V720-series Electromagnetic Inductive RFID System V720-CD1D/CD2D ID Controller

Operation Manual

Revised August 2001

Notice:

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

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

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

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

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

Visual Aids

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

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

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

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About this Manual:

This manual describes the installation and operation of the V720-series Electromagnetic Inductive RFID System (V720-CD1D or V720-CD2D ID Controller) and includes the sections described below.

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

Section 1 provides the characteristics and system configuration of the V720 RF ID System as well as an outline of its operation.

Section 2 provides the specifications and performance characteristics of the V720-CD1D/CD2D.

Section 3 provides the modes and functions in detail.

Section 4 provides installation information for the V720-CD1D/CD2D.

Section 5 provides the communications functions and provides details on communications–related data and commands.

Section 6 provides information on trial operation, errors and remedies, and maintenance and troubleshooting.

Section 7 provides reference data relating to V720 communications.

The ***Appendix*** provides an ASCII code table.

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

PRECAUTIONS

This section provides general precautions for using the V720-series Electromagnetic Inductive RFID System and related devices.

The information contained in this section is important for the safe and reliable application of the V720-series Electromagnetic Inductive RFID System. You must read this section and understand the information contained before attempting to set up or operate a V720-series Electromagnetic Inductive RFID System.

1 Intended Audience

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

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

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for installing and operating the V720-series Electromagnetic Inductive RFID System. Be sure to read this manual before attempting to use the System and keep this manual close at hand for reference during operation.

⚠ **WARNING** It is extremely important that a V720-series Electromagnetic Inductive RFID System be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying the System to the above-mentioned applications.

3 Safety Precautions

⚠ **WARNING** Always connect to a ground of 100 Ω or less when installing the System. Not connecting to a ground of 100 Ω or less may result in electric shock.

⚠ **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

⚠ **WARNING** Do not attempt to take any unit apart or touch the inside while the power is being supplied. Doing so may result in electric shock.

4 Application Precautions

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

- Do not use the System in an environment subject to flammable, explosive, or corrosive gases.
- Do not attempt to take any Units apart, to repair any Units, or to modify any Units in any way.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals.
- Use crimp terminals of specified size for wiring.
- Be sure that the items with locking devices are properly locked into place before using the System.
- Be sure that the DC Power Supply Unit exclusively designed for the V720 Series is used and is not connected to any other device.
- Be sure that the power supply voltage is within the rated range of 24 VDC +10% and -15%.
- Install the ferrite core supplied with the V720-CD1D/CD2D according to the specified instructions.
- Be sure to observe all warnings, cautions, and safety precautions specified in the manual.

5 Correct Use

⚠ **Caution** Do not install the V720-CD1D/CD2D in the following locations:

- Locations subject to direct sunlight.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to shock or vibration.

⚠ **Caution** Be sure to observe the following wiring precautions:

- Do not wire the lines of the RFID System alongside high–tension or power lines.
- Check the polarity of each terminal and make sure not to make mistakes in polarity.

⚠ **Caution** Be sure to observe the following precaution when cleaning the V720-CD1D/CD2D:

- Organic solvents may damage the paint coating on the casing or resin part of the product. Do not use paint thinner or any other organic solvent to clean the product.

6 Applicable Standards

The V720-CD1D/CD2D ID Controller conforms to the following standards:

- EC Directives EN55022: 1998
- EC Directives EN55024: 1998

7 EN/IEC Standards

- In connection with EC unification, eighteen European countries will integrate their conventional safety standards into EN standards. When the EN standards come into effect, they will apply as the unified European standards in place of the conventional safety standards.
- EN standards are based on IEC standards. Therefore, machines that are exported to Europe from Asia or North America must satisfy EN standards. Otherwise, the machines must satisfy IEC standards if the machines do not fall under EN standards.
- The CE marking is provided by EC Directives. A product bearing a CE marking meets the safety standards specified by all relevant EC Directives. If the product is a machine, it must satisfy the EC Machinery Directive, Low-voltage Directive (LVD), and EMC requirements of the EC Directives. The product must satisfy the EMC and LVD requirements of the EC Directives, if the product is a home electronics appliance or office machine. Machines bearing CE markings can be freely exported to European countries. In other words, a CE marking is the passport for export to Europe.
- EC Directives are provided for the purpose of European unification. Approximately 300 EC Directives have been passed. EC Directives for machines are called Machine Directives. According to the Machine Directives (EC Directive Document number 89/392/EEC), machines exported to Europe on and after January 1, 1995 must bear CE markings.
- EMC standards are for electromagnetic compatibility. A machine must satisfy the EMC requirements of EC directives by taking countermeasures against EMI (electromagnetic interference) and EMC (electromagnetic susceptibility).

Electromagnetic Inductive RFID System

The V720-CD1D/CD2D satisfies the following EC Directives.

ID Controller	EMC Directives	Remarks
V720-CD1D/CD2D	EMI Standard: EN55022 EMS Standard: EN55024	Attach a ferrite core (TDK ZCAT2032-0930) each to the DC power supply line and FG line of the Controller.

⚠ **WARNING** This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

8 FCC Notices

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 instruction manual, 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.

SECTION 1
Characteristics and System Configuration

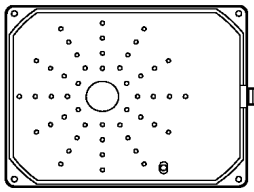
This section provides the characteristics and system configuration of the V720 System as well as an outline of its operation.

1-1 Features

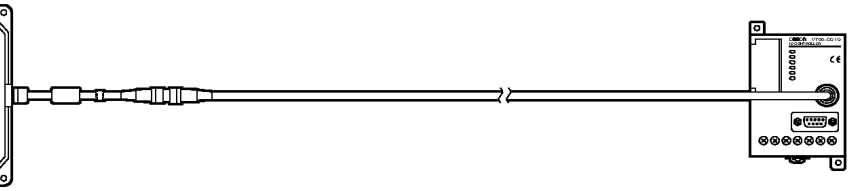
The V720-series Electromagnetic Inductive RFID System is ideal for the construction of highly functional, long-distance wireless ID systems for material control and logistics.

V720-D52P30
V720-D52P40

V720-H01-E



V720-CD1D/CD2D



V720-CD1D/CD2D ID Controller

The V720-CD1D/CD2D ID Controller incorporates an RS-232C interface, thus connecting to personal computers and Programmable Logic Controllers (PLCs) over RS-232C to process large amounts of data flexibly with simple commands.

Highly Functional RFID System

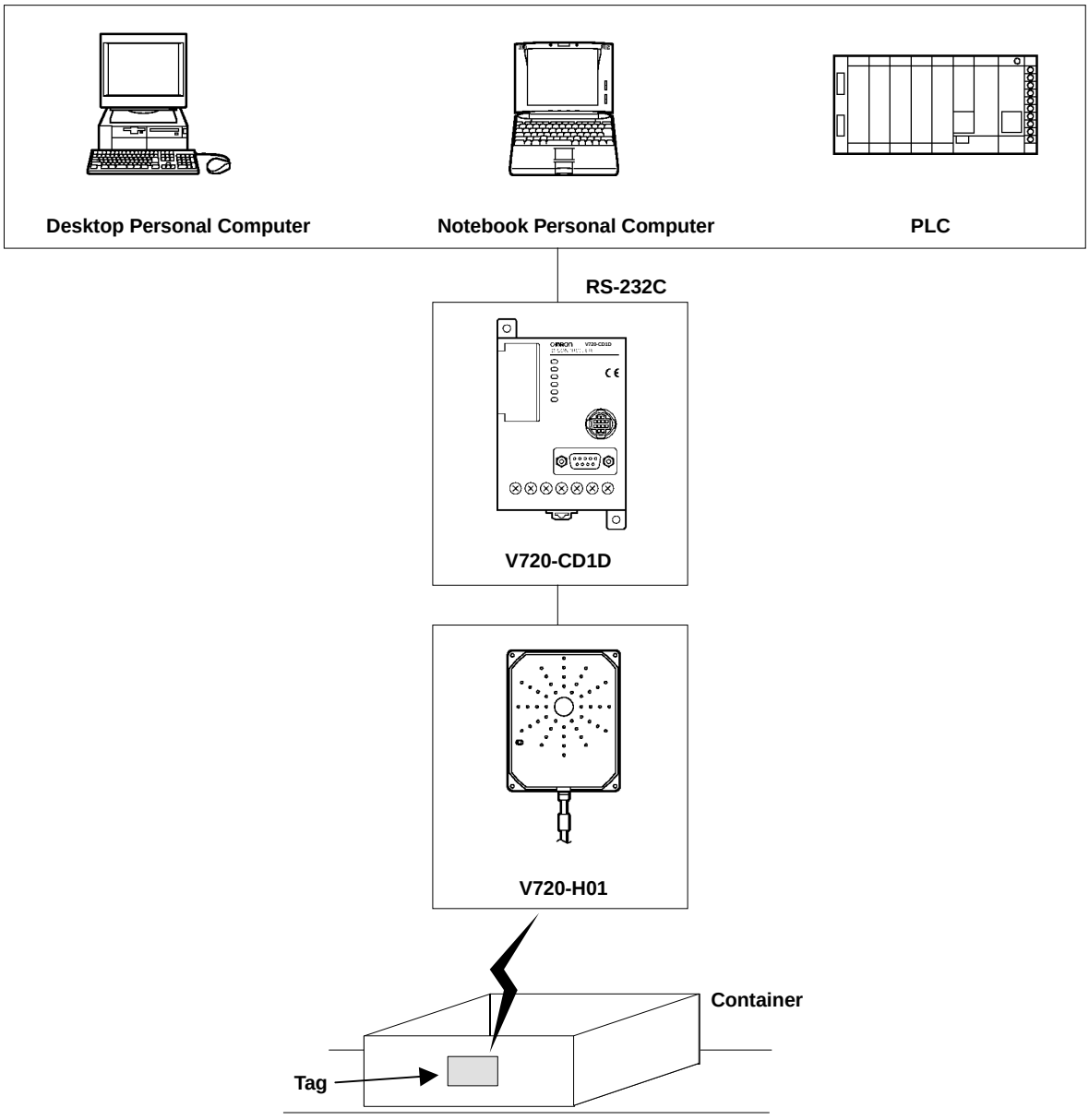
The RFID System operates in either multiple simultaneous access mode, selective access mode, or FIFO (first-in, first-out) read/write mode. In multiple simultaneous access mode, if there is more than one Tag in the communications area, the RFID System reads and writes data from and to all the Tags at one time. In selective access mode, the user can specify the Tags 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.

1-2 System Configuration

The V720-CD1D has a built-in serial interface conforming to RS-232C, thus making it possible to communicate with personal computers and PLCs. The host issues all commands to process usual communications data.

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

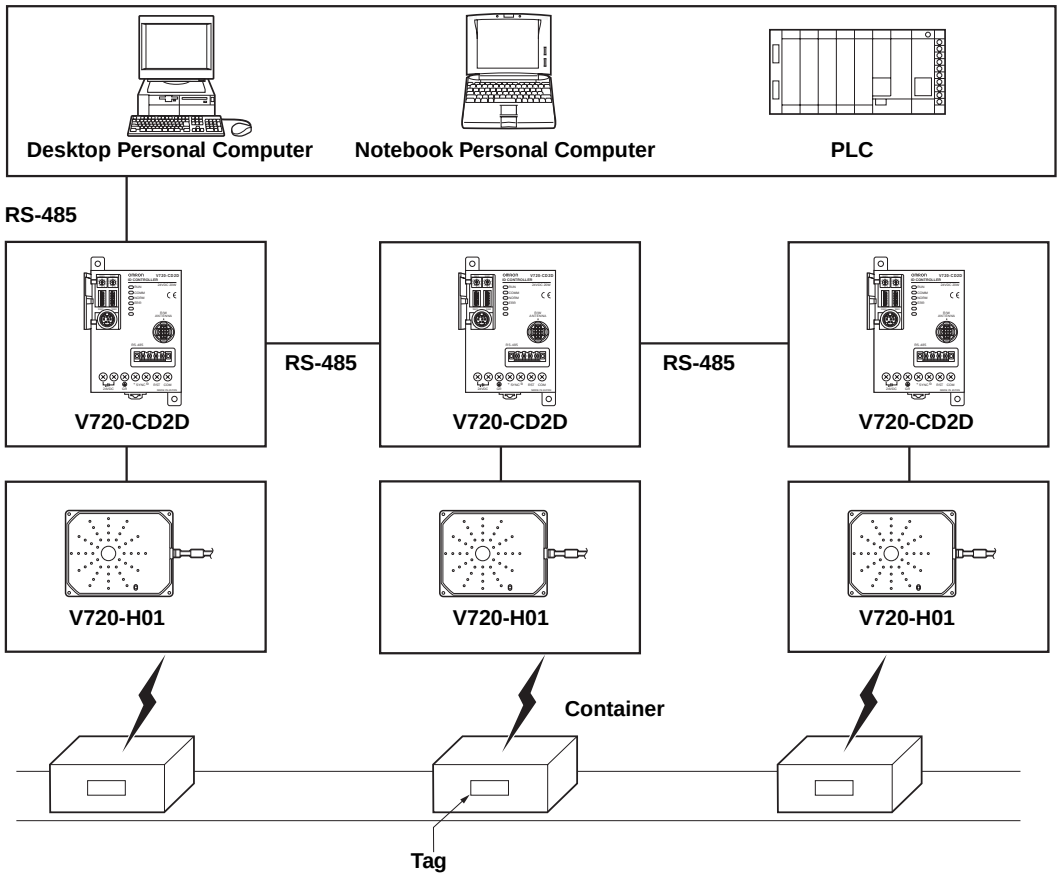
Host



1-2-2 Example of 1-to-N System Configuration (V720-CD2D)

The Controller's built-in RS-485 interface allows the connection of up to 10 Controllers to a single host device, such as a general-purpose computer or a PLC. The RS-485 cable can be extended up to a total length of 300 m.

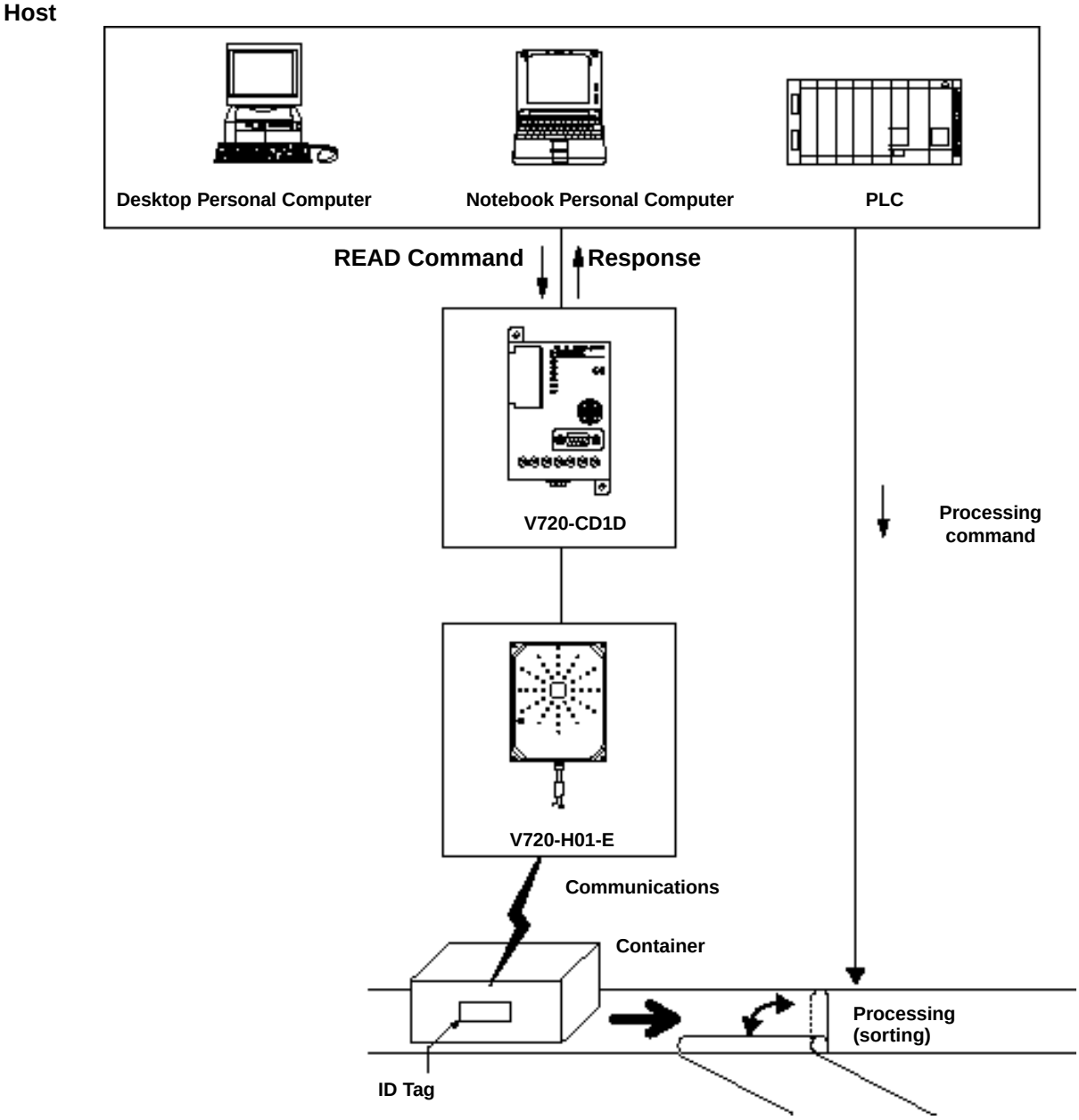
Host



Note The RS-232C interface does not support 1-to-N connections. Therefore, it is necessary to employ appropriate interfaces for data conversion, such as an RS-232C to RS-485 Converter. Use OMRON's RS-232C to RS-485 Converters or equivalent models. If connecting a 2-wire system between the Controller and the host using an RS-232C to RS-485 Converter, switch the host to receive within 5 ms after sending a command to the Controller. Failure to do so may result in loss of communications with the Controller.

1-3 Outline of Operation

The following provides the outline of the operation of the RFID System using an example that sorts items of container each attached with a Tag.



1, 2, 3...

1. When the host sends the command to the Controller, the Antenna stands by for the arrival of the Tag.
2. When the Tag arrives in the communications area, the Controller receives data in the memory area of a Tag specified by the READ command and sends the data as a response to the host.
3. The host sorts the container on the basis of the data.

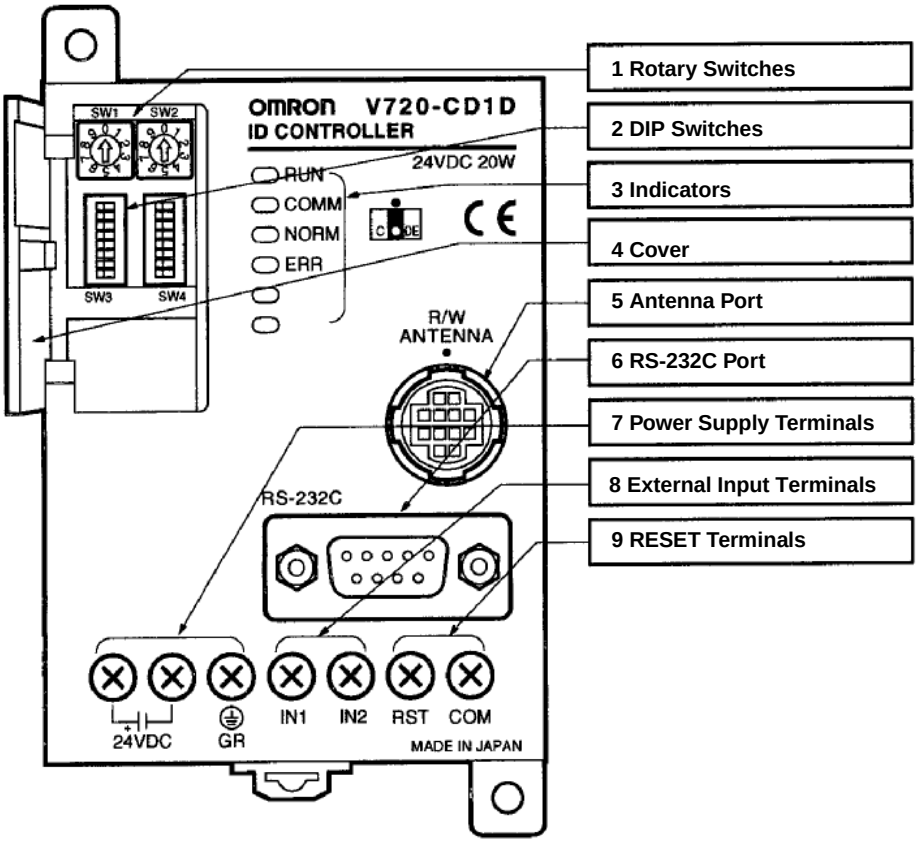
SECTION 2
Specifications and Performance

This section provides the specifications and performance characteristics of the ID Controller.

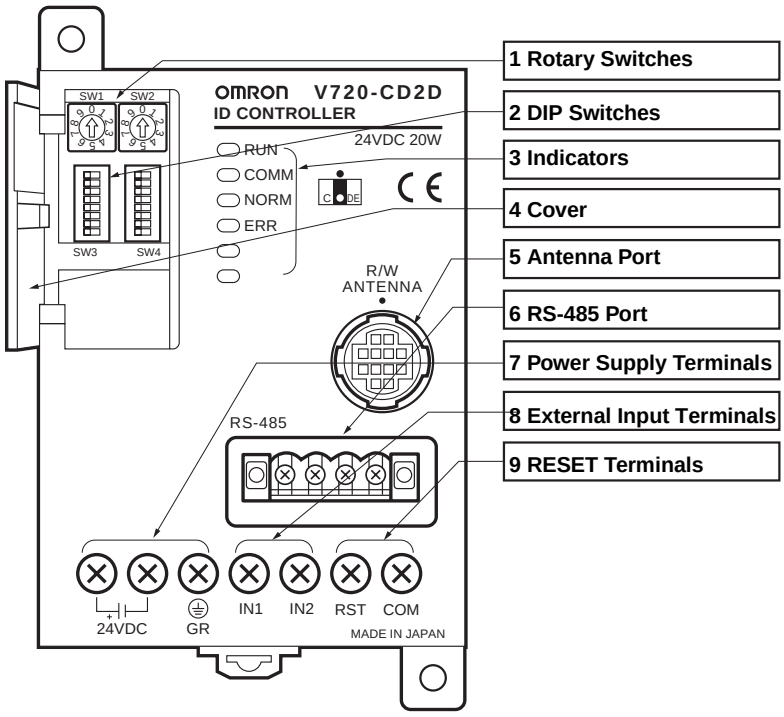
2-1 ID Controller

2-1-1 Nomenclature

V720-CD1D



V720-CD2D



Refer to all sections from *Section 3* onwards for the functions of the Controller in detail. Refer to *Section 4 Setting, Mounting and Connection Methods* for the settings and connections of the Controller.

No.	Name		Function	Description
1	Rotary switches		Used for node number settings (SW1)	The node number is used to identify each Controller when a single host computer is connected to a maximum of 10 Controllers.
2	DIP switches		Used for mode settings	Various settings are possible (e.g., Tag baud rate, offline read test mode, BCC, baud rate, data length, parity, stop bit length, communications mode, and timeout settings).
3	Indicators		The following indicators are available.	
	RUN	Green	RUN indicator	Turns ON when the Controller is in normal operation.
	COMM	Green	Communications indicator	Turns ON when the Controller is in communications with the Tag.
	NORM	Green	Normal indicator	Turns ON and OFF once when the communications finish with no error.
	ERR	Red	Error indicator	Turned ON and OFF once if a communications error results. Turned ON if a system error results.
4	Cover		Protection of SW 1 through SW4	Open the cover only when necessary.
5	Antenna Port		Connecting to the Antenna	A single Antenna can be connected through the V700-A4□ Antenna Cable (sold separately). The following Antennas are available. • V720-H01-E (standard antenna, 250 x 200 mm in size)
6	RS-232C port (V720-CD1D)		Connecting to host devices	Personal computers and PLCs can be connected over RS-232C.
	RS-485 port (V720-CD2D)			Personal computers and PLCs can be connected over RS-485.
7	Power supply terminals		Connecting to power supply	
	24 VDC+		Connecting to power supply	Connect 24 VDC.
	24 VDC-			Connect 0 V.
	GR		Connecting to ground	Ground this terminal at a resistance of less than 100 Ω.
8	External Input Terminals		User input signal	Status can be read using a command.
9	RESET terminals		Connecting to RESET signal	
	RST		RESET signal	These terminals are used together in order to use external RESET input.
	COM		COMMON signal	

Note 1. Lights once when command processing is not performed properly.

2. Remains lit or continues flashing when commands do not operate properly due to CPU error, memory error, or Antenna disconnection.

2-1-2 Specifications

2-1-2-1 General Specifications

Item	Specification
Supply voltage	24 VDC $^{+10\%}/_{-15\%}$
Power consumption	20 W max. including the power consumption of the Antenna (1.1 A at 12 V)
Insulation resistance	20 MΩ min. (at 100 VDC) between the ground and both power supply terminals, both power supply terminals and both I/O terminals, both power supply terminals and casing, both I/O terminals and ground, both I/O terminals and casing, and ground terminal and casing.
Dielectric strength	500 VAC (50/60 Hz) for 1 minute in any of the above combinations.
Vibration resistance	Destruction: 10 to 150 Hz, 0.2mm double amplitude at 15 m/s^2 in X, Y, and Z directions 10 times each for eight minutes
Shock resistance	Destruction: 150 m/s^2 in X, Y, and Z directions three times each
Ambient operating temperature	-10°C to 55°C (with no icing)
Ambient operating humidity	35% to 85% (with no condensation)
Ambient storage temperature	-25°C to 65°C (with no icing)
Ground	Ground at a resistance of less than 100 Ω.
Construction	Panel-mounting
Material	PC/ASA resin
Weight	Approx. 290 g
Number of connectable Antennas	1
Applicable standards	EN55022, EN55024, FCC Part 15 Subpart B CCA ICES-003, ASINZS 3548 (EN55022)

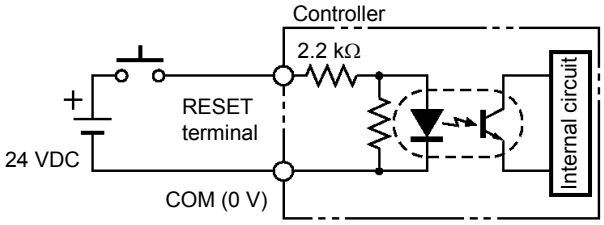
2-1-2-2 Performance Specifications

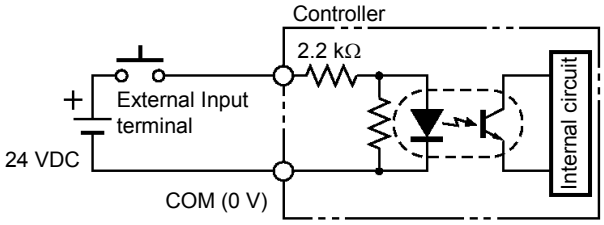
Item	Specification
Self-diagnostics	CPU, Memory, host communications, and Controller communications errors are checked.

2-1-2-3 I/O Specifications

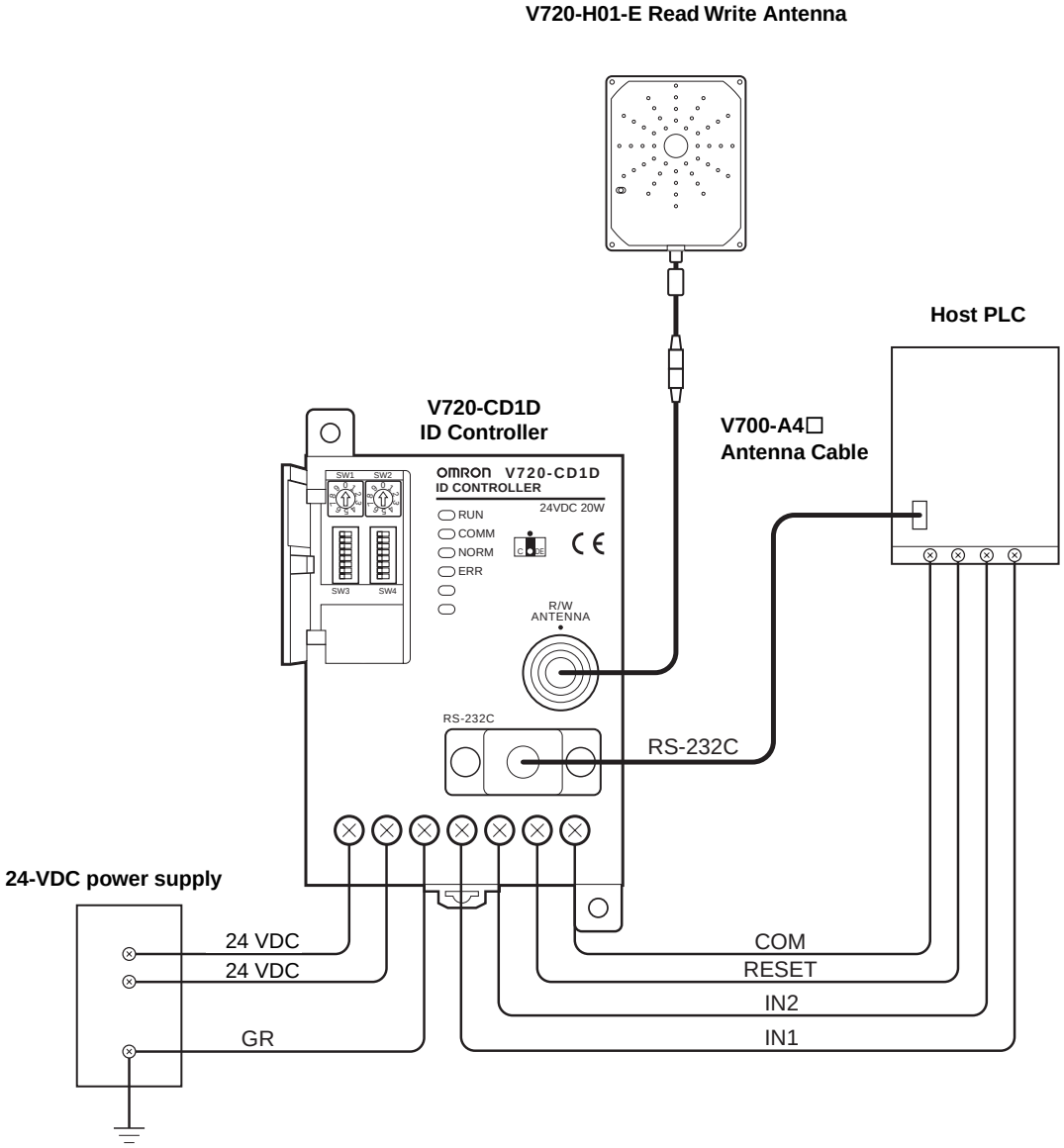
External Input and RESET Input (IN1 and IN2)	Input voltage	24 VDC $^{+10\%}/_{-15\%}$ (including ripples)
	Input impedance	2.2 kΩ
	Input current	10 mA TYP (24 VDC)
	ON voltage	19 V min.
	OFF voltage	5 V max.
	Input response time	70 ms max.

Circuit Configuration

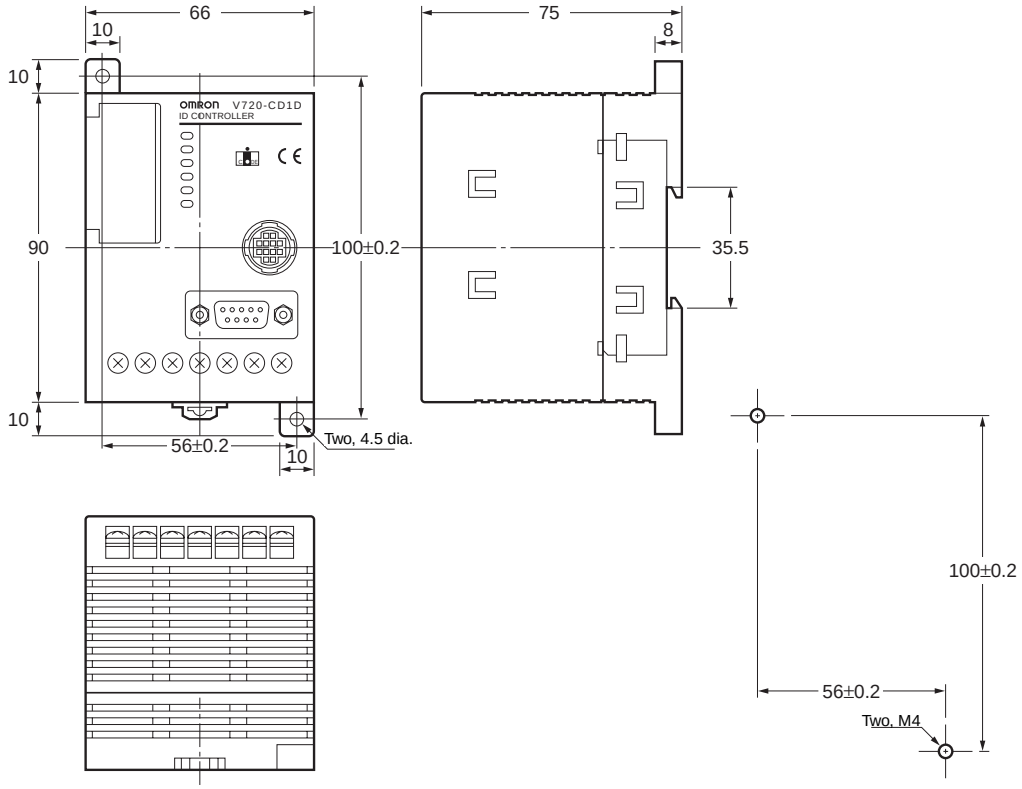




2-1-2-4 Wiring Example



2-1-3 Dimensions



Casing material: PC/ASA resin

2-2 Cable

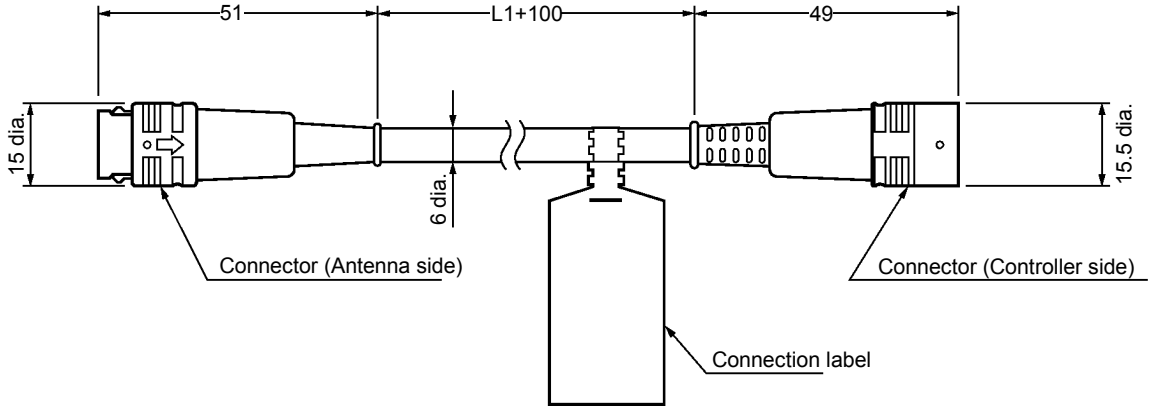
2-2-1 Specifications

Item	V700-A4□
Number of conductors	10
Insulation resistance	5 MΩ min. (at 500 VDC) between conductor and shield
Dielectric strength	500 VAC 1 min
Maximum operating temperature	80°C
Remarks	Connectors are not water resistant.

2-2-2 Dimensions

V700-A4□

Item	V700-A40	V700-A41	V700-A42	V700-A43	V700-A44	V700-A45
Length	Approx. 2 m	Approx. 3 m	Approx. 5 m	Approx. 10 m	Approx. 20 m	Approx. 30 m
Weight	Approx. 150 g	Approx. 220 g	Approx. 360 g	Approx. 700 g	Approx. 1,350 g	Approx. 2,000 g
L1	2,000	3,000	5,000	10,000	20,000	30,000



2-3 V720 Communications Specifications

V720-CD1D

The Controller can be connected to personal computers and PLCs over RS-232C.

Item	Specifications
Conforming standards	RS-232C
Communications method	EIA/TIA-232-E, 1-to-N half duplex
Baud rate	9,600 bps, 19,200 bps, 38,400 bps, 115,200 bps (see note)
Sync	Start-stop synchronization with 1 stop bit or 2 stop bits (see note)
Transmission code	ASCII7 or JIS8 (see note)
Max. connectable number of Controllers	10
Error control (see note)	Vertical parity (even, odd, or none) Horizontal parity as BCC (see note)
Cable length	15 m max.
Suitable connector	D-sub 9-pin male connector OMRON XM2A-0901 Plug and XM2S-0911 Hood provided with the Controller
Recommended cable	Hitachi Cable CO-MA-VV-SB 5Px28AWG

Note Make the settings using the DIP switches on the Controller. Refer to *Section 4 Setting, Mounting, and Connection Methods* for details.

V720-CD2D

The Controller can be connected to personal computers and PLCs over RS-485.

Item	Specifications
Conforming standards	RS-485
Communications method	EIA standard RS-485, 1-to-N 2-wire bi-directional half duplex
Baud rate	9,600 bps, 19,200 bps, 38,400 bps, 115,200 bps (see note)
Sync	Start-stop synchronization with 1 stop bit or 2 stop bits (see note)
Transmission code	ASCII7 or JIS8 (see note)
Max. connectable number of Controllers	10
Error control (see note)	Vertical parity (even, odd, or none) Horizontal parity as BCC (see note)
Cable length	300 m max.
Suitable connector	Weidmuller BLZ4CD2D, 1 set provided with the Controller
Recommended cable	Tachii MVVS2CX0.5Sq

Note Make the settings using the DIP switches on the Controller. Refer to *Section 4 Setting, Mounting, and Connection Methods* for details.

When not using the recommended cable (MVVS2CX0.5Sq) for the V720-CD2D, use a shielded twisted-pair cable of gauge AWG 20 or an equivalent cable.

2-4 External Communications Specifications

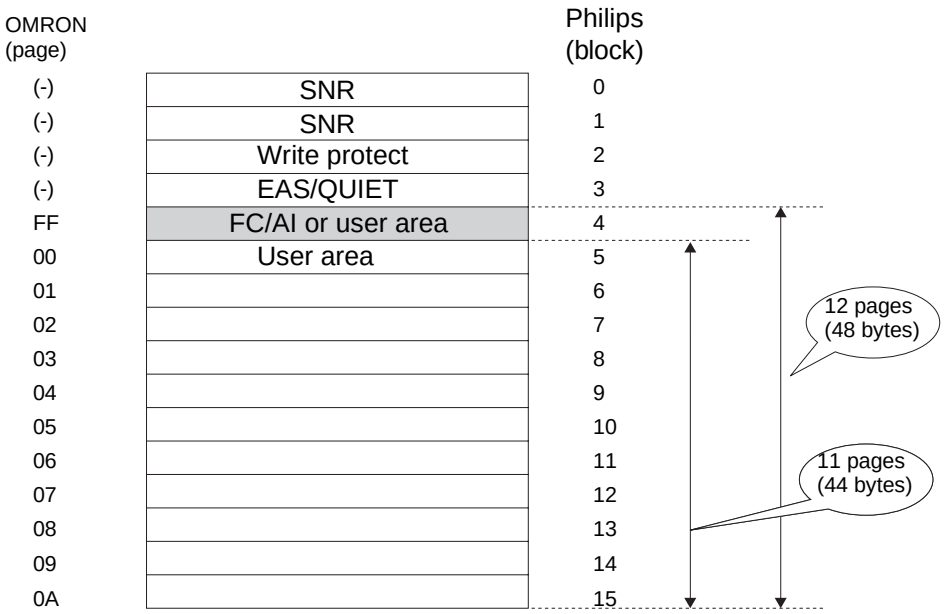
These specifications are for the Read Write Antenna connected to the Controller. For more detailed specifications, refer to the *V720 Series Read Write Antenna/Tag Operation Manual* (S907).

Item	Specification
Communications method	Electromagnetic induction (with no battery)
Modulation method	ASK mode
Transmission frequency	13.56 MHz

2-5 Tag Memory Map

The specifications provided here are for Tags equipped with I-CODE1 Label IC Chips (product number: SL1 ICS30 01) made by Philips Semiconductors, which are the Tags accessed using this system.

The chips contain 64 bytes of memory. The system area, which is used for functions other than user memory, consists of the uppermost 5 blocks (blocks 0 to 4). With the OMRON system, the system area can accessed easily using special commands. Refer to *5-3-6 System Commands and Responses* for details. With the OMRON system then, user memory is defined as starting from block 5, block 5 is allocated to page 00, and the rest of the memory is allocated in the way shown below. Each page consists of 4 bytes (= 32 bits). Reading from and writing to memory is performed in page units. Memory allocations referred to in these specifications are for use with the OMRON system.



Note Block 4 can be used as user memory if the Distinguished Tag Read/Write Function, which is based on the family code (FC) and application ID (AI), are not used. In this case, the corresponding page is defined as FF and user memory will consist of 12 pages.

SECTION 3
Functions

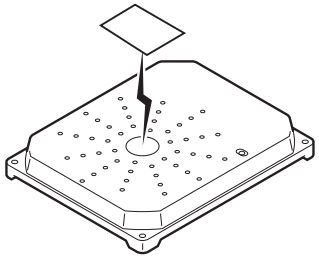
This section provides the modes and functions in detail.

3-1 Single, FIFO, Multiple, and Selective Access Functions

Four communication modes are available depending on the number or state of Tags in the communication area. Commands can be used for selecting one of them. Refer to *Section 5 Communications Functions* for details.

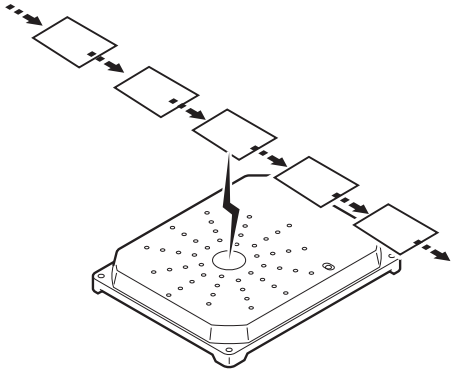
Single Access Mode

In this mode, only a single Tag can be in the communications area, otherwise a communications error will result.



FIFO Access Mode

In the FIFO (first-in, first-out) Access Mode, the RFID System reads and writes data to and from each Tag coming into the communications area one after another. 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. When the access-prohibited Tag moves out of the communications area, communications will become possible again.

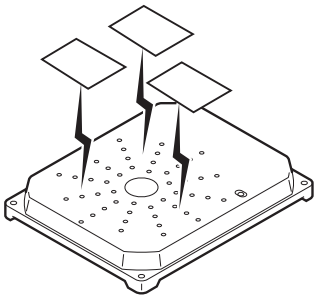


Multiple Access Mode

This function is also called 1:N access or multiple Tag simultaneous access.

In this mode, communications with multiple Tags in the communications area will be possible.

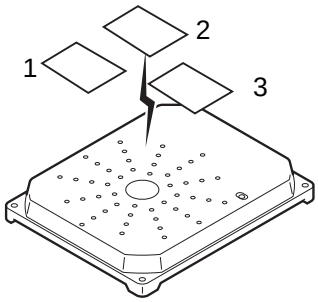
Set the maximum number of Tags (number of timeslots) within the communications area (hereafter called the Tag number setting) using a command. Refer to *5-7 Tag Number Setting* for details.



Selective Access Mode

Set Selective Access Mode when performing communications only with a specific Tag out of multiple Tags in the communications area. In this mode, a Tag Detection Command can be used to assigning numbers to Tags within the communications area and a Tag Designation Command can be used to communicate with a specified Tag based on the assigned numbers.

Set the maximum number of Tags (number of timeslots) using a command in the same way as for Multiple Access Mode.



Note 1: When using FIFO Access Mode, do not allow multiple Tags to enter the communications area at the same time. If multiple Tags enter the communications area at the same time, a communications error will occur, and communications will be disabled until there is only one Tag in the communications area.

Note 2: Be sure to set the Tag number setting in the access mode in use (Multiple Access Mode or Selective Access Mode) when using multiple Tags within the communications area. The maximum number of Tags setting is decided beforehand by the maximum number of Tags possible in the communications area. Refer to *5-7 Tag Number Setting* for details.

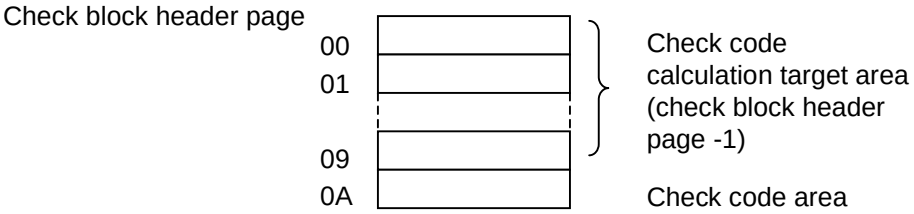
3-2 Memory Check Function

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.

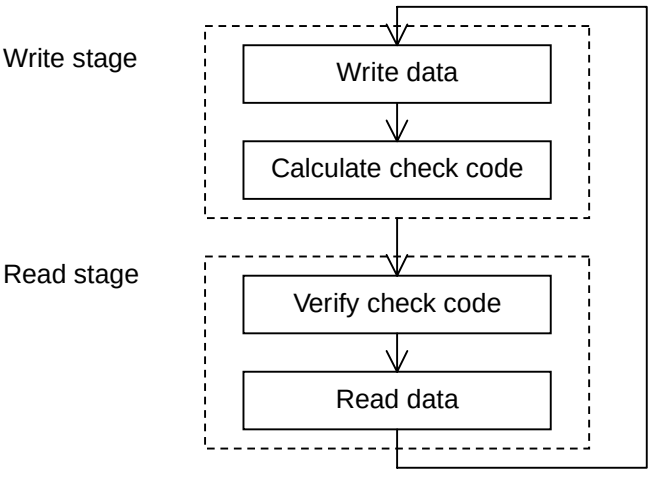
When a check code write command is sent, the CRC code for the data in the target calculation area is calculated, and written to the check code area. When the data verification command is sent, the CRC code for the data in the target calculation area is calculated, and compared with the data in the check code area. If these match, the number 75 is returned to the completion 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 number of check blocks is 0B.



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.



3-3 Lock Function

The Lock function protects against data being erased due to the unintentional overwriting of fixed data stored in the Tags.

There is a lock setting area in the Tag's system area, so you can write-protect user-defined areas by page. If a write command is performed on a page that is write-protected, a write processing error will occur.

The lock setting area is configured using one bit per page, to a total of 12 bits of data. Make the lock settings using the Lock Command (LK).

Refer to *5-3-6 System Commands and Responses* for details.

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	Family code and application ID	Fixed value 0	Fixed value 0	Fixed value 0	Fixed value 0

Note: With the Lock function used in the V720 Series, you cannot turn OFF the lock settings. Data cannot be written twice to pages that are write-protected, so be careful when using the function.

3-4 Distinguished Tag Read/Write Function

The V720-series Tag has two Tag classification codes: Family code and application ID. Each code consists of 1 byte of data. Communications can be limited to Tags that match the two codes. This is called the Distinguished Tag Read/Write Function.

For how to set and change the Tag identification code, refer to *Read of Application ID and Family Code (for Tag)* and *Write of Application ID and Family Code (for Tag), 5-3-6 System Commands and Responses*.

For setting and changing ID codes included in commands sent from the Antenna, refer to (5) *Setting of Family Code (for Controller)(FC)* and *(6) Setting of Application ID (for Controller)(AI), 5-3-6 System Commands and Responses* (for ID Controller). The factory setting for the Controller's ID code is 00h for both family code and application ID. This permits communications regardless of the Tag's codes.

No.	Controller setting		No.	Tag setting	
	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

Application Example

For the Controller settings given in 1), communications are possible with all the Tags because the codes set in the Controller are both 00 hexadecimal. For the settings in 2), communications are possible only with the A and B Tags, which have the specified family code. Communications are not possible with Tag C. For the settings in 3), communications are possible only with the A Tag, which has both the same family code and the same application ID. Communications with Tag B and Tag C are not possible.

3-5 External Input Function

There are two external user input terminals that can be controlled by commands. These can be used to design sequence operations, such as starting or stopping communications with Tags using external triggers.

3-6 Offline Read Test Function

Communications tests between the Antenna connected to the Controller and Tags can be performed without any connections to a host. This function can be used to check the Antenna mounting location before trial operation. The function is enabled by turning ON DIP switch pin 3-3 on the Controller before turning ON the power supply.

Display of Results for Offline Read Test Function

Indicator display	Result
Red indicator lights	No Tags in the communications area.
Green indicator lights	Normal communications with the Tags in the communications area
Red indicator flashes	Error in communications with the Tags in the communications area

SECTION 4
Setting, Mounting, and Connection Methods

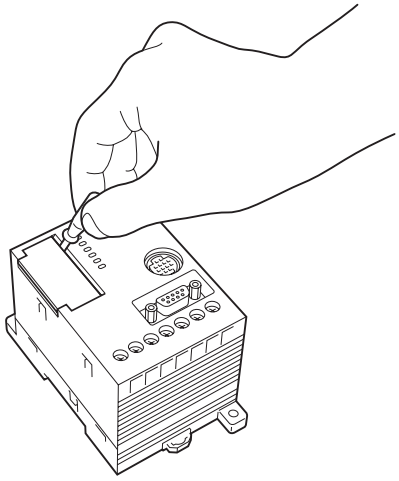
This section provides installation information for the ID Controller.

4-1 Switch Settings

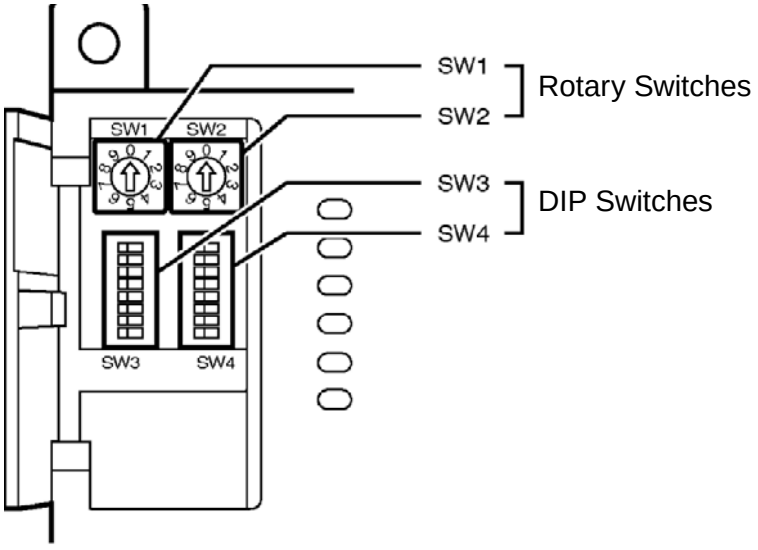
Open the cover of the Controller to make switch settings.

4-1-1 Opening the Cover

A screwdriver is provided with the Controller. Open the cover by inserting the screwdriver into the groove on the left side of the cover.

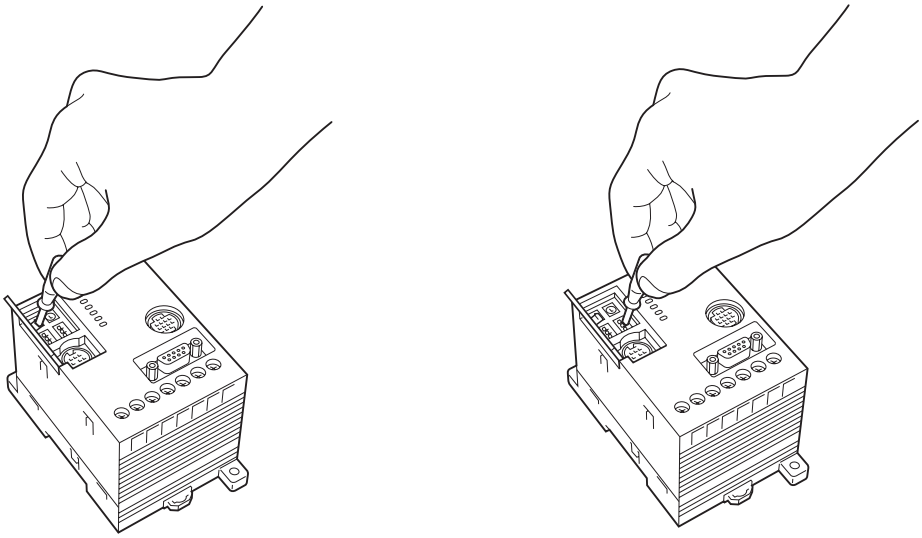


Under the cover, there are two Rotary switches (SW1 and SW2), and two DIP switches (SW3 and SW4).



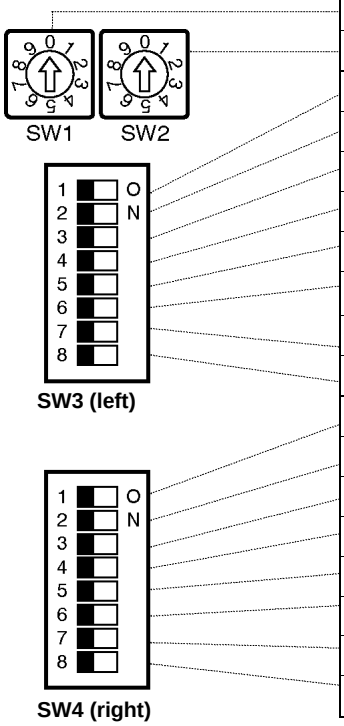
4-1-2 Settings

Use the provided screwdriver to make switch settings as shown below.



4-1-3 Default Set Values

The following table shows default set values.



	Name	Default set value	Meaning
SW1	Node number	0	Node number 0
SW2	RESERVED	0	Not used
SW3-1	Tag Communication speed	OFF	Standard mode
SW3-2	RESERVED	OFF	Not used
SW3-3	Offline Read Test mode setting	OFF	Normal mode
SW3-4	RESERVED	OFF	Not used
SW3-5		OFF	
SW3-6		OFF	
SW3-7		OFF	
SW3-8	BCC setting	OFF	BCC enable
SW4-1	Baud rate setting	OFF	38,400 bps
SW4-2		OFF	
SW4-3	Data length setting	OFF	7 (ASCII7)
SW4-4	Parity bit setting	OFF	Even
SW4-5		OFF	
SW4-6	Stop bit length setting	OFF	2
SW4-7	Communications mode setting	OFF	No ACK/NACK control
SW4-8	Time-out setting	OFF	See note. (500 ms)

Note The pin 8 setting of SW4 will be meaningless if pin 7 is set to OFF.

4-1-4 Rotary Switch Settings

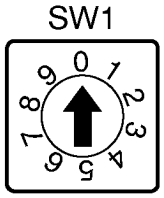
SW1
Node Number

If more than one Controller is connected to a single host through Link Adapters, each Controller needs an ID number so that the host can discriminate between each of them. Such an ID number is called node number. Each Controller must have a unique node number.

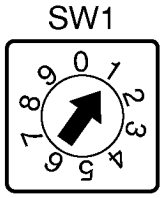
Each command or response of the Controller includes the node number of the Controller. Communications will not be possible if the node number is wrong. The node number must be correctly set regardless of whether the host is connected to a single or multiple Controllers.

As shown below, SW1 on the left is for the 1's digit, which can set numbers within a range between 0 and 9.

SW1	Node number
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9



NODE NO. 0



NODE NO. 1

The node number switches are factory-set to zero.

SW2
Reserved

Do not use this switch. Always set this switch to zero.

4-1-5 DIP Switch Settings

SW3

Pin 1: Tag communication speed

Pin 1 is used to set the speed of communications with Tags. When this pin is set to Standard Mode, a longer communications distance can be used, but communications will be slower. When this pin is set to Fast Mode, the communications distance with Tags will be reduced, but communications will be faster. Use the best mode for your application.

Note Although both modes can be used with the V720-H01-E Read Write Antenna, if large Antennas are added to the series in the future, there may be cases where Fast Mode cannot be used in Japan because of laws regarding electromagnetic waves. For details, refer to the documentation on the Read Write Antenna actually used.

Pin 1	Description
ON	Fast mode
OFF	Standard mode

Pin 2: Reserved

Do not use this pin. Always set this pin to OFF.

Pin 3: Offline Read Test mode

Pin 3 is used to set to the Offline Read Test Mode when performing communications tests between the Antenna connected to the Controller and Tags (Tag reading) without any connections to a host. To use this mode, turn ON pin 3 first and then turn ON the power supply. Set this pin to OFF for normal operation.

Pin 3	Description
ON	Offline Read Test mode
OFF	Normal mode

Pins 4, 5, and 6: Reserved

Do not use these pins. Always set these pins to OFF.

Pin 7: Not Used (V720-CD1D)

Do not use this pin. Always set this pin to OFF.

Pin 7: RS-485 Terminating Resistance (V720-CD2D)

To ensure stable operation when using more than one Controller with one host device, the RS-485 communications line must be terminated with a terminating resistance at the Controllers at both ends of the line or at the Controller at one end and the host device.

Pin 7 is used to enable or disable the built-in RS-485 terminating resistance.

Pin 7	Description
ON	RS-485 terminating resistance enable
OFF	RS-485 terminating resistance disable

Pin 8: BCC Setting

Pin 8 is used to set the BCC for command frames and response frames to enabled or disabled (i.e., whether or not BCC is sent and received).

Pin 8	Description
ON	BCC disable
OFF	BCC enable

SW4

Pins 1 and 2: Baud Rate Setting

Pin 1	Pin 2	Description
ON	ON	115,200 bps
	OFF	19,200 bps
OFF	ON	9,600 bps
	OFF	38,400 bps

Pin 3: Data Length Setting

Pin 3	Description
ON	8 bits (JIS 8 bits)
OFF	7 bits (ASCII 7 bits)

Pins 4 and 5: Parity Bit Setting

Pin 4	Pin 5	Description
ON	ON	No parity
	OFF	No parity
OFF	ON	Odd parity
	OFF	Even parity

Pin 6: Stop Bit Length Setting

Pin 6	Description
ON	1 bit
OFF	2 bits

Pin 7: Communications Mode Setting

This setting determines whether or not ACK/NACK control is performed between the host and Controller.

Pin 7	Description
ON	ACK/NACK control
OFF	No ACK/NACK control

Pin 8: Time-out Setting

This setting will be meaningless unless pin 7 (ACK/NACK control) is set to ON. If pin 7 is set to OFF, it does not matter what the pin 8 setting is.

Pin 8	Description
ON	5 s
OFF	500 ms

4-2 Installation Environment

Installation

The V720-CD1D Controller 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.

Do not install the Controller under the following conditions.

- The ambient temperature is not within a range between -10°C and 55°C 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 Controller is affected by direct vibration or shock.
- The Controller is exposed to direct sunlight.
- Water, oil, or chemical is sprayed onto the Controller.

Enclosed-mounting Position

The Controller can be used at an ambient temperature range between -10°C and 55°C.

- Make sure that the Controller is provided with sufficient ventilation space.
- Do not install the Controller close to heaters, transformers, or resistors that radiate excessive heat.
- If the ambient temperature exceeds 55°C, be sure to install a forced-ventilation fan or cooler to keep the temperature below 55°C.
- If power lines or high-tension lines with large currents are located close to the Controller, be sure to test the Controller carefully and make sure that wires connected to the Controller are not affected by the noise of power lines or high-tension lines.

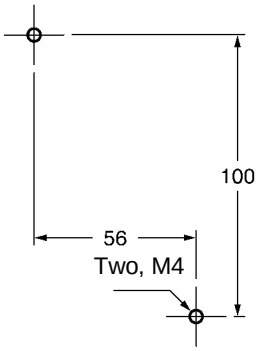
Note Be sure to abide by the above before installing the Controller and carefully test the Controller.

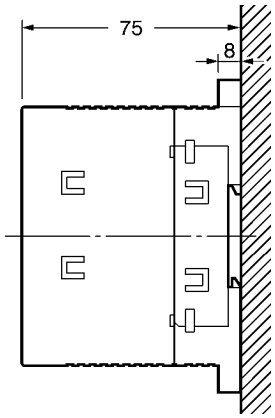
4-3 Mounting

The Controller can be mounted to DIN tracks or enclosed-mounted to panels with screws.

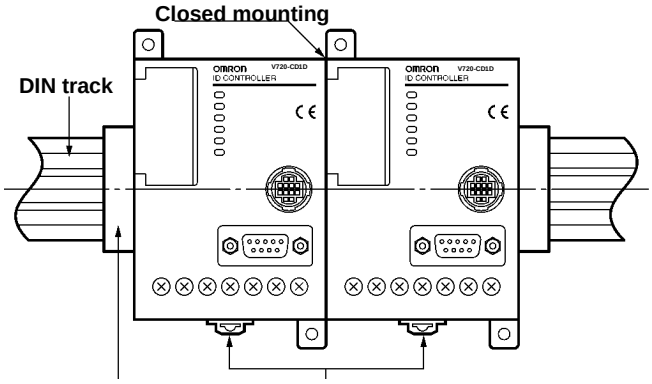
Enclosed Mounting

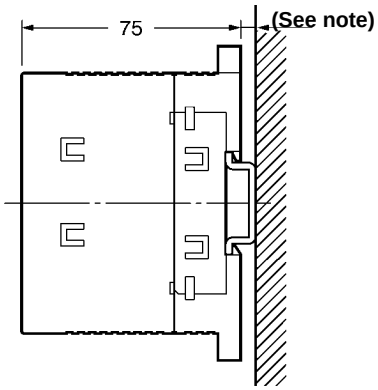
Be sure to secure the Controller with M4 screws together with spring washers and flat washers. Do not use an organic screw adhesive on the screws to fix them in place, as this may cause the Controller case to crack.



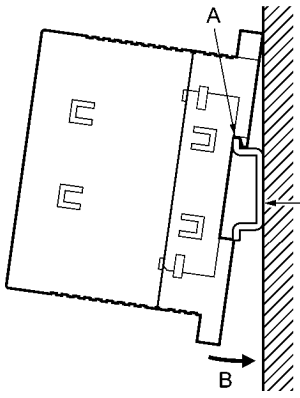


DIN Track Mounting





Note Take the height of the DIN track into consideration at the time of mounting.



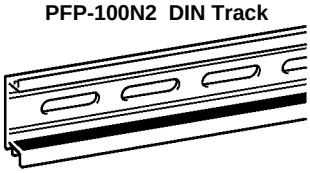
DIN track (1m long) OMRON PFP-100N2 is recommended.

Height: 80 mm max.

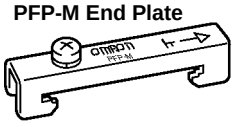
(1) Hook the Controller to part A. Then press the Controller in direction B to mount the Controller

(2) Pull the mounting hook downwards, then lift the Controller upwards to disconnect the Controller.

PFP-100N2 DIN Track



PFP-M End Plate

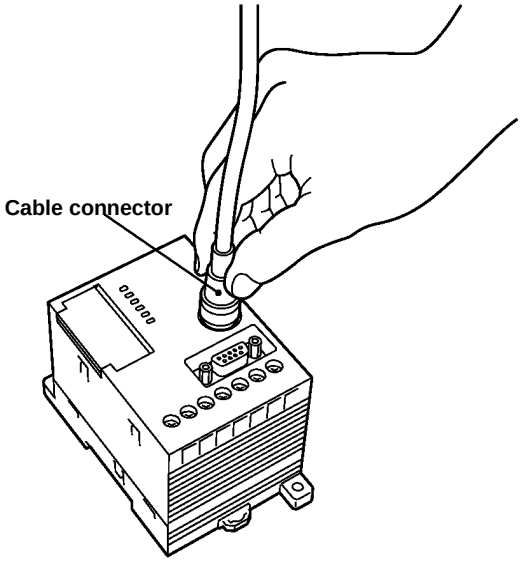


4-4 Connection and Disconnection of Antenna Connector

A single Antenna can be connected to the Controller through the V700-A4□ Antenna Cable (sold separately), the standard length of which is 30 m maximum.

Connection of Antenna Connector

Connection

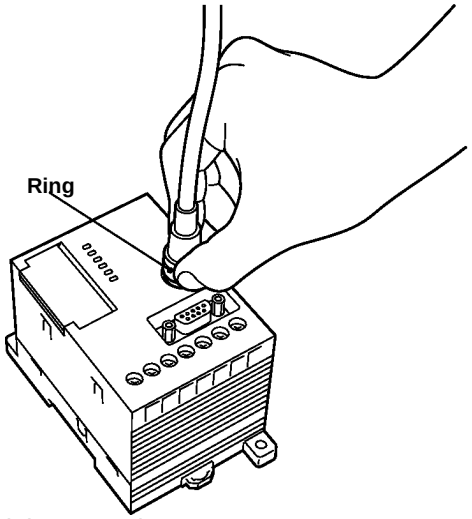


1, 2, 3...

1. Hold and insert the connector into the port so that the point marked in black on the panel of the Controller coincides with the point marked in white on the connector.
2. Press the connector straight until the connector is locked.

Note Do not hold and press the ring of the connector, otherwise the connector is not locked. Be sure to hold the connector.

Disconnection



Hold and pull the ring straight upwards.

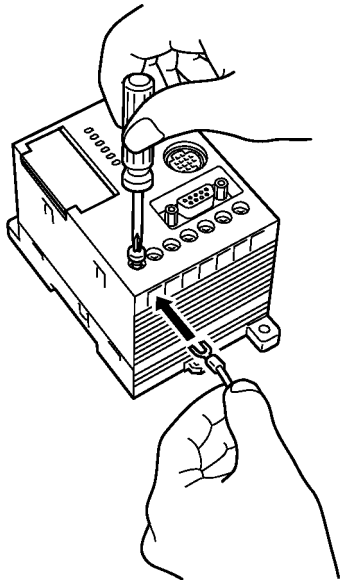
Note Do not hold and pull the connector, otherwise the connector cannot be removed. Be sure to hold the ring.

⚠ **Caution** Do not pull the cable, otherwise the cable may break or be damaged.

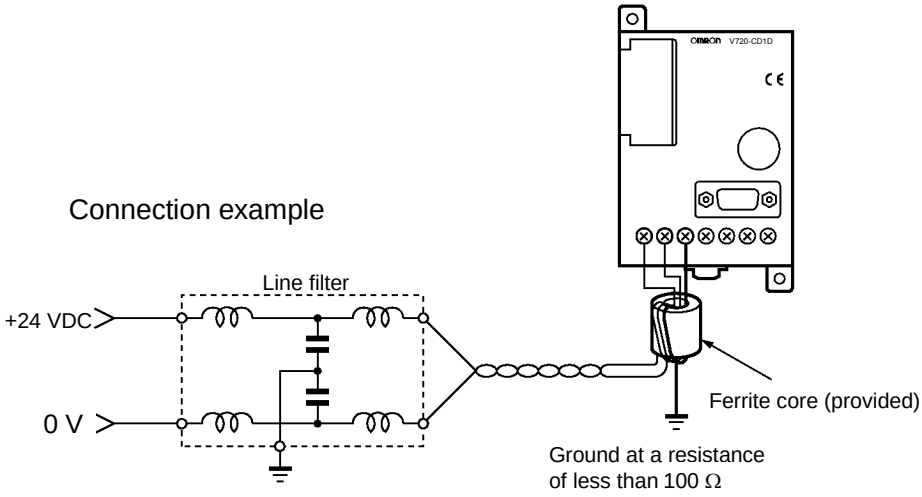
Note Do not connect or disconnect the connector while the Controller is turned ON, otherwise the Controller may malfunction.

4-5 Wiring

Wire the Controller as shown below.



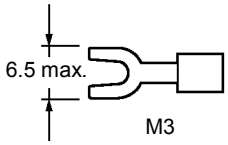
4-5-1 Power Supply and Ground Wires



The power supply and ground terminals use M3 set screws. The following type of solderless terminals can be connected to these terminals. Tighten each screw to a torque of approximately 6 kgf • cm.

Example of Suitable Solderless Terminals

Manufacturer	Model	Suitable wire	Shape
Nippon Atchaku Tanshi	1.25-N3A	AWG24 to AWG16	Fork-shaped
Nippon Atchaku Tanshi	1.25-Y3A		



The Controller can internally withstand the noise on the power line. By providing power to the Controller through the noise filter, the noise between the Controller and ground can be greatly reduced.

Recommended Compact DC Power Supply (OMRON)

Model	Output	Input voltage
S82K-03024	24 VDC 1.3 A	100/200 V
S82J-0224	24 VDC 1.1 A	100 V

The maximum power consumption of the Controller is 0.8 A at 24 VDC (i.e., 20 W). An inrush current, however, will flow when the Controller is turned ON. Take this into consideration when preparing the power supply. A power supply with an output of 1.1 A min. at 24 VDC is recommended.

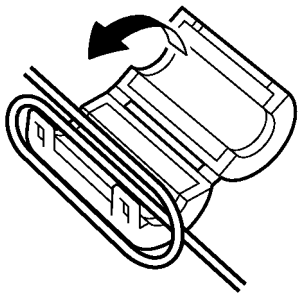
Note

1. If the Antenna and power supply are too close, some noise generated from the power supply may interfere with the communications of the Antenna. Make sure that there is a distance of 1 m or more between the Antenna and power supply.
2. If the Controller and Antenna are too close, the Controller may interfere with the communications between the Antenna and ID Tag. Make sure that there is a distance of 80 cm or more between the Controller and Antenna.
3. Provide 24 VDC to the Controller. The permissible variation of the power supply is between 20.4 and 26.4 VDC (i.e., 24 VDC $^{-15\%}/_{+10\%}$). Make sure that the supply voltage is within this range.
4. The maximum power consumption of the Controller is 20 W. An inrush current of approximately 30 A at 24 VDC, however, flows when the Controller is turned ON. Take this into consideration when preparing the power supply.
5. Provide a power wire with a thickness of at least AWG18 in order to prevent the dropping of voltage. It is recommended that twisted-pair wire be used for the power line.
6. Ground the Controller at a resistance of less than 100 Ω to protect the Controller from noise interference. The thickness of the ground wire must be at least AWG18.

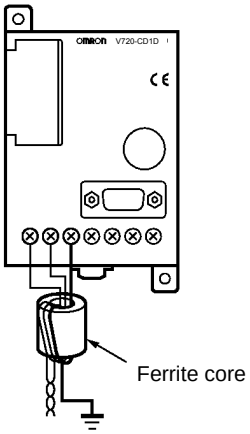
- Use the provided ferrite core for the suppression of noise generation as shown below.

1, 2, 3...

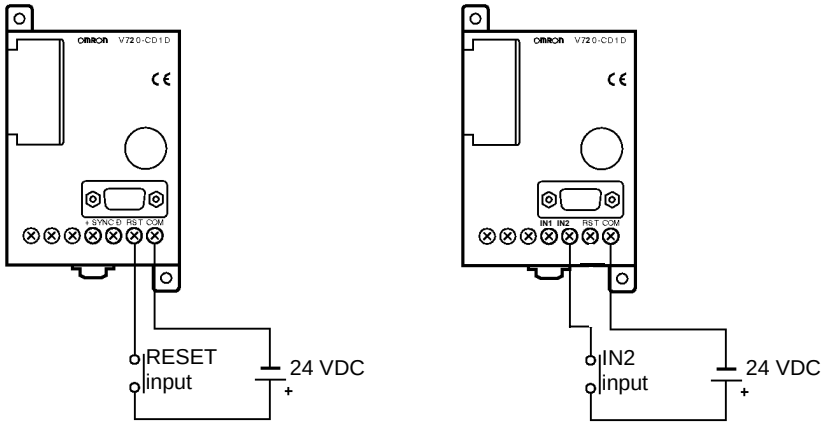
1. Wire the power supply and ground wires.
2. Wind the power supply and ground wires together around the ferrite core once so that the ferrite core will not move as shown below. The ferrite core must be located within 10 cm of the Controller.



3. Close and press the ferrite core until the ferrite core clicks so that the ferrite core will be locked.

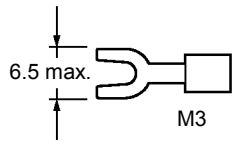


4-5-2 Wiring RESET Signal and External Input Signal



I/O Solderless Terminal

The I/O terminals use M3 set screws. The following type of solderless terminal can be connected to these terminals.



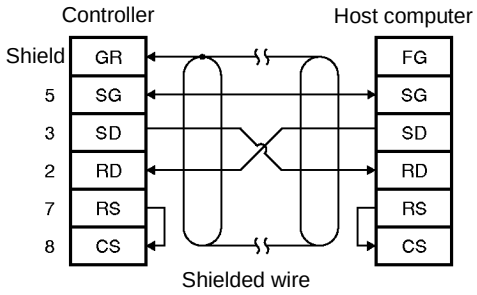
Tighten each screw to a torque of approximately 6 kgf • cm.

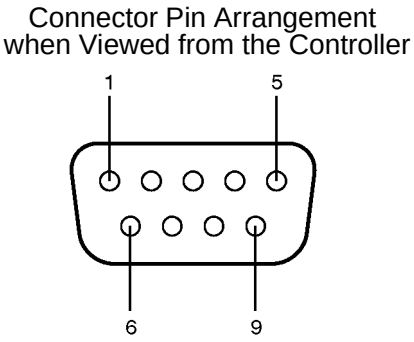
Note

1. Make sure that the input voltage does not exceed a maximum permissible input voltage of 26.4 V, otherwise the Controller may malfunction.
2. Separate power lines and high-tension lines from the input line in order to protect the input line from noise interference.

4-6 Connection of RS-232C Interface (V720-CD1D)

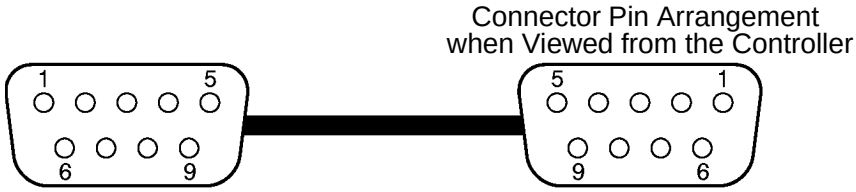
Signal name	Symbol	Signal direction		Pin number
		Input	Output	
Maintenance ground	GR	——	——	Shield
Signal ground or common retrace line	SG	——	——	5
Send data	SD	——	OK	3
Receive data	RD	OK	——	2
Request to send	RS	——	OK	7
Clear to send	CS	OK	——	8





Note 1. Ground the shielded wire on either the Controller side or the above host computer side.
2. Internally short-circuit pins 7 (RS) and 8 (CS).

Connection to Host through IBM PC/AT or Compatible Computer, 9-pin Port



Controller		connecting device	DOS personal computer	
9-pin male		cables with connectors	9-pin female	
Shield	GR		FG	
5	SG		SG	5
3	SD		SD	3
2	RD		RD	2
7	RS		RS	7
8	CS		CS	8

shielded wire

Connecting to OMRON C200H PC

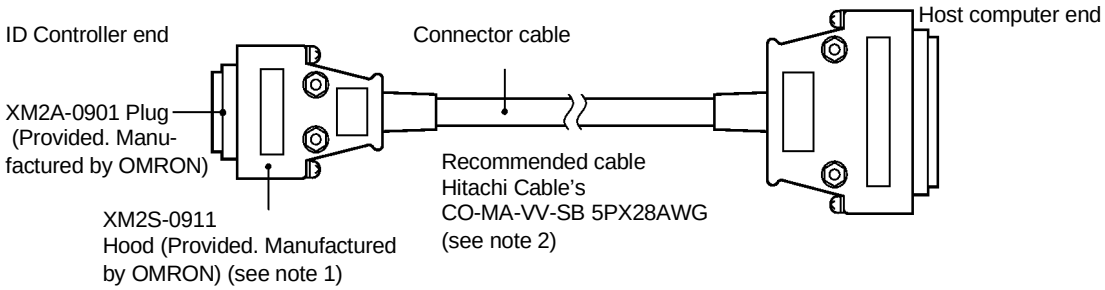
Connector Pin Arrangement
when Viewed from the Controller

Controller		Connecting device	C200H-ASC02	
9-pin male		Cables with connectors	9-pin male	
Shield	GR		FG	1
5	SG		SG	9
3	SD		SD	2
2	RD		RD	3
7	RS		RS	4
8	CS		CS	5

shielded wire

Assembly and Connection of Communications Connector

An OMRON communications connector conforming to EMI standards is provided with the Controller. Use this communications connector or an equivalent one.

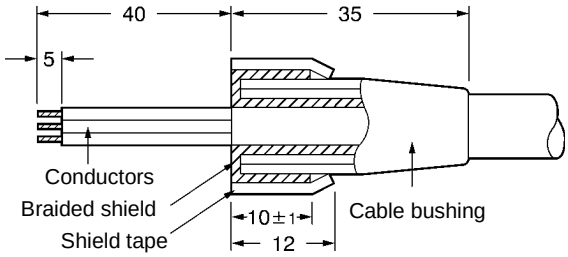


Note 1: A connector conforming to EMI standards is provided with the Controller.

Note 2: Use the above cable or equivalent with an external diameter of 7 mm.

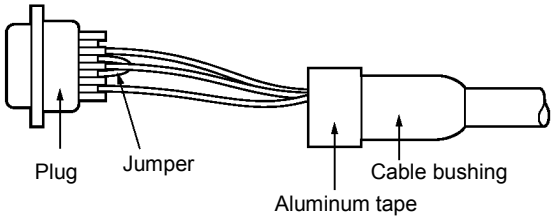
Assembly of Connector

1, 2, 3... 1. Process the end of the cable as shown below.



- Insert the cable into the cable bushing.
- Untangle the braided shield for approximately 10 mm and fold it back on the cable bushing.
- Apply shield tape to the untangled braided shield.

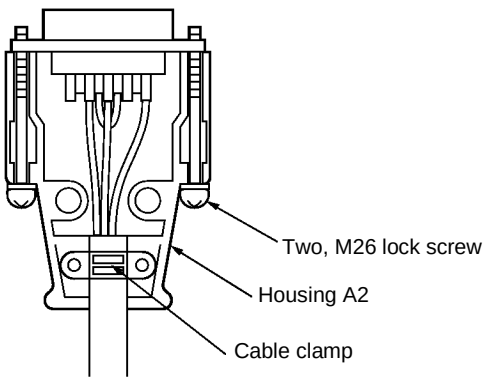
2. Solder the conductors to the plug pins.

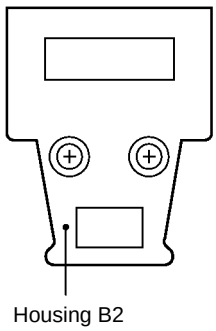


Pin number	Symbol	Name
Shield	GR	Ground
5	SG	Signal ground
3	SD	Send data
2	RD	Receive data
7 (see note)	RS	Request to send
8 (see note)	CS	Clear to send

Note Short-circuit pins 7 (RS) and 8 (CS) with a jumper.

3. Attach housing A2 of the Hood to the Plug and secure the aluminum-taped portion with the cable clamp and two screws.

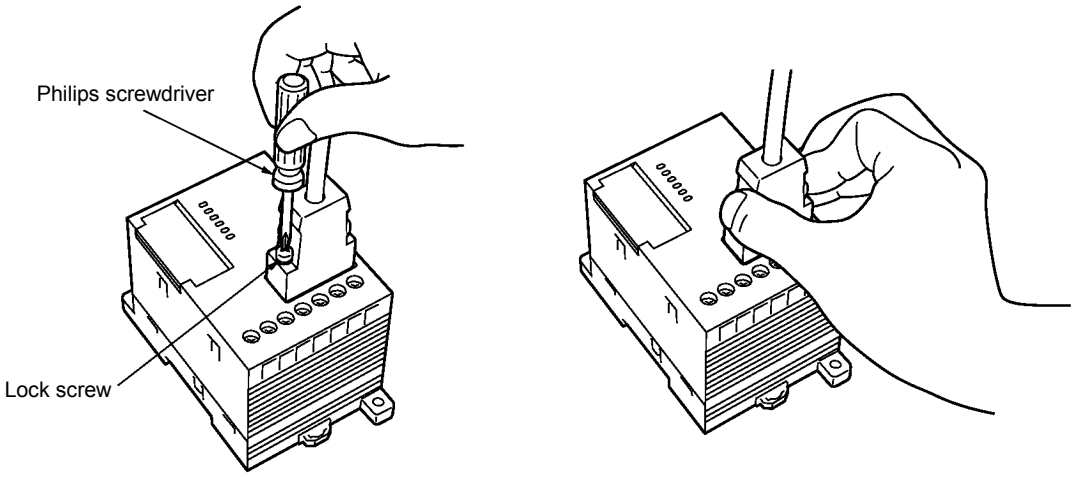




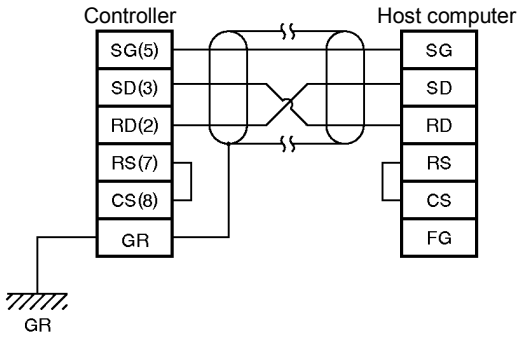
4. Put on housing B2 to complete the connector assembly.

Connection and Disconnection of Connector

- When connecting the connector, be sure to hold the connector by hand and insert the connector. Then secure the connector with two lock screws.
- When disconnecting the connector, completely loosen the two lock screws. Then hold the protruding part of the connector hood by hand and pull the connector straight out. If the connector is difficult to disconnect, hold the Controller by hand while pulling out the connector.

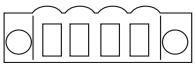


Note Example of Grounding from Controller



- The shielded wire must be grounded either from the Controller or the host computer for the prevention of system malfunctions. The above is an example of grounding from the Controller.
- Short-circuit the RS and CS pin in the connector.

4-7 Connection of RS-485 Interface (V720-CD2D)

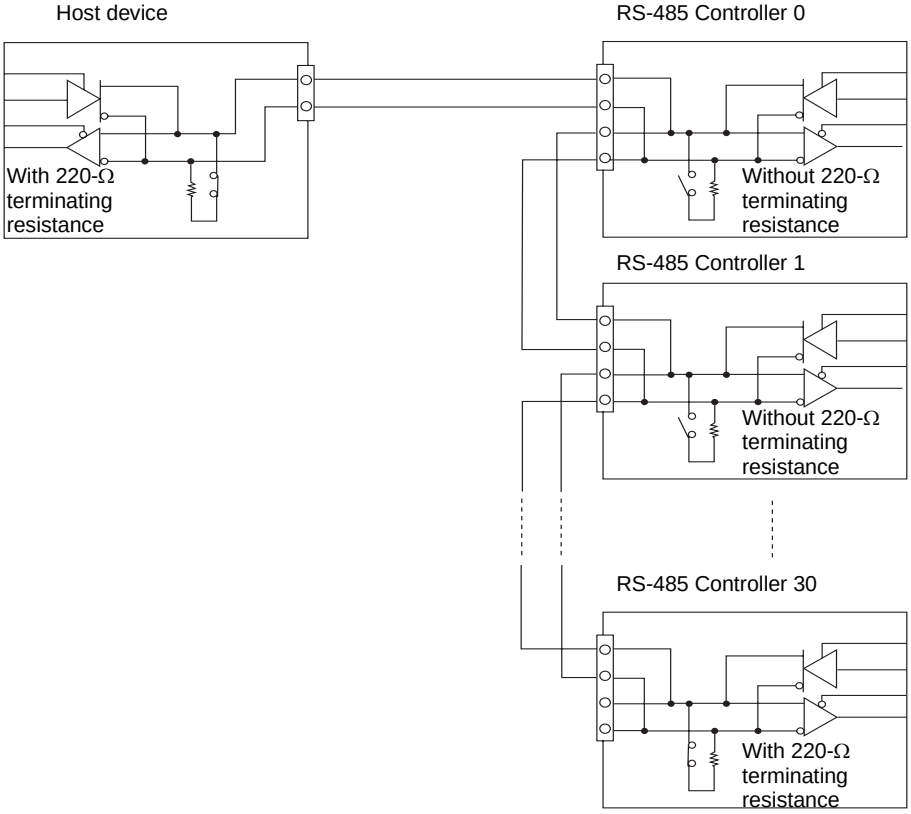


Terminal number 1 2 3 4

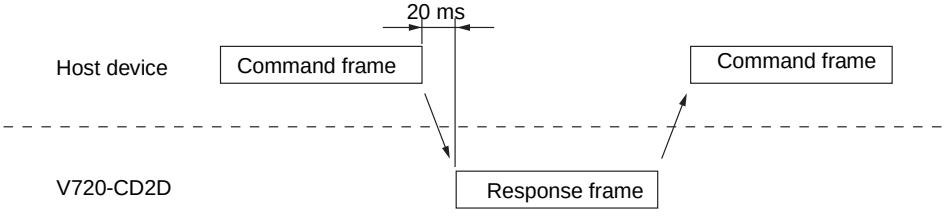
Terminal number	1	2	3	4
Polarity	+	–	+	–

Note Terminals 1 and 3 and terminals 2 and 4 are connected internally in the RS-485 Controller.

1-to-N Connection



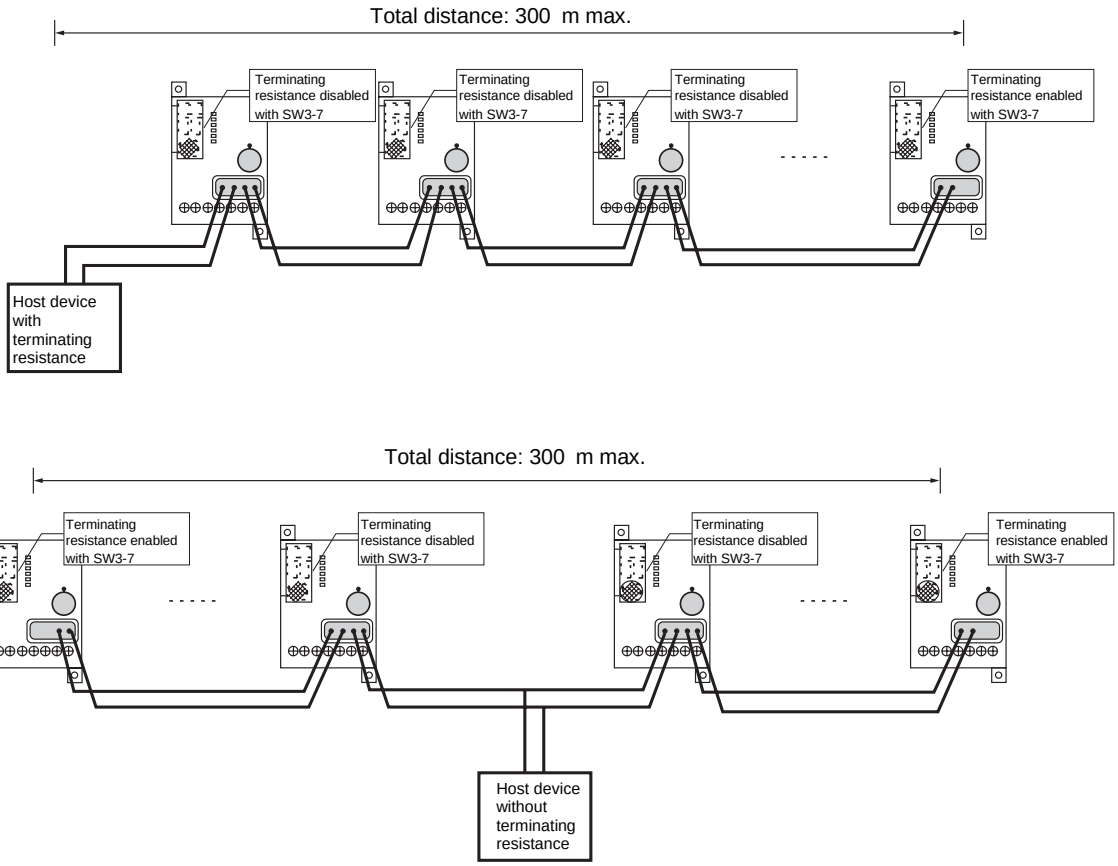
Note After sending a command from the host device, confirm that a response has been received from the Controller before sending the next command. When using an RS-232C/485 converter at the host device, do not send commands until the status has completely changed to clear-to-send status. Also, after sending all the commands, switch to the receive status. Communications with the Controller may not be possible if the above points are not observed.



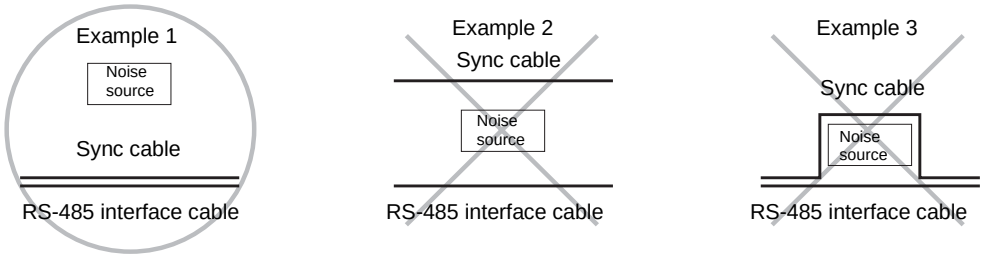
Connection Examples

Use a shielded cable for connection to the RS-485 interface. Connect the shield line to the ground terminal.

1-to-N Connection



Note When not using the recommended cable, wire a sync cable alongside the RS-485 interface cable. Even if a sync cable is wired in parallel with the RS-485 cable, if it is wired as in examples 2 and 3 below, noise resistance will be reduced.

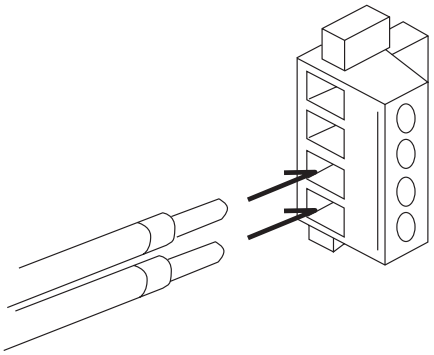


Noise sources: Other devices, power lines, AC adapters, etc.

Preparing and Installing Connectors

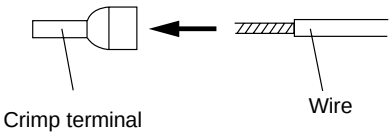
Use the following procedure to prepare and connect the communications connectors.

1, 2, 3... 1. Attach crimp terminals to the stripped ends of the communications wires. Check the alignment of the connector and insert the wires into the correct holes in the connector.



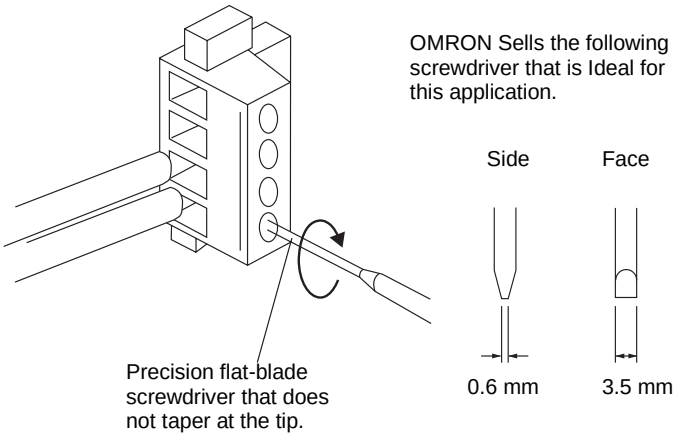
- Recommended Cable: MVVS 4CX0.5Sq

  Use two of the cable's wires as the RS–485 interface lines and the other two wires as the SYNC lines. Connect the shield wire to the ground terminal.
- Recommended Terminals: Nihon Weidmuller H–sleeve Series

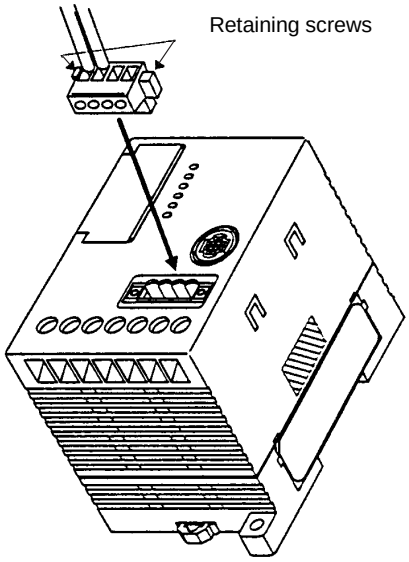


Insert the wire into the pin terminal and crimp it. Nihon Weidmuller sells the PZ-series Crimping Tool for crimping these terminals.

2. Tighten the connector's set screws to secure each of the wires in the connector. A regular screwdriver that tapers at the end may not fit into the screw hole, so use a screwdriver with a tip and shaft that are the same width. Tighten the screws to a proper torque (about 0.5 N•m).



3. Install the connector in the Controller. Align the cable's connector with the Controller's connector and insert the cable's connector fully into the Controller. Tighten the retaining screws to a proper torque (about 0.3 N•m).



4. To remove the connector, completely loosen the two retaining screws and pull the connector straight out of the Controller. If the connector is difficult to remove, push against the Controller while pulling out the connector.

Note Do not connect wires in the connector while it is installed in the Controller.

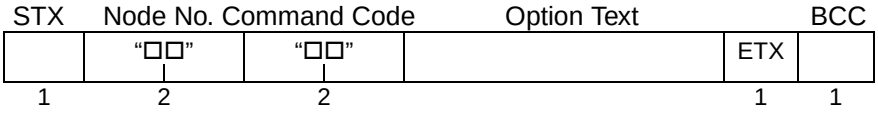
SECTION 5
Communications Functions

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

5-1 Command and Response Frame Structure

5-1-1 Command Frame Structure

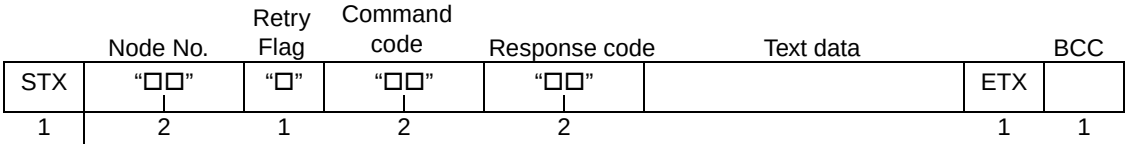
The ID Controller continuously receives signals from STX to ETX, and executes the command when the correct node number is received. If, after receiving an STX signal, another STX signal is received before an ETX signal is received, the second STX signal is given command priority.



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

5-1-2 Response Frame Structure

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



Name	Description
Retry Flag	In ACK/NACK control, when NACK is received and the previous response is returned, the retry flag is set to "1". In other cases, it is set to "0".
Command code	The received command code is returned.
Response code	Indicates the state of the Controller after command execution. Refer to *5-10 Response Code List*.
Text data	Sent in response to specific commands. For the content, refer to the frame structure of each command.

5-1-3 BCC Calculation Method

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

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

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

5-2 Command List

Command Name	Command Code	Description
Read	RD	Reads the memory data of a Tag.
Write	WT	Write data to the memory of a Tag.
Lock	LK	Write-protects Tag memory by page. Once a page has been write-protected, the write protection cannot be cleared.
Memory Check	MC	Compares check codes in Tag memory.
Memory Calculation	MK	Calculates check codes in Tag memory.
Polling Read	PR	Performs a single autoread using polling.
Polling Write	PW	Performs a single autowrite using polling.
Polling Check	PC	Checks polling.
Polling End	PE	Ends polling.
Stop	ST	Completes a command in execution.
Reset	XZ	Resets the Controller.
Controller Control	CC	Performs user input operation
Application ID setting	AI	Application ID setting for Controller
Family code setting	FC	Family code setting for Controller
Test	TS	Sends the received data to the host.
ACK	AK	Indicates that the host receives a response normally.
NACK	NK	Indicates that the host does not receive a response normally.

5-3 Communications Commands and Responses

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

5-3-1 Single Access Commands and Responses

1) Read (RD)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

2) Write (WT)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

5-3-2 FIFO Access Commands and Responses

1) Read (RD)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

2) Write (WT)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

5-3-3 Multiple Access Commands and Responses

1) Read (RD)

Command for the use of reading plural Tags

Command Frame Structure

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

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

Response Frame Structure

■READ DATA RESPONSE

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

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

■COMMUNICATIONS END RESPONSE (Multi-trigger Only)

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

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

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

2) Write (WT)

Command for the use of writing the same data to plural Tags.

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

Command Frame Structure

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

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

Response Frame Structure

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

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

5-3-4 Selective Access Commands and Responses

1) Detection of Tags

Command for the use of detecting Tags in communications area.

Command Frame Structure

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

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

Response Frame Structure

- Read data response

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

- Communications end response

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

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

2) Read (RD)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

3) Write (WT)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

5-3-5 Polling Commands and Responses

1) Polling Single Auto Read (PR)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

2) Polling Single Auto Write (PW)

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

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

3) Polling Check (PC)

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

Command frame structure

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

Response Frame Structure

- **Response to Read commands**

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

- **Response to Write commands**

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

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

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

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

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

4) Polling End (PE)

Command for the use of canceling Execution of Polling commands.

Command frame structure

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

Response Frame Structure

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

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

- **Response after a Tag is detected**

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

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

5-3-6 System Commands and Responses

1) Serial Number Read (RD)

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

Command frame structure

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

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

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

Response Frame Structure

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

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

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

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

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

2) Lock (LK)

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

Command Frame Structure

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

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

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

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

AI: Application ID FC: Family code

A format error will occur (error code 14) if a 1 is set for a bit marked "Fixed `0'."

Response Frame Structure

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

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

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

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

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

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

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

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

Command frame structure

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

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

Response Frame Structure

- **Single and FIFO Accesses**

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

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

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

- **Selective Access**

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

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

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

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

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

Command Frame Structure

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

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

Response Frame Structure

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

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

7) Setting of EAS (ES)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

8) EAS Check (EA)

The EA Command is used to perform EAS checks. This command is performed continuously until the Stop Command is sent.

Command Frame Structure

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

Response Frame Structure

STX	Node No.	Retry Flag	Command code "EA"	Response code "00"	EAS data "2FB36270D5 to 12A57237EF"	ETX	BCC
1	2	1	2	2	32	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.
EAS data	The received data at the lower level is returned, and the data is judged at the host device. The EAS data when all data is received normally is as follows. 2F B3 62 70 D5 A7 90 7F E8 B1 80 38 D2 81 49 76 82 DA 9A 86 6F AF 8B B0 F1 9C D1 12 A5 72 37 EF

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

9) Setting of Quiet Bit (QB)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

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

10) Version (VS)

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

Command Frame Structure

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

Response Frame Structure

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

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

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

5-3-7 General Commands and Responses

1) Special Read (RD)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

2) Stop (ST)

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

Command Frame Structure

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

Response Frame Structure

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

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

3) Reset (XZ)

This command software-resets the Controller.

Command Frame Structure

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

4) Controller Control command (CC)

This command is used for reading the user input terminal status.

Command Frame Structure

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

Response Frame Structure

STX	Node No.	Retry flag	Command code "IC"	Response code "00"	Input Status IN1	Input Status IN2	ETX	BCC
1	2	1	2	2	1	1	1	1

Response code	00 : Normal completion For other response codes, refer to *5-10 Response Code List*.
Input status 1,2	1:ON, 0:OFF

5) Test (TS)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

6) Memory Check (MC)

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

Command Frame Structure

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

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

Response frame structure

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

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

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

7) Memory Calculation (MK)

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

Command Frame Structure

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

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

Response Frame Structure

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

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

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

8) ACK (AK)

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

Command Frame Structure

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

9) NACK (NK)

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

Command Frame Structure

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

10)Response to undefined commands

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

Response Frame Structure

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

5-4 Command Connection

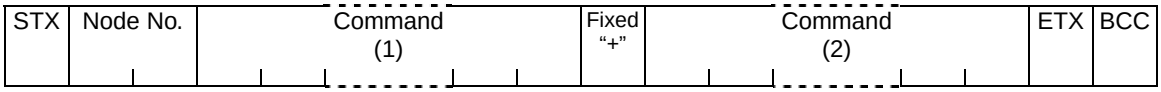
A command connection function allows the Controller to perform both read and write operations at a time by connecting commands from the host with “+”. Any of the following commands can be paired.

- Read (RD)
- Write (WT)
- Polling Single Auto Read (PR)
- Polling Single Auto Write (PW)
- Memory Check (MC)
- Memory Calculation (MK)

Example of command connection

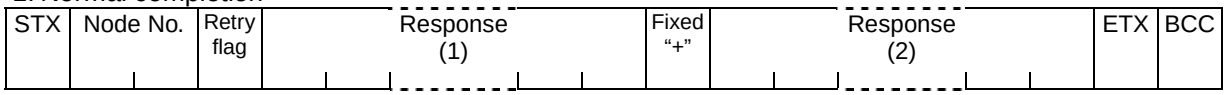
In a command connection function, a single STX, Node No., BCC and ETX are shared each, and connected to each other using “+”.

Command Frame Structure



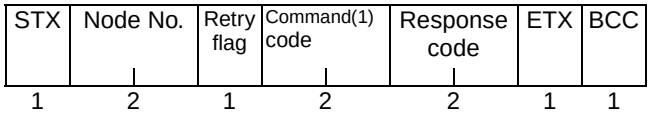
Response Frame Structure

1. Normal completion



2. Abnormal completion

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



The Following Combinations of Command Connections Are Possible

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

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

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

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

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

5-5 Communications Methods

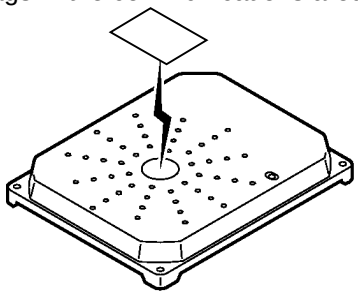
For communications, settings for access and mode should be made according to the state of Tags in the communications area of the Antenna and their operation after the Tags receive commands.

5-5-1 Access Settings

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

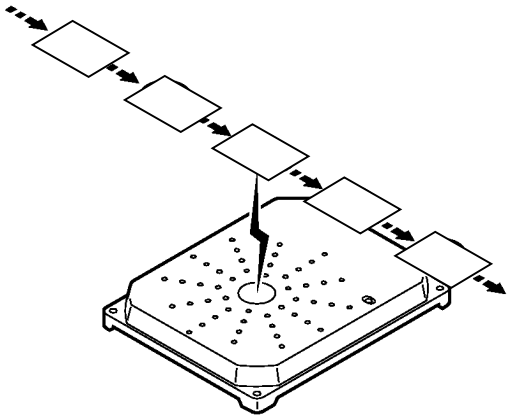
1) Single Access

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



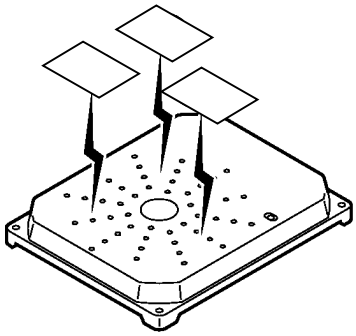
2) FIFO Access

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



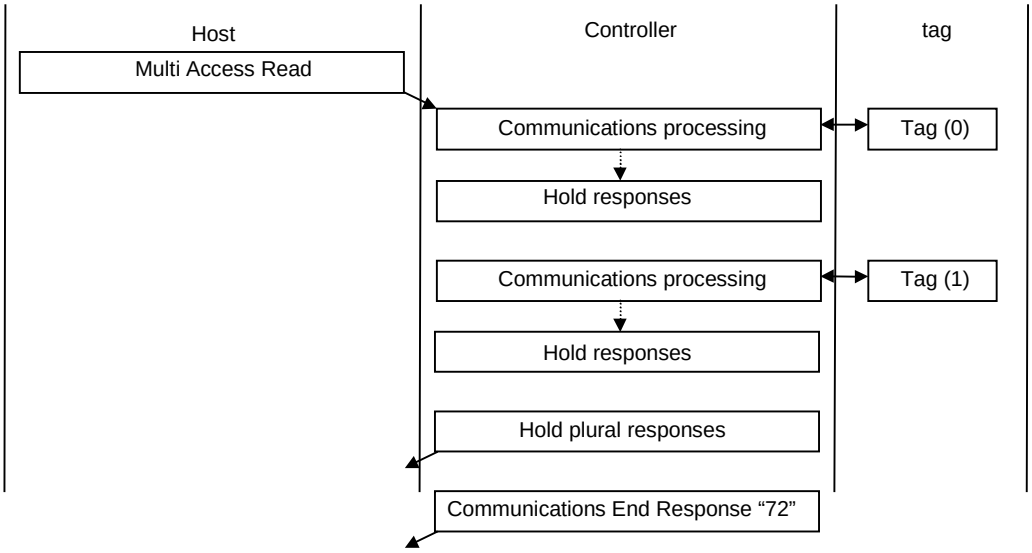
3) Multiple Access

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



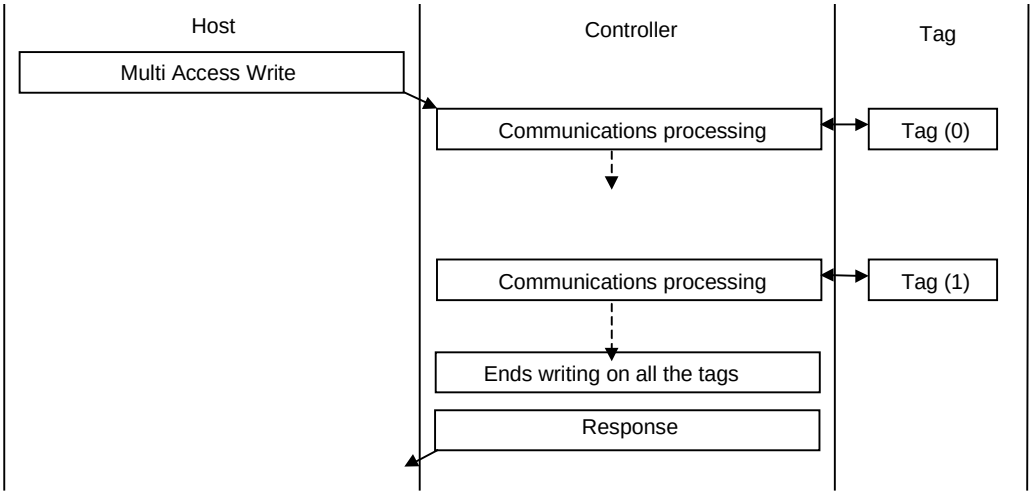
Multiple Access Read

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



Multiple Access Write

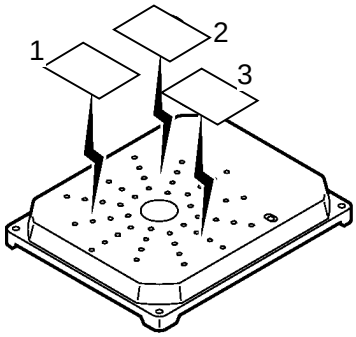
A response is returned once only when communications with all Tags within the communications range ends for the Multiple Access Write Command (WT).



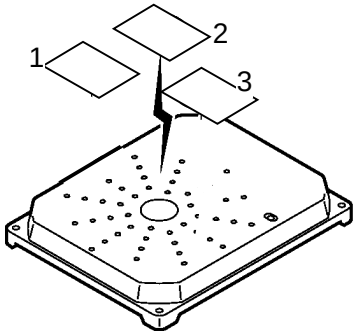
4) Selective Access (Trigger Mode only on Selective Access)

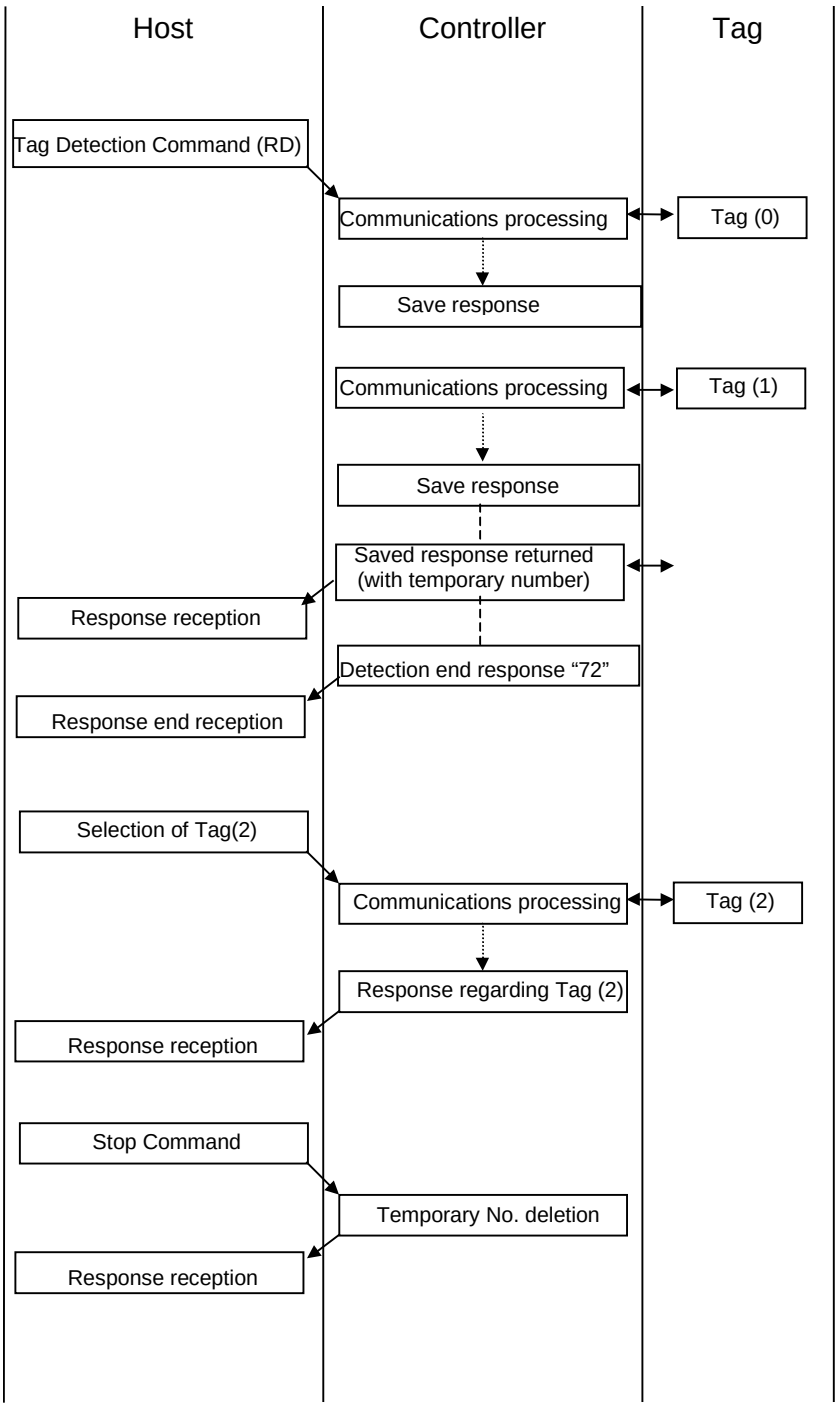
In the selective access trigger function, a selected Tag from among multiple Tags in the communications area of the Antenna is accessed. First, temporary numbers are assigned to the Tags in the communications area. The Tag Selection Command allows the Controller to communicate with a selected Tag according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

a. Temporary number assigned



b. Communications with Tag No. 2





1) The controller receives the Tag Detection command

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

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

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

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

6) The controller communicates with the specified temporary No.

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

■ Exceptions to the Selective Access Trigger Function

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

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

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

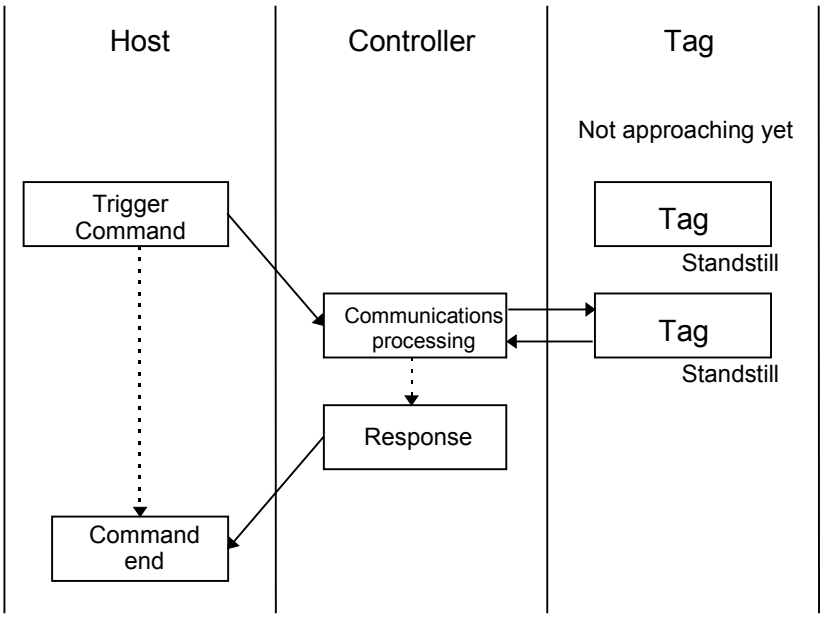
Note: The Tag Detection Command means that “LT” is set to the “communications” of a command frame. Also, the selection of Tag(1) means that “01” is set to the “communications” of the command frame.

5-5-2 Mode Settings

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

1) Trigger Mode

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

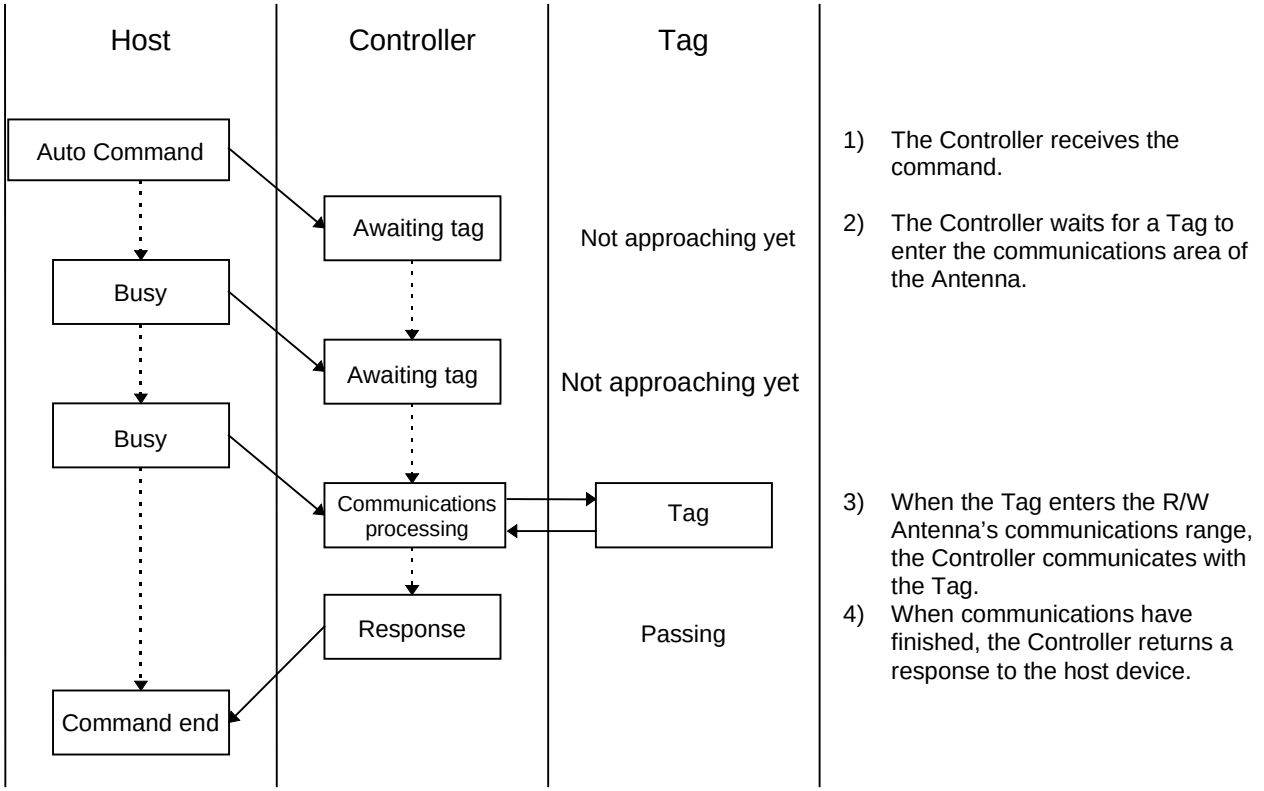


1) When a Tag exists in the communications area, the host sends the Trigger Command.
2) The Controller communicates with the Tag according to the command.
3) After completion of the communications, the Controller returns a response to the

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

2) Auto Mode

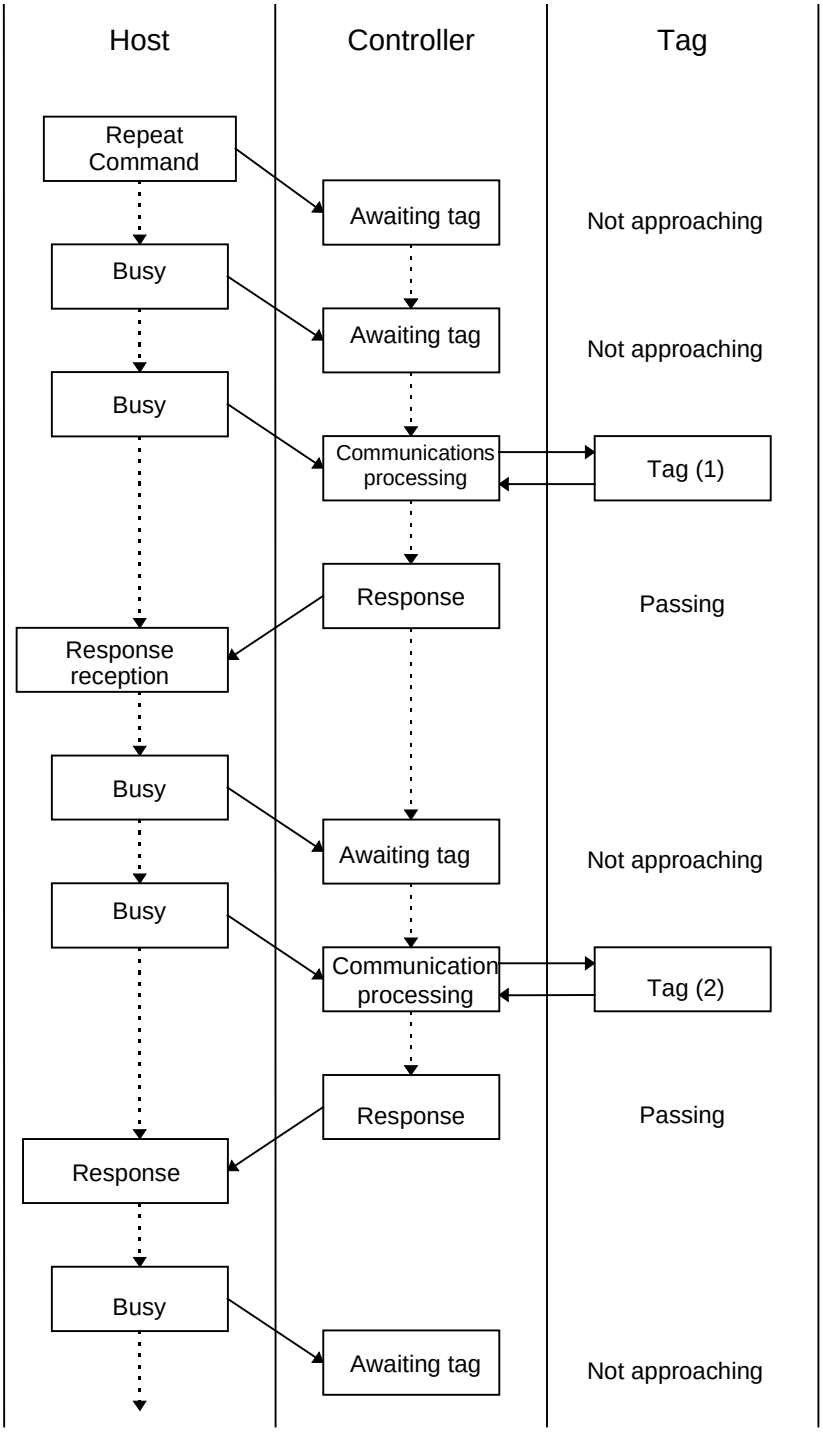
In auto mode, after receiving an Auto command from the host, the Controller waits for a Tag to enter the communications area. Since the Controller is in a busy state between Auto command reception and the completion of communications with the Tag, it does not accept any commands other than the Stop or Reset Command during the period.



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

3) Repeat Mode

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



1) The Controller waits for a Tag to enter the communications area of the Antenna.

2) The Controller communicates with the Tag.

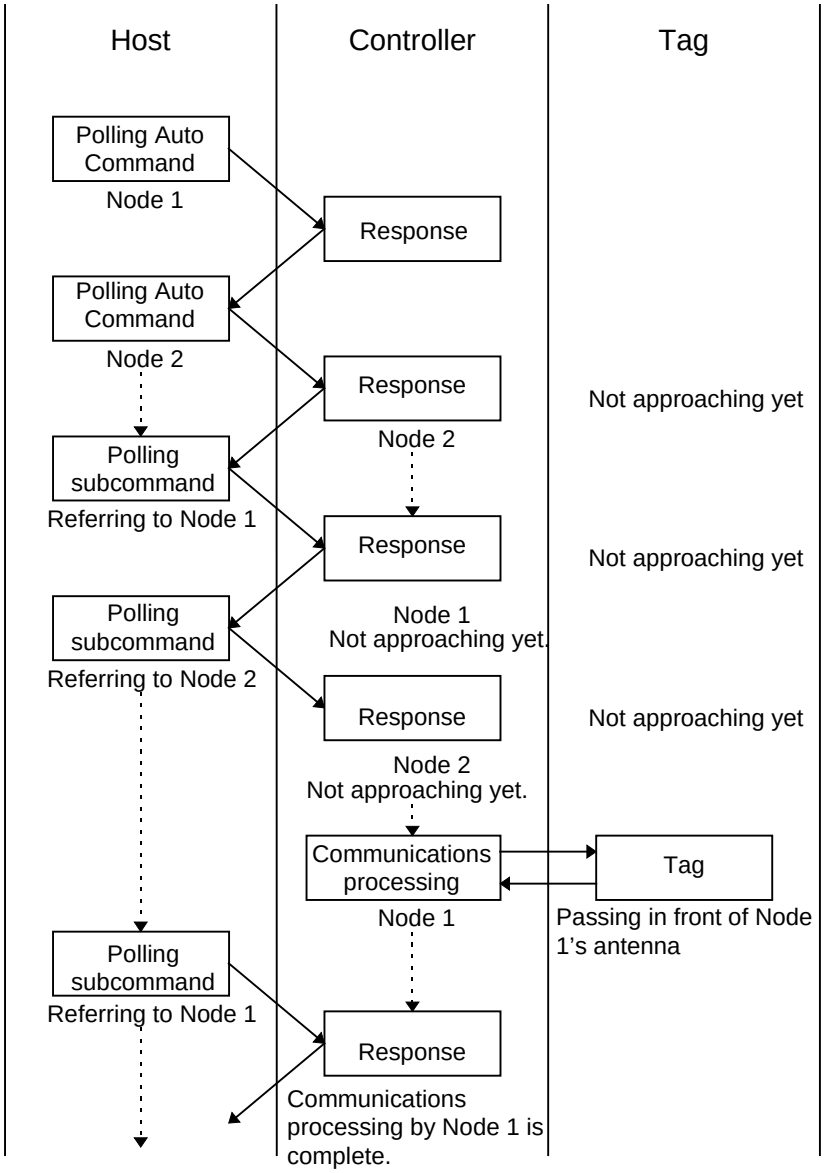
3) After the completion of the communications, the Controller returns a response, then waits for the next Tag to enter the communications area.

4) The Controller communicates with the next Tag.

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

4) Polling Auto Mode

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



1) The host sends the Polling Auto Command to the Node 1 Controller.

2) Immediately after command reception, Node 1 returns a response indicating the acceptance of the command.

3) The host sends the Polling Auto Command to Node 2.

4) Immediately after command reception, Node 2 returns a response indicating acceptance of the command.

5) The host inquires after the progress of the communications processing or stops the Polling Auto processing using the Polling sub command. When the communications processing is not yet complete, the Controller returns a response indicating unfinished processing in reply to the inquiry of the Polling sub command.

6) The Node 1 communicates with a Tag entering the communications area.

7) Node 1 returns a response indicating the results of communications with the Tag in reply to the Polling subcommand.

5-5-3 Table of Communications Methods

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

5-5-4 Table of Communications Methods for Commands

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

✓ :Able to select communications method
–:Not able to select communications method

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

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

5-6 Data Type

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

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

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

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

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

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

5-7 Tag Number Setting

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

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

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

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

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

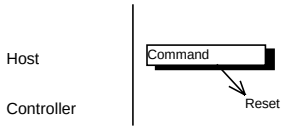
Note 3: The higher the timeslot setting, the longer the communications time required. Consequently, setting a higher timeslot setting than required for the number of Tags in use unnecessarily lengthens communications time, so select a suitable setting.

5-8 Communications Phase

The following commands and responses can be made by specifying different command communications settings.

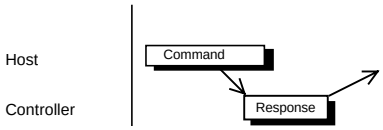
(1) No Response

When the Controller receives the Reset Command, it is reset without returning a response and waits for the next command.



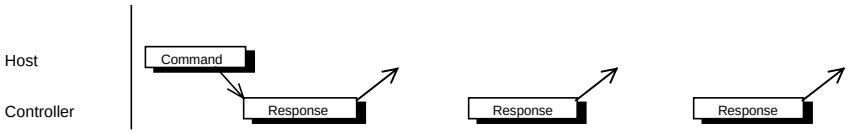
(2) 1-to-1

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



(3) Multiple Response

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



5-9 ACK/NACK Control

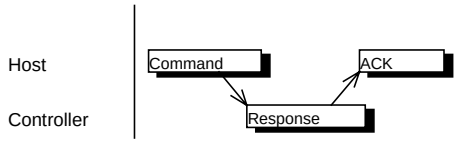
5-9-1 Error Handling in ACK/NACK Control

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

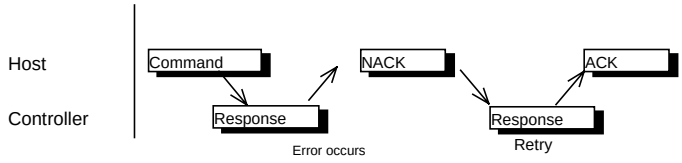
Using ACK/NACK Control

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

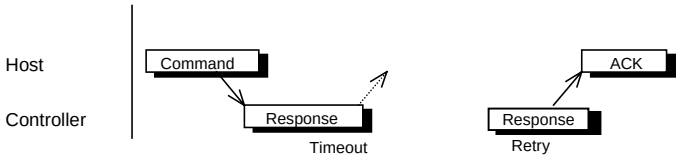
(1) Host Receives a Normal Response and Sends ACK Command



(2) Host Cannot Receive a Normal Response and Sends a NACK Command



(3) Host Did Not Send an ACK/NACK Command within the Timeout Period



5-10 Response Code List

Response codes in response frames are shown below.

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

SECTION 6
Startup and Full Operation

This section provides information on trial operation, errors and remedies, and maintenance and troubleshooting.

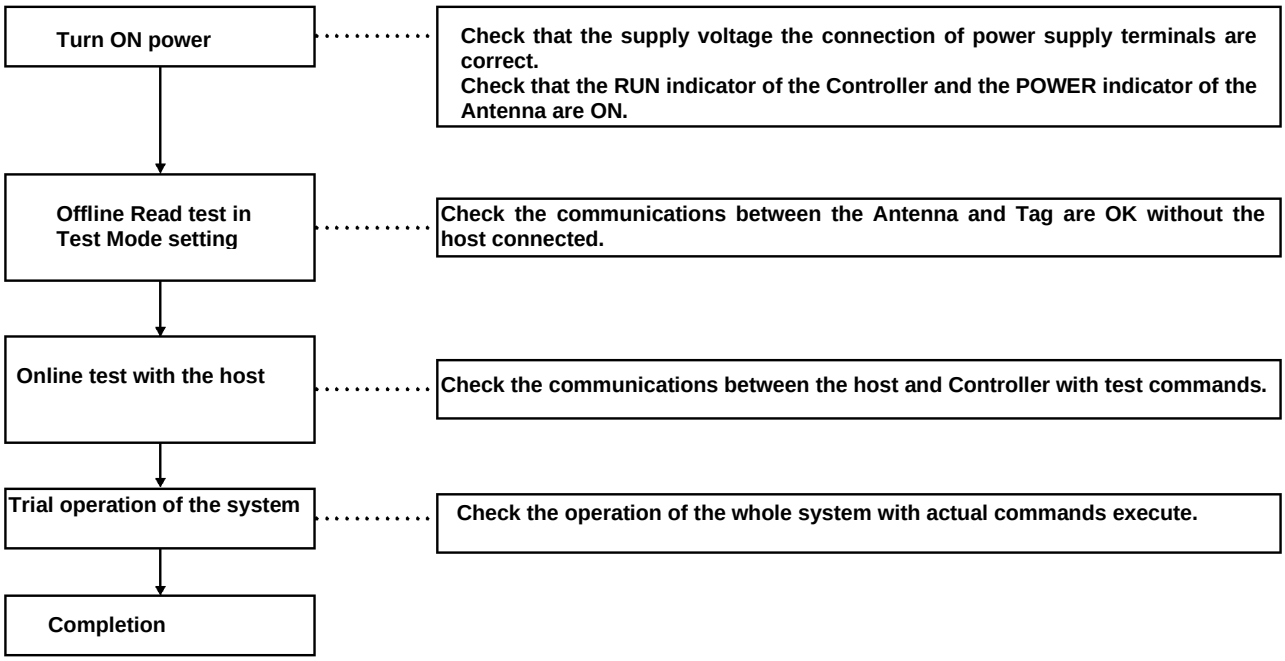
6-1 Trial Operation

Check Items

Check the following on the RFID System before the trial operation of the whole system.

Items	Detail	Section
Power supply and I/O lines	• Are the power supply and I/O lines properly wired? • Are all the terminal screws tightened securely?	4-5
DIP switch settings	• Is the node number set correctly? • Are the communications specifications set correctly?	4-1
Antenna	Is the Antenna connected properly?	4-4
Host	Is the RS-232C connector connected properly?	4-6
Location of Antenna and Tag	Are the Antenna and Tag located properly?	Refer to the V720 R/W Antenna and Tag User Manuals

Procedure for Trial Operation



Offline Read Test in Test Mode setting

Set offline Read Test Mode by turning ON pin 3 on Controller DIP switch 3. By setting the Test Mode, the communications between the Antenna and Tag can be tested without connecting the host. Use Test Mode to check the mounting position before the test run.

Communications Test with Host

By using test commands, the communications between the Controller 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.

- Prepare a simple communications program on the host and transmit test commands.
- If the communications line is normal, the Controller returns the data received.

6-2 Self-diagnostic Function

The Controller has a self-diagnostic function to check a variety of items in order to reduce the downtime of the system that may result due to operational failures.

Details of Errors

Errors detected by the Controller can be classified into “fatal errors” and “nonfatal errors.”

Fatal Errors

If the hardware of the Controller fails, the operation of the CPU will be interrupted and the ERROR indicator will turn ON or flash.

Nonfatal Errors

If there is a communications error between the Controller and host or the Antenna and Tag, the ERROR indicator will turn ON.

Error type	Item	Indicator			
		RUN	COMM	NORM	ERROR
Normal operation	Awaiting command	ON	OFF	OFF	OFF
	Communicating with Tag	ON	ON	OFF	OFF
	Normal completion of communications with Tag	ON	OFF	ON	OFF
Fatal error	CPU error	OFF	OFF	OFF	ON
	Memory error	OFF	OFF	OFF	Flashing
Nonfatal error	Communications error	ON	OFF	OFF	ON
	Host communications error	ON	OFF	OFF	ON

6-3 Errors and Remedies

The following are considered to be main causes of system breakdowns.

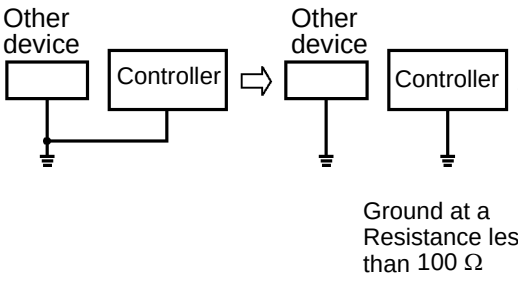
- Noise interference — Take appropriate countermeasures against noise.
- Failures in peripheral devices — Repairs are required.
- Failures in the Controller — Repairs are required.
- Failures in the Antenna — Repairs are required.
- Failures in the cable — Repairs are required.
- Failures in the Tag — Repairs are required.
- Other failures — Repairs are required.

Noise Interference

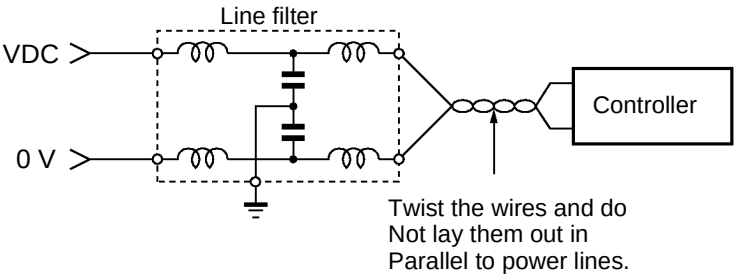
If the system malfunctions due to noise, refer to the following and take appropriate countermeasures.

Circumstance of failure	Probably cause	Remedy
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 Controller at a resistance less than 100 Ω.
Occurs irregularly	Noise on power line	• Provide the power through a 1-to-1 non-grounded insulating transformer or noise filter. • Independently ground the Controller at a resistance less than 100 Ω.
	More than one V720-series Antenna	• When operating more than one V720-series Antenna, provide a sufficient clearance between the Antennas. Refer to *V720 series Antenna, Tag Manual* for details.

Improvement in Grounding



Countermeasures Against Noise on Power Line



6-4 Maintenance and Inspection

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, 2, 3...

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.

■ **Inspection Items**

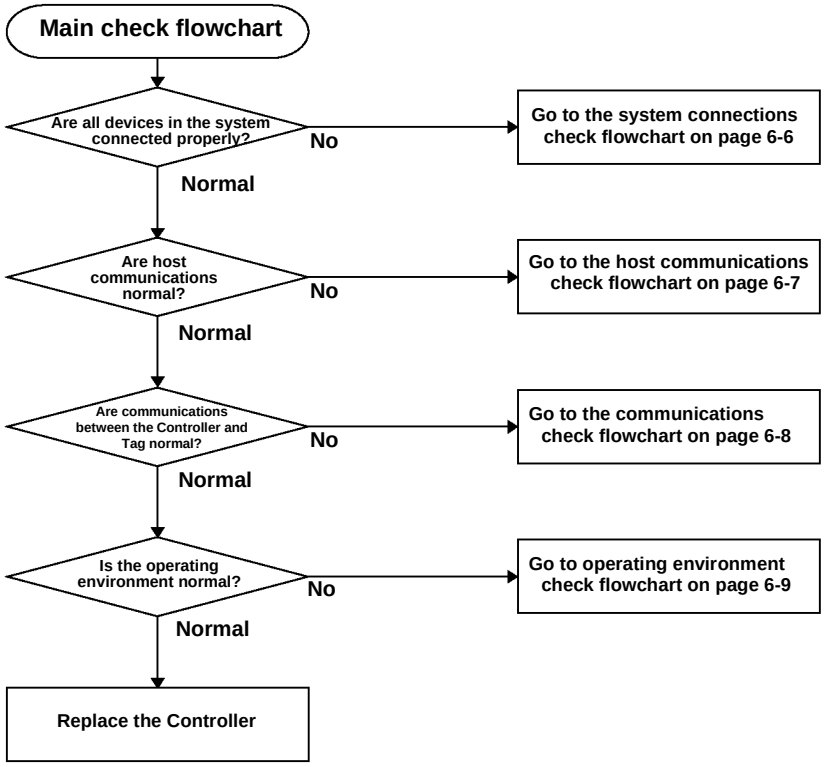
Item	Detail	Criteria	Remarks
Supply voltage fluctuation	(1) Check that the supply voltage fluctuation at the power supply terminal block is within the permissible range.	Supply voltage rating	Voltage tester
	(2) Check that there is no frequent instantaneous power failures or radical voltage drops.	Within permissible voltage fluctuation range	Power supply analyzer
Environment (1) Ambient temperature (2) Ambient humidity (3) Vibration and shock (4) Dust (5) Corrosive gas	(1) and (2) Check that the ambient temperature and humidity are within the specified ranges. (3) Check that no vibration or shock is transmitted from any machines. (4) Check that the system is free of dust accumulation. (5) Check that no metal part of the system is discolored or corroded.	(1), (2) and (3) Check that the ambient temperature and humidity are within the specified ranges. (4) Check there is no dust. (5) Check there is no corrosive gas.	Maximum and minimum thermometer Hygrometer
Panel condition (1) Ventilation (2) Packing for any enclosed construction	(1) Check that the system is ventilated properly with natural ventilation, forced ventilation, or cooling air. (2) Check that the packing is properly attached with no damage.	(1) The interior temperature must be within a range between -10°C and 55°C with proper ventilation. (2) The packing has no damage.	——
I/O power supply (1) Voltage fluctuation (2) 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 permissible ranges.	Voltage tester Oscilloscope
Mounting condition	Check that each device is securely mounted.	There must be no loose screws.	——
	Check that each connector is securely connected.	Each connector is locked or securely tightened with screws	——
	Check that no screw of the terminal block is loosened.	There must be no loose screws.	——
	Check that no wire is broken or nearly broken.	There must be no wire that is broken or nearly broken.	——
	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.	——
	Check that the GR terminal is grounded.	The terminal must be grounded to a resistance of 100 Ω or less.	——

6-5 Troubleshooting

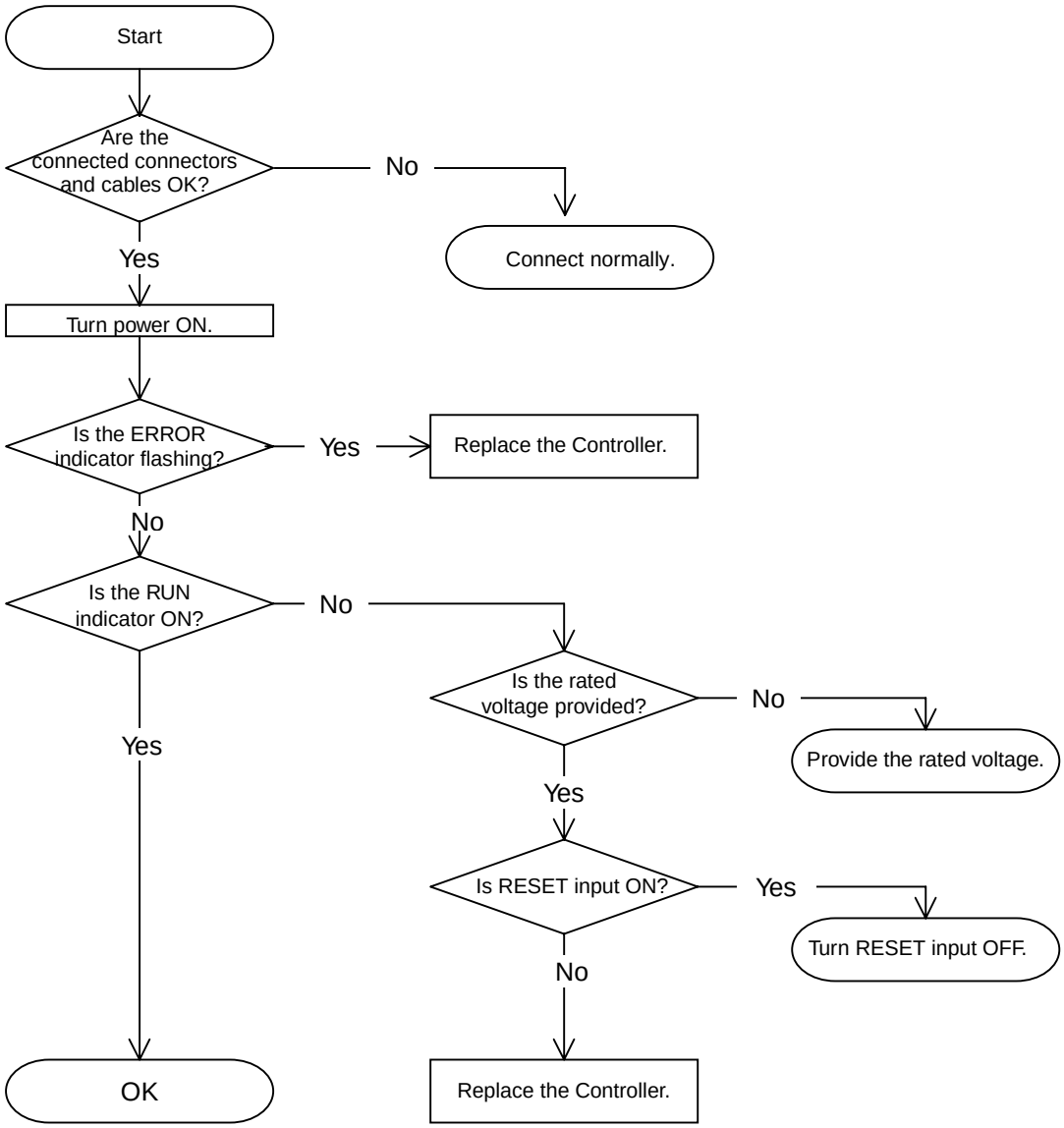
Main Check Flowchart

If an error results, fully check the whole situation, determine the relationship between the system and any other device, and refer to the following flowcharts for troubleshooting.

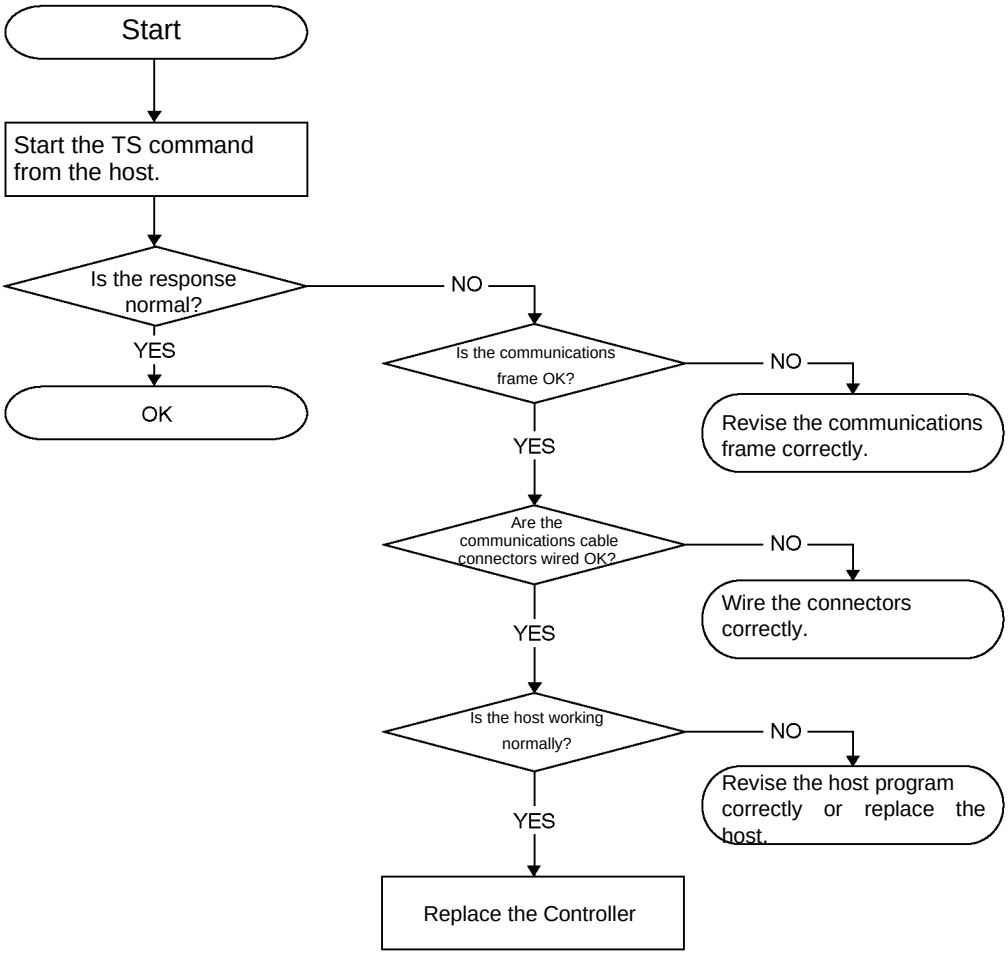
Use the following main check flowchart to determine the cause of the error.



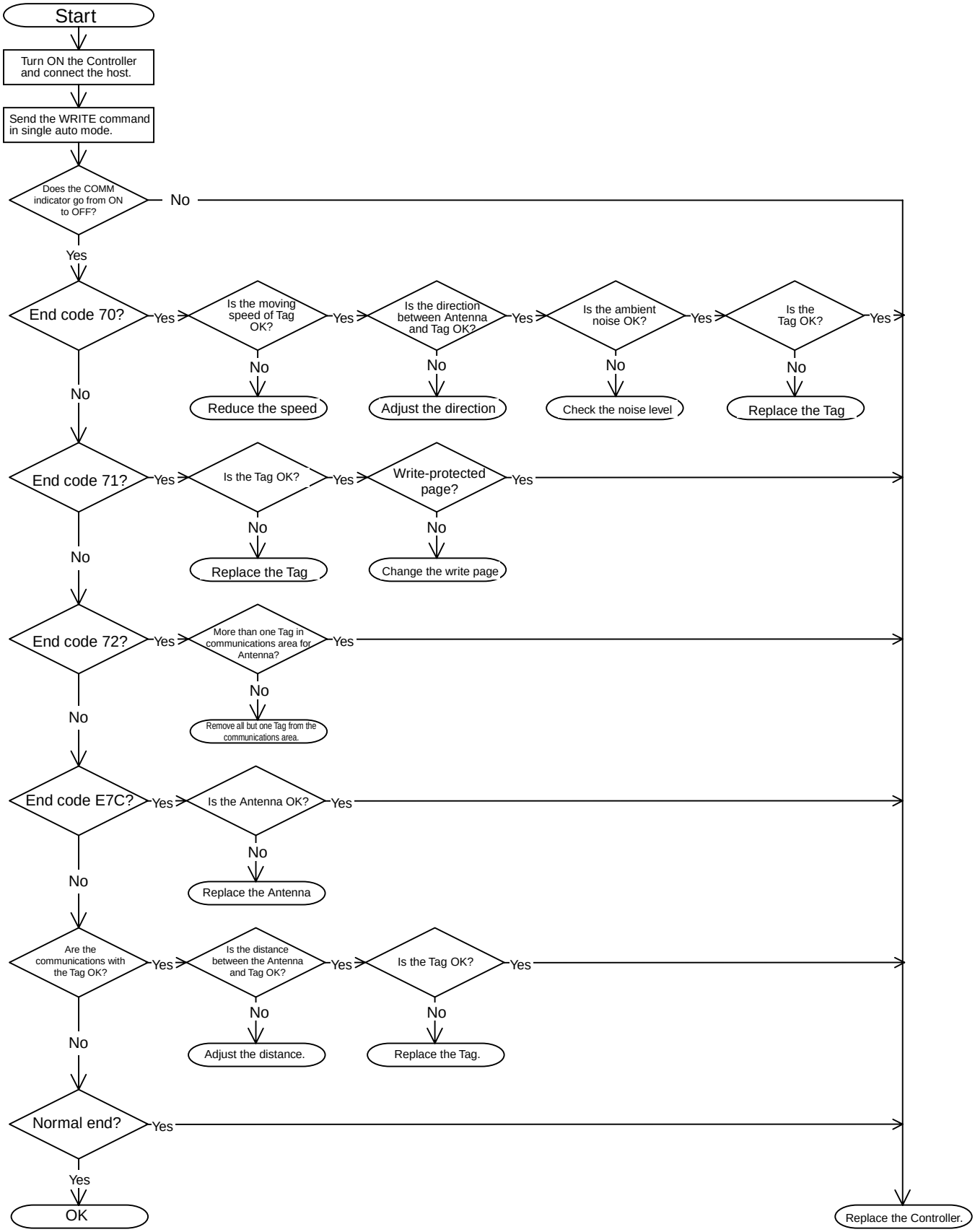
System Connections Check Flowchart



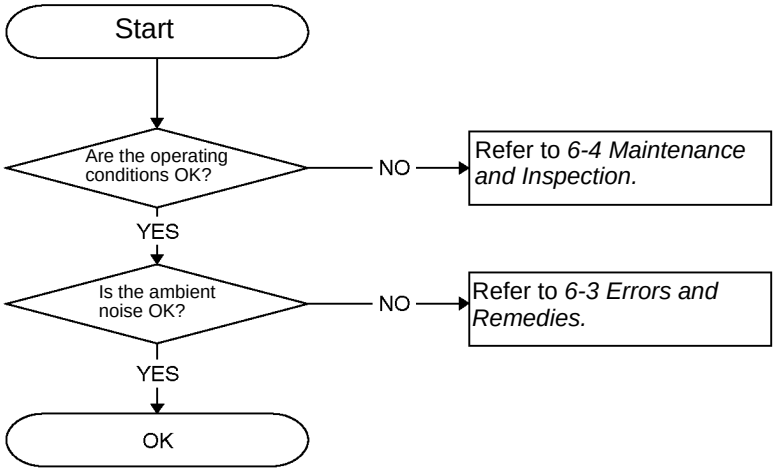
Host Communications Check Flowchart



Communications Check Flowchart



Operating Environment Check Flowchart



SECTION 7
Reference Data

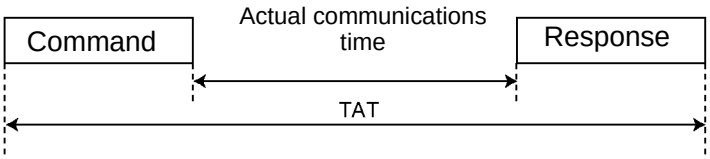
This section provides reference data relating to V720 communications.

7-1 Communications Time

The V720-series Controller reads or writes four-byte data per page.

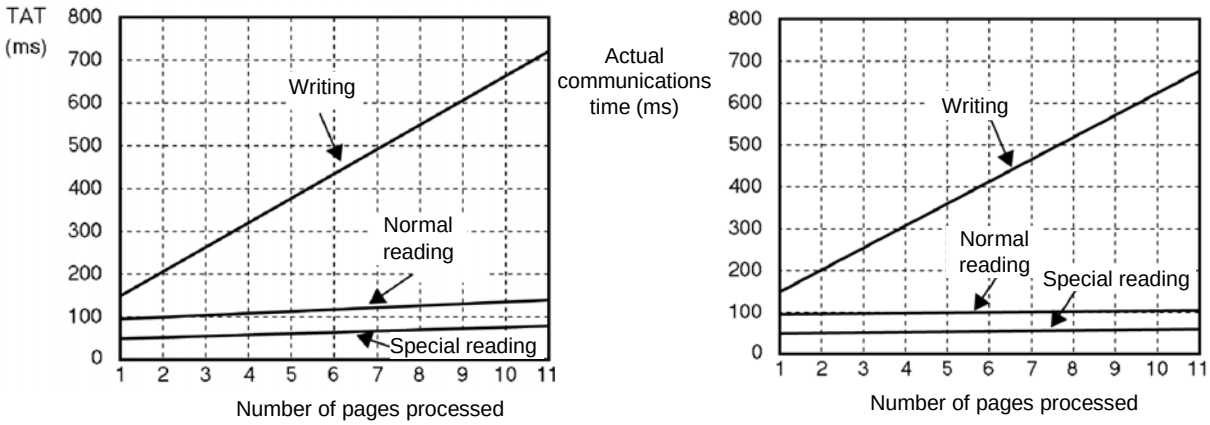
- The following chart specifies the TAT (turn-around time) and actual communications time.
- The actual communications time in the following chart is the time required for communications between the Antenna and Tag, not including communications with the host. Use this for calculating the speed of the Tag for the execution of auto commands.
- Immediately after the power is turned ON or reset (using hardware reset or the reset command), the communications time will be 30 ms longer than the time shown below.

Example



Standard mode

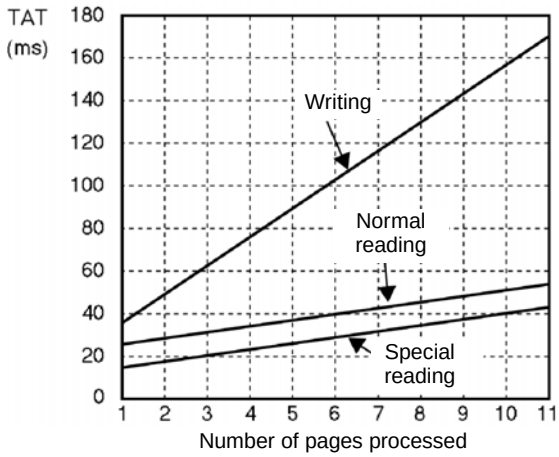
Calculation Formula

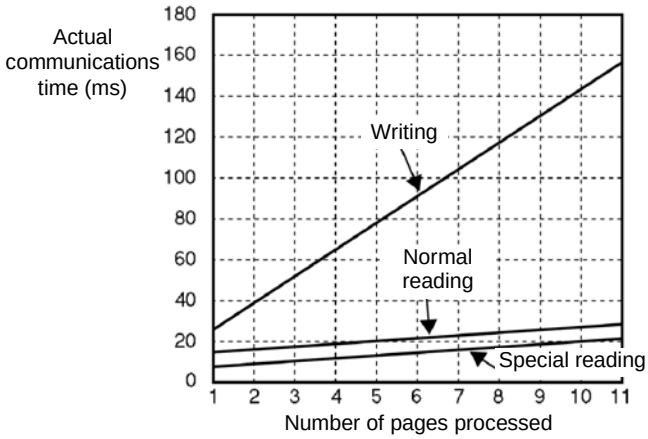


Operation	Actual communications time (ms)
Special reading	T = 1.3N + 43.4
Normal reading	T = 1.3N + 91.6
Writing	T = 54.2N + 90.0

Note N: Number of pages processed

Fast mode





Calculation Formula

Operation	Actual communications time (ms)
Special reading	T = 1.3N + 6.2
Normal reading	T = 1.3N + 12.7
Writing	T = 13N +13.5

Note N: Number of pages processed

Actual Communications Time in Multiple, Simultaneous Access Mode

The actual communications time between the Controller and Tag with multiple, simultaneous access mode varies with the operating conditions, such as the number of Tags in the communications area as well as the number of bytes to be processed. Refer to the following table for standard values in consideration of these conditions.

Number of Tags	Timeslot setting (Number of Timeslot)	2 page(8 bytes) to read (ms)		2 page(8 bytes) to write (ms)	
		Standard mode	Fast mode	Standard mode	Fast mode
2	1	560	144	715	190
4	2	917	301	1139	378
8	3	1659	644	2016	784
16	4	3239	1391	3867	1656

Note
1. The provided TAT data is an example in which the V720-CD1D Controller is used under the following conditions for host communications:
   The data is continuously sent with no space between characters, a baud rate of 38,400 bps, and a data length of 7 bits with 2 stop bits and even parity.
2. The number of bytes in TAT data is the number of code-specified bytes in ASCII.

Note When using auto commands, there is a difference in communication time which changes as the Tag approaches the Antenna's communications range. Calculate the communications time by adding 1 to the actual number of processing pages (e.g., 1 page becomes 2, etc.), and calculating the travel time from this value and the communications range. During actual operation, consider the effect of noise, etc., on-site, and design a system that also has sufficient margin from the travel time.

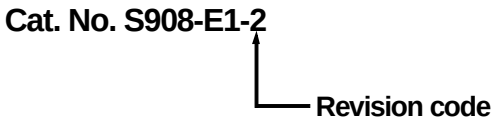
Appendix A
JIS 8 Code List (ASCII List)

Higher digits / Lower digits	b8~b5	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
b4~b1	Row / Column	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0000	0	NUL	TC_7(DLE)	(SP)	0	@	P	`	p								
0001	1	TC_1(SOH)	DC_1	!	1	A	Q	a	q								
0010	2	TC_2(STX)	DC_2	"	2	B	R	b	r								
0011	3	TC_3(ETX)	DC_3	#	3	C	S	c	s								
0100	4	TC_4(EOT)	DC_4	$	4	D	T	d	t								
0101	5	TC_5(ENQ)	TC_8(NAK)	%	5	E	U	e	u	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined
0110	6	TC_6(ACK)	TC_9(SYN)	&	6	F	V	f	v								
0111	7	BEL	TC_{10}(ETB)	'	7	G	W	g	w								
1000	8	FE_0(BS)	CAN	(	8	H	X	h	x								
1001	9	FE_1(HT)	EM	)	9	I	Y	i	y								
1010	10	FE_2(LF)	SUB	*	:	J	Z	j	z								
1011	11	FE_3(VT)	ESC	+	;	K	[	k	{								
1100	12	FE_4(FF)	IS_4(FS)	,	<	L	\	l	|								
1101	13	FE_5(CR)	IS_3(GS)	−	=	M	]	m	}								
1110	14	S0	IS_2(RS)	.	>	N	^	n	~								
1111	15	S1	IS_1(US)	/	?	O	_	o	DEL								

Note 1. The code at the 5th row, 12th column is "･" in ASCII code.
2. Do not use the undefined areas.

Revision History

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



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

Revision code	Date	Revised content
RF508-E1-1	March 2000	Original production
S908-E1-1	October 2000	Catalog number changed from RF508 to S908.
S908-E1-2	August 2001	Information related to the new V720-CD2D was added throughout the manual. In addition, the following changes were made. **Page 2-4**: Information on applicable standards changed. **Page 2-9**: Text added above table. Order of information on communications specifications changed. Information on Tag memory maps moved from *Section 5* to the end of *Section 2*. **Page 3-8**: Table added. **Pages 4-5, 5-15, 5-16, 5-24, 5-26, 5-27, 5-43**: Notes added. **Page 5-5**: Information on Tag memory maps moved to the end of *Section 2*. **Pages 5-6, 5-8, 5-10, 5-12, 5-13, 5-15, 5-24**: Information on first read page setting range added. Setting range for the number of read pages changed. **Pages 5-7, 5-9, 5-11, 5-14**: Information added to first paragraph. **Pages 5-7, 5-9, 5-11, 5-14, 5-16**: Information on first write page setting range added. Setting range for the number of write pages changed. **Pages 5-19, 5-21**: Information on communications methods added to table. **Page 5-20**: Changes made to first paragraph. **Page 5-23**: Information on ES, EA, QB, and VS Commands added. **Pages 5-26, 5-27**: Information on first page of check block added. Setting range for the number of pages in check block changed. **Page 5-46**: Information added for response code 71. **Page 7-3**: Changes made to timeslot settings.