7-6
<b>7-2</b>	<b>Calculating the speed of the Tag.....</b>	<b>7-7</b>

In the V720-series Reader/Writer, actual communications with a Tag are performed by reading or writing four-byte data per page.

- The following chart specifies the TAT (turn-around time) and actual communications time.
- The actual communications time in the following chart is the time required for communications between the Antenna and Tag, not including communications with the host. Use this for calculating the speed of the Tag for the execution of auto commands.

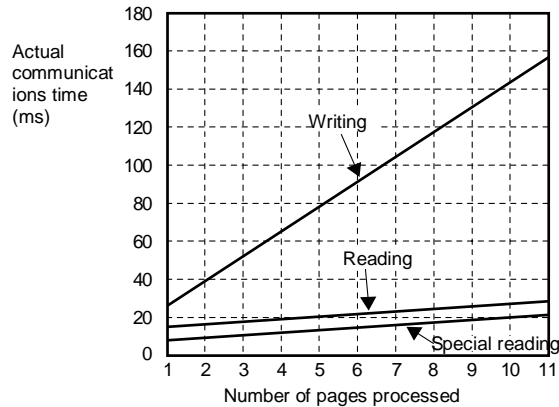
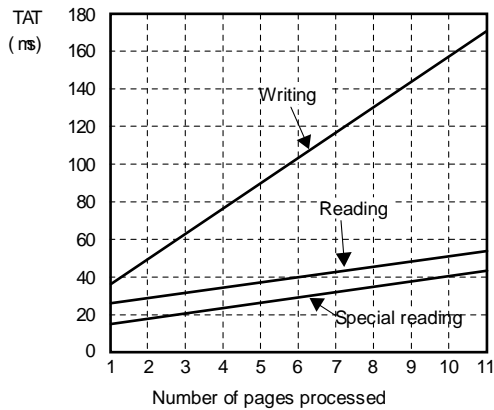
Ex.)



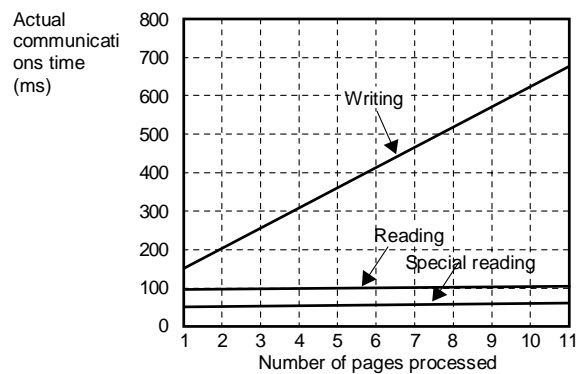
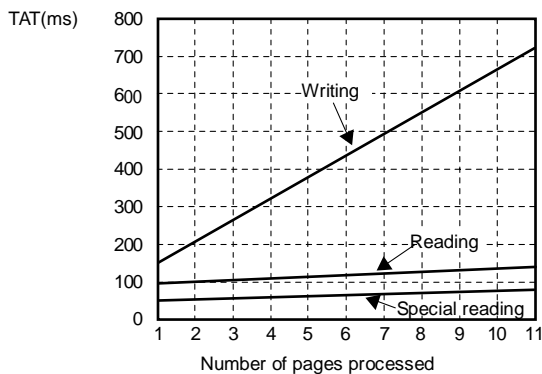
## 7-1-1 Communication time in I.CODE1 mode

### (1) Communication time in Single Access Mode

#### Fast mode




#### Standard Mode



Calculation Formula : I.CODE1 Chip

Communication time setting	Actual communications time (msec) N: Number of pages processed	
	Fast mode	Standard Mode
Special reading	$T = 1.3N + 6.2$	$T = 1.3N + 43.4$
Read	$T = 1.3N + 12.7$	$T = 1.3N + 91.6$
Write	$T = 13N + 13.5$	$T = 54.2N + 90.0$

- NOTE** :  The provided TAT graph data shows an example in which the V720S-BC5D4A Controller is used with the following communications specifications for host communications: Data is continuously sent with no space between characters, at a baud rate of 38,400 bps, in a data length of 7 bits with 1 start bit, 2 stop bits and even parity . The number of bytes in case ASCII are specified as the data code.
- The transmission rate of the Tag is set in Fast Mode as factory default.

**(2) Communication time in Multiple modes:** The communication time when the commands with multiple access options are used varies depending on operating conditions. Those conditions include the number of bytes, as well as the number of Tags in the communication area. The mean values in consideration of these conditions are shown in the table below.

Example of Multiple Access communication time: I.CODE1 Chip (msec)

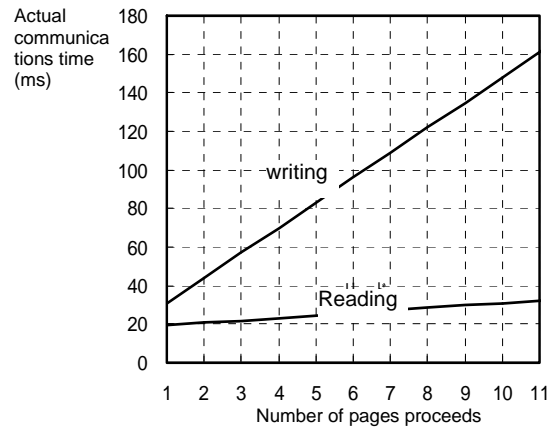
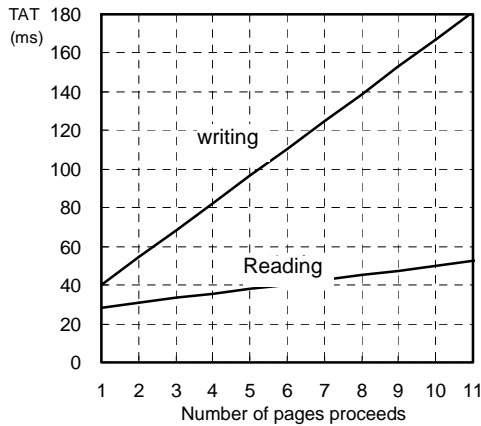
Number of Tags	Tag No.setting	2 pages (8 bytes) Read		2 pages (8 bytes) Write	
		Fast Mode	Standard Mode	Fast Mode	Standard Mode
2	1	144	560	190	715
4	2	301	917	378	1139
8	3	644	1659	784	2016
16	4	1391	3239	1656	3867

- NOTE** :  The transmission rate of the Tag is set in Fast Mode as factory default.

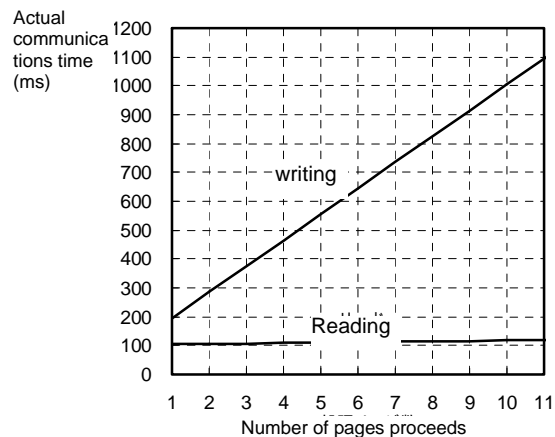
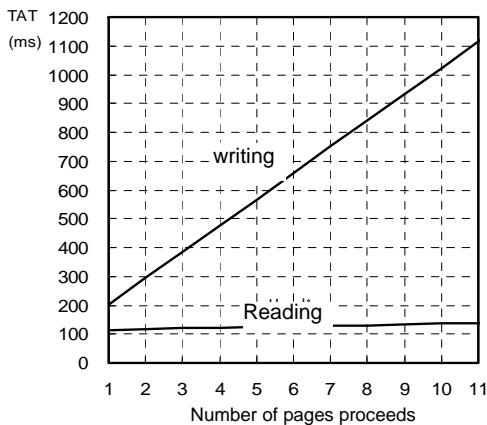
7-1-2 ISO mode - Communication time of I.CODE SLI chip

( 1 ) Communication time in Single Access Mode

Fast mode



Standard mode



Calculation Formula : I.CODE SLI Chip

Communication time setting	Actual communications time (msec) N: Number of pages processed	
	Fast mode	Standard Mode
Read	$T = 1.3N + 18.0$	$T = 1.3N + 104$
Write	$T = 13N + 18.0$	$T = 90N + 105$

- NOTE :**
- The provided TAT graph data shows an example in which the V720S-BC5D4 Controller is used with the following communications specifications for host communications: Data is continuously sent with no space between characters, at a baud rate of 38,400 bps, in a data length of 7 bits with 1 start bit, 2 stop bits and even parity . The number of bytes in case ASCII are specified as the data code.
  - The transmission rate of the Tag is set in Fast Mode as factory default.

- (2) **Communication time in Multiple modes:** The communication time when the commands with multiple access options are used varies depending on operating conditions. Those conditions include the number of bytes, as well as the number of Tags in the communication area. The mean values in consideration of these conditions are shown in the table below.

Example of Multiple Access communication time: I.CODE SLI Chip ( msec )

Number of Tags	2 pages (8 bytes) to read (ms)		2 pages (8 bytes) to write (ms)	
	Fast mode	Standard Mode	Fast mode	Standard Mode
2	115	749	161	1103
4	192	1300	285	2009
8	338	2354	525	3773
16	639	4511	1013	7349

**NOTE** : The transmission rate of the Tag is set in Fast Mode as factory default.

### 7-1-3 Turn Around Time (TAT) Calculation Method

#### Calculation of TAT

TAT can be calculated by adding the host communications time to the actual communications time. The host communications time varies depending on the communications settings and the codes that you specify.

Example of calculation: when operating in Single Access Mode and Trigger Mode to read 1 page (4 bytes) data

#### Code-specified in ASCII:

The total number of characters is 29, i.e., 15 characters in the command part and 14 characters in the response part. From this, the host communications time would be  $29 * 11 \text{ bits} / 38400(\text{bps}) * 1000 = 8.3 \text{ (ms)}$ . The communications time would be 14 ms for Fast Mode and 92.9 ms for Standard Mode. TAT, therefore, would be  $8.3 + 14 = 22.3 \text{ ms}$  for Fast Mode and  $8.3 + 92.9 = 101.2 \text{ ms}$  for Standard Mode.

#### Code-specified in HEX:

The total number of characters is 33, i.e., 15 characters in the command part and 18 characters in the response part. From this, the host communications time would be  $33 * 11 \text{ bits} / 38400(\text{bps}) * 1000 = 9.5 \text{ (ms)}$ . The communications time would be 14 ms for Fast Mode and 92.9 ms for Standard Mode. TAT, therefore, would be  $9.4 + 14 = 23.5 \text{ ms}$  for Fast Mode and  $9.4 + 92.9 = 102.4 \text{ ms}$  for Standard Mode.

**NOTE** :

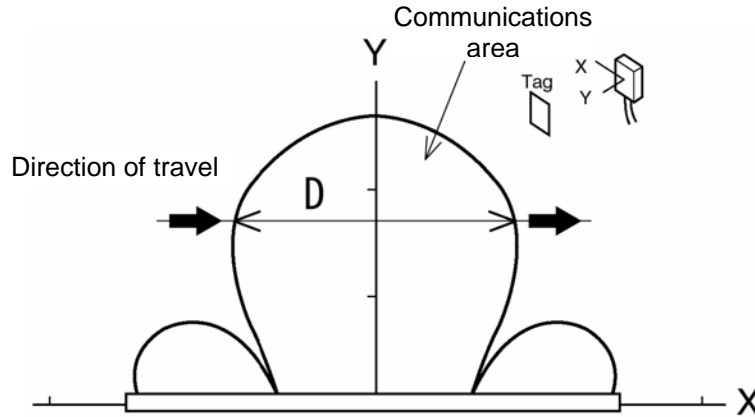
- The provided TAT graph data shows an example in which the V720S-BC5D4 Controller is used with the following communications specifications for host communications: The data is continuously sent with no space between characters, at a baud rate of 38,400 bps, in a data length of 7 bits with 1 start bit, 2 stop bits and even parity.

When communicating with a Tag in motion, select Auto or Repeat for the communications method.


The maximum speed at which the Tag can travel can be obtained easily, using the formula below.

$$\text{Max. traveling speed} = \frac{D \text{ (travel distance in communications area)}}{T \text{ (communications time)}} \times \text{Safety factor (0.5)}$$

Calculate D from the communications area drawing between the Antenna and the Tag or from the actual measurement.



**NOTE**

 : The formula above is for communications with one Tag. Be sure to check the traveling speed of multiple Tags in advance.

**Notes on the passing speed evaluation:**

- 1) As a precaution to ensure minimal noise, the Reader/Writer performs retransmission tests in the event of a communication error between the Tag and antenna. Since the transmission time is dependent on the noise conditions in each environment, a transmission test using the actual device must be conducted in advance. The calculation formula for the communication time does not assume retransmission.
- 2) The calculation formula above assumes the communication with one Tag. The communication with multiple Tags in transit must be tested in advance. It cannot be calculated with the formula. The anti-collision algorithm for the access to multiple Tags is derived from a probability theory; the communication time will fluctuate depending on how the collisions occur, which means enough time must be allowed for the communications.



# SECTION 8

## Appendix

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# Appendix 1 Accessories

## Appendix 1 Accessories

No.	Name	Model	Quantity
1)	Mounting plate (already attached to the Reader/Writer)	-	2
2)	I/O connector plug	NJW-2010-PM10 from Nanaboshi Electric Mfg. Co., Ltd.	1
3)	Ferrite core	ZCAT3035-1330 from TDK	1

### < Description >

#### 1) Mounting plate (already attached to the Reader/Writer)

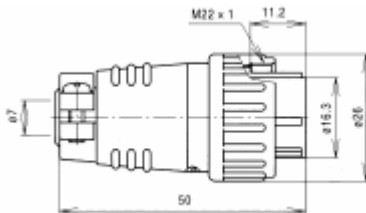
Secure the Reader/Writer by using four M6 screws to .

#### 2) I/O connector plug

Use the I/O connector plug under the following conditions:

Outer diameter of the cable to be used  $\phi 8.0$  to  $\phi 11.0$ .

For detail information for assemble, refer to 4-6-3-1 Assembly of Host Communications Connector and I/O Connector.

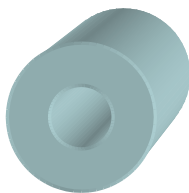


### < Contact >

Nanaboshi Electric Mfg. Co., Ltd.  
 49-15, Kamitakada 1-chome, Nakano-ku,  
 Tokyo 164-0022  
 TEL: 03-3386-3181  
 FAX: 03-3388-1561

#### 3) Ferrite core

Clamp the ferrite core around the wire near the 100VAC of power supply (S82K-03024 from OMRON recommended). For attachment method, refer to 4-6-1 "Power Supply and Grounding Wires".




### < Contact >

TDK. Corporation  
 1-13-1, Nihonbashi, Chuo-ku,  
 Tokyo, 103-8272  
 TEL: 03-3278-5111

## Appendix 2 JIS8 Code Table (ASCII Code Table)

High Order Low Order	b8 - b5	0000	0001	0010	0011	0100	0101	0110	0111
b4 - b1	Column Row	0	1	2	3	4	5	6	7
0000	0	NUL	TC <sub>7</sub> (DLE)	(SP)	0	@	P	`	p
0001	1	TC <sub>1</sub> (SOH)	DC <sub>1</sub>	!	1	A	Q	a	q
0010	2	TC <sub>2</sub> (STX)	DC <sub>2</sub>	"	2	B	R	b	r
0011	3	TC <sub>3</sub> (ETX)	DC <sub>3</sub>	#	3	C	S	c	s
0100	4	TC <sub>4</sub> (EOT)	DC <sub>4</sub>	\$	4	D	T	d	t
0101	5	TC <sub>5</sub> (NEQ )	TC <sub>8</sub> (NAK )	%	5	E	U	e	
0110	6	TC <sub>6</sub> (ACK)	TC <sub>9</sub> (SYN)	&	6	F	V	f	v
0111	7	BEL	TC <sub>10</sub> (ETB )	'	7	G	W	g	w
1000	8	FE <sub>0</sub> (BS)	CAN	(	8	H	X	h	x
1001	9	FE <sub>1</sub> (HT)	EM	)	9	I	Y	i	y
1010	10	FE <sub>2</sub> (LF)	SUB	*	:	J	Z	j	z
1011	11	FE <sub>3</sub> (VT)	ESC	+	;	K	[	k	{
1100	12	FE <sub>4</sub> (FF)	IS <sub>4</sub> (FS)	,	<	L	\	l	
1101	13	FE <sub>5</sub> (CR)	IS <sub>3</sub> (GS)	-	=	M	]	m	}
1110	14	S <sub>0</sub>	IS <sub>2</sub> (RS)	.	>	N	^	n	~
1111	15	S <sub>1</sub>	IS <sub>1</sub> (US)	/	?	O	_	o	DEL

**NOTE**

 : The ASCII code character for the fifth row, line 12 is “\”.

## Revision History

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

**SRFM- 002A**  
↑  
— Revision code

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

<b>Revision code</b>	<b>Date</b>	<b>Revised content</b>
1	September, 2006	First Edition (New issued for Rohs Directive)

**OMRON CORPORATION**  
**RFID BUSINESS DEVELOPMENT DEPARTMENT**

14th Fl., Gate City Osaki West Tower  
1-11-1 Osaki, Shinagawa-ku,  
Tokyo 141-0032 Japan  
Tel: (81)3-5435-2016/Fax: (81)3-5435-2017

**Regional Headquarters**

**OMRON ELECTRONICS LLC**

1920 Thoreau Drive Suite 165 Schaumburg, IL 60173  
U.S.A.

Tel: (1)847-303-0780/Fax: (1)847-925-1260

**OMRON EUROPE B.V.**

Wegalaan 57, NL-2132 JD Hoofddorp  
The Netherlands

Tel: (31)23-568-1200/Fax: (31)23-568-1222

**OMRON ASIA PACIFIC PTE. LTD.**

83 Clemenceau Avenue,  
#11-01, UE Square,  
239920 Singapore

Tel: (65)835-3011/Fax: (65)835-2711

**OMCC: OMRON (CHINA) CO., LTD.**

Rm.302, AZIA Center, 1233 Lujiazui Ring Road  
Pudong New Area, Shanghai 200120, PRC.

Tel: (86)21-5888-1666

Fax: (86)21-58888-7633/7933

Up-to-date information on RFID Systems can be accessed at OMRON's web site at  
<http://www.omronrfid.com/>

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