Cat. No. W336-E1-04

SYSMAC
CS/CJ Series

CS1W-SCB21-V1/SCB41-V1
Serial Communications Boards
CS1W-SCU21-V1 and CJ1W-SCU41
Serial Communications Units

OPERATION MANUAL

OMRON

SYSMAC CS/CJ Series
Serial Communications Boards and Serial Communications Units

Operation Manual

Revised December 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.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

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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Appendices

About this Manual:

This manual describes the installation and operation of the SYSMAC CS/CJ-series CS1W-SCB21-V1/SCB41-V1 Serial Communications Boards and CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units and includes the sections described on the next page.

The Serial Communications Boards are classified as Inner Boards and the Serial Communications Unit is classified as a CPU Bus Unit.

Please read this manual and all related manuals listed in the following table carefully and be sure you understand the information provided before attempting to install and operate a Serial Communications Board or Unit.

Name	Cat. No.	Contents
SYSMAC CS/CJ-series CS1W-SCB21-V1/41-V1, CS1W-SCU21-V1, CJ1W-SCU41 Serial Communications Boards and Serial Communications Unit Operation Manual (this manual)	W336	Describes the use of Serial Communications Unit and Boards to perform serial communications with external devices, including the usage of standard system protocols for OMRON products.
SYSMAC CS/CJ-series CQM1H-PRO-E1, CQM1-PRO01-E, C200H-PRO27-E Programming Consoles Operation Manual	W341	Provides information on how to program and operate CS/CJ-series PCs using a Programming Console.
SYSMAC CS-series CS1G/H-CPU□□-E, CS1G/H-CPU□□-EV1 Programmable Controllers Operation Manual	W339	Describes the installation and operation of the CS-series PCs.
SYSMAC CJ-series CJ1G/H-CPU□□H, CJ1G-CPU□□ Programmable Controllers Operation Manual	W393	Describes the installation and operation of the CJ-series PCs.
SYSMAC CS/CJ-series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CJ1G-CPU□□-E, CJ1G/H-CPU□□H Programmable Controllers Programming Manual	W394	Describes the ladder diagram programming functions and other functions supported by CS-series and CJ-series PCs.
SYSMAC CS/CJ-series CS1G/H-CPU□□H, CS1G/H-CPU□□-EV1, CJ1G-CPU□□H, CJ1G-CPU□□ Programmable Controllers Instructions Reference Manual	W340	Describes the ladder diagram programming instructions supported by CS-series and CJ-series PCs.
SYSMAC CS/CJ-series CS1G-/H-CPU□□H, CS1G/H-CPU□□-E, CS1W-SCB21/41, CS1W-SCU21, CJ1G/H-CPU□□H, CJ1G-CPU□□, CJ1W-SCU41 Communications Commands Reference Manual	W342	Describes the Host Link and FINS communications commands used with CS-series and CJ-series PCs.
SYSMAC WS02-CXP□□-E CX-Programmer Operation Manual	W361	Provides information on how to use the CX-Programmer, a programming device that supports the CS-series and CJ-series PCs.
SYSMAC WS02-PSTC1-E CX-Protocol Operation Manual	W344	Describes the use of the CX-Protocol to create protocol macros as communications sequences to communicate with external devices.
SYSMAC CS/CJ-series CS1W-ETN01, CS1W-ETN11, CJ1W-ETN11 Ethernet Unit Operation Manual	W343	Describes the installation and operation of CS1W-ETN01, CS1W-ETN11, and CJ1W-ETN11 Ethernet Unit.

About this Manual, Continued

This manual contains the following sections.

Section 1 introduces the hardware and software functions of the Serial Communications Boards and the Serial Communications Units, including the communications modes, system configurations, and specifications.

Section 2 describes the components of the Serial Communications Boards and the Serial Communications Units, the settings required for operation, and the memory allocated in the I/O memory of the CPU Unit for controlling and monitoring communications.

Section 3 describes how to mounting the Serial Communications Boards and Serial Communications Units, and how to connect the ports to external devices.

Section 4 describes the procedure and other information required to use Host Link communications.

Section 5 describes the procedure and other information required to use protocol macros.

Section 6 describes the procedure and other information required to use 1:N NT Links to Programmable Terminals.

Section 7 describes the procedure and other information required to conduct loopback test to check the serial communications ports.

Section 8 describes the troubleshooting and maintenance procedures for the Serial Communications Boards and the Serial Communications Units.

Appendix A to ***Appendix N*** provide the specifications of the standard system protocols.

Appendix O provides information on using STUP(237) to change serial communications port settings.

⚠ **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 CS/CJ-series Serial Communications Boards and Units.

The information contained in this section is important for the safe and reliable application of Programmable Controllers. You must read this section and understand the information contained before attempting to set up or operate a PC 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 FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA 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 programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠ **WARNING** It is extremely important that a PC and all PC Units 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 a PC System to the above-mentioned applications.

3 Safety Precautions

⚠ **WARNING** The CPU Unit refreshes I/O even when the program is stopped (i.e., even in PROGRAM mode). Confirm safety thoroughly in advance before changing the status of any part of memory allocated to I/O Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit may result in unexpected operation of the loads connected to the Unit. Any of the following operation may result in changes to memory status.

- Transferring I/O memory data to the CPU Unit from a Programming Device.
- Changing present values in memory from a Programming Device.
- Force--setting/-resetting bits from a Programming Device.
- Transferring I/O memory files from a Memory Card or EM file memory to the CPU Unit.
- Transferring I/O memory from a host computer or from another PC on a network.

⚠ **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so 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 disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠ **Caution** Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.

4 Operating Environment Precautions

⚠ **Caution** Do not operate the control system in the following places:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠ **Caution** The operating environment of the PC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PC System. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system. Follow all installation instructions and precautions provided in the operation manuals.

5 Application Precautions

Observe the following precautions when using the PC System.

⚠ WARNING Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.

- Always connect to a ground of 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
    - Mounting or dismounting Power Supply Units, I/O Units, CPU Units, Serial Communications Units, or any other Units.
    - Assembling the Units.
    - Setting DIP switches or rotary switches.
    - Connecting cables or wiring the system.
    - Mounting or dismounting terminal blocks.

⚠ Caution Failure to abide by the following precautions could lead to faulty operation of the PC or the system, or could damage the PC or PC Units. Always heed these precautions.

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Tighten the mounting screws at the bottom of Serial Communications Units to a torque of 0.4 N·m. An incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Always check polarity before wiring RS-422A/485 connectors. The polarity for the SDA/B and RDA/B signals can be different for some external devices.
- Check to be sure that terminating resistors have been correctly installed for RS-422A/485 systems before starting operation.
- Disconnect the functional ground terminal before conducting voltage withstand tests.
- Never turn OFF the power supply while writing protocol macro data.
- Wire all connections correctly according to instructions in this manual.
- Check terminal blocks completely before mounting them.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.

- Be sure that the Bus Connection Unit and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
  - Changing the operating mode of the PC.
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Observe the following precautions for communications cables.
  - Do not lay communications cables near power lines or high-voltage lines.
  - Always lay communications cables in ducts.
  - Do not pull on the communications cables or bend the communications cables beyond their natural limit. Doing either of these may break the cables.
  - Do not place objects on top of the communications cables or other wiring lines. Doing so may break the cables.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not touch circuit boards or the components mounted to them with your bare hands. There are sharp leads and other parts on the boards that may cause injury if handled improperly.
- When transporting or storing Boards, wrap them in material that will protect LSIs, ICs, and other components from static electricity and be sure that they remain within the storage temperature range.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

6-2 Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Note Applicable EMS (Electromagnetic Susceptibility) and EMI (Electromagnetic Interference) standards in the EMC (Electromagnetic Compatibility) standards are as follows:

Unit/Board	EMS	EMI
CS1W-SCB21-V1/ SCB41-V1 CS1W-SCU21-V1	EN61131-2	EN50081-2 (Radiated emission: 10-m regulations)
CJ1W-SCU41	EN61000-6-2	

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards for the PC (EN61131-2).

6-3 Conformance to EC Directives

The CS/CJ-series PCs comply with EC Directives. To ensure that the machine or device in which the CS/CJ-series PC is used complies with EC directives, the PC must be installed as follows:

1,2,3...

1. The CS/CJ-series PC must be installed within a control panel.
2. You must use reinforced insulation or double insulation for the DC power supplies used for the communications power supply and I/O power supplies.
3. CS/CJ-series PCs complying with EC Directives also conform to the Common Emission Standard (EN50081-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.

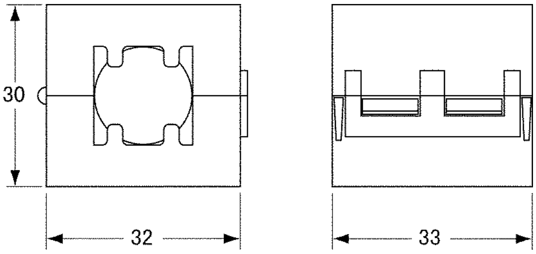
6-4 EMI Measures for Serial Communications Boards and Units

The CS/CJ-series PCs conform to the Common Emission Standards (EN50081-2) of the EMC Directives. However, the noise generated from Serial Communications Board or Unit communications cables may not satisfy these standards. In such a case, commercially available ferrite cores must be placed on the communications cable or other appropriate countermeasures must be provided external to the PC.

Recommended Ferrite Cores

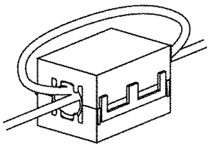
The following ferrite core (data line noise filter) is recommended:

0443-164151 by Fair-Rite Products Corp.
Low impedance, 25 MHz: 90 Ω, 100 MHz: 160 Ω

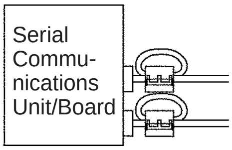


Recommended Mounting Method

Mount the core on one turn of the communications cable, as shown in the following illustration.



Mount the cores as lost to the end of the communications cable as possible, as shown in the following illustration.



6-5 EMC Measures for Serial Communications Units

The immunity testing conditions for the CJ1W-SCU41 Serial Communications Unit are as follows: A ferrite core is mounted on the test cable connected to the RS-422A/485 port.

Refer to *6-4 EMI Measures for Serial Communications Boards and Units* for information on mounting the ferrite core.

SECTION 1
Introduction

This section introduces the hardware and software functions of the Serial Communications Boards and the Serial Communications Units, including the communications modes, system configurations, and specifications.

1-1 Using this Manual

This manual is structured to provide information on Host Link, protocol macro, and 1:N NT link communications in functional units, as would be required in actual applications. You should read *Section 1 Introduction* first, and then read information in the rest of the manual and related manuals as required by your specific application.

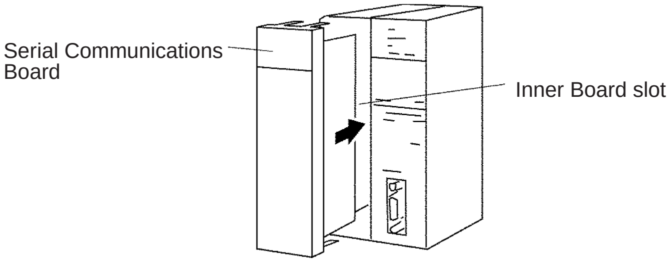
Information	Section or Manual
Overview and appearance of the Serial Communications Boards and Serial Communications Unit	1-2 Overview 2-1 Component Names and Functions
Overview, features, and specifications of serial communications	1-3 Protocol Overview 1-4 Features 1-6 Specifications 4-1 Host Link Communications 5-1 Overview of the Protocol Macro Functions 6-1 Overview of 1:N NT Links
Basic procedures and operations	1-9 Basic Operating Procedure
Selecting serial communications modes	1-8 Selecting the Serial Communications Mode
System configurations for serial communications modes	1-5 System Configurations
Memory Area allocations to the Serial Communications Boards and Serial Communications Unit	2-2 Data Exchange with the CPU Unit 2-3 I/O Memory Allocations
Installing and wiring the Serial Communications Boards and Serial Communications Unit	Section 3 Installation and Wiring
Memory Area allocations to individual serial communications modes	4-2, 5-2, and 6-2 Setup Area Allocations 4-3, 5-3, and 6-3 Auxiliary Area and CIO Area Allocations
Communications timing for slave-initiated Host Link communications	4-4 Communications Timing
Ladder diagram programming in protocol macros	5-4 Using Protocol Macros
Loopback tests for ports	Section 7 Loopback Test
Changing the communications port settings during operation	Appendix O Changing Communications Port Settings Using STUP(237)
Troubleshooting and maintenance	Section 8 Troubleshooting and Maintenance
The contents of standard system protocols and connection methods to OMRON components	Appendix A to Appendix N
Details on Host Link communications (including ladder diagram programming for slave-initiated communications)	SYSMAC CS/CJ-series CS1G/H-CPU□□-E, CS1W-SCB21/41, CS1W-SCU21 Communications Commands Reference Manual (W342)
Details on C-mode commands	
Details on FINS commands	
Details on the protocol macro function	SYSMAC WS02-PSTC1-E CX-Protocol Operation Manual (W344)

1-2 Overview

This section gives an overview of the Serial Communications Boards and the Serial Communications Unit.

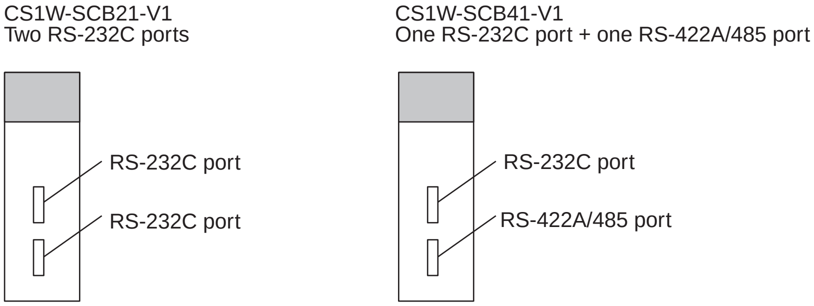
1-2-1 Serial Communications Boards

Serial Communications Boards are Inner Boards for the CS-series PCs. One Board can be installed in the Inner Board slot of a CPU Unit. Two serial communications ports are provided for connecting host computers, Programmable Terminals (PTs), general-purpose external devices, and Programming Devices (excluding Programming Consoles). This makes it possible to easily increase the number of serial communications ports for a CS-series PC.



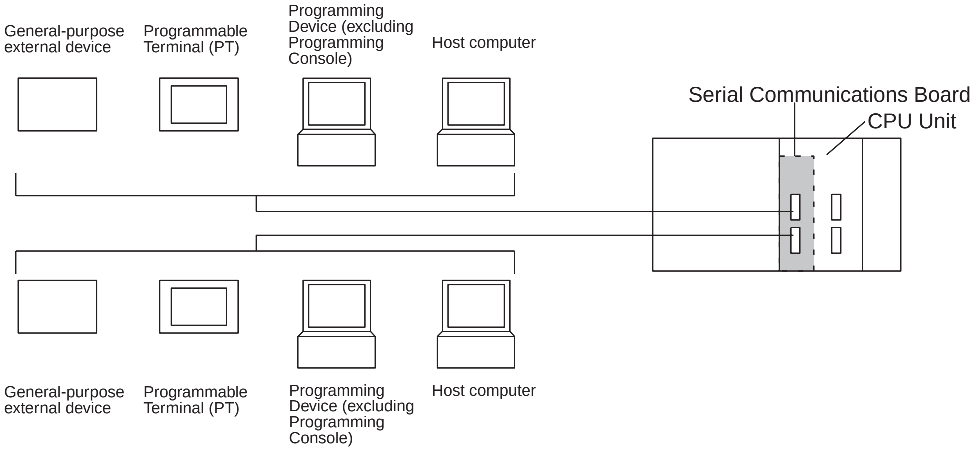
Models

The following two models are available:



Connectable Devices

The following serial communications modes are supported by the Serial Communications Unit: Host Link (SYSMAC WAY), protocol macro, 1:N NT Link, and loopback test modes. The devices shown in the following diagram can be connected.



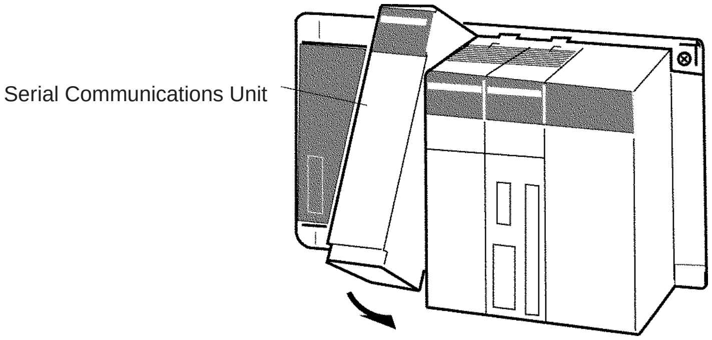
Note A 1:1 NT Link is not supported.

1-2-2 Serial Communications Units

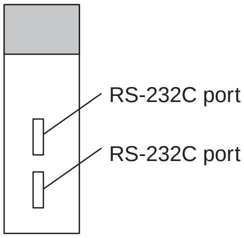
The Serial Communications Units are CPU Bus Unit. One or more Units can be mounted to the CPU Unit or a CS/CJ Expansion Rack. A total of up to 16 CPU Bus Units can be controlled by one CPU Unit. The CS-series Serial Communications Unit must be used for a CS-series PC and a CJ-series Serial Communications Unit must be used for a CJ-series PC.

Two serial communications ports are provided for connecting host computers, Programmable Terminals (PTs), general-purpose external devices, and Programming Devices (excluding Programming Console). This makes it possible to easily increase the number of serial communications ports for the CS/CJ-series PC.

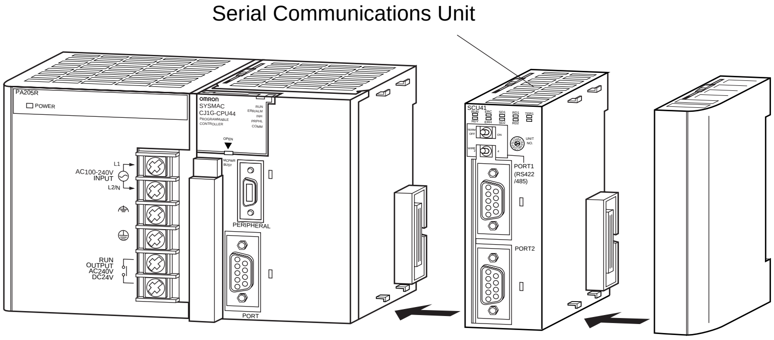
CS Series



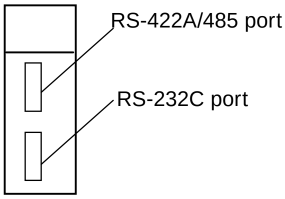
CS1W-SCU21-V1 (Two RS-232C ports)



CJ Series

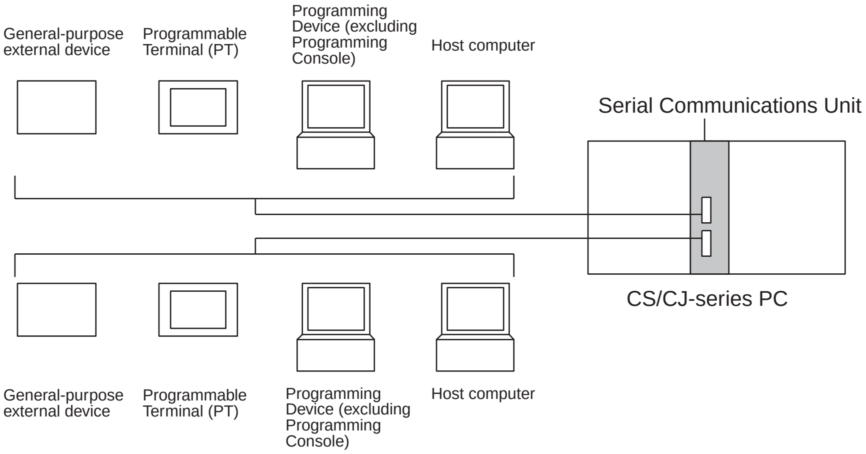


CJ1W-SCU41 (One RS-232C and One RS-422A/485 Port)



Connectable Devices

The following serial communications modes are supported by the Serial Communications Boards: Host Link (SYSMAC WAY), protocol macro, 1:N NT Link, and loopback test modes. The devices shown in the following diagram can be connected.



Note A 1:1 NT Link is not supported.

Functions Added in the "-V1" Upgrade

The CS1W-SCB21-V1 and CS1W-SCB41-V1 Serial Communications Boards and CS1W-SCU21-V1 Serial Communications Unit* were upgraded to support the Simple Backup Function in the "-V1" upgrade.

Note *The CS-series Serial Communications Boards/Units without the "-V1" suffix do not support this Simple Backup Function, but the CJ1W-SCU41 does support this function even though the model number lacks the "-V1" suffix.

- Simple Backup Function

  The CPU Unit's Simple Backup Function can be used to automatically backup, restore, and compare the Protocol Macro data (both standard system protocol and user-set protocol data) in the Serial Communication Board or Unit's flash memory with the data in the CPU Unit's Memory Card. The Protocol Macro data is backed up, restored, or compared along with all of the data in the CPU Unit. (The Simple Backup Function can be used with CS1-H and CJ1-H CPU Units only.)

1-3 Protocol Overview

A Serial Communications Board is an Inner Board for CS-series CPU Units that provides RS-232C and/or RS-422A/485 serial communications ports. An Inner Board is an option and is installed in the CPU Unit.

A Serial Communications Unit is a CPU Bus Unit that provides two RS-232C serial communications ports or one RS-232C and one RS-422A/485 port. The following four serial communications modes can be used as required for each serial communications port.

- Host Link: For connections between host computers and PCs
- Protocol macro: For communications between PCs and general-purpose external devices
- 1:N NT Link: For communications between PCs and Programmable Terminals (PTs)

- Loopback test: For testing the communications ports

PC Series	Product	Model number	Serial communications ports	Serial communications mode			
				Host Link	**Protocol macro**	**1:N NT Link (See note 2.)**	**Loopback test**
CS	Serial Communications Boards	CS1W-SCB21-V1	RS-232C	OK	OK	OK	OK
			RS-232C	OK	OK	OK	OK
		CS1W-SCB41-V1	RS-232C	OK	OK	OK	OK
			RS-422A/485	OK (See note 1.)	OK	OK	OK
	Serial Communications Unit	CS1W-SCU21-V1	RS-232C	OK	OK	OK	OK
			RS-232C	OK	OK	OK	OK
CJ	Serial Communications Unit	CJ1W-SCU41	RS-422A/485	OK (See note 1.)	OK	OK	OK
			RS-232C	OK	OK	OK	OK
CS/CJ	Device to be connected			Host computer or Programming Device	General-purpose external device	PT	None

A connection example for each serial communications mode is shown in the following sections for a Serial Communications Unit. The examples apply equally as well to the Serial Communications Boards.

Note
1. A 4-wire connection must be used when using Host Link communications for an RS-422A/485 connector.
2. A 1:1 NT Link is not supported.

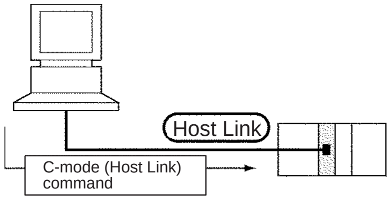
1-3-1 Host Link Mode

In Host Link mode, C-mode commands (Host Link commands) or FINS commands can be sent from a host computer to read or write I/O memory in the PC or to control the PC's operating modes. The host computer can be a personal computer or a Programmable Terminal. The FINS commands are sent with other data, such a Host Link header and terminator.

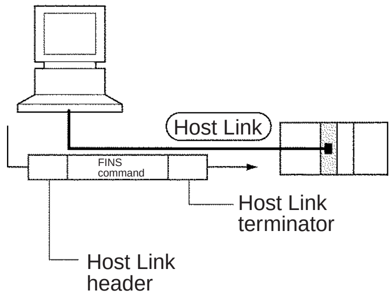
In Host Link mode, SEND(090), RECV(098), and CMND(490) instructions can be used to send FINS commands from PC to the host computer to read data, write data, or perform other operations. This is called slave-initiated communications or unsolicited communications. The FINS commands are sent with other data, such a Host Link header and terminator.

Note
1. FINS commands can be sent across up to three different networks (counting the local network) to a PC on a remote network or to a host computer connected to a PC on a remote network.
2. Programming Devices can also be connected in Host Link mode.

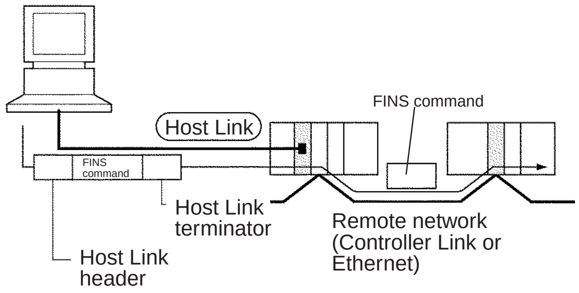
Sending C-mode Commands



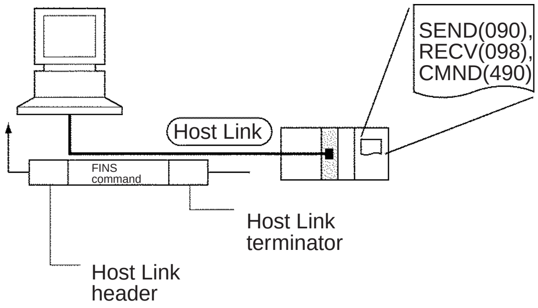
Sending FINS Commands



FINS commands can also be sent to PCs on remote networks.

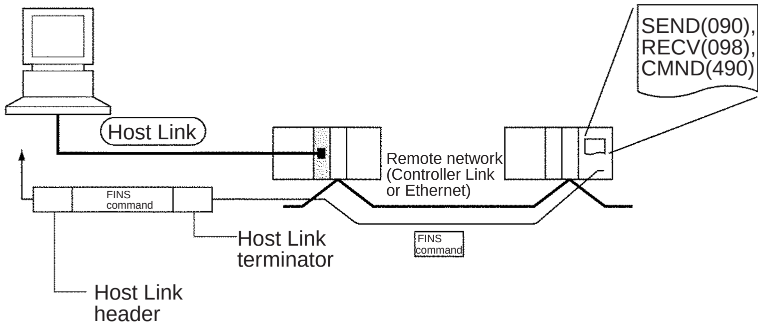


Slave-initiated Communications



SEND(090): Sends data to host computer
RECV(098): Reads data from host computer
CMND(490): Executes any FINS command

Slave-initiated FINS commands can also be sent from PCs on remote networks.

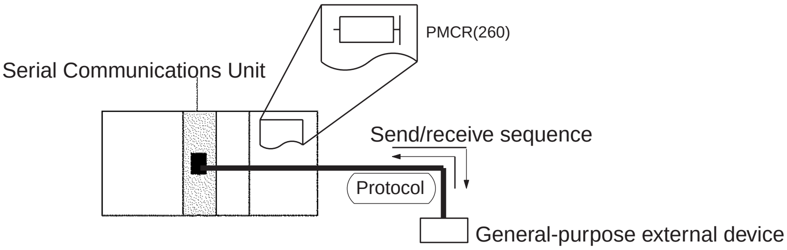


1-3-2 Protocol Macros

Data transfer procedures (protocols) with general-purpose external devices are created using the CX-Protocol to match the communications specifications (half-duplex or full-duplex, and start-stop synchronization) of the external device.

These protocols are stored in the Serial Communications Boards or the Serial Communications Unit, and enable data to be exchanged with general-purpose external devices simply by executing the PMCR(260) instruction in the CPU Unit.

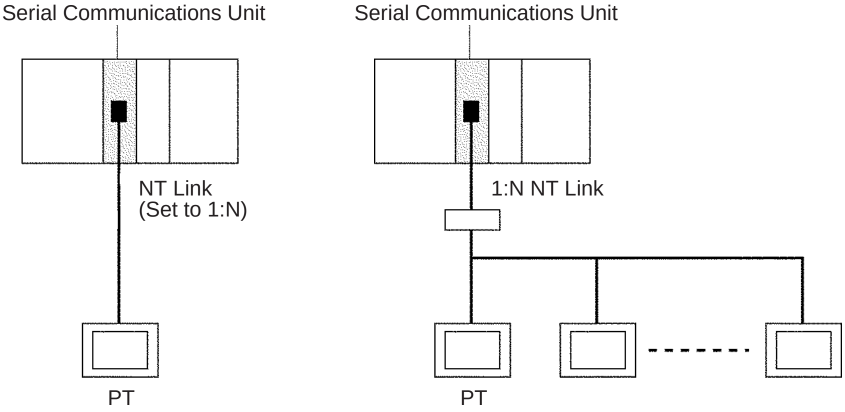
Standard system protocols for exchanging data with OMRON devices (such as Temperature Controllers, Intelligent Signal Processors, Bar Code Readers, and Modems) are provided as a standard feature in the Serial Communications Boards, the Serial Communications Unit, and the CX-Protocol. The CX-Protocol can also be used to change the standard system protocols according to user requirements.



1-3-3 1:N NT Links

A PC can be connected to one or more Programmable Terminals (PTs) using an RS-232C or RS-422A/485 port. The I/O memory of the PC is allocated to the Status Control Areas and the Status Notification Areas used by the PTs, as well as to display objects, such as touch switches, lamps, and memory tables. This enables the status of the I/O memory in the PC to be controlled and monitored by operations from the PTs, without the use of a ladder diagram programming in the PC. Up to eight PTs can be connected to a PC.

Note The user does not need to be aware of NT Link commands. The user only has to allocate the PC memory to the PTs.



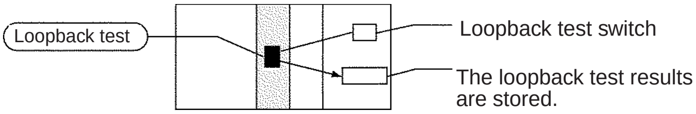
Note

1. The serial port on the PT must be set to a 1:N NT Link.
2. The Serial Communications Boards and Units do not support 1:1 NT Links. The NT Link must be set to 1:N even if only one PT is connected. Connection is not possible to PTs that do not support 1:N NT Links.
3. The NT20S, NT600S, NT30, NT30C, NT620, NT620C, and NT625C cannot be used if the cycle time of the CPU Unit is 800 ms or longer (even if only one of these PTs is used in a 1:N NT Link).
4. The Programming Console functions of the PT (Expansion Mode) cannot be used when connected to Serial Communications Board or Unit ports. They can be used only by connecting to the peripheral port or RS-232C port on the CPU Unit.
5. Set a unique unit number for each PT connected to the same PC. If the same unit number is set for more than one PT, malfunctions will occur.
6. NT Link serial communications are unique and are not compatible with other serial communications modes.

1-3-4 Loopback Test

A connector with a loopback connection is attached to the specified serial communications port to perform loopback tests. Data is sent to this port, and the communications circuit is tested by comparing the transmitted data and the data returned by loopback.

Note This loopback test is performed inside the specified serial communications port. It is not a loopback test using the RS-232C or RS-422A/485 communications path.



1-4 Features

This section describes the features of the Serial Communications Boards, the Serial Communications Unit, and the protocols.

1-4-1 Serial Communications Boards and Units

Serial Communications Boards (CS Series Only)

A Serial Communications Board is installed as an option in a CPU Unit. Two serial communications ports can thus be added without using an I/O slot.

There are two types of Serial Communications Boards: One with two RS-232C ports and one with one RS-232C and one RS-422A/485 port. The RS-422A/485 port can be used for a 1:N connection with general-purpose external devices without using Link Adapters to support the protocol macro function or NT Link function.

Serial Communications Unit (CS/CJ Series)

A total of up to 16 CPU Bus Units can be mounted on the CPU Rack or an Expansion Rack. The total of 16 must include all Serial Communications Units and all other CPU Bus Units. The PC can thus be expanded to provide additional serial communications ports as required by the system.

1-4-2 Protocols

Host Link Communications

Host Link communications are supported by all CS/CJ-series CPU Units. Serial Communications Boards and Units can be used to connect a single PC to more than one host computer for Host Link communications, including slave-initiated communications. Host Link communications provide the following features.

Connect One Computer to Multiple PCs

An RS-422A/485 port can be used to connect one host computer to up to 32 CS/CJ-series PCs.

Computer Monitoring and Control of PCs

Host Link communications enable the host computer to monitor or control PC operations and to read and write I/O memory in the PCs.

FINS Commands for Complete Control

In addition to C-series (Host Link) commands, FINS commands are also supported. FINS commands give you the power to control CS/CJ-series PC functionality.

Redundant Error Checking

Both vertical and horizontal (FCS) parity checks are performed on communications data to achieve essentially error-free communications. Combining error checking and retry processing goes one step further to eliminate nearly all the effects of communications problems.

Simultaneous Usage of Both Ports

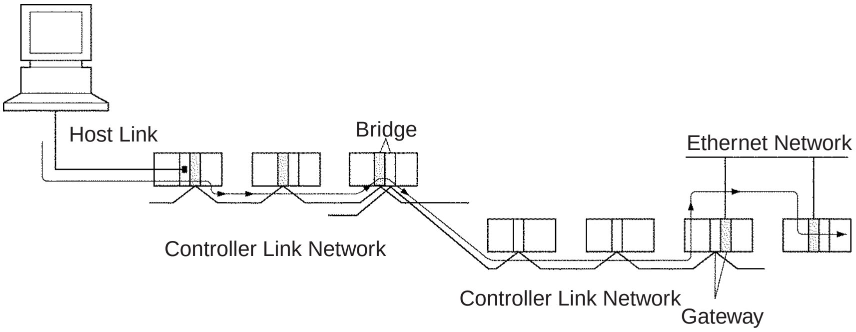
Each Serial Communications Board and Unit provides two serial communications ports that can be used simultaneously to connect to two different host computers. A total of up to 16 CPU Bus Units, including the Serial Communications Units, can be mounted to one PC. If all 16 CPU Bus Units are Serial Communications Units, then up to 32 ports can be added.

Slave-initiated Communications

Communications can be performed either by sending a command from a host computer and having the PC return a response, or by sending a command from a PC and having the computer send a response. Starting communications from a slave is called unsolicited communications, and is made possible through the SEND(090), RECV(098), and CMND(490) instructions. These can be used to send FINS commands to a host computer connected locally or to a host computer connected to a remote network up to three networks away (counting the local network).

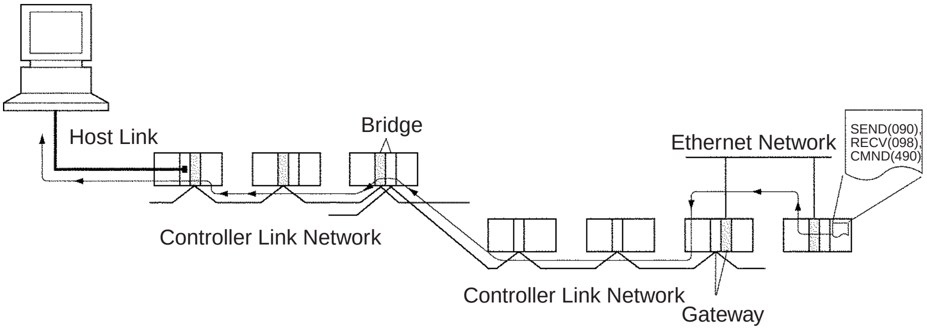
Send FINS Commands to Remote Networks

A FINS command contained within a Host Link header and terminator can be sent using Host Link communications to PCs connected not only on Host Link networks, but also other interconnected remote networks up to three networks away (counting the local network). Various types of networks can exist between the source of the command and the destination of the command.



Send FINS Commands to Computers Connected to Remote PCs

A FINS command contained within a Host Link header and terminator can be sent using Host Link communications to a host computer connected to a PC on a remote network up to three networks away (counting the local network, but not counting the final Host Link connection). Various types of networks can exist between the PC sending the command and the destination of the command.



Protocol Macros

The main features of the protocol macro functions are described below. For details, refer to the *CX-Protocol Operation Manual (W344)*.

Wide Range of Communications Protocols

Communications are possible with virtually any general-purpose external device, provided it has an RS-232C or RS-422A/485 port, supports half-duplex or full-duplex communications, and supports start-stop synchronization.

Send Frames and Receive Frames Matching Specifications

Send frames (command + data and other send frames) and receive frames (response and other frames) can be created and registered according to the communications frame specifications of the external device.

Communications-related Functions

Error check code calculations, frame length calculations during sending, and ASCII⇔Hexadecimal conversion of numeric data are supported.

Send/Receive Monitoring

Receive wait monitoring, receive completion monitoring, and send completion monitoring are supported. If monitoring times are exceeded, send/receive can either be terminated, or retry processing can be performed.

Retry Processing

Send/receive retry processing can be automatically executed when an error occurs, simply by setting the number of retries.

PC Read/Write Variables in Send Frames and Receive Frames

Variables for reading PC memory can be included in the actual send frames. These can be used as destination addresses or data when reading PC data while sending. Variables for writing to PC memory can be also included in the actual receive frames. These can be used to write the contents of destination addresses or data to the PC during reception.

Switch 1:N Communications or the Data Write Destinations Using Repeat Processing

Repeat processing (repeat counters) for send/receive processing can be specified in communications sequences. This enables the same data to be sent by switching destination addresses during communications 1:N (N = 32 max. due to restrictions in the physical layer) or by switching the PC memory write destination addresses during data reception.

PC Interrupts During Data Reception

An interrupt can be created in the PC’s CPU Unit during data reception, and an interrupt program can be executed in the CPU Unit. (The PC interrupt function is supported only for the Serial Communications Boards. This function cannot be used with Serial Communications Units.)

Next Process Switching According to Receive Data

The contents of up to 15 set of expected receive data can be compared with the receive data to determine the next process.

New Error Check Codes

LRC2 (two’s complement of LRC), and SUM1 (one’s complement of SUM) have been added to the error check codes.

Step Queuing for Sync Signal from the PC

At any step of the send/receive sequence, the next process can be made to wait until a sync signal from the PC’s CPU Unit has been input. This enables processing, such as data manipulations, to be performed in the CPU Unit during the send/receive sequence.

Half-duplex or Full-duplex Transmissions

With the conventional protocol macro functions, only half-duplex transmissions were possible. With half-duplex mode, the reception buffer is cleared immediately after the send operation is completed. Therefore, if there was a rapid response from the remote device, for example, the data received between data sending and the completion of the send operation could not be accessed as receive data by the next receive operation.

Support for the full-duplex transmissions enables all the data received in a sequence to be accessed. Data can also be received from a remote device while sending.

Note Full-duplex transmissions can be used with either RS-232C or RS-422A/485 as long as 1:1, 4-wire connections are used. Full-duplex transmissions cannot be used with 1:N connections or 2-wire connections.

Clear Reception Buffer at Any Time

With full-duplex mode, the reception buffer is cleared only immediately before a send/receive sequence is executed. When a reception or other fault occurs, the receive data can be cleared at any time using the reception buffer clear (FLUSH) command.

Control ER Signal at Any Time

With a connection to a modem, the ER signal is used to show the send/receive enabled status of a Serial Communications Board or Unit (Data Terminal Equipment (DTE)). In conventional operations, the ER signal could be turned ON only while a send/receive sequence was being executed.

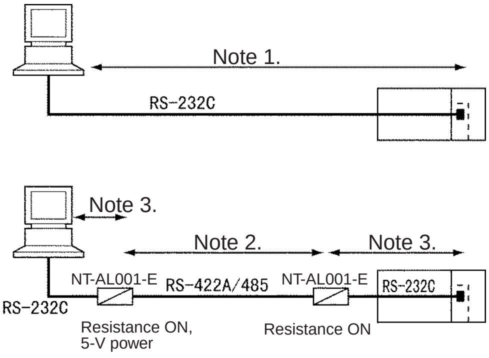
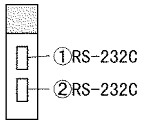
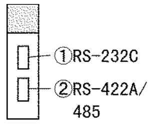
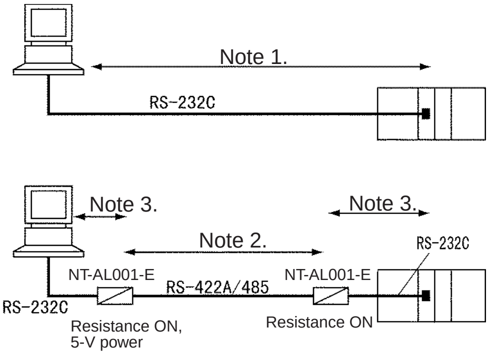
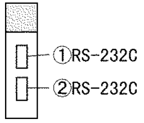
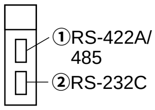
Improving this function has enabled the ER signal to be turned ON or OFF at any time during a send/receive sequence. This enables modem connections and disconnections to be performed by a protocol macro.

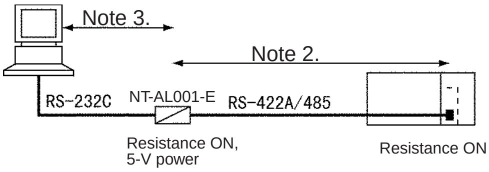
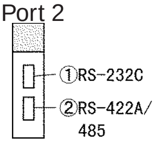
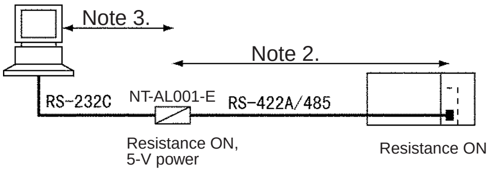
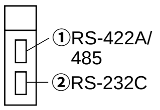
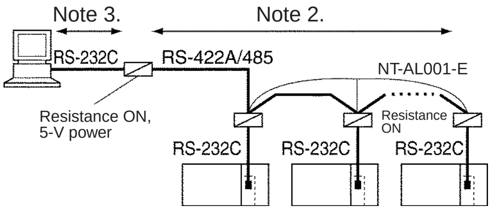
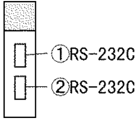
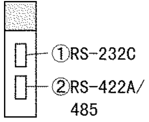
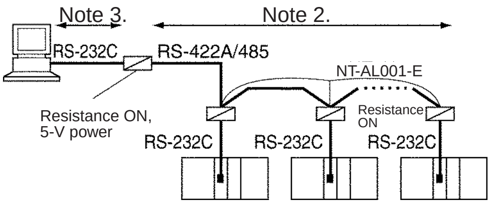
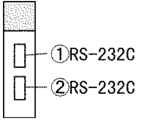
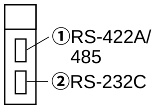
The ER signal can also be kept ON, even after a send/receive sequence has been completed. In this case, the ER signal remains ON, even after it has been switched to a different serial communications mode (for example, Host Link). This function enables remote programming and monitoring to be performed using remote Programming Devices, by switching to the Host Link mode with the STUP(237) instruction once the connection has been made with the modem.

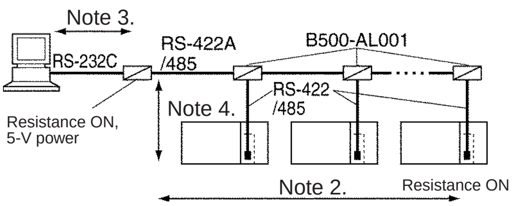
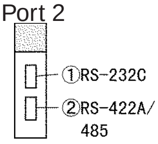
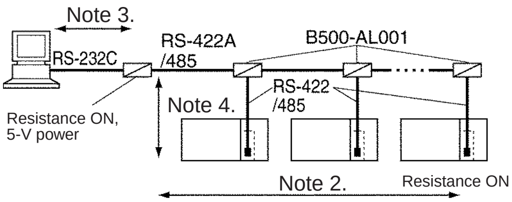
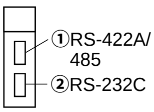
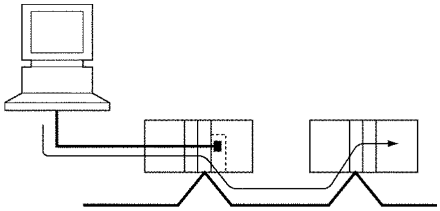
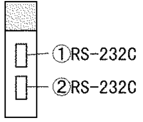
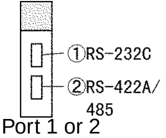
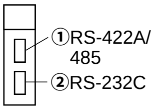
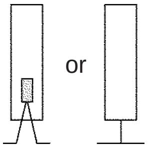
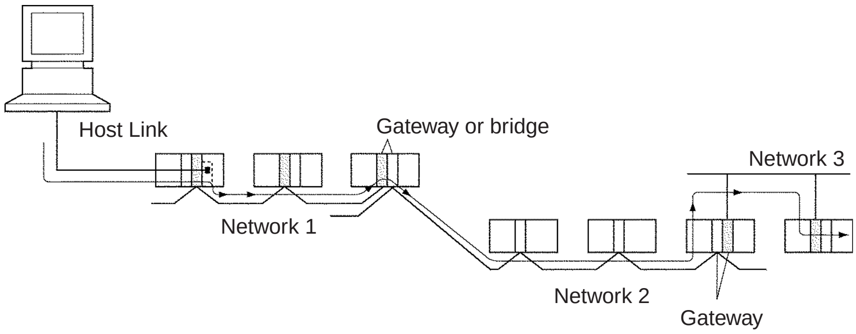
1-5 System Configurations

This section explains the system configuration supported by each serial communications mode.

Host Link Communications

PC: Computer	Connection configuration	Required devices	Connected serial communications port/ Remarks	Possible command flow
1:1 Port: RS-232C	Connection to Serial Communications Board.  	CS1W-SCB21-V1	Port 1 or 2  	Host computer to PC: C-mode or FINS commands PC to Host computer: FINS commands only
		CS1W-SCB41-V1	Port 1  	
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485	
		5-V power supply	For NT-AL001-E Link Adapter	
	Connection to Serial Communications Unit.  	CS1W-SCU21-V1	Port 1 or 2  	
		CJ1W-SCU41	Port 2  	
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485	
		5-V power supply	For NT-AL001-E Link Adapter	

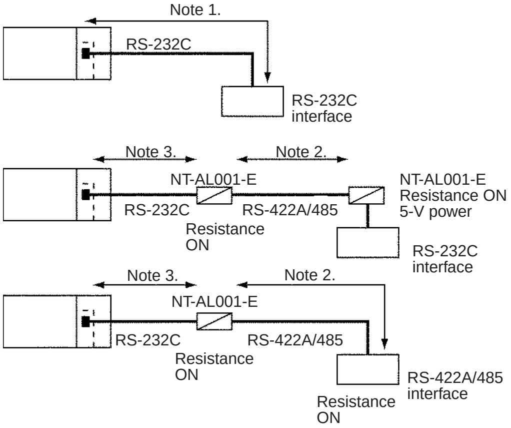
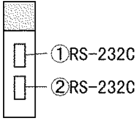
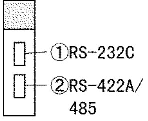
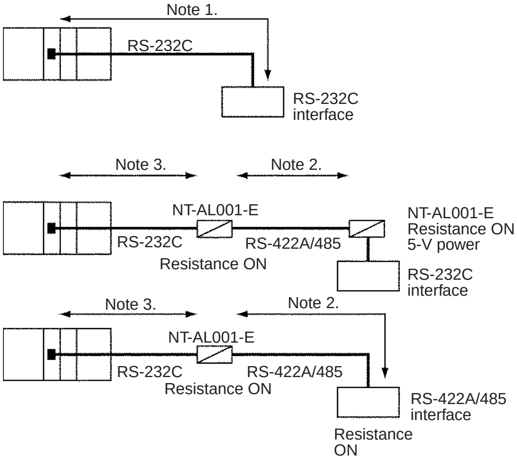
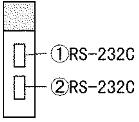
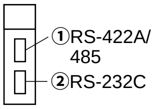
PC: Computer	Connection configuration	Required devices	Connected serial communications port/ Remarks	Possible command flow
1:1 Port: RS-422A/ 485	Connection to Serial Communications Board  	CS1W-SCB41-V1	Port 2  	Host computer to PC (4-wire only): C-mode or FINS commands
		NT-AL001-E Converting Link Adapter	RS-232C ⇔ RS422A/485	PC to Host computer (4-wire only): FINS commands only
		5-V power supply	For NT-AL001-E Link Adapter	
	Connection to Serial Communications Unit  	CJ1W-SCU41	Port 1  	Host computer to PC (4-wire only): C-mode or FINS commands
		NT-AL001-E Converting Link Adapter	RS-232C ⇔ RS422A/485	PC to Host computer (4-wire only): FINS commands only
		5-V power supply	For NT-AL001-E Link Adapter	
1:N Port: RS-232C	Connection to Serial Communications Board.  	CS1W-SCB21-V1	Port 1 or 2  	Host computer to PC (RS-422A/485 section: 4-wire): C-mode or FINS commands PC to Host computer: Commands cannot be sent.
		CS1W-SCB41-V1	Port 1  	
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485	
		5-V power supply	For NT-AL001-E Link Adapter	
	Connection to Serial Communications Unit.  	CS1W-SCU21-V1	Port 1 or 2  	
		CJ1W-SCU41	Port 2  	
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485	
		5-V power supply	For NT-AL001-E Link Adapter	

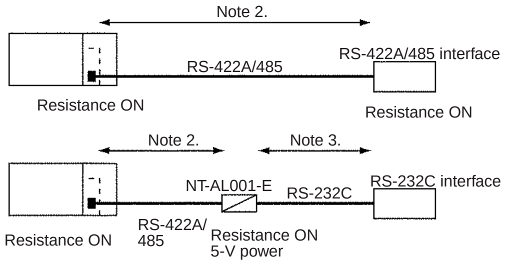
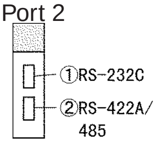
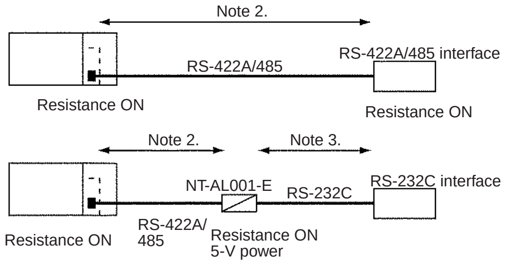
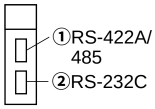
PC: Computer	Connection configuration	Required devices	Connected serial communications port/ Remarks	Possible command flow
1:N Port: RS-422A/ 485	Connection to Serial Communications Board  	CS1W-SCB41-V1	Port 2  	Host computer to PC (4-wire only): C-mode or FINS commands
		NT-AL001-E Converting Link Adapter	RS-232C ⇔ RS422A/485	PC to Host computer: Commands cannot be sent.
		5-V power supply	For NT-AL001-E Link Adapter	
	Connection to Serial Communications Unit  	CJ1W-SCU41	Port 1  	Host computer to PC (4-wire only): C-mode or FINS commands
		NT-AL001-E Converting Link Adapter	RS-232C ⇔ RS422A/485	PC to Host computer: Commands cannot be sent.
		5-V power supply	For NT-AL001-E Link Adapter	
Host computer to Network PCs, 1:N	Connection to Serial Communications Board or Serial Communications Unit  	CS1W-SCB21-V1, CS1W-SCB41-V1, CS1W-SCU21-V1, or CJ1W-SCU41	Port 1 or 2  Port 1 or 2  Port 1 or 2  	Host computer to PC: FINS commands only PC to Host computer: FINS commands only (RS-422A/485: 4-wire only)
		Communications Unit: Controller Link Unit or Ethernet Unit.	 	
	Communications can be sent across three different networks (counting the local network, but not including a Host Link connection). Routing tables must be set in the PCs.  			

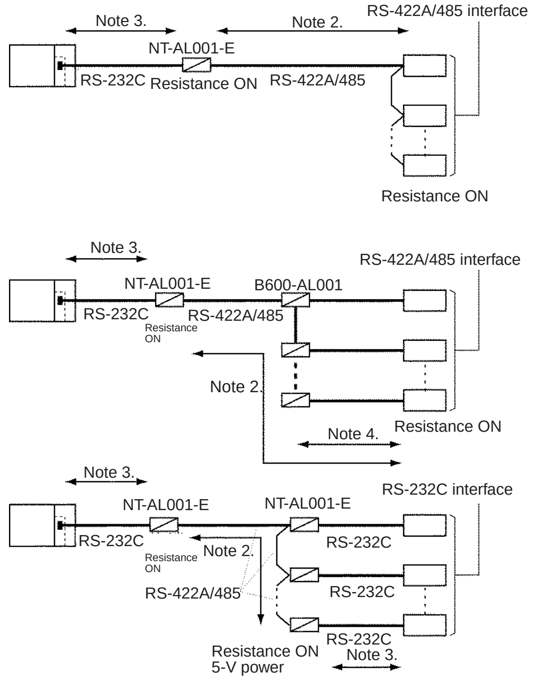
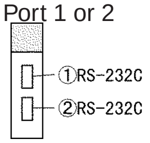
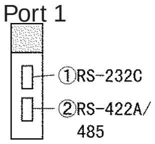
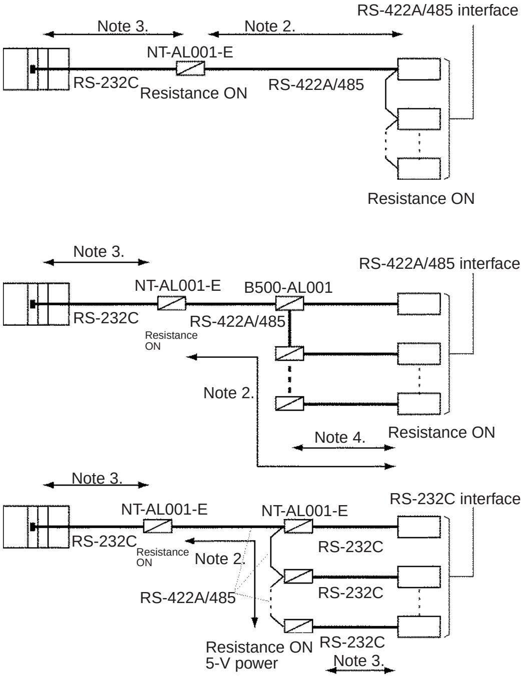
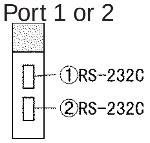
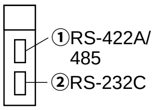
Note

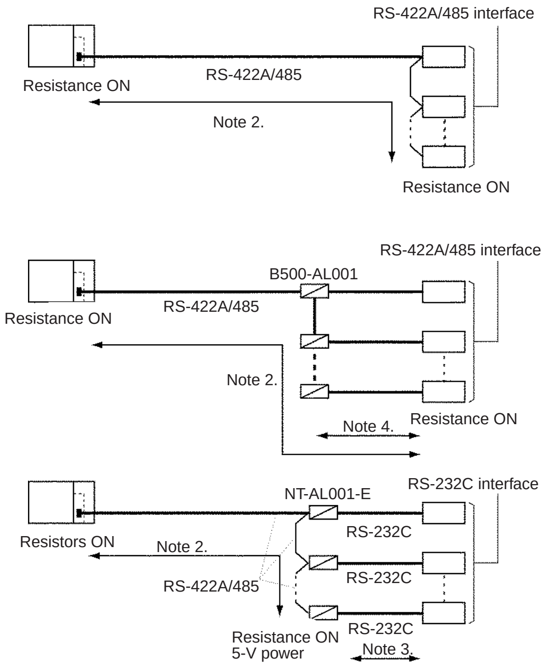
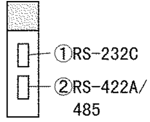
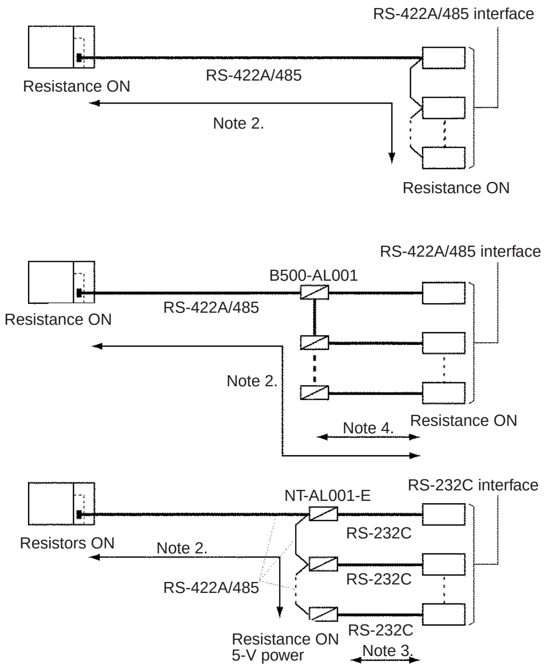
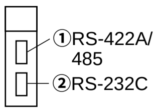
1. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.
2. The combined cable length for RS-422A/485 is 500 m including branch lines.
3. The maximum cable length is limited to 2 m when an NT-AL001-E Link Adapter is connected.
4. Branch lines must be a maximum of 10 m long.
5. Four-wire connections must be used for RS-422A/485 connections with Host Link communications.
6. “Resistance ON” indicates that the terminating resistance must be turned ON.
7. “5-V power” indicates that a 5-V power supply is required for the Link Adapter. Refer to the Link Adapter manual for details. Be sure that the power supply has sufficient capacity and accuracy and wire it away from high-power lines and another sources of noise. A 5-V power supply is not required for a Link Adapter connected to a Serial Communications Board or Unit because power is supplied from pin 6 of the connector.
8. The maximum baud rate of the NT-AL001-E Link Adapter is 64 Kbps. Do not use 115.2 Kbps when a Link Adapter is connected.

Protocol Macros

PC: External device	Connection configuration	Required devices	Connected serial communica-tions port/ Remarks
1:1 Port: RS-232C	Connection of a Serial Communications Board to a device with an RS-232C or RS-422A/485 port. 	CS1W-SCB21-V1	Port 1 or 2 
		CS1W-SCB41-V1	Port 1 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		5-V power supply	For NT-AL001-E Link Adapter
	Connection of a Serial Communications Unit to a device with an RS-232C or RS-422A/485 port. 	CS1W-SCU21-V1	Port 1 or 2 
		CJ1W-SCU41	Port 2 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		5-V power supply	For NT-AL001-E Link Adapter

PC: External device	Connection configuration	Required devices	Connected serial communica-tions port/ Remarks
1:1 Port: RS-422A/ 485	Connection of a Serial Communications Board to a device with an RS-232C or RS-422A/485 port  	CS1W-SCB41-V1	Port 2 
		NT-AL001-E Converting Link Adapter	Convert between RS-232C and RS-422A/485
		5-V power supply	For NT-AL001-E Link Adapter
	Connection of a Serial Communications Unit to a device with an RS-232C or RS-422A/485 port  	CJ1W-SCU41	Port 1 
		NT-AL001-E Converting Link Adapter	Convert between RS-232C and RS-422A/485
		5-V power supply	For NT-AL001-E Link Adapter

PC: External device	Connection configuration	Required devices	Connected serial communica-tions port/ Remarks
1:N Port: RS-232C	Connection of a Serial Communications Board to devices with RS-232C or RS-422A/485 ports 	CS1W-SCB21-V1	Port 1 or 2 
		CS1W-SCB41-V1	Port 1 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		B500-AL001 Link Adapter	For RS-422A/485 branching
		5-V power supply	For NT-AL001-E Link Adapter
	Connection of a Serial Communications Unit to devices with RS-232C or RS-422A/485 ports. 	CS1W-SCU21-V1	Port 1 or 2 
		CJ1W-SCU41	Port 2 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		B500-AL001 Link Adapter	For RS-422A/485 branching
		5-V power supply	For NT-AL001-E Link Adapter

PC: External device	Connection configuration	Required devices	Connected serial communica-tions port/ Remarks
1:N Port: RS-422A/485	Connection of a Serial Communications Board to devices with RS-232C or RS422A/485 ports 	CS1W-SCB41-V1	Port 2 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		B500-AL001 Link Adapter	For RS-422A/485 branching
		5-V power supply	For NT-AL001-E Link Adapter
	Connection of a Serial Communications Board to devices with RS-232C or RS422A/485 ports 	CJ1W-SCU41	Port 1 
		NT-AL001-E Converting Link Adapter	Converts between RS-232C and RS-422A/485
		B500-AL001 Link Adapter	For RS-422A/485 branching
		5-V power supply	For NT-AL001-E Link Adapter

Note 1. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

2. The combined cable length for RS-422A/485 is 500 m including branch lines.
3. The maximum cable length is limited to 2 m when an NT-AL001-E Link Adapter is connected.
4. Branch lines must be a maximum of 10 m long.

NT Link Communications

NT Link communications are used to connect an OMRON Programmable Controller (PC) and Programmable Terminal (PT). Up to 8 PTs can be connected to one PC. For details on the system configuration, refer to the user's manual for the PT.

1-6 Specifications

1-6-1 Serial Communications Boards and Unit

CS Series

Device name		Serial Communications Boards		Serial Communications Unit
Classification		Inner Board		CPU Bus Unit
Model number		CS1W-SCB21-V1	CS1W-SCB41-V1	CS1W-SCU21-V1
Serial communications ports	**Port 1**	RS-232C	RS-232C	RS-232C
	Port 2	RS-232C	RS-422A/485	RS-232C
Protocol	**Port 1**	Host Link, protocol macro, NT Link, or loopback test can be selected for each port.		
	Port 2			
Number of mountable Boards/Units	**CPU Unit**	One Board per Inner Board slot		None
	CPU Rack	None		A total of up to 16 Units, including all other CPU Bus Units. No restrictions on the mounting location.
	Expansion Rack	None		
Data exchange with the CPU Unit	**Ordinary refreshing of software switches and status**	Allocated 25 words of the 100 words in the Inner Board CIO Area (constant data exchange with the CPU Unit)		Allocated 25 words of the 25 words in the CPU Bus Unit CIO Area (constant data exchange with the CPU Unit)
	Transfer from the CPU Unit set by the system	Of the 768 words in the Inner Board DM Area, each serial port is allocated 10 words (total 20 words). Data is transferred from the CPU Unit at the following times: • Startup or restart • Ladder instruction: STUP(237) • Port Settings Changing Flag turns ON (Auxiliary Area)		Of the CPU Bus Unit DM Area, each serial port is allocated 10 words (total 20 words). Data is transferred from the CPU Unit at the following times: • Startup or restart • Ladder instruction: STUP(237) • Port Settings Changing Flag turns ON (Auxiliary Area)
Supporting CPU Units		CS1 CPU Units High-speed: CS1H-CPU67/CPU66/CPU65/CPU64/CPU63 Standard: CS1G-CPU45/CPU44/CPU43/CPU42 CS1-H CPU Units High-speed: CS1H-CPU67H/CPU66H/CPU65H/CPU64H/CPU63H Standard: CS1G-CPU45H/CPU44H/CPU43H/CPU42H		
Simple Backup Function		The CPU Unit's Simple Backup Function can be used to backup the Protocol Macro data in the Serial Communications Board/Unit to the CPU Unit's Memory Card. The backed-up data can be restored or compared. (The Simple Backup Function can be used only with a "-V1" model of Serial Communications Board/Unit in combination with a CS1-H CPU Unit.)		

Device name	Serial Communications Boards		Serial Communications Unit
Applicable Backplanes	None		CPU Backplanes: CS1W-BC103/BC083/BC053/BC033/BC023 CS Expansion Backplanes: CS1W-BI103/BI083/BI053/BI033
Current consumption (see note)	280 mA + x	360 mA + x	290 mA + x
Weight	100 g max.	110 g max.	200 g max.

Note The current consumption is for one Serial Communications Board or Unit. When an NT-AL001-E Link Adapter is connected to the Serial Communications Board or Unit, power is supplied to the Link Adapter from the Board or Unit. A current consumption of 150 mA must be added for each Link Adapter that is connected. In the above specifications, “x” indicates that 150 mA must be added for each port to which an NT-AL001-E Link Adapter is connected to provide the required 5-V power supply.

CJ Series

Device name		Serial Communications Unit
Classification		CPU Bus Unit
Model number		CJ1W-SCU41
Serial communications ports	**Port 1**	RS-422A/485
	Port 2	RS-232C
Protocol	**Port 1**	Host Link, protocol macro, NT Link, or loopback test can be selected for each port.
	Port 2	
Number of mountable Units	**CPU Unit**	None
	CPU Rack	A total of up to 16 Units, including all other CPU Bus Units. No restrictions on the mounting location.
	Expansion Rack	
Data exchange with the CPU Unit	**Ordinary refreshing of software switches and status**	Allocated 25 words of the 25 words in the CPU Bus Unit CIO Area (constant data exchange with the CPU Unit)
	Transfer from the CPU Unit set by the system	Of the CPU Bus Unit DM Area, each serial port is allocated 10 words (total 20 words). Data is transferred from the CPU Unit at the following times: • Startup or restart • Ladder instruction: STUP(237) • Port Settings Changing Flag turns ON (Auxiliary Area)
Supporting CPU Units		CJ1 CPU Units CJ1G-CPU45/CPU44 CS1-H CPU Units High-speed: CJ1H-CPU66H/CPU65H Standard: CJ1G-CPU45H/CPU44H/CPU43H/CPU42H
Simple Backup Function		The CPU Unit’s Simple Backup Function can be used to backup the Protocol Macro data in the Serial Communications Board/Unit to the CPU Unit’s Memory Card. The backed-up data can be restored or compared. (The Simple Backup Function can be used only with a CJ1W-SCU41 Serial Communications Unit in combination with a CJ1-H CPU Unit.)
Current consumption (see note)		380 mA + x
Weight		110 g max.

Note The current consumption is for one Serial Communications Unit. When an NT-AL001-E Link Adapter is connected to the Serial Communications Board or Unit, power is supplied to the Link Adapter from the Board or Unit. A current consumption of 150 mA must be added for each Link Adapter that is connected. In the above specifications, “x” indicates that 150 mA must be added for each port to which an NT-AL001-E Link Adapter is connected to provide the required 5-V power supply.

1-6-2 General Specifications

The general specifications of the CS-series Serial Communications Boards and Serial Communications Unit conform to the general specifications of the CS-series CPU Unit.

The general specifications of the CJ-series Serial Communications Unit conform to the general specifications of the CJ-series CPU Unit.

1-6-3 Protocol Specifications

Host Link Specifications

Item	Description		
Communications mode	Half-duplex (Full-duplex for slave-initiated communications)		
Synchronous mode	Start-stop synchronization (asynchronous mode)		
Baud rate (see note 1)	RS-232C port and RS-422A/485 ports: 1,200/2,400/4,800/9,600/19,200/38,400/57,600/115,200 bps Default setting: 9,600 bps		
Communications distance (see note 1)	RS-232C port: 15 m max. (see note 2) RS-442A/485 port: 500 m max. (The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)		
Connection configuration	RS-232C port: 1:1 (1:N (N = 32 Units max.) is possible using an Converting Link Adapters.) RS-422A/485 port: 1:N (N = 32 Units max.)		
Number of connected Units	32 Units max. (unit numbers 0 to 31; unit number 0 is set for 1:1 connection)		
Frame structure	C-mode commands	Header: @, address: (host link unit number) 0 to 31 (BCD), data: header code + text, error check code: FCS, terminator: *+CR	
	FINS commands	Header: @, address: (host link unit number) 0 to 31 (BCD), data: header code (always “FA”) + FINS header + FINS command + text, error check code: FCS, terminator: *+CR	
Error check codes	Vertical parity: Even, odd. or none FCS (horizontal parity converted to ASCII)		
Command flow and support	Command flow	Commands	Contents
	Host computer to PC	C-mode commands	1:1 or 1:N communications with directly connected PCs (The specified frame format must be prepared on the host computer and then sent.)
		FINS commands (in Host Link protocol)	1:1 or 1:N communications with directly connected PCs.
	PC to host computer	FINS commands (in Host Link protocol)	Communications using SEND(090), RECV(098), and CMND(490) from CPU Unit. The host computer must interpret the commands and return a response in the correct format. Connection between the host computer and PC must be 1:1.

Note

1. Confirm the baud rates and communications distance supported by connected devices.
2. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

Protocol Macro Function Specifications

Item		Description	
Number of protocols	**20 max.**	Can be created and registered with the Protocol Support Tool (CX-Protocol).	
Number of sequences	**1,000 max.**		
Per protocol	**Number of sequences**	60 max.	
	Number of messages	300 max.	
	Number of reception matrixes	100 max.	
Sequence execution condition		Using the CPU Unit's PMCR(260) instruction (specifying the sequence number)	
Communications mode		Half-duplex or full-duplex	
Synchronous mode		Start-stop synchronization (asynchronous mode)	
Baud rate (see note 1)		RS-232C port and RS-422A/485 ports: 1,200/2,400/4,800/9,600/19,200/38,400 bps Default setting: 9,600 bps	
Communications distance (see note 1)		RS-232C port: 15 m max. RS-442A/485 port: 500 m max. (The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)	
Connection configuration		RS-232C port: 1:1 (1:N (N = 32 Units max.) is possible using a Converting Link Adapter.) RS-422A/485 port: 1:N (N = 32 Units max.)	
Number of connected Units		32 Units max. (unit numbers 0 to 31; unit number 0 is set for 1:1 connection)	
Maximum number of data exchange words between PC and protocol macro function	**Operand setting**	250 words	Including the word that specifies the number of words (1 word)
	Link word setting	500 words	O1, O2, I1, and I2: 500 words total
	Direct setting	500 words	Maximum number of words per data attribute

Item		Description	
Sequence contents (step common parameters)	**Number of steps per sequence**	16 max.	
	Transmission control parameters	X-on/X-off flow, RS/CS flow, delimiter control, or contention control, and modem control can be selected.	
	Response notification method (operand)	Scan notification or interrupt notification (i.e., writing the receive data in the I/O memory area specified in the 4th operand of the PMCR(260) instruction) can be selected. Scan notification: Writes the receive data to I/O memory during CPU Unit scanning. Interrupt notification: Writes the receive data to I/O memory as soon as it is received, and at the same time specifies the execution of the interrupt program for the CPU Unit. **Note** The interrupt notification method can be executed only by a Serial Communications Board. It cannot be used for a Serial Communications Unit.	
		Scan method (fixed)	Board and Unit
		Interrupt notification	Board only (See note 2.)
		Interrupt notification for reception case number	Board only (See note 2.)
	Monitoring time during send/receive processing	Receive wait, receive completion, or send completion can be monitored. Setting range: 0.01 to 0.99 s, 0.1 to 9.9 s, 1 to 99 s, or 1 to 99 minutes	
	Link word setting	Area in which data is exchanged between the CPU Unit and the Serial Communications Board or Unit during Communications Board or Unit refreshing. Two areas are possible for each device: An area for storing receive data and an area for storing send data.	

Item		Description	
Step contents	**Commands**	Send only (SEND), receive only (RECV), send and receive (SEND&RECV), wait (WAIT), reception buffer clear (FLUSH), ER-ON (OPEN), or ER-OFF (CLOSE)	
	Repeat counter	1 to 255 times	
	Retry count	0 to 9 (Only when the command is SEND&RECV)	
	Send wait time	0.01 to 0.99 s, 0.1 to 9.9 s, 1 to 99 s, or 1 to 99 minutes (Only when the command is SEND or SEND&RECV)	
	With or without response write (operand)	When receive processing is completed (when the receive data is stored in the area specified in the 4th operand of the PMCR(260) instruction), whether or not to store the received messages can be selected.	
	Next processing	When a step has ended normally, End (sequence completed), Next (proceed to the next step No.), Goto (go to the specified step No.), or Abort (interrupt the step and terminate that sequence) can be selected.	
	Error processing	When a step has ended abnormally, End, Next, Goto, or Abort can be selected.	
	Send message	Data sent to the specified address when the command is SEND or SEND&RECV.	Consists of a header (*1), address (*2), length, data (*2), error check code (*3), and terminator (*1). For an explanation of *1, *2, and *3, see the next page.
	Receive message	Data sent from the specified address when the command is RECV or SEND&RECV.	
	Reception matrix	When the command is RECV or SEND&RECV, sets the expected receive messages (15 max.), and switches to the next processing according to the message received.	Specifies the receive messages and the next processing for each of cases No. 00 to No. 15. Of the maximum 16 cases, one case must be set as “Other” in the receive messages (in addition to the set receive messages).

Note

1. The baud rate and the communications distance sometimes depend on the remote device.
2. A macro syntax error will occur if the interrupt notification method is executed for a Serial Communications Unit.

Item			**Description**				
Message unit contents	*1: **Header and terminator data attributes**	**Constant**	ASCII data, hexadecimal data, or control code				
	*2: **Data attributes of addresses and data in send/receive messages**	**Constant**	ASCII data, hexadecimal data, or control code (with an address, no control code is possible)				
		Variable	No conversion, conversion to ASCII data, or conversion to hexadecimal data (the read/write direction can be specified)				
			Designation method	(X, Y) X: Effective address (where read from, or where written to) Y: Data size (1 to 1,000) **Note** The data size is the number of bytes on the transmission path.			
			X	Word designation	Word read (I/O memory to send data)	Specify using the 3rd operand of the PMCR(260) instruction.	Set leading address + n (The linear expression aN + b, including repeat counter N, is also possible for n.)
						Specify using a link word.	
						I/O memory direct designation	
					Word write (receive data to I/O memory)	Specify using the 4th operand of the PMCR(260) instruction.	
						Specify using a link word.	
						I/O memory direct designation	
				Wild card	*	Any data or address can be received (only in receive messages)	
				Repeat counter	N		

Item			**Description**				
Message unit contents	***2: Data attributes of addresses and data in send/receive messages**	**Variables**	Y	Linear expression including repeat counter	aN + b	a: 0 to 1000; b: 1 to 1000 N: Repeat counter value	
				Wild card	*	Can be received regardless of the length (only in receive messages)	
				Word designation	Word read (I/O memory to send data)	Specify using the 3rd operand of the PMCR(260) instruction.	Set leading address + n (The linear expression aN + b, including repeat counter N, is also possible for n.)
						Specify using a link word.	
						I/O memory direct designation	
	***3: Error check codes**		LRC, LRC2, CRC-CCITT, CRC-16, SUM, SUM1, and SUM2 can be calculated.				
	Maximum length of send/receive messages		1,000 bytes. (A maximum length between 200 and 1,000 bytes can be set in the Setup Area.)				
	Maximum number of data attributes registered in one message		96 attributes (see note 1)				
	Maximum number of write data attributes registered in one message		30 attributes (see note 2)				
Trace function			A total of up to 1,700 bytes (characters) of time-series data can be traced in send and receive messages. Changes to the step No. and control signals such as RS and CS can also be traced.				

Note

1. The CX-Protocol can be used to register up to 96 attributes per message.
2. A macro syntax error will occur when the protocol macro is executed if more than 31 write attributes are registered in one message.

1-7 Comparison to Previous Products

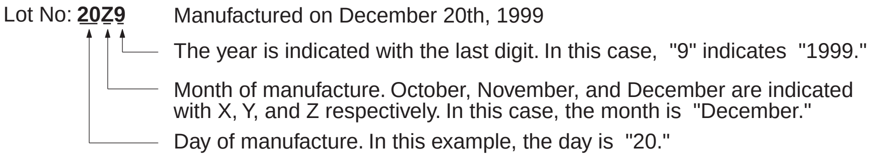
The following tables show a comparison between the CS/CJ-series Serial Communications Boards and Unit and the C200HX/HG/HE Communications Boards and Host Link Units.

Item			C200HX/HG/HE	CS	CJ
Model		Boards	C200HW-COM02/COM03/ COM04-E/COM05-E/ COM06-E Communications Boards	CS1W-SCB21-V1/SCB41 -V1 Serial Communications Board	None
		Units	C200H-LK101-PV1/LK201-V1 Host Link Unit	CS1W-SCU21 -V1 Serial Communications Unit	CJ1W-SCU41 Serial Communications Unit
Communications ports		Boards	2 RS-232C ports or 1 RS-232C and 1 RS422A/ 485 port or 1 CPU bus I/F and 1 RS-232C port or 1 RS-232C port or 1 RS-422A/485 port	2 RS-232C ports or 1 RS-232C and 1 RS422A/ 485 port	NA
		Units	1 RS-232C port or 1 RS-422A port or 1 optical fiber port	2 RS-232C ports	1 RS-232C and 1 RS422A/ 485 port
Number mountable per PC		Boards	1 Board	1 Board	NA
		Units	2 Units (CPU Rack or Expansion I/O Rack, but not two slots next to CPU Unit) Up to 4 ports maximum, 6 ports including those on CPU Unit.	16 Units (CPU Rack or CS Expansion Rack, but total of all CPU Bus Units must be 16 or less) Up to 32 ports maximum, 34 ports including those on CPU Unit.	16 Units (CPU Rack or CS Expansion Rack, but total of all CPU Bus Units must be 16 or less) Up to 32 ports maximum, 34 ports including those on CPU Unit.
Serial communications modes	Boards	Host Link communications	Supported. (See note 1.)	Supported. (See note 1.)	NA
		Protocol macros	Supported (except for COM02 and COM03).	Supported.	NA
		NT Link communications	Supported.	Supported (unified with 1:N NT Links).	NA
		No-protocol communications	Supported.	Not supported (included with protocol macros).	NA
		1:1 links	Supported.	Not supported (supported by Controller Link Units or PC Link Units).	NA
		Loopback tests	Not supported.	Supported.	NA

Item			C200HX/HG/HE	CS	CJ
Serial communications modes	Units	Host Link communications	Supported.	Supported.	Supported.
		Protocol macros	Not supported.	Supported.	Supported.
		NT Link communications	Not supported.	Supported (unified with 1:N NT Links).	Supported (unified with 1:N NT Links).
		No-protocol communications	Not supported.	Not supported (included with protocol macros).	Not supported (included with protocol macros).
		1:1 links	Not supported.	Not supported (supported by Controller Link Units or PC Link Units).	Not supported (supported by Controller Link Units or PC Link Units).
		Loopback tests	Not supported.	Supported.	Supported.
Baud rate		Host Link communications	19,200 bps max.	115,200 bps max.	115,200 bps max.
		Protocol macros	19,200 bps max.	38,400 bps max.	38,400 bps max.
		NT link (1:N mode)	Standard NT link	Standard NT link, high-speed NT link (see note 2)	Standard NT link, high-speed NT link (see note 2)
Host Link communications		C-mode commands	Supported.	Supported.	Supported.
		FINS commands	Not supported.	Supported.	Supported.
		Slave-initiated communications	Boards: Data can be sent with TXD(236) instruction. Units: Not supported.	Boards and Unit: FINS commands can be sent using SEND(090), RECV(098), and CMND(490).	Boards and Unit: FINS commands can be sent using SEND(090), RECV(098), and CMND(490).

Note

1. The number of words that can be read and written per frame (i.e., the text lengths) when using C-mode commands is different for C-series Host Link Units and CS/CJ-series Serial Communications Boards/Units. A host computer program previously used for C-series Host Link Units may not function correctly if used for CS/CJ-series PCs. Check the host computer program before using it and make any corrections required to handle different frame text lengths. Refer to the *CS/CJ-series Communications Commands Reference Manual (W342)* for details.
2. For CS-series PCs, a high-speed NT link is available only with Serial Communications Boards/Units manufactured on or after December 20th, 1999. With earlier models, only standard NT link is available.



Lot No: 20Z9 Manufactured on December 20th, 1999

The year is indicated with the last digit. In this case, "9" indicates "1999."

Month of manufacture. October, November, and December are indicated with X, Y, and Z respectively. In this case, the month is "December."

Day of manufacture. In this example, the day is "20."

NT31/631(C)-V2 are the only PTs for which high-speed NT link is supported.

The following tables shows the improvements made in the protocol macro function.

Protocol Macro Comparison

Item			C200HX/HG/HE	CS/CJ
Transmission mode			Half-duplex	Half or full-duplex
Commands			Send only: SEND, receive only: RECV, or send and receive: SEND and RECEIVE	Send only: SEND, receive only: RECV, send and receive: SEND and RECEIVE, wait: WAIT, clear reception buffer: FLUSH, ER-ON: OPEN, and ER-OFF: CLOSE
				WAIT: Progressing to next process controlled by signal from CPU Unit. FLUSH: Clears contents of reception buffer. OPEN: Used for modem control. Keeps ER signal ON even after end of sequence. CLOSE: Used for modem control. Turns OFF ER signal.
Reception buffer (per port)			256 bytes	2.5 Kbytes
Reception buffer flow control at Board/Unit (RS/CS or Xon/Xoff)	Start (CTS signal OFF to request canceling send from remote device)		200 bytes	2 Kbytes
	Clear (CTS signal ON to request restarting send from remote device)		At step transition	0.5 Kbytes
Send/receive message length	Bytes per send		256 bytes max.	1,000 bytes max.
	Bytes per receive	For RS/CS flow, Xon/Xoff flow, or delimiter control	200 bytes max.	Default: 200 bytes. Setting can be changed to between 200 and 1,000. Reception data is removed from the reception buffer in increments of the size set here.
		Other	256 bytes max.	

Item				C200HX/HG/HE	CS/CJ
Reception message length when using wildcard (*) for data length		For RS/CS flow, Xon/Xoff flow, or delimiter control		200 bytes max.	As set above. Default: 200 bytes. Setting can be changed to between 200 and 1,000.
		Other		256 bytes max.	
Send/ receive data storage locations and data capacity	Operand specification	Max. send data size		127 words max. (not including word specifying the number of send words)	250 words max. (including word specifying the number of send words)
		Max. receive data size		127 words max. (not including word specifying the number of receive words)	250 words max. (including word specifying the number of receive words)
	Link word specification	Area 1	IN	128 words max. total	500 words max. total
			OUT		
		Area 2	IN		
			OUT		
	Direct specification (variable)	Max. send or receive data size		128 words max. (no conversion)	500 words max. (no conversion)
Reception buffer clearing timing		Half-duplex		Before executing sequences. Before executing RECV processing.	Before executing sequences. Before executing SEND processing. Upon FLUSH command execution.
		Full-duplex		None	Before executing sequences. Upon FLUSH command execution.
Reception buffer reception processing		Half-duplex		Only during RECV processing.	Except when executing SEND processing.
		Full-duplex		None	During sequence execution (reception processing not performed except during sequence execution).
Character trace reception records		Half-duplex		Recorded except during SEND processing.	During sequence execution (even during SEND processing)
		Full-duplex		None	

Item		C200HX/HG/HE	CS/CJ
Transmission control signal operations	RTS signal	RTS/CTS flow control: RTS signal turned ON when reception buffer reaches 200 bytes. Modem control: RTS signal turned ON when data is sent and turned OFF when send is completed.	RTS/CTS flow control: RTS signal turned ON when reception buffer reaches approximately 2 Kbytes. Modem control: RTS signal turned ON when data is sent and turned OFF when send is completed.
	CTS signal	RTS/CTS flow control: Data send is on standby when CTS signal turns ON; data can be sent when CTS signal turns OFF.	RTS/CTS flow control: Data send is on standby when CTS signal turns ON; data can be sent when CTS signal turns OFF.
	ER signal	Modem control: ON when sequence execution is started, OFF when completed. Turns ON only for modem controls.	Modem control: ON when sequence execution is started, OFF when completed. Also can be turned ON or OFF as required during modem control by executing OPEN to turn ON the ER signal or by executing CLOSE to turn OFF the ER signal in sequence steps. The ER signal can also be controlled across multiple steps.
		During RTS/CTS flow control and modem control, the ER signal will be controlled according to modem control operations, the RTS signal will turn ON when sending, and the RTS/CTS flow control operations will be used for the RTS and CTS signals for receptions.	
Synchronization with CPU Unit after start of sequence execution		None	The WAIT command can be used to stop transitions between steps to allow transitions from the CPU Unit. This is useful, for example, to perform processing in the CPU Unit after a specific step but before executing the next step.
Send/receive messages	Reception length	No check.	The length of data set in the expected reception message will be fetched from the reception buffer as the message.
	Error check codes	No LRC2 or SUM1 checks.	LRC2 and SUM1 supported.
Interrupt notification function		Supported.	Boards: Supported. Units: Not supported.
Simple Backup Function		None	The CPU Unit's Simple Backup Function can be used to backup the Protocol Macro data in the Serial Communications Board/Unit to the CPU Unit's Memory Card. The backed-up data can be restored or compared. (When a CS1-H CPU Unit is being used, this function is supported by the CS1W-SCB21-V1, CS1W-SCB41-V1, and CS1W-SCU41. When a CJ1-H CPU Unit is being used, this function is supported by the CJ1W-SCU41.)

1-8 Selecting the Serial Communications Mode

Connect Device		Serial Communications Mode			Reference
Host computer	Communicating using an OMRON protocol	Host Link	Host computer ↓ Command interpretation by PC PC ↓ Command sent to host computer	(Host computer:PC = 1:1 or 1:N) C-mode commands or FINS commands (Host computer:PC = 1:1) FINS commands	Communications Commands Reference Manual (W342) Section 4 Using Host Link Communications
	Creating communications frame for a host computer protocol	Protocol macro			Section 5 Using Protocol Macros CX-Protocol Operation Manual (W344)
OMRON component	Standard system protocol	Protocol macro	Use a standard system protocol.		Section 5 Using Protocol Macros Appendices B to O
	User-created protocol	Protocol macro	Use the CX-Protocol to change a standard system protocol.		Section 5 Using Protocol Macros CX-Protocol Operation Manual (W344)
General-purpose external device	Protocol (including no-protocol) used mainly for stop-start synchronous data sending and reception	Protocol macro	Use the CX-Protocol to create a new protocol.		Section 5 Using Protocol Macros CX-Protocol Operation Manual (W344)
Programming Device (but not a Programming Console)	Remote programming and monitoring via a modem	Host Link **Note** When a Programming Device is connected to the PC, the Peripheral Bus can be used by connecting to the ports on the CPU Unit. This is faster than using Host Link communications.			Section 4 Using Host Link Communications Communications Commands Reference Manual (W342)
OMRON Programmable Terminal (PT)	High-speed communications for multiple PTs (up to eight).	1:N NT Link **Note** The PT must also be set for a 1:N NT Link. Communications will not be possible if the PT is set for a 1:1 NT Link.			Section 6 Using 1:N NT Links
	Low-speed communications and only one PT	Host Link			Section 4 Using Host Link Communications

1-9 Basic Operating Procedure

1-9-1 Overview

An overview of the basic operating procedure is provided here. Refer to the following pages for details.

1,2,3...

1. Turn OFF the power supply to the PC.
2. Set the unit number if a Serial Communications Unit is being used.

   Set the unit number using the rotary switch on the front panel of the Unit.
3. Install the Board or Unit.
4. Connect the Unit and the external device(s).
5. Turn ON the power supply to the PC
6. Create the I/O tables if a Serial Communications Unit is being used.

   Create the I/O tables using a Programming Device, such as a Programming Console.

   I/O tables must be created when a Serial Communications Unit (CPU Bus Unit) is used with a CS/CJ-series PC. (This aspect of operation is different from using Communications Boards with the C200HX/HG/HE, C200H, or C200HS.)
7. Set the Setup Area allocated in the DM Area.

   Make settings using a Programming Device, such as a Programming Console, or the CX-Protocol.

   The following words are allocated as the Setup Area in the DM Area:
   Board: 20 words beginning at D32000
   Unit: 20 of the 100 words starting from (D30000 + 100 × unit number)

   Make the following settings:

   - Serial communications mode (Host Link, protocol macro, NT Link, or loopback test)
   - Baud rate
   - Transmission mode for protocol macros (half-duplex or full-duplex), the maximum length of send/receive data, etc.
8. Make the new settings in the Setup Area valid by performing one of the following.
   - Turn the power OFF and then ON again.
   - Restart the Board by turning ON the Inner Board Restart Bit (A60800) or restart the Unit turning ON one of the CPU Bus Unit Restart Bits (A50100 to A50115, where the bit number corresponds to the unit number).
   - Restart the port on the Serial Communications Board by turning ON one of the Communications Board Port Settings Change Bits (A63601 for port 1 and A63602 for port 2) or restart the port on the Serial Communications Unit by tuning ON one of the Communications Unit Port Settings Change Bits (A620 to A635: The word will be A620 + unit number and the bit will be bit 01 for port 1 and bit 02 for port 2).
   - Execute the STUP(237) instruction. The STUP(237) instruction is executed in the ladder program to change the serial communications mode of a serial port. See *Appendix O Changing Port Settings Using STUP(237).*

9. Execute communications.

   Use the software switches or the allocated flags and words allocated in the CIO Area in the ladder program to control communications.

   The following words are allocated in the CIO Area:
   Board: 25 words from CIO1900
   Unit: 25 words from CIO 1500 + 25 × unit number

1-9-2 Explanation of Procedure

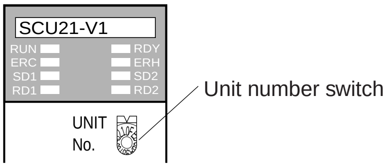
Turning OFF the Power

Check that the PC power has been turned OFF. If the power is ON, turn it OFF.

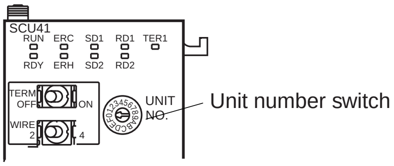
Setting the Unit Number for Serial Communications Units

When a Serial Communications Unit is used, set the unit number switch at the top of the front panel of the Unit to between 0 and F. The number that is set will determine which words are allocated as the Setup Area in the DM Area and which words are allocated in the CIO Area.

CS-series Units



CJ-series Units



First word in Setup Area allocated in DM Area:
m = D30000 + 100 × unit number
(20 words are used beginning from m,
10 words for each port)

Unit No.	Words
Unit No. 0	D30000 to D30099
Unit No. 1	D30100 to D30199
Unit No. 2	D30200 to D30299
Unit No. 3	D30300 to D30399
Unit No. 4	D30400 to D30499
Unit No. 5	D30500 to D30599
Unit No. 6	D30600 to D30699
Unit No. 7	D30700 to D30799
Unit No. 8	D30800 to D30899
Unit No. 9	D30900 to D30999
Unit No. A	D31000 to D31099
Unit No. B	D31100 to D31199
Unit No. C	D31200 to D31299
Unit No. D	D31300 to D31399
Unit No. E	D31400 to D31499
Unit No. F	D31500 to D31599

First word allocated in the CIO Area:
n = CIO 1500 + 25 × unit number
(all words are used beginning with n)

Unit No.	Words
Unit No. 0	CIO 1500 to CIO 1524
Unit No. 1	CIO 1525 to CIO 1549
Unit No. 2	CIO 1550 to CIO 1574
Unit No. 3	CIO 1575 to CIO 1599
Unit No. 4	CIO 1600 to CIO 1624
Unit No. 5	CIO 1625 to CIO 1649
Unit No. 6	CIO 1650 to CIO 1674
Unit No. 7	CIO 1675 to CIO 1699
Unit No. 8	CIO 1700 to CIO 1724
Unit No. 9	CIO 1725 to CIO 1749
Unit No. A	CIO 1750 to CIO 1774
Unit No. B	CIO 1775 to CIO 1799
Unit No. C	CIO 1800 to CIO 1824
Unit No. D	CIO 1825 to CIO 1849
Unit No. E	CIO 1850 to CIO 1874
Unit No. F	CIO 1875 to CIO 1899

With a Serial Communications Board, the following words are always allocated.

Setup Area in the DM Area:
D32000 to D32767

D32000 to D32009	Port 1 Setup Area
D32010 to D32019	Port 2 Setup Area
D32020 to D32767	Reserved for the system

Words allocated in the CIO Area:
CIO 1900 to CIO 1999

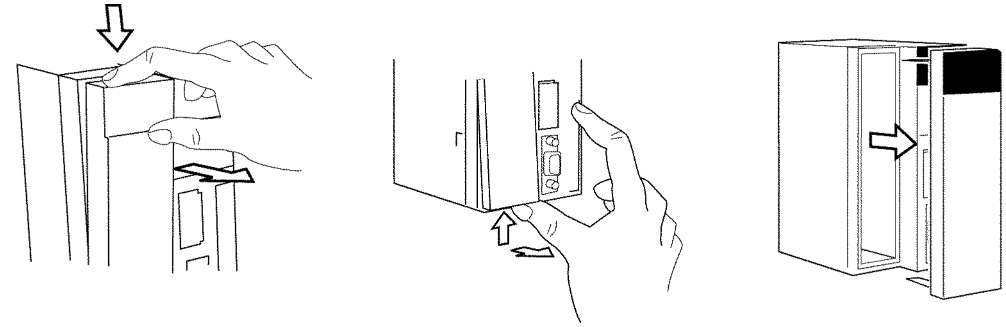
CIO 1900	Software switch
CIO 1901 to CIO 1904	Board status
CIO 1905 to CIO 1914	Port 1 status
CIO 1915 to CIO 1924	Port 2 status
CIO 1925 to CIO 1999	Reserved for the system

Installing the Board or Unit

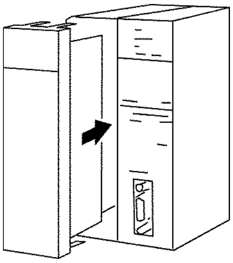
Serial Communications Board (CS Series Only)

1,2,3...

1. Press in the lever on the Inner Board installation cover, first on the top and then on the bottom, and remove the cover.



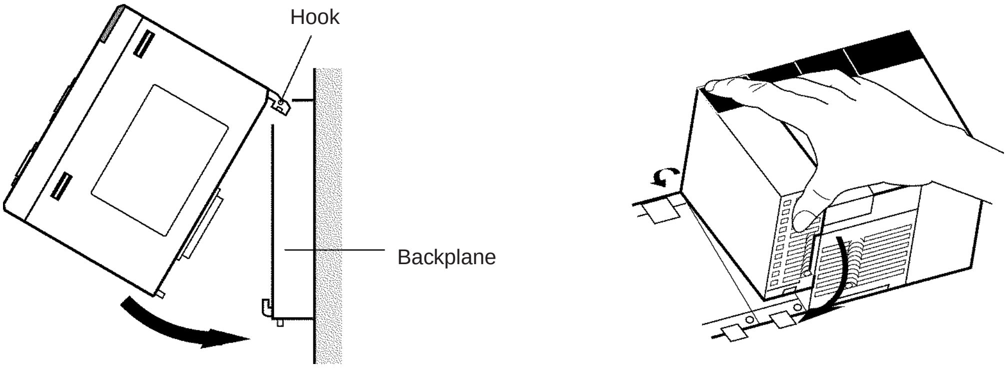
2. Install the Serial Communications Board.



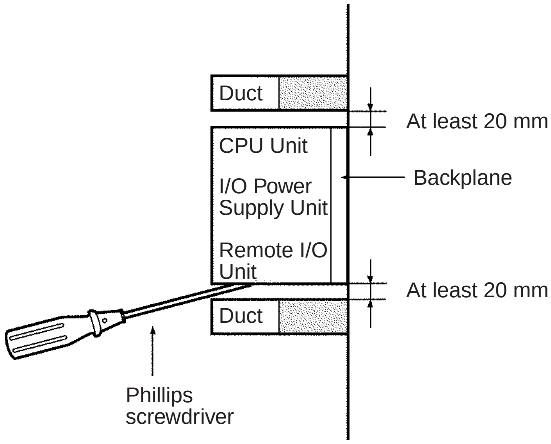
CS-series Serial Communications Unit

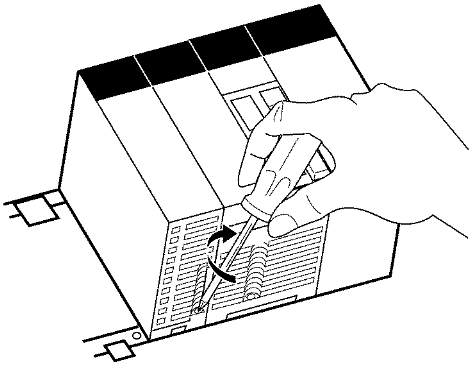
1,2,3...

1. Catch the hook on the top of the back of the Unit on the Backplane, and then rotate the Unit downward to mount it.



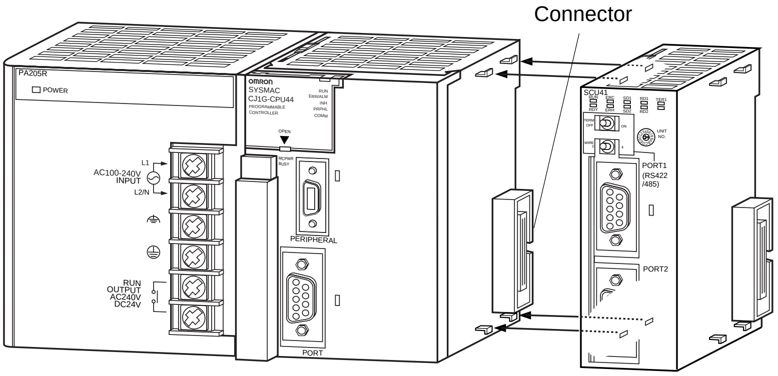
2. Insert the Unit firmly into the Backplane connector.
3. Tighten the screw at the bottom of the Unit with a Phillips screwdriver to a torque of 0.4 N•m. For this operation, the Phillips screwdriver must be placed at a slight angle. Therefore, leave sufficient space at the bottom of the Unit.



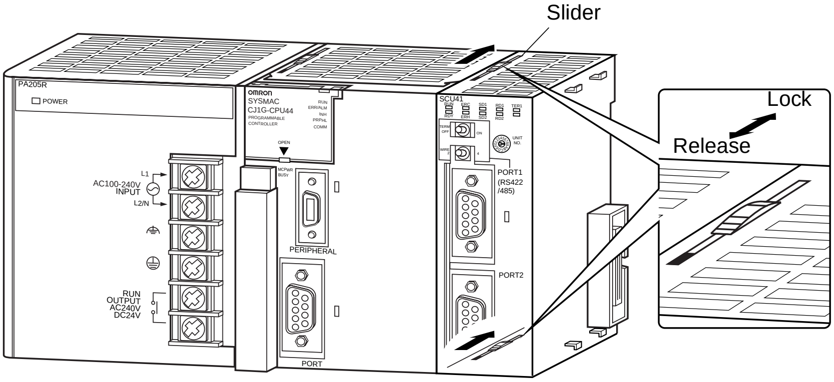


CJ-series Serial Communications Unit

1,2,3... 1. Align the connectors properly and then press in on the Unit to connect it.



2. Slide the sliders on the top and bottom of the Unit until they lock the Units together.



Note If the sliders are not locked properly, the Serial Communications Units may not function correctly.

Connections

Connect the external devices using RS-232C or RS-422A cables. For details on the connector pin layout and the connection methods, see *Section 3 Installation and Wiring*, and refer to the relevant manuals for the external devices to be connected.

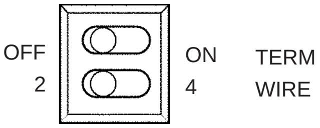
Types of Port for Different Models

The types of port for the different models of Serial Communication Boards and Units are shown in the following table.

PC Series	Type of Unit	Model	Port 1	Port 2
CS Series	Serial Communications Board	CS1W-SCB21-V1	RS-232C	RS-232C
		CS1W-SCB41-V1	RS-232C	RS-422A/485
	Serial Communications Unit	CS1W-SCU21-V1	RS-232C	RS-232C
CJ Series		CJ1W-SCU41	RS-422A/485	RS-232C

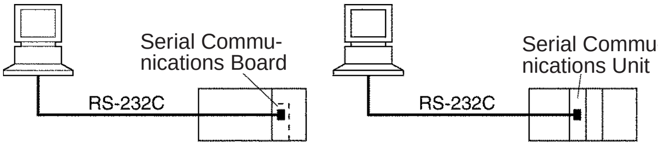
When an RS-422A/485 port is used, the following setting is required.

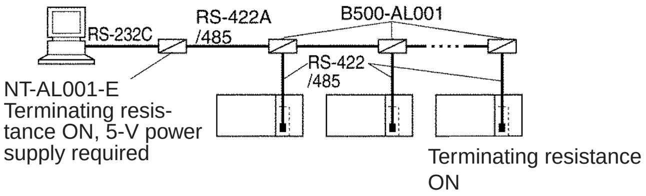
- TERM: Terminating resistance ON/OFF switch
  OFF: Terminating resistance OFF
  ON: Terminating resistance ON
- WIRE: 2-wire or 4-wire selector switch
  2: 2-wire; 4: 4-wire



Connection Example for Host Link Communications

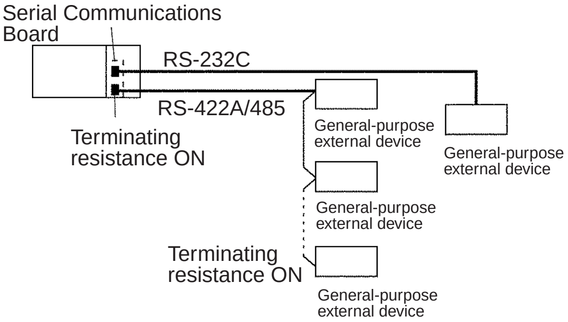
The host computer can be connected to a PC 1:1, or NT-AL001-E Converting Link Adapters can be used to convert from RS-232C to RS-422A/485 to connect the host computer to PCs 1:N.





Also perform other required processing, such as setting switches on the external device(s).

Connection Example for Protocol Macros



Also perform other required processing, such as setting switches on the external device(s).

Connection Example for 1:N NT Links

Refer to the manual for the PT.

Connecting Programming Devices

Connect the Programming Console, CX-Programmer, or CX-Protocol to the CPU Unit as required.

Turning ON Power

Turn ON the PC power supply to the PC.

Creating I/O Tables for Serial Communications Units

I/O tables must be created for Serial Communications Units. Create the I/O table using a Programming Device, such as a Programming Console or CX-Programmer.

Setting the Setup Area in the DM Area

Set the serial communications mode and the communications specifications for the Board or Unit. Use a Programming Device, such as a Programming Console or CX-Programmer, or the CX-Protocol to set the Setup Area.

Host Link Communications

The following table shows the default (standard) settings for Host Link communications.

m = D30000 + 100 × unit number

Board (CS Series only)		Unit (CS/CJ Series)		Bit	Setting	Meaning
Port 1	Port 2	Port 1	Port 2			
D32000	D32010	m	m+10	15	0	Start bit: 1 bit Data length: 7 bits Parity: Even Stop bits: 2 bits Baud rate: 9,600 bps
				08 to 11	5	Host Link mode
D32001	D32011	m+1	m+11	00 to 03	0	The baud rate setting is disabled when the default settings are used.
D32002	D32012	m+2	m+12	15	0	Send delay: 0 ms
D32003	D32013	m+3	m+13	15	0	CTS control: No
				00 to 07	00	Host Link unit number: 0

Protocol Macros

The following table shows the default (standard) settings for protocol macros.

m = D30000 + 100 × unit number

Board (CS Series only)		Unit (CS/CJ Series)		Bit	Setting	Meaning
Port 1	Port 2	Port 1	Port 2			
D32000	D32010	m	m + 10	15	0	Start bit: 1 bit Data length: 7 bits Parity: Even Stop bits: 2 bits Baud rate: 9,600 bps
				11 to 08	6	Protocol Macro mode
D32001	D32011	m + 1	m + 11	03 to 00	0	The baud rate setting is disabled when the default settings are used.
D32008	D32018	m + 8	m + 18	15	0	Half-duplex
D32009	D32019	m + 9	m + 19	15 to 00	00C8 hex	Maximum number of bytes in protocol macro send/receive data: 200 bytes

NT Link Mode

The following table shows the default (standard) settings for NT link when the maximum PT unit number is 5.

m = D30000 + 100 × unit number

Board (CS Series only)		Unit (CS/CJ Series)		Bit	Setting	Meaning
Port 1	Port 2	Port 1	Port 2			
D32000	D32010	m	m + 10	11 to 08	2	1:N NT Link
D32001	D32011	m + 1	m + 11	03 to 00	0	The baud rate is set to the standard NT link setting when the default settings are used.
D32006	D32016	m + 6	m + 16	02 to 00	5	1:N NT Link maximum unit number (example)

Validate the New Settings

Make the new settings in the Setup Area valid by performing one of the following.

- Turn the power OFF and then ON again. The Setup Area allocated in the DM Area will be read when the power is turned ON.
- Restart the Board by turning ON the Inner Board Restart Bit (A60800) or restart the Unit turning ON one of the CPU Bus Unit Restart Bits (A50100 to A50115, where the bit number corresponds to the unit number). (See following table.)
- Restart the port on the Serial Communications Board by turning ON one of the Communications Board Port Settings Change Bits (A63601 for port 1 and A63602 for port 2) or restart the port on the Serial Communications Unit by tuning ON one of the Communications Unit Port Settings Change Bits (A620 to A635: The word will be A620 + unit number and the bit will be bit 01 for port 1 and bit 02 for port 2).

Inner Board Restart Bit and CPU Bus Unit Restart Bits

Board	A60800
Units	A50100 (Unit No. 0)
	A50101 (Unit No. 1)
	A50102 (Unit No. 2)
	A50103 (Unit No. 3)
	A50104 (Unit No. 4)
	A50105 (Unit No. 5)
	A50106 (Unit No. 6)
	A50107 (Unit No. 7)
	A50108 (Unit No. 8)
	A50109 (Unit No. 9)
	A50110 (Unit No. A)
	A50111 (Unit No. B)
	A50112 (Unit No. C)
	A50113 (Unit No. D)
	A50114 (Unit No. E)
	A50115 (Unit No. F)

Communications Board/Unit Port Settings Change Bits

Unit number		Port 1	Port 2
Board		A63601	A63602
Units	Unit No. 0	A62001	A62002
	Unit No. 1	A62101	A62102
	Unit No. 2	A62201	A62202
	Unit No. 3	A62301	A62302
	Unit No. 4	A62401	A62402
	Unit No. 5	A62501	A62502
	Unit No. 6	A62601	A62602
	Unit No. 7	A62701	A62702
	Unit No. 8	A62801	A62802
	Unit No. 9	A62901	A62902
	Unit No. A	A63001	A63002
	Unit No. B	A63101	A63102
	Unit No. C	A63201	A63202
	Unit No. D	A63301	A63302
	Unit No. E	A63401	A63402
	Unit No. F	A63501	A63502

- Execute the STUP(237) instruction. The Board or Unit Setup Area can be changed while the PC power supply is ON. The STUP(237) instruction can be used, for example, when a send/receive sequence for a modem connection is executed in Protocol Macro Mode to switch the operating mode to Host Link Mode when a certain condition is established. This enables monitoring or programming of the CPU Unit to be carried out from a host computer. See *Appendix O Changing Port Settings Using STUP(237).*

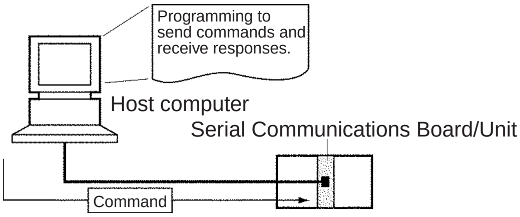
Executing Communications

The required data and ladder program are created to perform communications in the serial communications mode that has been set.

Host Link Communications

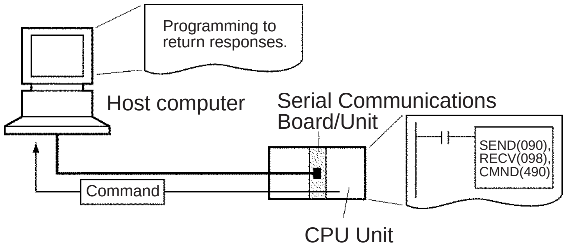
Sending C-mode and FINS Commands from Host Computers to PCs

To send C-mode commands or FINS commands, programs must be created on the host computer to send commands to PCs and to receive responses back from the PCs. Refer to the *CS/CJ-series Communications Commands Reference Manual (W342)* for details.

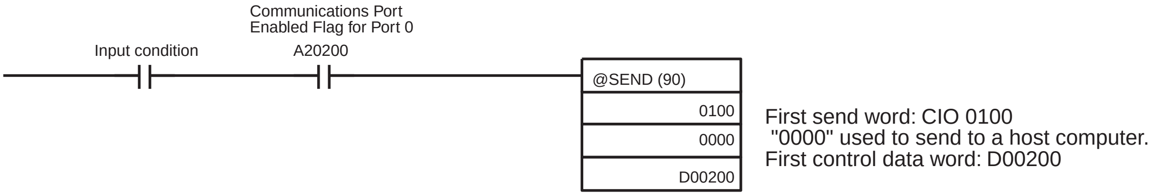


Sending FINS Commands from PCs to Host Computers

SEND(090), RECV(098), and CMND(490) can be used to execute slave-initiated communications. Also, programming is required at the host computer to received data and return responses. An example is provided below for SEND(090).



SEND(090) can be used to send data from the PC to a host computer. If the input condition turns ON when the Communications Port Enabled Flag is ON, 10 words of data from CIO 0100 to CIO 0109 will be sent to the host computer connected to port 1 on the Serial Communications Unit with network address 0, node address 0, and unit address 10 Hex.



The control data for the above instruction is shown in the following table.

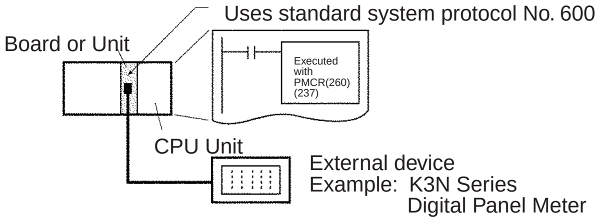
Word	Contents	Meaning
D00200	000A	Number of send words: 10
D00201	0100	Bits 00 to 07: Destination network address 0 Bits 08 to 10: Serial Communications Unit port 1
D00202	0010	Bits 00 to 07: Destination unit address 10 Hex Bits 08 to 15: Destination node address 0
D00203	0000	Bits 00 to 04: Number of retries is 0 Bits 08 to 11: Communications port 0 Bit 15: Response required
D00204	0000	Response monitoring time: 2 s (default value for 0000)

A program would be required at the host computer to receive the above data and return a response.

Protocol Macros

When a standard system protocol (provided in the Serial Communications Board, Serial Communications Unit, and CX-Protocol) is executed.

Using Standard System Protocols



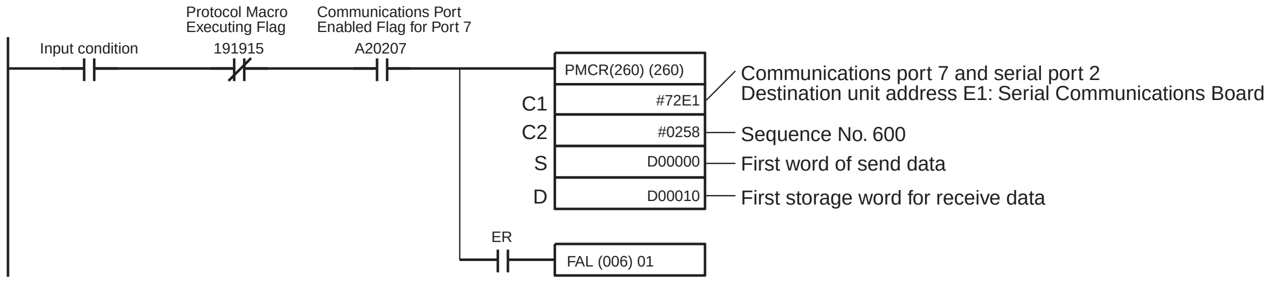
1,2,3...

1. Setting the Send Data

   Refer to information on the 3rd operand of PMCR(260) in *Appendix B CompoWay/F Master Protocol* and set the number of send data words in S, and set the send data starting in S+1.

2. Coding PMCR(260)

   Example:
   The following example shows how to use a Serial Communications Board to read the present value for a K3N-series Digital Panel Meter using the CompoWay/F Master standard system protocol sequence No. 600: Send/receive with ASCII conversion and response.



If the input condition turns ON when the Protocol Macro Executing Flag (CIO 191915 for Port 2) is OFF and the Communications Port Enabled Flag (A20207: Internal logic port, communications port 7) is ON, send/receive sequence No. 600 of the standard system protocol in the Serial Communications Board is called, and data is sent and received via port 2 of the Serial Communications Board.

Send Data

S:D00000	0007	7 words from D00000 to D00006
D00001	0000	K3N node No. : 00
D00002	0101	CompoWay/F command "0101" (reads the K3N present value)
D00003	000C	Number of send bytes
D00004	C000	CompoWay/F command send data (Variable type, read start address, 00, number of elements)
D00005	0000	
D00006	0001	

Receive Data

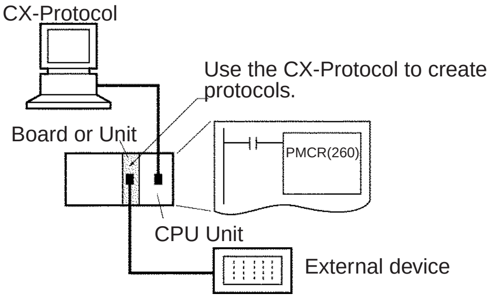
D:D00010	0004	4 words from D00010 to D00013
D00011		Response code is stored.
D00012		The read data (in this case, the present value of K3N) is stored.
D00013		

3. Executing the PMCR(260) Instruction

4. For details on confirming operation, see *Section 12 Tracing and I/O Memory Monitoring* in the *CX-Protocol Operation Manual (W344)*.

   - Transmission Line Tracing
     The data in the send/receive messages flowing over the transmission line (RS-232C or RS-422A/485) and the control codes are traced.
   - I/O Memory Monitoring
     Monitors send/receive data and the status of the various flags.

Executing User-created Protocols



Section references in the following procedure refer to the *CX-Protocol Operation Manual (W344)*.

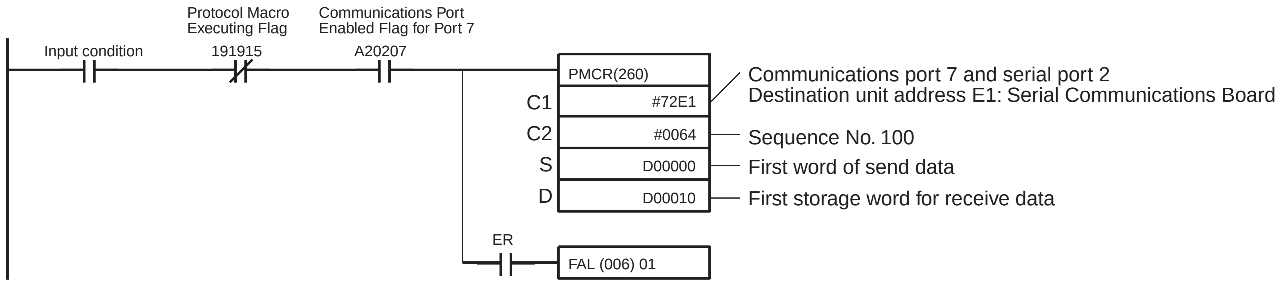
1,2,3...

1. For details on designing protocols, see Section 4 and Section 5.
    a) Create a send/receive sequence status transition chart.
    b) From the status transition chart, divide the processing contents into sequence steps.
    c) Determine the send/receive message contents.
2. Use the CX-Protocol to create and send a project (protocol data).
   See *1.10* for the outline flow.
    a) Creating a new project:
       See *5.1 Creating a New Project or Protocol*.
    b) Creating a new send/receive sequence:
       See *5.2 Creating a New Sequence* or *7.1 Setting a Sequence*.
    c) Creating steps:
       See *5.2 Creating a New Sequence* and *8.1 Setting a Step*.
    d) Creating messages:
       See *9.1 Setting a Message*.

   Note After creating messages, steps can also be created by specifying message names.

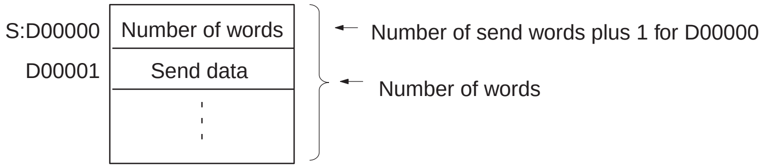
    e) Transferring the created project to a Board or Unit:
       See *11.1 Transferring and Reading Protocol Data between Personal Computers and Serial Communications Boards*.
3. Create the ladder program.
    a) Setting Send Data
        - Specifying Operands
          Set the send data in the I/O memory after the S+1 operand of the PMCR(260) instruction. Set the number of send data words (including S itself) in S.
        - Direct Designations
          Set the send data in the I/O memory specified by the read variables in the send message.
        - Specifying Link Words
          Set the send data in the O1 or O2 area of the Link Word Area.
    b) Coding PMCR(260)

Example for a Serial Communications Board

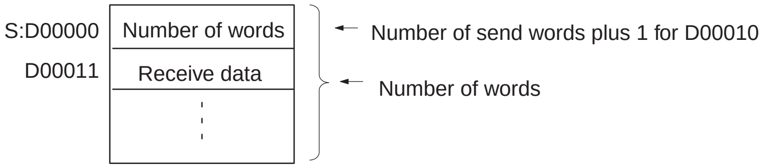


If the input condition turns ON when the Protocol Macro Executing Flag (CIO 191915 for port 2) is OFF and the Communications Port Enabled Flag (A20207 for internal logic port, communications port 7) is ON, send/ receive sequence No. 100 registered in the Serial Communications Board is called, and data is sent and received via port 2 of the Serial Communications Board.

The amount of send data depends on the number of words specified in D00000 (the number of words after D00001 plus 1 for D00000 itself), and is sent from the next word after D00001.



The receive data is stored in consecutive words beginning with D00011, and the number of words actually stored in D00010 (the number of words after D00011 plus 1 for D00010 itself) is stored.



c) Execute PMCR(260)

4. For details on the confirming operation, see *Section 12 Tracing and I/O Memory Monitoring*.
   - Transmission Line Tracing
     The data in the send/receive messages flowing over the transmission line (RS-232C or RS-422A/485) and the control codes are traced.
   - I/O Memory Monitoring
     Monitors send/receive data and the status of the various flags.

1:N NT Links

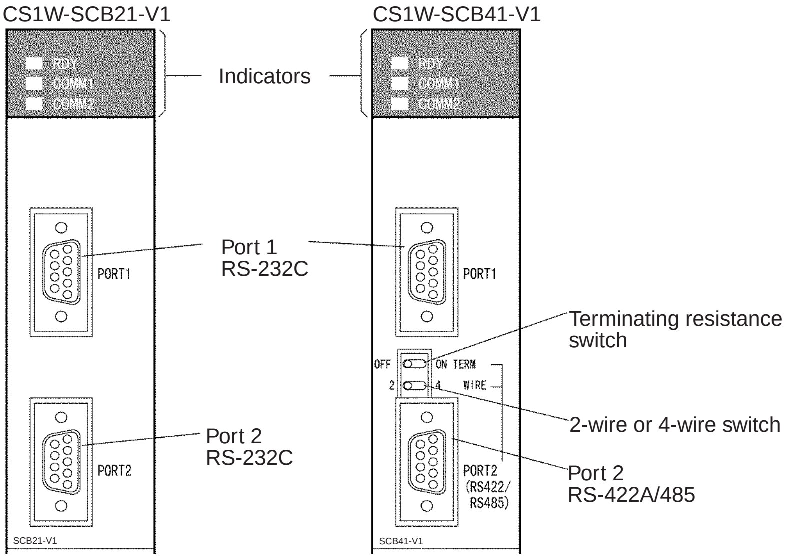
Refer to the user’s manual for the PT.

SECTION 2
Initial Settings and I/O Memory Allocations

This section describes the components of the Serial Communications Boards and the Serial Communications Units, the settings required for operation, and the memory allocated in the I/O memory of the CPU Unit for controlling and monitoring communications.

2-1 Component Names and Functions

2-1-1 Serial Communications Boards (CS Series Only)



Indicators

Indicator	Color	Status	Meaning
RDY	Green	Lit	Operating normally, and protocol macro preparations have been completed.
		Flashing	Operating normally, and protocol macros are being prepared. (See note)
		Not lit	An error has occurred in the Serial Communications Board. Board/Unit error, CPU Unit watchdog timer error, Board watchdog timer error
COMM1	Yellow	Lit	Port 1 is being used for sending or receiving.
		Not lit	Port 1 is not being used for sending or receiving.
COMM2	Yellow	Lit	Port 2 is being used for sending or receiving.
		Not lit	Port 2 is not being used for sending or receiving.

Note Depending on the interval of flashing, the meaning is as follows:
Protocol data being initialized: 0.3 s
Protocol data being overwritten: 1.0 s
Protocol data error: 1.0 s and CPU Unit ERR/ALM indicator is flashing

CPU Unit Indicators

A Serial Communications Board is mounted as an Inner Board in the CPU Unit and thus affect the CPU Unit ERR/ALM indicator.

Indicator	Color	Status	Meaning	
ERR/ALM	Red	Lit	Fatal error	If a fatal error occurs, the CPU Unit will stop operation in either RUN or MONITOR mode.
		Flashing	Non-fatal error	If a non-fatal error occurs, the CPU Unit will continue operation in either RUN or MONITOR mode.
		Not lit	Normal operation	The CPU Unit is operating normally.

If an error in the Inner Board is the cause of the error indicated on the ERR/ALM indicator, information on the error will be stored in A424: Inner Board Error Information. Refer to *Inner Board Error Information* under *2-3-3 Related Auxiliary Area Bits.*

For actions required when an error occurs, refer to *Section 8 Troubleshooting and Maintenance*.

RS-232C Ports

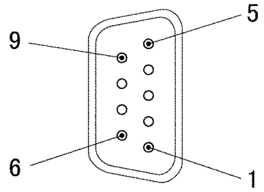
Port 1 and port 2 are RS-232C ports on the CS1W-SCB21-V1. Only port 1 is an RS-232C port on the CS1W-SCB41-V1.

Protocol	Host Link	Protocol macro	1:N NT Links
Communications method	Full-duplex	Full-duplex or half-duplex	Half-duplex
Synchronization	Start-stop synchronization (asynchronous)		
Baud rate	1,200/2,400/4,800/9,600/19,200/38,400/57,600/115,200 bps	1,200/2,400/4,800/9,600/19,200/38,400 bps	Standard NT link or high-speed NT link
Connections	1:1 (1:N is possible using Link Adapters)		
Transmission distance	15 m max. (see note 2)		
Interface	Complies with EIA RS-232C		

Note

1. High-speed NT link is only available with Serial Communications Boards/Units manufactured on or after December 20th, 1999. With earlier models, only standard NT link is available.
2. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

Connector Pin Layout



Pin No.	Abbreviation	Signal name	I/O
1 (see note 1)	FG	Shield	---
2	SD	Send data	Output
3	RD	Receive data	Input
4 (see note 2)	RTS (RS)	Request to send	Output
5 (see note 2)	CTS (CS)	Clear to send	Input
6 (see note 3)	5V	Power supply	---
7 (see note 2)	DSR (DR)	Data set ready	Input
8 (see note 2)	DTR (ER)	Data terminal ready (See note 4)	Output
9	SG	Signal ground	---
Shell (see note 1)	FG	Shield	---

Note

1. Pin No. 1 and the shell are connected to the ground terminal (GR) of the Power Supply Unit inside of the Serial Communications Board. Therefore, the cable shield can be grounded by grounding the GR of the Power Supply Unit.
2. The status of the RTS (RS), CTS (CS), DSR (DR), and DTR (ER) signals can be monitored in the words allocated in the CIO Area. For details, refer to *2-3 I/O Memory Allocations*.
3. Pin 6 (5 V) is required when the NT-AL001-E Link Adapter is connected. For details on connection methods, refer to *3-3 Wiring*.

4. The DSR signal is used to monitor the signal cable. It can also be used as a CD (carrier detect) signal. (The DSR signal does not affect system operation, and is available for use by the user.)

⚠ **Caution** Do not connect the 5-V power supply of Pin 6 to any external device other than an NT-AL001-E Link Adapter. Otherwise, the external device and the Serial Communications Board or Unit may be damaged.

The following cables are provided for connection to NT-AL001-E Link Adapters. We recommend that these cables be used.

NT-AL001-E connecting cables: XW2Z-070T-1 (0.7 m)
XW2Z-200T-1 (2 m)

Applicable Connectors

Plug: XM2A-0901 (manufactured by OMRON) or equivalent
Hood: XM2S-0911-E (manufactured by OMRON) or equivalent
One plug and one hood are provided for each port.

Recommended Cables

UL2426 AWG28 × 5P IFS-RVV-SB (UL-approved, Fujikura Ltd.)
AWG28 × 5P IFVV-SB (not UL-approved, Fujikura Ltd.)

UL2426-SB (MA) 5P × 28AWG (7/0.127) (UL-approved, Hitachi Cable, Ltd.)
CO-MA-VV-SB 5P × 28AWG (7/0.127) (not UL-approved, Hitachi Cable, Ltd.)

Cable length: 15 m max.

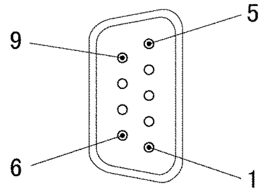
RS-422A/485 Port

Port 2 of the CS1W-SCB41-V1 is an RS-422A/485 port.

Protocol	Host Link	Protocol macro	1:N NT Links
Communications method	Full-duplex	Full-duplex or half-duplex	Half-duplex
Synchronization	Start-stop synchronous (asynchronous)		
Baud rate	1,200/2,400/4,800/ 9,600/19,200/ 38,400/57,600/ 115,200 bps	1,200/2,400/4,800/ 9,600/19,200/ 38,400 bps	Standard NT link or high-speed NT link
Connections	1:N (N: 32 Units max.)		1:N (N: 8 Units max.)
Transmission distance	500 m max. (The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)		
Interface	Complies with EIA RS-485		

Note High-speed NT link is only available with Serial Communications Boards/Units manufactured on or after December 20th, 1999. With earlier models, only standard NT link is available.

Connector Pin Layout



Pin No.	Abbreviation	Signal name	I/O
1 (see note 1)	SDA	Send data -	Output
2 (see note 1)	SDB	Send data +	Output
3	NC	Not used	---
4	NC	Not used	---
5	NC	Not used	---
6 (see note 1)	RDA	Receive data -	Input
7	NC	Not used	---
8 (see note 1)	RDB	Receive data +	Input
9	NC	Not used	---
Shell (see note 2)	FG	Shield	---

Note

1. When 2-wire connections are used, use Pins 1 and 2, or Pins 6 and 8.
2. The shell is connected to the ground terminal (GR) of the Power Supply Unit inside of the Serial Communications Board. Therefore, the cable shield can be grounded by grounding the GR of the Power Supply Unit.
3. With SDA/B or RDA/B, the signal polarity may be reversed by the remote device. Be sure to check the polarity before wiring.

Applicable Connectors

Plug: XM2A-0901 (OMRON) or equivalent
Hood: XM2S-0911-E (OMRON) or equivalent
One plug and one hood are provided for each port.

Recommended Cables

CO-HC-ESV-3P × 7/0.2 (manufactured by Hirakawa Hewtech Corp.)
Cable length: 500 m max. (The total combined cable length is 500 m max. T-branch lines must be a maximum of 10 m long.)

Terminating Resistance Switch: TERM

The terminating resistance switch is provided on the CS1W-SCB41-V1 only.

When an RS-422/485 port is used, set the switch to ON if the Serial Communications Board is on the end of the transmission line. Refer to *Section 3 Installation and Wiring* for the ON/OFF settings.

Label	Name	Settings	Factory setting
TERM	Terminating resistance switch	ON: Terminating resistance ON OFF: Terminating resistance OFF	OFF: Terminating resistance OFF

Note The status of terminating resistance setting can be monitored in the words allocated in the CIO Area. For details, refer to *2-3 I/O Memory Allocations*.

2-Wire or 4-Wire Switch: WIRE

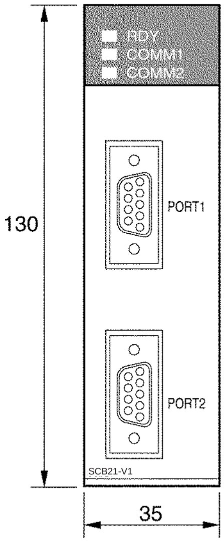
The 2-wire or 4-wire switch is provided on the CS1W-SCB41-V1 only.

When an RS-422/485 port is used, set the switch to “2” when 2-wire connections are used, and set the switch to “4” when 4-wire connections are used. For details, refer to *Section 3 Installation and Wiring*.

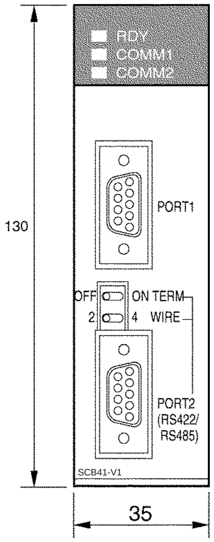
Label	Name	Settings	Factory setting
WIRE	2-wire or 4-wire switch	2: 2-wire 4: 4-wire	2: 2-wire

External Dimensions

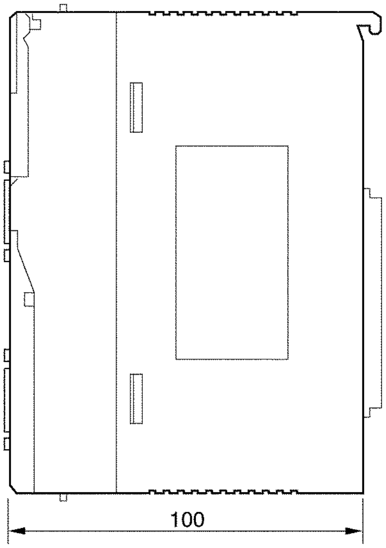
CS1W-SCB21-V1



CS1W-SCB41-V1

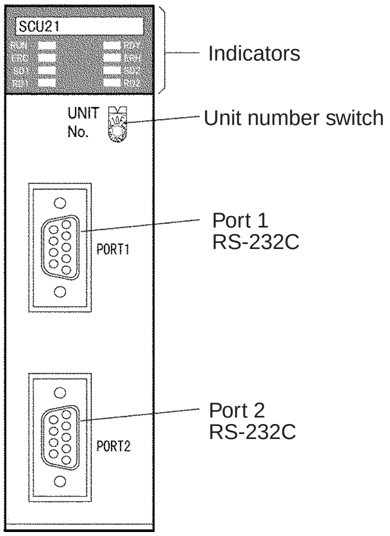


Mounted in the CPU Unit



2-1-2 CS-series Serial Communications Unit

CS1W-SCU21-V1



Indicators

Indicator	Color	Status	Meaning
RUN	Green	Lit	Operating normally
		Not lit	Unit hardware error.
RDY	Green	Lit	Protocol macro preparations have been completed.
		Flashing	Protocol macros are being prepared. (See Note 1.)
		Not lit	Hardware error in Serial Communications Unit.

Indicator	Color	Status	Meaning
ERH	Red	Lit	CPU Unit error, or this Unit has not been registered in the I/O table. Routing tables incorrectly registered in the Unit.
		Flashing	System Setup error (See note 2)
		Not lit	CPU Unit is operating normally and the Setup Area settings are normal.
ERC	Red	Lit	Unit hardware error, or loopback test error
		Flashing	Protocol data syntax error or protocol data error (SUM error).
		Not lit	Unit is operating normally.
SD1	Yellow	Lit	Port 1 is being used for sending.
		Not lit	Port 1 is not being used for sending.
RD1	Yellow	Lit	Port 1 is being used for receiving.
		Not lit	Port 1 is not being used for receiving.
SD2	Yellow	Lit	Port 2 is being used for sending.
		Not lit	Port 2 is not being used for sending.
RD2	Yellow	Lit	Port 2 is being used for sending.
		Not lit	Port 2 is not being used for sending.

Note

1. Depending on the interval of flashing, the meaning is as follows:
   Protocol data being initialized: 0.3 s
   Protocol data initialized, or being overwritten: 1.0 s
   Protocol data error: 1.0 s and CPU Unit ERC indicator is flashing
2. The Setup Area is allocated in the DM Area according to the unit number setting. For details, refer to *2-3 I/O Memory Allocations*.

For the action required when an error occurs, refer to *Section 8 Troubleshooting and Maintenance*.

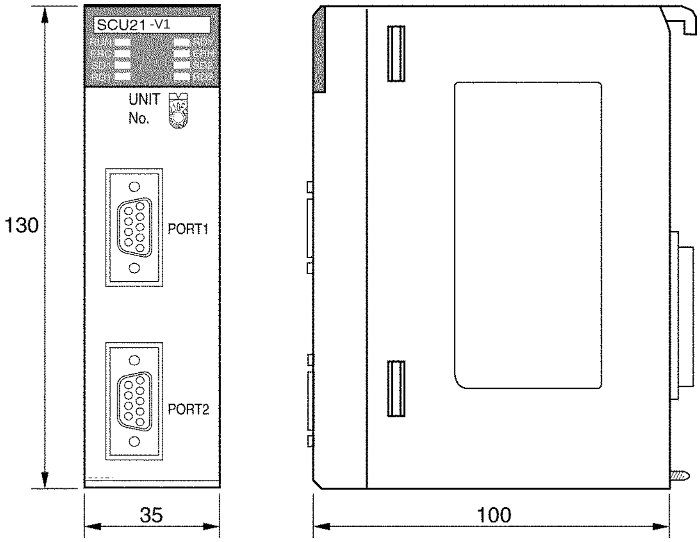
UNIT No. Switch: Unit Number

Set the CPU Bus Unit unit number for the Unit. The CIO Area and DM Area are allocated according to the unit number setting. The words that are allocated are used for the software switches, Status Area, and the System Setup. Set the unit number between 0 and F. The factory setting is for unit number 0.

RS-232C Ports

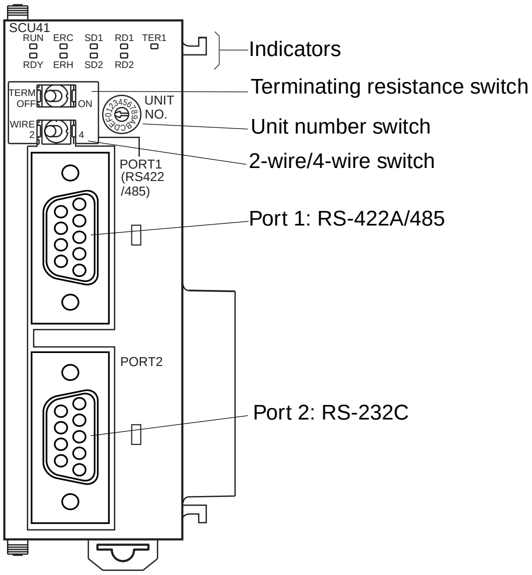
The specifications of the RS-232C are the same as those for the RS-232C port on the Serial Communications Board. See *RS-232C Ports* on page 49.

Dimensions (Unit: mm)



2-1-3 CJ-series Serial Communications Unit

CJ1W-SCU41



Indicators

Indicator	Color	Status	Meaning
RUN	Green	Lit	Operating normally
		Not lit	Unit hardware error.
RDY	Green	Lit	Protocol macro preparations have been completed.
		Flashing	Protocol macros are being prepared. (See Note 1.)
		Not lit	Hardware error in Serial Communications Unit.
ERH	Red	Lit	CPU Unit error, or this Unit has not been registered in the I/O table. Routing tables incorrectly registered in the Unit.
		Flashing	System Setup error (See note 2)
		Not lit	CPU Unit is operating normally and the Setup Area settings are normal.
ERC	Red	Lit	Unit hardware error
		Flashing	Protocol data syntax error or protocol data error (SUM error).
		Not lit	Unit is operating normally.
SD1	Yellow	Lit	Port 1 is being used for sending.
		Not lit	Port 1 is not being used for sending.
RD1	Yellow	Lit	Port 1 is being used for receiving.
		Not lit	Port 1 is not being used for receiving.
TER1	Yellow	Lit	Terminating resistance is connected internally for port 1.
		Not lit	Terminating resistance is not connected internally for port 1.
SD2	Yellow	Lit	Port 2 is being used for sending.
		Not lit	Port 2 is not being used for sending.
RD2	Yellow	Lit	Port 2 is being used for receiving.
		Not lit	Port 2 is not being used for receiving.

Note

1. Depending on the interval of flashing, the meaning is as follows:
   Protocol data being initialized: 0.3 s
   Protocol data initialized, or being overwritten: 1.0 s
   Protocol data error: 1.0 s and CPU Unit ERC indicator is flashing
2. The Setup Area is allocated in the DM Area according to the unit number setting. For details, refer to *2-3 I/O Memory Allocations*.

For the action required when an error occurs, refer to *Section 8 Troubleshooting and Maintenance*.

Unit Number Switch

Set the CPU Bus Unit unit number for the Unit. The CIO Area and DM Area are allocated according to the unit number setting. The words that are allocated are used for the software switches, Status Area, and the System Setup. Set the unit number between 0 and F. The factory setting is for unit number 0.

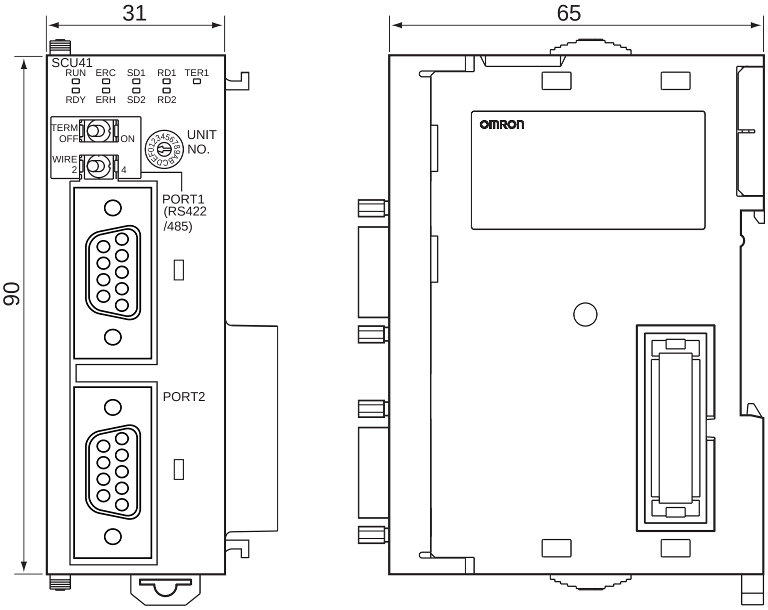
RS-422A/485 Port: Port 1

The specifications of the RS-422A/485 are the same as those for the -RS-422A/485 port on the Serial Communications Board. See *RS-422A/485 Port* on page 50.

RS-232C Port: Port 2

The specifications of the RS-232C are the same as those for the RS-232C port on the Serial Communications Board. See *RS-232C Ports* on page 49.

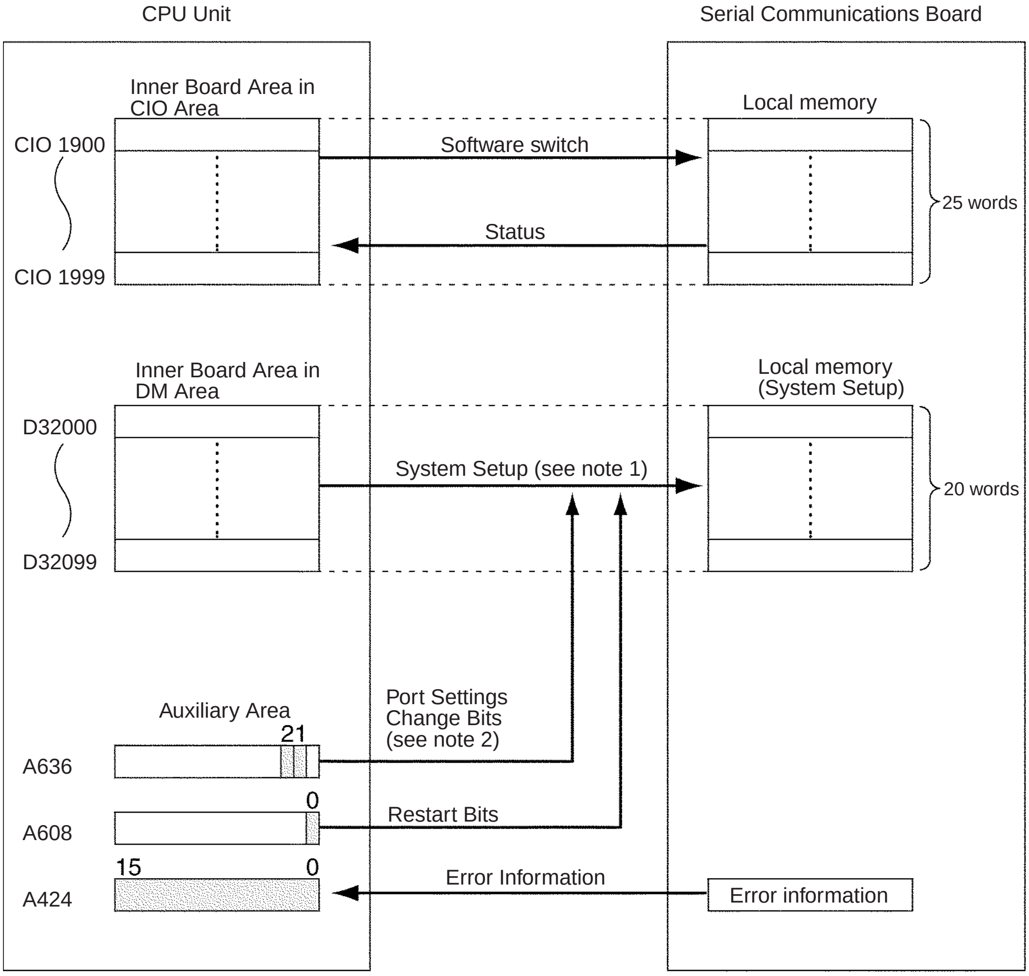
Dimensions (Unit: mm)



2-2 Data Exchange with the CPU Unit

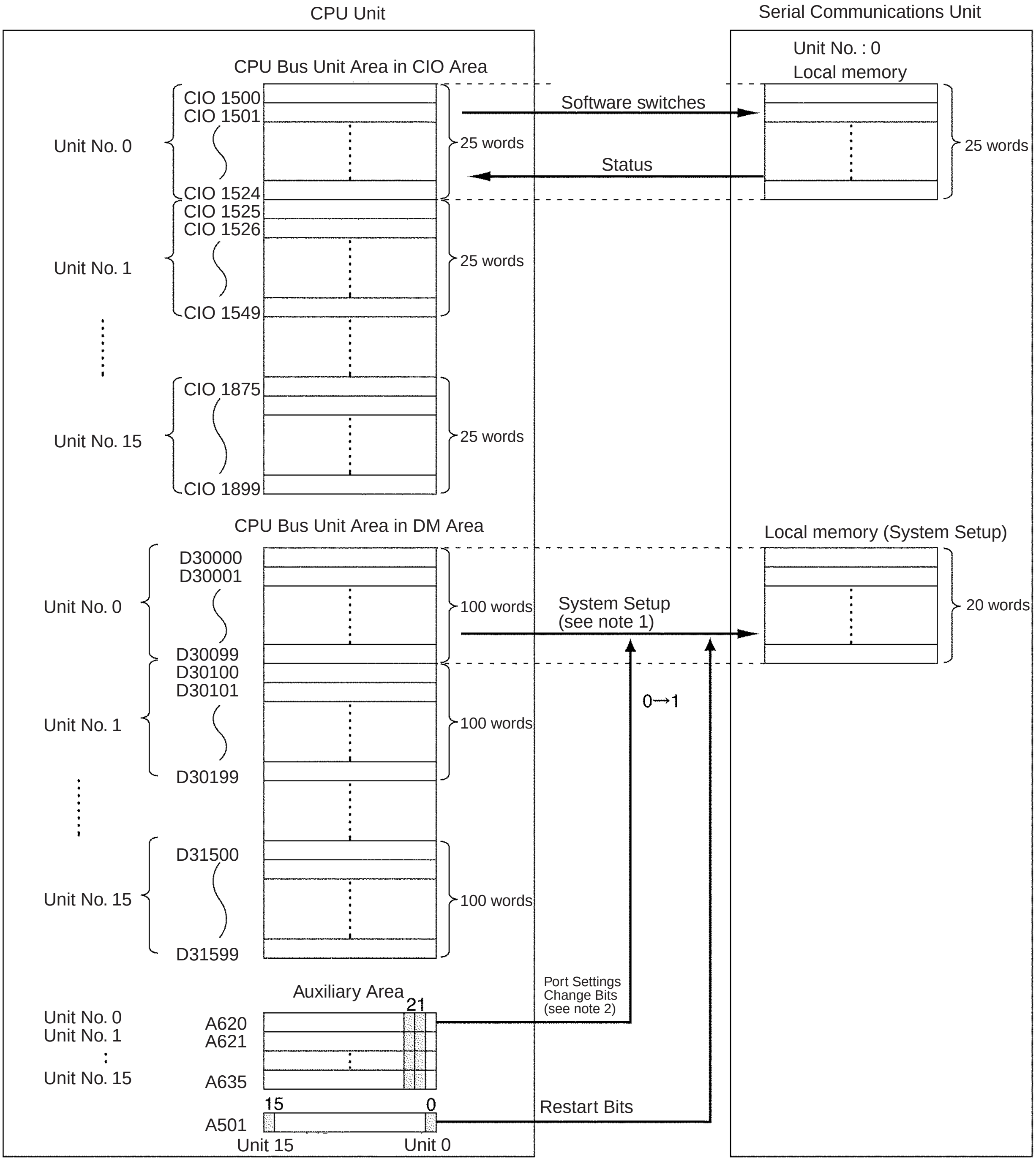
Data exchange with the CPU Units uses the I/O memory allocated to the Serial Communications Board and Serial Communications Unit. For details on allocations, refer to *2-3 I/O Memory Allocations*.

2-2-1 Serial Communications Board (CS Series Only)



Note
1. Set the Serial Communications Board mode and the communications settings (System Setup) in the words allocated in the DM Area. Use a Programming Device, such as a Programming Console or the CX-Programmer, to make these settings. The System Setup is transferred to the Serial Communications Board at the following times:
   - When the power to the CPU Unit is turned ON, when the Serial Communications Board is restarted (A60800 is turned ON), or when the STUP(237) instruction is executed.
   - When the Port 1 Port Settings Change Bit (A63601) or Port 2 Port Settings Change Bit (A63602) is turned ON.
2. When STUP(237) is executed, the CPU Unit automatically turns ON the Port 1 or Port 2 Port Settings Change Bit and updates the System Setup. For details on the STUP(237) instruction, see *Appendix O Changing Communications Port Settings Using STUP(237)*.

2-2-2 Serial Communications Units (CS/CJ Series)



Note 1. Set the Serial Communications Unit mode and the communications settings (System Setup) in the words allocated in the DM Area. Use a Programming Device, such as a Programming Console or the CX-Programmer, to make these settings. The System Setup is transferred to the Serial Communications Unit at the following times:

- When the power to the CPU Unit is turned ON, when the Serial Communications Unit is restarted (a bit between A50100 to A50115 is turned ON), or when the STUP(237) instruction is executed.

- When the Port 1 Port Settings Change Bit (a bit between A62001 to A63501 (see note a)) or Port 2 Port Settings Change Bit (a bit between A62002 to A63502 (see note b)) is turned ON.

Note a) Bits are allocated in the following order: Unit number 0: A62001, unit number 1: A62101, unit number 2: A62201, and so on through unit number F: A63501.

b) Bits are allocated in the following order: Unit number 0: A62002, unit number 1: A62102, unit number 2: A62202 and so on through unit number F: A63502.

2. When STUP(237) is executed, the CPU Unit automatically turns ON the Port 1 or Port 2 Port Settings Change Bit and updates the System Setup. For details on the STUP(237) instruction, see *Appendix O Changing Communications Port Settings Using STUP(237)*.

2-3 I/O Memory Allocations

This section explains the DM Area, CIO Area, and Auxiliary Area allocations to the Serial Communications Boards and Serial Communications Units. The Serial Communications Board uses the allocations for the Inner Board of the CPU Unit. The Serial Communications Unit is allocated I/O memory as a CPU Bus Unit according to the unit number setting.

2-3-1 DM Area

Serial Communications Boards (CS Series Only)

The Setup Area allocated in the DM Area consists of 20 words between D32000 and D32767. These words are used to set the serial communications mode, communications specifications, and other settings for the Serial Communications Board.

The 10 words from D32000 to D32009 are used for port 1, and the 10 words from D32010 to D32019 are used for port 2. The remaining words are reserved for the system.

Setup Area Allocated in the DM Area

D32000 to D32767

Words	Usage
D32000 to D32009	Port 1 Settings
D32010 to D32019	Port 2 Settings
D32020 to D32767	Reserved for the system

Serial Communications Units (CS/CJ Series)

The Setup Area allocated in the DM Area is used to set the serial communications mode, communications specifications, and other settings for the Serial Communications Units. The words from D30000 to D31599 (100 words per Unit × 16 Units) are allocated according to the unit number settings.

The first 10 words are used for port 1, and the next 10 words are used for port 2. The other 80 words are reserved for the system.

m = D30000 + 100 × unit number

Unit No.	Words
Unit No. 0	D30000 to D30099
Unit No. 1	D30100 to D30199
Unit No. 2	D30200 to D30299
Unit No. 3	D30300 to D30399
Unit No. 4	D30400 to D30499
Unit No. 5	D30500 to D30599
Unit No. 6	D30600 to D30699
Unit No. 7	D30700 to D30799
Unit No. 8	D30800 to D30899
Unit No. 9	D30900 to D30999
Unit No. A	D31000 to D31099
Unit No. B	D31100 to D31199
Unit No. C	D31200 to D31299
Unit No. D	D31300 to D31399
Unit No. E	D31400 to D31499
Unit No. F	D31500 to D31599

m to m + 9: Port 1 Settings
m + 10 to m + 19: Port 2 Settings
m + 20 to m + 99: Reserved for the system

Setting the Setup Areas

The following methods can be used to set the Unit settings in the Setup Areas.

- Use a Programming Device, such as a Programming Console (see note a), CX-Protocol, or CX-Programmer.
- Use the STUP(237) instruction (see note b) in the ladder diagram program. If it is necessary to change the System Setup while the ladder diagram program is being executed, use this method to change the System Setup.

Note a) If settings are changed from a Programming Device, cycle the power to the CPU Unit, use a Restart Bit to restart the Unit or Board, or use the Port Settings Change Bits to restart the port. Refer to *2-2 Data Exchange with the CPU Unit* for the specific addresses to use.

b) For the procedure used to change the System Setup using the STUP(237) instruction, refer to *Appendix O Changing Communications Port Settings Using STUP(237)*.

The usage of the System Setup differs according to the serial communications mode. For details, refer to the following sections.

Host Link communications:	*Section 4 Using Host Link Communications*.
Protocol macros:	*Section 5 Using Protocol Macros*.
1:N NT Links:	*Section 6 Using 1:N NT Links*.
Loopback test:	*Section 7 Loopback Test*.

Setup Area

m = D30000 + 100 × unit number

<table>
<tr><th colspan="4">Words</th><th rowspan="3">Bit</th><th rowspan="3" colspan="2">Setting contents</th></tr>
<tr><th colspan="2">Board
(CS Series only)</th><th colspan="2">Unit
(CS/CJ Series)</th></tr>
<tr><th>Port 1</th><th>Port 2</th><th>Port 1</th><th>Port 2</th></tr>
<tr><td rowspan="9">D32000</td><td rowspan="9">D32010</td><td rowspan="9">m</td><td rowspan="9">m + 10</td><td>15</td><td colspan="2">Port settings (see note 1) 0: Defaults; 1: User settings</td></tr>
<tr><td>12 to 14</td><td colspan="2">Reserved</td></tr>
<tr><td>08 to 11</td><td colspan="2">Serial communications mode (see note 2)
0: Default (Host Link); 2: 1:N NT Links (see note 3); 5: Host Link; 6: Protocol macro; F: Loopback test</td></tr>
<tr><td>05 to 07</td><td colspan="2">Reserved</td></tr>
<tr><td>04</td><td colspan="2">Start bits
0: 1 bit; 1: 1 bit (1 start bit is always used regardless of this setting)</td></tr>
<tr><td>03</td><td colspan="2">Data length 0: 7 bits; 1: 8 bits</td></tr>
<tr><td>02</td><td colspan="2">Stop bits 0: 2 bits; 1: 1 bit</td></tr>
<tr><td>01</td><td colspan="2">Parity 0: Yes; 1: No</td></tr>
<tr><td>00</td><td colspan="2">Parity 0: Even; 1: Odd</td></tr>
<tr><td rowspan="2">D32001</td><td rowspan="2">D32011</td><td rowspan="2">m + 1</td><td rowspan="2">m + 11</td><td>04 to 15</td><td colspan="2">Reserved</td></tr>
<tr><td>00 to 03</td><td colspan="2">Baud rate (Unit: bps) (see note 4)
0: Default (9,600); 3: 1,200; 4: 2,400; 5: 4,800; 6: 9,600; 7: 19,200; 8: 38,400; 9: 57,600; A: 115,200</td></tr>
<tr><td rowspan="2">D32002</td><td rowspan="2">D32012</td><td rowspan="2">m+ 2</td><td rowspan="2">m + 12</td><td>15</td><td rowspan="5">Host Link</td><td>Send delay time 0: Default (0 ms); 1: Setting in bits 00 to 14</td></tr>
<tr><td>00 to 14</td><td>Send delay (0000 to 7530 hex) (Unit: 10 ms)</td></tr>
<tr><td rowspan="3">D32003</td><td rowspan="3">D32013</td><td rowspan="3">m + 3</td><td rowspan="3">m + 13</td><td>15</td><td>CTS control (see note 5) 0: No; 1:Yes</td></tr>
<tr><td>08 to 14</td><td>Reserved</td></tr>
<tr><td>00 to 07</td><td>Host Link unit number (00 to 1F hex)</td></tr>
<tr><td>D32004</td><td>D32014</td><td>m + 4</td><td>m + 14</td><td>00 to 15</td><td colspan="2">Reserved</td></tr>
<tr><td>D32005</td><td>D32015</td><td>m + 5</td><td>m + 15</td><td>00 to 15</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="2">D32006</td><td rowspan="2">D32016</td><td rowspan="2">m + 6</td><td rowspan="2">m + 16</td><td>03 to 15</td><td colspan="2">Reserved</td></tr>
<tr><td>00 to 02</td><td colspan="2">1:N NT Links maximum unit number (0 to 7)</td></tr>
<tr><td>D32007</td><td>D32017</td><td>m + 7</td><td>m + 17</td><td>00 to 15</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="2">D32008</td><td rowspan="2">D32018</td><td rowspan="2">m + 8</td><td rowspan="2">m + 18</td><td>15</td><td colspan="2">Protocol macro transmission method 0: Half-duplex; 1:Full-duplex</td></tr>
<tr><td>00 to 14</td><td colspan="2">Reserved</td></tr>
<tr><td>D32009</td><td>D32019</td><td>m + 9</td><td>m + 19</td><td>00 to 15</td><td colspan="2">Maximum number of bytes in protocol macro send/receive data (00C8 to 03E8) (see note 6)</td></tr>
</table>

Note

1. The default settings used are as follows: Baud rate: 9,600 bps, start bits: 1 bit, data length: 7 bits, parity: even, and stop bits: 2 bits (with the Host Link, protocol macro, and loopback test serial communications modes).
2. A System Setup error will occur if 1, 3, 4, or 7 to E is set, and the Unit will operate with the default Host Link settings (9,600 bps, unit number 00).
3. The PTs connected to the port must also be set for a 1:N NT Link. Communications will not be possible if a PT is set for a 1:1 NT Link.
4. Do not set B to F settings, and baud rates that are not supported by the serial communications mode. A System Setup error will result. Settings of 1 and 2 are reserved for the system and should not be used.
5. With CTS control, turn ON the request to send (RTS) signal before stating to send, and be sure the clear to send (CTS) signal is ON before sending data. When there is no CTS control, turn ON the request to send (RTS) signal before sending, and then send data without checking the request to send (RTS) signal.

6. For settings below 00C8, use 00C8 Hex; for settings above 03E8, use 03E8 Hex.

2-3-2 CIO Area

Words in the CIO Area are allocated as Software Switches, which are manipulated from the CPU Unit to control the operation of the Serial Communications Board or Unit, and for a Status Area, which contains status and error information for the Serial Communications Board or Unit.

Serial Communications Boards (CS Series Only)

Words CIO 1900 to CIO 1999 in the Inner Board Area are used for the Software Switches and Status Area. CIO 1900 contains software switches, and the 24 words from CIO 1901 to CIO 1924 are used for the Status Area.

Inner Board CIO Area
CIO 1900 to CIO 1999

Words	Usage
CIO 1900	Software switch
CIO 1901 to CIO 1904	Board status
CIO 1905 to CIO 1914	Port 1 status
CIO 1915 to CIO 1924	Port 2 status
CIO 1925 to CIO 1999	Reserved for the system

Serial Communications Units (CS/CJ Series)

Words are allocated in the CIO Area for Software Switches and Status Area. Words CIO 1500 to CIO 1899 in the CPU Bus Unit Area in the CIO Area are allocated according to the unit number setting. Each Unit is allocated 25 words. The first word is used for Software Switches, and the remaining 24 words are used for the Status Area.

CPU Bus Unit Area
CIO 1500 to CIO 1899

n = CIO 1500 + 25 × unit number

Unit No.	Words
Unit No. 0	CIO 1500 to CIO 1524
Unit No. 1	CIO 1525 to CIO 1549
Unit No. 2	CIO 1550 to CIO 1574
Unit No. 3	CIO 1575 to CIO 1599
Unit No. 4	CIO 1600 to CIO 1624
Unit No. 5	CIO 1625 to CIO 1649
Unit No. 6	CIO 1650 to CIO 1674
Unit No. 7	CIO 1675 to CIO 1699
Unit No. 8	CIO 1700 to CIO 1724
Unit No. 9	CIO 1725 to CIO 1749
Unit No. A	CIO 1750 to CIO 1774
Unit No. B	CIO 1775 to CIO 1799
Unit No. C	CIO 1800 to CIO 1824
Unit No. D	CIO 1825 to CIO 1849
Unit No. E	CIO 1850 to CIO 1874
Unit No. F	CIO 1875 to CIO 1899

n: Software switches (Ports 1 and 2)
n + 1 to n + 4: Unit status
n + 5 to n + 14: Port 1 status
n + 15 to n + 24: Port 2 status

Software Switches

Software Switches are used to output control signals from the CPU Unit to the Serial Communications Board or Unit. The software switches are used for loopback tests and to abort, release wait status, and control other functions for protocol macros. For details on the software switch functions, refer to *Section 5 Using Protocol Macros* and *Section 7 Loopback Test*.

n = CIO 1500 + 25 × unit number

Words		Bit	Function	
Board (CS only)	Unit (CS/ CJ)			
CIO 1900	n	15	Port 2	Reserved
		14		Loopback Test Switch (loopback tests) 1: Start, 0: Stop
		13		Reserved
		12		Reserved
		11		Abort Switch (protocol macros) 1: Abort, 0: Aborted
		10		One-shot Trace Switch (protocol macros, see note) 1: Start, 0: Stop
		09		Continuous Trace Switch (protocol macros, see note) 1: Start, 0: Stop
		08		Wait Release Switch (protocol macros) 1: Release wait, 0: Wait released
		07	Port 1	Reserved
		06		Loopback Test Switch (loopback tests) 1: Start, 0: Stop
		05		Reserved
		04		Reserved
		03		Abort Switch (protocol macros) 1: Abort, 0: Aborted
		02		One-shot Trace Switch (protocol macros, see note) 1: Start, 0: Stop
		01		Continuous Trace Switch (protocol macros, see note) 1: Start, 0: Stop
		00		Wait Release Switch (protocol macros) 1: Release wait, 0: Wait released

Note The One-shot Trace Switch and Continuous Trace Switch are used for the Serial Communications Board/Unit only when executing traces from the CX-Protocol in protocol macro mode. Do not manipulate these switches from a ladder diagram.

Status Area

The Status Area is used for status information input from Serial Communications Board or Unit to the CPU Unit. The Status Area is where the Serial Communications Board or Unit sets communications status, the transmission control signal status, the transmission error status, and the protocol status.

n = CIO 1500 + 25 × unit number

Words				Bit	Contents		
Board (CS Series only)		Unit (CS/CJ Series)					
Port 1	Port 2	Port 1	Port 2				
CIO 1901		n + 1		02 to 15	Reserved		
				01	1: Error log EEPROM error	0: Error log EEPROM normal	
				00	1: Protocol data error	0: Protocol data normal	
CIO 1902		n + 2		00 to 15	Reserved		
CIO 1903		n + 3		00 to 15	Reserved		
CIO 1904		n + 4		00 to 15	Reserved		
CIO 1905	CIO 1915	n + 5	n + 15	12 to 15	Port setting status	Serial communications mode (See note 1)	Serial communications mode
				08 to 11			Baud rate
				05 to 07			Reserved
				04			Start bits: Always 1
				03			Data length: 7 or 8 bits
				02			Stop bits: 1 or 2 bits
				01			Parity: Yes/No
				00			Parity: Even/Odd
CIO 1906	CIO 1916	n + 6	n + 16	15		Hardware settings (See note 2)	0 0 No 0 1 RS-232C 1 0 RS-422A/485 1 1 Reserved
				14			
				13			0: Terminating resistance OFF 1: Terminating resistance ON
				12 to 02		Reserved	
				01		1: System Setup error; 0: System Setup normal	
				00		1: Port operating; 0: Port stopped	
CIO 1907	CIO 1917	n + 7	n + 17	15 to 11	Communications status	Reserved	
				10		1: Remote Unit busy receiving (Flow control) 0: Remote Unit ready to receive	
				09		Reserved	
				08		1: Local Unit busy receiving (Flow control) 0: Local Unit ready to receive	
				07	Transmission control signal status	DTR (ER) signal	
				06		DSR (DR) signal	
				05		Reserved	
				04		CTS (CS) signal	
				03		RTS (RS) signal	
				00 to 02		Reserved	

Words				Bit	Contents	
Board (CS Series only)		Unit (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1908	CIO 1918	n + 8	n + 18	15	Transmission error status	1: Transmission error (See note 3); 0: No transmission error
				14		1: Tfs (send finished monitoring time) exceeded (See note 4); 0: Normal
				13		1: Tfr (receive finished monitoring time) exceeded (See note 4); 0: Normal
				12		1: Tr (receive wait monitoring time) exceeded (See note 4) 0: Normal
				08 to 11		Number of retries (See note 4)
				07		1: FCS check error (See note 4); 0: FCS check normal
				06		1: Command error (See note 4); 0: No command error
				05		1: Timeout (Tfs, Tfr, or Tr) error (See note 4); 0: Normal
				04		1: Overrun error (See note 5); 0: Normal
				03		1: Framing error (See note 5); 0: Normal
				02		1: Parity error (See note 5); 0: Normal
				00, 01		Reserved
CIO 1909 to CIO 1914	CIO 1919 to CIO 1924	n + 9 to n + 14	n + 19 to n + 24	00 to 15	Protocol status (See *Protocol Status* on page 64.)	

Note

1. The port settings in the Setup Area allocated in the DM Area is read. For details on the contents that are read, see *2-3-1 DM Area*. If a System Setup error occurs, the default settings will be read.
2. The port types for the Serial Communications Board or Unit and the terminating resistance switch setting are read.
3. Turned ON if an overrun error (bit 04), a framing error (bit 03), or a parity error (bit 02) occurs with the Host Link mode. If any of the error bits 00 to 14 turns ON in the protocol macro mode but then communications are recovered within the specified number of retries, the bit will turn OFF. The bit will remain ON if recovery is not possible within the specified number of retries.
4. Used only with protocol macros. Not used with any other serial communications mode.
5. Used with Host Link communications or protocol macros. Not used with any other serial communications mode.

Protocol Status

The protocol status is used in protocol macro mode, NT Link mode, or loopback tests. It is not used with other modes. The contents depend on the serial communications mode, as shown in the following tables.

Protocol Macro Mode

n = CIO 1500 + 25 × unit number

Words				Bit	Contents	
Board (CS Series only)		Unit (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1909	CIO 1919	n + 9	n + 19	15	Port operating status	Protocol Macro Executing Flag
				14		Step Troubleshooting Flag
				13		Aborted Flag
				12		Tracing Flag
				11		Sequence End Completion Flag
				10		Sequence Abort Completion Flag
				09		Sequence Waiting Flag
				04 to 08		Reserved
				00 to 03		Error codes 0: No error 2: Sequence number error 3: Data read/write area exceeded error 4: Protocol data syntax error 5: CPU Unit error
CIO 1910	CIO 1920	n + 10	n + 20	12 to 15	Reserved	
				00 to 11	Send/Receive Sequence Number 000 to 999 (000 to 3E7 hex)	
CIO 1911	CIO 1921	n + 11	n + 21	12 to 15	Reserved	
				08 to 11	Executed Step Number (code) 0 to 15 (0 to F hex)	
				04 to 07	Reserved	
				00 to 03	Executed Reception Case Number (code) 0 to 15 (0 to F hex)	
CIO 1912	CIO 1922	n + 12	n + 22	00 to 15	Executed Reception Case Number Storage Flag 0 to 15: Correspond to bits 00 to 15	
CIO 1913	CIO 1923	n + 13	n + 23	00 to 15	Executed Step Number Storage Flag 0 to 15: Correspond to bits 00 to 15	
CIO 1914	CIO 1924	n + 14	n + 24	08 to 15	Repeat Counter Setting Value 0 to 255 (00 to FF hex)	
				00 to 07	Repeat Counter Present Value 0 to 255 (00 to FF hex)	

NT Links

n = CIO 1500 + 25 × unit number

Words				Bit	Contents
Board (CS Series only)		Unit (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
CIO 1909	CIO 1919	n + 9	n + 19	08 to 15	PT Priority Registered Flag
				00 to 07	PT Communications Flag
CIO 1910 to CIO 1914	CIO 1920 to CIO 1924	n + 10 to n + 14	n + 20 to n + 24	00 to 15	Reserved

Loopback Tests

n = CIO 1500 + 25 × unit number

Words				Bit	Contents	
Board (CS Series only)		Unit (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1909	CIO 1919	n + 9	n + 19	15	Test status	1: Error; 0: Normal
				09 to 14		Reserved
				08		1: DSR (DR) signal check error; 0: Normal
				07		1: CTS (CS) signal check error; 0: Normal
				06		Reserved
				05		1: Timeout error; 0: Normal
				04		1: Parity error; 0: Normal
				03		1: Overrun error; 0: Normal
				02		1: Framing error; 0: Normal
				01		Reserved
				00		1: Conveyor error; 0: Normal
CIO 1910	CIO 1920	n + 10	n + 20	00 to 15	Number of tests executed	
CIO 1911	CIO 1921	n+11	n+21	00 to 15	Number of test errors	
CIO 1912 to CIO 1914	CIO 1922 to CIO 1924	n + 12 to n + 14	n + 22 to n + 24	00 to 15	Reserved	

2-3-3 Related Auxiliary Area Bits

Serial Communications Boards (CS Series Only)

Port 1 and Port 2 Port Settings Change Bits

These bits can be turned ON from the program using the OUT or other instructions to change communications settings and restart the Serial Communications Board ports. When changing the settings and restarting the port have been completed, the bit will automatically be turned OFF.

Note These bits are used both to change the port settings and to restart the port at the same time. One of these bits can be turned ON to restart a port without changing the port settings in the Setup Area allocated in the DM Area. The STUP(237) instruction can also be used to just restart a communications port by executing STUP(237) with the same port settings as the ones already being used.

Word	Bit	Contents
A636	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Inner Board Error Information

Word	Bit	Contents	
A424	12 to 15	Non-fatal errors (Note 1)	Reserved
	11		1 Error log EEPROM error; 0: Normal
	10		1: Protocol macro execution error; 0: Normal This bit will be turned ON when code 3, 4, or 5 is stored in the error code for bits 00 to 03 of CIO 1909 or CIO 1919 in the CIO Area,
	09		1: Protocol data error (SUM error); 0: Normal
	08		1: System Setup error; 0: Normal
	07		1: Routing table error; 0: Normal
	06		Reserved
	05		1: Cyclic monitoring error; 0: Normal
	04		Reserved
	03	Fatal errors (Note 2)	Reserved
	02		Reserved
	01		1: Inner Bus error; 0: Normal
	00		1: Inner Board watchdog timer error; 0: Normal

Note

1. When any one of bits 04 to 11 is ON, A40208 (Inner Board Error Flag) (non-fatal error) will be ON.
2. When bit 00 or 01 is ON, A40112 (Inner Board Fatal Error Flag) will be ON.

For details on each type of error, refer to *Section 8 Troubleshooting and Maintenance*.

Restart Bit: A60800

The Restart Bit can be turned ON and then OFF to restart the Serial Communications Board without turning OFF the PC power supply.

Bit	Function
A60800	Inner Board Restart Bit

Serial Communications Units (CS/CJ Series)

Port 1 and Port 2 Port Settings Change Bits

These bits can be turned ON from the program using the OUT or other instructions to change communications settings and restart the Serial Communications Unit ports. When changing the settings and restarting the port have been completed, the bit will automatically be turned OFF. The port 1 or port 2 Port Settings Change Bits and Restart Bits are allocated in the Auxiliary Area according to the unit number as shown below.

Note These bits are used both to change the port settings and to restart the port at the same time. One of these bits can be turned ON to restart a port without changing the port settings in the Setup Area allocated in the DM Area. The STUP(237) instruction can also be used to just restart a communications port by executing STUP(237) with the same port settings as the ones already being used.

n = A620 + unit number

Words	Bit	Contents
n	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Unit	Port 1 Settings Change Bit	Port 2 Settings Change Bit
Unit No. 0	A62001	A62002
Unit No. 1	A62101	A62102
Unit No. 2	A62201	A62202
Unit No. 3	A62301	A62302
Unit No. 4	A62401	A62402
Unit No. 5	A62501	A62502
Unit No. 6	A62601	A62602
Unit No. 7	A62701	A62702
Unit No. 8	A62801	A62802
Unit No. 9	A62901	A62902
Unit No. A	A63001	A63002
Unit No. B	A63101	A63102
Unit No. C	A63201	A63202
Unit No. D	A63301	A63302
Unit No. E	A63401	A63402
Unit No. F	A63501	A63502

Restart Bit

A Restart Bit can be turned ON and then OFF to restart the Serial Communications Board without turning OFF the PC power supply.

Unit	Function
A50100	Unit No. 0 Restart Bit
A50101	Unit No. 1 Restart Bit
A50102	Unit No. 2 Restart Bit
A50103	Unit No. 3 Restart Bit
A50104	Unit No. 4 Restart Bit
A50105	Unit No. 5 Restart Bit
A50106	Unit No. 6 Restart Bit
A50107	Unit No. 7 Restart Bit
A50108	Unit No. 8 Restart Bit
A50109	Unit No. 9 Restart Bit
A50110	Unit No. A Restart Bit
A50111	Unit No. B Restart Bit
A50112	Unit No. C Restart Bit
A50113	Unit No. D Restart Bit
A50114	Unit No. E Restart Bit
A50115	Unit No. F Restart Bit

SECTION 3
Installation and Wiring

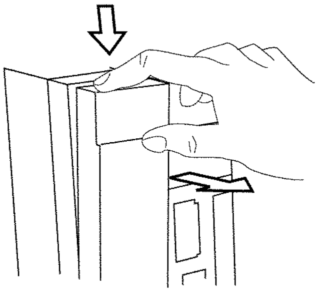
This section describes how to mounting the Serial Communications Board and Serial Communications Units, and how to connect the ports to external devices.

3-1 Installing a Serial Communications Board

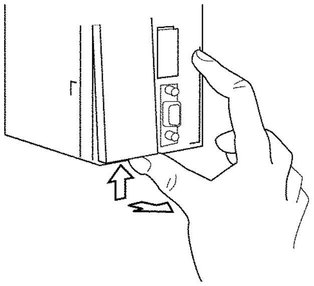
Installation Procedure This section describes how to install a Serial Communications Board in the option slot of a CPU Unit. Only one Serial Communications Board can be installed in each CPU Unit.

Note
1. Always turn OFF the power before installing or removing the Serial Communications Board. Installing or removing the Serial Communications Board with the power ON can cause the CPU Unit to malfunction, damage internal components, or cause communications errors.
2. Before handling the Serial Communications Board, touch a grounded metallic object in order to discharge any static build-up from your body.

1,2,3...
1. Press the catches at the top and bottom of the Inner Board compartment cover.

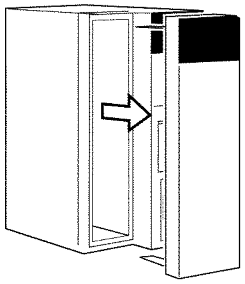


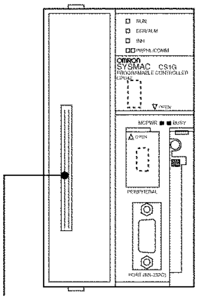
Press the top catch.



Press the bottom catch.

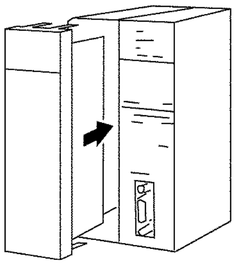
2. Remove the Inner Board compartment cover.





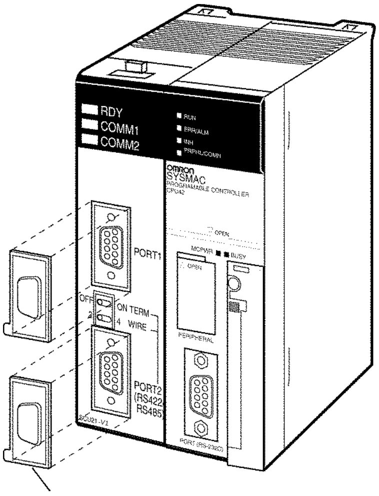
Inner Board Connector

3. Insert the Serial Communications Board.



3-1-1 Precautions in Handling the Board

- Turn OFF the power supply to the CPU Unit before mounting or connecting the Board.
- Separate the port connector lines from the high-tension or power lines to reduce external noise.
- Leave the port cover attached when not using a communications port.



Port cover

3-2 Installing Serial Communications Units

3-2-1 System Configuration Precautions

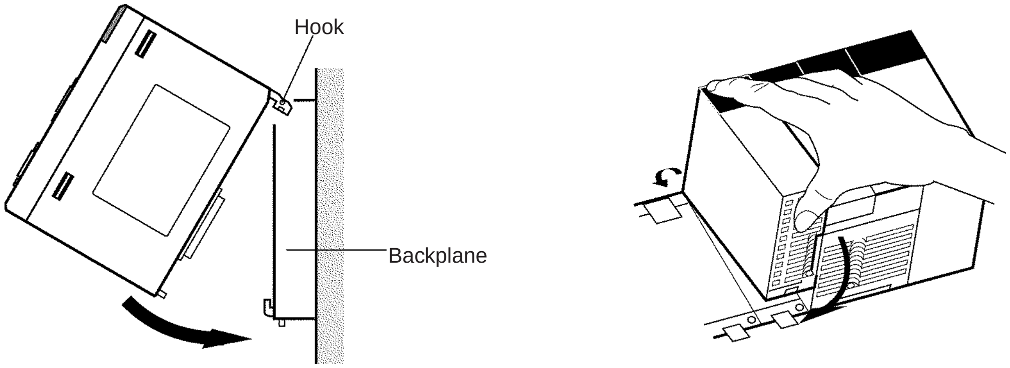
- Words in I/O memory are allocated to the Serial Communications Unit according to the setting of the unit number switch on the front panel of the Unit. Allocations are not affected by the slot in which the Unit is mounted. Refer to *2-3 I/O Memory Allocations*.
- For CS-series PCs, Serial Communications Units can be mounted to CS1W-BC□□8 CPU Backplanes and CS1W-BI□□3 Expansion Backplanes. Up to 16 Serial Communications Units can be mounted for each PC (as long as no other CPU Bus Units are mounted).
- For CJ-series PCs, Serial Communications Units can be connected in the CPU Rack or Expansion Rack. (No more than 10 optional Units can be connected in each Rack.) Up to 16 Serial Communications Units can be connected in each PC (as long as no other CPU Bus Units are mounted).

3-2-2 CS-series Serial Communications Unit

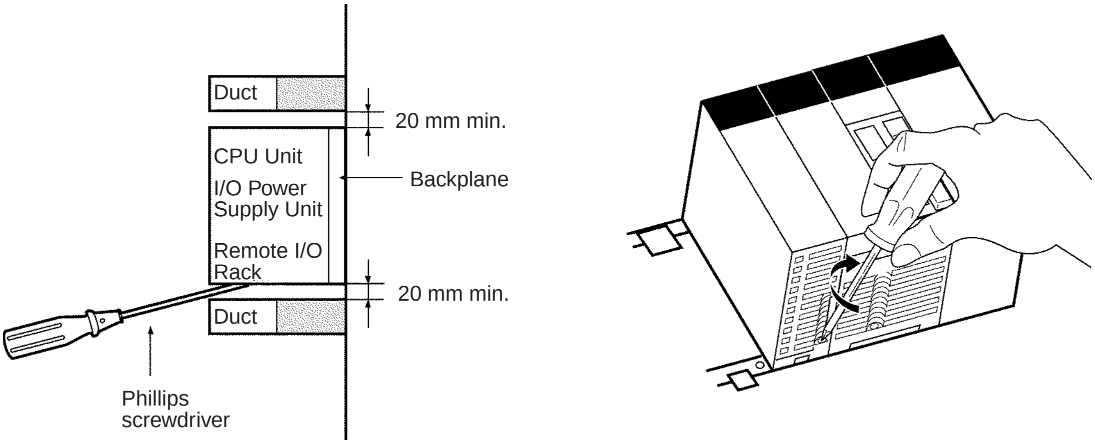
Use the following steps to mount or remove Serial Communications Units.

1,2,3...

1. Mount the Unit to the Backplane by hooking the top of the Unit into the slot on the Backplane and rotating the Unit downwards.

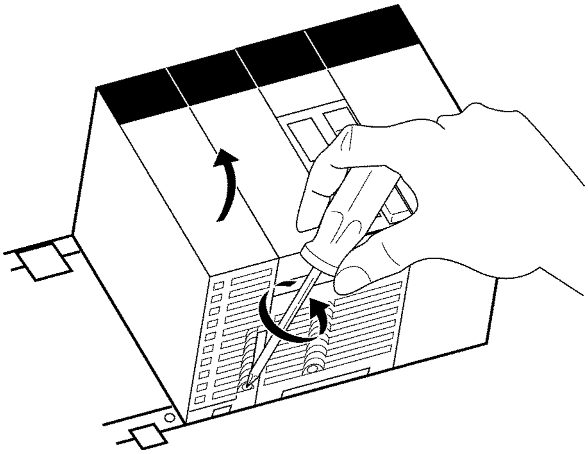


2. Make sure that the connector on the back of the Unit is properly inserted into the connector in the Backplane.
3. Use a Phillips screwdriver to tighten the screw on the bottom of the Unit. The screwdriver must be held at a slight angle, so be sure to leave enough space below the Rack.



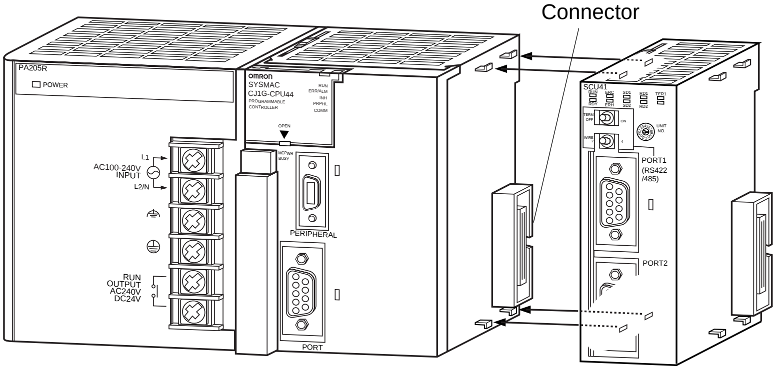
Note Tighten the screw to a torque of 0.4 N-m.

To remove the Unit, loosen the screw with a Phillips screwdriver, rotate the Unit upwards, and then remove it.

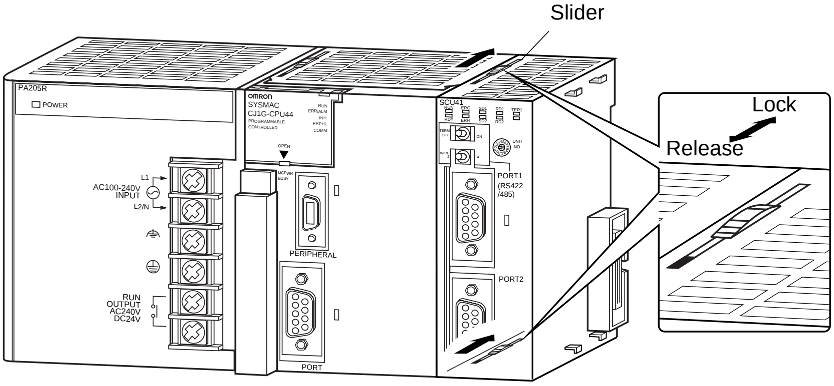


3-2-3 CJ-series Serial Communications Unit

1,2,3... 1. Align the connectors properly and then press in on the Unit to connect it.



2. Slide the sliders on the top and bottom of the Unit until they lock the Units together.



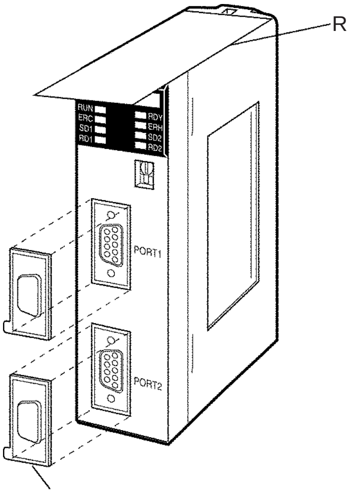
Note If the sliders are not locked properly, the Serial Communications Units may not function correctly.

To remove the Unit, move the sliders to the release position and then pull the Units gently apart.

3-2-4 Unit Handling Precautions

- Always turn OFF the CPU Unit before mounting or removing a Serial Communications Unit or connecting or disconnecting cables to/from the Serial Communications Unit.
- Place the port connecting cables in a different duct from those for high-voltage lines or power lines to prevent the effects of electrical noise from these lines.
- Do not remove the protective label from the top of the Unit until wiring has been completed. This label prevents wire strands and other foreign matter from entering the Unit during wiring. Remove the label after wiring has been completed to allow air circulation needed for cooling.
- If a serial communications port is not being used, leave the cover on the port to prevent dust from entering.

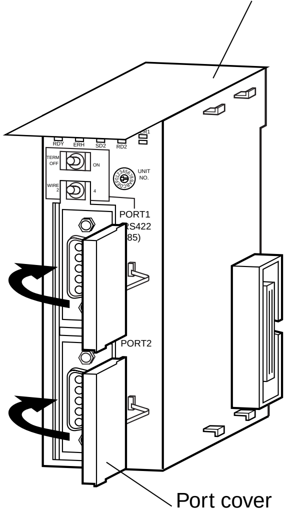
CS-series Unit



Remove label after wiring.

Port cover

CJ-series Unit



Remove label after wiring.

Port cover

3-3 Wiring

3-3-1 Wiring Precautions

- Before connecting or disconnecting the communications cables, always make sure that the PC is turned OFF.
- Tighten the communications connector screws firmly with your fingers.
- Serial Communications Boards and Units can be connected to various devices. For compatibility, refer to the operation manuals for the devices to which they are to be connected.

3-3-2 Port Types

The following port types are provided on the Serial Communications Boards and Units.

PC Series	Unit type	Model	Port 1	Port 2
CS Series	Serial Communications Board	CS1W-SCB21-V1	RS-232C	RS-232C
		CS1W-SCB41-V1	RS-232C	RS-422A/485
	Serial Communications Unit	CS1W-SCU21-V1	RS-232C	RS-232C
CJ Series		CS1W-SCU41	RS-422A/485	RS-232C

The following sections describe the connection methods used for each serial communications mode of the Serial Communications Board and Unit ports.

3-3-3 Communications Modes and Ports

The following table shows the relationship between the communications ports and the communications modes for the Serial Communications Boards and Unit. Serial Communications Units provide only RS-232C ports.

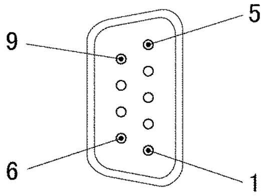
Communications mode	RS-232C		RS-422A/485			
	1:1	1:N (see note 1)	1:1 4-wire	1:N 4-wire	1:1 2-wire	1:N 2-wire
Host Link	YES	YES (see note 2)	YES	YES	No	No
Protocol macros	YES	YES	YES	YES	YES	YES
NT Link	YES	YES	YES	YES	YES	YES

Note

1. The NT-AL001-E Link Adapter can be used to convert between RS-232C and RS-422A/485 to enable 1:N communications.
2. Use 4-wire connections between Link Adapters.

3-3-4 Connector Pin Layout

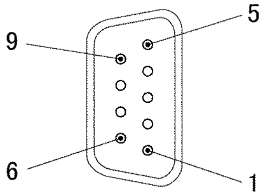
RS-232C Ports



Pin	Abbreviation	Signal name	I/O
1	FG	Shield	---
2	SD	Send data	Output
3	RD	Receive data	Input
4	RTS (RS)	Request to send	Output
5	CTS (CS)	Clear to send	Input
6	5V	Power supply	---
7	DSR (DR)	Data set ready	Input
8	DTR (ER)	Data terminal ready	Output
9	SG	Signal ground	---
Hood	FG	Shield	---

Refer to *2-1 Component Names and Functions* for signal precautions.

RS-422A/485 Ports

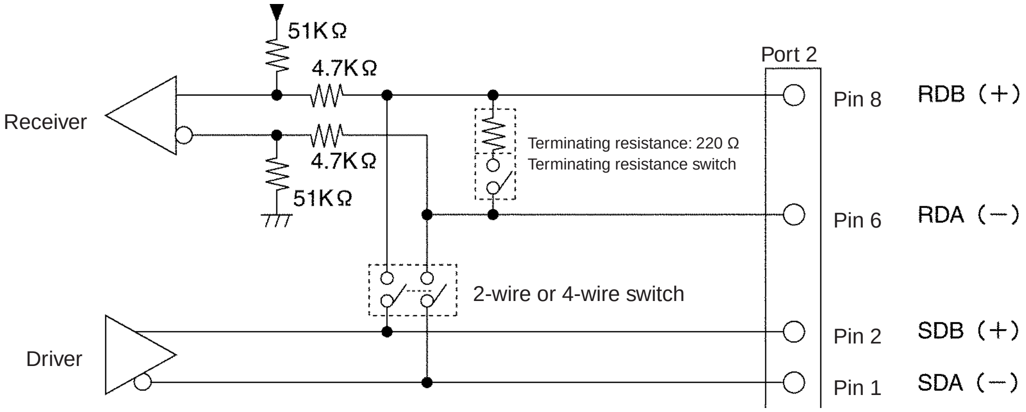


Pin	Abbreviation	Signal name	I/O
1	SDA	Send data -	Output
2	SDB	Send data +	Output
3	NC	Unused	---
4	NC	Unused	---
5	NC	Unused	---
6	RDA	Receive data -	Input
7	NC	Unused	---
8	RDB	Receive data +	Input
9	NC	Unused	---
Hood	FG	Shield	---

Note When the 2-wire connections are used, use either pins 1 and 2, or pins 6 and 8.

Refer to *2-1 Component Names and Functions* for signal precautions.

The internal circuits are shown in the following diagram.

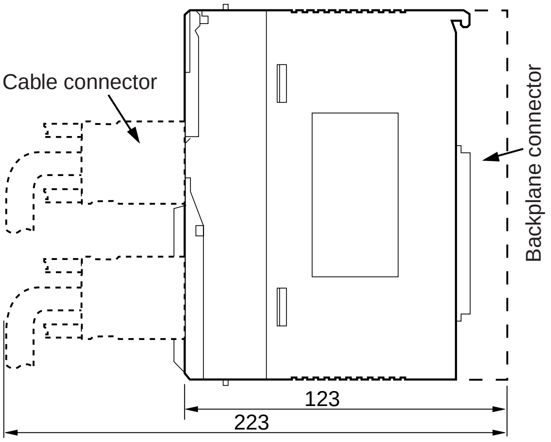


Note The signal names SDA/B and RDA/B do not always have the same polarity as that shown above. Check the polarity of the external device before making connections.

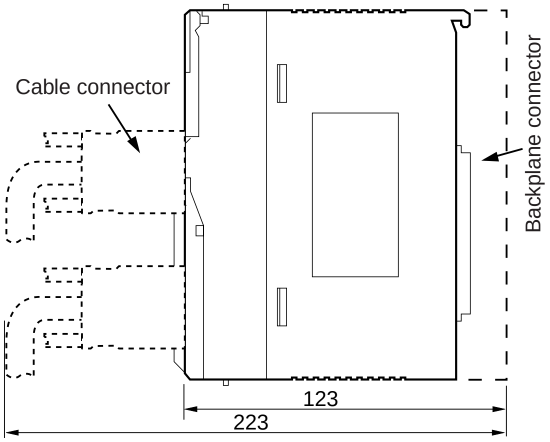
3-3-5 Mounting Height and Connector Cover Dimensions

When mounting the Serial Communications Board or Unit, make sure to provide space for the mounting height and connector cover dimensions shown below.

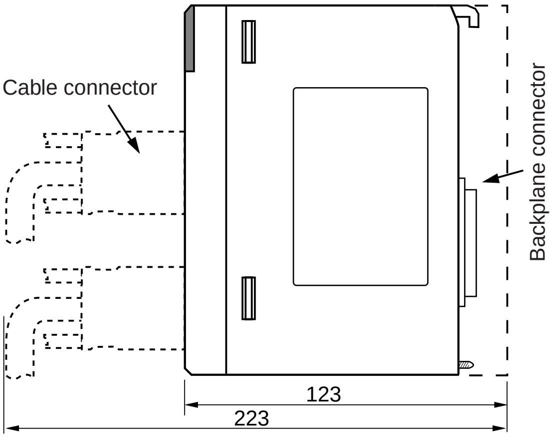
CS1W-SCB21-V1 Serial Communications Board (mounted to CPU Unit)



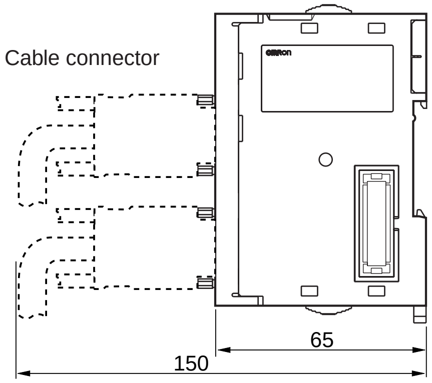
CS1W-SCB41-V1 Serial Communications Board (mounted to CPU Unit)



CS1W-SCU21-V1 Serial Communications Unit



CJ1W-SCU41 Serial Communications Unit

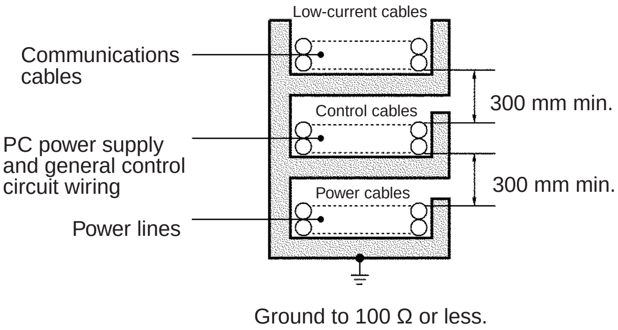


Note The mounting heights shown above are applicable when the attached connectors, connector covers, and recommended cables are used. The mounting height may differ when other connectors, connector covers, and cables are used. Determine the mounting height, taking into account the connectors, connector covers, and the minimum bending radius of the cables.

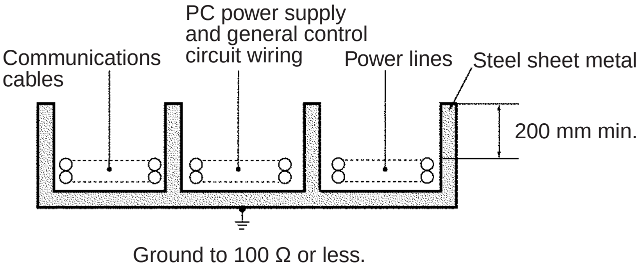
3-3-6 Reducing Electrical Noise for External Wiring

Observe the following precautions for external wiring.

- When multi-conductor signal cable is being used, avoid using I/O wires and other control wires in the same cable.
- If wiring racks are running in parallel, allow at least 300 mm between the racks.

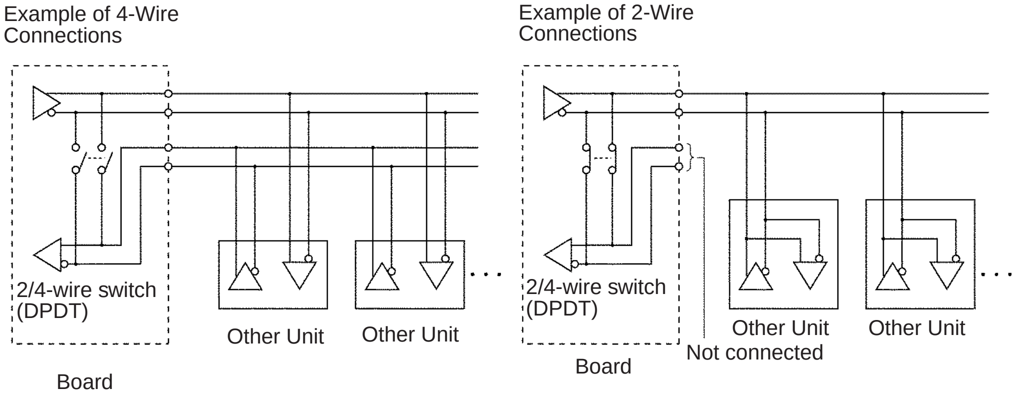


- If the I/O wiring and power cables must be placed in the same duct, they must be shielded from each other using grounded steel sheet metal.



3-3-7 2-Wire and 4-Wire Connections

The transmission circuits for 2-wire and 4-wire connections are different, as shown in the following diagram.



Note

1. Use the same transmission circuit (2-wire or 4-wire) for all nodes.
2. Do not use 4-wire connections when the 2/4-wire switch on the Board is set to 2-wire.
3. In protocol macro mode, do not use full-duplex transmissions when the 2/4-wire switch on the Unit is set to 2-wire. Otherwise, the data sent from the Serial Communications Board or Unit will be directly returned as receive data. In this case, the Board or Unit cannot determine whether the data in the receive buffer is its own send data or the data received from a remote node, and thus cannot perform receive processing properly. To avoid this problem, always use half-duplex transmissions with a 2-wire setting. Either half-duplex or full-duplex transmissions can be used with a 4-wire setting.

3-3-8 NT-AL001-E Link Adapter Settings

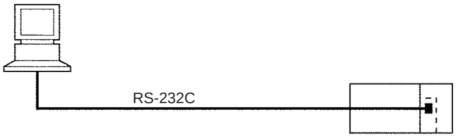
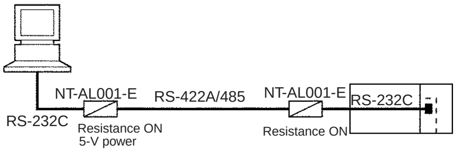
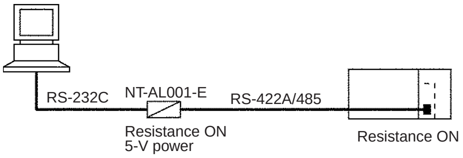
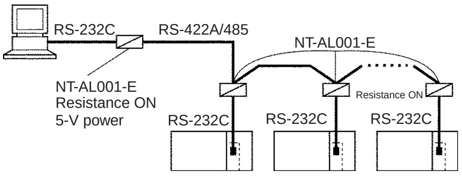
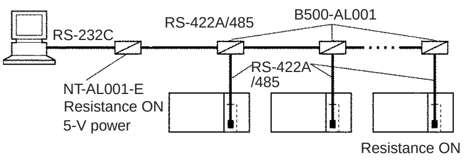
The NT-AL001-E Link Adapter has a DIP switch for setting RS-422A/485 communications conditions. When connecting the Unit or Board, refer to the DIP switch settings shown in the following table.

Pin	Function	Factory setting
1	Not used. Always set this pin to ON.	ON
2	Built-in terminating resistance setting ON: Connects terminating resistance. OFF: Disconnects terminating resistance.	ON
3	2/4-wire setting 2-wire: Set both pins to ON. 4-wire: Set both pins to OFF.	OFF
4		OFF
5	Transmission mode (see note) Constant transmission: Set both pins to OFF. Transmission performed when CTS signal in RS-232C interface is at high level: Set pin 5 to OFF and pin 6 to ON. Transmission performed when CTS signal in RS-232C interface is at low level: Set pin 5 to ON and pin 6 to OFF.	ON
6		OFF

Note When connecting to a CS/CJ-series CPU Unit, turn OFF pin 5 and turn ON pin 6.

3-3-9 Connections for Host Link Communications

Port connections for Host Link communications are shown in the following table. Up to 32 Units and Boards can be connected for 1:N connections.

Port	Configuration	Schematic diagram, RS-232C ports	Schematic diagram, RS-422A/485 ports
RS-232C Computer to PC: C-mode or FINS commands PC to computer: FINS commands	1:1	 	
RS-232C Computer to PC: C-mode or FINS commands	1:N		

Note
1. Four-wire connections must be used for RS-422A/485 connections with Host Link communications.
2. "Resistance ON" indicates the terminating resistance must be turned ON.
3. "5-V power" indicates that a 5-V power supply is required for the Link Adapter. Refer to the Link Adapter manual for details. A 5-V power supply

is not required for a Link Adapter connected to a Serial Communications Board or Unit because power is supplied from pin 6 of the connector.

4. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

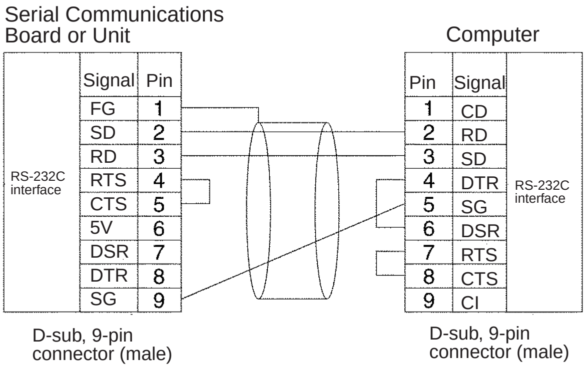
Connection Examples

The connection examples in the remainder of this section show only the basic connection diagrams. We recommend that appropriate noise countermeasures be taken in actual applications, including the use of shielded twisted-pair cables. Refer to *3-4 RS-232C and RS-422A/485 Wiring* for actual wiring methods.

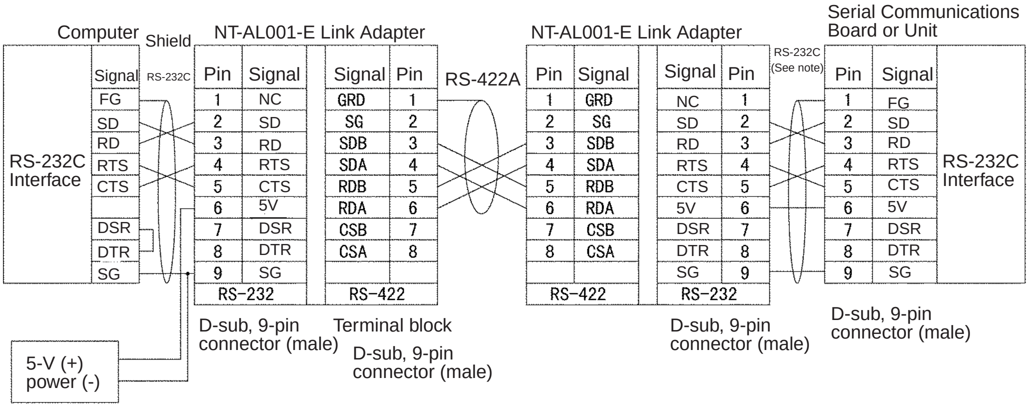
Host Computer Connections

1:1 Connections Using RS-232C Ports

IBM PC/AT or Compatible Computers



Using NT-AL001-E Converting Link Adapters



DIP Switch Settings
Pin 1: ON
Pin 2: ON
 (terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF

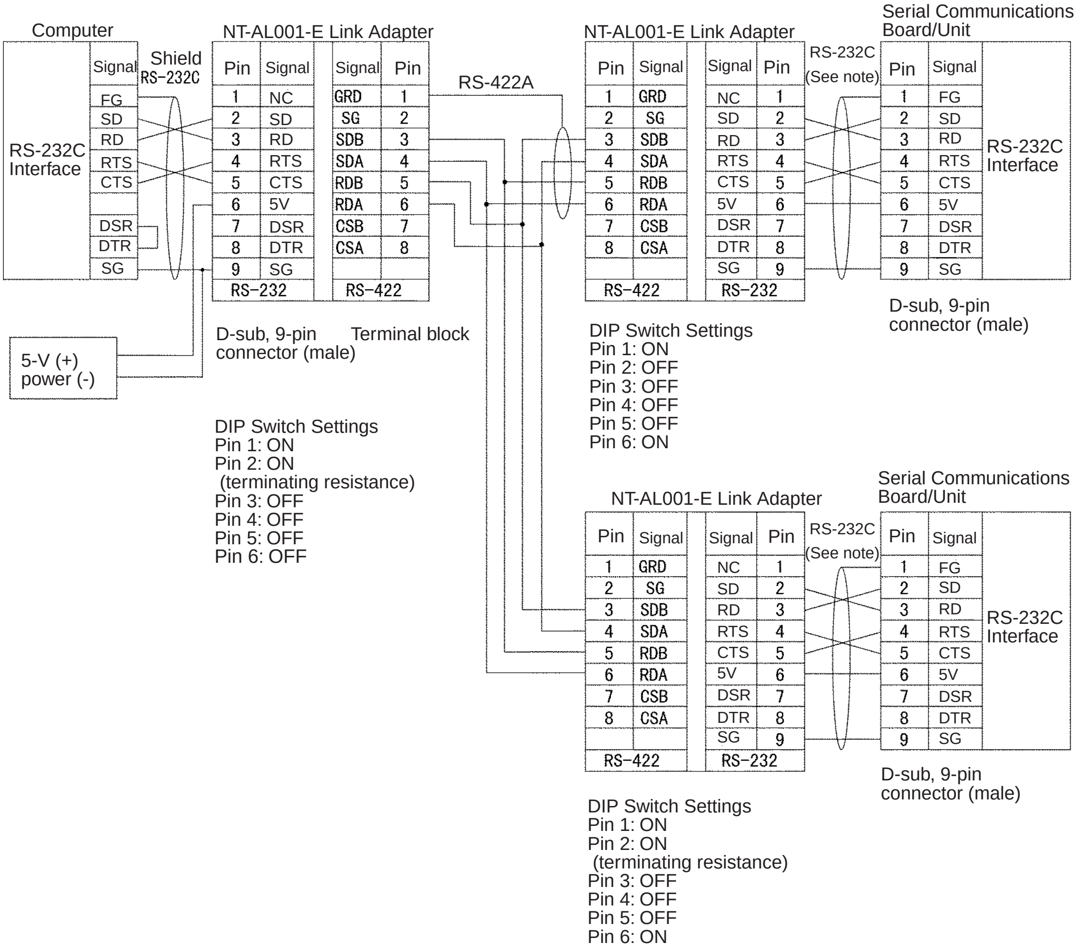
DIP Switch Settings
Pin 1: ON
Pin 2: ON
 (terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: ON

Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters.

XW2Z-070T-1: 0.7 m
XW2Z-200T-1: 2 m

⚠ Caution Do not use the 5-V power from pin 6 of the RS-232C port for anything but the NT-AL001-E Link Adapter. Using this power supply for any other external device may damage the Serial Communications Board/Unit or the external device.

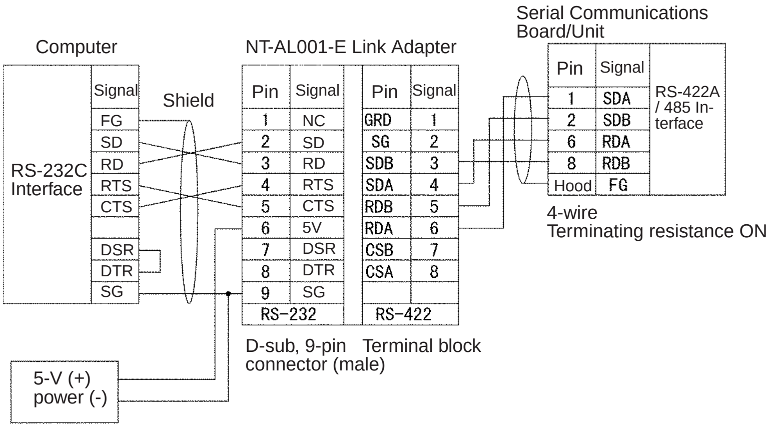
1:N Connections Using RS-232C Ports



Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters.

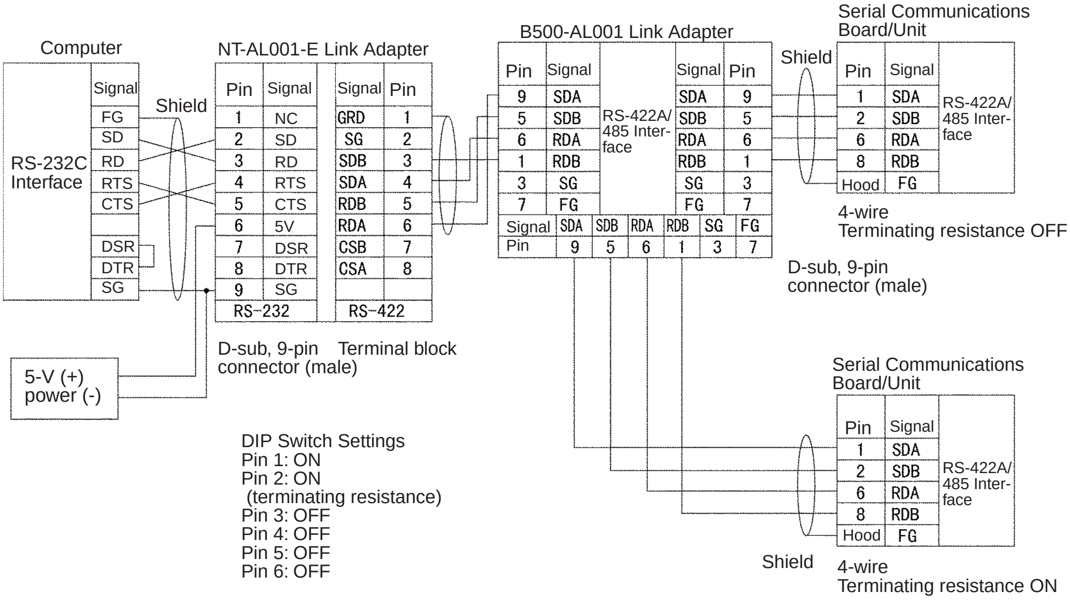
XW2Z-070T-1: 0.7 m
XW2Z-200T-1: 2 m

1:1 Connections Using RS-422A/485 Ports

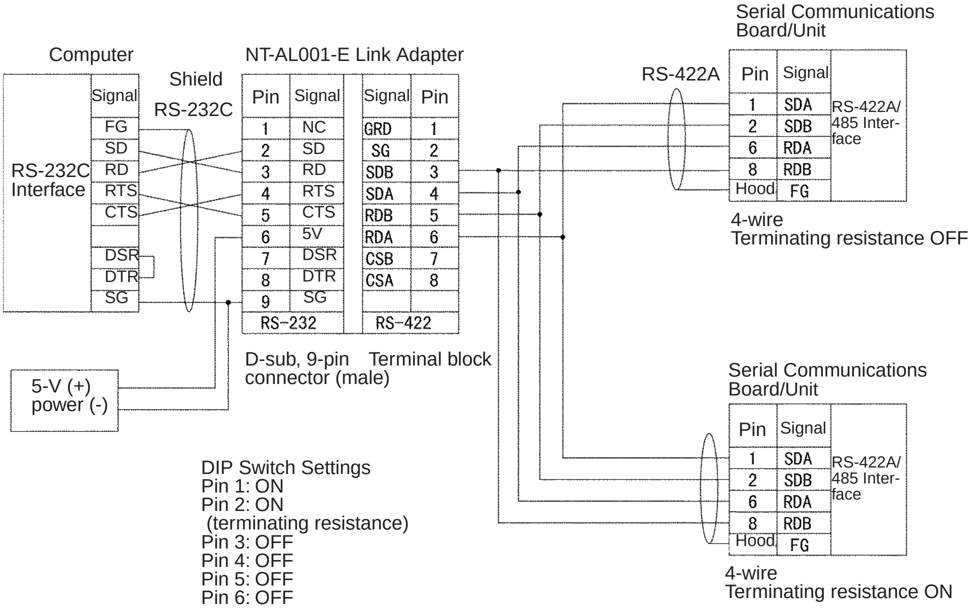


DIP Switch Settings
Pin 1: ON
Pin 2: ON
(terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF

1:N Connections Using RS-422A/485 Ports



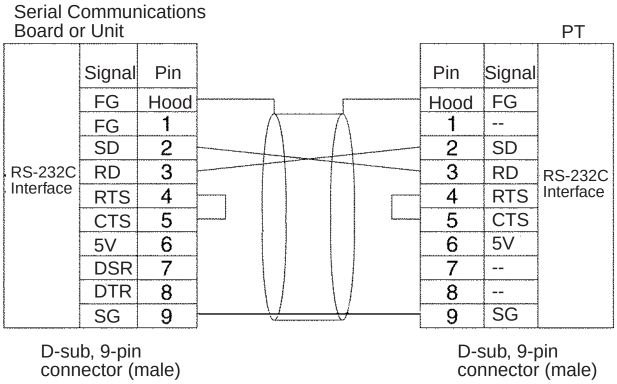
DIP Switch Settings
Pin 1: ON
Pin 2: ON
 (terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF



DIP Switch Settings
Pin 1: ON
Pin 2: ON
 (terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF

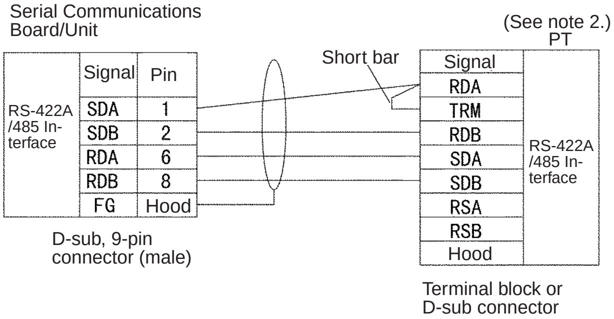
Programmable Terminal (PT) Connections

Direct Connections from RS-232C to RS-232C Ports



- Communications Mode: Host Link (unit number 0 only for Host Link)
  NT Link (1:N, N = 1 Unit only)
- OMRON Cables with Connectors:
  XW2Z-070T-1: 0.7 m
  XW2Z-200T-1: 2 m

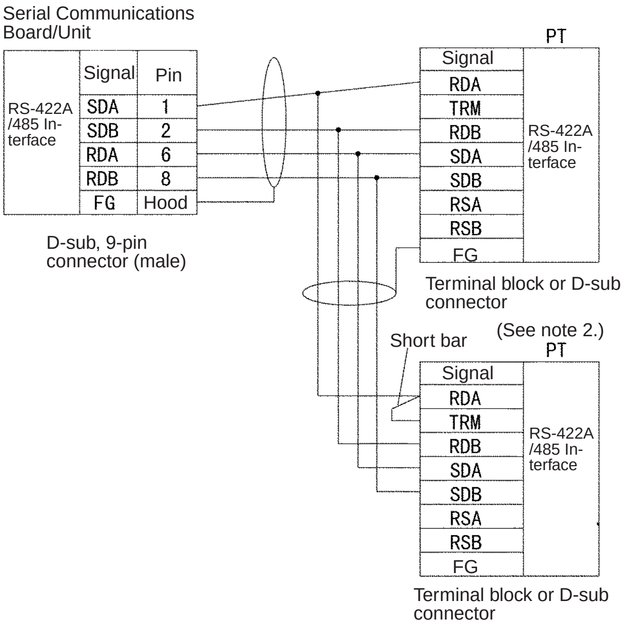
1:1 Connections from RS-422A/485 to RS-422A/485 Ports



Communications Mode: Host Link (unit number 0 only for Host Link)
NT Link (1:N, N = 1 Unit only)

Note
1. Serial Communications Board/Unit settings:
   Terminating resistance ON, 4-wire.
2. The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

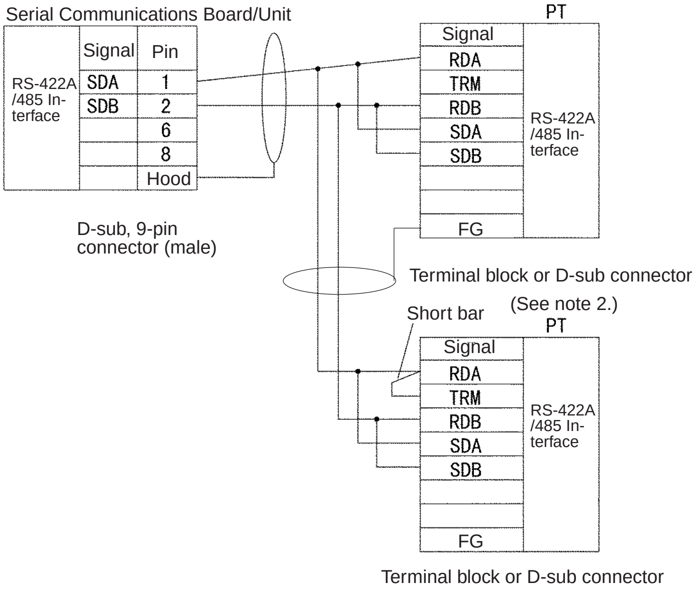
1:N, 4-wire Connections from RS-422A/485 to RS-422A/485 Ports



Communications Mode: 1:N NT Link

Note
1. Serial Communications Board/Unit settings:
   Terminating resistance ON, 4-wire.
2. The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

1:N, 2-wire Connections from RS-422A/485 to RS-422A/485 Ports



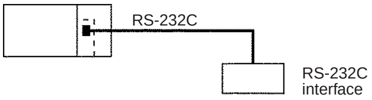
Communications Mode: 1:N NT Link

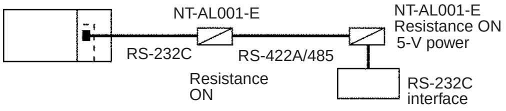
Note
1. Serial Communications Board/Unit settings:
   Terminating resistance ON, 2-wire.

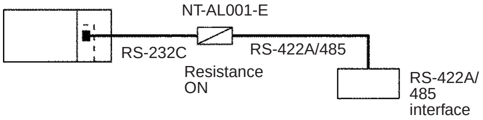
2. The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

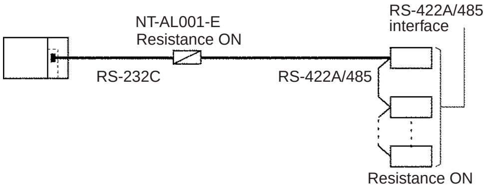
3-3-10 Connections for Protocol Macros

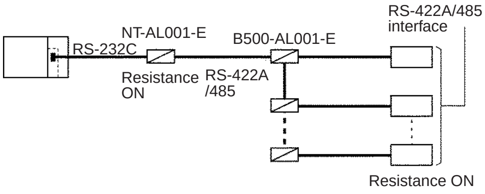
This section describes the connections for protocol macros. Up to 32 Boards or Units can be used for 1:N connections.

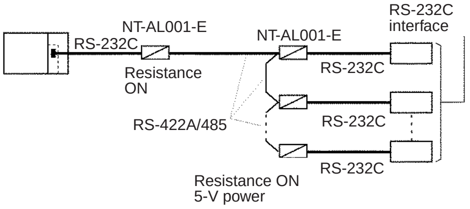
<table>
<tr><th>Port</th><th>Configu-ration</th><th>Schematic diagram</th></tr>
<tr><td>RS-232C</td><td>1:1</td><td>




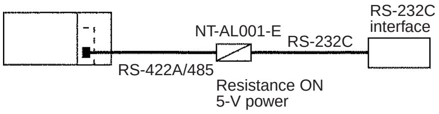
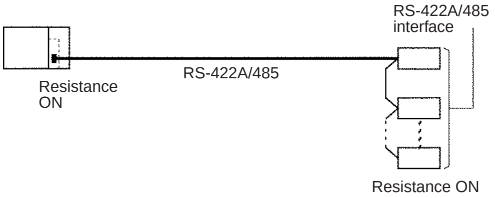
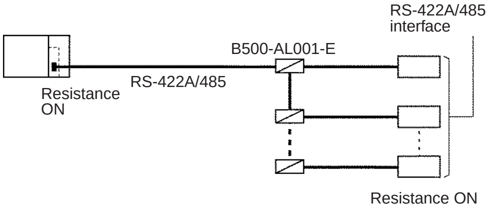
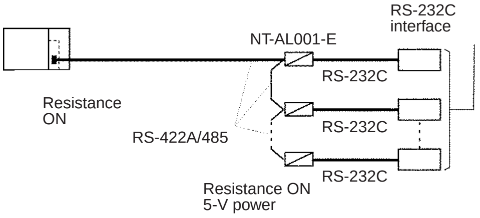


</td></tr>
<tr><td>RS-232C</td><td>1:N</td><td>






</td></tr>
</table>

Port	Configu-ration	Schematic diagram
RS-422A/485	1:1	 
RS-422A/485	1:N	  

Note

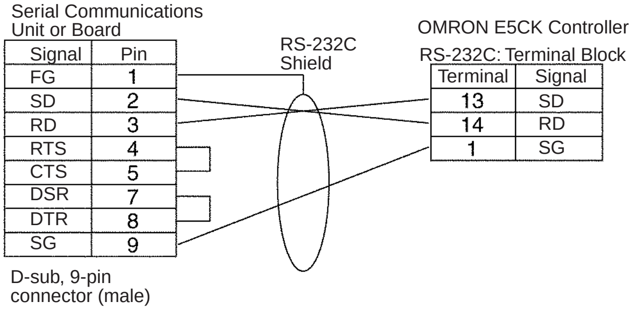
1. The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.
2. The combined cable length for RS-422A/485 is 500 m including branch lines.
3. The maximum cable length is limited to 2 m when an NT-AL001-E Link Adapter is connected.
4. Branch lines must be a maximum of 10 m long.

Connection Examples

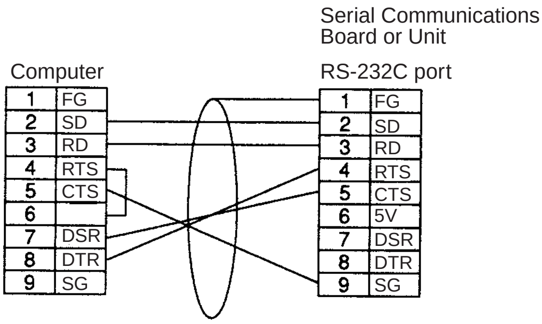
The connection examples in the remainder of this section show only the basic connection diagrams. We recommend that appropriate noise countermeasures be taken in actual applications, including the use of shielded twisted-pair cables. Refer to *3-4 RS-232C and RS-422A/485 Wiring* for actual wiring methods.

Connecting RS-232C Ports 1:1

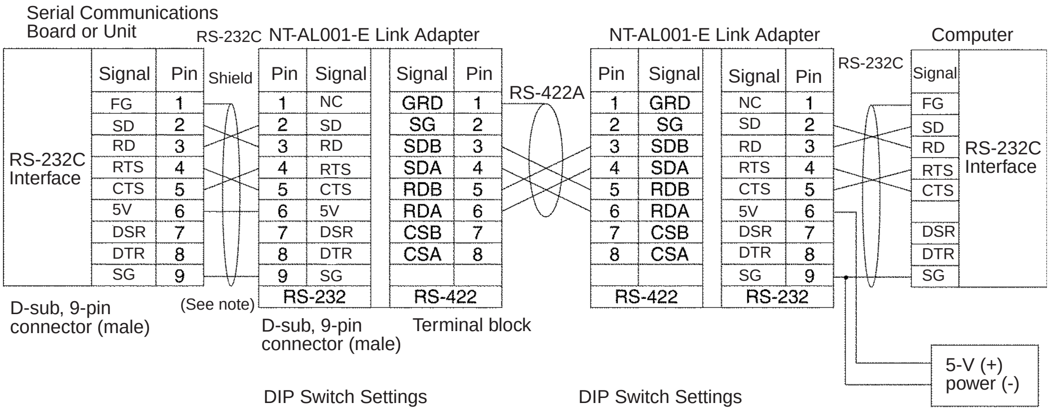
Connections to E5CK Controller



Connections to a Personal Computer with RTS-CTS Flow Control



Connecting a Host Computer with NT-AL001-E Converting Link Adapters



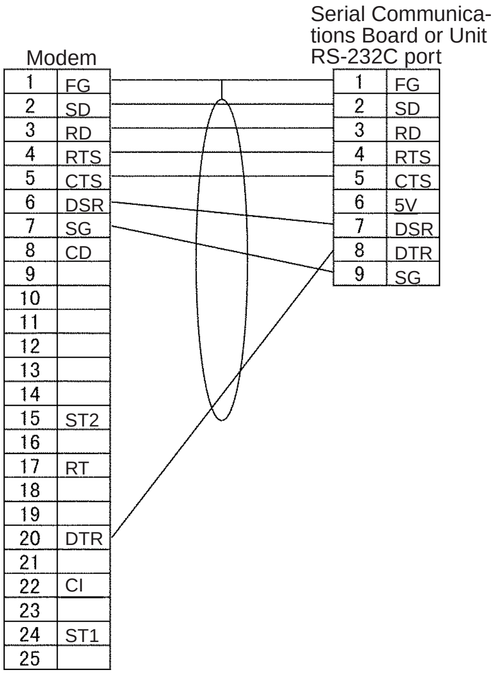
DIP Switch Settings
Pin 1: ON
Pin 2: ON
(terminating resistance)
Pin 3: OFF (4-wire)
Pin 4: OFF
Pin 5: OFF
Pin 6: ON

DIP Switch Settings
Pin 1: ON
Pin 2: ON
(terminating resistance)
Pin 3: OFF (4-wire)
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF

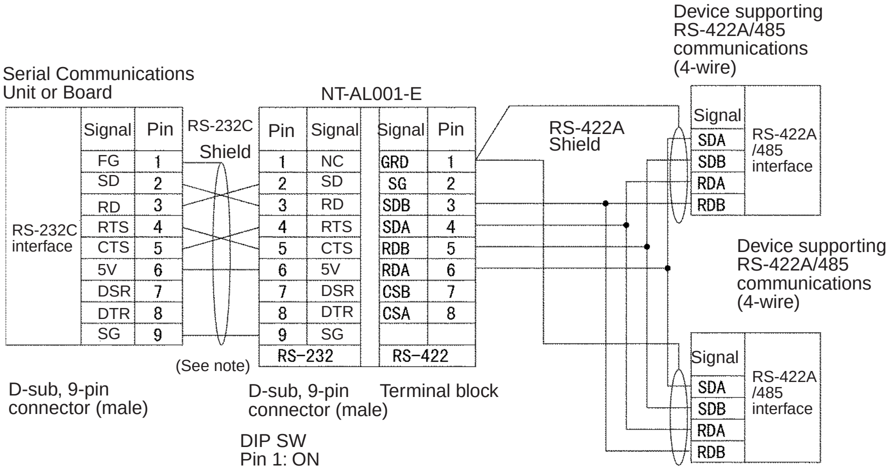
Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters.

XW2Z-070T-1: 0.7 m
XW2Z-200T-1: 2 m

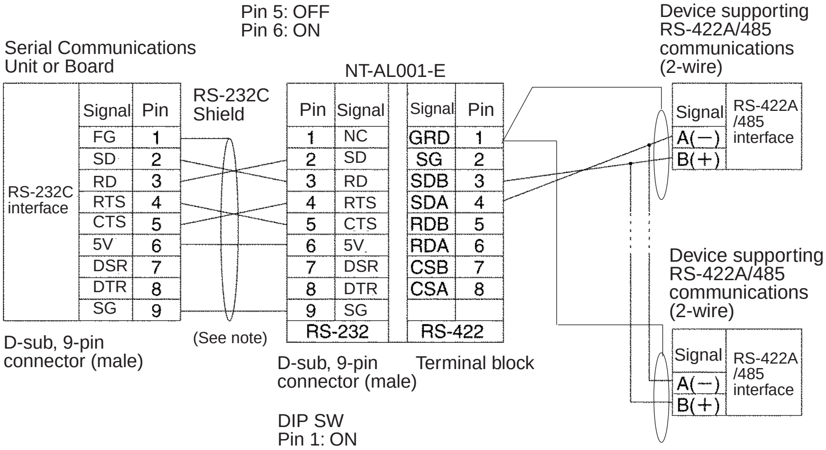
Connections to a Modem



1:N Connections Using RS-232C Ports



DIP SW
Pin 1: ON
Pin 2: ON Terminating resistance
Pin 3: OFF 4-wire
Pin 4: OFF
Pin 5: OFF
Pin 6: ON

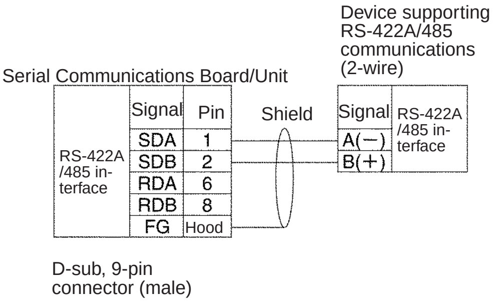


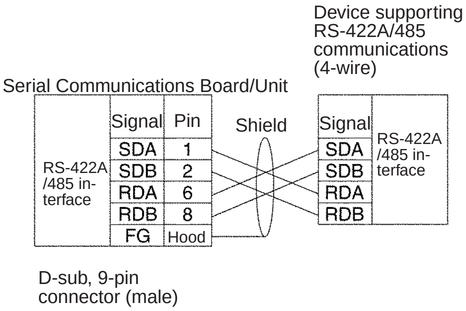
DIP SW
Pin 1: ON
Pin 2: ON Terminating resistance
Pin 3: ON 2-wire
Pin 4: ON
Pin 5: OFF
Pin 6: ON

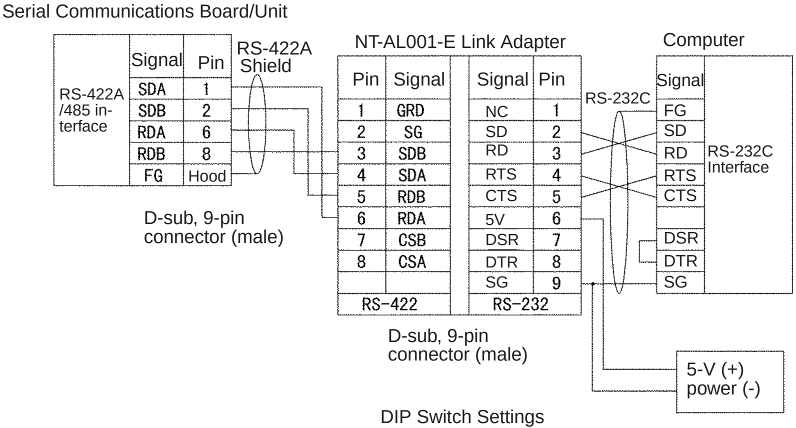
Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters.

XW2Z-070T-1: 0.7 m
XW2Z-200T-1: 2 m

1:1 Connections Using RS-422A/485 Ports

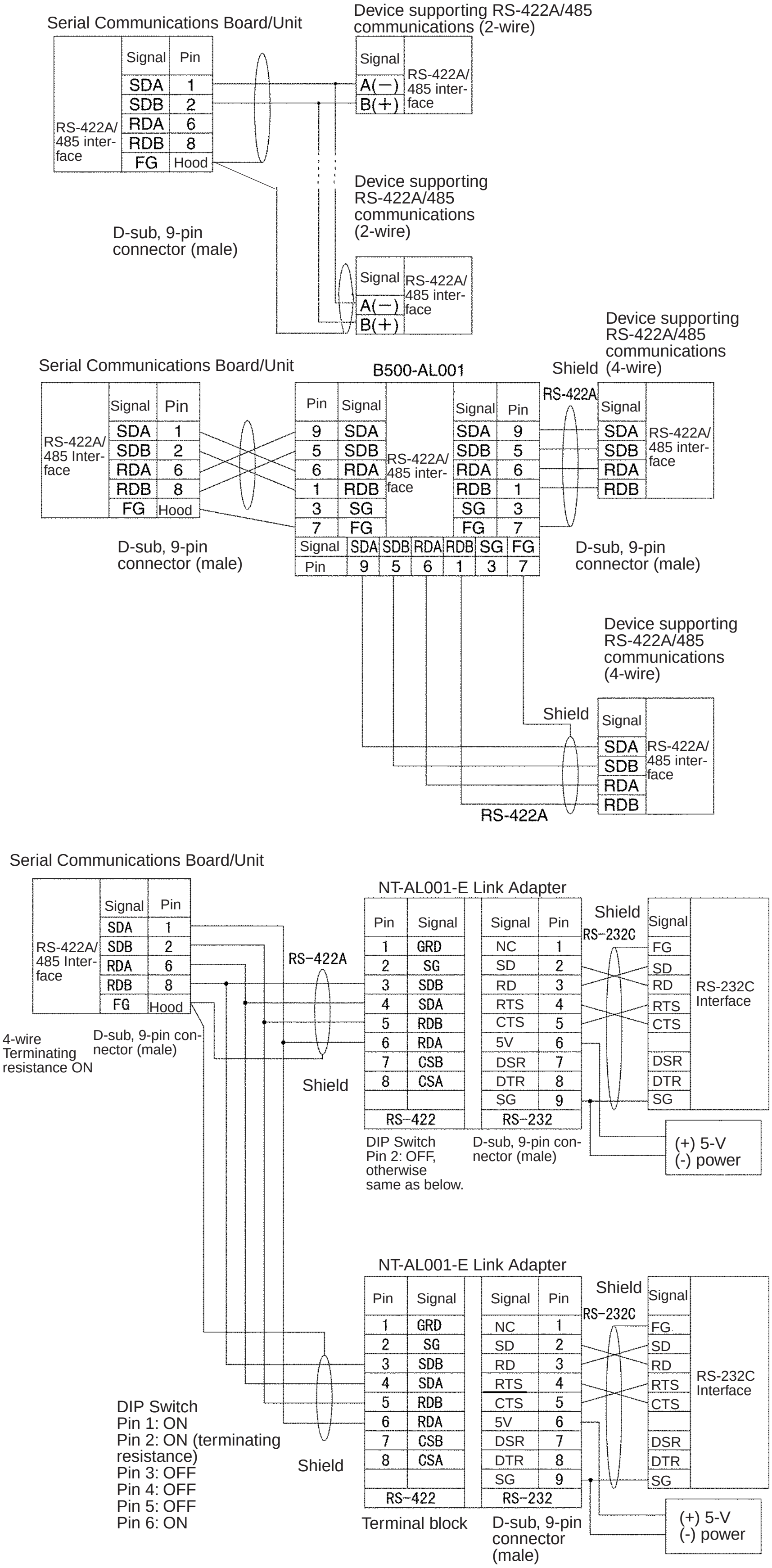






DIP Switch Settings
Pin 1: ON
Pin 2: ON
(terminating resistance)
Pin 3: OFF
Pin 4: OFF
Pin 5: OFF
Pin 6: OFF

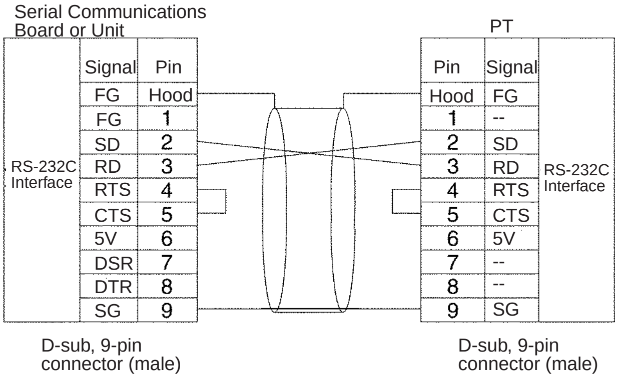
1:N Connections Using RS-422A/485 Ports



3-3-11 1:N NT Link Connections with Programmable Terminals

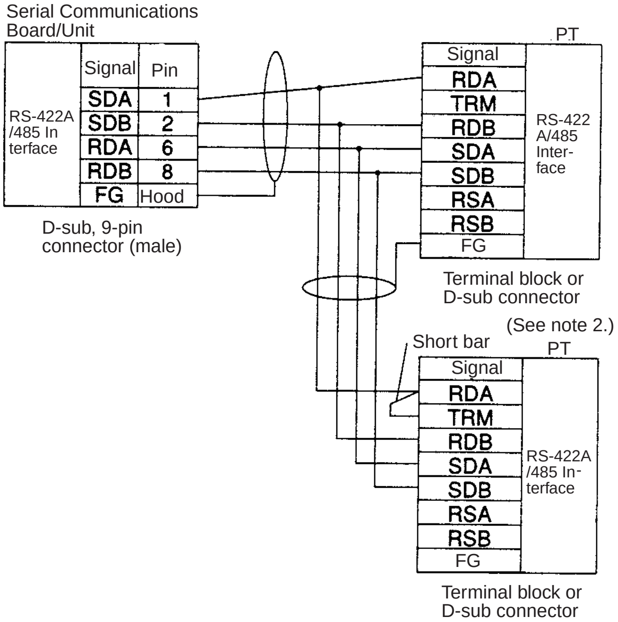
The connections used for each port type in NT Link mode are the same as for protocol macro mode. See *3-3-10 Connections for Protocol Macros*. Up to eight Units or Boards can be used for a 1:N connection.

Direct Connections from RS-232C to RS-232C Ports



- Communications Mode: Host Link (unit number 0 only for Host Link)
  NT Link (1:N, N = 1 Unit only)
- OMRON Cables with Connectors:
  XW2Z-070T-1: 0.7 m
  XW2Z-200T-1: 2 m

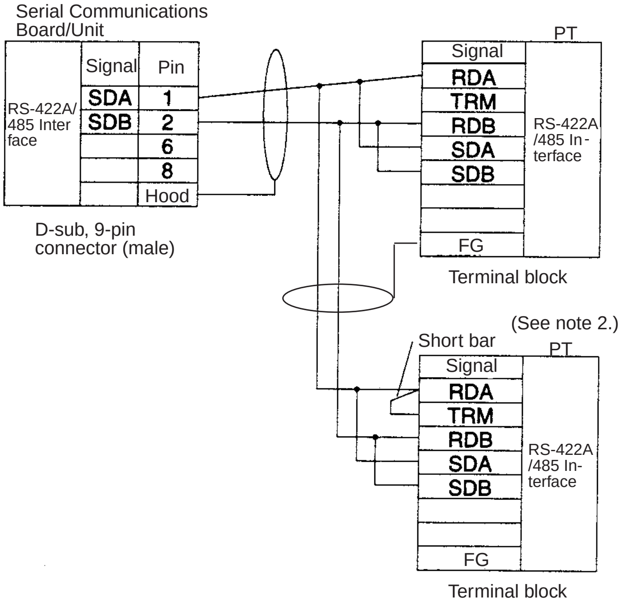
1:N, 4-wire Connections from RS-422A/485 to RS-422A/485 Ports



Communications Mode: 1:N NT Link

Note
1. Serial Communications Board/Unit settings:
   Terminating resistance ON, 4-wire.
2. The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

1:N, 2-wire Connections from RS-422A/485 to RS-422A/485 Ports

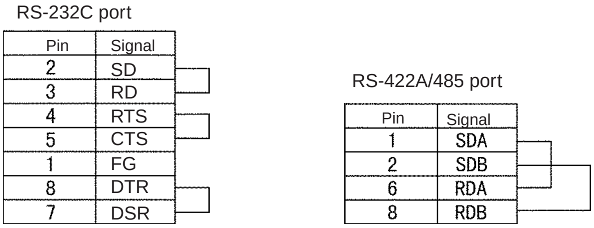


Communications Mode: 1:N NT Link

Note
1. Serial Communications Board/Unit settings: Terminating resistance ON, 2-wire.
2. The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

3-3-12 Connections in Loopback Test

Connect the communications ports as shown below.



3-4 RS-232C and RS-422A/485 Wiring

3-4-1 Recommended RS-232C Wiring Examples

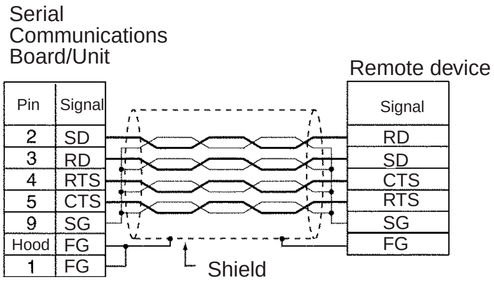
It is recommended that RS-232C cables be connected as described below especially when the Serial Communications Board or Unit is used in an environment where it is likely to be subject to electrical noise.

1,2,3... 1. Always use shielded twisted-pair cables as communications cables.

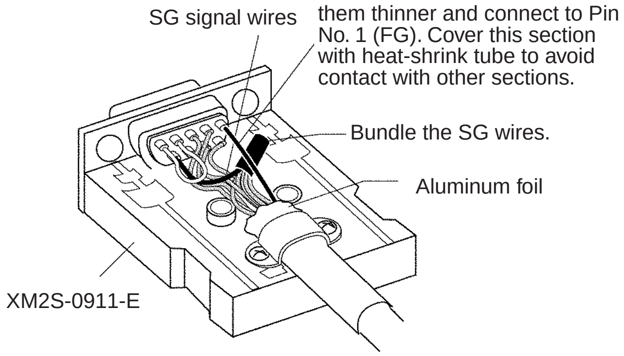
Model	Manufacturer
UL2464 AWG28x5P IFS-RVV-SB (UL product) AWG28x5P IFVV-SB (non-UL product)	Fujikura Ltd.
UL2464-SB (MA) 5Px28AWG (7/0.127) (UL product) CO-MA-VV-SB 5Px28AWG (7/0.127) (non-UL product)	Hitachi Cable, Ltd.

2. Combine signal wires and SG (signal ground) wires in a twisted-pair cable. At the same time, bundle the SG wires to the connectors on the Serial Communications Board/Unit and the remote device.
3. Connect the shield of the communications cable to the Hood (FG) terminal of the RS-232C connector on the Serial Communications Board/Unit. At the same time, ground the ground (GR) terminal of the Power Supply Unit on the CPU Rack or CS Expansion Rack to 100 Ω or less.
4. A connection example is shown below.

   Example: Twisted-pair Cable Connecting SD-SG, RD-SG, RTS-SG, and CTS-SG Terminals

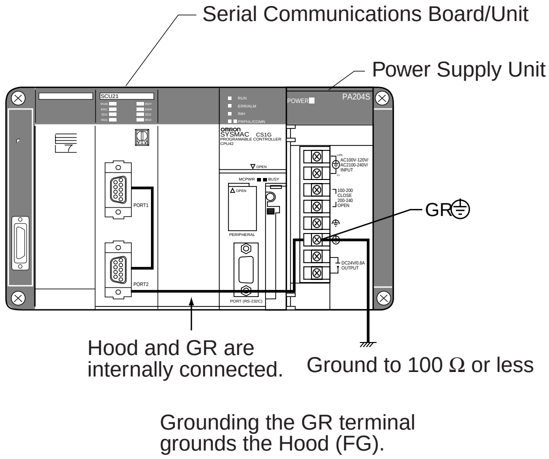


Actual Wiring Example

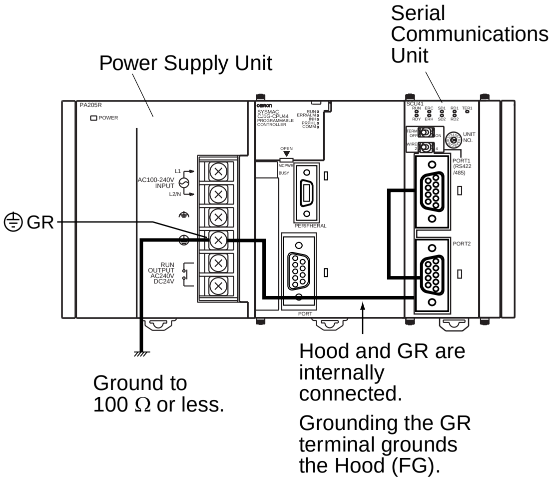


Note The Hood (FG) is internally connected to the ground terminal (GR) on the Power Supply Unit via the CPU Rack or CS Expansion Rack. Therefore, FG is grounded by grounding the ground terminal (GR) on the Power Supply Unit. Although there is conductivity between the Hood (FG) and pin 1 (FG), connect the Hood (FG) to the shield because the Hood (FG) has smaller contact resistance with the shield than pin 1 (FG), and thus provides better noise resistance.

CS-series PC



CJ-series PC



3-4-2 Recommended RS-422A/485 Wiring Examples

Recommended RS-422A/485 Cable

1,2,3...

1. Always use shielded twisted-pair cables as communications cables.

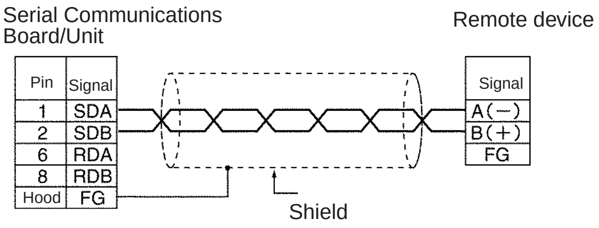
Model	Manufacturer
CO-HC-ESV-3Px7/0.2	Hirakawa Hewtech Corp.

2. Connect the shield of the communications cable to the Hood (FG) of the RS-422A/485 connector on the Serial Communications Board or Unit. At the same time, ground the ground (GR) terminal of the Power Supply Unit on the CPU Rack or CS Expansion Rack to 100 Ω or less.

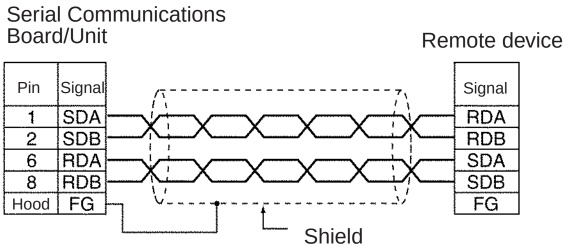
Note Always ground the shield only at the Board/Unit end. Grounding both ends of the shield may damage the device due to the potential difference between the ground terminals.

Connection examples are shown below.

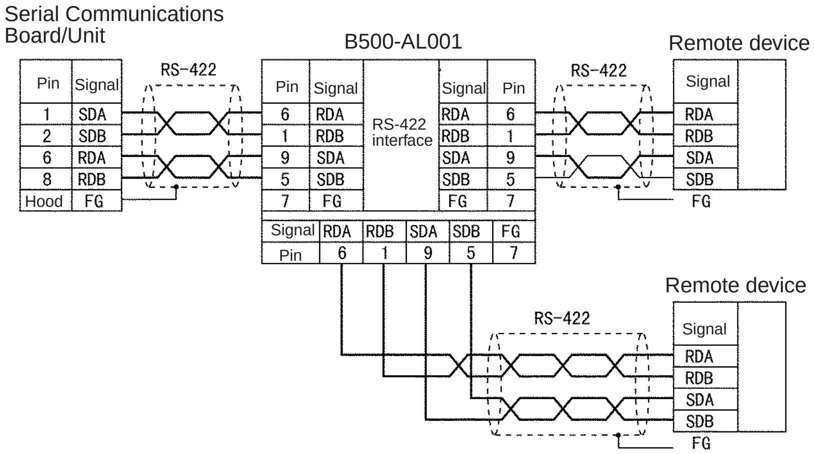
2-Wire Connections



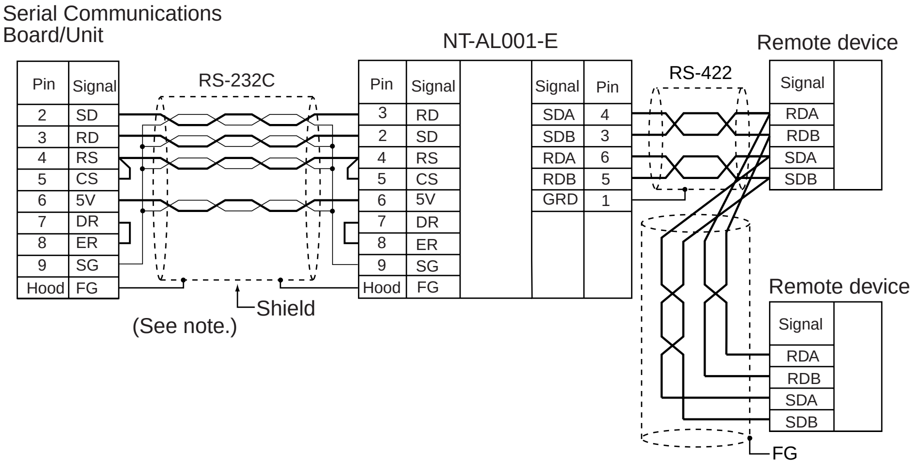
4-Wire Connections



Using a B500-AL001-E Link Adapter



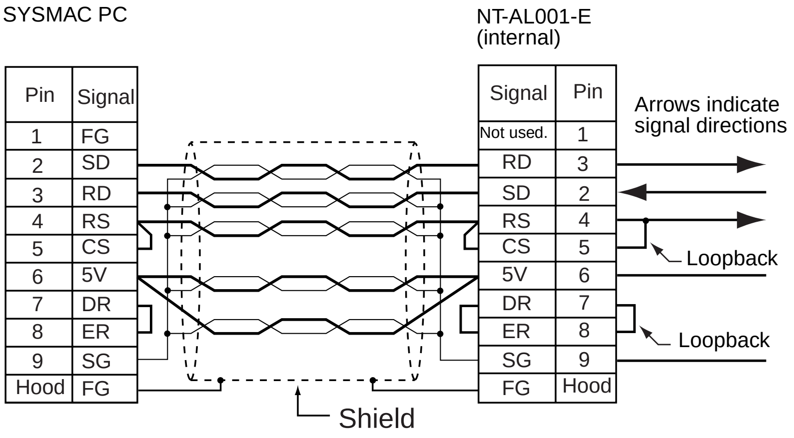
- With NT-AL001-E RS-232C/RS-422 Link Adapter



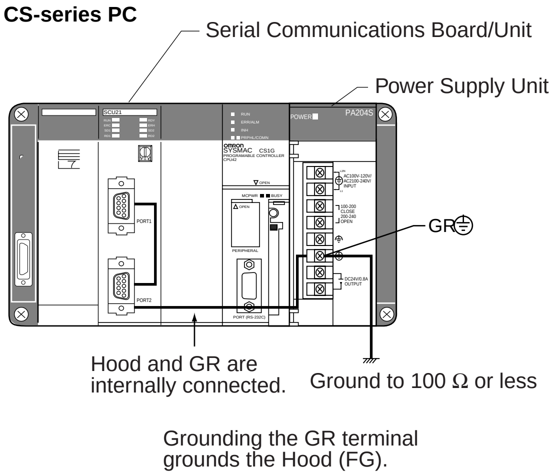
Note 1. The following cables are available for this connection.

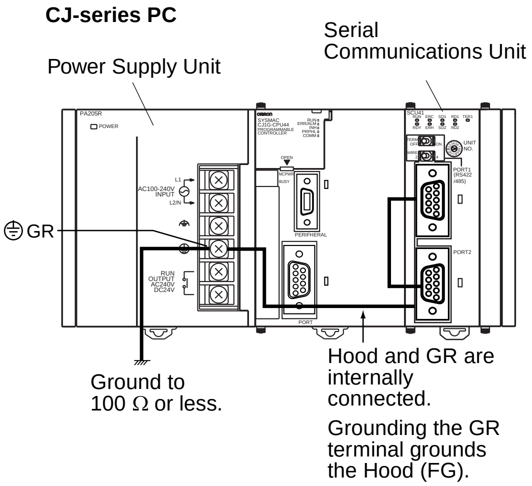
Length	Model
70 cm	XW2Z-070T-1
2 m	XW2Z-200T-1

It is recommended that one of these cables be used to connect the RS-232C port on the Serial Communications Board or Unit to the NT-AL001-E RS-232C/RS-422 Link Adapter. The recommended wiring for these cables is shown below.



2. The XW2Z-070T-1 and XW2Z-200T-1 Connecting Cables for the NT-AL001-E Link Adapter uses special wiring for the DTS and RTS signals. Do not use these signals with other devices; they may be damaged.
3. The Hood (FG) is internally connected to the ground terminal (GR) on the Power Supply Unit via the CPU Rack or CS Expansion Rack. Therefore, FG is grounded by grounding the ground terminal (GR) on the Power Supply Unit.





4. Be sure to turn ON the terminating resistance at the last Unit at the end of the RS-422A/485 cable.

3-4-3 Wiring Connectors

Use the following steps to wire connectors.

Cable Preparation

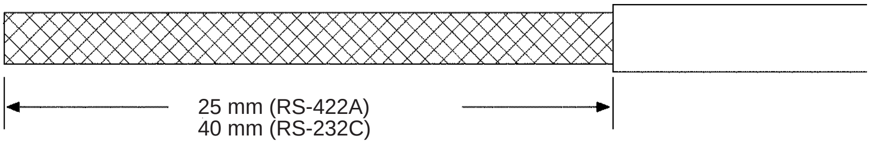
See the following diagrams for the length of the cable portion to be cut in each step.

Shield Connected to Hood (FG)

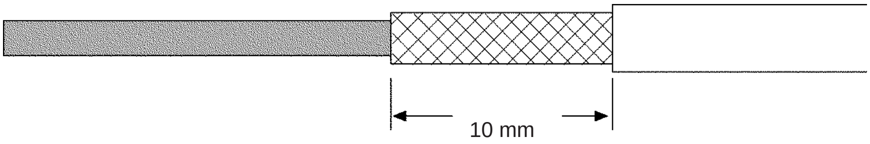
1,2,3...

1. Cut the cable to the required length.

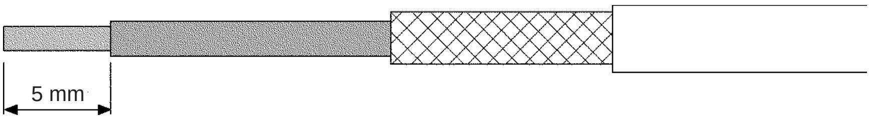
2. Remove the specified length of the sheath from the cable using a knife. Be careful not to scratch the braided shield.



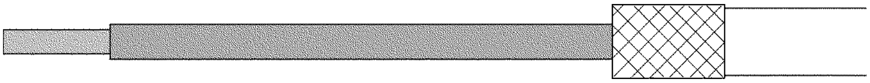
3. Trim off the braided shield using scissors so that the remaining shield length is 10 mm.



4. Remove the insulation from each conductor using a stripper so that the exposed conductor length is 5 mm.



5. Fold back the braided shield.



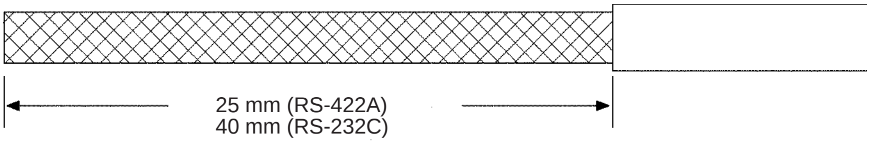
6. Wrap aluminum foil tape around the folded shield.

Shield Not Connected to Hood (FG)

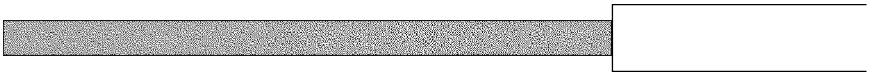
1,2,3...

1. Cut the cable to the required length.

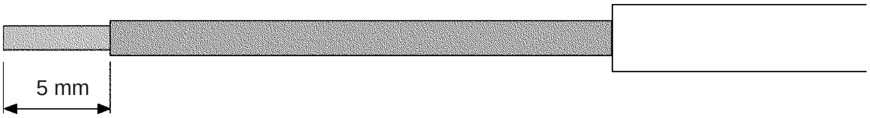
2. Remove the specified length of the sheath from the cable using a knife. Be careful not to scratch the braided shield.



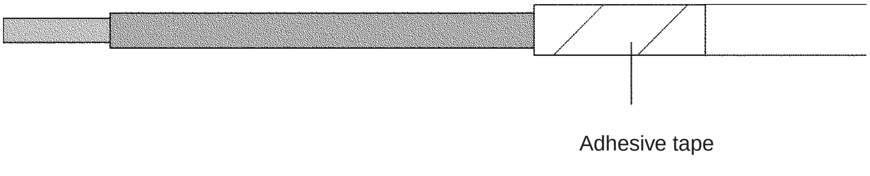
3. Trim off all the braided shield using scissors.



4. Remove the insulation from each conductor using a stripper so that the exposed conductor length is 5 mm.



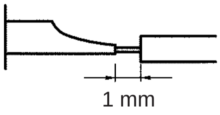
5. Wrap adhesive tape around the conductor from which the braided shield was removed.

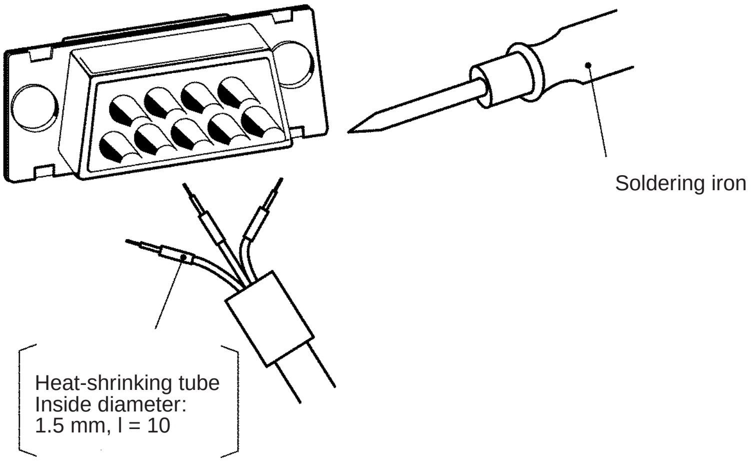


3-4-4 Soldering

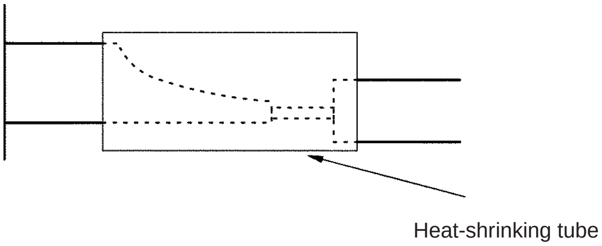
1,2,3...

1. Thread a heat-shrinking tube through each conductor.
2. Temporarily solder each conductor to the corresponding connector terminals.
3. Completely solder each conductor.



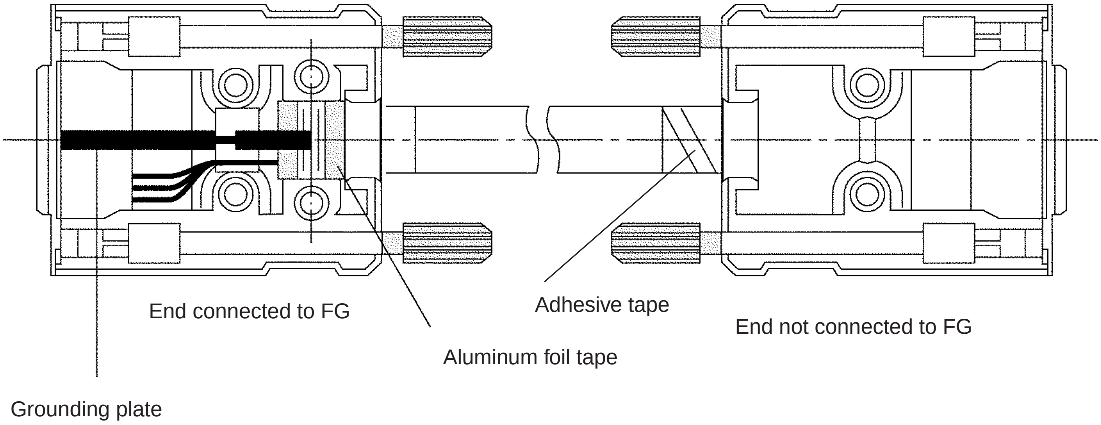


4. Return the heat-shrinking tube to the soldered portion, then heat the tube to shrink it in place.



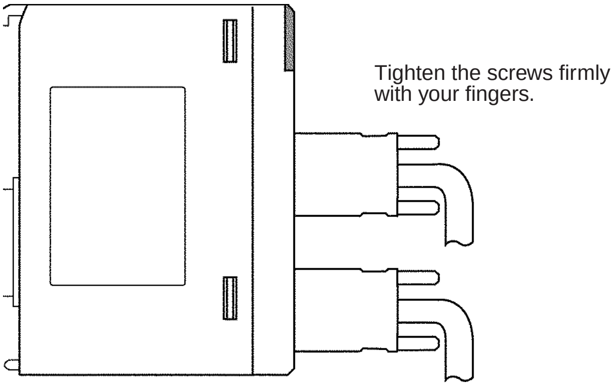
3-4-5 Assembling Connector Hood

Assemble the connector hood as shown below.

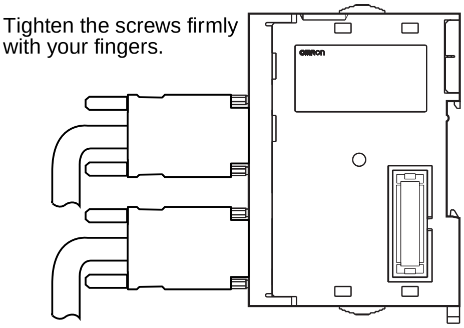


3-4-6 Connecting to Unit

CS-series Unit



CJ-series Unit



SECTION 4
Using Host Link Communications

This section describes the procedure and other information required to use Host Link communications.

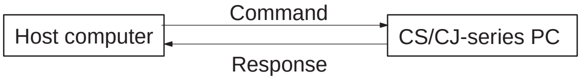
4-1 Host Link Communications

Host Link System can be used to send C-mode commands or FINS commands from a host computer (e.g., personal computer or PT) to a PC to read/ write I/O memory, control operating modes, etc. The PC can also use the SEND(090), RECV(098), and CMND(490) instructions to send FINS commands to the host computer for “slave-initiated communications.” Using the PC to control communications enables controlling and monitoring of the overall system operating status.

Refer to the *CS/CJ-series Communications Commands Reference Manual (W342)* for details on C-mode and FINS commands.

Host-initiated Communications

Communications in a Host Link System are normally started by the host computer.

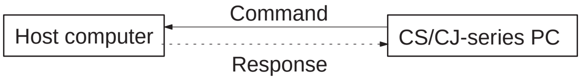


The host computer sends a command to the PC. The PC processes the command and returns a response to the host computer. This process is repeated, allowing the host computer to monitor and control PC operation.

Both C-mode and FINS commands can be used in host-initiated communications.

PC-initiated Communications

The PC can also initiate communications with the host computer, as may be necessary when errors occur on the line controlled by the PC or to confirm the operating status of the host computer.



The PC sends a command to the host computer through a Serial Communications Unit or Board. The host computer processes the command and, when necessary, returns a response to the PC.

Using PC-initiated communications requires that a program be prepared on the host computer to process commands received from a PC and return the required responses. Only FINS commands can be used in PC-initiated communications.

Note Always transfer uppercase letters when using Host Link communications. Lowercase letters cannot be processed.

4-2 Setup Area Allocations

This section describes the Setup Area allocated to the Serial Communications Board and Serial Communications Units in the DM Area when Host Link communications are used.

4-2-1 Setup Area Words

The Serial Communications Board and Serial Communications Units use the following words as a Setup Area in the DM Area when Host Link communications are used. The words allocated to the Serial Communications Board are different from those allocated to the Serial Communications Units (which are allocated words according to the unit numbers).

Serial Communications Boards (CS Series only)

Setup Area Allocated in the DM Area: D32000 to D32099

Words	Usage
D32000 to D32003	Port 1 Settings
D32010 to D32013	Port 2 Settings
D32004 to D32009 D32014 to D32019	Not used in Host Link Communications
D32020 to D32767	Reserved for the system

Serial Communications Units (CS/CJ Series)

Setup Area Allocated in the DM Area: D30000 to D31599
First Word in Setup Area Allocated in the DM Area:
m = D30000 + 100 × unit number

Unit No.	Words
Unit No. 0	D30000 to D30099
Unit No. 1	D30100 to D30199
Unit No. 2	D30200 to D30299
Unit No. 3	D30300 to D30399
Unit No. 4	D30400 to D30499
Unit No. 5	D30500 to D30599
Unit No. 6	D30600 to D30699
Unit No. 7	D30700 to D30799
Unit No. 8	D30800 to D30899
Unit No. 9	D30900 to D30999
Unit No. A	D31000 to D31099
Unit No. B	D31100 to D31199
Unit No. C	D31200 to D31299
Unit No. D	D31300 to D31399
Unit No. E	D31400 to D31499
Unit No. F	D31500 to D31599

m to m + 3: Port 1 Settings
m + 10 to m + 13: Port 2 Settings
m + 14 to m + 9 and m + 14 to m + 19: Not used in Host Link communications
m + 20 to m + 99: Reserved for the system

4-2-2 Setup Area Contents

m = D30000 + 100 × Unit No.

Words				Bit	Setting contents
Board (CS Series only)		Unit (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
D32000	D32010	m	m + 10	15	Port settings 0: Defaults; 1: User settings
				12 to 14	Reserved
				08 to 11	Serial communications mode 0: Default (Host Link) 5: Host Link
				05 to 07	Reserved
				04	Start bits 0: 1 bit; 1: 1 bit (1 start bit is always used regardless of this setting)
				03	Data length 0: 7 bits; 1: 8 bits
				02	Stop bits 0: 2 bits; 1: 1 bit
				01	Parity 0: Yes; 1: No
				00	Parity 0: Even; 1: Odd
D32001	D32011	m + 1	m + 11	04 to 15	Reserved
				00 to 03	Baud rate (bps) 0: Default (9,600); 3: 1,200; 4: 2,400; 5: 4,800; 6: 9,600; 7: 19,200; 8: 38,400; 9: 57,600; A: 115,200
D32002	D32012	m+ 2	m + 12	15	Send delay time 0: Default (0 ms); 1: Setting in bits 00 to 14
				00 to 14	Send delay (0000 to 7530 hex) (Unit: 10 ms)
D32003	D32013	m + 3	m + 13	15	CTS control 0: No; 1:Yes
				08 to 14	Reserved
				00 to 07	Host Link unit number (00 to 1F hex)

Port Settings

The setting for the port settings determine if the default settings or user settings will be used for port 1 and port 2. Be sure to use the same settings as the RS-232C port on the host computer connected via the Host Link System.

If the default port settings are specified, then the setting of bits 00 to 04 and the baud rate in D32001 will be ignored.

The default settings used are as follows: Baud rate: 9,600 bps, start bits: 1 bit, data length: 7 bits, parity: even, and stop bits: 2 bits.

If user port settings are specified, set bits 00 to 04 and set the baud rate in D32001.

Setting Example: 0100 Hex = Host link mode with default port settings.

Serial Communications Mode

Set the serial communications mode to 5 Hex to use Host Link communications. The default setting of 0 Hex can also be used to operate in Host Link mode with unit number 00.

Start Bits, Data Length, Stop Bits, Parity, Baud Rate

If user settings are specified for the port settings, the number of start bits, data length, number of stop bits, parity, and baud rate must be set. The start bits setting, however, will be ignored and 1 start bit will always be used.

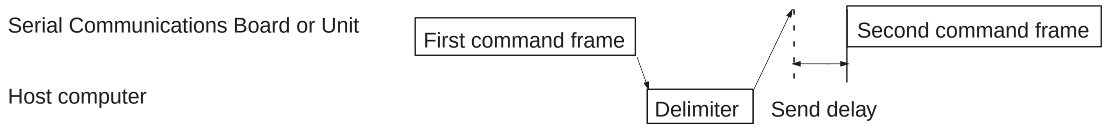
Do not set the baud rate setting to between B and F. A setup error will occur if these settings are used, and the default setting of 9,600 bps will be used. Do not use setting 1 and 2, which are reserved for the system.

Send Delay

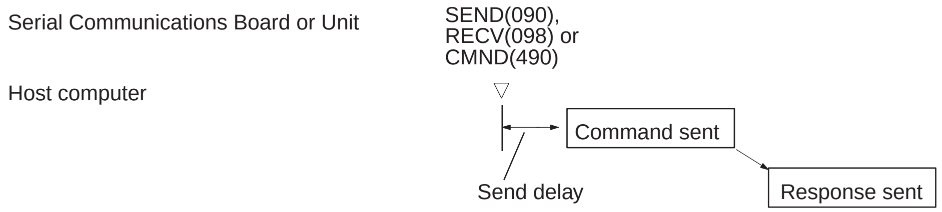
If response frames cannot be completely received regardless of the communications processing used at the host computer, a send delay can be set for the response. Any setting higher than 7530 Hex will be treated as 7530 Hex.

Case 1

Case 2

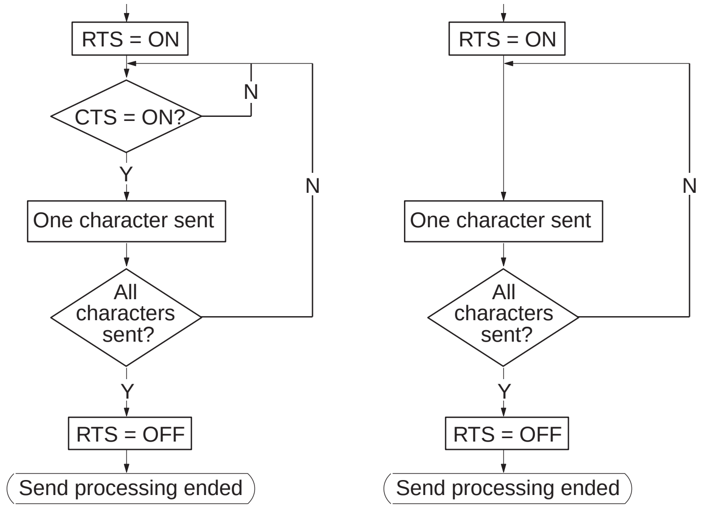


Case 3



CTS Control

If CTS control is enabled, the RTS signal is turned ON before starting to transfer and then the send is started after confirming that the CTS signal is ON. If CTS control is not enabled, the RTS signal is turned ON before starting to transfer and then the send is started without checking the status of the CTS signal.



Host Link Unit Number

Set the setting to 00 to 1F Hex to set Host Link unit numbers 0 to 31.

4-3 Auxiliary Area and CIO Area Allocations

This section describes the bits and words used by the Serial Communications Board and Serial Communications Units in the Auxiliary Area and the Status Area allocated in the CIO Area. The Software Switches allocated in the CIO Area are not used for Host Link communications.

4-3-1 Auxiliary Area Allocations

Port 1 and Port 2 Port Settings Change Bits

These bits can be turned ON from the program using the OUT or other instructions to change communications settings and restart the Serial Communications Board ports. When changing the settings and restarting the port have been completed, the bit will automatically be turned OFF.

Note These bits are used both to change the port settings and to restart the port at the same time. One of these bits can be turned ON to restart a port without changing the port settings in the Setup Area allocated in the DM Area. The STUP(237) instruction can also be used to just restart a communications port by executing STUP(237) with the same port settings as the ones already being used.

Serial Communications Boards (CS Series only)

Word	Bit	Contents
A636	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Serial Communications Units (CS/CJ Series) n = A620 + unit number

Words	Bit	Contents
n	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Inner Board Error Information (CS-series Serial Communications Board Only)

A424 contains error information for the Serial Communications Board.

Word	Bit	Contents	
A424	12 to 15	Non-fatal errors (Note 1)	Reserved
	11		1 Error log EEPROM error; 0: Normal
	10		1: Protocol macro execution error; 0: Normal This bit will be turned ON when code 3, 4, or 5 is stored in the error code for bits 00 to 03 of CIO 1909 or CIO 1919 in the CIO Area,
	09		1: Protocol data error (SUM error); 0: Normal
	08		1: Setup error; 0: Normal
	07		1: Routing table error; 0: Normal
	06		Reserved
	05		1: Cyclic monitoring error; 0: Normal
	04		Reserved
	03	Fatal errors (Note 2)	Reserved
	02		Reserved
	01		1: Inner Bus error; 0: Normal
	00		1: Inner Board watchdog timer error; 0: Normal

Note 1. When any one of bits 05 to 11 is ON, A40208 (Inner Board Error Flag) (non-fatal error) will be ON.

2. When bit 00 or 01 is ON, A40112 (Inner Board Fatal Error Flag) will be ON.

For details on errors, refer to *Section 8 Troubleshooting and Maintenance*.

4-3-2 CIO Area Allocations

Words in the CIO Area are allocated for a Status Area, which contains status and error information for the Serial Communications Board or Unit. These allocations are described in this section.

Serial Communications Boards (CS Series only)

Words CIO 1900 to CIO 1999 in the Inner Board Area are used for a Status Area. Only the words shown in the following table are used for the Status Area with Host Link communications.

Inner Board CIO Area
CIO 1900 to CIO 1999

Words	Usage
CIO 1901 to CIO 1904	Board status
CIO 1905 to CIO 1908	Port 1 status
CIO 1915 to CIO 1918	Port 2 status

Serial Communications Units (CS/CJ Series)

Words CIO 1500 to CIO 1899 in the CPU Bus Unit Area in the CIO Area are allocated according to the unit number setting. Each Unit is allocated 25 words. Only the words shown in the following table are used for the Status Area with Host Link communications.

CPU Bus Unit Area
CIO 1500 to CIO 1899

n = CIO 1500 + 25 × unit number

Unit No.	Words
Unit No. 0	CIO 1500 to CIO 1524
Unit No. 1	CIO 1525 to CIO 1549
Unit No. 2	CIO 1550 to CIO 1574
Unit No. 3	CIO 1575 to CIO 1599
Unit No. 4	CIO 1600 to CIO 1624
Unit No. 5	CIO 1625 to CIO 1649
Unit No. 6	CIO 1650 to CIO 1674
Unit No. 7	CIO 1675 to CIO 1699
Unit No. 8	CIO 1700 to CIO 1724
Unit No. 9	CIO 1725 to CIO 1749
Unit No. A	CIO 1750 to CIO 1774
Unit No. B	CIO 1775 to CIO 1799
Unit No. C	CIO 1800 to CIO 1824
Unit No. D	CIO 1825 to CIO 1849
Unit No. E	CIO 1850 to CIO 1874
Unit No. F	CIO 1875 to CIO 1899

n + 1 to n + 4: Unit status
n + 5 to n + 8: Port 1 status
n + 15 to n + 18: Port 2 status

Status Area

The Status Area is used for status information input from Serial Communications Board or Unit to the CPU Unit. The Status Area is where the Serial Communications Board or Unit set communications status, the transmission control signal status, and the transmission error status.

n = CIO 1500 + 25 × unit number

Words				Bit	Contents		
Boards (CS Series only)		Units (CS/CJ Series)					
Port 1	Port 2	Port 1	Port 2				
CIO 1901		n + 1		02 to 15	Reserved		
				01	1: Error log EEPROM error	0: Error log EEPROM normal	
				00	1: Protocol data error	0: Protocol data normal	
CIO 1902		n + 2		00 to 15	Reserved		
CIO 1903		n + 3		00 to 15	Reserved		
CIO 1904		n + 4		00 to 15	Reserved		
CIO 1905	CIO 1915	n + 5	n + 15	12 to 15	Port setting status	Setup settings	Serial communications mode (Note 1)
				08 to 11			Baud rate (Note 1)
				05 to 07			Reserved
				04			Start bits: Always 1
				03			Data length: 7 or 8 bits (Note 1)
				02			Stop bits: 1 or 2 bits (Note 1)
				01			Parity: Yes/No (Note 1)
				00			Parity: Even/Odd (Note 1)
CIO 1906	CIO 1916	n + 6	n + 16	15		Hard-ware settings	0: No; 0: RS-232C;1: RS-422A/485; 1: Reserved
				14			0: 1: 0: 1: Reserved
				13			0: Terminating resistance OFF 1: Terminating resistance ON
				02 to 12			Reserved
				01			1: Setup error; 0: Setup normal
				00			1: Port operating; 0: Port stopped
CIO 1907	CIO 1917	n + 7	n + 17	11 to 15	Communications status	Reserved	
				10		1: Remote Unit busy receiving (Flow control) 0: Remote Unit ready to receive (Note 2)	
				09		Reserved	
				08		1: Local Unit busy receiving (Flow control) 0: Local Unit ready to receive (Note 3)	
				07	Transmission control signal status	ER signal	
				06		DTR signal	
				05		Reserved	
				04		CTS signal	
				03		RTS signal	
				00 to 02		Reserved	
CIO 1908	CIO 1918	n + 8	n + 18	15	Transmission error status	1: Transmission error; 0: No transmission error	
				05 to 14		Not used.	
				04		1: Overrun error; 0: Normal	
				03		1: Framing error; 0: Normal	
				02		1: Parity error; 0: Normal	
				00, 01		Reserved	

Note

1. The settings in the Setup Area are reflected here. The default settings will be used and will be stored here if a setup error occurs.
2. The status of this bit is not stable in Host Link mode.
3. Always 0 in Host Link mode.

Error Log EEPROM Error

This bit will be set to 1 if an error occurs in reading or writing the error log stored in EEPROM on the assumption that the EEPROM has reached its useful life. If a Serial Communications Unit is being used, the ERC indicator will also light. If a Serial Communications Board is being used, A42411 will turn ON and the ERR/ALM indicator on the CPU Unit will flash, indicating a non-fatal error.

Protocol Data Error

This bit will be turned ON if a checksum error is detected in the protocol data at startup. The checksum is checked for all serial communications modes. If a Serial Communications Unit is being used, the ERC indicator will also flash. If a Serial Communications Board is being used, A42409 will turn ON, the ERR/ALM indicator on the CPU Unit will flash, and the RDY indicator will flash at 1-second intervals, indicating a non-fatal error.

The operation of Host Link communications is not affected by a protocol data error.

Port Setting Status

The settings in the Setup Area for the following items will be stored: Serial communications mode, baud rate, start bits, data length, stop bits, parity, ports, terminating resistance, setup error, and port operating/stopped status. The port operating/stopped status will always be 1 for Host Link mode.

Communications Status

The flow control and buffer status is stored. These bits are cleared at startup or when a port is restarted using STUP(237) or a Port Settings Change Bit (Auxiliary Area).

Transmission Control Signal Status

The status of the following transmission control signals is stored: ER signal, DTR signal, CTS signal, and RTS signal. 1: High, 0: Low

Transmission Error Status

The Transmission Error Flag (bit 15) will turn ON if any of the following flags turn ON: Overrun Error (bit 04), Framing Error (bit 03), or Parity Error (bit 02).

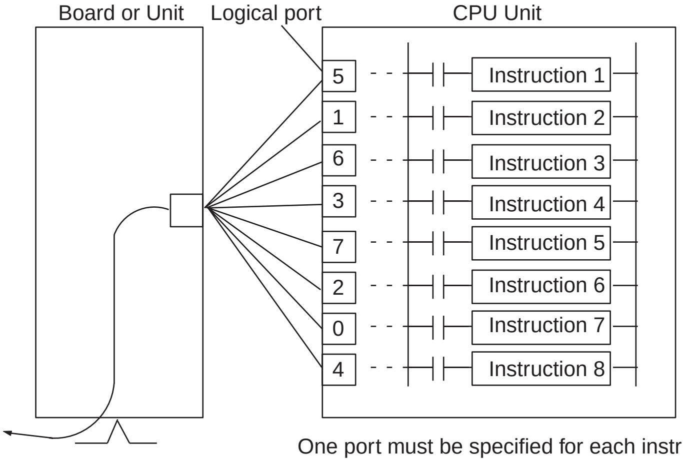
4-4 Communications Timing

This section describes the timing of sending commands and controlling communications in the Host Link mode.

4-4-1 Simultaneous Commands and Communications Ports

The CS/CJ-series CPU Units provide eight logical ports that can be used when executing SEND(090), RECV(098), and CMND(490). Therefore, up to eight commands can be executed for one physical port during any one cycle.

The maximum number of messages, however, that can be sent or received in one CPU Bus Unit service time is two messages from the CPU Unit to the Board or Unit and two messages from the Board or Unit to the CPU Unit.



One port must be specified for each instruction.

Note
1. If more than eight communications instructions are being used, then exclusive control must be performed to make sure that not more than eight are executed at the same time. Refer to descriptions of network communications instructions in the *CS/CJ-series Communications Commands Reference Manual (W342)*.
2. The same communications port numbers are used by both the communications instructions (SEND(090), RECV(098), and CMND(490)) and the PROTOCOL MACRO instruction (PMCR(260)). The same port number cannot be used by more than one of these instructions at the same time.

4-4-2 Communications Control Signals and Communications Timing

If CTS control is enabled in the Setup Area, the RTS output signal will be turned ON from the Board or Unit and the send process will go on standby until the CTS input signal turns ON. Either release this busy status by incorporating the RTS output signal for the CTS input signal at the host computer, or loop the RTS output signal back to the CTS input signal at the Unit or Board.

Note The status of the RTS and CTS signals can be confirmed in the Transmission Control Signal Status in the Status Area. Refer to page 109.

4-4-3 Flags for Network Communications

This section describes the flags in the Auxiliary Area that are used when executing SEND(090), RECV(098), and CMND(490).

Communications Port Enabled Flags

A Communications Port Enabled Flag turns ON when SEND(090), RECV(098), and CMND(490) can be executed. The flag will turn OFF during execution of these commands and turn ON again when the command execution is completed. When creating the ladder diagram, use these flags as input conditions when executing these instructions.

Word	Bit	Content
A202	08 to 15	Reserved
	07	Communications Port Enabled Flag, Port No. 7
	06	Communications Port Enabled Flag, Port No. 6
	05	Communications Port Enabled Flag, Port No. 5
	04	Communications Port Enabled Flag, Port No. 4
	03	Communications Port Enabled Flag, Port No. 3
	02	Communications Port Enabled Flag, Port No. 2
	01	Communications Port Enabled Flag, Port No. 1
	00	Communications Port Enabled Flag, Port No. 0

Communications Port Error Flags

A Communications Port Error Flag will turn ON in the following cases.

- When an error is generated during execution of SEND(090), RECV(098), or CMND(490).
- When an error response or retry error has been generated for the port.

These Flags will turn OFF when the corresponding Communications Port Enabled Flag is turned OFF at the start of operation or at the start of executing the SEND(090), RECV(098), or CMND(490).

Word	Bit	Content
A219	08 to 15	Reserved
	07	Communications Port Error Flag, Port No. 7
	06	Communications Port Error Flag, Port No. 6
	05	Communications Port Error Flag, Port No. 5
	04	Communications Port Error Flag, Port No. 4
	03	Communications Port Error Flag, Port No. 3
	02	Communications Port Error Flag, Port No. 2
	01	Communications Port Error Flag, Port No. 1
	00	Communications Port Error Flag, Port No. 0

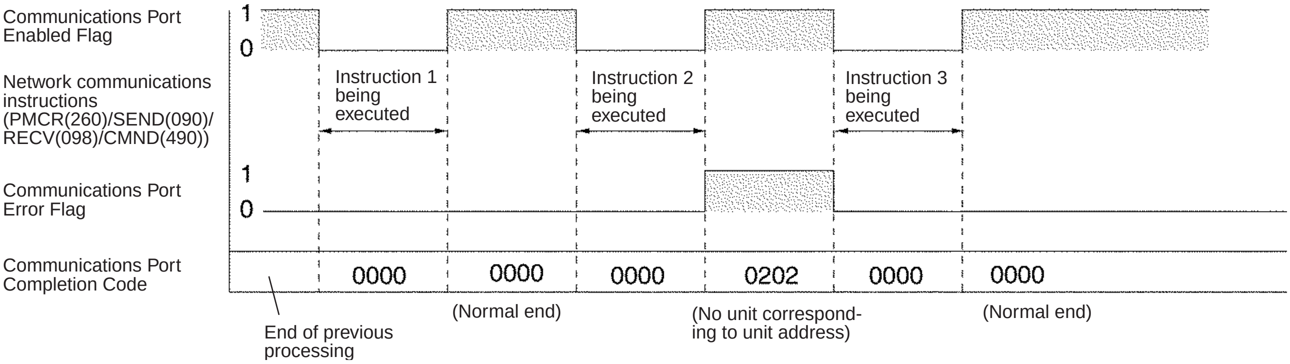
Communications Port Completion Codes

The Communications Port Completion Code words will contain the FINS end code after SEND(090), RECV(098), or CMND(490) has been executed.

If the Communications Port Enabled Flag turns OFF when operation is started or SEND(090), RECV(098), or CMND(490) are executed, the contents of these words will be cleared.

Word	Content
A203	Communications Port Completion Code, Port No. 0
A204	Communications Port Completion Code, Port No. 1
A205	Communications Port Completion Code, Port No. 2
A206	Communications Port Completion Code, Port No. 3
A207	Communications Port Completion Code, Port No. 4
A208	Communications Port Completion Code, Port No. 5
A209	Communications Port Completion Code, Port No. 6
A210	Communications Port Completion Code, Port No. 7
A211 to A218	Reserved

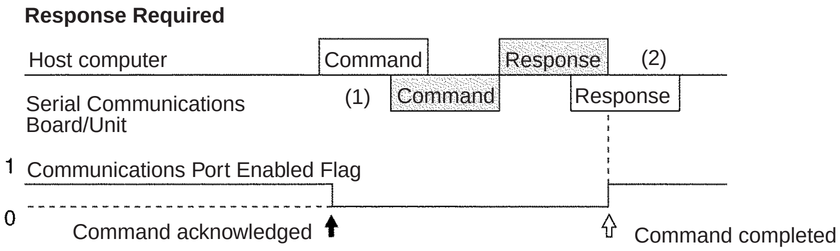
Flag Transitions

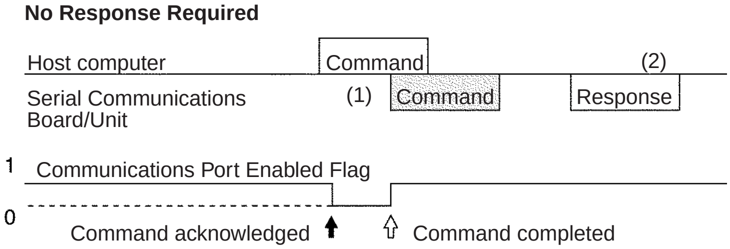


4-4-4 Timing of Commands Addressed to a Host Computer

Commands addressed to a host computer are sent at the timing shown in the following diagrams.

Host Computer Sending Data



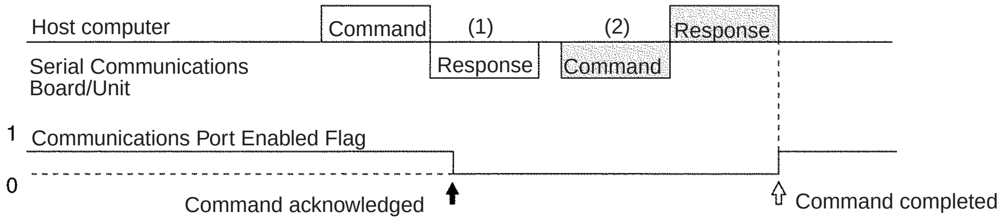


Command transmission to the host computer can start even when the port is receiving a command from the host computer (1). The transmission of a response to the command from the host computer is postponed until the transmission of the command to the host computer is completed (2).

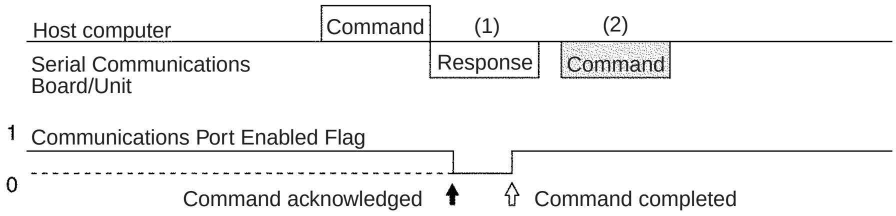
When a response is not required from the host computer, the Communications Port Enabled Flag will turn ON when the command to the host computer has passed from the CPU Unit to the port.

Host Computer Receiving Data

Response Required



No Response Required

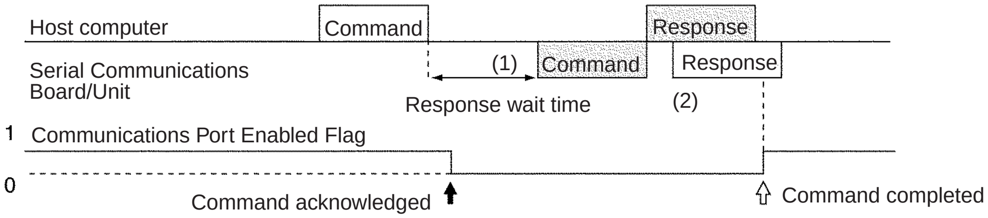


At (1) in the diagram, the response to a command sent from the host computer is being transmitted from the port. In this case, the command transmission to the host computer is postponed until the response transmission is completed (2).

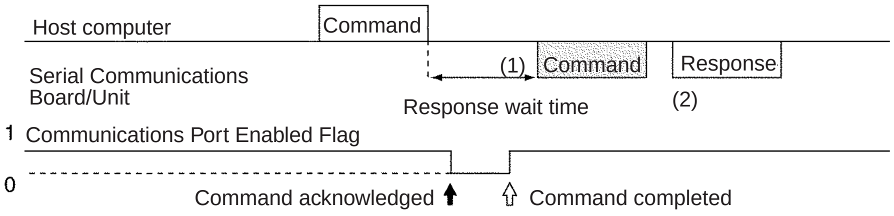
When a response is not required from the host computer, the Communications Port Enabled Flag will turn ON when the command to the host computer has passed from the CPU Unit to the port.

Response Wait Time After Host Computer Sends Data

Response Required



No Response Required



When response wait time has been set in the command format from the host computer, commands to the host computer will not be transmitted until the response time has elapsed (1). Transmission of responses to commands from the host computer will be postponed until the command transmission to the host computer has been completed (2).

When a response is not required from the host computer, the Communications Port Enabled Flag will turn ON when the command to the host computer has passed from the CPU Unit to the port.

4-4-5 Reception Buffers

In Host Link mode, each port has a reception buffer of 1,200 bytes. This is sufficient to hold the maximum Host Link frame length for an FA command response frame (1,115 bytes) + 85 bytes. If a frame larger than 1,200 bytes is sent from the host computer (from @ to the carriage return), the frame will be discarded and no response will be returned.

4-4-6 Error Responses

When Host Link FA commands are used for FINS commands, an error code will returned as the end code in the FINS response whenever there is a mistake in the FINS command settings or an FINS response is required that is too long for the legal response frame.

An end code of 110B Hex is returned when the response exceeds the maximum response length. The Host Link response frame will contain the requested read data after the end code through the end of the maximum legal response frame length.

Note We recommend programming retry processing at any device sending commands in case noise or other factors result in transmission errors.

4-5 Changes from Previous Products

There are differences between Host Link Systems created using the CS/CJ-series Serial Communications Boards and Unit in comparison to Host Link Systems created with Host Link Units and CPU Units in other PC product series. These differences are described in this sections.

4-5-1 RS-232C Ports

Take the following differences into consideration when changing from an existing Host Link System to one using an RS-232C port on a CS/CJ-series CPU Unit, Serial Communications Boards, or Serial Communications Unit (CS1H/

G-CPU□□ RS-232C port, CS1W-SCU21-V1 ports, CJ1W-SCU41 port 2, CS1W-SCB21-V1 ports, or CS1W-SCB41-V1 port 1).

Previous products	Model number	Changes required for CS/CJ-series product	
		Wiring	Other
C-series Host Link Units	3G2A5-LK201-E C500-LK203 3G2A6-LK201-E	The connector has been changed from a 25-pin to a 9-pin connector. The CS/CJ-series products do not support the ST1, ST2, and RT signals and wiring them is not required.	**The following changes are necessary for systems that sync with ST1, ST2, and RT.** Synchronized transfers will no longer be possible. Full-duplex transmissions will be possible with the CS/CJ-series product, but the host computer's communications program, hardware, or both will need to be altered. **The following changes are necessary for systems that did not sync with ST1, ST2, and RT.** It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different text lengths in frames or different CS/CJ command specifications. (See note.)
	C200H-LK201	The connector has been changed from a 25-pin to a 9-pin connector.	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different text lengths in frames or different CS/CJ command specifications. (See note.)
C-series CPU Units	SRM1 CPM1 CPM1A CQM1-CPU□□-E C200HS-CPU□□-E C200HX/HG/HE-CPU□□-E C200HW-COM□□-E	No changes have been made in wiring.	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different CS/CJ command specifications.
CVM1 or CV-series CPU Units	CVM1/CV-CPU□□	No changes have been made in wiring.	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different CS/CJ command specifications.
CVM1 or CV-series Host Link Unit	CV500-LK201	Port 1: The connector has been changed from a 25-pin to a 9-pin connector. Port 2 set for RS-232C: The SG signal has been changed from pin 7 to pin 9.	**The following changes are necessary for half-duplex transmissions that use CD.** Check the system for timing problems when using SEND, RECV, or CMND to initiate communications from the PC or timing problems in sending commands from the host computer. If necessary, switch to full-duplex transmissions. **The following changes are necessary for full-duplex transmissions that do not use CD.** Half-duplex It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different CS/CJ command specifications.

Note The number of words that can be read and written per frame (i.e., the text lengths) when using C-mode commands is different for C-series Host Link Units and CS/CJ-series Serial Communications Boards/Units. A host computer program previously used for C-series Host Link Units may not function correctly if used for CS/CJ-series PCs. Check the host computer program before using it and make any corrections required to handle different frame text lengths. Refer to the *CS/CJ-series Communications Commands Reference Manual (W342)* for details.

4-5-2 RS-422A/485 Ports

Take the following differences into consideration when changing from an existing Host Link System to one using an RS-422A/485 port on a CS/CJ-series Serial Communications Board (CS1W-SCB41-V1 port 2 or CJ1W-SCU41 port 1).

Previous products	Model number	Changes required for CS/CJ-series product	
		Wiring	**Other**
C-series Host Link Units	3G2A5-LK201-E C200H-LK202 3G2A6-LK202-E	Wiring pins have been changed as shown below. SDA: Pin 9 to pin 1 SDB: Pin 5 to pin 2 RDA: Pin 6 to pin 6 RDB: Pin 1 to pin 8 SG: Pin 3 to Not connected FG: Pin 7 to pin Connector hood	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different text lengths in frames or different CS/CJ command specifications. (See note.)
C200HX/HG/HE Communications Board	C200HW-COM□□-E	No changes have been made in wiring.	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different CS/CJ command specifications.
CVM1 or CV-series CPU Units	CVM1/CV-CPU□□	No changes have been made in wiring.	It may be possible to use the host computer programs without alteration as long as the same communications settings (e.g., baud rate) are used. It may be necessary, however, to change programs to allow for different CS/CJ command specifications.
CVM1 or CV-series Host Link Unit	CV500-LK201		

Note The number of words that can be read and written per frame (i.e., the text lengths) when using C-mode commands is different for C-series Host Link Units and CS/CJ-series Serial Communications Boards/Units. A host computer program previously used for C-series Host Link Units may not function correctly if used for CS/CJ-series PCs. Check the host computer program before using it and make any corrections required to handle different frame text lengths. Refer to the *CS/CJ-series Communications Commands Reference Manual (W342)* for details.

SECTION 5
Using Protocol Macros

This section describes the procedure and other information required to use protocol macros.

5-1 Overview of the Protocol Macro Functions

5-1-1 Protocol Macro Functions

The protocol macro function is used to control devices by using the PMCR(260) instruction in the ladder program to execute the data send/ receive sequences (protocols) with the various communications devices, such as general-purpose devices, connected to the RS-232C or RS-422A/485 port.

Standard system protocols are provided in the Serial Communications Board or Unit for controlling OMRON devices (such as Digital Controllers and Temperature Controllers).

Using the Protocol Support Tool called the CX-Protocol, the protocol macro function can be used to create new protocols for commercially available measuring instruments and devices, and to create protocols by modifying one of the standard system protocols. The standard system protocols are also provided with the CX-Protocol.

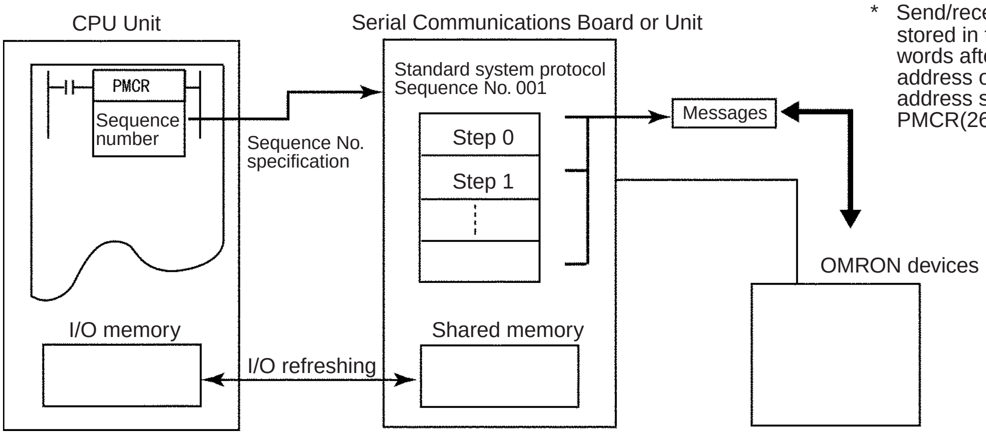
For details on the use of the CX-Protocol and the protocol macro function, refer to the *CX-Protocol Operation Manual (W344)*.

5-1-2 Using the Protocol Macro Function

The following three methods are available for using the protocol macro function.

Using the Standard System Protocols

When connecting OMRON devices, data is sent and received between the CS/CJ-series CPU Unit and these devices by specifying the sequence number of the standard system protocol provided in the Serial Communications Board, Serial Communications Unit, and CX-Protocol, and executing the sequence using the PROTOCOL MACRO instruction (PMCR(260)).



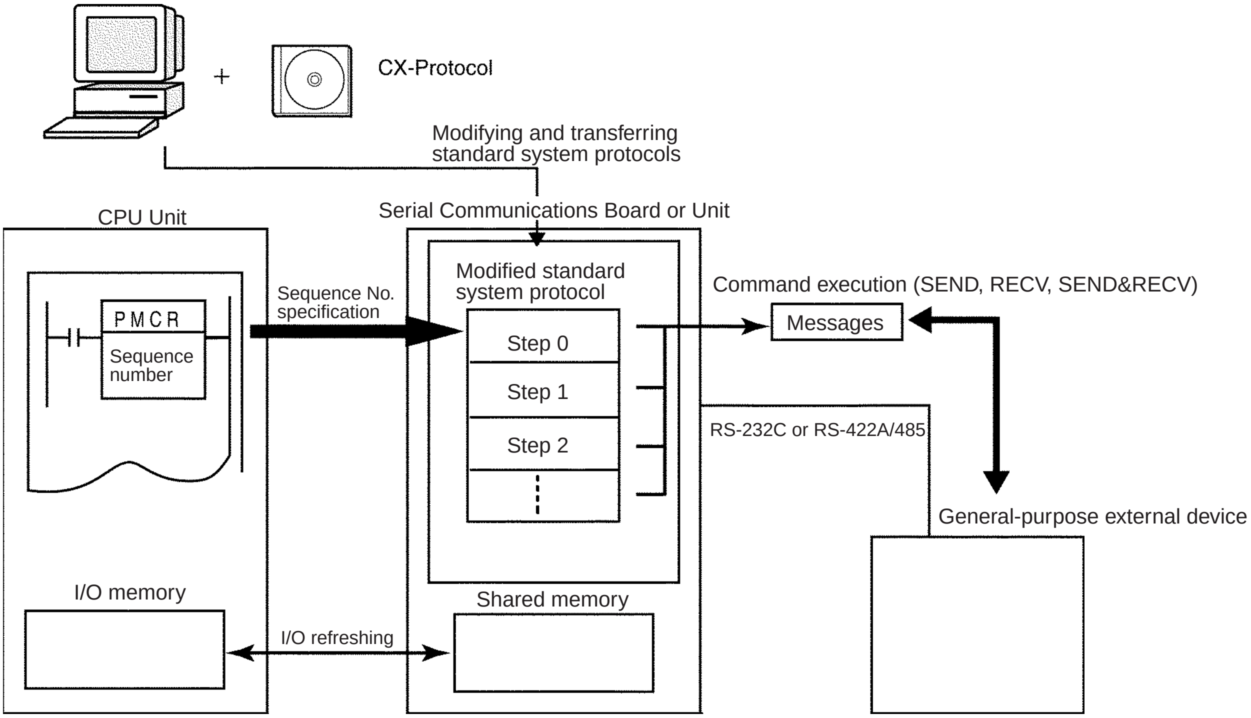
* Send/receive messages are stored in the area one or more words after the send data address or the receive data address specified in the PMCR(260) instruction.

Note The devices for which standard system protocols are provided are listed below. For details, refer to *5-4 Using Protocol Macros*.

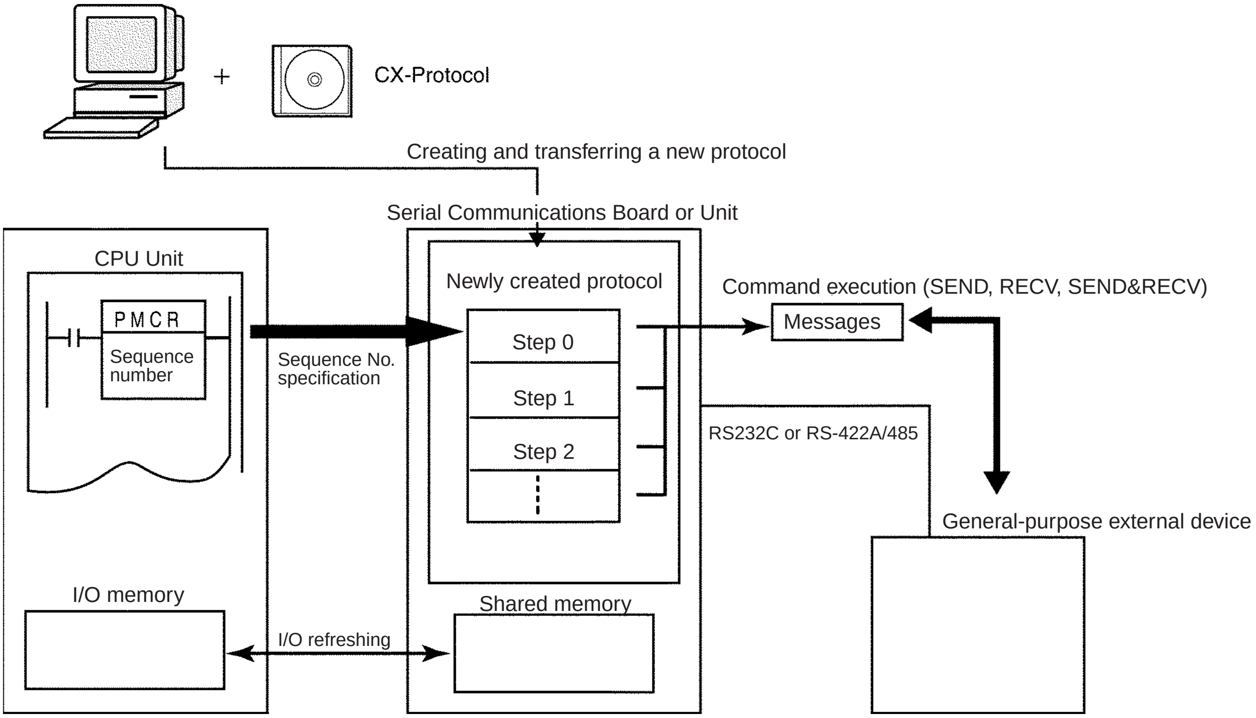
Digital Controllers (E5□K, ES100□), Temperature Controllers (E5ZE, E5□J), Intelligent Signal Processors (K3T□), Bar Code Readers (V500/ V520), Laser Micrometers (3Z4L), Visual Inspection Units (F200/F300/ F350), ID Controllers (V600/V620), Hayes Modem AT Command, and devices supporting the CompoWay/F protocol.

Modifying Standard System Protocols

When connecting OMRON devices, if there is no standard system protocol or you wish to modify part of the protocol, use the CX-Protocol to modify the standard system protocol, transfer this as a separate send/receive sequence to the Serial Communications Board or Unit, and execute the PMCR(260) instruction.



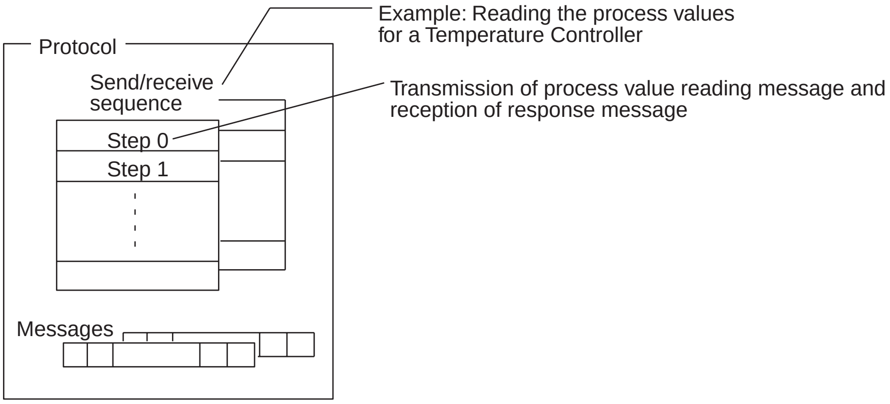
Creating a New Protocol When connecting a general-purpose external device that has an RS-232C or RS-422A/485 port, use the CX-Protocol to create a new protocol containing the communications specifications for the general-purpose external device, transfer these specifications to the Serial Communications Board or Unit, and execute the PMCR(260) instruction.



In this manual, the protocol structure is explained in simple terms, and examples are given of the use of the PMCR(260) instruction when controlling OMRON devices using standard system protocols. For details on the protocols, the method of modifying the standard system protocols, and the method of creating new sequences, refer to the *CX-Protocol Operation Manual (W344)*.

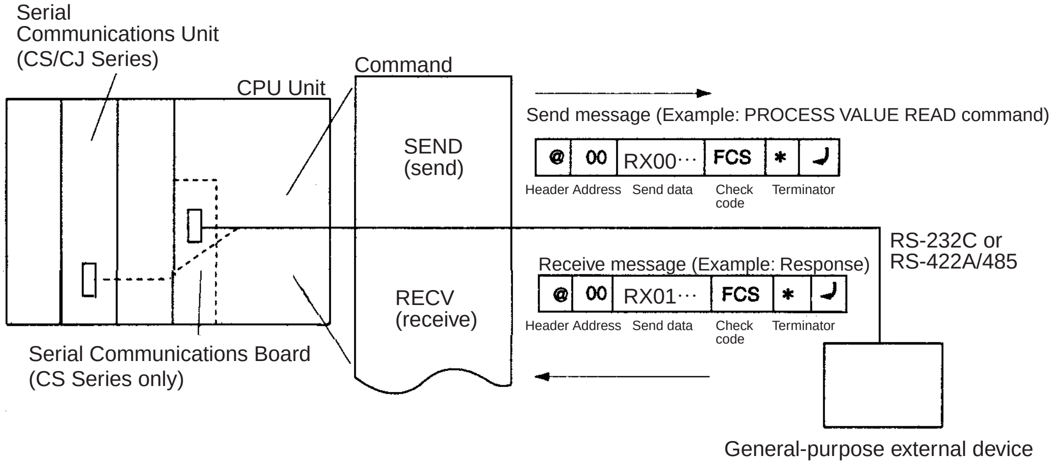
5-1-3 Protocol Structure

Protocols consist of send/receive sequences. A sequence consists of steps. These steps can be repeated, or they can be branched or ended depending on the responses received. A step consists of a command, send/receive messages, processing results, and the next process (which depends on the processing results).

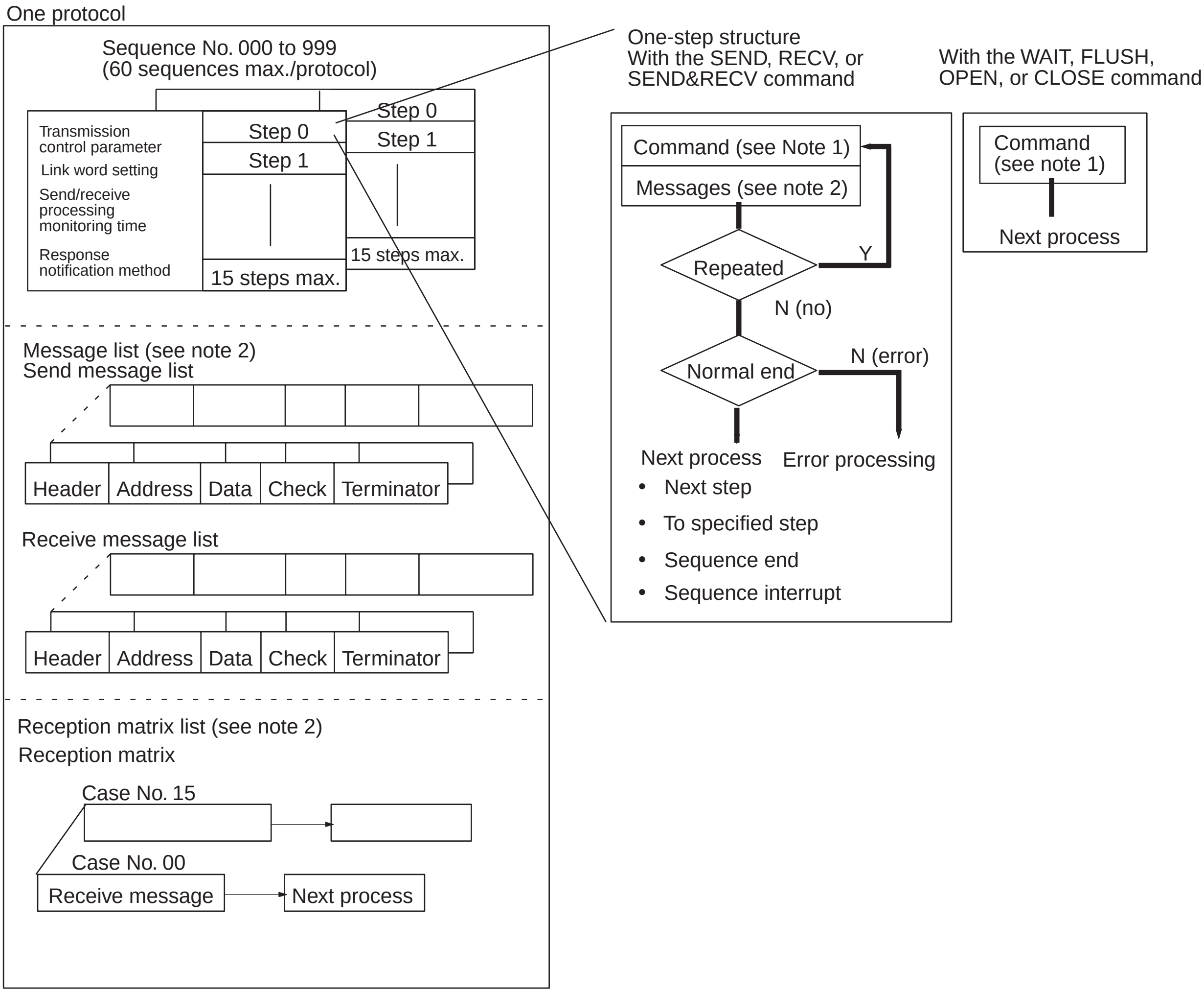


A protocol consists of processing sequences (such as reading the process value for a Temperature Controller) for a general-purpose external device. A sequence consists of a group of steps, each of which consists of a send/receive/control command, send/receive message, processing result, and a next step that depends on the processing results.

For example, with a sequence that reads the process value for a Temperature Controller, the sequence sends the send message for the connected Temperature Controller (a character string in which the Process Value Read command is inserted between the header + address and the check code + terminator) and receives the receive message (a character string in which the Process Value Read command response is inserted between the header + address and the check code + terminator).



Depending on the response received, the user can either choose to resend the same send message (retry processing), or to perform the next process (for example, read the process value for a Temperature Controller with a different address).



Note

1. The SEND, RECV, SEND&RECV, WAIT, FLUSH (reception buffer clear), OPEN (ER-ON), or CLOSE (ER-OFF) commands can be used.
2. Three types of reception matrix are available for switching the processing, depending on whether the messages are send messages, receive (wait) messages, or multiple receive (wait) messages. Unlike sequences, these matrixes are managed as lists.

Sequence Parameters

Parameter	Meaning
Transmission control parameters	Control methods, such as flow control
Link words	Settings for shared words between the PC and the Serial Communications Board.
Monitoring time	Monitoring time for send/receive processing
Response notification method	Timing for writing received data to I/O memory in the PC

Step Parameters

<table>
<tr><th colspan="2">Parameter</th><th>Meaning</th></tr>
<tr><td colspan="2">Command</td><td>One of the following: SEND, RECV, SEND&RECV, WAIT, FLUSH, OPEN, or CLOSE</td></tr>
<tr><td rowspan="4">Messages</td><td>Send message</td><td>The message sent for SEND.</td></tr>
<tr><td>Receive message</td><td>The expected message for RECV.</td></tr>
<tr><td>Send message and receive message</td><td>The message sent and the expected message for SEND&RECV.</td></tr>
<tr><td>Reception matrix</td><td>A group of expected messages that can be used to switch to different next processes when RECV or SEND&RECV is used.</td></tr>
<tr><td>Repeat counter</td><td colspan="2">The number of times to repeat the step (0 to 255). The repeat counter can be used to change send/receive messages.</td></tr>
<tr><td>Retry count</td><td colspan="2">Used for SEND&RECV to retry the command for errors (0 to 9).</td></tr>
<tr><td>Send wait time</td><td colspan="2">Used for SEND or SEND&RECV to create a wait time before sending data.</td></tr>
<tr><td>Response write enable (for operand specification)</td><td colspan="2">Specification of whether or not to write the received data to memory.</td></tr>
<tr><td>Next process</td><td colspan="2">Specifies the next step or to end the sequence when the current step is completed normally.</td></tr>
<tr><td>Error processing</td><td colspan="2">Specifies the next step or to end the sequence when the current step ends in an error.</td></tr>
</table>

Note We recommend programming retry processing at any device sending commands in case noise or other factors result in transmission errors.

Standard System Protocol Example

Process Value Read Sequence for E5□K Controller Read Protocol

Level	Item	Setting
Sequence	Link words	---
	Transmission control parameters	Modem control
	Response notification method	Scan
	Reception wait time Tr	3 s
	Reception finished wait time Tfr	3 s
	Send finished wait time Tfs	3 s
Steps	Step number	00
	Repeat counter	Reset/001
	Command	SEND&RECV
	Retry count	3
	Send wait time	---
	Send message	SD (00) _1
	Receive message	RV (00) _1
	Response write enable	Write
	Next process	End
	Error process	Abort
Send message SD (00) _1	Header <h>	“@”
	Terminator <t>	[2A0D]
	Error check code <c>	LRC (horizontal parity) (0) (2 bytes of ASCII)
	Length <l>	---
	Address <a>	$ (R (1)) ,2)
	Message edited	<h> + <a> + $\underbrace{\text{"1" + "00" + "0000"}}_{\text{Data}}$ + <c> + <t>
Receive message RV (00) _1	Header <h>	“@”
	Terminator <t>	[2A0D]
	Error check code <c>	LRC (horizontal parity) (0) (2 bytes of ASCII)
	Length <l>	---
	Address <a>	& (R (1)) ,2)
	Message edited	<h> + <a> + $\underbrace{\text{"00" + "00" + \& (W (1)}}_{\text{Data}}$,4) + <c> + <t>

DM Area Settings for Standard System Protocol

The following data is set in the Setup Area in the DM Area for a standard system protocol.

m = D30000 + 100 × unit number

Board (CS Series only)		Unit (CS/CJ Series)		Contents	Setting for a standard system protocol
Port 1	Port 2	Port 1	Port 2		
D32000	D32010	m	m + 10	Bits 00 to 04: Communications parameters	Set to match the parameters of the external device.
				Bits 08 to 11: Serial communications mode	Set to 6 Hex to specify Protocol Macro Mode.

Board (CS Series only)		Unit (CS/CJ Series)		Contents	Setting for a standard system protocol
Port 1	Port 2	Port 1	Port 2		
D32001	D32011	m + 1	m + 11	Bits 00 to 03: Baud rate	Set to match the baud rate of the external device.
D32008	D32018	m + 8	m + 18	Bit 15: Transmission method	Set to 0 Hex to specify half-duplex.
D32009	D32019	m + 9	m + 19	Bits 00 to 15: Max. No. of send/ receive bytes	Set to 03E8 Hex to specify 1,000 bytes.

Handling Communications Problems for Standard System Protocols

The CS/CJ-series PCs provide standard system protocols to enable communications with OMRON components without having to create send/receive sequences. The sequences in the standard system protocols can be executed merely by setting operands for the PMCR(260) instruction.

Processing for communications line problems during communications for the standard system protocols are set to normal settings, as shown in the following table. If these settings are not suitable to the application or if improvements are desired, use the CX-Protocol to modify the following settings in the required sequences. For details on the use of the CX-Protocol, refer to the *CX-Protocol Operation Manual (W344)*. Refer to the appendices for the settings in the standard system protocols.

Level	Item	Possible changes in settings
Sequence parameters	Link words	No reason to change.
	Transmission control parameters	
	Response notification method	
	Reception wait time Tr	The monitoring times are set to 3 seconds for most sequences. The settings are different for send-only and receive-only sequences, as well as for sequences that require time for responses.
	Reception finished wait time Tfr	
	Send finished wait time Tfs	
Step parameters	Repeat counter	No reason to change.
	Command	
	Retry count	The retry count is general set to 3 retries (4 tries total) for sequences that use the SEND&RECV command. Different settings are used for sequences that have other commands.
	Send wait time	No reason to change.
	Send message	
	Receive message	
	Response write enable	
	Next process	
	Error process	

5-2 Setup Area Allocations

This section explains the Setup Area allocated in the DM Area when a Serial Communications Board or a Serial Communications Unit is used in protocol macro mode.

5-2-1 Setup Area Words

The Serial Communications Board and Serial Communications Units use the following words as a Setup Area in the DM Area when Protocol Macros are used. The words allocated to the Serial Communications Board are different from those allocated to the Serial Communications Units (which are allocated words according to unit numbers).

Serial Communications Boards (CS Series Only)

Setup Area Allocated in the DM Area: D32000 to D32099

Words	Usage
D32000 to D32001 D32008 to D32009	Port 1 Settings
D32010 to D32011 D32018 to D32019	Port 2 Settings
D32002 to D32007 D32012 to D32017	Not used with the protocol macro mode
D32020 to D32767	Reserved for the system

Serial Communications Units (CS/CJ Series)

Setup Area Allocated in the DM Area: D30000 to D31599
First Word in Setup Area Allocated in the DM Area:
m = D30000 + 100 × unit number

Unit No.	DM Area
Unit No. 0	D30000 to D30099
Unit No. 1	D30100 to D30199
Unit No. 2	D30200 to D30299
Unit No. 3	D30300 to D30399
Unit No. 4	D30400 to D30499
Unit No. 5	D30500 to D30599
Unit No. 6	D30600 to D30699
Unit No. 7	D30700 to D30799
Unit No. 8	D30800 to D30899
Unit No. 9	D30900 to D30999
Unit No. A	D31000 to D31099
Unit No. B	D31100 to D31199
Unit No. C	D31200 to D31299
Unit No. D	D31300 to D31399
Unit No. E	D31400 to D31499
Unit No. F	D31500 to D31599

m to m + 1, m + 8 to m + 9: Port 1 Settings
m + 10 to m + 11, m + 18 to m + 19: Port 2 Settings
m + 2 to m + 7, m + 12 to m + 17: Not used
m + 20 to m + 99: Not used

5-2-2 Setup Area Allocations

m = D30000 + 100 × unit number

DM Area				Bit	Setting contents
Boards (CS Series only)		Units (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
D32000	D32010	m	m + 10	15	Port settings 0: Defaults, 1: User settings
				12 to 14	Reserved
				08 to 11	Serial communications mode 6: Protocol macro
				05 to 07	Reserved
				04	Start bits 0: 1 bit; 1: 1 bit (1 start bit is always used regardless of this setting)
				03	Data length 0: 7 bits; 1: 8 bits
				02	Stop bits 0: 2 bits; 1: 1 bit
				01	Parity 0: Yes; 1: No
				00	Parity 0: Even; 1: Odd
D32001	D32011	m + 1	m + 11	04 to 15	Reserved
				00 to 03	Baud rate (Unit: bps) 0: Default (9,600); 3: 1,200; 4: 2,400; 5: 4,800; 6:9,600; 7: 19,200; 8: 38,400
D32002 to D32007	D32012 to D32017	m + 2 to m+7	m + 12 to m+17	00 to 15	Not used.
D32008	D32018	m + 8	m + 18	15	Transmission method 0: Half-duplex; 1: Full-duplex
				00 to 14	Reserved
D32009	D32019	m + 9	m + 19	00 to 15	Maximum number of bytes in send/receive data: 00C8 to 03E8 Hex

Port Settings

The setting for the port settings determines if the default settings or user settings will be used for port 1 and port 2. Be sure to use the same settings as the RS-232C port on the host computer connected via the Host Link System.

If the default port settings are specified, then the settings of bits 00 to 04 and the baud rate in D32001 will be ignored.

The default settings used are as follows: Baud rate: 9,600 bps, start bits: 1 bit, data length: 7 bits, parity: even, and stop bits: 2 bits.

If user port settings are specified, set bits 00 to 04 and set the baud rate in D32001.

Setting Example:
0600 Hex = Protocol macro mode with default port settings and baud rate.

Serial Communications Mode

Set the serial communications mode to 6 Hex to use protocol macros.

Start Bits, Data Length, Stop Bits, Parity, and Baud Rate

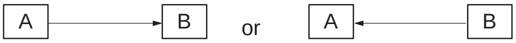
If user settings are specified for the port settings, the number of start bits, data length, number of stop bits, parity, and baud rate must be set. The start bits setting, however, will be ignored and 1 start bit will always be used.

Do not set the baud rate setting to between 9 and F. A setup error will occur if these settings are used, and the default setting of 9,600 bps will be used. Do not use settings 1 and 2, which are reserved for the system.

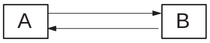
Transmission Method

Set half-duplex (0) or full-duplex (1) as the transmission mode for the external device.

Note Half-duplex: Allows data to be sent between two Units in one direction only at any one time.



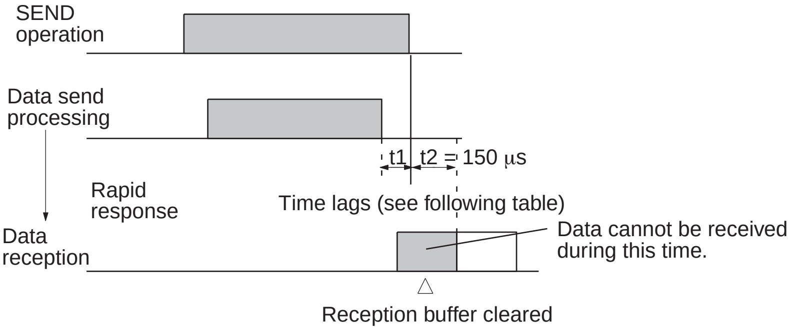
Full-duplex: Allows data to be exchanged both ways between two Units at the same time.



With half-duplex transmissions, the reception buffer is cleared immediately before the sequence is executed and immediately following SEND completion (SEND or SEND&RECV command). Therefore, the data received before and during SEND execution cannot be accessed as receive data by the next RECV command.

Note When using SEND with half-duplex transmission, there is a time lag, t1, between data send processing completion and SEND completion. Therefore, if there is a rapid response from the remote device and a response is returned for SEND after data is sent (communications or other command) and before SEND is completed, the response during that time cannot be received using half-duplex transmissions. If this problem occurs, use the full-duplex transmissions.

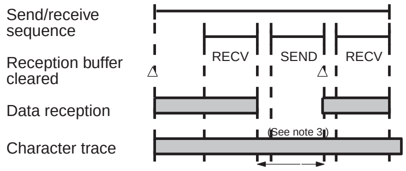
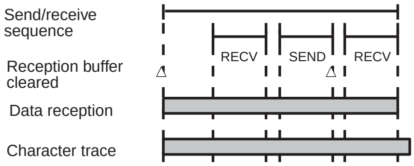
Also, if the external device is connected using 2-wire connections from an RS-422A/485 port, send and receive data cannot both be on the same transmission line at the same time. This will create an additional lag time, t2, or 150 µs. If responses are being received quickly from the external device, i.e., faster than t1 +t2, create a send delay at the external device or take other measures to allow for the lag times.



Time Lag t1

Baud rate (bps)	Time lag (µs)
1,200	1,116
2,400	578
4,800	288
9,600	144
19,200	73
38,400	36

With full-duplex mode, the reception buffer is cleared immediately before the sequence is executed. While both the SEND&RECV commands are being executed, data is input into the reception buffer and is used as the macro data.

Transmission mode	Time reception buffer cleared	Data reception	Character trace	Timing chart (example)
Half-duplex	Immediately before send/receive sequence execution and immediately following SEND completion by the SEND or SEND&RECV command	From SEND completion to RECV completion, or following SEND completion to immediately before SEND execution	All during trace execution	
Full-duplex (See note 1)	Immediately before send/receive sequence execution (See note 2)	All during send/ receive sequence execution	All during trace execution	

Note

1. With full-duplex, RS-232C or RS-422A/485 (1:1 and 4-wire connections) can be used. RS-422A/485 1:N or 2-wire transmissions cannot be used.
2. The FLUSH command is used to clear the reception buffer, and can be used at any time.
3. Although the received data is discarded until completion of SEND execution, it is reflected in the character trace.

Maximum Number of Send/Receive Data Bytes

From 200 bytes up to a maximum of 1,000 bytes can be set in hexadecimal, i.e., between 00C8 Hex and 03E8 Hex. Any setting below 00C8 Hex, will be treated as 00C8 Hex; any setting above 03E8 Hex, will be treated as 03E8 Hex.

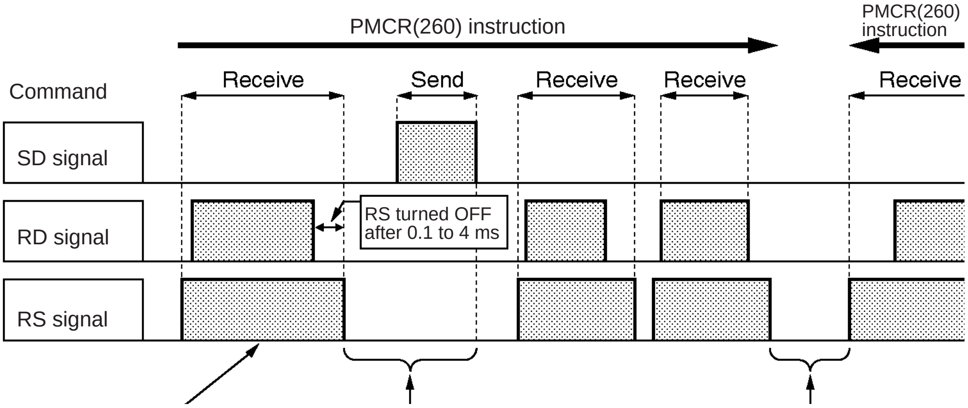
Note Flow Control and Maximum Number of Send/Receive Data Bytes

There is a 2.5-Kbyte reception buffer for each serial port in a Serial Communications Board or Unit. When using flow control, initiate flow control after receiving about 2 Kbytes, and then release control after processing all but 0.5 Kbytes of receive data. Up to 1,000 bytes (500 words) of data can be stored for each RECV command if 2 Kbytes of receive data is first stored in the buffer and 1,000 bytes (03E8 Hex) is set as the maximum number of send/ receive data bytes.

RS/CS Flow Control

Half-duplex Communications

With CS/CJ-series half-duplex protocol macro communications (see note), or with C200HX/HG/HE protocol macro communications, flow control can be released by turning ON the RS signal (CS signal at the communications partner) while the RECV command is being executed. The timing of this operation is shown below. (Signal names used below are those at the Serial Communications Board.)



RS signal ON while RECV command is executed.

Data received before SEND is completed is discarded.

Data received while the PMCR(260) instruction is not being executed is discarded (controlled by turning OFF the RS signal).
The OFF status of the RS signal is maintained after execution of the PMCR(260) instruction.

1,2,3...

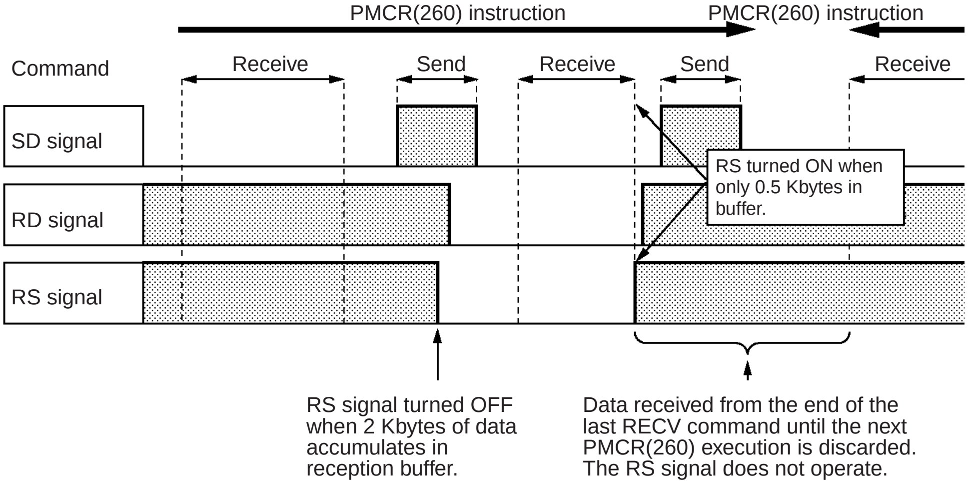
1. With protocol communications in half-duplex mode, the RS signal is ON only while the RECV command is being executed.
2. The receive data (RD signal) from the communications partner is initially stored in the reception buffer.
3. The data in the reception buffer is analyzed, and a search is performed for data matching an expected message registered with the RECV command.
4. When matching data is found, the RS signal is turned OFF. The search starts after the final data has been received. It takes between 100 µs and 4 ms from starting the search until the RS signal turns OFF.
5. While the SEND command is being executed, and while the PMCR instruction is not being executed, the RS signal stays OFF and receive data is discarded.

Note RS/CS flow control in half-duplex mode is supported only by CS-series Serial Communications Boards/Units manufactured on or after December 20th, 1999. With earlier models, half-duplex mode will operate in the same way as full-duplex mode.

Lot No: **20Z9** Manufactured on December 20th, 1999
The year is indicated with the last digit. In this case, "9" indicates 1999."
Month of manufacture. October, November, and December are indicated with X, Y, and Z respectively. In this case, the month is "December."
Day of manufacture. In this example, the day is "20."

Full-duplex Mode

There is a 2.5-Kbyte reception buffer for each serial port in a CS/CJ-series Serial Communications Board or Unit. When using flow control, initiate flow control after receiving about 2 Kbytes, and then release control after processing all but 0.5 Kbytes of receive data. Up to 1,000 bytes (500 words) of data can be stored for each RECV command if 2 Kbytes of receive data is first stored in the buffer and 1,000 bytes (03E8 Hex) is set as the maximum number of send/receive data bytes. The timing of this operation is shown below. (Signal names used below are those at the Serial Communications Board.)



1,2,3...

1. With full-duplex protocol communications, the RS signal is turned OFF when 2 Kbytes of data has been stored in the reception buffer (i.e., with 0.5 Kbytes remaining).
2. The receive data (RD signal) from the communications partner is initially stored in the reception buffer.
3. The data in the reception buffer is analyzed, and a search is performed for data matching an expected message registered with the RECV command.
4. When matching data is found, all the previous data is deleted from the reception buffer.
5. If this results in the amount of data stored in the reception buffer dropping to less than 0.5 Kbytes (i.e., more than 2 Kbytes remaining), the RS signal is turned ON.
6. Data that is received while the PMCR(260) instruction is not being executed is discarded.
7. In full-duplex mode, the data left over after the analysis performed with the last RECV command and any subsequent data received before the next PMCR(260) execution is discarded. During this interval, RS flow control cannot be used.

Note Full-duplex mode is supported only by the CS/CJ Series.

5-3 Auxiliary Area and CIO Area Allocations

This section describes the bits and words used by the Serial Communications Board and Serial Communications Units in the Auxiliary Area and the Software Switches and Status Area allocated in the CIO Area.

5-3-1 Auxiliary Area Allocations

Port 1 and Port 2 Port Settings Change Bits

These bits can be turned ON from the program using the OUT or other instructions to change communications settings and restart the Serial Communications Board ports. When changing the settings and restarting the port have been completed, the bit will automatically be turned OFF.

Note These bits are used both to change the port settings and to restart the port at the same time. One of these bits can be turned ON to restart a port without changing the port settings in the Setup Area allocated in the DM Area. The STUP(237) instruction can also be used to just restart a communications port by executing STUP(237) with the same port settings as the ones already being used.

Serial Communications Boards (CS Series Only)

Word	Bit	Contents
A636	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Serial Communications Boards (CS/CJ Series) n = A620 + unit number

Words	Bit	Contents
n	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Inner Board Error Information (CS-series Serial Communications Board Only)

A424 contains error information for the Serial Communications Board.

Word	Bit	Contents	
A424	12 to 15	Non-fatal errors (Note 1)	Reserved
	11		1 Error log EEPROM error; 0: Normal
	10		1: Protocol macro execution error; 0: Normal This bit will be turned ON when code 3, 4, or 5 is stored in the error code for bits 00 to 03 of CIO 1909 or CIO 1919 in the CIO Area,
	09		1: Protocol data error (SUM error); 0: Normal
	08		1: Setup error; 0: Normal
	07		1: Routing table error; 0: Normal
	06		Reserved
	05		1: Cyclic monitoring error; 0: Normal
	04		Reserved
	03	Fatal errors (Note 2)	Reserved
	02		Reserved
	01		1: Inner Bus error; 0: Normal
	00		1: Inner Board watchdog timer error; 0: Normal

Note

1. When any one of bits 05 to 11 is ON, A40208 (Inner Board Error Flag) (non-fatal error) will be ON.
2. When bit 00 or 01 is ON, A40112 (Inner Board Fatal Error Flag) will be ON.

For details on errors, refer to *Section 8 Troubleshooting and Maintenance*.

Auxiliary Area Bit Descriptions

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Board/Unit Watchdog Timer Error Flags	Board: A42400 Units: A40207 and A417 (Unit numbers 0 to F correspond to bits 00 to 15 of A417.)	The corresponding flag will turn ON when the Board or Unit is faulty. If the problem persists even when the Board or Unit is remounted or used with another CPU Unit, replace the Board or Unit.	Startup (See note.)	At error	Startup
Inner Bus Error Flag	Board: A42401 (No flags are provided for Units.)	The flag will turn ON when an error occurs in the Inner bus. If the problem persists even when the Board is remounted or used with another CPU Unit, replace the Board.	Startup	At error	Startup
Protocol Macro Execution Error Flag	Board: A42410 (No flags are provided for Units.)	The flag will turn ON when and attempt was made to read or write data at an illegal address (error code 3) or a protocol macro syntax error occurred (error code 4).	Startup	At error	Start of Sequence
Port 1/2 Port Settings Change Bits	Board: A63601 and A63602 Units: A620 + unit number, bits 01 and 02	The communications port setting can be changed and the port restarted by turning on the corresponding bit.	Startup	STUP(237) execution or user manipulation	After port settings have been changed and the port has been restarted.

Note The flags will also be initialized at the following times: When the operating mode is changed between PROGRAM and RUN or MONITOR modes and when the Board or Unit is restarted. If an error flag turns ON, remove the cause of the error and then reset the error indication from the Programming Console or other Programming Device.

5-3-2 CIO Area Allocations

The following areas are allocated as the status area and the software switch area, which show the status of the Serial Communications Board and Serial Communications Unit or the error information.

Serial Communications Boards (CS Series Only)

Words CIO 1900 to CIO 1999 in the Inner Board Area are used for Software Switches and Status Area. Only the words shown in the following table are used for Protocol Macros.

Inner Board CIO Area
CIO 1900 to CIO 1999

Words	Usage
CIO 1900	Software switches
CIO 1901 to CIO 1904	Board status
CIO 1905 to CIO 1914	Port 1 status
CIO 1915 to CIO 1924	Port 2 status
CIO 1925 to CIO 1999	Reserved for the system

Serial Communications Units (CS/CJ Series)

Words CIO 1500 to CIO 1899 of the CPU Bus Unit Area in the CIO Area are allocated according to the unit number setting. Each unit number is allocated 25 words. With the protocol macro mode, the words shown in the following table are used for the Software Switches and Status Area.

CPU Bus Unit Area

CIO 1500 to CIO 1899

n = CIO 1500 + 25 × unit number

Unit No.	Words
Unit No. 0	CIO 1500 to CIO 1524
Unit No. 1	CIO 1525 to CIO 1549
Unit No. 2	CIO 1550 to CIO 1574
Unit No. 3	CIO 1575 to CIO 1599
Unit No. 4	CIO 1600 to CIO 1624
Unit No. 5	CIO 1625 to CIO 1649
Unit No. 6	CIO 1650 to CIO 1674
Unit No. 7	CIO 1675 to CIO 1694
Unit No. 8	CIO 1700 to CIO 1724
Unit No. 9	CIO 1725 to CIO 1749
Unit No. A	CIO 1750 to CIO 1774
Unit No. B	CIO 1775 to CIO 1799
Unit No. C	CIO 1800 to CIO 1824
Unit No. D	CIO 1825 to CIO 1849
Unit No. E	CIO 1850 to CIO 1874
Unit No. F	CIO 1875 to CIO 1899

n: Software switches (port 1/Port 2)
n + 1 to n + 4: Unit status
n + 5 to n + 14: Port 1 status
n + 15 to n + 24: Port 2 status

5-3-3 Software Switches

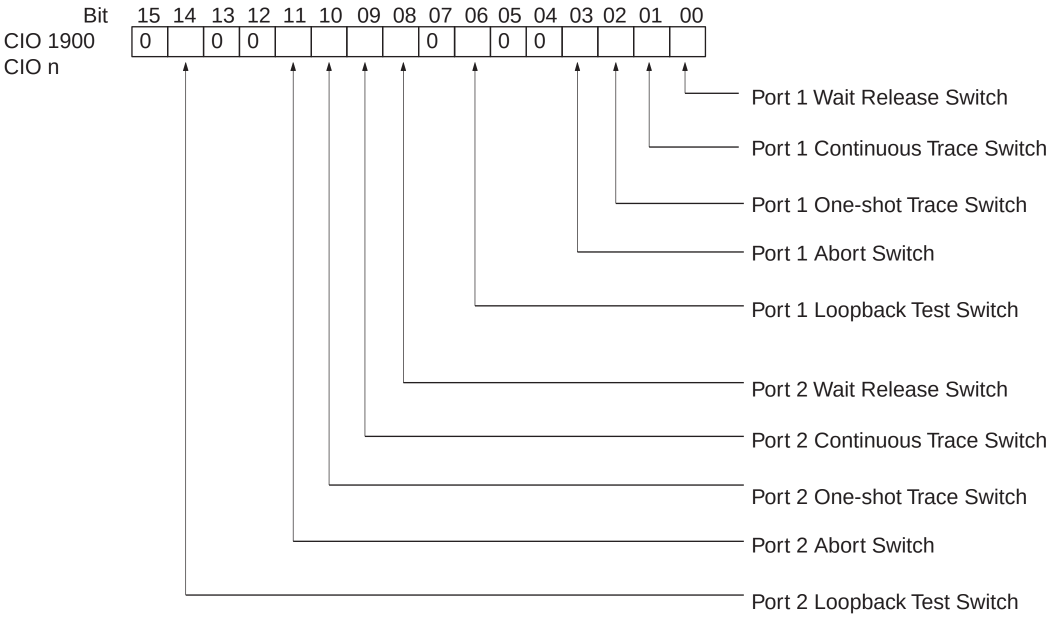
The Software Switches are used from the CPU Unit to control the Serial Communications Board and Serial Communications Unit.

Software Switches are used to output control signals from the CPU Unit to the Serial Communications Board or Unit.

n = CIO 1500 + 25 × unit number

Words		Bit	Contents	
Boards (CS Series Only)	Unit (CS/CJ Series)			
CIO 1900	n	15	Port 2	Reserved
		14		Used for loopback tests
		12, 13		Reserved
		11		Abort Switch
		10		One-shot Trace Switch
		09		Continuous Trace Switch
		08		Wait Release Switch
		07	Port 1	Reserved
		06		Used for loopback tests
		04, 05		Reserved
		03		Abort Switch
		02		One-shot Trace Switch
		01		Continuous Trace Switch
		00		Wait Release Switch

Software Switches



Software Switch Descriptions

The Software Switches function as described in the following table.

Name	Bits in CIO 1900 or CIO n	Meaning	Timing		
			Initialize	ON	OFF
Abort Switch	Bits 03 and 11	Protocol processing will be aborted when the switch is turned ON. (Processing may be completed if the switch is turned ON too late.)	Startup (Note 1)	Manipulated by user.	Manipulated by system.
One-shot Trace Switch (Note 2)	Bits 02 and 10	The CX-Protocol will start a one-shot trace when the Switch turns ON. The trace is ended when the Switch is turned OFF. The Board or Unit will be cleared when the trace buffer becomes full. The CPU Unit will manipulate the One-shot Trace Switch and Continuous Trace Switch when trace operations are performed from the CX-Protocol. Do not manipulate these switches directly from a ladder diagram.		Manipulated by CX-Protocol.	At end of one-shot trace
Continuous Trace Switch (Note 2)	Bits 01 and 09	The CX-Protocol will start a continuous trace when the Switch turns ON. The trace is ended when the Switch is turned OFF.		Manipulated by CX-Protocol.	Manipulated by CX-Protocol.
Wait Release Switch	Bits 00 and 08 (Not supported by C200HX/HG/HE)	Standby status for the WAIT command will be released when the switch is turned ON.		Manipulated by user.	At end of WAIT command

Note

1. The Software Switches will also be initialized at the following times: When the operating mode is changed between PROGRAM and RUN or MONITOR modes, when STUP(237) is executed, when the Board or Unit is restarted, or when the communications port is reset.
2. The first switch of the One-shot Trace Switch and Continuous Trace Switch to turn ON will determine the trace operation. If a Trace Switch turns ON when a trace operation is already in progress, the switch will not be effec-

tive even when the current trace operation is completed unless the switch is first turned OFF. If the One-shot Trace Switch and Continuous Trace Switch turn ON simultaneously, the Continuous Trace Switch will take priority.

5-3-4 Status Area

The Status Area is used to input status information from Serial Communications Board or Unit to the CPU Unit. The Status Area is where the Serial Communications Board or Unit set communications status, the transmission control signal status, and the transmission error status.

n = CIO 1500 + 25 × unit number

Words				Bit	Contents		
Boards (CS Series Only)		Units (CS/CJ Series)					
Port 1	Port 2	Port 1	Port 2				
CIO 1901		n + 1		02 to 15	Reserved		
				01	1: Error log EEPROM error	0: Error log EEPROM normal	
				00	1: Protocol data error	0: Protocol data normal	
CIO 1902		n + 2		00 to 15	Reserved		
CIO 1903		n + 3		00 to 15	Reserved		
CIO 1904		n + 4		00 to 15	Reserved		
CIO 1905	CIO 1915	n + 5	n + 15	12 to 15	Port setting status	Setup settings	Serial communications mode: Always 6 Hex (see note)
				08 to 11			Baud rate (Note 1)
				05 to 07			Reserved: Always 0
				04			Start bits: Always 1
				03			Data length: 7 or 8 bits (Note 1)
				02			Stop bits: 1 or 2 bits (Note 1)
				01			Parity: Yes/No (Note 1)
				00			Parity: Even/Odd (Note 1)
CIO 1906	CIO 1916	n + 6	n + 16	15	Port setting status	Hardware settings (See note 2)	0 0 No 0 1 RS-232C 1 0 RS-422A/485 1 1 Reserved
				14			
				13			0: Terminating resistance OFF 1: Terminating resistance ON
				12 to 02		Reserved	
				01		1: System Setup error; 0: System Setup normal	
				00		1: Port operating; 0: Port stopped	
CIO 1907	CIO 1917	n + 7	n + 17	15 to 11	Communications status	Reserved	
				10		1: Remote Unit busy receiving (Flow control) 0: Remote Unit ready to receive	
				09		Reserved	
				08		1: Local Unit busy receiving (Flow control) 0: Local Unit ready to receive	
				07	Transmission control signal status	DTR (ER) signal 1: High, 0: Low	
				06		DSR (DR) signal 1: High, 0: Low	
				05		Reserved	
				04		CTS (CS) signal 1: High, 0: Low	
				03		RTS (RS) signal 1: High, 0: Low	

Words				Bit	Contents	
Boards (CS Series Only)		Units (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1908	CIO 1918	n + 8	n + 18	15	Trans-mission error status	1: Transmission error 0: No transmission error
				14		1: Tfs (send finished monitoring time) exceeded 0: Normal
				13		1: Tfr (receive finished monitoring time) exceeded 0: Normal
				12		1: Tr (receive wait monitoring time) exceeded 0: Normal
				08 to 11		Number of retries: 0 to 9: 0 to 9 hex
				07		1: FCS check error; 0: FCS check normal
				06		1: Command error; 0: No command error
				05		1: Timeout (Tfs, Tfr, or Tr) error; 0: Normal
				04		1: Overrun error; 0: Normal
				03		1: Framing error; 0: Normal
				02		1: Parity error; 0: Normal
				00, 01		Reserved
CIO 1909 to CIO 1914	CIO 1919 to CIO 1924	n + 9 to n + 14	n + 19 to n + 24	00 to 15	Protocol status (See *Protocol Status* on page 64.)	

Note
1. The settings in the Setup Area are reflected here. The default settings will be used and will be stored here if a setup error occurs.
2. With a Board, the same bit is used as for A42409 (protocol data error) of the Auxiliary Area.

Status Area Descriptions

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Error log data error	Board: CIO 190101 Unit: n + 1 bit 01	If a write to EEPROM fails for the error log, it is assumed the EEPROM is beyond its useful life and this flag is turned ON. With a Serial Communications Unit, the ERC indicator will also light. Although this has no effect on communications and other functions, replace the Board or Unit promptly for ease of maintenance.	Startup (See note.)	At error	Startup
Protocol data error	Board: CIO 190100 Unit: n + 1 bit 00 Board only: A42409	This flag is turned ON if an error is detected in the protocol data SUM check when the power is turned ON. With a Serial Communications Board, the ERR/ALM indicator on the CPU Unit will also flash and the RDY indicator will flash at 1-second intervals. A42409 (Board only) of the Auxiliary Area will also turn ON. With a Serial Communications Unit, the RDY and ERC indicator will flash. This error may occur if the communications connector becomes disconnected or the PC power is turned OFF during protocol data transfer. Use the CX-Protocol to transfer of the protocol data again.	Startup (See note.)	At error	When protocol data has been successfully transferred.

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Setup error	Board: CIO 190601 (port 1) CIO 191601 (port 2) Unit: n + 6 bit 01 (port 1) n + 16 bit 01 (port 2) Board only: A42408 (not available for Unit)	This flag is turned ON if a Setup error occurs in the allocated DM Area, After changing the Setup, turn ON the power again, restart the Board/Unit, restart the port, or execute the STUP(237) instruction.	Startup (See note.)	At error	Startup (See note.)
Port operating	Board: CIO 190600 (port 1) CIO 191600 (port 2) Unit: n + 6 bit 00 (port 1) n + 16 bit 00 (port 2)	ON when the port can operate correctly. OFF when protocol macro data is being transferred.	Startup (See note.)	At error	After protocol data has been transferred.
Remote Unit receive busy/receive wait	Board: CIO 190710 (port 1) CIO 191710 (port 2) Unit: n + 7 bit 10 (port 1) n + 17 bit 10 (port 2)	This flag indicates the receive status of a remote Unit during SEND when Xon/Xoff flow control or RS/CS flow control is set in the transmission control parameters. When Xon/Xoff flow control is set, the reception buffer is cleared when the sequence starts, so the status area is set to remote Unit receive wait (0). 1: Remote Unit receive busy (Reception is disabled because the reception buffer is full.) 0: Remote Unit receive wait (Reception is enabled.)	Startup (See note.)	When status is read.	After busy status has been released.
Local Unit receive busy/receive wait	Board: CIO 190708 (port 1) CIO 191708 (port 2) Unit: n + 7 bit 08 (port 1) n + 17 bit 08 (port 2)	This flag indicates the receive status of a local Unit (Board or Unit) during RECV when Xon/Xoff flow control is set in the transmission control parameters. 1: Local Unit receive busy (Reception is disabled because the reception buffer is more than 4/5 (= 2 Kbytes) full.) 0: Local Unit receive wait (Reception is enabled because the reception buffer is less than 1/5 (= 0.5 Kbytes) full.) This bit is cleared when the power is turned ON, at port restart by the STUP(237) instruction or by the Port 1 or Port 2 Port Settings Change Bit (Auxiliary Area), or when the next sequence is started.	Startup	When status is read.	After busy status has been released.
Transmission control signal status	Board: CIO 1907 bits 03, 04, 06, 07 (port 1) CIO 1917 bits 03, 04, 06, 07 (port 2) Unit: n + 7 bits 03, 04, 06, 07 (port 1) n + 17 bits 03, 04, 06, 07 (port 2)	The status of each transmission control signal (ER, DTR, CTS, and RTS) for each port is always read to these flags. 1: High, 0: Low	Startup	When status is read.	After busy status has been released.

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Transmission error status	Board: CIO 1908 bits 00 to 15 (port 1) CIO 1918 bits 00 to 15 (port 2) Unit: n + 8 bits 00 to 15 (port 1) n + 18 bits 00 to 15 (port 2)	When an error occurs during transmission, the corresponding flag is turned ON. The Transmission Error Flag (bit 15) is turned ON when the protocol macro has moved to error processing due to an error in bits 00 to 14. The cause of the error and of the SEND&RECV retry will be shown in bits 00 to 15. When communications are restored by protocol macro retry processing, the error in bits 00 to 14 is stored. The Transmission Error Flag (bit 15), however, will remain OFF. If another error occurs during retry processing, the status of the bit indicating the cause will be held.	Startup	At error	When sequence begins.
Port setting status	Board: CIO 1906 bits 00 to 15 (port 1) CIO 1916 bits 00 to 15 (port 2) Unit: n + 6 bits 00 to 15 (port 1) n + 16 bits 00 to 15 (port 2)	The following are read in port setting status: The serial communications modes and communications specifications set in the Setup Area (D32000, D32010, m, or m+10). The ports and the terminating resistance hardware settings. Setup errors, and Port Operating/Stopped Flags. In Protocol Macro mode, the port will be stopped if a protocol data error occurs while protocol data is being transferred. If there is no protocol data error after the protocol data has been transferred, the flag will be turned ON.	Startup	When status is read.	When protocol data has been successfully transferred.

Note The flags will also be initialized at the following times: When the operating mode is changed between PROGRAM and RUN or MONITOR modes and when the Board or Unit is restarted. If an error flag turns ON, remove the cause of the error and then reset the error indication from the Programming Console or other Programming Device.

Protocol Macro Function

With the protocol macro function, each port is provided with a reception buffer that will hold 2.5 Kbytes max. The reception buffer can be used to hold a large quantity of data when it is being received at once, or when the send/receive sequence is waiting due to the WAIT command.

If the protocol macro function is used and receive operations are performed when the reception buffer is full, the receive data will overwrite the 2.5 Kbytes of previously received data in the buffer. Therefore, always set flow control when performing these operations.

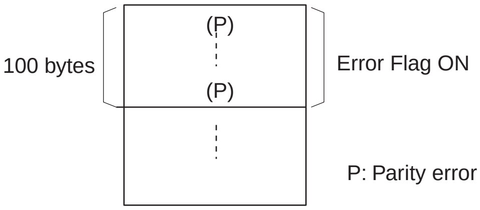
Overrun Errors, Framing Errors, Parity Errors and Error Flags

If an overrun error, framing error, or parity error is detected when the protocol macro function is being used, the receive data will be stored in the buffer with the error status included. The corresponding error flags will turn ON or OFF according to the following conditions.

Error Data In Data Agreeing with Expected Receive Message

When RECV is executed, an expected receive message is searched for in the reception buffer. If the data that has been received agrees with an expected receive message, it is processed as receive data. If error details are included in the receive data, the corresponding error flags will turn ON.

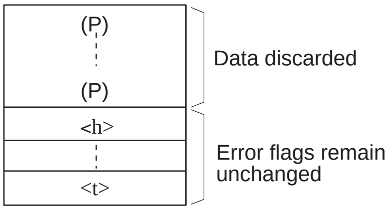
The following example shows when 100 bytes of data is received that agrees with an expected receive message.



Data Not Agreeing with Expected Receive Message

If error details are included in data that do not agree with an expected receive message, the data will simply be discarded and the error flag status will remain unchanged. For trace information, all error details in the reception buffer will be stored within capacity for the trace data.

The following example shows when a parity error occurs for data that does not agree with an expected receive message.



Protocol Status

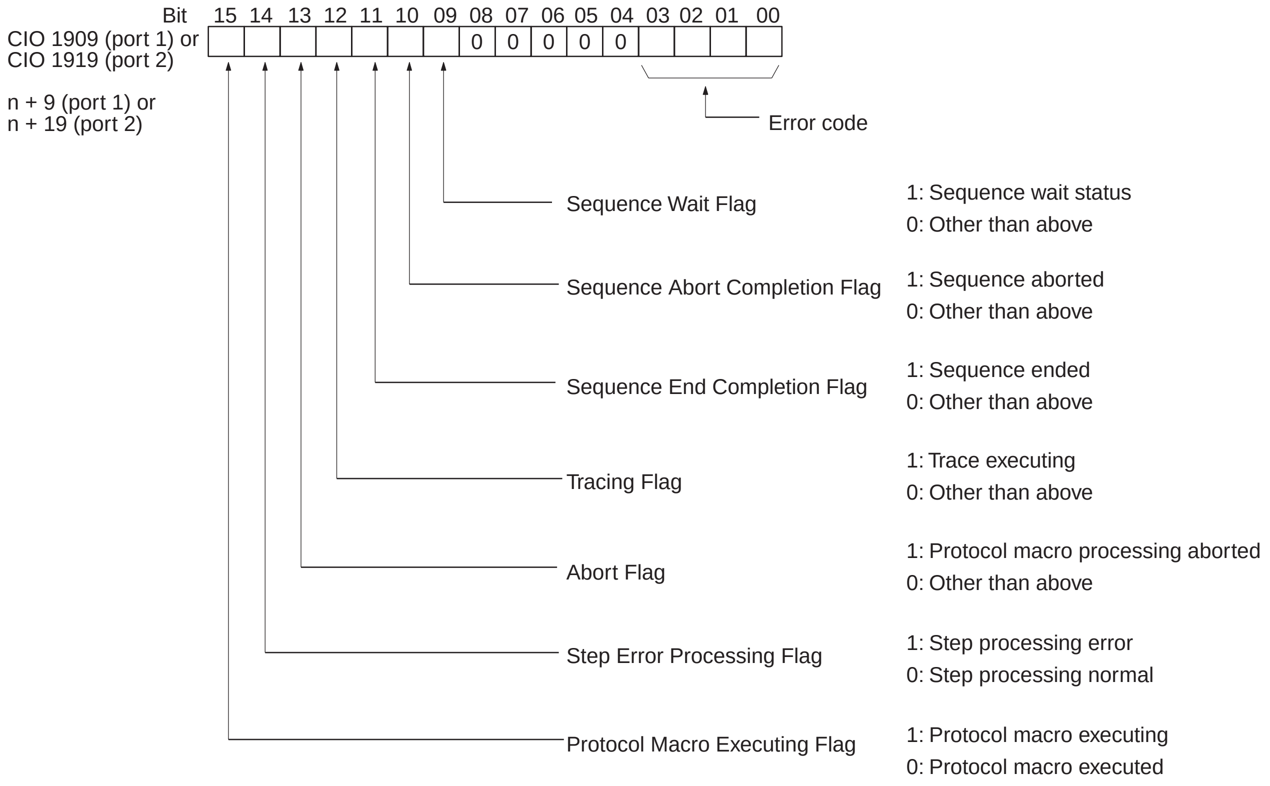
The information shown in the following table is input from the Board or Unit to the Protocol Status Words in the CPU Unit.

n = CIO 1500 + 25 × unit number

Words				Bit	Setting contents	
Boards (CS Series Only)		Unit (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1909	CIO 1919	n + 9	n + 19	15	Port Operating Status	Protocol Macro Executing Flag
				14		Step Error Processing Flag
				13		Abort Flag
				12		Tracing Flag
				11		Sequence End Completion Flag
				10		Sequence Abort Completion Flag
				09		Sequence Wait Flag
				08 to 04		Reserved
				03 to 00		Error codes
CIO 1910	CIO 1920	n + 10	n + 20	15 to 12	Reserved	
				11 to 00	Send/Receive Sequence No. 000 to 999 (000 to 3E7 hex)	
CIO 1911	CIO 1921	n + 11	n + 21	15 to 12	Reserved	
				11 to 08	Executed Step No. (code) 0 to 15 (0 to F hex)	
				07 to 04	Reserved	
				03 to 00	Executed Reception Case No. (code) 0 to 15 (0 to F hex)	
CIO 1912	CIO 1922	n + 12	n + 22	15 to 00	Executed Reception Case No. Flag No. 0 to 15: Correspond to bits 00 to 15	
CIO 1913	CIO 1923	n + 13	n + 23	15 to 00	Executed Step No. Flag No. 0 to 15: Correspond to bits 00 to 15	

Words				Bit	Setting contents
Boards (CS Series Only)		Unit (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
CIO 1914	CIO 1924	n + 14	n + 24	15 to 08	Repeat Counter Setting Value 1 to 255 (01 to FF hex) (See note.)
				07 to 00	Repeat Counter Present Value 1 to 255 (01 to FF hex) (See note.)

Note When the repeat counter is used to read words and 0 is read, 0 will be stored and the step will be skipped.



Protocol Status Area

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Protocol Macro Executing Flag	Board: CIO 190915 (port 1) CIO 191915 (port 2) Unit: n + 9 bit 15 (port 1) n + 19 bit 15 (port 2)	This flag is turned ON when a PMCR(260) instruction (sequence) is executed. The flag remains OFF when execution fails. When the sequence is completed and receive data is written, the flag is turned OFF after all the receive data has been written to I/O memory. This flag is turned OFF when the sequence is completed (either when it is ended by End, or when it is ended by Abort). When the scan response notification method is set for the sequence, first a check is made to see if the received data has been written to I/O memory before the Protocol Macro Executing Flag is turned OFF.	Startup. (See note.)	When command is executed.	When command has finished executing.
Step Error Processing Flag	Board: CIO 190914 (port 1) CIO 191914 (port 2) Unit: n + 9 bit 14 (port 1) n + 19 bit 14 (port 2)	This flag is turned ON when a step has ended abnormally. It is turned OFF if the step ends normally as a result of a retry. 1: Step ended abnormally 0: Step ended normally	Startup. (See note.)	When verification error occurs after receiving.	When sequence starts.
Abort Flag	Board: CIO 190913 (port 1) CIO 191913 (port 2) Unit: n + 9 bit 13 (port 1) n + 19 bit 13 (port 2)	This flag is turned ON when processing is ended using the Abort Switch from the user program. When the Abort Switch is turned ON at the end of a sequence, the sequence may end with either End or Abort status.	Startup. (See note.)	When a forced abort occurs.	When sequence starts.
Tracing Flag	Board: CIO 190912 (port 1) CIO 191912 (port 2) Unit: n + 9 bit 12 (port 1) n + 19 bit 12 (port 2)	Depending on the instruction from the CX-Protocol, this flag is turned ON while time-series data for send and receive messages is being traced.	Startup. (See note.)	When trace begins.	When sequence starts.
Sequence End Completion Flag	Board: CIO 190911 (port 1) CIO 191911 (port 2) Unit: n + 9 bit 11 (port 1) n + 19 bit 11 (port 2)	This flag is turned ON when a sequence is completed for the next process or for an error process with an END command. When a sequence has ended normally, setting END (ABORT when the sequence has ended abnormally) enables this flag to be used to determine whether or not the sequence execution has ended normally. 1: Sequence ended 0: Sequence not ended		When sequence ends.	When sequence starts, and when trace ends.
Sequence Abort Completion Flag	Board: CIO 190910 (port 1) CIO 191910 (port 2) Unit: n + 9 bit 10 (port 1) n + 19 bit 10 (port 2)	This flag is turned ON when a sequence is ended for the next process or for an error processing with an ABORT command. 1: Sequence aborted 0: Sequence not aborted	Startup. (See note.)	When sequence aborts.	When sequence starts.

Name	Address	Meaning	Timing		
			Initialize	**ON**	**OFF**
Sequence Wait Flag	Board: CIO 190909 (port 1) CIO 191909 (port 2) Unit: n + 9 bit 09 (port 1) n + 19 bit 09 (port 2)	This flag is turned ON when a sequence is waiting due to the WAIT command. Waiting is released when the Wait Release Switch is turned ON in the ladder program, and the sequence will move to the next step. Make sure to set the Wait Release Switch from the ladder program to turn ON the switch. If the Forced Set Key on Programming Console is used, the Wait Release Switch will remain ON, and may stop the protocol macro function from being able to turn OFF the flag.	Startup. (See note.)	When WAIT command is executing.	When Wait Release Switch is ON, and when sequence starts.
Protocol Macro Error Code	Board: CIO 1909 bits 00 to 03 (port 1) CIO 1919 bits 00 to 03 (port 2) Unit: n + 9 bits 00 to 03 (port 1) n + 19 bits 00 to 03 (port 2)	The list of error codes is provided at the end of this table on page 146. If a Serial Communications Board is used and either error code 3 (data read/write area exceeded error) or 4 (protocol data syntax error) is stored, A4241 (protocol macro syntax error) will be turned ON, the ERR/ALM indicator on the CPU Unit will flash, and a non-fatal error will occur. If a Serial Communications Unit is used, the ERC indicator will flash. Only error codes 0, 2, 3, and 4 are used. When an error occurs, the error code is held until the next sequence starts. The error code is cleared when the STUP(237) instruction is executed, when the Unit/Board is restarted, or when the next sequence execution starts. When a Board is used, clear the non-fatal error resulting from error codes 3 and 4 by removing the cause of the error, and then clear the error display by executing the next sequence or the STUP(237) instruction, by restart, or by switching the CPU Unit to PROGRAM mode.	Startup (See note.)	At error	When sequence starts.
Send/ Receive Sequence No.	Board: CIO 1910 bits 00 to 11 (port 1) CIO 1920 bits 00 to 11 (port 2) Unit: n + 10 bits 00 to 11 (port 1) n + 20 bits 00 to 11 (port 2)	The current send/receive sequence number is set when the sequence execution starts. This number does not change when a sequence number error (error code 2) occurs.	Startup (See note.)	When sequence starts.	None.
Executed Step No. (code)	Board: CIO 1911 bits 08 to 11 (port 1) CIO 1921 bits 08 to 11 (port 2) Unit: n + 11 bits 08 to 11 (port 1) n + 21 bits 08 to 11 (port 2)	Step numbers 0 to 15 (0 to F hex) are stored for the steps for which execution has been completed.	Startup (See note.)	When step is executed.	When sequence starts.

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Executed Reception Case No. (code)	Board: CIO 1910 bits 00 to 03 (port 1) CIO 1920 bits 00 to 03 (port 2) Unit: n + 10 bits 00 to 03 (port 1) n + 20 bits 00 to 03 (port 2)	Reception matrix case numbers 0 to 15 (0 to F hex) are stored for which reception has been completed. The number is cleared when the sequence execution starts, when the STUP(237) instruction is executed, and at restarts. The Executed Reception Case No. is stored only when the reception matrix is set using the RECV or SEND&RECV command. If a reception matrix is not set, the case number will be set to 0 (cleared) when another command is executed.	Startup (See note.)	When matrix is received.	When sequence starts.
Executed Reception Case No. Flags	Board: CIO 1912 bits 00 to 15 (port 1) CIO 1922 bits 00 to 15 (port 2) Unit: n + 12 bits 00 to 15 (port 1) n + 22 bits 00 to 15 (port 2)	Reception matrix case numbers 0 to 15 for which reception has been completed correspond to individual bits (00 to 15), and are turned ON to indicate execution. The numbers are cleared when the sequence execution starts, when the STUP(237) instruction is executed, at restarts, and when the execution of each step starts. The reception matrix case number can be checked from the ladder program when the WAIT command is executed or when the sequence is ended after the reception matrix RECV command is executed. The Executed Reception Case No. Flag in the bit corresponding to the stored case number will be turned ON only when the reception matrix is set for the RECV or SEND&RECV command. If a reception matrix is not set, the case number will be set to 0 (cleared) when another command is executed.	Startup (See note.)	When matrix is received.	When sequence starts.
Executed Step No. Flags	Board: CIO 1913 bits 00 to 15 (port 1) CIO 1923 bits 00 to 15 (port 2) Unit: n + 13 bits 00 to 15 (port 1) n + 23 bits 00 to 15 (port 2)	Case numbers 0 to 15 for the steps for which execution has been completed correspond to individual bits (00 to 15), and are turned ON in ascending order. Once a bit has been executed, the bit corresponding to the executed step is turned ON in ascending order to hold the bit ON during the sequence (and after completion).	Startup. (See note.)	When step is executed.	When sequence starts.

Name	Address	Meaning	Timing		
			Initialize	ON	OFF
Repeat Counter Set Value	Board: CIO 1914 bits 08 to 15 (port 1) CIO 1924 bits 08 to 15 (port 2) Unit: n + 14 bits 08 to 15 (port 1) n + 24 bits 08 to 15 (port 2)	The number of times a step is repeated is set in these bits.	Startup. (See note.)	When step starts.	When sequence starts.
Repeat Counter Present Value	Board: CIO 1914 bits 00 to 07 (port 1) CIO 1924 bits 00 to 07 (port 2) Unit: n + 14 bits 00 to 07 (port 1) n + 24 bits 00 to 07 (port 2)	The repeat counter variable N is set. The value is cleared when the sequence execution starts, when the STUP(237) instruction is executed, and at restarts. The present value N varies according to the method used to initialize the value. For resets, the variable N is set to 0 when the step is started, and the step is executed according to the set number of times. For holds, the variable N for the present value is held when the step is started, and the step is executed according to the set number of times. If the Repeat Counter Setting Value is set to read word R ( ), and 0 is read, then 0 will be stored and this step will be skipped (the next process setting will be ignored), and the sequence will move to the next step (+ 1). For details, refer to the *CX-Protocol Operation Manual (W344)*.	Startup. (See note.)	When repeat counter is refreshed.	When sequence starts.

Note The flags will also be initialized at the following times: When the operating mode is changed between PROGRAM and RUN or MONITOR modes and when the Board or Unit is restarted. If an error flag turns ON, remove the cause of the error and then reset the error indication from the Programming Console or other Programming Device.

Error Codes

The contents of the error codes are shown in the following table.

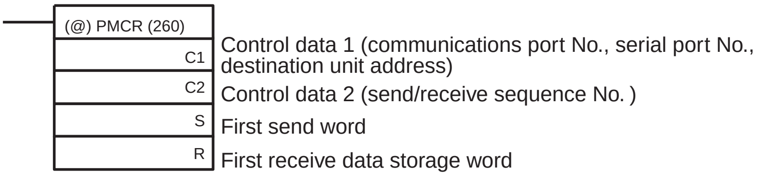
Code	Error contents	Protocol macro execution
0	No error	Executed
2	Sequence No. Error The sequence number specified by the PMCR(260) instruction does not exist in the Board or Unit.	Not executed
3	Data Read/Write Area Exceeded Error When data is written or read to the CPU Unit, the specified area range was exceeded.	Execution stops after the error occurs.
4	Protocol Data Syntax Error A code that cannot be executed occurs while the protocol macro was executed. (Example: A header occurs after a terminator.)	

5-4 Using Protocol Macros

5-4-1 Executing Send/Receive Sequences

Use the PMCR(260) instruction to execute send/receive sequences.

PMCR(260) Instruction Specifications



Control Data 1 (C1)

15 12	11 08	07 00
Communications port No.	Serial port No.	Destination unit address

The following items are specified in C1.

Communications Port No. (Internal Logical Port Number)
Specify internal logical port 0 to 7 Hex for executing the PMCR(260) instruction.

Note A CS/CJ-series CPU Unit has eight internal logical ports for executing FINS commands. Specify the logical port number to be used for execution. These ports are also used by the SEND(090), RECV(098), and CMND(490) instructions used for Host Link communications. Refer to *4-4-1 Simultaneous Commands and Communications Ports* for details.

Serial Port No. (Physical Port)
Set the physical port number of the Serial Communications Board or Unit connected to the remote device.
Port 1: 1 Hex, Port 2: 2 Hex

Destination Unit Address
Specify the Unit address of the Serial Communications Board or Unit to execute the protocol macro.
Serial Communications Board: E1 Hex
Serial Communications Unit: Unit number (see note) + 10 Hex
Setting range: 10 to 1F Hex

Note This is the unit number (0 to F) for the CPU Bus Unit set on the rotary switch on the front panel of the Unit.

Control Data 2 (C2) C2 specifies the send/receive sequence number in hexadecimal (000 to 999).
Setting range: 0000 to 03E7 Hex

First Send Data Word (S) S specifies the first word of the area in which the data required for sending is stored.

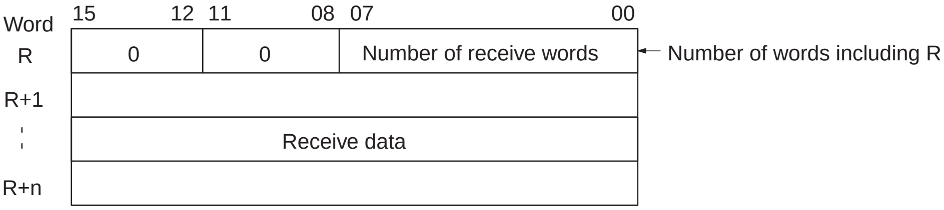
Word	15 12	11 08	07 00	
S	0	0	Number of send words	← Total number of words including S
S+1	Send data			
¦				
S+n				

The number of send words in S+1 and the following words is stored in the rightmost 8 bits of S. The setting range is 01 to FA Hex (250 words or less). S is also included in the number of words. The data to be sent is stored in S+1 and the following words.

Note When there is no send data, set S to #0000.

First Receive Data Storage Word (R)

R specifies the first word of the area used to initialize the reception buffer or the first word of the area used to store the receive data.



Before Execution of PMCR(260)

The contents of R+1 and following words are set in the reception buffer. The number of words of data from R through the end of the receive data is specified in the rightmost 8 bits of R. The range that can be set is 02 to FA Hex (2 to 250 words). If 00 Hex or 01 Hex is set, the reception buffer will remain cleared after PMCR(260) execution and before executing the send/receive sequence.

After Execution of PMCR(260)

The number of words of receive data in R+1 and the following words is stored in the rightmost 8 bits of R. The range is 01 to FA Hex (250 words or less). R is also included in the number of words. The receive data is stored in R+1 and the following words.

Note

1. The function of the receive data storage words (start from R for the number of words specified in R) differs before and after execution of PMCR(260).
    a) Before Execution of PMCR(260)
    The contents of the receive data storage words is used as initialization data for the reception buffer before the send/receive sequence is executed.
    b) After Execution of PMCR(260)
    Data received for the RECV command is stored in the receive data storage words if there is response data to be written.
2. When there is no receive data, set R to #0000.

PMCR(260) Operation

When PMCR(260) is executed, the send/receive sequence specified in C2 is executed for the communications port specified in bits 12 to 15 of C1 (internal logical port 0 to 7) from the serial communications port specified in bits 08 to 11 (physical port) of C1 of the device with the unit address specified in bits 00 to 07 of C1.

If an operand is specified as a variable in the send message, data starting in S+1 for the number of words specified in S is used as the send data. If an operand is specified as a variable in the receive message, data will be received in words starting from R+1 and the number of words of received data will be automatically stored in R.

If reception processing fails, the data that was stored started at R+1 (i.e., the number of words specified in R) is again read from the reception buffer and stored again beginning at R+1. This ensures that the current data will not be cleared and that the previous receive data will be maintained when receptions fail.

Flags

Name	Label	ON	OFF
Error Flag	ER	• The Communications Port Enabled Flag for the specified communications port (internal logical port) was OFF when the instruction was executed. • The specified serial port (physical port) is not set to protocol macro mode. • The data setting in C1 is not within the allowed range. • The number of words specified in S or D exceeds 249 (when a word address was specified for S or D).	All other cases
Access Error Flag	AER	A read/write-protected area was specified for send data or receive data. A write-protected area was specified for receive data.	All other cases

Operand Areas and Address Ranges

Area	C1	C2	S	R
CIO Area	CIO 0000 to CIO 6143			
Work Area	W000 to W511			
Holding Area	H000 to H511			
Auxiliary Area	A000 to A959			A448 to A959
Timer Area	T0000 to T4095			---
Counter Area	C0000 to C4095			---
Data Memory (DM) Area	D00000 to D32767			
Extended Data Memory (EM) Area	E00000 to E32767			(see note)
Extended Data Memory (EM) Area (including bank specification)	En_00000 to En_32767 (n = 0 to C)			(see note)
Indirect DM/EM address, Binary	@D00000 to @32767, @E00000 to @E32767, @En_00000 to @En_32767			(see note)
Indirect DM/EM address, BCD	*D00000 to *D32767, *E00000 to *E32767, *En_00000 to *En_32767			(see note)
Constant Area	See *Control Data 1 (C1)*.	0000 to 037E Hex (0 to 999)	#0000 to FFFF (Binary data)	
Data Registers	DR0 to DR15		---	
Index Registers, direct	---			
Index Registers, indirect	,IR0 to ,IR15 -2048 to +2047,IR0 to -2048 to +2047,IR15 DR0 to DR15,IR0 to IR15 ,IR0+(++) to ,IR15+(++) ,-(- -)IR0 to ,-(- -)IR15			(see note)

Note The EM Area cannot be specified for the receive data when the interrupt notification function is being used for a Serial Communications Board. If the EM Area is specified, a protocol macro syntax error will occur and A42410 will turn ON.

Network Communications Flags

The following table shows the Auxiliary Area flags that are used when the PMCR(260) instruction is executed.

Communications Port Enabled Flags

These flags turn ON when execution of the PMCR(260) instruction is enabled. Depending on the PMCR(260) instruction, they turn OFF at execution, and turn ON when the port enters an enabled status.

Word	Bit	Contents
A202	08 to 15	Reserved
	07	Communications Port No. 7 Enabled Flag
	06	Communications Port No. 6 Enabled Flag
	05	Communications Port No. 5 Enabled Flag
	04	Communications Port No. 4 Enabled Flag
	03	Communications Port No. 3 Enabled Flag
	02	Communications Port No. 2 Enabled Flag
	01	Communications Port No. 1 Enabled Flag
	00	Communications Port No. 0 Enabled Flag

Communications Port Error Flags

These flags turn ON in the following cases:

- When an error occurs while the PMCR(260) instruction is being executed
- When an error response corresponding to each communications port occurs, or a resend error occurs

When operations start or when the PMCR(260) instruction is executed, if the Communications Port Enabled Flag turns OFF, then the corresponding Error Flag also turns OFF.

Word	Bit	Contents
A219	08 to 15	Reserved
	07	Communications Port No. 7 Error Flag
	06	Communications Port No. 6 Error Flag
	05	Communications Port No. 5 Error Flag
	04	Communications Port No. 4 Error Flag
	03	Communications Port No. 3 Error Flag
	02	Communications Port No. 2 Error Flag
	01	Communications Port No. 1 Error Flag
	00	Communications Port No. 0 Error Flag

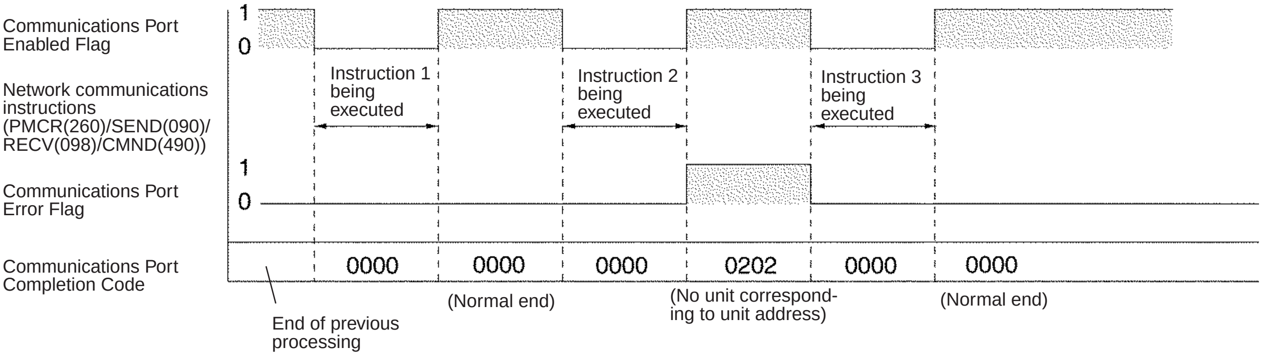
Communications Port Completion Codes

The response codes (FINS completion codes) are set when the PMCR(260) instruction is executed. The contents of these words are also cleared when the Communications Port Enabled Flag turns OFF at the start of operations or when the PMCR(260) instruction is executed.

Word	Contents
A203	Communications Port No. 0 Completion Code
A204	Communications Port No. 1 Completion Code
A205	Communications Port No. 2 Completion Code
A206	Communications Port No. 3 Completion Code
A207	Communications Port No. 4 Completion Code
A208	Communications Port No. 5 Completion Code
A209	Communications Port No. 6 Completion Code
A210	Communications Port No. 7 Completion Code
A211 to A218	Reserved

Note Refer to *8-3-3 Protocol Macros* for information on completion codes.

Flag Transitions



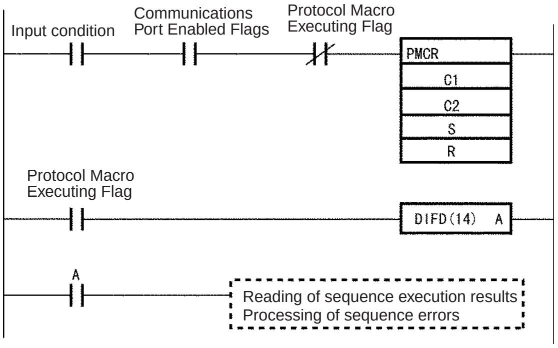
Note Before executing a PMCR(260) instruction, be sure that the communications port is set to the Protocol Macro serial communications mode. If a PMCR(260) instruction is executed for a communications port set in Host Link mode, a meaningless message may be sent from the port. The current serial communications mode can be checked in bits 12 to 15 (Protocol Macro = 6 Hex) of the following words. Boards: CIO 1905 for port 1 and CIO 1915 for port 2. Units: CIO n + 5 for port 1 and CIO n + 15 for port 2. Refer to *2-3-1 DM Area* for DM Area allocations and settings.

5-4-2 Ladder Program Structure

When creating a ladder program, note the following points.

- To ensure that a PMCR(260) instruction is not executed while another PMCR(260) instruction is being executed, use the Protocol Macro Executing Flag in an NC input condition.
- Use an OFF condition for the Protocol Macro Executing Flag and perform processing to read the results of sequence execution, or perform processing when a sequence ends in an error.

Programming Example

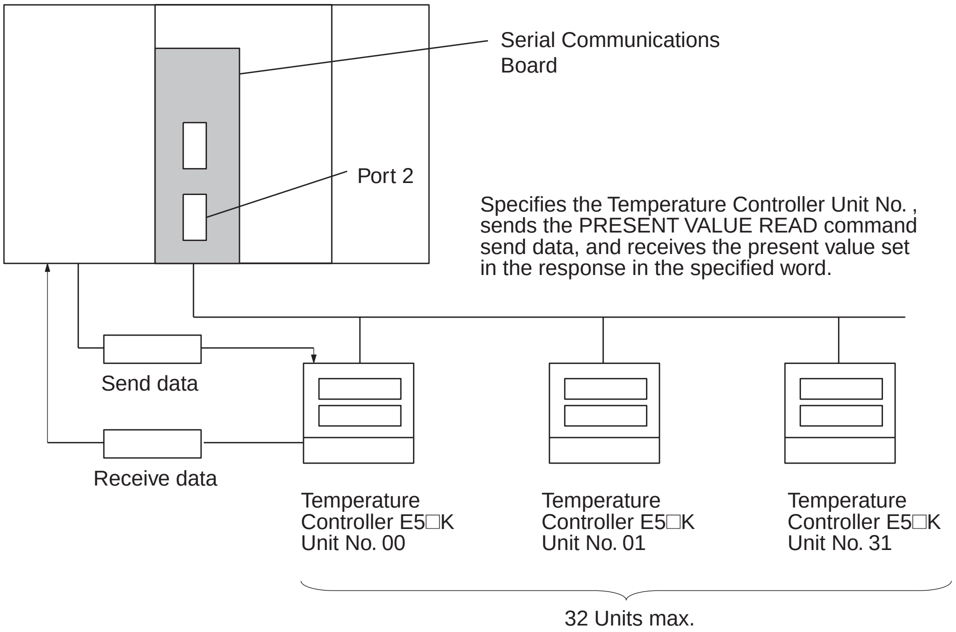


Note When executing the PMCR(260) instruction, be sure to check that the serial communications mode for the port used for communications is set to protocol macro. If the PMCR(260) instruction is executed with the serial communications mode set to Host Link (SYSWAY), messages that cannot be used for the application will be output from the serial communications port. The serial communications mode settings can be confirmed in bits 12 to 15 of the following words in the CIO Area: Serial Communications Board, port 1: 1905, port 2: 1915; Serial Communications Unit, port 1 = n+5, port 2 = n+15. The setting for protocol macro is 6 Hex. For details of DM Area allocations, refer to *2-3-1 DM Area*.

5-4-3 Ladder Program Example

The following diagram shows an example in which sequence number 000 (Present Value Read) of a Temperature Controller (E5☐K Read Protocol) is executed using the protocol for an OMRON Temperature Controller connected to port 2 (RS-422A/485) of a Serial Communications Board.

Connections



Send Word Allocation for Sequence No. 000 (Present Value Read)

First word of send data	S	Number of send data words	
	S + 1	(Undefined)	Unit No.

Word	Contents (data format)	Data
S	Number of send data words (4-digit BCD)	0002 (fixed)
S + 1	Unit No. (2-digit BCD)	00 to 31

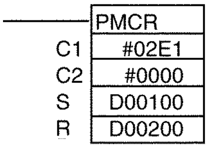
Receive Word Allocation for Sequence No. 000 (Present Value Read)

Receive data storage words	R	Number of receive data words
	R + 1	Present value

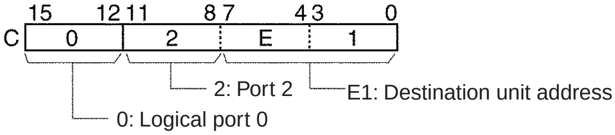
Word	Contents (data format)	Data
R	Number of receive data words (4-digit BCD)	0002
R + 1	Present value (4-digit BCD)	Scaling Lower limit to upper limit

Operand Settings for the PMCR(260) Instruction

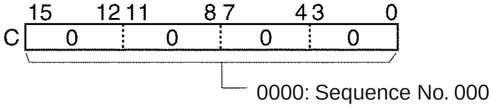
Reading the present value of E5□K Unit No. 03 and storing it in DM00201



C1: Control data



C2: Control data



S: First send data word

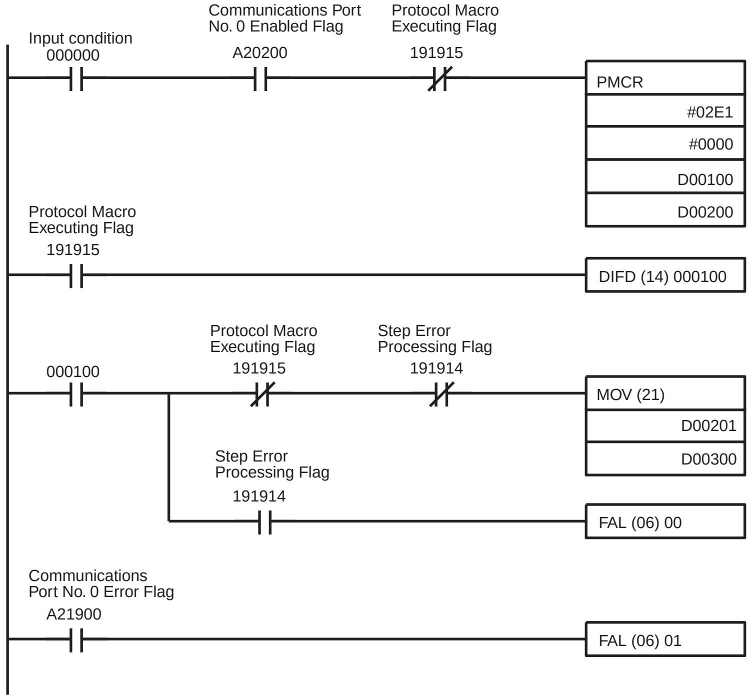
		15 … 0	
S :	DM00100	0 0 0 2	Number of send data words = 2
S+1 :	DM00101	0 0 0 3	Unit No. = 03

R: First receive data storage word

		15 … 0	
R :	DM00200	0 0 0 2	Number of receive data words = 2
R+1 :	DM00201	Present value	← Present value is stored. (4-digit BCD)

Ladder Programming Example

The following diagram shows an example in which sequence number 000 (PRESENT VALUE READ) of a Temperature Controller (E5☐K Read System) is executed using the PMCR(260) instruction. If the sequence has been completed normally, the present value that has been read is transferred to another word.



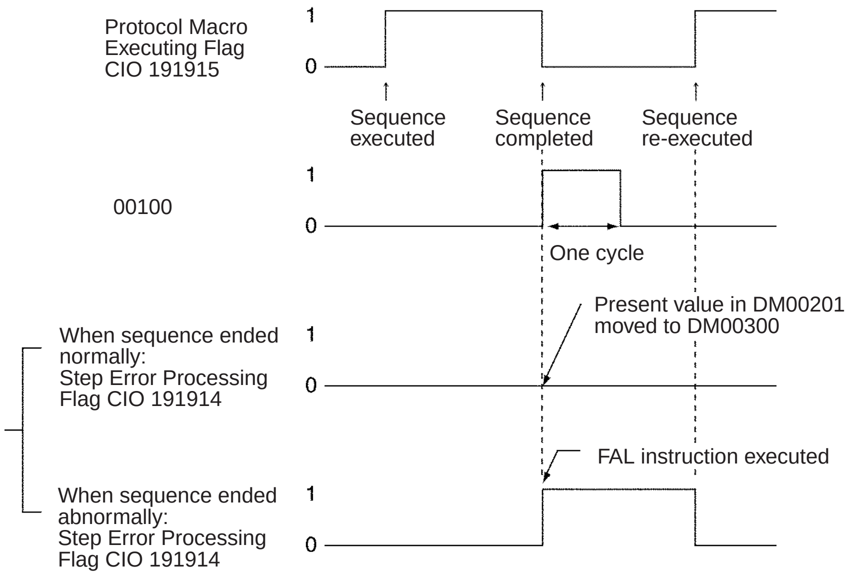
If input condition CIO 000000 is ON, Communications Port No. 0 Enabled Flag A20200 is ON, and Protocol Macro Executing Flag CIO 191915 is OFF, then sequence No. 000 is executed for Serial Communications Board port 2 and the present value is stored in DM00201.

If Protocol Macro Executing Flag CIO 191915 turns OFF, CIO 000100 turns ON (and remains ON for one cycle).

If Protocol Macro Executing Flag CIO 191915 is OFF and Step Error Processing Flag CIO 191914 is OFF when CIO 000100 turns ON, then the received present value in DM00201 is moved to DM00300.

If CIO 000100 is ON (sequence end) and Step Error Processing Flag CIO 191914 is ON, the sequence ends abnormally and a FAL(06) instruction (Non-Fatal Diagnostic Instruction) is executed.

If the Communications Port Error Flag for port 0 turns ON, a FAL(06) instruction (Non-Fatal Diagnostic Instruction) is executed.

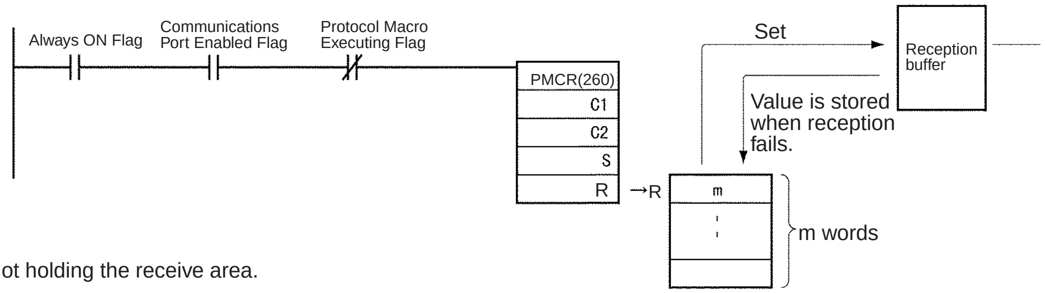


Receive Data Storage Area before Executing PMCR(260)

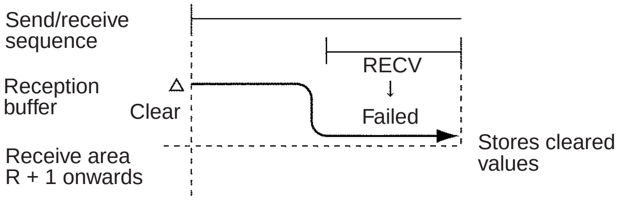
When the PMCR(260) instruction is executed, the reception buffer is cleared to 0 once immediately before the send/receive sequence is executed. If a ladder program is used that regularly reads the present value data, as shown in the following diagram, the present value data would normally be cleared to 0 if the data is not retrieved due to an error, such as a reception error. If reception processing fails, however, the data that was stored started at R+1 (i.e., the number of words specified in R) is again read from the reception buffer and stored again beginning at R+1. This ensures that the current data will not be cleared and that the previous receive data will be maintained when receptions fail. Make sure to set the number of words m for the data that is to be held. If the data is set to 0 or 1, the most recent receive data will not be held. Instead, it will be cleared to 0.

Example:

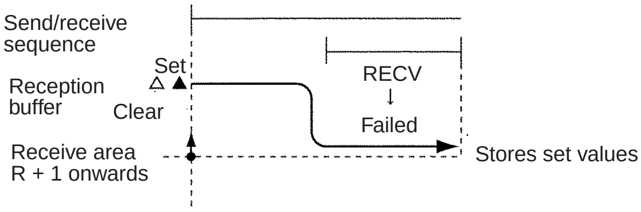
The following protocol can be used to regularly execute the PMCR(260) instruction to retrieve receive data by performing the send/receive operation once only.



Not holding the receive area.



Holding the receive area.



Receive Data Storage Area Function

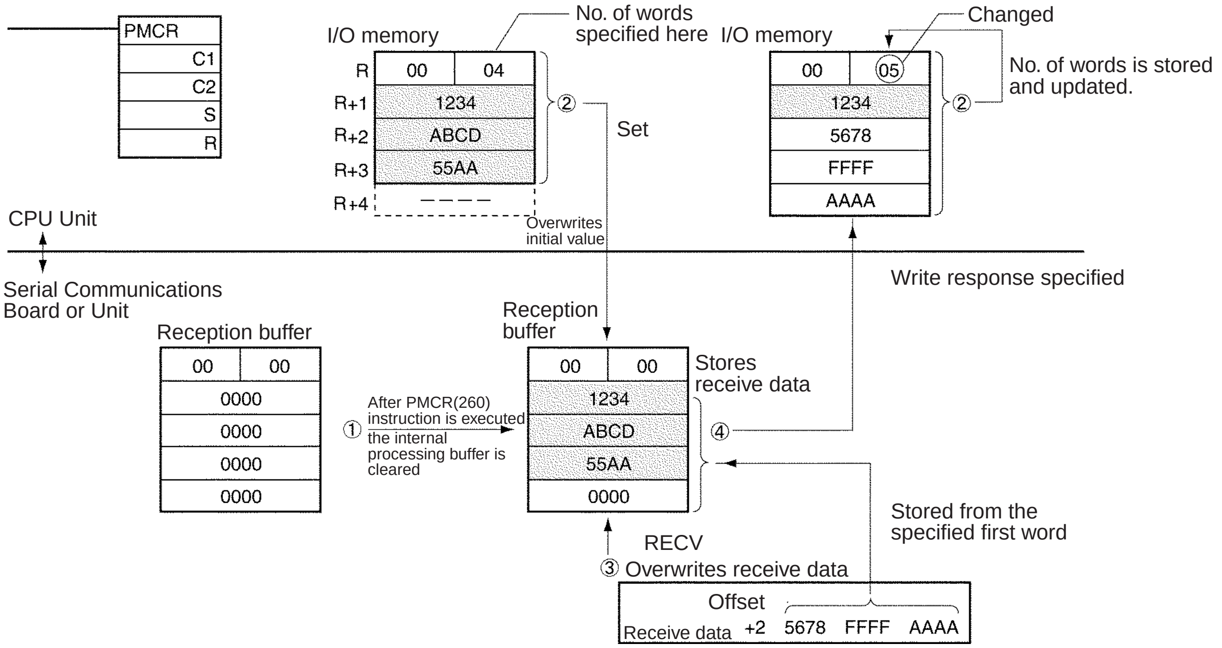
The receive data storage area is used according to the following procedure.

1,2,3...

1. When the PMCR(260) instruction is executed, 250 words of the reception buffer in the Serial Communications Board or Serial Communications Unit are cleared.
2. Before executing the send/receive sequence, the contents of one less than the number of words specified in R starting from word R + 1 are used to overwrite the contents of the reception buffer (excluding the first word).This becomes the initial value of the reception buffer, and the results of the RECV command execution are waited for. If the contents of the reception buffer exceeds the contents of the number of words specified in R (or the

whole area if the number of words is specified as 00), then the initial value will be set to 0000 Hex.

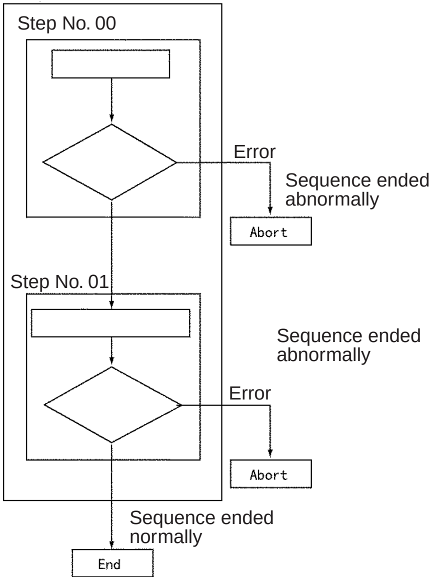
3. The data that has been received as the result of executing the RECV command will be stored in the reception buffer (except for the first word) from the specified first word (offset) and will be verified against the expected receive messages. If writing the response data is not specified, the receive data will be saved in the reception buffer and will not be stored in the CPU Unit.
4. If writing the response data is specified, the data in the reception buffer up to the most recent data (except for the first word), will be stored in from words R+1 onwards. The data stored for the number of words (including R) up to the last word will be saved. Whenever the number of data words stored exceeds the maximum, the number of words in R will be updated.
5. Steps 3 and 4 are repeated until the protocol macro operation is completed.



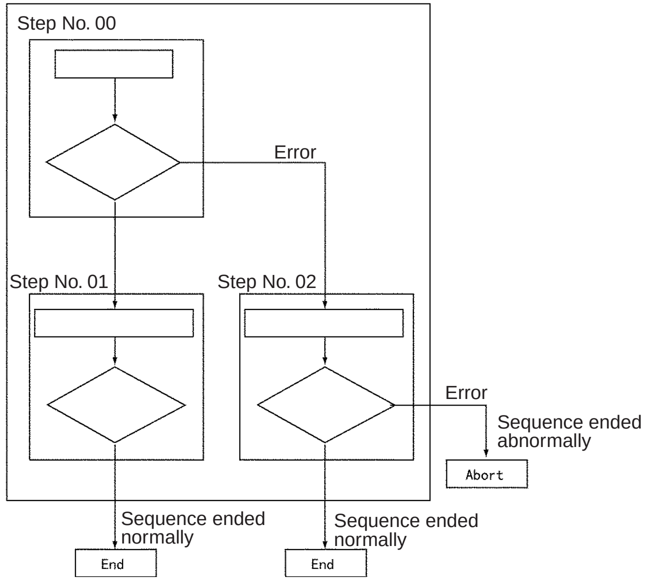
Note **Processing When a Sequence Ends Abnormally**

As shown in the following examples, if END is set when a sequence ends normally and ABORT is set when a sequence ends abnormally, it is possible to determine whether each sequence has ended normally or abnormally by using the Sequence End Completion Flag and the Sequence Abort Completion Flag.

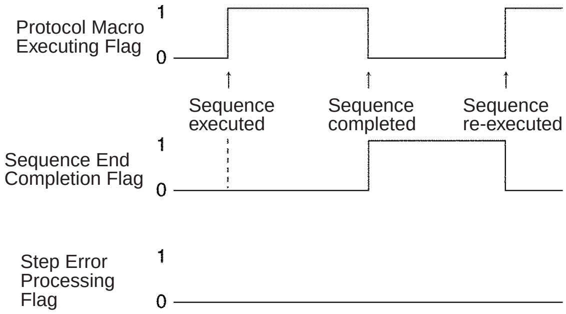
Example 1



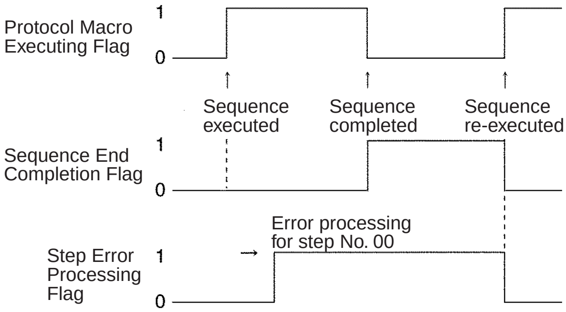
Example 2



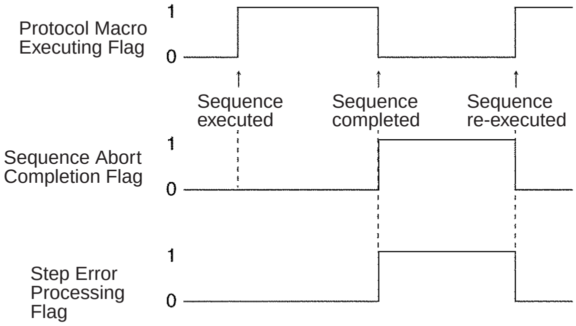
When the sequence ends normally



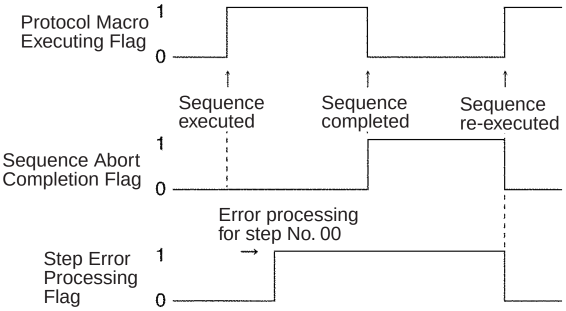
When the sequence ends normally



When the sequence ends abnormally



When the sequence ends abnormally



Note The Step Error Processing Flag is used to see whether error processing has been executed for an individual step in a sequence, and not for the overall steps. Therefore, as shown in Example 2 above, after executing error processing during a sequence (step No. 00), the flag will remain ON, even if the next step ends normally. Care is therefore required because it is not always possible to use this flag to determine whether the overall sequence has ended abnormally.

Note **Abort Switch Precaution**

The Abort Switch can be used to abort the sequence that is being executed. The Abort Switch can be turned ON from a ladder diagram or from a Programming Device. It will be turned OFF automatically by the system when abort processing has been completed. Do not attempt to force the Abort Switch to stay ON from a ladder diagram or from a Programming Device.

5-5 Simple Backup Function (Backup of Protocol Macro Data)

Overview

The “-V1” versions of the CS-series Serial Communications Boards/Unit (CS1W-SCB21-V1, CS1W-SCB41-V1, and CS1W-SCU21-V1) and the CJ1W-SCU41 Serial Communications Unit* support the Simple Backup Function when connected to a CS1-H or CJ1-H CPU Unit.

Note *The CS-series Serial Communications Boards/Units without the “-V1” suffix do not support this Simple Backup Function, but the CJ1W-SCU41 does support this function even though the model number lacks the “-V1” suffix.

The CPU Unit’s Simple Backup Function will automatically backup, restore, or compare the Protocol Macro data (both standard system protocol and user-set protocol data) in the Serial Communications Board/Unit’s flash memory to the CPU Unit’s Memory Card. The Protocol Macro data is backed up, restored, or compared along with all of the data in the CPU Unit. (The Simple Backup Function can be used with CS1-H and CJ1-H CPU Units only.)

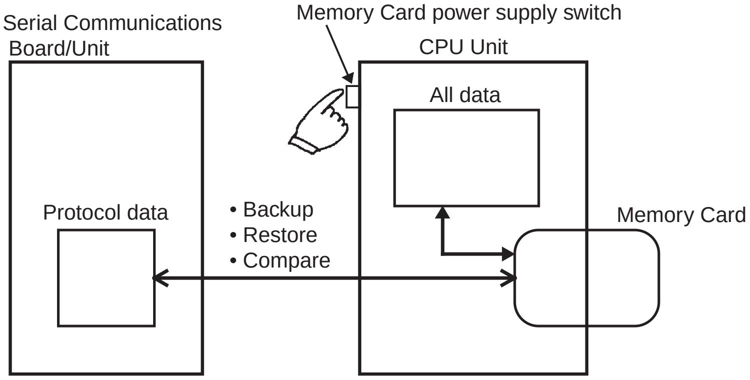
When the Protocol Macro data in the Serial Communications Board/Unit is written to the Memory Card by the Simple Backup Operation, the data is saved as a Unit/Board Backup File with the filename shown below.

Note A Unit/Board Backup File for a Serial Communications Unit or Board is referred to as a “Protocol Data File” in this manual.

Filename: BACKUP□□.PRM

(The value □□ is the unit address. A Serial Communications Unit’s unit address is the Unit number + 10 Hex. A Serial Communications Board’s unit address is E1 Hex.)

The Protocol Data File is accessed from the Memory Card during read and compare operations.



Note The following table shows the combinations of CPU Units and Serial Communications Board/Unit that support the Simple Backup Function.

CPU Unit	Serial Communications Board/Unit	
	CS1W-SCB21-V1, CS1W-SCB41-V1, or CS1W-SCU21-V1	CS1W-SCB21, CS1W-SCB41, or CS1W-SCU21
CS1-H CPU Unit	Supported	Not supported
CS1 CPU Unit	Not supported	Not supported

CPU Unit	Serial Communications Board/Unit
	CJ1W-SCU41
CJ1-H CPU Unit	Supported
CJ1 CPU Unit	Not supported

Precations for Using the Simple Backup Function

When using the Simple Backup Function in CS1H/G-CPU□□H products of Lot No. 011101 or earlier* combined with the Serial Communications Board (CS1W-SCB□□-V1), proper backup will not be possible if the backup file (BACKUPE1.PRM) remains in the Memory Card.

*Reading lot numbers

CS1H/G-CPU□□H Lot No. 01 11 01 ...Produced November 1, 2001
Production day (in this example: 1)
Production month (in this example: 11)
Production year (in this example: 2001)

In order to use the Simple Backup Function in this combination, delete the backup file (BACKUPE1.PRM) inside the Memory Card, then execute the backup.

If backup is executed without deleting this backup file, the RDY LED and the CPU Unit's ERR/ARM LED will both flash, and the Protocol Data Error Flag (bit A42409) will turn ON with the restore operation. The Serial Communications Board will also automatically delete the backup file (BACKUPE1.PRM).

Applications

Use the Simple Backup Function when replacing all Units or creating backup files of all of the PC's data, including the data in the CPU Unit and Serial Communications Boards or Units.

Operation

Use the following procedures to create a Protocol Data File on the Memory Card, restore the Protocol Data File, and compare the protocol data with the Memory Card's Protocol Data File.

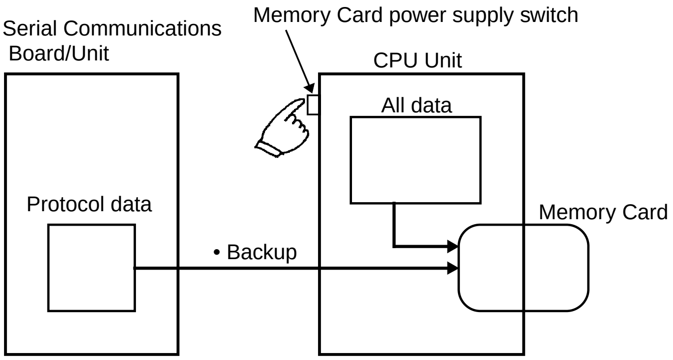
■ Backing Up the Protocol Data to the Memory Card

Follow these steps to back up the Serial Communications Board/Unit's protocol data to the Memory Card:

1. Make the following settings to pins 7 and 8 in the DIP Switch on the front of the CPU Unit.

Pin	Setting
7	ON
8	OFF

2. Press and hold the Memory Card power supply switch for 3 seconds.



This procedure creates the Protocol Data File and writes it to the Memory Card along with the other backup files.

When the Memory Card power supply switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being written. The Indicator will go OFF after the data has been written properly.

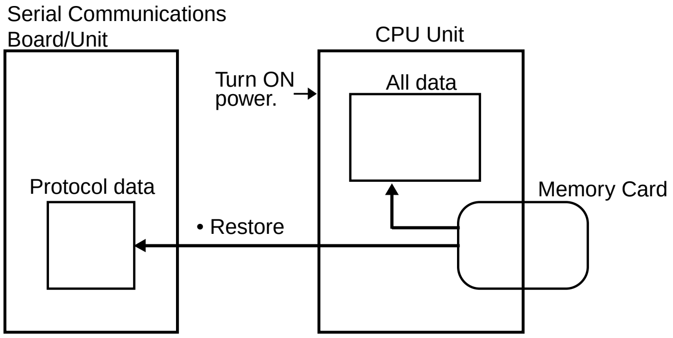
■ Restoring the Protocol Data from the Memory Card

Follow these steps to restore the Protocol Data File, i.e., read the protocol data from the Memory Card and set it in the Serial Communications Board/ Unit.

1. Make the following settings to pins 7 and 8 in the DIP Switch on the front of the CPU Unit.

Pin	Setting
7	ON
8	OFF

2. Turn the PC's power supply from OFF to ON.



This procedure reads the Serial Communications Board/Unit's Protocol Data File from the Memory Card and sets that data in the Serial Communications Board/Unit.

When the PC's power is turned ON, the MCPWR Indicator on the front of the CPU Unit will light and flash once. The MCPWR Indicator will remain lit while the data is being read. The Indicator will go OFF after the data has been read properly.

Serial Communications Board Operation

The Serial Communications Board's RDY Indicator will flash during the restore operation and it will be lit when the restore operation is completed normally.

If the restore operation fails, the RDY Indicator will continue to flash. The CPU Unit's ERR/ALM Indicator will flash and bit A42409 (the Protocol Data Error Flag) will be turned ON.

Serial Communications Unit Operation

The Serial Communications Unit's RDY Indicator will flash during the restore operation. Both the RDY Indicator and RUN Indicator will be lit when the restore operation is completed normally.

If the restore operation fails, the RDY Indicator will continue to flash and the ERC Indicator will be lit.

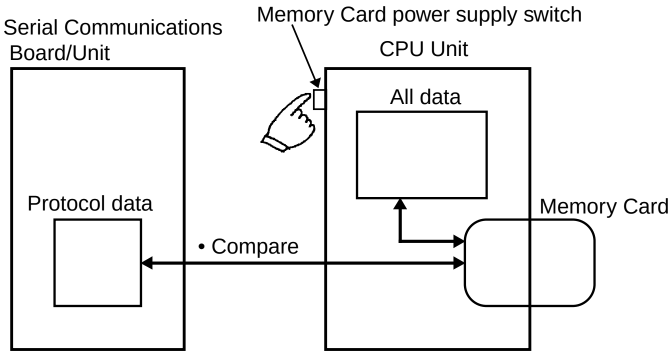
■ Comparing the Protocol Data with the Memory Card's Protocol Data File

Follow these steps to compare the Serial Communications Board/Unit's protocol data with the Protocol Data File in the Memory Card:

1. Make the following settings to pins 7 and 8 in the DIP Switch on the front of the CPU Unit.

Pin	Setting
7	OFF
8	OFF

2. Press and hold the Memory Card power supply switch for 3 seconds.



This procedure compares the protocol data in the Serial Communications Board/Unit with the data in the Protocol Data File in the CPU Unit's Memory Card.

When the Memory Card power supply switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being compared. If the data matches, the Indicator will go OFF after the data has been compared.

SECTION 6
Using 1:N NT Links

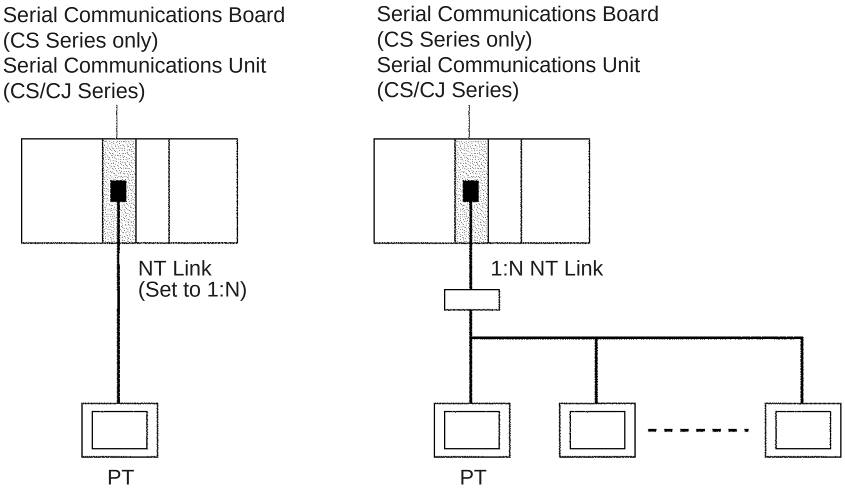
This section describes the procedure and other information required to use 1:N NT Links to Programmable Terminals.

6-1 Overview of 1:N NT Links

A PC can be connected to Programmable Terminals (PTs) using an RS-232C or RS-422A/485 port. The I/O memory of the PC is allocated as a Status Control Area and a Status Notification Area for the PT, as well as to objects, such as touch switches, lamps, and memory tables. This enables the status of the I/O memory in the PC to be controlled and monitored by operations from the PT, without the use of ladder programming in the PC. One PC can be connected to up to eight PTs.

The user does not need to be aware of the 1:N NT Links commands. All that is necessary is to allocate PC memory for the PTs.

This section explains the Setup Area and the Protocol Status Flags when a Serial Communications Board or Unit is used with 1:N NT Links. For details on the operating PTs, refer to the operation manual for the PT.

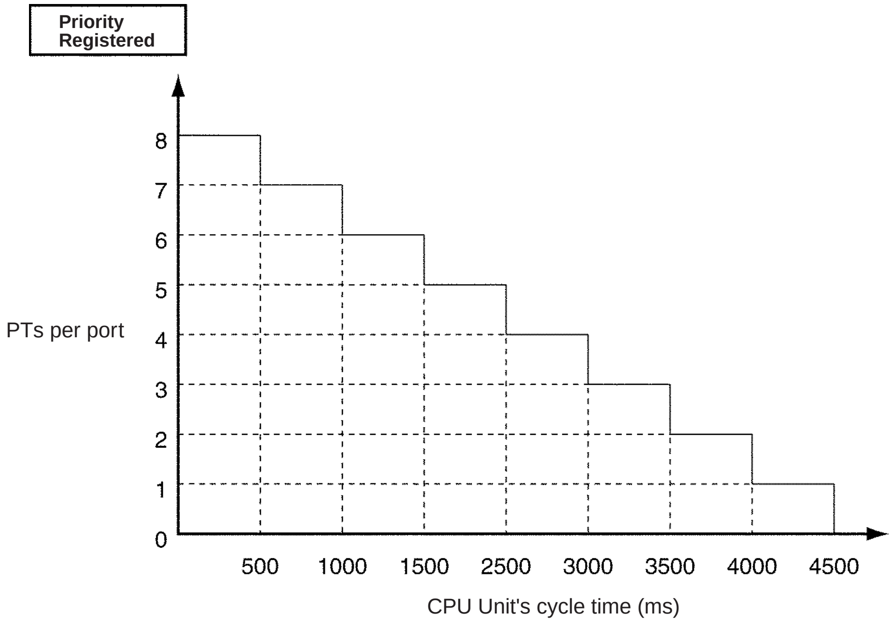


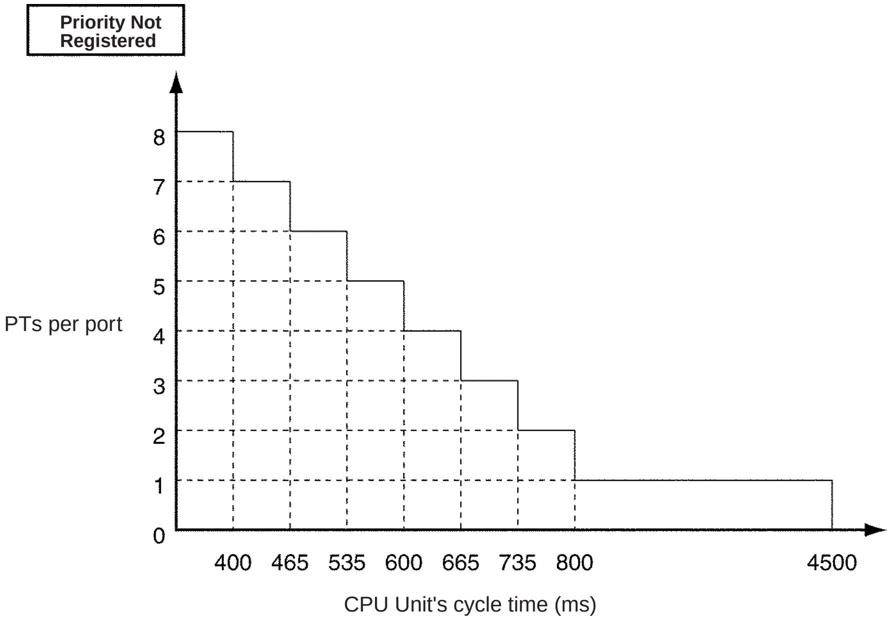
Note

1. Set the serial port on the PT to a 1:N NT Link. The Serial Communications Board or Unit will not be able to communicate if the PT port is set for a 1:1 NT Link. Connection is not possible to PTs that do not support 1:N NT Links.
2. The number of PTs that can be connected to one port is limited by the CPU Unit's cycle time when a Serial Communications Board or Unit is used in a 1:N NT Link, as shown in the following diagrams. Although some communications will be possible even if these restrictions are exceeded, communications errors will occur depending on the PT operating conditions and communications load. Always abide by these restrictions.
3. The Programming Console functions of the PT (Expansion Mode) cannot be used when connected to Serial Communications Board or Unit ports. They can be used only by connecting to the peripheral port or RS-232C port on the CPU Unit.
4. Set a unique unit number for each PT connected to the same PC. If the same unit number is set for more than one PT, malfunctions will occur.

5. NT Link serial communications are unique and are not compatible with other serial communications modes.

Example for NT31/NT631(C) PTs





6. The NT20S, NT600S, NT30, NT30C, NT620, NT620C, and NT625C cannot be used if the cycle time of the CPU Unit is 800 ms or longer (even if only one of these PTs is used in a 1:N NT Link).
7. With some PTs, timeout settings can be changed to eliminate some of the communications errors. Refer to the operation manual for the PT for details.
8. If more PTs are required by the system than allowed by the above restrictions, connect the PTs in smaller groups to different ports and increase the number ports by adding Serial Communications Units or a Serial Communications Board (if one is not already being used).

6-2 Setup Area Allocations

This section explains the Setup Area (Allocation DM Area) when a Serial Communications Board or a Serial Communications Unit is used in 1:N NT Link mode.

6-2-1 Setup Area Words

The Serial Communications Board and Serial Communications Units use the following words as a Setup Area in the DM Area when 1:N NT Links are used. The words allocated to the Serial Communications Board are different from those allocated to the Serial Communications Units (which are allocated words according to the unit numbers).

Serial Communications Boards (CS Series Only)

Setup Area Allocated in the DM Area: D32000 to D32767

Words	Usage
D32000, D32006	Port 1 Settings
D32010, D32016	Port 2 Settings
D32001 to D32005 D32007 to D32009 D32011 to D32015 D32017 to D32019	Not used with1:N NT Links
D32020 to D32767	Reserved for the system

Serial Communications Units (CS/CJ Series)

Setup Area Allocated in the DM Area: D30000 to D31599
First Word in Setup Area Allocated in the DM Area:
m = D30000 + 100 × unit number

Unit No.	DM Area
Unit No. 0	D30000 to D30099
Unit No. 1	D30100 to D30199
Unit No. 2	D30200 to D30299
Unit No. 3	D30300 to D30399
Unit No. 4	D30400 to D30499
Unit No. 5	D30500 to D30599
Unit No. 6	D30600 to D30699
Unit No. 7	D30700 to D30799
Unit No. 8	D30800 to D30899
Unit No. 9	D30900 to D30999
Unit No. A	D31000 to D31099
Unit No. B	D31100 to D31199
Unit No. C	D31200 to D31299
Unit No. D	D31300 to D31399
Unit No. E	D31400 to D31499
Unit No. F	D31500 to D31599

m, m + 6: Port 1 Settings

m + 10, m + 16: Port 2 Settings

m + 1 to m + 5, m + 7 to m + 9, m + 11 to m + 15, m + 17 to m + 19: Not used with 1:N NT Links

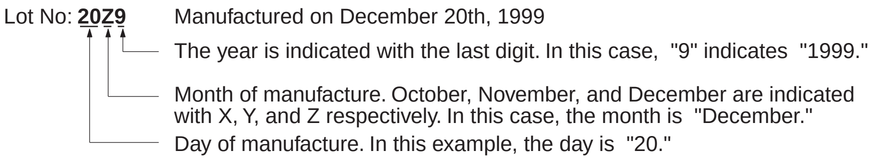
m+20 to m+99: Not used

6-2-2 Setup Area Contents

m = D30000 + 100 × unit number

DM Area				Bit	Setting contents
Boards (CS Series only)		Unit (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
D32000	D32010	m	m + 10	15	Port settings Setting not required.
				14 to 12	Reserved
				11 to 08	Serial communications mode: Always 2 Hex (1:N NT Link)
				07 to 05	Reserved
				04	Start bits Setting not required.
				03	Data length Setting not required.
				02	Stop bits Setting not required.
				01	Parity Setting not required.
				00	Parity Setting not required.
D32001	D32011	m + 1	m + 11	15 to 04	Reserved
				03 to 00	Baud rate (bps) 0 to 9 Hex: Standard NT link A Hex: High-speed NT link (see note)
D32006	D32016	m + 6	m + 16	15 to 03	Reserved
				02 to 00	Maximum 1:N NT Link (1:N) unit number (0 to 7 Hex)

Note With CS-series, a high-speed NT link is available only with Serial Communications Boards/Units manufactured on or after December 20th, 1999. With earlier models, only standard NT link is available.



Lot No: **20Z9** Manufactured on December 20th, 1999

The year is indicated with the last digit. In this case, "9" indicates "1999."

Month of manufacture. October, November, and December are indicated with X, Y, and Z respectively. In this case, the month is "December."

Day of manufacture. In this example, the day is "20."

NT31/631(C)-V2 are the only PTs for which high-speed NT link is supported.

Except for the baud rate, the 1:N NT Link communications specifications are fixed. Therefore, the port settings, start bits, stop bits, and parity need not be set. Even if they are set, they are ignored.

Serial Communications Mode Set the serial communications mode to 2 Hex to use 1:N NT Link mode.

Maximum 1:N NT Links Unit No. With 1:N NT Links, up to eight Programmable Terminals (PTs) can be connected. The highest connected unit number is set here.

6-3 Auxiliary Area and CIO Area Allocations

This section describes the bits and words used by the Serial Communications Board and Serial Communications Units in the Auxiliary Area and the Status Area allocated in the CIO Area. The Software Switches allocated in the CIO Area are not used for 1:N NT Links.

6-3-1 Auxiliary Area Allocations

Port 1 and Port 2 Port Settings Change Bits

These bits can be turned ON from the program using the OUT or other instructions to change communications settings and restart the Serial Communications Board ports. When changing the settings and restarting the port have been completed, the bit will automatically be turned OFF.

Note These bits are used both to change the port settings and to restart the port at the same time. One of these bits can be turned ON to restart a port without changing the port settings in the Setup Area allocated in the DM Area. The STUP(237) instruction can also be used to just restart a communications port by executing STUP(237) with the same port settings as the ones already being used.

Serial Communications Boards (CS Series Only)

Word	Bit	Contents
A636	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Serial Communications Units (CS/CJ Series) n = A620 + unit number

Words	Bit	Contents
n	03 to 15	Reserved
	02	1: Port 2 Settings Change Bit
	01	1: Port 1 Settings Change Bit
	00	Reserved

Inner Board Error Information (CS-series Serial Communications Board Only)

A424 contains error information for the Serial Communications Board.

Word	Bit	Contents	
A424	12 to 15	Non-fatal errors (Note 1)	Reserved
	11		1 Error log EEPROM error; 0: Normal
	10		1: Protocol macro execution error; 0: Normal This bit will be turned ON when code 3, 4, or 5 is stored in the error code for bits 00 to 03 of CIO 1909 or CIO 1919 in the CIO Area,
	09		1: Protocol data error (SUM error); 0: Normal
	08		1: Setup error; 0: Normal
	07		1: Routing table error; 0: Normal
	06		Reserved
	05		1: Cyclic monitoring error; 0: Normal
	04		Reserved
	03	Fatal errors (Note 2)	Reserved
	02		Reserved
	01		1: Inner Bus error; 0: Normal
	00		1: Inner Board watchdog timer error; 0: Normal

Note

1. When any one of bits 05 to 11 is ON, A40208 (Inner Board Error Flag) (non-fatal error) will be ON.
2. When bit 00 or 01 is ON, A40112 (Inner Board Fatal Error Flag) will be ON.

For details on errors, refer to *Section 8 Troubleshooting and Maintenance*.

6-3-2 CIO Area Allocations

Words in the CIO Area are allocated for a Status Area, which contains status and error information for the Serial Communications Board or Unit. These allocations are described in this section.

Serial Communications Boards (CS Series Only)

Words CIO 1900 to CIO 1999 in the Inner Board Area are used for a Status Area. Only the words shown in the following table are used for the Status Area with 1:N NT Links.

Inner Board CIO Area
CIO 1900 to CIO 1999

Words	Usage
CIO 1901 to CIO 1904	Board status
CIO 1905 to CIO 1914	Port 1 status
CIO 1915 to CIO 1924	Port 2 status
CIO 1925 to CIO 1999	Reserved

Serial Communications Units (CS/CJ Series)

Words CIO 1500 to CIO 1899 in the CPU Bus Unit Area in the CIO Area are allocated according to the unit number setting. Each Unit is allocated 25 words. Only the words shown in the following table are used for the Status Area with 1:N NT Links.

CPU Bus Unit Area
CIO 1500 to CIO 1899

n = CIO 1500 + 25 × unit number

Unit No.	Words
Unit No. 0	CIO 1500 to CIO 1524
Unit No. 1	CIO 1525 to CIO 1549
Unit No. 2	CIO 1550 to CIO 1574
Unit No. 3	CIO 1575 to CIO 1599
Unit No. 4	CIO 1600 to CIO 1624
Unit No. 5	CIO 1625 to CIO 1649
Unit No. 6	CIO 1650 to CIO 1674
Unit No. 7	CIO 1675 to CIO 1694
Unit No. 8	CIO 1700 to CIO 1724
Unit No. 9	CIO 1725 to CIO 1749
Unit No. A	CIO 1750 to CIO 1774
Unit No. B	CIO 1775 to CIO 1799
Unit No. C	CIO 1800 to CIO 1824
Unit No. D	CIO 1825 to CIO 1849
Unit No. E	CIO 1850 to CIO 1874
Unit No. F	CIO 1875 to CIO 1899

n + 1 to n + 4: Unit status
n + 5 to n + 14: Port 1 status
n + 15 to n + 24: Port 2 status

6-3-3 Status Area Contents

The Status Area is used to input status information from Serial Communications Board or Unit to the CPU Unit. The Status Area is where the Serial Communications Board or Unit set communications status, the transmission control signal status, and the transmission error status.

n = CIO 1500 + 25 × unit number

Words				Bit	Contents		
Boards (CS Series only)		Units (CS/CJ Series)					
Port 1	Port 2	Port 1	Port 2				
CIO 1901		n + 1		02 to 15	Reserved		
				01	1: Error log data error 0: Error log data normal		
				00	1: Protocol data error 0: Protocol data normal		
CIO 1902		n + 2		00 to 15	Reserved		
CIO 1903		n + 3		00 to 15	Reserved		
CIO 1904		n + 4		00 to 15	Reserved		
CIO 1905	CIO 1915	n + 5	n + 15	12 to 15	Port setting status	Setup Area	Serial communications mode: Always 2 Hex
				08 to 11			Baud rate: 0 to 9 Hex, A Hex (see note)
				05 to 07			Reserved
				04			Start bit: Always 0 Hex
				03			Data length: Always 1 Hex
				02			Stop bit: Always 1 Hex
				01			Parity, Yes/No: Always 0 Hex
				00			Parity, Even/Odd: Always 1 Hex
CIO 1906	CIO 1916	n + 6	n + 16	15	Port setting status	Hardware settings	0: No; 0: RS-232C;1: RS-422A/485; 1: Reserved
				14			0: 1: 0: 1: Reserved
				13			0: Terminating resistance OFF 1: Terminating resistance ON
				02 to 12		Reserved	
				01		1: Setup error 0: Setup normal	
				00		1: Port operating 0: Port stopped	
CIO 1907	CIO 1917	n + 7	n + 17	11 to 15	Communications status	Reserved	
				10		1: Remote Unit receive busy (flow control) 0: Remote Unit receive wait (Always 0 Hex)	
				09		Reserved	
				08		1: Local Unit receive busy (flow control) 0: Local Unit receive wait (Always 0 Hex)	
				07	Transmission control signal status	ER signal	
				06		DTR signal	
				05		Reserved	
				04		CTS signal	
				03		RTS signal	
				00 to 02		Reserved	
CIO 1908	CIO 1918	n + 8	n + 18	00 to15	Reserved		
CIO 1909 to CIO 1914	CIO 1919 to CIO 1924	n + 9 to n + 14	n + 19 to n + 24	15 to 00	Protocol status		

Note The baud rate that is input to the CPU Unit will depend on the setting in the System Setup. If the default value is used because of a System Setup error, this default setting is input.

Error Log EEPROM Error

This bit will be set to 1 if an error occurs in reading or writing the error log stored in EEPROM on the assumption that the EEPROM has reached its useful life. If a Serial Communications Unit is being used, the ERC indicator will also light. If a Serial Communications Board is being used, A42411 will turn ON and the ERR/ALM indicator on the CPU Unit will flash, indicating a non-fatal error.

Protocol Data Error

This bit will be turned ON if a checksum error is detected in the protocol data at startup. The checksum is checked for all serial communications modes. If a Serial Communications Unit is being used, the ERC indicator will also flash. If a Serial Communications Board is being used, A42409 will turn ON, the ERR/ALM indicator on the CPU Unit will flash, and the RDY indicator will flash at 1-second intervals, indicating a non-fatal error.

The operation of the 1:N NT Links will not be affected by a protocol data error.

Port Setting Status

The settings in the Setup Area for the following items will be stored: Serial communications mode, baud rate, start bits, data length, stop bits, parity, ports, terminating resistance, terminating resistance, setup error, and port operating/stopped status. The port operating/stopped status will always be 1 for 1:N NT Links.

Communications Status

The flow control and buffer status is stored. This status is not used for 1:N NT Links. These bits are cleared at startup or when a port is restarted using STUP(237) or a Port Settings Change Bit (Auxiliary Area).

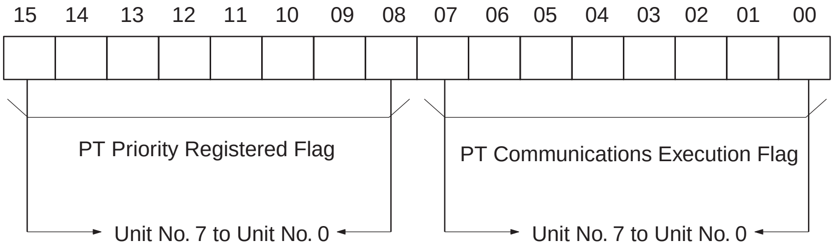
Transmission Control Signal Status

The status of the transmission control signals is stored.

Protocol Status

The bits corresponding to the unit numbers of the connected PTs for which priority processing has been set and the bits corresponding to the unit numbers for which communications are being executed are turned ON.

Words				Bit	Contents
Boards (CS Series Only)		Unit (CS/CJ Series)			
Port 1	Port 2	Port 1	Port 2		
CIO 1909	CIO 1919	n + 9	n + 19	15 to 08	PT Priority Registered Flag
				07 to 00	PT Communications Execution Flag
CIO 1910 to CIO 1914	CIO 1920 to CIO 1924	n + 10 to n + 14	n + 20 to n + 24	15 to 00	Reserved



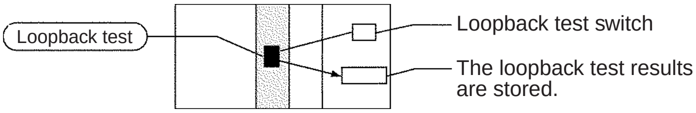
SECTION 7
Loopback Test

This section describes the procedure and other information required to conduct loopback test to check the serial communications ports.

7-1 Executing Loopback Tests

7-1-1 Overview

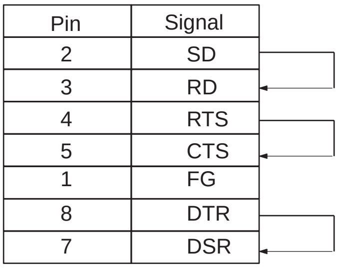
Executing a loopback test will allow you to test a port communications circuit by connecting a loopback-wire connector to the port of a Serial Communications Board or Unit, looping back the transmitted data to make it the received data for the Unit or Board, and then comparing and checking the data.



7-1-2 Connection Method

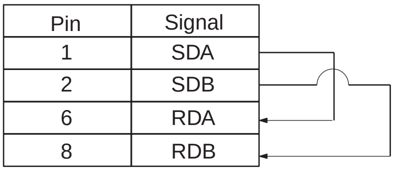
Make the connections according to the type of port, as shown in the following diagrams.

RS-232C Port



Pin	Signal
2	SD
3	RD
4	RTS
5	CTS
1	FG
8	DTR
7	DSR

RS-422A/485 Port



Pin	Signal
1	SDA
2	SDB
6	RDA
8	RDB

7-1-3 Procedure

The loopback test is performed using the procedure shown below.

1,2,3...

1. Connect the connector of the port to be used to execute the loopback test. See *7-1-2 Connection Method* for details.
2. Set the serial communications mode in the Setup Area to Loopback Test (F Hex). Refer to *7-2 Setup Area Allocations*.
3. Set the following communications settings for the loopback test in the Setup Area: Baud rate, stop bits, parity, and data length. Refer to *7-2 Setup Area Allocations*.
4. Cycle the power, restart the Unit or Board, or restart the port.

   Use the following bits to restart the Board or Unit.

Board:	A60800
Units:	A501, bits 00 to 15 (bits correspond to unit numbers 0 to F)

   Use the following bits to restart the port.

Board:	A636, bit 01 for port 1 and bit 02 for port 2
Units:	A620 + unit number, bit 01 for port 1 and bit 02 for port 2

5. Turn ON the Loopback Test Switch. To end the test, turn OFF the switch.

   The Loopback Test Switches are as follows:
   Board: CIO 1900, bit 06 for port 1 and bit 14 for port 2
   Unit: n, bit 06 for port 1 and bit 14 for port 2 (n = CIO 1500 + 25 x Unit No.)

   Refer to *7-3 CIO Area Allocations.*

6. Use the protocol status to check the results.

   Refer to *7-3 CIO Area Allocations.*

7-1-4 Indicators Used for the Loopback Test

When the test is being executed, the indicators shown below will flash. Use the protocol status to check whether or not the test has been executed normally.

Serial Communications Boards (CS Series Only)

Port 1: COMM1 indicator
Port 2: COMM2 indicator

Serial Communications Units (CS/CJ Series)

Port 1: SD1/RD1 indicator
Port 2: SD2/RD2 indicator

7-2 Setup Area Allocations

This section describes the Setup Area allocated to the Serial Communications Board and Serial Communications Units in the DM Area when loopback tests are performed.

The loopback test is performed using the Host Link mode protocol. The Setup is basically the same as for the Host Link mode.

m = D30000 + 100 × unit number

DM Area				Bit	Settings	
Board (CS Series only)		Unit (CS/CJ Series)				
Port 1	Port 2	Port 1	Port 2			
D32000	D32010	m	m + 10	15	Port settings	0: Defaults, 1: User settings
				14 to 12	Reserved	
				11 to 08	Serial communications mode: Always F Hex (Loopback test)	
				07 to 05	Reserved	
				04	Start bits 0: 1 bit; 1: 1 bit (1 start bit is always used regardless of this setting)	
				03	Data length	0: 7 bits, 1: 8 bits
				02	Start bits	0: 2 bits, 1: 1 bit
				01	Parity	0: Yes, 1: No
				00	Parity	0: Even, 1: Odd
D32001	D32011	m + 1	m + 11	15 to 04	Reserved	
				03 to 00	Baud rate (bps) 0: Default (9,600); 3: 1,200; 4: 2,400; 5: 4,800; 6: 9,600; 7: 19,200; 8: 38,400; 9: 57,600; A: 115,200	

Serial Communications Mode

Set the serial communications mode to F Hex to perform a loopback test.

For the other settings, refer to *4-2 Setup Area Allocations.*

7-3 CIO Area Allocations

The loopback test execution results can be read form the protocol status area allocated in the CIO Area.

Protocol Status

The information shown in the following table is input to the CPU Unit in the protocol status area. If an error occurs, the flags will be turned ON

n = 1500 + 25 × unit number

Word				Bit	Contents	
Board (CS-series only)		Unit (CS/CJ-series)				
Port 1	Port 2	Port 1	Port 2			
CIO 1909	CIO 1919	n + 9	n + 19	15	Test status	Error
				14 to 09		Reserved
				08		DTR check error
				07		CTS check error
				06		Reserved
				05		Timeout error
				04		Parity error
				03		Overrun error
				02		Framing error
				01		Reserved
				00		Conveyor error
CIO 1910	CIO 1920	n + 10	n + 20	15 to 00	Test execution count	
CIO 1911	CIO 1921	n + 11	n + 21	15 to 00	Test error count	
CIO 1912 to CIO 1914	CIO 1922 to CIO 1924	n + 12 to n + 14	n + 22 to n + 24	15 to 00	Reserved	

The test execution count and test error count are cleared at startup. If the number of tests or the number of test errors is counted to FFFF (hex), the value of the count will remain at FFFF, but testing will continue.

SECTION 8
Troubleshooting and Maintenance

This section describes the troubleshooting and maintenance procedures for the Serial Communications Boards and the Serial Communications Unit.

8-1 Indicator Error Displays

8-1-1 Serial Communications Boards (CS Series Only)

Indicators		Possible cause	Remedy
RDY	**ERR/ALM CPU Unit**		
Lit	Not lit	The Board has started normally.	---
Not lit	Lit	The Board is faulty (hardware self-diagnostic function).	If the ERR and ALM indicators light when the Board is mounted to another CPU Unit, replace the Board.
		A bus error has occurred.	Firmly secure the Board to the CPU Unit.
		An initialization recognition error has occurred (the Board is not correctly recognized by the CPU Unit).	If the ERR and ALM indicators light when the Board is mounted to another CPU Unit, replace the Board.
Not lit	Flashing	An initialization recognition error has occurred (the Serial Communications Unit was not recognized by the CPU Unit).	If the ERR and ALM indicators light when the Board is mounted to another CPU Unit, replace the Board.
Not lit	Not lit	The CPU Unit is not receiving normal power supply.	Check the power supply voltage and supply the correct electric power to the Unit.
		The Board is not correctly secured to the CPU Unit.	Firmly secure the Board.
		The Board is faulty.	If all the indicators are not lit when the Board is mounted to another CPU Unit, replace the Board.
		An error (such as a CPU Unit WDT error) has occurred in the CPU Unit.	Eliminate the cause of the error. If the error persists, replace the CPU Unit.
Lit	Lit	The Board is faulty.	If all the indicators are not lit when the Serial Communications Unit is mounted to another CPU Unit, replace the Unit.
		A bus error has occurred.	Check the operating environment and eliminate the cause of the error. Firmly secure the Board. Refer to A42400 and A42401.
Lit	Flashing	The communications circuit is faulty.	Conduct a loopback test. If an error occurs, replace the Board.
		A protocol data syntax error has occurred.	Correct the protocol data and transfer it to the Board. Try executing a normal sequence for the serial port where the error is occurring or switch the CPU Unit to PROGRAM mode and remove the cause of the error.
		A system setting error has occurred.	Correct the Setup Area settings, and cycle the power, restart the Board, restart the port, or execute STUP(237).
		The routing tables are not set correctly.	When the routing tables are used, set them correctly. When the routing tables are not used, delete the Board settings from the table.
		An error has occurred in the CPU Unit.	Eliminate the cause of the error. If the error persists, replace the CPU Unit.
		The error log EEPROM is faulty.	Cycle the power supply. If the error persists, replace the CPU Unit.
Flashing	Not lit	A Protocol Data File (BACKUP□□.PRM) is being read (restored) from the CPU Unit's Memory Card to the Board.	---

Indicators		Possible cause	Remedy
RDY	ERR/ALM CPU Unit		
Lit	Not lit	A Protocol Data File (BACKUP□□.PRM) was read (restored) from the CPU Unit's Memory Card to the Board properly.	---
Flashing	Flashing	A protocol data write error has occurred or protocol data has been destroyed. There is no protocol data.	If the indicator status remains the same when the protocol data is retransmitted, replace the Board. Transfer protocol data to the Board.
Flashing	Flashing	The Protocol Data File (BACKUP□□.PRM) restore operation failed when restoring protocol data from the CPU Unit's Memory Card to the Board. The Protocol Data Error Flag (bit A42409 in CPU Unit's Auxiliary Area) will be turned ON if the restore operation fails.	Write (backup) the protocol data from the Board to the Memory Card again and then execute the restore operation again. If the restore operation fails two times in succession, use CX-Protocol to transfer the protocol data to the Board.

Serial Communications Board Error Information (A424)

For Serial Communications Boards, refer to the following Auxiliary Area word (A424) as well as the indicator displays shown on the previous page. When an error occurs, the corresponding flag is turned ON.

Bit	Flag		Possible cause	Remedy
00	Fatal error	Inner Board WDT error	The Board is faulty.	Firmly secure the Board to the CPU Unit. If the error persists when the Board is mounted to another CPU Unit, replace the Board.
01		Inner Bus error	A bus error has occurred.	Firmly secure the Board to the CPU Unit. If the error persists when the Board is mounted to another CPU Unit, replace the Board.
04	Non-fatal error	Inner Board service failure	An initial recognition error has occurred.	This flag will not turn ON in the present system.
05		Cyclic monitoring error	The Inner Bus access right cannot be retained for more than the specified time.	CPU Unit and system load is too high. Review the application.
07		Routing table error	The routing tables are not set correctly.	Correct the routing tables and retransfer them.
08		System setting error	A system setting error has occurred.	Correct the Setup Area settings, cycle the power supply, restart the Board, or restart the port, or execute STUP(237).
09		Protocol data error	A protocol data checksum error has occurred.	If the error persists when protocol data is retransmitted, replace the Board.
10		Protocol macro execution error	A syntax error has occurred during protocol macro execution.	Correct the protocol data and retransfer it. Try executing a correct sequence for the serial port where the error is occurring or switch the CPU Unit to PROGRAM mode and remove the cause of the error.
11		Error Log data error	The service life of the EEPROM has expired.	If this error persists even if the power supply is cycled, replace the Board.

When a fatal error occurs, the ERR and ALM indicators on the CPU Unit will light. When a non-fatal error occurs, the ERR and ALM indicators on the CPU Unit will flash. Refer to the indicator error displays.

Note The ERR/ALM indicator will continue to flash even after the cause of a non-fatal error has been removed for the Serial Communications Board. The indicator can be stopped by clearing the error from a Programming Console or other Programming Device for errors for bits 05, 07, 08, 09, and 10. Press the FUN Key and then the MONITOR Key from the Programming Console. Refer to the *CX-Programmer Operation Manual* for the CX-Programmer procedure.

8-1-2 Serial Communications Units (CS/CJ Series)

Indicators				Possible cause	Remedy
RUN	**ERC**	**ERH**	**RDY**		
Lit	Not lit	Not lit	Lit	The Serial Communications Unit has started normally.	---
Not lit	Lit	---	---	The Serial Communications Unit is found to be faulty (by the hardware self-diagnostic function).	If the ERC indicator lights up when the Serial Communications Unit is mounted to another CPU Unit, replace the Unit.
Not lit	Not lit	Lit	---	There is more than one identical unit number within the same CPU Unit. An initial recognition error has occurred (the Serial Communications Unit was not correctly recognized by the CPU Unit).	Assign a unique unit number to each Serial Communications Unit on the CPU Rack and Expansion Racks. If the ERH indicator lights up when the Serial Communications Unit is mounted to another CPU Unit, replace the Unit.
Not lit	Lit	Lit	---	An initial recognition error has occurred (the Serial Communications Unit was not correctly recognized by the CPU Unit).	If the ERC and ERH indicators light when the Serial Communications Unit is mounted to another CPU Unit, replace the Unit.
Not lit	Not lit	Not lit	Not lit	The CPU Unit is not receiving normal power supply. The Serial Communications Unit is not correctly secured to the Backplane (CS-series only) or not correctly secured to the next Unit (CJ-series only). The Serial Communications Unit is not mounted in an appropriate slot. The Serial Communications Unit is faulty.	Check the power supply voltage and supply the correct electric power to the Unit. Firmly secure the Unit. Mount the Unit in an appropriate slot. If all the indicators are not lit when the Serial Communications Unit is mounted to another CPU Unit, replace the Unit.
Lit	---	Flashing	---	A system setting error has occurred.	Correct the Setup Area settings, cycle the power supply, restart the Unit/Board, or restart the port, or execute STUP(237).
Lit	Lit	---	---	The error log EEPROM is faulty.	If the problem persists even if the power supply is cycled, replace the Unit.
Lit	---	Lit	---	The routing tables are not set correctly. An error (such as a CPU Unit WDT error) has occurred in the CPU Unit. A CPU Unit service monitoring error has occurred. A bus error has occurred.	When the routing tables are used, set them correctly. When the routing tables are not used, delete the Unit settings from the table. Eliminate the cause of the error. If the error persists, replace the CPU Unit. Check the operating environment and eliminate the cause of the error. (Check to be sure that the problem is not caused by another CPU Bus Unit having the same unit number.) Check the operating environment and eliminate the cause of the error. Firmly secure the Unit.
Not lit	Not lit	Not lit	Flashing	A Protocol Data File (BACKUP□□.PRM) is being read (restored) from the CPU Unit's Memory Card to the Serial Communications Unit.	---

Indicators				Possible cause	Remedy
RUN	ERC	ERH	RDY		
Lit	Not lit	Not lit	Lit	A Protocol Data File (BACKUP□□.PRM) was read (restored) from the CPU Unit's Memory Card to the Serial Communications Unit properly.	---
Lit	Flashing	---	Flashing	A protocol data write error has occurred or protocol data has been destroyed. There is no protocol data.	If the indicator status remains the same when the protocol data is retransmitted, replace the Unit. Transfer protocol data to the Unit.
Lit	Flashing	---	Lit	A protocol data syntax error has occurred.	Correct the protocol data and transfer it to the Unit. The ERC indicator can also be turned OFF by executing a normal sequence for the serial port for which the error is occurring or by switching the CPU Unit to PROGRAM mode temporarily.
Lit	Lit	---	Flashing	• The flash memory for protocol data is faulty. • The Protocol Data File (BACKUP□□.PRM) restore operation failed when restoring protocol data from the CPU Unit's Memory Card to the Serial Communications Unit.	• Transfer the protocol data to the Unit. If the problem persists after correct protocol data is transferred, replace the Unit. • Write (backup) the protocol data from the Unit to the Memory Card again and then execute the restore operation again. • If the restore operation fails two times in succession, use CX-Protocol to transfer the protocol data to the Serial Communications Unit.

8-2 Status Area Error Indications

This section describes status area error information.

Status Area Error Information

When an error occurs, the corresponding flag is turned ON.

n = CIO 1500 + 25 × unit number

Word				Bit	Flag name	Possible cause	Remedy
Boards (CS Series only)		Units (CS/CJ Series)					
CIO 1901		n + 1		01	Error Log data error	The error log EEPROM is faulty.	If the problem persists even if the power supply is cycled, replace the Board/Unit.
				00	Protocol data error	A protocol data checksum error has occurred.	If the error persists when protocol data is retransmitted, replace the Board or Unit.
CIO 1906	CIO 1916	n + 6	n + 16	01	System Setup error	A System Setup error has occurred.	Correct the Setup Area settings, cycle the power supply, restart the Unit/Board, or restart the port, or execute the STUP(237) instruction.
CIO 1907	CIO 1917	n + 7	n + 17	10	Remote node receive busy	The remote node is in receive buffer busy status when flow control is set for the protocol.	Cancel the communications with the remote node until this flag is turned OFF.
				08	Local node receive busy	The local node is in receive buffer busy status.	Increase the transmission interval to reduce transmission load to the remote node for which flow control is set.

8-3 Troubleshooting

This section describes how to resolve transmission and reception problems. “m” and “n” in the tables represent the following word addresses for the Board and Unit.

Symbol	Boards (CS Series only)	Units (CS/CJ Series)
m	D32000	D30000 + 100 x unit number
n	CIO 1900	CIO 1500 + 25 x unit number

8-3-1 Host Link Communications

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Serial communications mode is not set to Host Link.	---	---	Bits 12 to 15 (Serial Communications Mode) of CIO Area words n + 5/n + 15 are set to a value other than 5 Hex.	Serial communications mode is not set correctly.	Set bits 08 to 11 (Serial Communications Mode) of DM Area words m/m + 10 to 0 or 5 Hex (Host Link).

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Serial communications mode is set to Host Link.	The SD□/RD□ and COM□ indicators do not flash at all. (Communications have not been electrically established.)	---	---	Cables are incorrectly connected. The RS-422A/485 port setting (2-wire or 4-wire) is incorrect. Adapters such as the NT-AL001-E are incorrectly wired or set.	Check the wiring. Reset the port to the correct wiring setting. Wire all nodes using the 4-wire method.
				Commands are not being set from the host.	Reset the serial communications port at the host, and rewrite the program.
				This is a hardware error.	Set bits 08 to 11 (Serial Communications Mode) of DM Area words m/m + 10 to F Hex (Loopback Test Serial Communications Mode). Then, connect the connector wire for a loopback test and conduct a loopback test by turning ON bit 14 (Loopback Test Switch) of CIO Area word n. The test data is reflected in CIO Area words n+9/n+19. If an error occurs during the test, replace the Board or Unit.
	The RD□ and COM□ indicators are flashing, but the response has not been returned from the host. For the Unit, the SD□ indicator does not flash at all (Communications have been electrically established.)	There is no transmission error.	CIO Area words n + 8/n + 18 (transmission error status) are set to 0000 Hex. CIO Area words n + 5/n + 15 (port settings in the System Setup) do not correspond to the settings of the remote device.	The System Setup in DM Area words m + 2 and m + 3/m + 12 and m + 13 of the Board or Unit (Host Link Unit No., Host Link send delay time, etc.) does not correspond to the settings for the remote device. The command format and data length of the data sent from the host are incorrect.	Reset the settings in DM Area words m + 2 and m + 3/m + 12 and m + 13 of the Board or Unit (Host Link Unit No., Host Link send delay time, etc.), so that they correspond to the settings at the host device. Correct the command frame (header, Host Link Unit No., terminator, etc.) and the program.
			---	Cables are incorrectly connected. The RS-422A/485 port setting (2-wire or 4-wire) is incorrect. Adapters such as the NT-AL001-E are incorrectly wired or set.	Check the wiring and switch settings, and correct if necessary.

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Serial communications mode is set to Host Link.	The RD☐ and COM☐ indicators are flashing, but the response has not been returned from the host. For the Unit, the SD☐ indicator does not flash at all. (Communications have been electrically established.)	There is no transmission error.	---	This is a transmission circuit hardware error.	Conduct a loopback test in serial communications mode to check the transmission lines. If an error occurs during the test, replace the Board or Unit.
				The following settings in the FA command frame are incorrect. The ICF is set to have no response. The value of the remote destination address (DNA, DA1, DA2) has not been properly set.	Reset the frame parameters correctly.
				The send delay time setting is too long.	Reset the parameters in the System Setup correctly.
			CTS control is ON and bit 04 of CIO Area words n + 7/n + 17 (CTS signal) is OFF.	The CTS control is set, but the RTS signal from the remote Unit has not entered in the CTS signal of the local Unit.	Perform one of the following: Wire the local Unit RTS signal to the CTS signal using loopback. Disable the CTS control. Enter the RTS signal of the remote Unit into the CTS signal of the local Unit, and then use CTS control.
		There is a transmission error.	In CIO Area words n + 8/ n + 18, bit 15 (transmission error status) is turned ON, and bit 04 (overrun error), bit 03 (framing error), or bit 02 (parity error) is turned ON.	The communications conditions and baud rate do not match the settings at the host.	Review the System Setup, the host's settings and program (such as commands and frame format) based on the response contents, and the transmission error codes in CIO Area words n + 8/ n + 18.
				There is noise interference.	Use shielded twisted-pair cables. Lay power lines separately using ducts. Review the installation environment to reduce noise interference.

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Serial communications mode is set to Host Link.	The RD□/SD□ and COM□ indicators are flashing, and an error response has returned to the host. The RD□/SD□ and COM□ indicators are flashing, but sometimes there is no response returned.	There is no transmission error.	CIO Area words n + 8/ n + 18 (transmission error status) are set to 0000 Hex.	A command was sent from the host with incorrect parameters.	Review the host's settings and program (such as parameter settings) based on the response contents.
		There is a transmission error.	In CIO Area words n + 8/ n + 18, bit 15 (transmission error status) is turned ON, and bit 04 (overrun error), bit 03 (framing error), or bit 02 (parity error) is turned ON.	The communications conditions and baud rate do not match the settings at the host.	Review the System Setup, the host's settings and program (such as commands and frame format) based on the response contents, and the transmission error codes in CIO Area words n + 8/ n + 18.
		There is a transmission error sometimes.	In CIO Area words n + 8/ n + 18, bit 15 (transmission error status) is turned ON, and bit 04 (overrun error), bit 03 (framing error), or bit 02 (parity error) is turned ON.	The baud rate is outside the allowable range, and the stop bits do not match, causing the bits to be out of alignment.	Review the System Setup. Review the host's settings and program (such as baud rate and frame format).
			Terminating resistance switch (TERM ON/OFF) status	Cables are incorrectly connected. The RS-422A/485 port terminating resistance setting is incorrect. Adapters such as the NT-AL001-E are incorrectly wired or the terminating resistance is incorrectly set.	Check the wiring. Turn ON the terminating resistance of the Board and the last node by using the terminating resistance switch. Turn OFF the terminating resistance of other nodes.
			CIO Area words n + 8/ n + 18 (transmission error status) are not set to 0000 Hex.	Transmission errors are occurring that are caused by noise interference.	Use shielded twisted-pair cables. Lay power lines separately using ducts. Review the installation environment to reduce noise interference. Programming retry processing for communications if necessary.

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Host Link (with unsolicited communications)	The SD□/RD□ and COM□ indicators are all flashing.	SEND(090)/ RECV(098)/ CMND(490) instructions have been executed but have not been sent.	The AER Flag (one of the condition flags) is ON.	The contents of the S, C, and D operands for the SEND(090), RECV(098), and CMND(490) instructions is set in a read-protected area.	Check the contents of the S, C, and D operands of the SEND(090), RECV(098), and CMND(490) instructions, and correct if necessary.
			Bit 00 to 07 of word A219 (Communications Port Error Flag) are set to 1 (ON).	The contents of the S, C, and D operands for the SEND(090), RECV(098), and CMND(490) instructions is set incorrectly.	Check the contents of the S, C, and D operands of the SEND(090), RECV(098), and CMND(490) instructions, and correct if necessary.
			The ER Flag (one of the condition flags) is ON.	The communications port number to be used is executing a SEND(090)/ RECV(098)/ CMND(490) instruction or PMCR(260) instruction.	Either use a different communications port number than the one being used to execute the SEND(090)/ RECV(098)/ CMND(490) instruction or PMCR(260) instruction, or wait for the same communications port number to be enabled and execute the instruction.
			The Communications Port Enabled Flag (A20200 to A20207)is OFF (execution disabled)		
			The Communications Port Enabled Flag (A20200 to A20207) is set as an NC the execution condition for SEND(090), RECV(098), and CMND(490) instructions.	Program is incorrect.	Set the Communications Port Enabled Flag as an NC execution condition for SEND(090), RECV(098), and CMND(490) instructions.
			Bit 15 of DM Area words m + 3/m + 13 (CTS control) is turned ON, and bit 04 of CIO Area words n + 7/n + 17 (CTS signal) is turned OFF.	The Board or Unit is set for CTS control, but the RTS signal from the host is not input into the CTS signal of the local Unit.	Perform one of the following error processing methods. Loopback the RTS and CTS signals on the local Unit. Set to no CTS control. Input the RTS signal from the remote Unit into the CTS signal of the local Unit for CTS control.

Serial communications mode	Indicator status	Status information, etc.	CIO Area	Cause	Remedy
Host Link, slave-initiated communications	The SD☐ and COM☐ indicators are flashing, but there is no response from the host.	A transmission error has not been detected at the host.	---	There is a hardware error in the reception circuit.	Conduct a loopback test in serial communications mode to check the transmission lines. If an error occurs during the test, replace the Board or Unit.
			---	Cables are incorrectly wired.	Check the wiring and correct.
			---	There is a hardware error in the reception circuit. Adapters such as the NT-AL001-E are incorrectly wired or set.	Conduct a loopback test in serial communications mode to check the transmission lines. If an error occurs during the test, replace the Board or Unit.
			---	---	Check the program at the host. When unsolicited communications are used with Host Link mode, there must be a response returned from the host for every command sent from the Board or Unit.
			CIO Area words n + 5/n + 15 (port setting status in Setup Area settings) do not correspond with the settings at the host.	The communications conditions and baud rate do not match the settings at the host.	Reset the parameters in the System Setup and at the host correctly.

Note The System Setup cannot be changed unless the power supply is cycled, the Board or Unit is restarted, the port is restarted, or the STUP(237) instruction is executed. Refer to *1-7 Comparison to Previous Products* for details.

8-3-2 1:N NT Link Mode

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is not set to NT Link.	---	---	Bits 12 to 15 of the words allocated in the CIO Area n+5/n+15 are set to a value other than 2 Hex.	Serial communications mode is not set correctly.	Review the Setup Area settings.
Serial communications mode is set to NT Link.	The SD□/RD□ and COM□ indicators do not flash at all. (Communications have not been electrically established.)	---	---	This is a hardware error.	Conduct a loopback test in serial communications mode to check the transmission lines. If an error occurs during the test, replace the Board or Unit.
	The SD□ and COM□ indicators are flashing, but the Unit or Board cannot communicate with the Programmable Terminal (PT).	---	---	The baud rate setting is different to the PT's baud rate setting.	Either change the baud rate setting in the System Setup or change the baud rate setting for the PT.
				There is a setting error for the PT serial port.	Correct the PT serial port settings.
				The I:N NT Link unit number of the PT is incorrect. The same 1:N NT Link unit number has been set for more than one PT	Review the NT Link unit number of the PT.
				The maximum allowable NT Link unit number is incorrectly set for the system.	Review the Setup Area settings.
				Cables are incorrectly connected. The RS-422A/485 port setting (2-wire or 4-wire) is incorrect. Adapters such as the NT-AL001-E are incorrectly wired or set.	Review the wiring or switch settings.
				A communications error frequently occurs due to noise, etc.	Review the wiring and installation environment.
				There is a PT hardware error.	Replace the PT.

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is set to NT Link.	The SD□/RD□ and COM□ indicators are flashing, but a communications error sometimes occurs in the PT.	---	---	Cables are incorrectly connected. The RS-422A/485 port setting (2-wire or 4-wire) is incorrect. Adapters such as the NT-AL001-E are incorrectly wired or set.	Review the wiring or switch settings. Check whether the terminating resistances of the host computer and the last Unit are set to ON, and the terminating resistances of other Units are set to OFF.
				A communications error frequently occurs due to noise, etc.	Review the wiring and installation environment. Increase the number of retries for the PT as required.
				The communications monitoring time for the PT is insufficient.	Increase the communications monitoring time for the PT.
				The load on the PC is too high.	Lighten the load on the PC. Reduce the number of PTs connected to each serial port by using other ports for some of the PTs. Adjust the timeout and retry settings in the PT.

Note

1. The PT serial port must be set for a 1:N NT Link. The PT will not be able to communicate with a Serial Communications Board or Unit if the PT is set for a 1:1 NT Link.
2. The System Setup cannot be changed unless the power supply is cycled, the Board or Unit is restarted, the port is restarted, or the STUP(237) instruction is executed. Refer to *1-7 Comparison to Previous Products* for details.

8-3-3 Protocol Macros

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is not set to protocol macro.	---	---	Bits 12 to 15 of the words allocated in the CIO Area n+5/ n+15 are set to a value other than 6 Hex.	Serial communications mode is not set correctly.	Set bits 11 to 08 (Serial Communications Mode) of the Allocation DM Area m/m+10 to 6 Hex (Protocol Macro).
Serial communications mode is set to protocol macro.	The SD□/ RD□ and COM□ indicators do not flash at all. (Communications has not been electrically established.)	The PMCR(260) instruction is executed, but bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 does not turn ON.	Bits 00 to 07 of the Communications Port Error Flags in A219 are set to 1 (ON).	The PMCR(260) instruction operand settings or execution timing are incorrect.	See note 1.
			As PMCR(260) instruction execution conditions, bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/ n+19 is set as a NO execution condition.	The program is incorrect.	As PMCR(260) instruction execution conditions, set bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 to a NC execution condition.
			The ER Flag (one of Condition Flags) is set to ON.	The problem cause is one of the following: - The data range for the PMCR(260) instruction C1 operand is incorrect. - The number of data words in the S or D operand exceeds 250. - The Communications Port Error Flag is set to OFF.	Check the PMCR(260) instruction C1, C2, C3, S, and D operand settings for errors.
			The AER Flag (one of the Conditions Flags) is ON.	An illegal address is specified for the S or D operands of the PMCR(260) instruction.	Correct any mistakes in the operands of PMCR(260).
			Bits 00 to 03 (Error Code) of the words allocated in the CIO Area n+9/n+19 are set to 2 Hex (Sequence Number Error).	The sequence number specified in the PMCR(260) instruction C2 operand is a value other than 000 Hex to 3E7 Hex (000 to 999 in decimal notation). The specified send/ receive sequence number does not exist in the protocol data.	Set the PMCR(260) instruction C2 operand to a value between 000 Hex and 03E7 Hex (between 000 and 999 in decimal notation). Check whether the send/ receive sequence number is correct.
			Bits 00 to 03 (Error Code) of the words allocated in the CIO Area n+9/n+19 are set to 3 Hex (Data Read/Write Range Error).	The data range of the specified area is exceeded when data is being written to or read from the I/O memory of the CPU Unit.	Specify another area, or reduce the size of the data to be sent or received.

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is set to protocol macro.	The SD□/RD□ and COM□ indicators do not flash at all. (Communications have not been electrically established.)	The PMCR(260) instruction is executed, but bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 does not turn ON.	Bits 00 to 03 (Error Code) of the words allocated in the CIO Area n+9/n+19 are set to 4 Hex (Protocol Data Syntax Error).	The protocol data in the Board or Unit is incorrect.	Use CX-Protocol to correct and transfer the protocol data.
			The Network Communications Instruction Execution Enabled Flag (A20200 to A20207) is set to OFF (Execution Disabled).	The SEND(090), RECV(098), CMND(490), or another PMCR(260) instruction is currently being executed using the same communications port number.	Execute the PMCR(260) instruction using a communications port number (set in bits 12 to 15 of C1) other than that used for the SEND(090), RECV(098), CMND(490), or another PMCR(260) instruction.
			As PMCR(260) instruction execution conditions, the Network Communications Instruction Execution Enabled Flag (A20200 to A20207) is set as a NC execution condition.	The program is incorrect.	As PMCR(260) instruction execution conditions, set the Network Communications Instruction Execution Enabled Flag (A20200 to A20207) to a NO execution condition.
			Bit 00 (Port Active) of the words allocated in the CIO Area n+6/n+16 remains 0 (Port Inactive).	Protocol data is being transferred, or a SUM value error has occurred.	Wait for the transfer of protocol data to finish or use CX-Protocol to transfer the protocol data.
		Bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 is turned ON when the PMCR(260) instruction is executed, but data cannot be sent or received properly.	Send processing is not executed.	The send wait time specified in send/receive sequence step units is too long.	Use CX-Protocol to check whether the send wait time is correctly set.
			Bit 10 (Remote Node Receive Busy) of the words allocated in the CIO Area n+7/n+17 is set to ON (Remote Node Busy).	The CS signal from the remote node cannot turn ON (the remote node remains in busy status) because the transmission control parameter "RS/CS Flow Control" is set to "Yes."	Release the remote node busy status to enable the local node CS signal to turn ON.
			Bit 09 (Sequence Wait) of the words allocated in the CIO Area n+9/n+19 is set to ON (Sequence Wait Status).	The WAIT command cannot be released.	Review the program so that bits 00 and 08 (Wait Release Switch) of word n in the words allocated in the CIO Area can be switched from OFF to ON.

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is set to protocol macro.	The SD☐/RD☐ and COM☐ indicators do not flash at all. (Communications has not been electrically established.)	Bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 momentarily turns ON when the PMCR(260) instruction is executed, but it cannot remain ON.	Bits 03 and 11 (Abort Switch) of the words allocated in the CIO Area n are force-set.	Abort Switch is force-set.	Release the forced or Abort Switch.
		Send data has already been transmitted, but there is no response from the remote node.	---	This is a hardware error.	Set bits 11 to 08 (Serial Communications Mode) of the Allocation DM Area to F Hex (Loopback Test Serial Communications Mode), connect the connector wired for a loopback test, then conduct a loopback test by turning ON bit 14 of word n. The test data is reflected in the Allocation DM Area n+9/n+19. If an error occurs during the test, replace the Board or Unit.
	The SD☐/RD☐ and COM☐ indicators are flashing, but the Unit or Board cannot perform communications.	Bit 10 (Sequence Abort End Flag) of the Protocol words allocated in the CIO Area n+9/n+19 is set to ON.	The sequence is aborted (the step is interrupted).	Protocol macro data is not set correctly. The Setup Area settings such as the baud rate and frame format differ from those of the remote node.	Use CX-Protocol transmission line trace to check whether the protocol data and Setup Area settings are correct.
		Bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 remains ON when the PMCR(260) instruction is executed without setting the monitoring time in sequence units.	The sequence is running and does not end (the words allocated in the CIO Area is in receive status).		

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is set to protocol macro.	The SD□/RD□ and COM□ indicators are flashing, but the Unit or Board cannot perform communications.	Send data has already been transmitted, but there is no response from the remote node.	The contents of the words allocated in the CIO Area n+5/n+15 (System Port Settings) do not match those of the remote node.	The baud rate is outside the allowable range, or there are bit errors due to mismatched stop bits and so on.	Review the Setup Area settings. Review the remote node settings and the program (including the baud rate, frame format, and so on).
			Bit 15 (Transmission Error) of the words allocated in the CIO Area n+8/n+18 is set to ON. There is an error in bits 0 to 14.	The wiring is faulty. The setting of the 2/4-wire switch for the RS-422A/485 port does not match the actual wiring. The wiring of adapters such as the NT-AL001-E is faulty.	Check the wiring. Turn ON the terminating resistances of the Board and the last node. Turn OFF the terminating resistances of other nodes.
	The SD□/RD□ and COM□ indicators are flashing, but the Unit or Board cannot perform communications or a communications error sometimes occurs.	A transmission error occurs.	Bit 15 (Transmission Error) of the words allocated in the CIO Area n+8/n+18 is set to ON. There is an error in bits 0 to 14.	The Setup Area settings such as the baud rate and frame format differ from those of the remote node. The baud rate is outside the allowable range, or there are bit errors due to mismatched stop bits and so on.	Review the Setup Area settings. Review the remote node settings and the program (including the baud rate, frame format, and so on).
			The contents of the words allocated in the CIO Area n+5/n+15 (System Port Settings) do not match those of the remote node.		
		Data is received through CX-Protocol transmission line trace, but the protocol macros behave as if no data is received.	---	Because response from the remote node in half-duplex mode is received too fast, the data received from the time the data send processing was completed until the Send operation was completed is discarded.	Use full-duplex mode.
		The remote node sometimes returns no response to sent data. Response may be received by performing retries.	---	The transmission timing is too fast for the remote node to receive data.	Set or increase the transmission wait time (time to await data transmission) in step units.

Serial communications mode	Indicator display	Status information, etc.	Words allocated in the CIO Area	Cause	Remedy
Serial communications mode is set to protocol macro.	The SD☐/RD☐ and COM☐ indicators are flashing, but the Unit or Board cannot perform communications or a communications error sometimes occurs.	A transmission error sometimes occurs.	Bit 15 (Transmission Error) of the words allocated in the CIO Area n+8/n+18 is set to ON. There is an error in bits 0 to 14.	The wiring is faulty. The RS-422A/485 port terminating resistance setting is incorrect. Adapters such as the NT-AL001-E are incorrectly wired, or the terminating resistance setting is incorrect.	Check the wiring. Turn ON the terminating resistance of the Board and the last node by using the terminating resistance switch. Turn OFF the terminating resistance of other nodes.
				A communications error frequently occurs due to noise and so on.	Use shielded twisted pair cables. House the communications cables in a different duct from those for power lines and so on. Review the operating environment to prevent noise problems. Programming retry processing for communications if necessary.
	The RDY and ERC indicators are flashing (ERR/ALM).	---	Bit 00 (Protocol Data Error) of the words allocated in the CIO Area n+1 is set to ON.	The protocol macro data SUM value is abnormal.	Use CX-Protocol to transfer the correct protocol data.
	The RDY indicator is lit and the ERC indicator is flashing (ERR/ALM).	---	Bits 00 to 03 (Port Status Error Code) of the words allocated in the CIO Area n+9/n+19 are set to a value other than 0 Hex. (An error has occurred.)	An error has been detected in the protocol macros, making the operation impossible.	See page 196.

Note The following table shows the measures to correct the errors indicated by network communications end codes (A203 to A210).

Network communications end code		Error details	Remedy
Bits 08 to 15	Bits 00 to 07		
02 Hex	02 Hex	There is no Board or Unit corresponding to the unit address.	Check whether a different Board/Unit or serial port (physical port) is specified in the PMCR(260) instruction C1 operand (communications port number).
04 Hex	01 Hex	The specified service is not supported.	Check whether a different Board/Unit or serial port (physical port) is specified in the PMCR(260) instruction C1 operand (communications port number). Check whether the serial communications mode of the serial port specified in the C1 operand is protocol macro. If not, set the serial communications mode to protocol macro.
02 Hex	05 Hex	The watchdog timer expires because no response is received from the remote node within the specified time.	Check whether the serial communications mode of the serial port specified in the C1 operand is protocol macro. If not, set the serial communications mode to protocol macro.
11 Hex	06 Hex	The specified send/receive sequence number does not exist.	The send/receive sequence number specified in the PMCR(260) instruction C2 operand is unregistered. Use CX-Protocol to register the send/receive sequence number.
22 Hex	01 Hex	PMCR(260) instruction cannot be executed because protocol macro is currently being executed.	An attempt is made to execute the PMCR(260) instruction while protocol macros are being executed. Modify the ladder program so that bit 15 (Protocol Macro Executing Flag) of the words allocated in the CIO Area n+9/n+19 is set to a NC execution condition for the PMCR(260) instruction.
24 Hex	01 Hex	No registration table exists.	The problem cause is one of the following: • Protocol macro (send/receive sequence) data has not been registered. • Protocol macro (send/receive sequence) data is currently being registered or transferred. • Protocol macro (send/receive sequence) data contains a SUM value error. Use CX-Protocol to transfer the correct protocol macro (send/receive sequence) data.

Note The following table shows the measures to correct the errors indicated in bits 00 to 03 (Error Code) of words allocated in the CIO Area words n+9/n+19.

Error code	Indicator	Error details	Cause	Remedy
0 Hex	No display	Normal	---	---
1 Hex	No display	Reserved	---	---
2 Hex	No display	Sequence number error	The send/receive sequence number specified in the PMCR(260) instruction's C2 operand is not registered.	Correct the send/receive sequence number. Use CX-Protocol to register the specified send/receive sequence number.
3 Hex	ERC: Flashing ERR/ALM: Flashing	Data read/write range error	The data range of the specified area is exceeded when data is being written to or read from the I/O memory of the CPU Unit.	For operand specification: Check the PMCR(260) instruction S and D operand specifications. For direct specification of link words: Use CX-Protocol to check the specified range.
4 Hex	ERC: Flashing ERR/ALM: Flashing	Protocol data syntax error	There is a code that cannot be executed during protocol execution.	Check the following items and correct the problem. • Check whether the total specified number of link words in the area (O1, O2, I1, I2) exceeds 500. • The same area with link word specification is used by both ports 1 and 2. • A write instruction with constant specification is specified. • An EM Area read/write instruction is specified as an interrupt notification (for Boards only). • An interrupt notification is specified at the Unit (for Units only). • There are more than 30 write attributes set for one message. • The length of a send/receive message is set to 0 bytes. • The length of a send/receive message is longer than the maximum send/receive message bytes setting. • No messages are registered for matrix reception. • Both RTS/CTS flow control and Xon/Xoff flow control are set for the same transmission line.

8-4 Error Logs

The error log function records the errors detected in the Serial Communications Board or Serial Communications Unit together with the time that the error occurred.

8-4-1 Error Log Table

RAM Error Log Table

For every error that occurs, one record is logged in the RAM error log table in the Board or Unit for up to 64 errors.

EEPROM Error Log Table

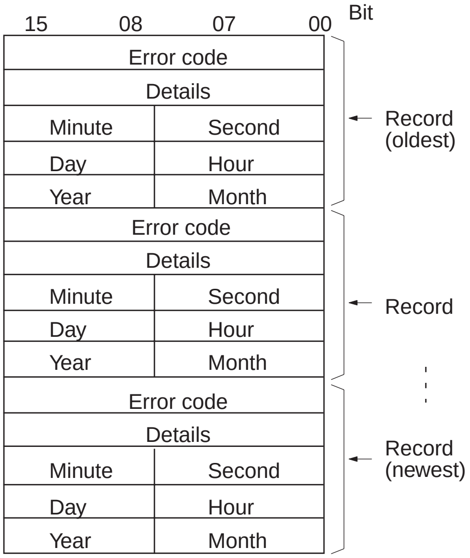
Records of errors that are particularly serious are logged in both the RAM error log table and the EEPROM error log table in the Board or Unit when they occur. The contents of errors logged in the EEPROM error log table remain even if the power to the Board or Unit is turned OFF or the Board or Unit is restarted. The contents of the EEPROM error log table is automatically read to the RAM error log table when the power is turned ON. One record is logged in the EEPROM error log table for each error that occurs for up to 32 errors max.

8-4-2 Error Log Specifications

Item	Specifications
Record length	10 bytes per record
Record configuration	Error code: 2 bytes Details: 2 bytes Time: 6 bytes
Data format	Binary (time information is in BCD)
Number of records	RAM: 64 records max. EEPROM: 32 records max.
Storage order	Records are stored in order from the oldest to the most recent errors.

When the number of errors recorded in the RAM error log table reaches 64 (or 32 records for the EEPROM error log table), the oldest records will be deleted to store the most recent errors.

8-4-3 Error Log Table Configuration



Error Codes and Details Refer to the list of error codes and details on page 198.

Time of Error The time the error occurred is recorded including the year (rightmost two digits), month, day, hour, minute, and second in 1-byte BCD (binary coded decimal).

Reading and Clearing Error Log Tables The error log table can be read or cleared using FINS commands sent to the Serial Communications Board or Serial Communications Unit. Refer to *8-4-6 Reading and Clearing Error Log Tables* for details.

Note The Serial Communications Board and Serial Communications Unit use the time information read from the CPU Unit. If the time cannot be read from the CPU Unit, the time of the error in the error log will be recorded as all zeros.

For all CS/CJ-series PCs, the time of the CPU Unit's built-in clock must be set when the power is turned ON after the battery is mounted. If the built-in clock time is not set, the time recorded in the error log will be incorrect, and when the error log is read, the time will be irregular.

8-4-4 Error Codes and Details

Error code	Error contents	Details		Stored in EEPROM
		First byte	Second byte	
0001 Hex	CPU Unit watchdog timer error	Always 00 Hex	Always 00 Hex	Yes
0002 Hex	CPU Unit service monitoring error	Monitoring time (Unit: 1 ms)		Yes
0006 Hex	Other CPU Unit errors	Bit 11: The unit number is not included in the registered I/O tables. Other bits not used.		Yes
000F Hex	CPU Unit initial processing error	Always 00 Hex	Always 00 Hex	Yes
0011 Hex	CPU Unit initial processing error	Not fixed	Not fixed	Yes
0012 Hex	CPU Unit memory error	01 Hex: Read error 02 Hex: Write error	03 Hex: Routing tables 05 Hex: CPU Bus Unit/ Inner Board DM Area	No

Error code	Error contents	Details		Stored in EEPROM
		First byte	Second byte	
0014 Hex	Inner bus error	Always 00 Hex	Always 00 Hex	Yes
0108 Hex	Send not possible because Unit is not detected	Event Send/Receive Errors Commands: Send source network address < 80 Bit 15: OFF Bits 08 to 14: Send source network address Bits 00 to 07: Send source node address Send source network address ≥ 80 Bit 15: OFF Bits 08 to 14: 00 Bits 00 to 07: Send source network address Responses: Send destination network address < 80 Bit 15: ON Bits 08 to 14: Send destination network address Bits 00 to 07: Send destination node address Send destination network address ≥ 80 Bit 15: ON Bits 08 to 14: 00 Bits 00 to 07: Send destination network address		No
010B Hex	Send not possible due to CPU Unit error			No
010D Hex	Send not possible due to remote address setting error			No
010E Hex	Send not possible because routing tables are not set properly			No
0112 Hex	Send not possible due to header setting error			No
0117 Hex	Internal reception buffer full			No
0118 Hex	Illegal packet discarded			No
011B Hex	Parity error	01 Hex: Port 1 02 Hex: Port 2	Always 00 Hex	No
011C Hex	Framing error			No
011D Hex	Overrun error			No
011E Hex	FCS check error			No
021A Hex	Setting table logic error	Always 00 Hex	03 Hex: Routing tables 05 Hex: CPU Bus Unit/ Inner Board DM Area	No
0300 Hex	Parameter packet discarded	Same contents as event send/receive errors.		No
0301 Hex	Protocol macro operation error	01 Hex: Port 1 02 Hex: Port 2	Protocol macro error code	No
0302 Hex	Illegal protocol packet discarded.	01 Hex: Port 1 02 Hex: Port 2	Always 00 Hex	No
0601 Hex	Board/Unit error	Check the operating environment.		Yes
0602 Hex	CPU Bus Unit/Inner Board memory error	01 Hex: Read error 02 Hex: Write error	06 Hex: Error log 07 Hex: Protocol data	No

8-4-5 Error Codes and Troubleshooting

Error code	Troubleshooting	Serial communications mode			
		Protocol macro	Host Link	1:N NT Link	Loopback test
0001 Hex	Replace the CPU Unit.	Yes	Yes	Yes	Yes
0002 Hex	Check the operating environment.	Yes	Yes	Yes	Yes
0006 Hex	Check the unit number setting. Recreate the I/O tables.	Yes	Yes	Yes	Yes
000F Hex	Check the operating environment.	Yes	Yes	Yes	Yes
0011 Hex	Check the operating environment.	Yes	Yes	Yes	Yes
0012 Hex	Check the relevant data.	Yes	Yes	Yes	Yes
0014 Hex	Check the operating environment.	Yes	Yes	Yes	Yes
0108 Hex	Check the unit number setting.	Yes	Yes	Yes	Yes
010B Hex	Eliminate the cause of the error, referring to the CPU Unit’s operation manual. If the error persists, replace the CPU Unit.	Yes	Yes	Yes	Yes
010D Hex	Set the destination address in the routing tables.	Yes	Yes	Yes	Yes
010E Hex	Set the destination address in the routing tables.	Yes	Yes	Yes	Yes
0112 Hex	Make sure to use the FINS command addresses correctly.	No	Yes	No	No
0117 Hex	Increase the number of retries or correct the system so that communications do not jam.	Yes	Yes	Yes	Yes
0118 Hex	Check whether there is a node sending irregular data.	Yes	Yes	Yes	Yes
011B Hex	Correct the transmission method and baud rate settings. Check for noise interference.	No	Yes	No	No
011C Hex	Correct the transmission method and baud rate settings. Check for noise interference.	No	Yes	No	No
011D Hex	Correct the transmission method and baud rate settings. Check for noise interference.	No	Yes	No	No
011E Hex	Correct the transmission method and baud rate settings. Check for noise interference. Check whether the FCS calculation method is correct.	No	Yes	No	No
021A Hex	Reset the relevant table.	Yes	Yes	Yes	Yes
0300 Hex	Conduct a loopback test, and eliminate the cause of the error.	Yes	Yes	Yes	Yes
0301 Hex	Eliminate the cause of the error, referring to the processing of protocol macro error codes on page 196.	Yes	No	No	No
0302 Hex	A new command is received during command processing. Correct the applications at the host computer.	No	Yes	No	No
0601 Hex	Check the operating environment.	Yes	Yes	Yes	Yes
0602 Hex	Depending on the error details, delete the error log and transfer protocol macro data. If the error persists, replace the Board/Unit.	Yes	Yes	Yes	Yes

8-4-6 Reading and Clearing Error Log Tables

The error log table can be read or cleared by sending FINS commands to the Serial Communications Board or Serial Communications Unit. Refer to the *CS/CJ-series Communications Command Reference Manual (W342)* for details on FINS commands.

Set the send destination unit address for the FINS commands to the unit number of the Serial Communications Board or Serial Communications Unit, as follows:

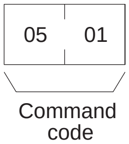
Serial Communications Board:	E1 hexadecimal
Serial Communications Unit:	10 hexadecimal + unit number

8-4-7 CONTROLLER DATA READ: 05 01

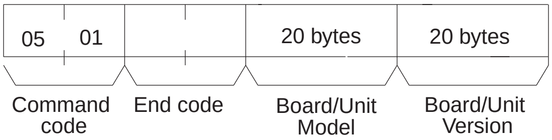
Reads the following data for the Serial Communications Board or Serial Communications Unit.

- Serial Communications Board or Unit Model
- Serial Communications Board or Unit Version

Command Format



Response Format

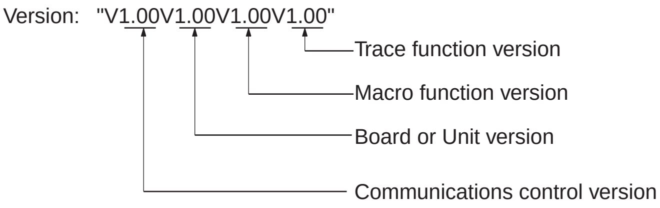


Parameters

Model, Version (Response)

The Serial Communications Board or Serial Communications Unit model and version are specified in the response each as ASCII data up to 20 bytes max. If the data is less than 20 bytes, the remaining bytes will be expressed as 20 hexadecimal (space).

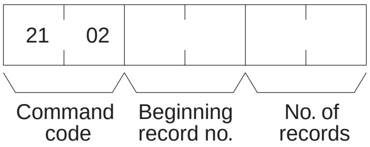
Board or Unit	Model
CS-series Serial Communications Unit (two RS-232C ports)	CS1W-SCU21-V1
CS-series Serial Communications Board (two RS-232C ports)	CS1W-SCB21-V1
CS-series Serial Communications Board (one RS-232C and one RS-422A/485 port)	CS1W-SCB41-V1
CJ-series Serial Communications Unit (one RS-232C and one RS-422A/485 port)	CJ1W-SCU41



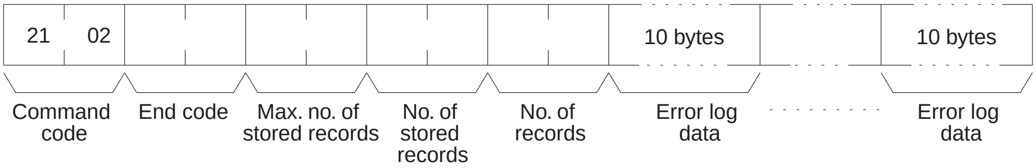
8-4-8 ERROR LOG READ: 21 02

This command reads the Board or Unit's error log.

Command Format



Response Format



Parameters

Beginning record number (command)
Specify the first record to be read as 2-byte (4-digit) hexadecimal. The first record number is 0000 Hex and the setting range is 0000 to 003F Hex (0 to 63 decimal).

Number of records (command, response)
Specify the number of records to read. The setting range is 0001 to 0040 Hex (1 to 64 decimal). The number of read records will be returned with the response. If there is no error log, the response will be 0000.

Maximum number of stored records (response)
Indicates the maximum number of records that can be stored. The number is always 0040 Hex (64 records) for Serial Communications Boards and Units.

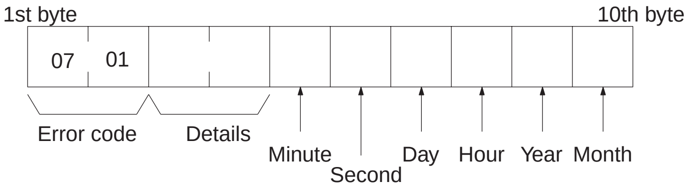
Number of stored records (response)
Indicates the number of records recorded at the time the command is executed. The number of stored records will be returned with the response within the range of 0000 to 0040 Hex (0 to 64 decimal).

When the FA command for Host Link communications is used to read the error log, set the number of stored records to between 0001 and 0035 Hex (1 to 53 decimal). Higher numbers cannot be set because they would cause the response to exceed the maximum Host Link frame length. If a larger number is set and the setting agrees with the actual number of stored records, 110B Hex will be returned as the end code followed by all the records that can be returned without exceeding the maximum frame length.

Error log data (response)
The specified number of error log records will be returned in sequence starting from the beginning record number. The total number of bytes for the error log data required is calculated as follows:

No. of records x 10 bytes

The configuration of each error log record is returned in 10 bytes, as follows:



Error Code and Details

Indicates the error contents of the error recorded. Refer to *8-4-4 Error Codes and Details*.

Minute, Second, Day, Hour, Year, Month

Records the time the error occurred.

Comments

If the error log does not contain the specified number of records, the records up to the last recorded stored at the time the command was executed will be returned, and a normal response will be returned. The number of records actually read will be returned as the number of stored records.

If the beginning record is specified higher than the current number of records in the error log, an end code of 1103 Hex will be returned.

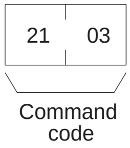
If the beginning record number is specified as 0000, the response will be completed normally, even if no error log is recorded.

If the number of records is set to 0000, the end code will be returned as 110C Hex.

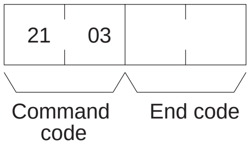
8-4-9 ERROR LOG CLEAR: 21 023

This command clears all stored error log records to 0.

Command Format



Response Format



Comments

The ERROR LOG CLEAR: 21 03 command clears the error log records that are stored in the RAM error log table and the EEPROM error log table.

8-5 Cleaning and Inspection

Use the cleaning and inspection methods described here for daily maintenance of the devices.

8-5-1 Cleaning

To keep the Serial Communications Board in optimum condition, regularly clean the Board or Unit, as follows:

- Wipe the surface of the Board or Unit daily with a soft, dry cloth.

- If any dirt cannot be removed with a dry cloth, moisten the cloth with a mild detergent diluted to 2%, and squeeze out any excess moisture before wiping the Board or Unit.
- Do not adhere materials, such as gum, vinyl, or tape to the Board or Unit for long periods of time. Doing so may cause scratches on the device. Remove any adhered materials when cleaning the Board or Unit.

Note Never use benzene, paint thinner, or other volatile solvents, and do not use chemically treated cloths.

8-5-2 Inspection

To keep the Board or Unit in optimum condition, regular inspections must be performed. Normally, inspect the devices once every six months or every year. Inspect the devices at more regular intervals when they are being used in environments subject to high temperatures, high humidity, or high dust levels.

Materials for Inspection

Prepare the following materials before performing any inspections.

Materials Required Daily
For daily inspection, a Phillips screwdriver, flat-blade screwdriver, tester (or digital voltmeter), industrial strength alcohol, and all-cotton cloth are required.

Materials Required Occasionally
For some inspections, a synchroscope, a pen oscilloscope, a temperature gage, and a hydroscope will be required.

Inspection Items

Inspect the following items to check whether the Board or Unit is operating within the specified criterion. If the Board or Unit is not within the criterion, improve the ambient operating environment and readjust the device.

Item	Details	Criterion	Inspection materials
Operating environment	Check the ambient temperature and the temperature of the control panel.	0 to 55°C	Temperature gage
	Check the ambient humidify and the humidity of the control panel.	10% to 90% RH (no condensation or icing)	Hydroscope
	Check for accumulated dust.	No dust	Visual inspection
Installation	Check that the Board or Unit is mounted securely.	Board or Unit must be mounted securely.	---
	Check for loose screws on the communications cables.	Screws must be securely tightened.	Phillips screwdriver
	Check for damaged communications cables.	Cables should be fully intact.	Visual inspection

8-6 Replacement Precautions

A malfunction of the Serial Communications Board or Serial Communications Unit may affect the operation of remote communications devices, so be sure to perform repairs or replace the faulty Board or Unit promptly. Make sure a spare Serial Communications Board or Unit is available to replace a faulty one, so that functionality can be restored without delay.

8-6-1 Precautions when Replacing Board or Unit

Observe the following precautions when replacing the Serial Communications Board or Serial Communications Unit.

- Always turn OFF the power to the PC before replacing the Board or Unit.
- Be sure to check that the Board or Unit replacing the faulty one is not defective.
- If the defective Board or Unit is to be dispatched to the manufacturer for repair, be sure to include documentation stating the nature of the fault in as much detail as possible, and send to your nearest OMRON branch or sales office, listed at the back of this manual.

If the contacts are defective, clean the contacts with a clean all-cotton cloth moistened with industrial-strength alcohol. Remove any cloth particles before mounting the Board or Unit.

Note Turn OFF the power to all serial external devices when replacing the Board or Unit to prevent malfunctions.

8-6-2 Settings after Replacing Board or Unit

After replacing the Serial Communications Board or Serial Communications Unit, make sure that wiring and settings, such as hardware switch settings, the Unit/Board Setup, and protocol macro data are the same as the Board or Unit that was replaced.

Note

1. If the CPU Unit is to be replaced, transfer to the replacement CPU Unit the contents of the Holding Areas and DM Area required for operating the Unit before starting operation. If the relationship between the DM Area and Holding Area and the program is not maintained, unexpected malfunctions may result.
2. The System Setup of the Serial Communications Board or Unit is saved in the DM Area of the CPU Unit. If the CPU Unit is to be replaced, either transfer the System Setup data to the CX-Programmer before replacing the CPU Unit or reset the System Setup.

8-6-3 Replacing the Board or Unit

Standard System Protocols, Host Link Communications, or 1:N NT Links

1,2,3...

1. Turn OFF the power to the PC to which the Serial Communications Board or Unit to be replaced is mounted, and to all serially connected external devices.
2. Disconnect the communications cables connected to the Serial Communications Board or Unit to be replaced, and also remove the Board or Unit.
3. Set the hardware switches of the replacement Board or Unit to the same settings of the Board or Unit being replaced before mounting, as follows:
    - CS1W-SCB21-V1:No setting switches.
    - CS1W-SCB41-V1:Terminating resistance switch and 2/4-wire switch.
    - CS1W-SCU21-V1:Unit number switch.
    - CJ1W-SCU41:Unit number switch, terminating resistance switch, and 2/4-wire switch.
4. Turn ON the power of the PC to which the replacement Serial Communications Board or Unit is mounted, and to all serially connected external devices, and start operating the system.

5. Check from the indicators and status display that the system is operating normally.

Protocol Macros Designed with CX-Protocol

Using CX-Protocol

1,2,3...

1. Connect Programming Console or CX-Protocol to the PC to which the replacement Serial Communications Board or Unit is mounted, and switch to PROGRAM mode.
2. Save the protocol macro data using the CX-Protocol. Refer to the *CX-Protocol Operation Manual (W344)* for details.
3. Turn OFF the power to the PC to which the Serial Communications Board or Unit to be replaced is mounted, and to all serially connected external devices.
4. Disconnect the communications cables connected to the Serial Communications Board or Unit to be replaced, and also remove the Board or Unit.
5. Set the hardware switches of the replacement Board or Unit to the same settings of the Board or Unit being replaced before mounting, as follows:
    - CS1W-SCB21-V1:No setting switches.
    - CS1W-SCB41-V1:Terminating resistance switch and 2/4-wire switch.
    - CS1W-SCU21-V1:Unit number switch.
    - CJ1W-SCU41:Unit number switch, terminating resistance switch, and 2/4-wire switch.
6. Turn ON the power of the PC to which the replacement Serial Communications Board or Unit is mounted, and to all serially connected external devices, and start operating the system.
7. Switch the CPU Unit to PROGRAM mode, and using the CX-Protocol, transfer the protocol macro data to the Board or Unit. Refer to the *CX-Protocol Operation Manual (W344)* for details.
8. Switch the CPU Unit to MONITOR mode, and start operating the system.
9. Check from the indicators and status display that the system is operating normally.

Using the Simple Backup Function

This function can be used with a CS1-H or CJ1-H CPU Unit only.

1,2,3...

1. Check the settings of pins 7 and 8 on the DIP switch on the front of the CPU Unit. Turn ON pin 7 and turn OFF pin 8 to backup the protocol data from the Serial Communication Board/Unit to the Memory Card.
2. Turn ON the PC's power supply.
3. Insert the Memory Card into the CPU Unit.
4. Press and hold the Memory Card power supply switch for 3 seconds. When the switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being written. The Indicator will go OFF after the data has been written properly.
5. If necessary, compare the data in the Memory Card with the protocol data in the Serial Communication Board/Unit.

    To compare the protocol data, turn OFF pins 7 and 8 on the DIP switch on the front of the CPU Unit and press the Memory Card power supply switch for 3 seconds. When the Memory Card power supply switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being compared. If the data matches, the Indicator will go OFF after the data has been compared.

6. Turn OFF the power to the PC to which the Serial Communications Board or Unit to be replaced is mounted, and to all serially connected external devices.
7. Disconnect the communications cables connected to the Serial Communications Board or Unit to be replaced, and also remove the Board or Unit.
8. Set the hardware switches of the replacement Board or Unit to the same settings of the Board or Unit being replaced before mounting, as follows:
   - CS1W-SCB21-V1: No setting switches.
   - CS1W-SCB41-V1: Terminating resistance switch and 2/4-wire switch.
   - CS1W-SCU21-V1: Unit number switch.
   - CJ1W-SCU41: Unit number switch, terminating resistance switch, and 2/4-wire switch.
9. To restore the protocol data from the Memory Card to the Serial Communications Board or Unit, turn ON pin 7 and turn OFF pin 8 on the DIP switch on the front of the CPU Unit for which the Board or Unit was replaced.
10. Turn ON the PC's power supply. At this point, leave the power supplies OFF to all serially connected external devices.

    When the PC's power is turned ON, the MCPWR Indicator on the front of the CPU Unit will light and flash once. The MCPWR Indicator will remain lit while the data is being read. The Indicator will go OFF after the data has been read properly.

    - Serial Communications Board Operation:
      The Board's RDY Indicator will flash during the restore operation and it will be lit when the restore operation is completed normally.
      If the restore operation fails, the RDY Indicator will continue to flash. The CPU Unit's ERR/ALM Indicator will flash and bit A42409 (the Protocol Data Error Flag) will be turned ON.
    - Serial Communications Unit Operation:
      The Unit's RDY Indicator will flash during the restore operation. Both the RDY Indicator and RUN Indicator will be lit when the restore operation is completed normally.
      If the restore operation fails, the RDY Indicator will continue to flash and the ERC Indicator will be lit.

    If the restore operation fails, return to step 1 and perform the replacement procedure again. If the restore operation fails two times in succession, use CX-Protocol to transfer the protocol data to the Board. Refer to *Using CX-Protocol* on page 206 for details.
11. If necessary, compare the data in the Memory Card with the protocol data in the Serial Communication Board/Unit.

    To compare the protocol data, turn OFF the PC's power supply, turn OFF pins 7 and 8 on the DIP switch on the front of the CPU Unit, turn the PC ON again, and press the Memory Card power supply switch for 3 seconds. When the Memory Card power supply switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being compared. If the data matches, the Indicator will go OFF after the data has been compared.
12. Turn ON the power to all serially connected external devices, switch the CPU Unit to MONITOR mode, and start the system.

13. Check the status of the Serial Communications Board or Unit's indicators and status display and confirm that the system is operating normally.

Note

1. The protocol macro data for the Board or Unit is stored in the flash memory of the Board or Unit.
2. When protocol macro data designed with the CX-Protocol is used, a backup of the protocol macro data created from the CX-Protocol must be transferred to the Board or Unit after replacing.
3. The System Setup of the Serial Communications Board or Unit is allocated to the DM Area saved in the battery backup of the CPU Unit, and if the exclusively designed macro data is not used, the System Setup can be used as before, simply by setting the hardware.

Precautions for Using the Simple Backup Function

When using the Simple Backup Function in CS1H/G-CPU□□H products of Lot No. 011101 or earlier* combined with the Serial Communications Board (CS1W-SCB□□-V1), proper backup will not be possible if the backup file (BACKUPE1.PRM) remains in the Memory Card.

*Reading lot numbers

CS1H/G-CPU□□H Lot No. 01 11 01 ...Produced November 1, 2001
Production day (in this example: 1)
Production month (in this example: 11)
Production year (in this example: 2001)

In order to use the Simple Backup Function in this combination, delete the backup file (BACKUPE1.PRM) inside the Memory Card, then execute the backup.

If backup is executed without deleting this backup file, the RDY LED and the CPU Unit's ERR/ARM LED will both flash, and the Protocol Data Error Flag (bit A42409) will turn ON with the restore operation. The Serial Communications Board will also automatically delete the backup file (BACKUPE1.PRM).

Appendix A

Introduction

Appendices B the N provide information on the standard system protocols provided with the CX-Protocol, the Serial Communications Boards, and the Serial Communications Units. Refer to *5-4 Using Protocol Macros* for details on using PMCR(260).

Using Standard System Protocols

Standard system protocols can be executed merely by specifying the sequences number to be executed in the second operand of PMCR(260) and settings the data described in the appendices in the proper format starting at the word specified with the third operand of PMCR(260). The data received as a response to executing the sequence will be automatically stored starting at the word specified with the fourth operand of PMCR(260).

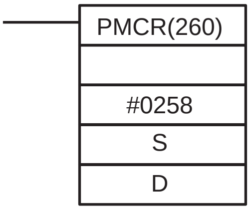
Procedure

1,2,3...

1. Set the sequence number as a hexadecimal value in the second operand of PMCR(260).
2. Specify the address of the first word containing the data required for the sequence as the third operand (S: First word of send data) of PMCR(260).
3. Specify the address of the first word where respond data is to be stored as the fourth operand (D: First receive data storage word) of PMCR(260). Unless there is a reason to specify otherwise, set 0000 Hex in D at the initial value.

Example

The following data would be used to execute sequence number 600 in the CompoWay/F Master Protocol for a transmission with ASCII conversion.



Send/receive sequence number 600 (0258 Hex)

S: Send Data Word Allocation (3rd Operand)

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Node number
	+2	(Undefined)	SRC
	+3	Number of send bytes	
	+4	Send data	

Offset	Contents (data format)		Data
S+0	Number of send data words (4 digits Hex)		0005 to 00FA Hex (5 to 250 decimal)
S+1	(Undefined)	Node No. (2 digits BCD)	00 to 99
S+2	MRC (2 digits Hex)	SRC (2 digits Hex)	Set the command code for the required service
S+3	Number of send bytes (4 digits Hex)		Number of data bytes from the next byte after the command code until the byte just before the ETX. 0000 to 0492
S+4 on	Send data (4-digit Hex)		The data specified in hexadecimal here will be converted to ASCII and the number of bytes specified in S+3 will be sent.

D: Receive Data Word Allocation (4th Operand)

Receive data storage words	+0	Number of receive data words
	+1	Response code
	+2	Receive data

Offset	Contents (data format)	Data
D+0	Number of receive data words (4 digits Hex)	0003 to 00FA Hex (3 to 250 decimal)
D+1	Response code (4 digits Hex)	The response code will be stored in hexadecimal form.
D+2 on	Receive data (4-digit Hex)	The data from just after the response code until just before the ETX will be converted from ASCII to hexadecimal and stored here.

Standard System Protocols

The following 13 standard system protocols are provided with the CX-Protocol, Serial Communications Boards, and Serial Communications Unit.

Protocol name	Function
CompoWay/F Master	Protocol for sending CompoWay/F commands as a Master to OMRON CompoWay/F slave components and receiving responses.
E5□K Digital Controller Read	Protocol for controlling an E5□K Digital Controller via the Communications Board. Procedures for reading the MV the operating parameter settings
E5□K Digital Controller Write	Protocol for controlling an E5□K Digital Controller via the Communications Board. Procedures for writing set points and operating parameters.
E5ZE Temperature Controller Read	Protocol for controlling an E5ZE Temperature Controller via the Communications Board. Procedures for reading measured temperature and operating parameter settings.
E5ZE Temperature Controller Write	Protocol for controlling an E5ZE Temperature Controller via the Communications Board. Procedures for writing control temperatures and operating parameters.
E5□J Temperature Controller	Protocol for controlling a E5□J Temperature Controller via the Communications Board. Procedures for writing set points, reading output amounts, and reading/writing operating parameters.
ES100□ Controller	Protocol for controlling an ES100□ Controller via the Communications Board. Procedures for writing adjustment parameters, reading operation amounts, and writing/reading operating parameters.
Digital Panel Meter	Protocol for controlling a Digital Panel Meter via the Communications Board. Procedures for writing comparison values and reading display values are set.
V500/V520 Bar Code Reader	Protocol for controlling a Bar Code Reader via the Communications Board. Procedures for controlling the Bar Code Reader in remote mode, reading the data that has been read by the Bar Code Reader, and reading/writing operating parameters.
3Z4L Laser Micrometer	Protocol for controlling a Laser Micrometer via the Communications Board. Procedures for controlling the Laser Micrometer in remote mode, reading measured data, and writing/reading operating parameters.
F200/F300/F350 Visual Inspection Systems	Protocol for controlling a Visual Inspection System via the Communications Board. Procedures for controlling the Visual Inspection System in remote mode, reading measured values, and writing/reading operating parameters.
V600/V620 ID Controllers	Protocol for controlling an ID Controller via the Communications Board. Procedures for performing Read/Write operations of the ID Controller and writing/reading operating parameters.
Hayes modem AT commands	Protocol for controlling a Hayes modem (AT commands) via the Communications Board. Procedures for initialization of the modem, dialing, data transmission, switching to escape mode, and disconnecting the line.

Appendix B

CompoWay/F Master Protocol

The CompoWay/F Master Protocol is used to send CompoWay/F commands with the CS/CJ-series PC serving as the host (master).

CompoWay/F

CompoWay/F is a protocol used by many OMRON components for serial communications. A host computer of a PC can function as a host (master) to send CompoWay/F commands (message frames) to OMRON components, which function as slaves. The components will return responses to these commands. Using CompoWay/F commands, the host can read/write data, settings, and operating status to control the operation of the components.

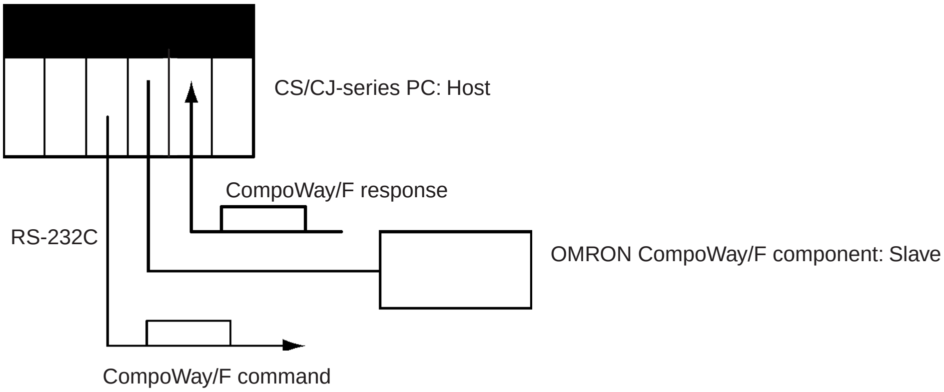
CompoWay/F has the following features.

- The same message frame format is used, eliminating the need for special protocols for each component. The same commands can thus be used for serial communications with all CompoWay/F components.
- The CompoWay/F protocol conforms to OMRON's standard FINS command protocol, providing compatibility with other networks and more flexible expansions in the future.

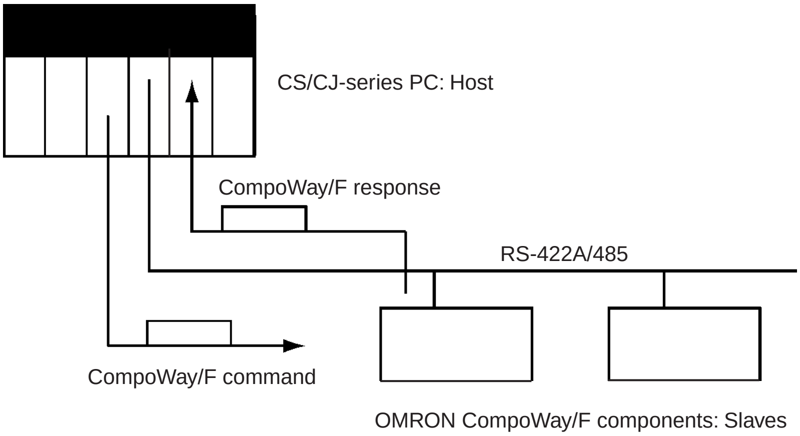
The CompoWay/F Master Protocol is provided as a standard system protocol to enable the CS/CJ-series PC to executed read/write sequences for CompoWay/F commands.

System Configuration for Standard System Protocol

RS-232C Connections



RS-422A/486 Connections

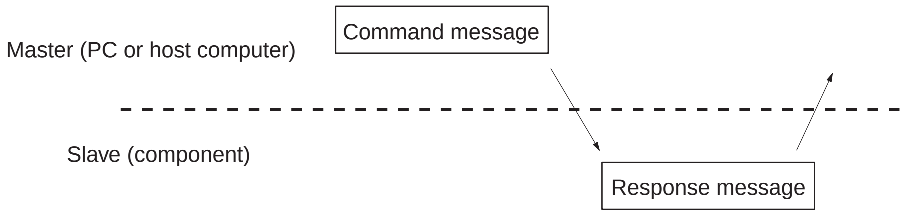


Communications Specifications

Item	Specification
Transmission path connections	Multipoint
Communications	RS-232C, RS-422A/485, 4-wire half-duplex, 2-wire half-duplex
Synchronization	Start-stop
Baud rate	1,200/2,400/4,800/9,600/19,200/38,400 bps Default: 9,600 bps
Transmitted code	ASCII
Data length	7 bits or 8 bits (Default: 7 bits) Note: A 7-bit code is used with 0 added to the beginning.
Stop bits	1 bit or 2 bits (Default: 2 bits)
Error detection	Horizontal parity (none, even, or odd) (Default: Even) BCC (block check character) *1: Start-stop Sync Data Configuration for Protocol Macros LRC, 1 byte, equivalent to binary

Transmission Procedure

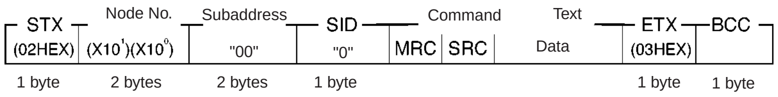
The PC or host computer serving as the master sends a command and the component serving as the slave returns a response for the command message contained in the command. One response message is returned for each command message. The movement of command and response messages is shown below.



Command and Response Formats

Note In the following diagrams “Hex” indicates hexadecimal values. Values in quotation marks, such as “00” indicate ASCII characters.

Command Format



Response Format

Note 1. Data is not saved in the response if there is a command frame error (i.e., if the end code is not 00 or 0F).

2. Other values are possible for the subaddress and SID.

Command Frame Contents

Item	Meaning
STX	A code, 02 Hex, indicating the beginning of a communications frame (text). This code must always be set as the first byte.
Node number	The node number identifies the source of the command frame. Specify “XX” to broadcast a transmission. There will be no response made to a broadcast.
Subaddress	Set “00” for most components. Other values must be set for special components.
SID	Set “0” for most components. Other values must be set for special components.
Command and text	The command and required text are placed here. Refer to the command codes and text for individual sequences.
MRC and SRC	The command code specifies the service being used. Refer to the command codes and text for individual sequences.
ETX	A code, 03 Hex, indicating the end of text.
BCC	The block check character (horizontal parity, 1 byte). The character is an exclusive OR of all data from just after the STX to the ETX.

Response Frame Contents

Item	Meaning
STX	A code, 02 Hex, indicating the beginning of a communications frame (text). This code must always be set as the first byte.
Node number	The node number identifies the source of the command frame. “XX” is specified to broadcast a transmission. There will be no response made to a broadcast.
Subaddress	“00” for most components. Other values must be set for special components.
SID	“0” for most components. Other values must be set for special components.
End code (See note.)	The results of executing the command frame. **Note:** The response code (MRES and SRES) indicates the results for the command code; the end code indicates the results for the command frame. These are not the same.
Response and text	The response and requested text are placed here. Refer to the response and text for individual sequences.
MRES and SRES	The response code specifies the results of processing the service requested by the command code. Refer to the response codes and text for individual sequences.
ETX	A code, 03 Hex, indicating the end of text.
BCC	The block check character (horizontal parity, 1 byte). The character is an exclusive OR of all data from just after the STX to the ETX.

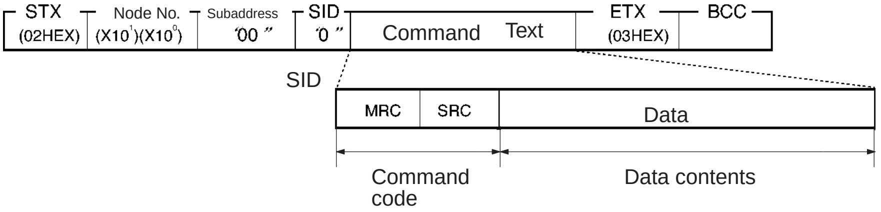
Note The end codes are described in the following table.

End code	Name	Meaning
“00”	Normal end	The command frame was processed normally without any of the following errors.
“0F”	Command error	The specified command could not be executed. Refer to the response code for more information.
“10”	Parity error	A parity error was detected for one of the characters that was received.
“11”	Framing error	A framing error was detected for one of the characters that was received.
“12”	Overrun error	A overrun error was detected for one of the characters that was received.
“13”	BCC error	The BCC for the receive frame was incorrect.
“14”	Format error	An illegal command or illegal character was received in the command and text (characters other than ASCII 0 to 9 or A to F).
“16”	Subaddress error	The receive frame contained an illegal subaddress.
“18”	Frame length error	The receive frame was too long.

Example

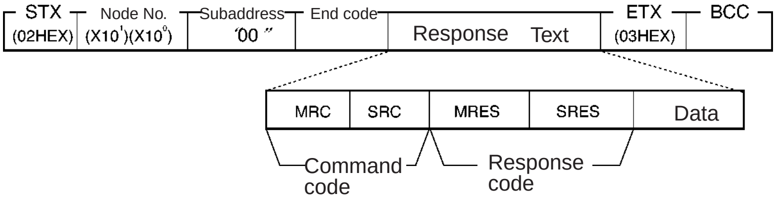
The command and response frames for a K3N☐-series Intelligent Signal Processor are shown below.

Command Frame



Command	Command code		Data contents				
VARIABLE AREA READ	"01"	"01"	Variable type	Address	"00"	No. of elements	
VARIABLE AREA WRITE	"01"	"02"	Variable type	Address	"00"	No. of elements	Write data
PARAMETER AREA READ	"02"	"01"	Parameter type	Address	No. of elements		Write data
PARAMETER AREA WRITE	"02"	"02"	Parameter type	Address	No. of elements		
PROCESSOR STATUS READ	"05"	"03"					
CONTROLLER STATUS READ	"06"	"01"					
ECHOBACK TEST	"08"	"01"	Text data				
OPERATION COMMAND	"30"	"05"	Command code				

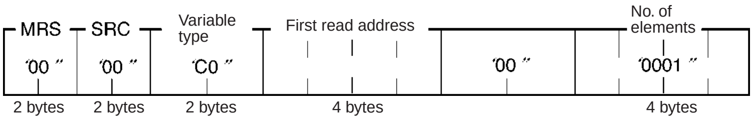
Response Format



Example: VARIABLE AREA READ

The following command and text are used to read the present value, maximum value, minimum value, and status of the Intelligent Signal Processor.

Command and Text



1. Variable Type

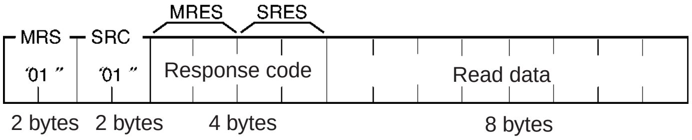
Variable type	Contents
“C0”	Present value, maximum value, minimum value, status, and comparison value

2. First Read Address
   Specify the address of the data to be read in 4 digits Hex.
3. Number of Elements: 4 Digits Hex

Number of elements	Process
“0001”	Read the data and end normally.

Note If “0000” is specified, nothing will be read and a normal end will be returned. A parameter error will occur for any settings other than “0000” and “0001.”

Response Text



1. Response Code: MRES, SRES

Response code	Meaning
“0000”	Normal end
“1001”	Command too long
“1002”	Command too short
“1100”	Parameter error
“1101”	Area type error
“1103”	First address range error
“2203”	Operating error

2. Read Data
   The specified data is returned in 8 digits of hexadecimal data.

CompoWay/F Master Protocol Sequences

The CompoWay/F Master Protocol provides six communications sequences that can be used for the following:

- Converting to ASCII data or not converting to ASCII data
- Sending to a specified Unit or broadcasting
- Specifying from the command code or specifying from the subaddress and SID.

Structure of the Protocol

The following table shows the structure of the CompoWay/F Master Protocol.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
600 (0258)	Send with ASCII conversion, with response	Converts the specified data beginning with the command code to ASCII and sends it to the specified Unit. The response is converted to hexadecimal and stored starting at the specified word.	Yes	Yes
601 (0259)	Broadcast with ASCII conversion, no response	A broadcast version of sequence No. 600. No responses are received.	Yes	No
602 (025A)	Send with no conversion and with response	Sends specified data beginning with the command code to the specified Unit. The response is stored starting at the specified word. This is the same as sequence No. 600 without data conversion and can be used when conversion is not required.	Yes	Yes
603 (025B)	Broadcast with no conversion and no response	A broadcast version of sequence No. 602. No responses are received.	Yes	No
604 (025C)	General-purpose send with no conversion and with response	Sends specified data beginning with the subaddress and SID to the specified Unit. The response is stored starting at the specified word. This sequence can be used whenever it is necessary to specify the subaddress or SID.	Yes	Yes
605 (025D)	General-purpose broadcast with no conversion and no response	A broadcast version of sequence No. 604. No responses are received.	Yes	No

Note The hexadecimal equivalents of sequences numbers are given in parentheses.

Sequence No. 600 can be used for the normal CompoWay/F Master function (ASCII conversion, specification from command code).

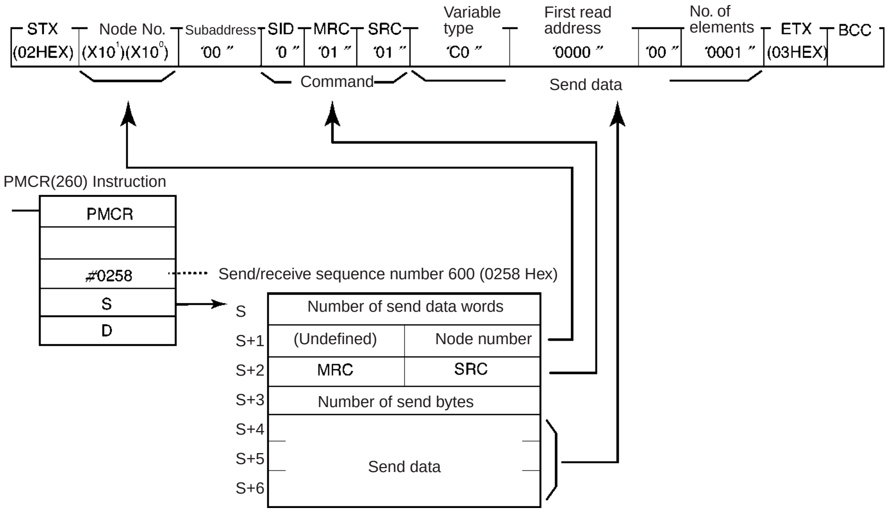
Refer to the communications specifications for the OMRON CompoWay/F component to which the command is being sent and set the command code and required data starting at the words specified for the 3rd operand of PMCR(260).

The relationship between the CompoWay/F command and response frames and the operands of PMCR(260) is described next.

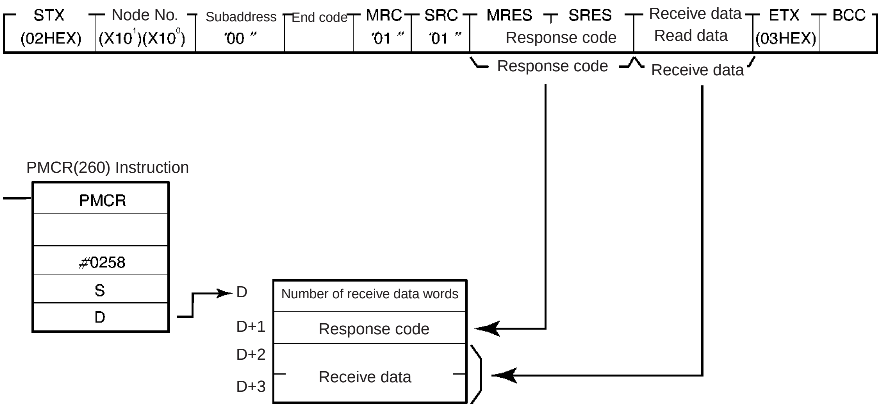
CompoWay/F Message Frames and PMCR(260) Operands

The relationship between the CompoWay/F command and response frames and the operands of PMCR(260) is shown below, using communications sequence No. 600 as an example.

Command Frame



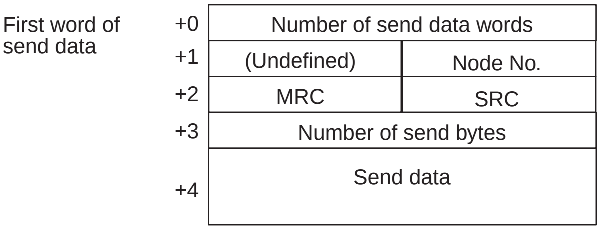
Response Frame



Send with ASCII Conversion, with Response: (Sequence No. 600 (Hex 0258))

This sequence converts the specified data beginning with the command code to ASCII and sends it to the specified Unit. The response is converted to hexadecimal and stored starting at the specified word.

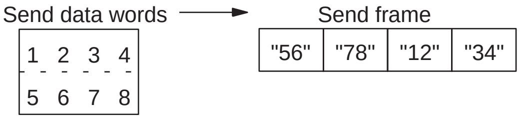
Send Data Word Allocation (3rd Operand of PMCR(260))



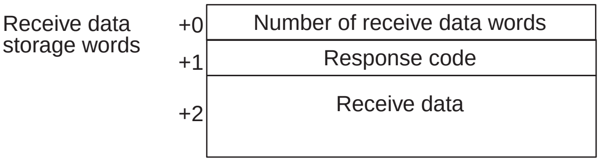
Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0005 to 00FA Hex (5 to 250 decimal)
+1	(Undefined)	Node No. (2 digits BCD)	00 to 99
+2	MRC (2 digits Hex)	SRC (2 digits Hex)	Set the command code for the required service
+3	Number of send bytes (4 digits Hex)		Number of data bytes from the next byte after the command code until the byte just before the ETX. 0000 to 03D8 Hex (0 to 984 decimal)
+4 on	Send data (4-digit Hex)		The data specified in hexadecimal here will be converted to ASCII and the number of bytes specified in S+3 will be sent.

Note 1. Set the number of send bytes to twice the number of bytes in memory. This is necessary because the data is converted to ASCII data before being sent.

2. When hexadecimal data is converted to ASCII data, data is sent starting from the send data word with the largest offset. This is done because ladder programming handles data in 4-byte units.

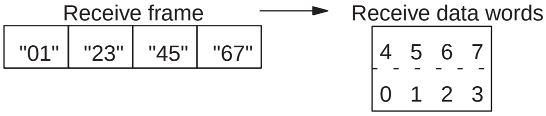


Receive Data Word Allocation (4th Operand of PMCR(260))

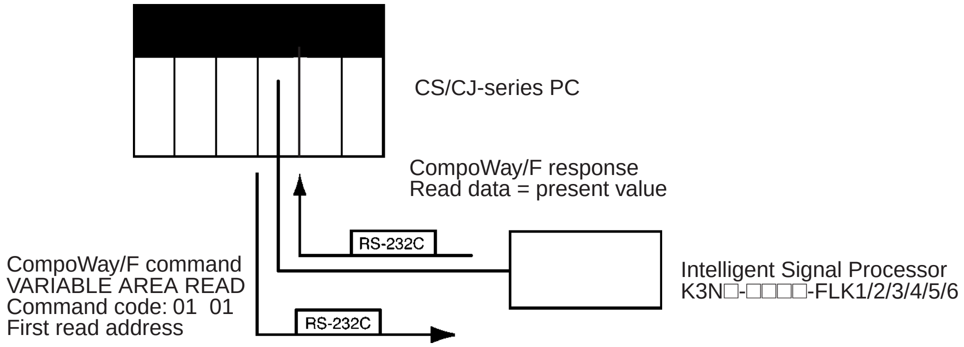


Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003 to 00FA Hex (3 to 250 decimal)
+1	Response code (4 digits Hex)	The response code will be stored in hexadecimal form.
+2 on	Receive data (4-digit Hex)	The data from just after the response code until just before the ETX will be converted from ASCII to hexadecimal and stored here.

Note When ASCII data is converted to hexadecimal data, data is stored starting from the receive data word with the largest offset. This is done because ladder programming handles data in 4-byte units.



Example: The following example illustrates reading the present value from a K3N□-series Intelligent Signal Processor.



Sequence No. 600 (Send with ASCII Conversion, with Response) is used. The specified data beginning with the command code is converted ASCII and sent to the Intelligent Signal Processor with the specified node number. The response is converted to hexadecimal and stored starting at the specified word.

The command frame for reading the present value for a K3N□-□□□□-FLK1/2/3/4/5/6 Intelligent Signal Processor (command code 01 01) is shown below. The following data is specified in the operands for PMCR(260).

- Rightmost byte of S+1: Node number (2 digits BCD)
- S+2: Command code: MRC + SRC = “0101”
- S+4 on: Send data = Variable type + first read address + 00 + number of elements.

STX	Node No.		Subad-dress	SID	Command code		Send data				ETX	BCC
					MRC	SRC	Variable type	First read address (Note)	Always 00	No. of ele-ments		
(02 Hex)	($\times10^1$)	($\times10^1$)	00	0	01	01	C0	0000	00	0001	(03 Hex)	

Data in shaded portions is specified in the PMCR(260) instruction.

Note A first read address of 0000 specifies the present value. An address of 0001 specifies the maximum value; 0002, the minimum value; and 0003, the status.

The response frame is shown below. The response code and receive data are stored according to the operands for PMCR(260) as follows:

- D+1: Response code
- D+2 and on: Receive data

STX	Node No.		Subad-dress	End code	Command code		Response code		Receive data	ETX	BCC
					MRC	SRC	Note 1		Read data (Note 2)		
(02 Hex)	($\times10^1$)	($\times10^1$)			01	01	00	00	0000	(03 Hex)	

Data in shaded portions is stored at the location specified by the operand in the PMCR(260) instruction.

Note 1. Response Codes

Response code	Meaning
“0000”	Normal end
“1001”	Command too long
“1002”	Command too short
“1100”	Parameter error
“1101”	Area type error
“1103”	First address range error
“2203”	Operating error

2. The read data is returned as 4-digit hexadecimal as follows: F0019999 to 00099999 Hex.

The 3rd and 4th operands of the PMCR(260) instruction are specified as follows.

Send Data Word Allocation (3rd Operand of PMCR(260))

Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0007 Hex
+1	(Undefined)	Node No. (2 digits BCD)	0000 Hex
+2	MRC (2 digits Hex)	SRC (2 digits Hex)	0101 Hex
+3	Number of send bytes (4 digits BCD)		000C Hex
+4	Send data (12 digits Hex)		C000 Hex
+5			0000 Hex
+6			0001 Hex

Receive Data Word Allocation (4th Operand of PMCR(260))

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	EX is stored at reception (0004 Hex)
+1	Response code (4 digits Hex)	The response code will be stored in hexadecimal form. The normal end response code is 0000.
+2	Receive data (8 digits Hex)	The 4 bytes of read data.
+3		

Broadcast with ASCII Conversion, No Response (Sequence No. 601 (Hex 0259))

This sequence converts the specified data beginning with the command code to ASCII and broadcasts it. No responses are received.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	
	+2	MRC	SRC
	+3	Number of send bytes	
	+4	Send data	

Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0005 to 00FA Hex (5 to 250 decimal)
+1	(Undefined)		---
+2	MRC (2 digits Hex)	SRC (2 digits Hex)	Set the command code for the required service
+3	Number of send bytes (4 digits Hex)		Number of data bytes from the next byte after the command code until the byte just before the ETX. 0000 to 03D8 Hex (0 to 984 decimal)
+4 on	Send data (4-digit Hex)		The data specified in hexadecimal here will be converted to ASCII and the number of bytes specified in S+3 will be sent.

Note 1. Set the number of send bytes to twice the number of bytes in memory. This is necessary because the data is converted to ASCII data before being sent.

2. When hexadecimal data is converted to ASCII data, data is sent starting from the send data word with the largest offset. This is done because ladder programming handles data in 4-byte units.

Send data words →

1	2	3	4
5	6	7	8

Send frame

"56"	"78"	"12"	"34"

Receive Data Word Allocation (4th Operand of PMCR(260))

None. (Specify a dummy value for the operand, such as #0000.)

Send with No Conversion and with Response (Sequence No. 602 (Hex 025A))

This sequence sends the specified data beginning with the command code to the specified Unit. The response is stored starting at the specified word. No conversions are performed on the send and receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Node No.
+2	MRC	SRC
+3	Number of send bytes	
+4	Send data	

Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0005 to 00FA Hex (5 to 250 decimal)
+1	(Undefined)	Node No. (2 digits BCD)	00 to 99
+2	MRC (2 digits Hex)	SRC (2 digits Hex)	Set the command code for the required service
+3	Number of send bytes (4 digits Hex)		Number of data bytes from the next byte after the command code until the byte just before the ETX. 0000 to 01EC Hex (0 to 492 decimal)
+4 on	Send data		The data specified in hexadecimal here is not converted and the number of bytes specified in S+3 is sent.
	+0	+1	
	+2	+3	
	+4	+5	
	+6 etc.		

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words
+1	Response code
+2	Receive data

Offset	Contents (data format)		Data
+0	Number of receive data words (4 digits Hex)		0003 to 00FA Hex (3 to 250 decimal)
+1	Response code (4 digits Hex)		The response code will be stored in hexadecimal form.
+2 on	Receive data (Hex)		The data from just after the response code until just before the ETX is stored here without conversion.
	+0	+1	
	+2	+3	
	+4	+5	
	+6 etc.		

Broadcast with No Conversion and No Response (Sequence No. 603 (Hex 025B))

This sequence broadcasts the specified data beginning with the command code No responses are received and no conversions are performed on the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

<table>
<tr><td>First word of send data</td><td>+0</td><td colspan="2">Number of send data words</td></tr>
<tr><td></td><td>+1</td><td colspan="2">(Undefined)</td></tr>
<tr><td></td><td>+2</td><td>MRC</td><td>SRC</td></tr>
<tr><td></td><td>+3</td><td colspan="2">Number of send bytes</td></tr>
<tr><td></td><td>+4</td><td colspan="2">Send data</td></tr>
</table>

<table>
<tr><th>Offset</th><th colspan="2">Contents (data format)</th><th>Data</th></tr>
<tr><td>+0</td><td colspan="2">Number of send data words
(4 digits Hex)</td><td>0005 to 00FA Hex (5 to 250 decimal)</td></tr>
<tr><td>+1</td><td colspan="2">(Undefined)</td><td>---</td></tr>
<tr><td>+2</td><td>MRC
(2 digits Hex)</td><td>SRC
(2 digits Hex)</td><td>Set the command code for the required service</td></tr>
<tr><td>+3</td><td colspan="2">Number of send bytes (4 digits Hex)</td><td>Number of data bytes from the next byte after the command code until the byte just before the ETX.
0000 to 01EC Hex (0 to 492 decimal)</td></tr>
<tr><td rowspan="5">+4
on</td><td colspan="2">Send data</td><td rowspan="5">The data specified in hexadecimal here is not converted and the number of bytes specified in S+3 is sent.</td></tr>
<tr><td>+0</td><td>+1</td></tr>
<tr><td>+2</td><td>+3</td></tr>
<tr><td>+4</td><td>+5</td></tr>
<tr><td>+6 etc.</td><td></td></tr>
</table>

Receive Data Word Allocation (4th Operand of PMCR(260))

None. (Specify a dummy value for the operand, such as #0000.)

General-purpose Send with No Conversion and with Response (Sequence No. 604 (Hex 025C))

This sequence sends the specified data beginning with the subaddress and SID to the specified Unit. The response is stored starting at the specified word. No conversions are performed on the send and receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Node No.
	+2	(Undefined)	Subaddress
	+3	(Undefined)	SID
	+4	Number of send bytes	
	+5	Send data	

Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0006 to 00FA Hex (6 to 250 decimal)
+1	Always 00 Hex	Node No. (2 digits BCD)	00 to 99
+2	MRC (2 digits Hex)	Subaddress (2 digits Hex)	Specify the subaddress of the device being communicated with.
+3	Always 00 Hex	SID (1 digit Hex)	Set the service ID of the required service (e.g., retries).
+4	Number of send bytes (4 digits Hex)		Number of data bytes from the MCR until the byte just before the ETX. 0000 to 01EA Hex (0 to 490 decimal)
+5 on	Send data		The data specified in hexadecimal here is not converted and the number of bytes specified in S+4 is sent.
	+0	+1	
	+2	+3	
	+4	+5	
	+6 etc.		

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Response code
	+2	Response data

Offset	Contents (data format)		Data
+0	Number of receive data words (4 digits Hex)		0003 to 00FA Hex (3 to 250 decimal)
+1	Response code (4 digits Hex)		The response code will be stored in hexadecimal form.
+2 on	Receive data		The data from just after the response code until just before the ETX is stored here without conversion.
	+0	+1	
	+2	+3	
	+4	+5	
	+6 etc.		

General-purpose Broadcast with No Conversion and No Response (Sequence No. 605 (Hex 025D))

This sequence broadcasts the specified data beginning with the subaddress and SID. No responses are received and no conversions are performed on the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	
	+2	(Undefined)	Subaddress
	+3	(Undefined)	SID
	+4	Number of send bytes	
	+5	Send data	

Offset	Contents (data format)		Data
+0	Number of send data words (4 digits Hex)		0006 to 00FA Hex (6 to 250 decimal)
+1	Always 0000 Hex		---
+2	MRC (2 digits Hex)	Subaddress (2 digits Hex)	Specify the subaddress of the device being communicated with.
+3	Always 00 Hex	SID (1 digit Hex)	Set the service ID of the required service (e.g., retries).
+4	Number of send bytes (4 digits Hex)		Number of data bytes from the MCR until the byte just before the ETX. 0000 to 01EA Hex (0 to 490 decimal)
+5 on	Send data		The data specified in hexadecimal here is not converted and the number of bytes specified in S+4 is sent.
	+0	+1	
	+2	+3	
	+4	+5	
	+6 etc.		

Receive Data Word Allocation (4th Operand of PMCR(260))

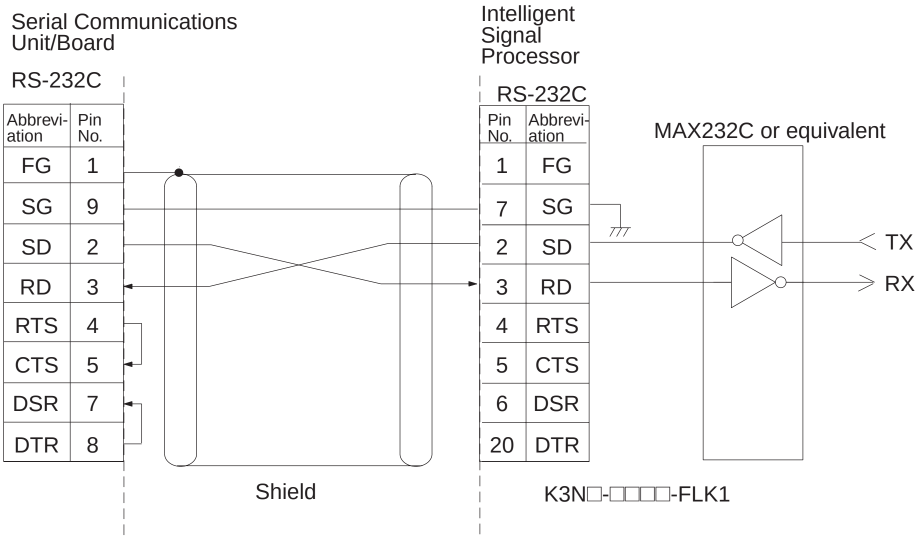
None. (Specify a dummy value for the operand, such as #0000.)

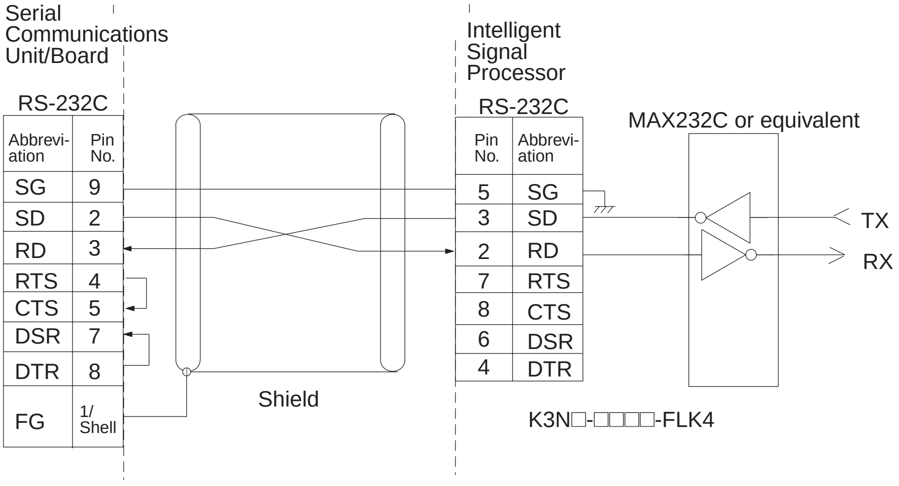
Connections

Connection methods between a Serial Communications Board or Unit and the K3N□-series Intelligent Signal Processor are shown below.

RS-232C

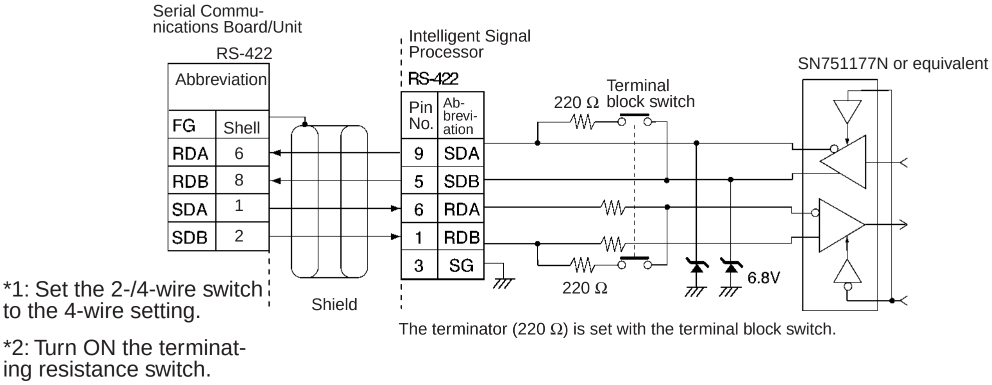
- RS-232C connections are one-to-one.
- The max. cable length is 15 m. Use an RS-232C optical interface (Z3RN) when extending the transmission line beyond 15 m.
- Use shielded, twisted-pair cable.





RS-422 4-wire Connections

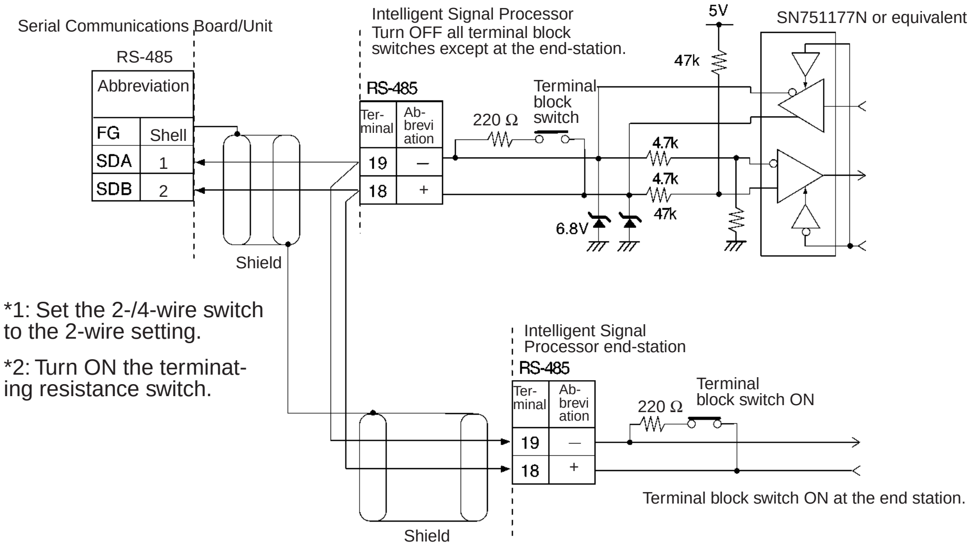
- RS-422 connections can be one-to-one, or one-to-N when a 3G2A9-AL001 Link Adapter is used. A maximum of 32 Serial Communications Boards and Unit can be connected in one-to-N systems.
- The total cable length can be 500 m max.
- Use shielded, twisted-pair cable.
- Be sure to turn ON the terminating resistance switches at the device at each end of the transmission line.



The terminator (220 Ω) is set with the terminal block switch.

RS-485 2-wire Connections

- RS-485 connections can be one-to-one or one-to-N. A maximum of 32 Serial Communications Units/Boards can be connected in one-to-N systems.
- The total cable length can be 500 m max.
- Use shielded, twisted-pair cable.
- Be sure to turn ON the terminator switches only in the devices at each end of the transmission line.



Terminal block switch ON at the end station.

Note SYSMAC BUS Wired Remote I/O devices cannot be connected.

Appendix C

E5☐K Digital Controller Read Protocol

The E5☐K Digital Controller Read Protocol reads and controls various parameters in remote mode for the Controller connected to the Serial Communications Unit/Board via RS-232C or RS-485 cable.

Structure of the Protocol

The following table shows the structure of the E5☐K Digital Controller Read Protocol.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
000 (0000)	Read process value	Reads the process value.	Yes	Yes
001 (0001)	Read set point during SP ramp	Reads the set point during SP ramp.	Yes	Yes
002 (0002)	Read MV	Reads the MV (heating, cooling).	Yes	Yes
003 (0003)	Read set point	Reads the set point.	Yes	Yes
004 (0004)	Read alarm value	Reads alarm value 1, 2.	Yes	Yes
005 (0005)	Read proportional band, integral time, and derivative time	Reads the proportional band, integral (reset) time, and derivative (rate) time	Yes	Yes
006 (0006)	Read cooling coefficient	Reads the cooling coefficient.	Yes	Yes
007 (0007)	Read dead band	Reads the dead band.	Yes	Yes
008 (0008)	Read manual reset value	Reads the manual reset value.	Yes	Yes
009 (0009)	Read hysteresis	Reads the hysteresis (heating, cooling).	Yes	Yes
010 (000A)	Read control period	Reads the control period (heating, cooling).	Yes	Yes
011 (000B)	Read SP ramp time unit and set value	Reads the SP ramp time unit and SP ramp set value.	Yes	Yes
012 (000C)	Read LBA detection time	Reads the LBA detection time.	Yes	Yes
013 (000D)	Read MV at stop and PV error	Reads the MV at stop and the MV at PV error.	Yes	Yes
014 (000E)	Read MV limits	Reads the MV limits.	Yes	Yes
015 (000F)	Read input digital filter	Reads the input digital filter.	Yes	Yes
016 (0010)	Read alarm hysteresis	Reads the alarm 1, 2 hysteresis.	Yes	Yes
017 (0011)	Read input shifts	Reads the input shift limits.	Yes	Yes
018 (0012)	Read level 0 parameters	Reads parameters in level 0.	Yes	Yes
019 (0013)	Read level 1 parameters 1	Reads parameters in level 1.	Yes	Yes
020 (0014)	Read level 1 parameters 2	Reads parameters in level 1.	Yes	Yes
021 (0015)	Read level 2 parameters 1	Reads parameters in level 2.	Yes	Yes
022 (0016)	Read level 2 parameters 2	Reads parameters in level 2.	Yes	Yes
023 (0017)	General-purpose read	Reads the value of the specified parameter.	Yes	Yes

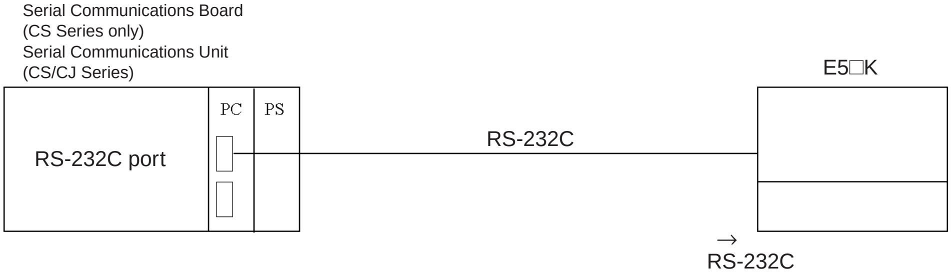
Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

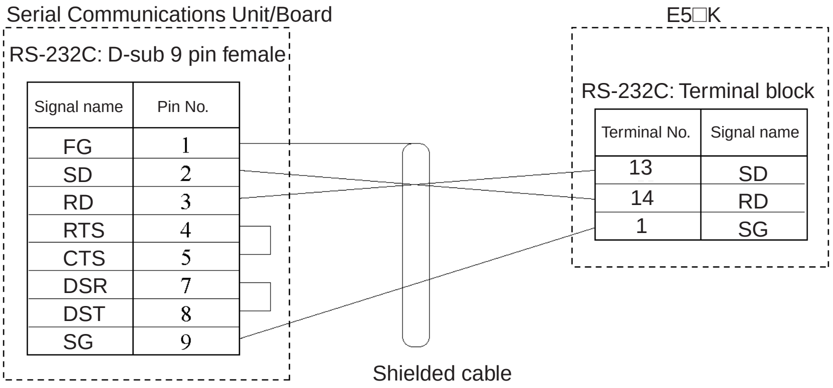
2. **Ladder Interface Settings**
YES: User settings are required for the 3rd or 4th operands of PMCR.
NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
Receive word allocation: Set the constant 0000 for the 4th operand (D).

Connection Configuration

The connection configuration for using the E5□K Digital Controller Read Protocol is shown below.

RS-232C Connection

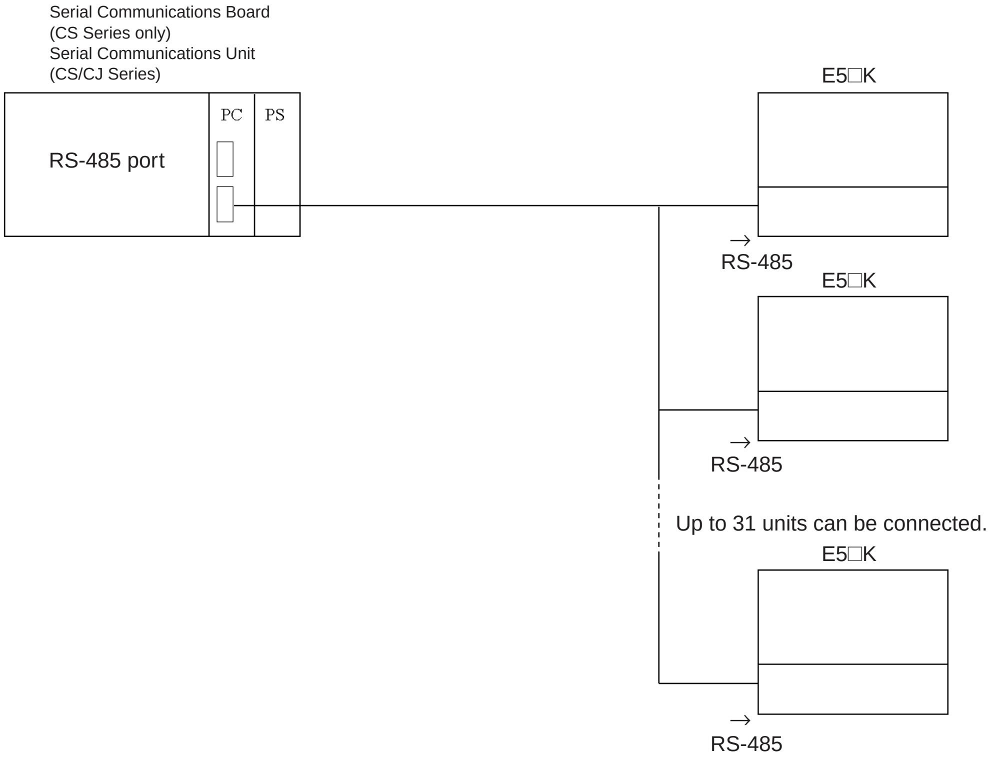




Note 1. The communications configuration is a one-to-one configuration and the maximum cable length is 15 m.

2. Use shielded twisted-pair cable (AWG28i or greater).

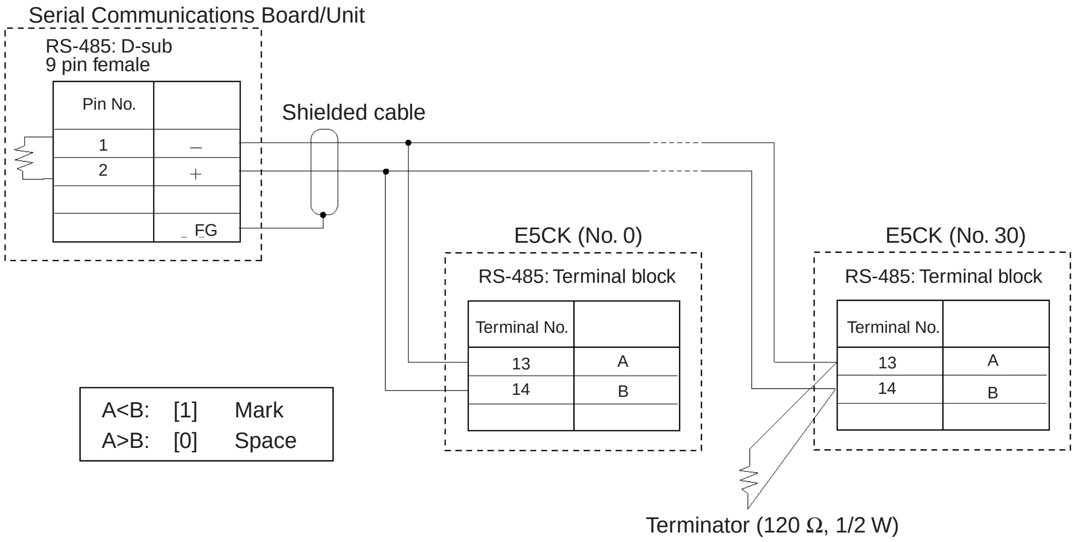
RS-485 Connection



Note 1. The communications configuration is a one-to-one configuration or a one-to-N configuration. In the one-to-N configuration, up to 32 units including the Serial Communications Unit/Board can be connected.

2. The maximum cable length is 500 m. Use a shielded twisted-pair cable for the cable (AWG28i or greater).

3. Connect a terminator only at both ends of the transmission path. For instance, in the example shown below, connect a terminator to the Serial Communications Unit/Board and unit No.30 and do not connect any terminator to units No.0 to No.29. Use a resistance of 120Ω (1/2W) for the terminators (the total resistance of both ends must be 54Ω or more).



Read Process Value (Sequence No. 000 (Hex 0000))

Reads the process value and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Process value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Process value (4 digits BCD)	Scaling lower limit to upper limit

Read Set Point during SP Ramp (Sequence No. 001 (Hex 0001))

Reads the set point during the SP ramp and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Set point during SP ramp

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Set point during SP ramp (4 digits BCD)	Set point lower limit to upper limit

Read MV (Sequence No. 002 (Hex 0002))

Reads the MV (manipulated variable) for heating and cooling and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	MV (heating)
	+2	MV (cooling)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	MV (heating) (4 digits BCD)	F050 to 1050, 0000 to 1050 for heating/cooling control F indicates a negative value.
+2	MV (cooling) (4 digits BCD)	F050 to 1050 F indicates a negative value.

Read Set Point (Sequence No. 003 (Hex 0003))

Reads the set point and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Set point

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Set point (4 digits BCD)	Set point lower limit to upper limit

Read Alarm Value (Sequence No. 004 (Hex 0004))

Reads alarm value 1 and alarm value 2 and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Alarm value 1
	+2	Alarm value 2

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Alarm value 1 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+2	Alarm value 2 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.

Read Proportional Band, Integral Time, and Derivative Time (Sequence No. 005 (Hex 0005))

Reads the proportional band, integral time, and derivative time and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Proportional band
	+2	Integral time
	+3	Derivative time

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004
+1	Proportional band (4 digits BCD)	0000 to 9999
+2	Integral time (4 digits BCD)	0000 to 3999
+3	Derivative time (4 digits BCD)	0000 to 3999

Read Cooling Coefficient (Sequence No. 006 (Hex 0006))

Reads the cooling coefficient and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Cooling coefficient

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Cooling coefficient (4 digits BCD)	0001 to 9999

Read Dead Band (Sequence No. 007 (Hex 0007))

Reads the dead band and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Dead band

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Dead band (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.

Read Manual Reset Value (Sequence No. 008 (Hex 0008))

Reads the manual reset value and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Manual reset value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Manual reset value (4 digits BCD)	0000 to 1000

Read Hysteresis (Sequence No. 009 (Hex 0009))

Reads the hysteresis for heating and for cooling and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Hysteresis (heating)
	+2	Hysteresis (cooling)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Hysteresis (heating) (4 digits BCD)	0001 to 9999
+2	Hysteresis (cooling) (4 digits BCD)	0001 to 9999

Read Control Period (Sequence No. 010 (Hex 000A))

Reads the control period for heating and for cooling and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Control period (heating)
	+2	Control period (cooling)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Control period (heating) (4 digits BCD)	0001 to 0099
+2	Control period (cooling) (4 digits BCD)	0001 to 0099

Read SP Ramp Time Unit and Set Value (Sequence No. 011 (Hex 000B))

Reads the SP ramp time unit and SP ramp set value and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	SP ramp time unit
	+2	SP ramp set value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	SP ramp time unit (4 digits BCD)	0000: s, 0001: hr
+2	SP ramp set value (4 digits BCD)	0000 to 9999

Read LBA Detection Time (Sequence No. 012 (Hex 000C))

Reads the LBA (loop break alarm) detection time and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	LBA detection time

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	LBA detection time (4 digits BCD)	0000 to 9999

Read MV at Stop Time and at PV Error (Sequence No.013 (Hex 000D))

Reads the MV at stop time and at PV error and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	MV at stop time
	+2	MV at PV error

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	MV at stop time (4 digits BCD)	F050 to 1050 F indicates a negative value. A050 to 1050 for heating/cooling control A indicates a negative value.
+2	MV at PV error (4 digits BCD)	F050 to 1050 F indicates a negative value.

Read MV Limits (Sequence No. 014 (Hex 000E))

Reads the MV upper limit, MV lower limit, and MV change rate limit and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	MV upper limit
	+2	MV lower limit
	+3	MV change rate limit

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004
+1	MV upper limit (4 digits BCD)	MV lower limit + 1 to 1050 0000 to 1050 for heating/cooling control

Offset	Contents (data format)	Data
+2	MV lower limit (4 digits BCD)	F050 to MV upper limit –1 F indicates a negative value values. A050 to 1050 for heating/cooling control A indicates a negative value.
+3	MV change rate limit (4 digits BCD)	0000 to 1000

Read Input Digital Filter (Sequence No. 015 (Hex 000F))

Reads the input digital filter and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Input digital filter

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Input digital filter (4 digits BCD)	0000 to 9999

Read Alarm Hysteresis (Sequence No. 016 (Hex 0010))

Reads the alarm 1 hysteresis and alarm 2 hysteresis and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Alarm 1 hysteresis
	+2	Alarm 2 hysteresis

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Alarm 1 hysteresis (4 digits BCD)	0001 to 9999
+2	Alarm 2 hysteresis (4 digits BCD)	0001 to 9999

Read Input Shift Limits (Sequence No. 017 (Hex 0011))

Reads the input shift upper limit and input shift lower limit and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Input shift upper limit
	+2	Input shift lower limit

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Input shift upper limit (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+2	Input shift lower limit (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.

Read Level 0 Parameters (Sequence No. 018 (Hex 0012))

Reads parameters in level 0 (process value, set point during SP ramp, MV (heating), MV (cooling), and set point) from multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~			
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Process value	1st unit
	+2	Set point during SP ramp	
	+3	MV (heating)	
	+4	MV (cooling)	
	+5	Set point	
		⋮	
	+36	Process value	8th unit (max.)
	+37	Set point during SP ramp	
	+38	MV (heating)	
	+39	MV (cooling)	
	+40	Set point	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 5 + 1
+1	1st unit Process value (4 digits BCD)	Scaling lower limit to upper limit
+2	1st unit Set point during SP ramp (4 digits BCD)	Set point lower limit to upper limit
+3	1st unit MV (heating) (4 digits BCD)	F050 to 1050 F indicates a negative value. 0000 to 1050 for heating/cooling control
+4	1st unit MV (cooling) (4 digits BCD)	0000 to 1050
+5	1st unit Set point (4 digits BCD)	Set point lower limit to upper limit
	⋮	
+40 (max.)	8th unit Set point (4 digits BCD)	Set point lower limit to upper limit

Read Level 1 Parameters 1 (Sequence No. 019 (Hex 0013))

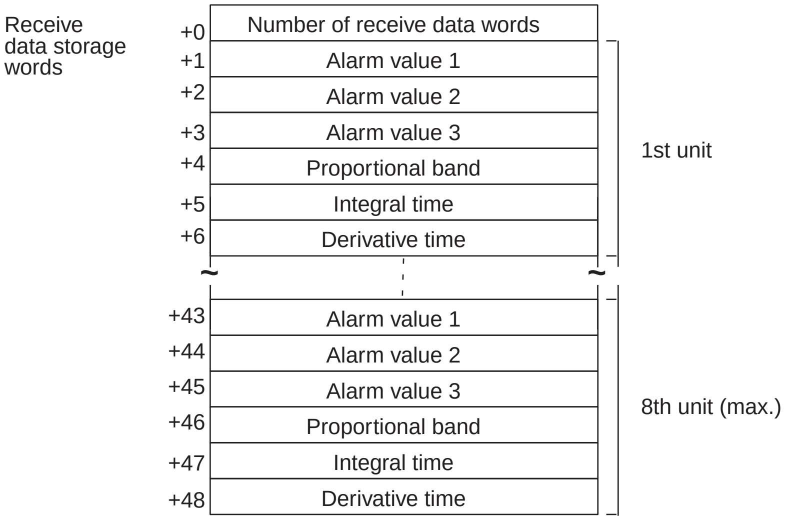
Reads parameters in level 1 (alarm value 1, alarm value 2, alarm value 3, proportional band, integral time, and derivative time) from multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of units	
	+2	(Undefined)	Unit No.
	+3	(Undefined)	Unit No.
		⋮	
	+9	(Undefined)	Unit No. (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 6 + 1
+1	1st unit Alarm value 1 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+2	1st unit Alarm value 2 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+3	1st unit Alarm value 3 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+4	1st unit Proportional band (4 digits BCD)	0001 to 9999
+5	1st unit Integral time (4 digits BCD)	0000 to 3999
+6	1st unit Derivative time (4 digits BCD)	0000 to 3999
	• • •	
+48 (max.)	8th unit Derivative time (4 digits BCD)	0000 to 3999

Read Level 1 Parameters 2 (Sequence No. 020 (Hex 0014))

Reads parameters in level 1 (cooling coefficient, dead band, manual reset value, hysteresis (heating), hysteresis (cooling), control period (heating), and control period (cooling)) from multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	Number of units	
+2	(Undefined)	Unit No.
+3	(Undefined)	Unit No.
~		
+9	(Undefined)	Unit No. (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Cooling coefficient	1st unit
+2	Dead band	
+3	Manual reset value	
+4	Hysteresis (heating)	
+5	Hysteresis (cooling)	
+6	Control period (heating)	
+7	Control period (cooling)	
~		
+50	Cooling coefficient	8th unit (max.)
+51	Dead band	
+52	Manual reset value	
+53	Hysteresis (heating)	
+54	Hysteresis (cooling)	
+55	Control period (heating)	
+56	Control period (cooling)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 7 + 1
+1	1st unit Cooling coefficient (4 digits BCD)	0001 to 9999
+2	1st unit Dead band (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+3	1st unit Manual reset value (4 digits BCD)	0000 to 1000
+4	1st unit Hysteresis (heating) (4 digits BCD)	0001 to 9999
+5	1st unit Hysteresis (cooling) (4 digits BCD)	0001 to 9999
+6	1st unit Control period (heating) (4 digits BCD)	0001 to 0099
+7	1st unit Control period (cooling) (4 digits BCD)	0001 to 0099

Offset	Contents (data format)	Data
	• • •	
+56 (max.)	8th unit Control period (cooling) (4 digits BCD)	0001 to 0099

Read Level 2 Parameters 1 (Sequence No. 021 (Hex 0015))

Reads parameters in level 2 (SP ramp time unit, SP ramp set value, LBA detection time, MV at stop, MV at PV Error, MV upper limit, MV lower limit, and MV change rate limit) from multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~		~	
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	SP ramp time unit	1st unit
	+2	SP ramp set value	
	+3	LBA detection time	
	+4	MV at stop	
	+5	MV at PV error	
	+6	MV upper limit	
	+7	MV lower limit	
	+8	MV change rate limit	
	~		~
	+57	SP ramp time unit	8th unit (max.)
	+58	SP ramp set value	
	+59	LBA detection time	
	+60	MV at stop	
	+61	MV at PV error	
	+62	MV upper limit	
	+63	MV lower limit	
	+64	MV change rate limit	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 8 + 1
+1	1st unit SP ramp time unit (4 digits BCD)	0000: s, 0001: hr
+2	1st unit SP ramp set value (4 digits BCD)	0000 to 9999
+3	1st unit LBA detection time (4 digits BCD)	0000 to 9999
+4	1st unit MV at stop (4 digits BCD)	F050 to 1050 F indicates a negative value. A050 to 1050 for heating/cooling control A indicates a negative value.
+5	1st unit MV at PV error (4 digits BCD)	F050 to 1050 F indicates a negative value. A050 to 1050 for heating/cooling control A indicates a negative value.
+6	1st unit MV upper limit (4 digits BCD)	MV lower limit + 1 to 1050 0000 to 1050 for heating/cooling control
+7	1st unit MV lower limit (4 digits BCD)	F050 to MV upper limit –1 F indicates a negative value. A050 to 1050 for heating/cooling control A indicates a negative value.
+8	1st unit MV change rate limit (4 digits BCD)	0000 to 1000
	• • •	
+64 (max.)	8th unit MV change rate limit (4 digits BCD)	0000 to 1000

Read Level 2 Parameters 2 (Sequence No. 022 (Hex 0016))

Reads parameters in level 2 (input digital filter, alarm 1 hysteresis, alarm 2 hysteresis, alarm 3 hysteresis, input shift upper limit, and input shift lower limit) from multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~		~	
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Input digital filter	1st unit
+2	Alarm 1 hysteresis	
+3	Alarm 2 hysteresis	
+4	Alarm 3 hysteresis	
+5	Input shift upper limit	
+6	Input shift lower limit	
	⋮	
+43	Input digital filter	8th unit (max.)
+44	Alarm 1 hysteresis	
+45	Alarm 2 hysteresis	
+46	Alarm 3 hysteresis	
+47	Input shift upper limit	
+48	Input shift lower limit	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 6 + 1
+1	1st unit Input digital filter (4 digits BCD)	0000 to 9999
+2	1st unit Alarm 1 hysteresis (4 digits BCD)	0001 to 9999
+3	1st unit Alarm 2 hysteresis (4 digits BCD)	0001 to 9999
+4	1st unit Alarm 3 hysteresis (4 digits BCD)	0001 to 9999
+5	1st unit Input shift upper limit (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+6	1st unit Input shift lower limit (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
	• • •	
+48 (max.)	8th unit Input shift lower limit (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.

General-purpose Read (Sequence No. 023 (Hex 0017))

Reads the specified parameter and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Undefined)	Parameter No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Parameter No. (2 digits BCD)	Refer to the manual for the E5□K.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Read data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Read data (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.

Note To read parameters in the setup mode or extended mode, execute Switch to Level 1 (Sequence No. 075) in advance.

Appendix D

E5☐K Digital Controller Write Protocol

The E5☐K Digital Controller Write Protocol writes and controls various settings in remote mode for the Controller connected to the Serial Communications Unit/Board via RS-232C or RS-485 cable.

Note Negative values cannot be written. All values must be set as unsigned BCD.

Structure of the Protocol

The following table shows the structure of the E5☐K Digital Controller Write Protocol.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
050 (0032)	Write set point	Writes the set point.	Yes	No
051 (0033)	Write alarm value	Writes alarm value 1, 2.	Yes	No
052 (0034)	Write proportional band, integral time, and derivative time	Writes the proportional band, integral time, and derivative time.	Yes	No
053 (0035)	Write cooling coefficient	Writes the cooling coefficient.	Yes	No
054 (0036)	Write dead band	Writes the dead band.	Yes	No
055 (0037)	Write manual reset value	Writes the manual reset value.	Yes	No
056 (0038)	Write hysteresis	Writes the hysteresis (heating, cooling)	Yes	No
057 (0039)	Write control period	Writes the control period (heating, cooling)	Yes	No
058 (003A)	Write SP ramp time units and set value	Writes the SP ramp time unit and SP ramp set value.	Yes	No
059 (003B)	Write LBA detection time	Writes the LBA detection time.	Yes	No
060 (003C)	Write MV at stop time and PV error	Writes the MV at stop and the MV at PC error.	Yes	No
061 (003D)	Write MV limits	Writes the MV limits.	Yes	No
062 (003E)	Write input digital filter	Writes the input digital filter.	Yes	No
063 (003F)	Write alarm hysteresis	Writes alarm 1, 2 hysteresis.	Yes	No
064 (0040)	Write input shift values	Writes the input shift values.	Yes	No
065 (0041)	Write level 0 parameters	Writes parameters in level 0.	Yes	No
066 (0042)	Write level 1 parameters 1	Writes parameters in level 1.	Yes	No
067 (0043)	Write level 1 parameters 2	Writes parameters in level 1.	Yes	No
068 (0044)	Write level 2 parameters 1	Writes parameters in level 2.	Yes	No
069 (0045)	Write level 2 parameters 2	Writes parameters in level 2.	Yes	No
070 (0046)	General-purpose write	Writes the value of the specified parameter.	Yes	No
071 (0047)	Switch to level 0 (software reset)	Switches the setting level to level 0.	Yes	No
072 (0048)	Run/stop	Initiates Run or Stop.	Yes	No
073 (0049)	Remote/local	Switches the mode to remote or local.	Yes	No
074 (004A)	Execute/cancel AT	Executes or cancels AT.	Yes	No
075 (004B)	Switch to level 1	Switches the setting level to level 1.	Yes	No
076 (004C)	Software reset	Resets the E5☐K.	Yes	No

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

2. **Ladder Interface Settings**
YES: User settings are required for the 3rd or 4th operands of PMCR.

NO:	Send word allocation:	Set the constant 0000 for the 3rd operand (S).
	Receive word allocation:	Set the constant 0000 for the 4th operand (D).

Connections

The connections are the same as that for the E5□K Digital Controller Read Protocol.

Write Set Point (Sequence No. 050 (Hex 0032))

Writes the set point.

Send Data Word Allocation (3rd Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Read data

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Set point (4 digits BCD)	Set point lower limit to upper limit

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Alarm Value (Sequence No. 051 (Hex 0033))

Writes alarm value 1 and alarm value 2.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Alarm value 1	
	+3	Alarm value 2	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Alarm value 1 (4 digits BCD)	0000 to 999
+3	Alarm value 2 (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (3rd Operand of PMCR(260))

None.

Write Proportional Band, Integral Time, and Derivative Time (Sequence No. 052 (Hex 0034))

Writes the proportional band, integral time, and derivative time.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Proportional band	
	+3	Integral time	
	+4	Derivative time	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Proportional band (4 digits BCD)	0001 to 9999
+3	Integral time (4 digits BCD)	0000 to 3999
+4	Derivative time (4 digits BCD)	0000 to 3999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Cooling Coefficient (Sequence No. 053 (Hex 0035))

Writes the cooling coefficient.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Cooling coefficient	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Cooling coefficient (4 digits BCD)	0001 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Dead Band (Sequence No. 054 (Hex 0036))

Writes the dead band.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Dead band	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Dead band (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Manual Reset Value (Sequence No. 055 (Hex 0037))

Writes the manual reset value.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Manual reset value	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Manual reset value (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Hysteresis (Sequence No. 056 (Hex 0038))

Writes the hysteresis for heating and for cooling.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Hysteresis (heating)	
	+3	Hysteresis (cooling)	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Hysteresis (heating) (4 digits BCD)	0001 to 9999
+3	Hysteresis (cooling) (4 digits BCD)	0001 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Control Period (Sequence No. 057 (Hex 0039))

Writes the control period for heating and for cooling.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Control period (heating)	
	+3	Control period (cooling)	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Offset	Contents (data format)	Data
+2	Control period (heating) (4 digits BCD)	0001 to 0099
+3	Control period (cooling) (4 digits BCD)	0001 to 0099

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write SP Ramp Time Unit and Set Value (Sequence No. 058 (Hex 003A))

Writes the SP ramp time unit and SP ramp set value.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	SP ramp time unit	
	+3	SP ramp set value	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	SP ramp time unit (4 digits BCD)	0000: Minutes 0001: Hours
+3	SP ramp set value (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write LBA Detection Time (Sequence No. 059 (Hex 003B))

Writes the LBA detection time.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	LBA detection time	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	LBA detection time (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write MV at Stop Time and at PV Error (Sequence No. 060 (Hex 003C))

Writes the MV at stop time and the MV at PV error.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	MV at stop time	
	+3	MV at PV error	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	MV at stop time (4 digits BCD)	0000 to 1050
+3	MV at PV error (4 digits BCD)	0000 to 1050

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write MV Limits (Sequence No. 061 (Hex 003D))

Writes the MV upper limit, MV lower limit, and MV change rate limit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	MV upper limit	
	+3	MV lower limit	
	+4	MV change rate limit	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	MV upper limit (4 digits BCD)	MV lower limit + 1 to 1050 Heating/cooling control time: 0000 to 1050
+3	MV lower limit (4 digits BCD)	0000 to MV upper limit – 1
+4	MV change rate limit (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Input Digital Filter (Sequence No. 062 (Hex 003E))

Writes the input digital filter.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Input digital filter	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Input digital filter (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Alarm Hysteresis (Sequence No. 063 (Hex 003F))

Writes the alarm 1 hysteresis and alarm 2 hysteresis.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Alarm 1 hysteresis	
	+3	Alarm 2 hysteresis	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Alarm 1 hysteresis (4 digits BCD)	0001 to 9999
+3	Alarm 2 hysteresis (4 digits BCD)	0001 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Input Shift Value (Sequence No. 064 (Hex 0040))

Writes the input shift upper limit and input shift lower limit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Input shift upper limit	
	+3	Input shift lower limit	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Input shift upper limit (4 digits BCD)	0000 to 9999
+3	Input shift lower limit (4 digits BCD)	0000 to 9999

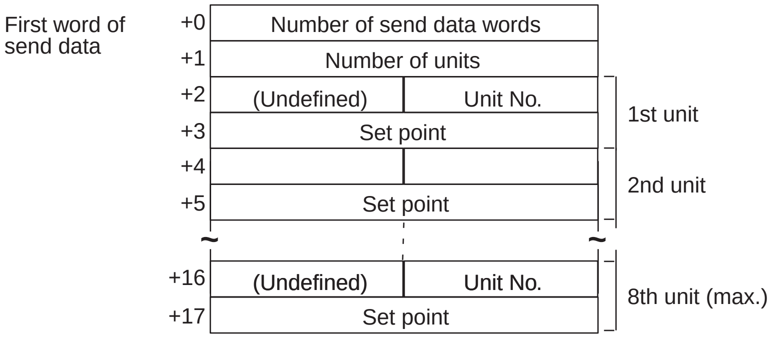
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Level 0 Parameters (Sequence No. 065 (Hex 0041))

Writes parameters (set points) in level 0 to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Set point (4 digits BCD)	Set point lower limit to upper limit
	• • •	
+17 (max.)	8th unit Set point (4 digits BCD)	Set point lower limit to upper limit

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Level 1 Parameters 1 (Sequence No. 066 (Hex 0042))

Writes parameters in level 1 (alarm value 1, alarm value 2, alarm value 3, proportional band, integral time, and derivative time) to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Alarm value 1		
	+4	Alarm value 2		
	+5	Alarm value 3		
	+6	Proportional band		
	+7	Integral time		
	+8	Derivative time		
	~	⋮		
	+51	(Undefined)	Unit No.	8th unit (max.)
	+52	Alarm value 1		
	+53	Alarm value 2		
	+54	Alarm value 3		
	+55	Proportional band		
	+56	Integral time		
	+57	Derivative time		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 7 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Alarm value 1 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+4	1st unit Alarm value 2 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+5	1st unit Alarm value 3 (4 digits BCD)	A999 to 9999 F indicates a negative value and A indicates –1.
+6	1st unit Proportional band (4 digits BCD)	0001 to 9999
+7	1st unit Integral time (4 digits BCD)	0000 to 3999
+8	1st unit Derivative time (4 digits BCD)	0000 to 3999
	• • •	
+57 (max.)	8th unit Derivative time (4 digits BCD)	0000 to 3999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Level 1 Parameter 2 (Sequence No. 067 (Hex 0043))

Writes parameters in level 1 (cooling coefficient, dead band, manual reset value, hysteresis (heating), hysteresis (cooling), control period (heating), and control period (cooling)) to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Cooling coefficient		
	+4	Dead band		
	+5	Manual reset value		
	+6	Hysteresis (heating)		
	+7	Hysteresis (cooling)		
	+8	Control period (heating)		
	+9	Control period (cooling)		
	~		~	
	+58	(Undefined)	Unit No.	8th unit (max.)
	+59	Cooling coefficient		
	+60	Dead band		
	+61	Manual reset value		
	+62	Hysteresis (heating)		
	+63	Hysteresis (cooling)		
	+64	Control period (heating)		
	+65	Control period (cooling)		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 8 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Cooling coefficient (4 digits BCD)	0001 to 9999
+4	1st unit Dead band (4 digits BCD)	0000 to 9999
+5	1st unit Manual reset value (4 digits BCD)	0000 to 1000
+6	1st unit Hysteresis (heating) (4 digits BCD)	0001 to 9999
+7	1st unit Hysteresis (cooling) (4 digits BCD)	0001 to 9999
+8	1st unit Control period (heating) (4 digits BCD)	0001 to 0099
+9	1st unit Control period (cooling) (4 digits BCD)	0001 to 0099
	• • •	
+65 (max.)	8th unit Control period (cooling) (4 digits BCD)	0001 to 0099

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Level 2 Parameters 1 (Sequence No. 068 (Hex 0044))

Writes parameters in level 2 (SP ramp time unit, SP ramp set value, LBA detection time, MV at stop time, MV at PV error, MV upper limit, MV lower limit, and MV change rate limit) to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	SP ramp time unit		
	+4	SP ramp set value		
	+5	LBA detection time		
	+6	MV at stop		
	+7	MV at PV error		
	+8	MV upper limit		
	+9	MV lower limit		
	+10	MV change rate limit		
	+65	(Undefined)	Unit No.	8th unit (max.)
	+66	SP ramp time unit		
	+67	SP ramp set value		
	+68	LBA detection time		
	+69	MV at stop		
	+70	MV at PV error		
	+71	MV upper limit		
	+72	MV lower limit		
	+73	MV change rate limit		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 9 + 2
+1	Number of units (4 digits BCD)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit SP ramp time unit (4 digits BCD)	0000 to 0001
+4	1st unit SP ramp set value (4 digits BCD)	0000 to 9999
+5	1st unit LBA detection time (4 digits BCD)	0000 to 9999
+6	1st unit MV at stop (4 digits BCD)	0000 to 1050
+7	1st unit MV at PV error (4 digits BCD)	0000 to 1050
+8	1st unit MV upper limit (4 digits BCD)	MV lower limit + 1 to 1050
+9	1st unit MV lower limit (4 digits BCD)	0000 to MV upper limit –1
+10	1st unit MV change rate limit (4 digits BCD)	0000 to 1000
	• • •	
+73 (max.)	8th unit MV change rate limit (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Level 2 Parameters 2 (Sequence No. 069 (Hex 0045))

Writes parameters in level 2 (input digital filter, alarm 1 hysteresis, alarm 2 hysteresis, alarm 3 hysteresis, input shift upper limit, and input shift lower limit) to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Input digital filter		
	+4	alarm 1 hysteresis		
	+5	alarm 2 hysteresis		
	+6	alarm 3 hysteresis		
	+7	Input shift upper limit		
	+8	Input shift lower limit		
	~	:		
	+51	(Undefined)	Unit No.	8th unit (max.)
	+52	Input digital filter		
	+53	alarm 1 hysteresis		
	+54	alarm 2 hysteresis		
	+55	alarm 3 hysteresis		
	+56	Input shift upper limit		
	+57	Input shift lower limit		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 7 + 2
+1	Number of units (4 digits BCD)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Input digital filter (4 digits BCD)	0000 to 9999
+4	1st unit Alarm 1 hysteresis (4 digits BCD)	0001 to 9999
+5	1st unit Alarm 2 hysteresis (4 digits BCD)	0001 to 9999
+6	1st unit Alarm 3 hysteresis (4 digits BCD)	0001 to 0099
+7	1st unit Input shift upper limit (4 digits BCD)	000 to 9999
+8	1st unit Input shift lower limit (4 digits BCD)	000 to 9999
	• • •	
+57 (max.)	8th unit Input shift lower limit (4 digits BCD)	000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

General-purpose Write (Sequence No. 070 (Hex 0046))

Writes the specified parameter.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Undefined)	Parameter No.
	+3	Write data	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Parameter No. (2 digits BCD)	Refer to the manual of E5□K.
+3	Write data (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note To write parameters in the setup mode or extended mode, execute Switch to Level 1 (Sequence No. 075) in advance.

Switch to Level 0 (Software Reset) (Sequence No. 071 (Hex 0047))

Resets the operation of the E5□K and waits until communications are enabled. This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~		~	
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

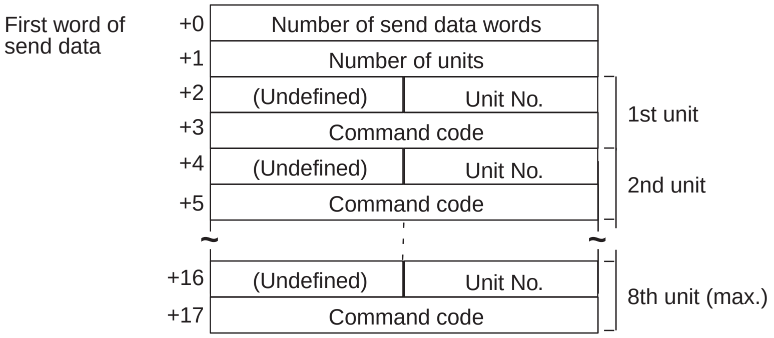
None.

Note When this sequence is executed, a software reset command is issued and the operation of the E5□K is reset (equivalent to turning on the power supply). About five seconds will be required until communications are enabled.

Run/Stop (Sequence No. 072 (Hex 0048))

Switches the mode to Run or Stop according to the command code. This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Command code (4 digits BCD)	0000: Run 0001: Stop
	• • •	
+17 (max.)	8th unit Command code (4 digits BCD)	0000: Run 0001: Stop

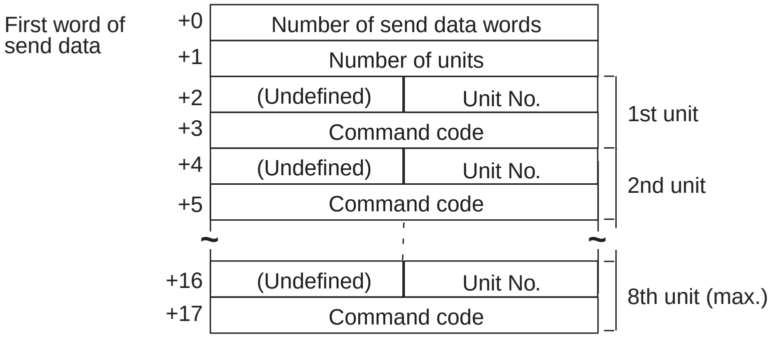
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Remote/Local (Sequence No. 073 (Hex 0049))

Switches to remote operation or local operation according to the command mode. This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Command code (4 digits BCD)	0000: Local 0001: Remote
	• • •	
+17 (max.)	8th unit Command code (4 digits BCD)	0000: Local 0001: Remote

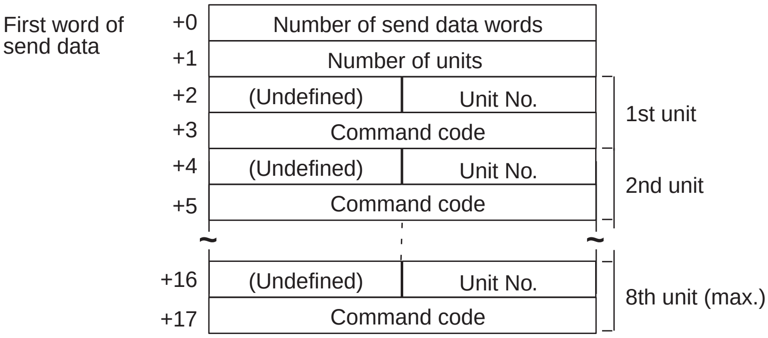
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Execute/Cancel AT (Sequence No. 074 (Hex 004A))

Executes or cancels AT (autotuning) according to the command code. This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Command code (4 digits BCD)	0000: Stop 0001: Execute AT 40% 0002: Execute AT 100%
	• • •	
+17 (max.)	8th unit Command code (4 digits BCD)	0000: Stop 0001: Execute AT 40% 0002: Execute AT 100%

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Switch to Level 1 (Sequence No. 075 (Hex 004B))

Switches the setting level to level 1 (setup mode, extended mode). This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~			
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Software Reset (Sequence No. 076 (Hex 004C))

Resets the operation of the E5□K (equivalent to turning on the power supply). This sequence can be executed for multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	(Undefined)	Unit No.	
	~			
	+9	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0008
+2 to 9	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Communications with the E5□K are disabled for about five seconds after this sequence is executed.

Appendix E

E5ZE Temperature Controller Read Protocol

The E5ZE Temperature Controller Read Protocol reads and controls various parameters in remote mode for the Temperature Controller connected to the Serial Communications Unit/Board via RS-232C or RS-422/485 cable.

Note All sequences in this appendix operate on memory bank 0 and cannot be used for other memory banks.

Structure of the Protocol

The following table shows the structure of the E5ZE Temperature Controller Read Protocol

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
100 (0064)	Read set point	Reads the set points.	Yes	Yes
101 (0065)	Read process value	Reads the process values.	Yes	Yes
102 (0066)	Read output value	Reads the output values.	Yes	Yes
103 (0067)	Read set point, process value, and output value	Reads the set points, process values, and output values.	Yes	Yes
104 (0068)	Read proportional band, integral time, and derivative time	Reads the proportional bands, integral times, and derivative times.	Yes	Yes
105 (0069)	Read control period	Reads the control periods.	Yes	Yes
106 (006A)	Read output mode	Reads the output modes.	Yes	Yes
107 (006B)	Read alarm mode	Reads the alarm modes.	Yes	Yes
108 (006C)	Read alarm temperature	Reads the alarm temperatures.	Yes	Yes
109 (006D)	Read hysteresis	Reads the hysteresis.	Yes	Yes
110 (006E)	Read operation status	Reads the operation status.	Yes	Yes
111 (006F)	Read error status	Reads the error status.	Yes	Yes
112 (0070)	Read setting unit	Reads the setting units.	Yes	Yes
113 (0071)	Read input shift value	Reads the input shift values.	Yes	Yes
114 (0072)	Read manual reset value	Reads the manual reset values.	Yes	Yes
115 (0073)	Read ramp value	Reads the ramp values.	Yes	Yes
116 (0074)	Read present set point	Reads the present set points.	Yes	Yes
117 (0075)	Read output value limits	Reads the output value limits.	Yes	Yes
118 (0076)	Read output value change rate limit	Reads the output value change rate limits.	Yes	Yes
119 (0077)	Read HB alarm and HS alarm valid channels	Reads the HB alarm and HS alarm valid channels.	Yes	Yes
120 (0078)	Read heater burnout/SSR failure detection currents	Reads the heater burnout/SSR failure detection currents.	Yes	Yes
121 (0079)	Read heater current and SSR leakage current	Reads the heater currents and SSR leakage currents.	Yes	Yes
122 (007A)	Read dead band/overlap band	Reads the dead bands and overlap bands.	Yes	Yes
123 (007B)	Read cooling coefficient	Reads the cooling coefficients.	Yes	Yes

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

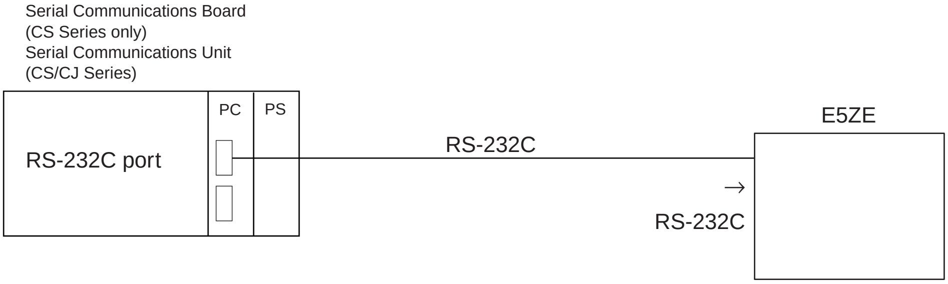
2. **Ladder Interface Settings**
YES: User settings are required for the 3rd or 4th operands of PMCR.

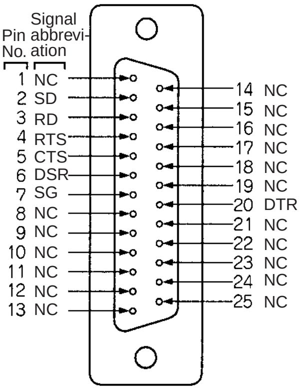
NO:	Send word allocation:	Set the constant 0000 for the 3rd operand (S).
	Receive word allocation:	Set the constant 0000 for the 4th operand (D).

Connections

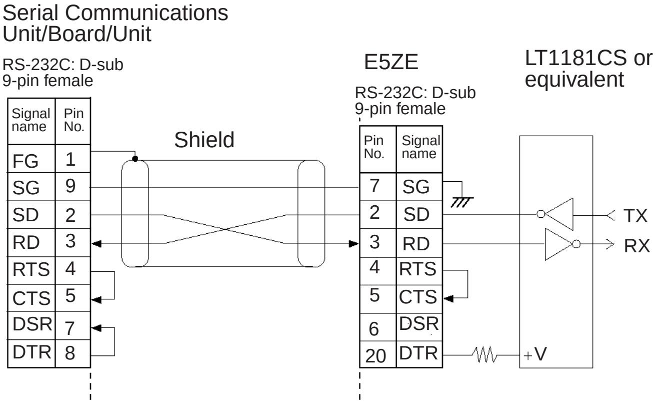
This section shows connections for using the E5ZE Temperature Controller Read Protocol.

RS-232C Connections





Signal name	Abbreviation	Signal direction	Pin No.
Signal ground or common return line	SG	---	7
Send data	SD	Output	2
Receive data	RD	Input	3
Request to send	RTS	Output	4
Clear to send	CTS	Input	5
Data set ready	DSR	Input	6
Data terminal ready	DTR	Output	20
Disabled (Do not connect.)	NC	---	1, 8 to 19, 21 to 25

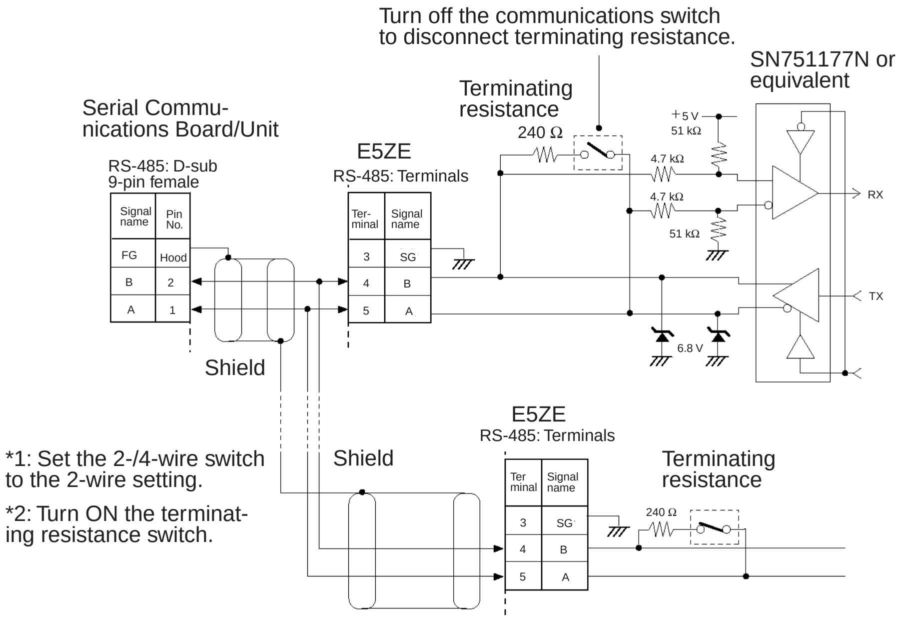


Note 1. The maximum communications cable length is 15 m. Use a shielded twisted-pair cable for the cable.
2. Use a 25-pin D-sub Plug (OMRON XM2A-2501).
3. Use XM2S-2511 Hood (OMRON) or an equivalent.

RS422/485 Connections

- **RS-485 2-wire Connections**

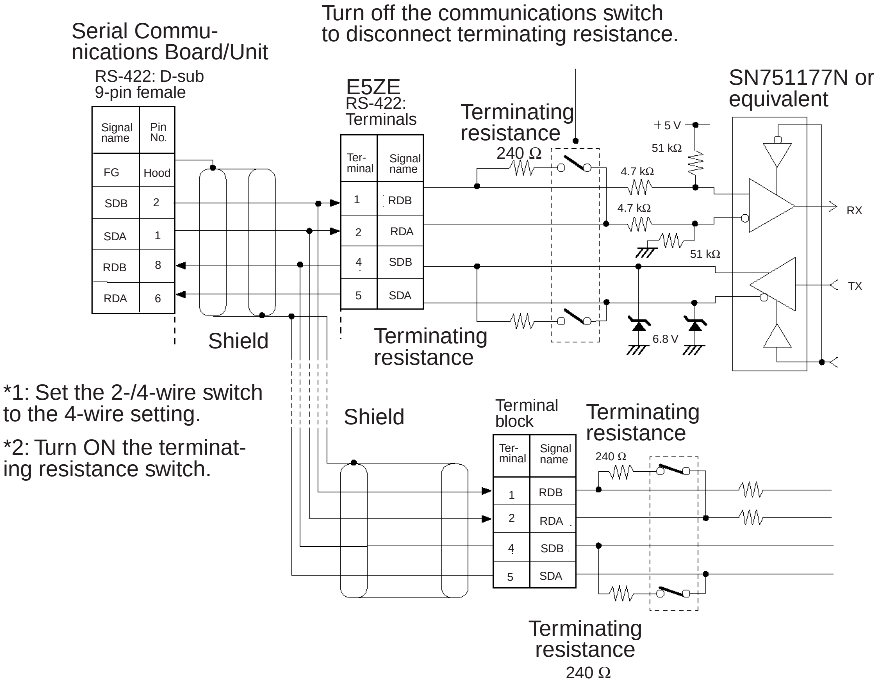
Pin No.	Signal name	Abbreviation	Signal direction
1	Disabled (Do not connect.)	---	---
2	Disabled (Do not connect.)	---	---
3	Signal ground	SG	---
4	Terminal B (+ side)	B	I/O
5	Terminal A (– side)	A	I/O



Note Terminal block pins 1 and 2 cannot be connected. If these blocks are used, operation of the E5ZE may fail.

- **RS-422 4-wire Connections**

Pin No.	Signal name	Abbreviation	Signal direction
1	Receive data B	RDB	Input
2	Receive data A	RDA	Input
3	Signal ground	SG	---
4	Send data B	SDB	Output
5	Send data A	SDA	Output



*1: Set the 2-/4-wire switch to the 4-wire setting.

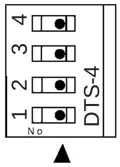
*2: Turn ON the terminating resistance switch.

Switch Settings

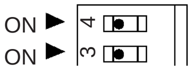
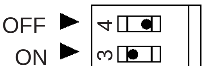
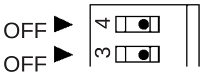
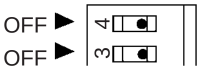
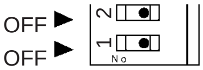
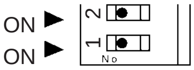
This section shows the switch settings for using the E5ZE Temperature Controller Read Protocol.

Communications Parameter DIP Switch

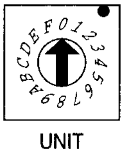
Pins 3 and 4: Terminating resistance
Pins 1 and 2: RS-422/RS-485



Factory defaults: All OFF

Pins	Parameter		RS-422	RS-485
3 and 4	Terminating resistance	ON	 ON ON	 OFF ON
		OFF	 OFF OFF	 OFF OFF
1 and 2	RS-422 or RS-485		 OFF OFF	 ON ON

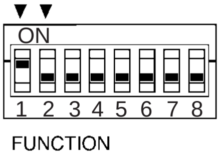
Unit Number Switch



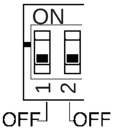
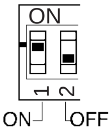
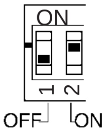
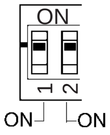
Setting	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Unit No.	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

▲ Factory defaults

Baud Rate DIP Switch



Factory default: 9,600 bps
(pin 1 ON, pin 2 OFF)

Baud rate (bps)	19,200	9,600	4,800	2,400
Pins 1 and 2	 OFF OFF	 ON OFF	 OFF ON	 ON ON

Read Set Point (Sequence No. 100 (Hex 0064))

Reads the set points and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Set point (rightmost 4 digits)	Channel 0
	+2	Set point (leftmost 1 digit)	
	~		
	+15	Set point (rightmost 4 digits)	Channel 7
	+16	Set point (leftmost 1 digit)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE. F indicates a negative value.
+2	Channel 0 Set point (leftmost 1 digit) (1 digit BCD)	
	• • •	
+15	Channel 7 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer the manual for the E5ZE. F indicates a negative value.
+16	Channel 7 Set point (leftmost 1 digit) (1 digit BCD)	

Read Process Value (Sequence No. 101 (Hex 0065))

Reads the process values and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Process value (rightmost 4 digits)	Channel 0
+2	Process value (leftmost 1 digit)	
+3	Process value (rightmost 4 digits)	Channel 1
+4	Process value (leftmost 1 digit)	
~	⋮	~
+15	Process value (rightmost 4 digits)	Channel 7
+16	Process value (leftmost 1 digit)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Process value (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE. F indicates a negative value.
+2	Channel 0 Process value (leftmost 1 digit) (1 digit BCD)	
	• • •	
+15	Channel 7 Process value (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE. F indicates a negative value.
+16	Channel 7 Process value (leftmost 1 digit) (1 digit BCD)	

Read Output Values (Sequence No. 102 (Hex 0066))

Reads the output values of the control outputs and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Output value	Channel 0
+2	Cooling output value	
+3	Output value	Channel 1
+4	Cooling output value	
~	⋮	~
+15	Output value	Channel 7
+16	Cooling output value	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Output value (4 digits BCD)	0000 to 1000
+2	Channel 0 Cooling output value (4 digits BCD)	0000 to 1000
+3	Channel 1 Output value (4 digits BCD)	0000 to 1000
+4	Channel 1 Cooling output value (4 digits BCD)	0000 to 1000
	• • •	
+15	Channel 7 Output value (4 digits BCD)	0000 to 1000
+16	Channel 7 Cooling output value (4 digits BCD)	0000 to 1000

Read Set Point, Process Value, and Output Value (Sequence No. 103 (Hex 0067))

Reads the set points, process values, and output values and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Set point (rightmost 4 digits)	Channel 0
	+2	Set point (leftmost 1 digit)	
	+3	Process value (rightmost 4 digits)	
	+4	Process value (leftmost 1 digit)	
	+5	Output value	
	~		~
	+36	Set point (rightmost 4 digits)	Channel 7
	+37	Set point (leftmost 1 digit)	
	+38	Process value (rightmost 4 digits)	
	+39	Process value (leftmost 1 digit)	
	+40	Output value	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0029 (0041 decimal)
+1	Channel 0 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+2	Channel 0 Set point (leftmost 1 digit) (1 digit BCD)	
+3	Channel 0 Process value (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+4	Channel 0 Process value (leftmost 1 digit) (1 digit BCD)	
+5	Channel 0 Output value (4 digits BCD)	0000 to 1000
	• • •	
+36	Channel 7 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+37	Channel 7 Set point (leftmost 1 digit) (1 digit BCD)	
+38	Channel 7 Process value (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+39	Channel 7 Process value (leftmost 1 digit) (1 digit BCD)	
+40	Channel 0 Output value (4 digits BCD)	0000 to 1000

Read Proportional Band, Integral Time, and Derivative Time (Sequence No. 104 (Hex 0068))

Reads the proportional bands (constant P), integral times (constant I), and derivative times (Constant D) and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Constant P	Channel 0
	+2	Constant I	
	+3	Constant D	
		⋮	
	+22	Constant P	Channel 7
	+23	Constant I	
	+24	Constant D	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0019 (0025 decimal)
+1	Channel 0 Constant P (4 digits BCD)	0000 to 9999
+2	Channel 0 Constant I (4 digits BCD)	0000 to 3999
+3	Channel 0 Constant D (4 digits BCD)	0000 to 3999
	• • •	
+22	Channel 7 Constant P (4 digits BCD)	0000 to 9999
+23	Channel 7 Constant I (4 digits BCD)	0000 to 3999
+24	Channel 7 Constant D (4 digits BCD)	0000 to 3999

Read Control Period (Sequence No. 105 (Hex 0069))

Reads the control periods and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Control period	Channel 0
	+2	Cooling control period	
	+3	Control period	Channel 1
	+4	Cooling control period	
		⋮	
	+15	Control period	Channel 7
	+16	Cooling control period	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Control period (4 digits BCD)	0001 to 0099
+2	Channel 0 Cooling control period (4 digits BCD)	0001 to 0099
	• • •	
+15	Channel 7 Control period (4 digits BCD)	0001 to 0099
+16	Channel 7 Cooling control period (4 digits BCD)	0001 to 0099

Read Output Mode (Sequence No. 106 (Hex 006A))

Reads the output modes (normal/reverse) and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	(Undefined)	Set code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Set code (2 digits Hex)	00 to FF

Read Alarm Mode (Sequence No. 107 (Hex 006B))

Reads the alarm modes and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	(Undefined)	Alarm 1 set code	Channel 0
	+2	(Undefined)	Alarm 2 set code	
	+3	(Undefined)	Alarm 1 set code	Channel 1
	+4	(Undefined)	Alarm 2 set code	
		~	~	
	+15	(Undefined)	Alarm 1 set code	Channel 7
	+16	(Undefined)	Alarm 2 set code	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Alarm 1 set code (2 digits Hex)	00 to 0C
+2	Channel 0 Alarm 2 set code (2 digits Hex)	00 to 0C
	• • •	
+15	Channel 7 Alarm 1 set code (2 digits Hex)	00 to 0C
+16	Channel 7 Alarm 2 set code (2 digits Hex)	00 to 0C

Read Alarm Temperatures (Sequence No. 108 (Hex 006C))

Reads the alarm temperatures and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Alarm 1 set value (rightmost 4 digits)	Channel 0
+2	Alarm 1 set value (leftmost 1 digit)	
+3	Alarm 2 set value (rightmost 4 digits)	
+4	Alarm 2 set value (leftmost 1 digit)	
~	:	~
+29	Alarm 1 set value (rightmost 4 digits)	Channel 7
+30	Alarm 1 set value (rightmost 1 digit)	
+31	Alarm 2 set value (rightmost 4 digits)	
+32	Alarm 2 set value (leftmost 1 digit)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0021 (0033 decimal)
+1	Channel 0 Alarm 1 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999 F indicates a negative number.
+2	Channel 0 Alarm 1 set value (leftmost 1 digit) (4 digits BCD)	0000 to 0009 F indicates a negative number.
+3	Channel 0 Alarm 2 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999 F indicates a negative number.
+4	Channel 0 Alarm 2 set value (leftmost 1 digit) (4 digits BCD)	0000 to 0009 F indicates a negative number.
	• • •	
+29	Channel 7 Alarm 1 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999 F indicates a negative number.
+30	Channel 7 Alarm 1 set value (leftmost 1 digit) (4 digits BCD)	0000 to 0009 F indicates a negative number.
+31	Channel 7 Alarm 2 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999 F indicates a negative number.
+32	Channel 07 Alarm 2 set value (leftmost 1 digit) (4 digits BCD)	0000 to 0009 F indicates a negative number.

Read Hysteresis (Sequence No. 109 (Hex 006D))

Reads the hysteresis and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Hysteresis	Channel 0
	+2	Cooling hysteresis	
	+3	Hysteresis	Channel 1
	+4	Cooling hysteresis	
	~	~	
	+15	Hysteresis	Channel 7
	+16	Cooling hysteresis	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Hysteresis (4 digits BCD)	0000 to 0999
+2	Channel 0 Cooling hysteresis (4 digits BCD)	0000 to 0999
	• • •	
+15	Channel 7 Hysteresis (4 digits BCD)	0000 to 0999
+16	Channel 7 Cooling hysteresis (4 digits BCD)	0000 to 0999

Read Operation Status (Sequence No. 110 (Hex 006E))

Reads the operation status of the E5ZE and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Status code	Channel 0
+2	Status code	Channel 1
~	⋮	~
+8	Status code	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Status code (4 digits Hex)	0000 to FFFF
+2	Channel 1 Status code (4 digits Hex)	0000 to FFFF
	• • •	
+8	Channel 7 Status code (4 digits Hex)	0000 to FFFF

Read Error Status (Sequence No. 111 (Hex 006F))

Reads the contents of errors if they have occurred and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words
+1	Status code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Status code (4 digits BCD)	0000 to FFFF

Read Setting Unit (Sequence No. 112 (Hex 0070))

Reads the setting units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Set code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Set code (4 digits BCD)	0000: unit of 1 0001: unit of 0.1

Read Input Shift Value (Sequence No. 113 (Hex 0071))

Reads the input shift values and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Input shift value	Channel 0
	+2	Input shift value	Channel 1
	~	⋮	~
	+8	Input shift value	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Input shift value (4 digits BCD)	0000 to 0999 F indicates a negative number.
+2	Channel 1 Input shift value (4 digits BCD)	0000 to 0999 F indicates a negative number.
	• • •	
+8	Channel 7 Input shift value (4 digits BCD)	0000 to 0999 F indicates a negative number.

Read Manual Reset Value (Sequence No. 114 (Hex 0072))

Reads the manual reset value and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Manual reset value	Channel 0
+2	Manual reset value	Channel 1
	⋮	
+8	Manual reset value	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Manual reset value (4 digits BCD)	0000 to 1000
+2	Channel 1 Manual reset value (4 digits BCD)	0000 to 1000
	• • •	
+8	Channel 7 Manual reset value (4 digits BCD)	0000 to 1000

Read Ramp Value (Sequence No. 115 (Hex 0073))

Reads the ramp values and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	(Undefined)	Ramp value	Channel 0
+2	Time unit	(Undefined)	
+3	(Undefined)	Ramp value	Channel 1
+4	Time unit	(Undefined)	
	⋮		
+15	(Undefined)	Ramp value	Channel 7
+16	Time unit	(Undefined)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Ramp value (3 digits BCD)	000 to 999
+2	Channel 0 Time unit (one ASCII character)	S: Seconds; M: Minutes; H: Hours
	• • •	

Offset	Contents (data format)	Data
+15	Channel 7 Ramp value (3 digits BCD)	000 to 999
+16	Channel 7 Time unit (one ASCII character)	S: Seconds; M: Minutes; H: Hours

Read Present Set Point (Sequence No. 116 (Hex 0074))

Reads the present set points during ramp operation and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	Channel 0
	+1	Present set point (rightmost 4 digits)	
	+2	Present set point (leftmost 1 digit)	
	~	~	
	+15	Present set point (rightmost 4 digits)	Channel 7
	+16	Present set point (leftmost 1 digit)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Present set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE. F indicates a negative value.
+2	Channel 0 Present set point (leftmost 1 digit) (1 digit BCD)	
	• • •	
+15	Channel 7 Present set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE. F indicates a negative value.
+16	Channel 7 Present set point (leftmost 1 digit) (1 digit BCD)	

Read Output Value Limit (Sequence No. 117 (Hex 0075))

Reads the output value limits and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Output value lower limit	Channel 0
+2	Output value upper limit	
+3	Cooling control output value lower limit	
+4	Cooling control output value upper limit	
~	⋮	~
+29	Output value lower limit	Channel 7
+30	Output value upper limit	
+31	Cooling control output value lower limit	
+32	Cooling control output value upper limit	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0021 (0033 decimal)
+1	Channel 0 Output value lower limit (4 digits BCD)	0000 to 1000
+2	Channel 0 Output value upper limit (4 digits BCD)	0000 to 1000
+3	Channel 0 Cooling control output value upper limit (4 digits BCD)	0000 to 1000
+4	Channel 0 Cooling control output value upper limit (4 digits BCD)	0000 to 1000
	• • •	
+31	Channel 7 Cooling control output value upper limit (4 digits BCD)	0000 to 1000
+32	Channel 7 Cooling control output value upper limit (4 digits BCD)	0000 to 1000

Read Output Value Change Rate Limit (Sequence No. 118 (Hex 0076))

Reads the output value change rate limits and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Output value change rate limit	Channel 0
+2	Output value change rate limit	Channel 1
~	⋮	~
+8	Output value change rate limit	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Output value change rate limit (4 digits BCD)	0000 to 1000
+2	Channel 1 Output value change rate limit (4 digits BCD)	0000 to 1000
	• • •	
+8	Channel 7 Output value change rate limit (4 digits BCD)	0000 to 1000

Read HB Alarm and HS Alarm Valid Channels
(Sequence No. 119 (Hex 0077))

Reads the valid or invalid channels for HB alarms and HS alarms and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	(Undefined)	Set code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Set code (2 digits Hex)	00 to FF

Read Heater Burnout and SSR Failure Detection Currents
(Sequence No. 120 (Hex 0078))

Reads the heater burnout and SSR failure detection currents and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Heater burnout detection current	Channel 0
	+2	SSR failure detection current	
	+3	Heater burnout detection current	Channel 1
	+4	SSR failure detection current	
		⋮	
	+15	Heater burnout detection current	Channel 7
	+16	SSR failure detection current	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Heater burnout detection current (4 digits BCD)	0000 to 0500
+2	Channel 0 SSR failure detection current (4 digits BCD)	0000 to 0500
	• • •	
+15	Channel 7 Heater burnout detection current (4 digits BCD)	0000 to 0500
+16	Channel 7 SSR failure detection current (4 digits BCD)	0000 to 0500

Read Heater Current and SSR Leakage Current (Sequence No.121 (Hex 0079))

Reads the heater currents and SSR leakage currents and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Heater current	Channel 0
	+2	SSR leakage current	
	+3	Heater current	Channel 1
	+4	SSR leakage current	
		⋮	
	+15	Heater current	Channel 7
	+16	SSR leakage current	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0011 (0017 decimal)
+1	Channel 0 Heater current (4 digits BCD)	0000 to 0500
+2	Channel 0 SSR leakage current (4 digits BCD)	0000 to 0500
	• • •	
+15	Channel 7 Heater current (4 digits BCD)	0000 to 0500
+16	Channel 7 SSR leakage current (4 digits BCD)	0000 to 0500

Note The read data will be 0000 for all channels for which HB and HS alarms are not enabled and for all channels for which control is stopped.

Read Dead Band/Overlap Band (Sequence No. 122 (Hex 007A))

Reads the dead bands/overlap bands and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Dead band/overlap band	Channel 0
	+2	Dead band/overlap band	Channel 1
		⋮	
	+8	Dead band/overlap band	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Dead band/overlap band (4 digits BCD)	0000 to 0999 F indicates a number.
+2	Channel 1 Dead band/overlap band (4 digits BCD)	0000 to 0999 F indicates a number.
	• • •	
+8	Channel 7 Dead band/overlap band (4 digits BCD)	0000 to 0999 F indicates a number.

Read Cooling Coefficient (Sequence No. 123 (Hex 007B))

Reads the cooling coefficients and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Cooling coefficient	Channel 0
	+2	Cooling coefficient	Channel 1
		~	
	+8	Cooling coefficient	Channel 7

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0009
+1	Channel 0 Cooling coefficient (4 digits BCD)	0000 to 0100
+2	Channel 1 Cooling coefficient (4 digits BCD)	0000 to 0100
	• • •	
+8	Channel 7 Cooling coefficient (4 digits BCD)	0000 to 0100

Appendix F
E5ZE Temperature Controller Write Protocol

The E5ZE Temperature Controller Write Protocol writes and controls various settings in remote mode for the Temperature Controller connected via a RS-232C or RS-422/485 cable from the PC via the Serial Communications Unit/Board.

Note 1. Negative values cannot be written. All values must be set as unsigned BCD.

2. All sequences in this appendix operate on memory bank 0 and cannot be used for other memory banks.

Structure of the Protocol

The following table shows the structure of the E5ZE Temperature Controller Write Protocol.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
150 (0096)	Write set point (setting unit 1)	Writes the set points using a setting unit of 1.	Yes	No
151 (0097)	Write set point (setting unit 0.1)	Writes the set points using a setting unit of 0.1.	Yes	No
152 (0098)	Write proportional band, integral time, and derivative time	Writes the proportional bands, integral times, and derivative times.	Yes	No
153 (0099)	Write control period	Writes the control periods.	Yes	No
154 (009A)	Write output mode	Writes the output modes.	Yes	No
155 (009B)	Write alarm mode	Writes the alarm modes.	Yes	No
156 (009C)	Write alarm temperature (setting unit 1)	Writes the alarm temperatures using a setting unit of 1.	Yes	No
157 (009D)	Write alarm temperature (setting unit 0.1)	Writes the alarm temperatures using a setting unit of 0.1.	Yes	No
158 (009E)	Write hysteresis	Writes the hysteresis.	Yes	No
159 (009F)	Start autotuning	Starts autotuning.	Yes	No
160 (00A0)	Cancel autotuning	Cancels autotuning.	Yes	No
161 (00A1)	Write setting unit	Writes the setting units.	Yes	No
162 (00A2)	Write input shift value	Writes the input shift values.	Yes	No
163 (00A3)	Write manual reset value	Writes the manual reset values.	Yes	No
164 (00A4)	Write ramp value	Writes the ramp values.	Yes	No
165 (00A5)	Write manual output value	Writes the manual output values.	Yes	No
166 (00A6)	Write output value limit	Writes the output value limits.	Yes	No
167 (00A7)	Write output value change rate limit	Write output value change rate limits.	Yes	No
168 (00A8)	Save settings	Saves settings.	Yes	No

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
169 (00A9)	Initialize settings	Initializes settings.	Yes	No
170 (00AA)	Write HB alarm and HS alarm valid channels	Writes the HB alarm and HS alarm valid channels.	Yes	No
171 (00AB)	Write heater burnout and SSR failure detection currents	Writes the heater burnout and SSR failure detection currents.	Yes	No
172 (00AC)	Write dead band/overlap band	Writes the dead bands/overlap bands.	Yes	No
173 (00AD)	Write cooling coefficient	Writes the cooling coefficients.	Yes	No
174 (00AE)	Start control	Starts temperature control.	Yes	No
175 (00AF)	Stop operation or control	Stops temperature control or manual operation.	Yes	No
176 (00B0)	Start manual operation	Starts manual operation.	Yes	No

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

2. **Ladder Interface Settings**
   YES: User settings are required for the 3rd or 4th operands of PMCR.
   NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
   Receive word allocation: Set the constant 0000 for the 4th operand (D).

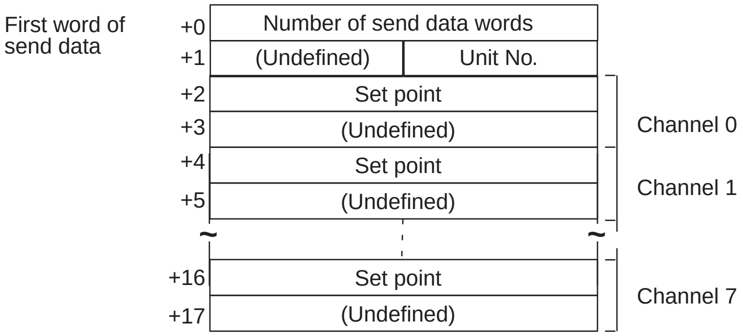
Connections

The connections are the same as that for the E5ZE Temperature Controller Read Protocol.

Write Set Point (Setting Unit 1) (Sequence No. 150 (Hex 0096))

Writes the set points using a setting unit of 1 (4 digits).

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Set point (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
	• • •	
+16	Channel 7 Set point (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+17	Not used	---

Receive Data Word Allocation (4th Operand of PMCR(260))

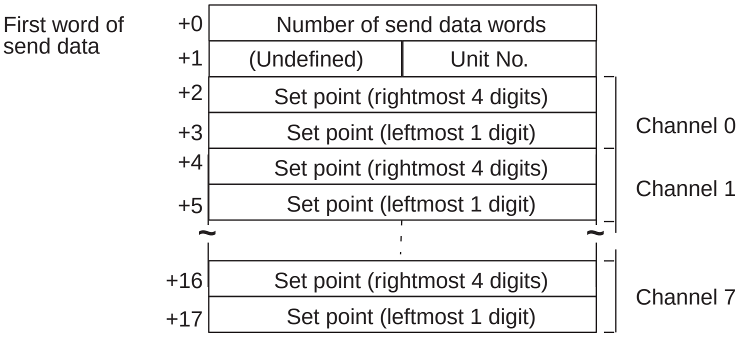
None.

Note When the setting unit for the set point is 0.1 (5 digits), use Write Set Point (Setting Unit 0.1), Sequence No.151.

Write Set Point (Setting Unit 0.1) (Sequence No. 151 (Hex 0097))

Writes the set points using a setting unit of 0.1 (5 digits).

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+3	Channel 0 Set point (leftmost 1 digit) (1 digit BCD)	
	• • •	
+16	Channel 7 Set point (rightmost 4 digits) (4 digits BCD)	Varies according to the temperature sensor type. Refer to the manual for the E5ZE.
+17	Channel 7 Set point (rightmost 1 digit) (1 digit BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

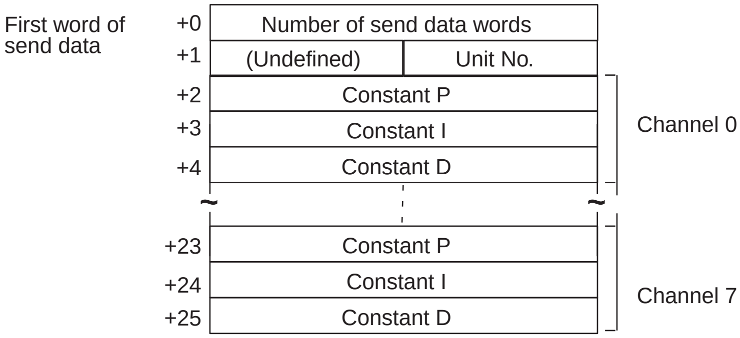
None.

Note When the setting unit for the set point is 1 (4 digits), use Write Set Point (Setting Unit 1), Sequence No.150.

Write Proportional Band, Integral Time, and Derivative Time (Sequence No. 152 (Hex 0098))

Writes the proportional bands (constant P), integral times (constant I), and derivative times (constant D).

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	001A (0026 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Constant P (4 digits BCD)	0000 to 9999
+3	Channel 0 Constant I (4 digits BCD)	0000 to 3999
+4	Channel 0 Constant D (4 digits BCD)	0000 to 3999
	• • •	
+23	Channel 7 Constant P (4 digits BCD)	0000 to 9999
+24	Channel 7 Constant I (4 digits BCD)	0000 to 3999
+25	Channel 7 Constant D (4 digits BCD)	0000 to 3999

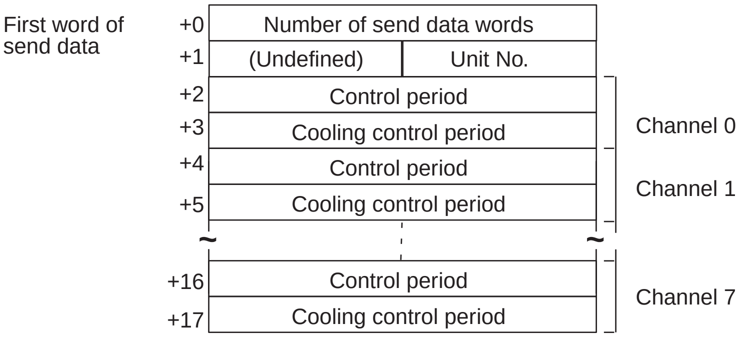
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Control Period (Sequence No. 153 (Hex 0099))

Writes the control periods and cooling control periods.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Control period (4 digits BCD)	0001 to 0099
+3	Channel 0 Cooling control period (4 digits BCD)	0001 to 0099
+4	Channel 1 Control period (4 digits BCD)	0001 to 0099
+5	Channel 1 Cooling control period (4 digits BCD)	0001 to 0099
	• • •	
+16	Channel 7 Control period (4 digits BCD)	0001 to 0099
+17	Channel 7 Cooling control period (4 digits BCD)	0001 to 0099

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Output Mode (Sequence No. 154 (Hex 009A))

Writes the output mode (normal/reverse).

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Undefined)	Write code

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Write code (2 digits Hex)	00 to FF

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Alarm Mode (Sequence No. 155 (Hex 009B))

Writes the alarm modes for alarm 1 and alarm 2.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	(Undefined)	Alarm 1 set code	Channel 0
	+3	(Undefined)	Alarm 2 set code	
	+4	(Undefined)	Alarm 1 set code	Channel 1
	+5	(Undefined)	Alarm 2 set code	
	~		~	
	+16	(Undefined)	Alarm 1 set code	Channel 7
	+17	(Undefined)	alarm 2 set code	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Alarm 1 set code (2 digits Hex)	00 to 0C
+3	Channel 0 Alarm 2 set code (2 digits Hex)	00 to 0C
+4	Channel 1 Alarm 1 set code (2 digits Hex)	00 to 0C
+5	Channel 1 Alarm 2 set code (2 digits Hex)	00 to 0C
	• • •	
+16	Channel 7 Alarm 1 set code (2 digits Hex)	00 to 0C
+17	Channel 7 Alarm 2 set code (2 digits Hex)	00 to 0C

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Alarm Temperature (Setting Unit 1) (Sequence No. 156 (Hex 009C))

Writes the alarm temperatures using a setting unit of 1 (4 digits)

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words		
+1	(Undefined)	Unit No.	
+2	Alarm 1 set value		Channel 0
+3	(Undefined)		
+4	Alarm 2 set value		
+5	(Undefined)		
	⋮		
+30	Alarm 1 set value		Channel 7
+31	(Undefined)		
+32	Alarm 2 set value		
+33	(Undefined)		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0022 (0034 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Alarm 1 set value (4 digits BCD)	0000 to 9999
+3	Not used	
+4	Channel 0 Alarm 2 set value (4 digits BCD)	0000 to 9999
+5	Not used	
	• • •	
+32	Channel 7 Alarm 2 set value (4 digits BCD)	0000 to 9999
+33	Not used	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Alarm Temperature (Setting Unit 0.1) (Sequence No. 157 (Hex 009D))

Writes the alarm temperatures using a setting unit of 0.1 (5 digits)

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Alarm 1 set value (rightmost 4 digits)		Channel 0
	+3	Alarm 1 set value (leftmost 1 digit)		
	+4	Alarm 2 set value (rightmost 4 digits)		
	+5	Alarm 2 set value (leftmost 1 digit)		
	~			
	+30	Alarm 1 set value (rightmost 4 digits)		Channel 7
	+31	Alarm 1 set value (leftmost 1 digit)		
	+32	Alarm 2 set value (rightmost 4 digits)		
	+33	Alarm 2 set value (leftmost 1 digit)		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0022 (0034 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Alarm 1 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999
+3	Channel 0 Alarm 1 set value (leftmost 1 digits) (4 digits BCD)	0000 to 0009
+4	Channel 0 Alarm 2 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999
+5	Channel 0 Alarm 2 set value (leftmost 1 digits) (4 digits BCD)	0000 to 0009
	• • •	
+32	Channel 7 Alarm 2 set value (rightmost 4 digits) (4 digits BCD)	0000 to 9999
+33	Channel 7 Alarm 2 set value (leftmost 1 digits) (4 digits BCD)	0000 to 0009

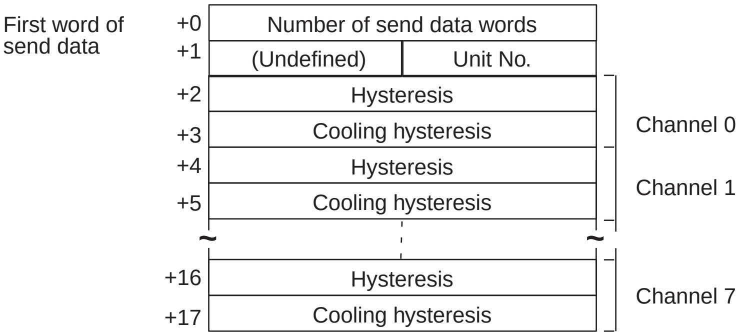
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Hysteresis (Sequence No. 158 (Hex 009E))

Writes the hysteresis for control outputs for ON/OFF control.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Hysteresis (4 digits BCD)	0000 to 0999
+3	Channel 0 Cooling hysteresis (4 digits BCD)	0000 to 0999
+4	Channel 1 Hysteresis (4 digits BCD)	0000 to 0999
+5	Channel 1 Cooling hysteresis (4 digits BCD)	0000 to 0999
	• • •	
+16	Channel 7 Hysteresis (4 digits BCD)	0000 to 0999
+17	Channel 7 Cooling hysteresis (4 digits BCD)	0000 to 0999

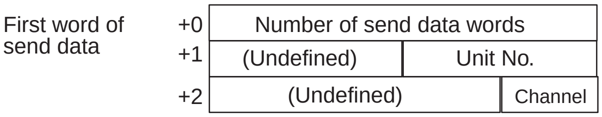
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Start Autotuning (Sequence No. 159 (Hex 009F))

Starts autotuning (AT).

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel (Channel) No. (1 digit BCD)	0 to 7

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Cancel Autotuning (Sequence No. 160 (Hex 00A0))

Cancels Autotuning (AT) for all channels.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Setting Unit (Sequence No. 161 (Hex 00A1))

Writes the setting unit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Write code	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Write code (4 digits BCD)	0000: unit of 1 0001: unit of 0.1

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Input Shift Value (Sequence No. 162 (Hex 00A2))

Writes the input shift values.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Input shift value		Channel 0
	+3	Input shift value		Channel 1
	+4	Input shift value		Channel 2
	+5	Input shift value		Channel 3
	+6	Input shift value		Channel 4
	+7	Input shift value		Channel 5
	+8	Input shift value		Channel 6
	+9	Input shift value		Channel 7

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (000A decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Input shift value (4 digits BCD)	0000 to 0999
+3	Channel 1 Input shift value (4 digits BCD)	0000 to 0999
+4	Channel 2 Input shift value (4 digits BCD)	0000 to 0999
	• • •	
+8	Channel 6 Input shift value (4 digits BCD)	0000 to 0999
+9	Channel 7 Input shift value (4 digits BCD)	0000 to 0999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Manual Reset Value (Sequence No. 163 (Hex 00A3))

Writes the manual reset values.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Manual reset value		Channel 0
	+3	Manual reset value		Channel 1
	+4	Manual reset value		Channel 2
	+5	Manual reset value		Channel 3
	+6	Manual reset value		Channel 4
	+7	Manual reset value		Channel 5
	+8	Manual reset value		Channel 6
	+9	Manual reset value		Channel 7

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (0010 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Manual reset value (4 digits BCD)	0000 to 1000
+3	Channel 1 Manual reset value (4 digits BCD)	0000 to 1000
+4	Channel 2 Manual reset value (4 digits BCD)	0000 to 1000
	• • •	
+8	Channel 6 Manual reset value (4 digits BCD)	0000 to 1000
+9	Channel 7 Manual reset value (4 digits BCD)	0000 to 1000

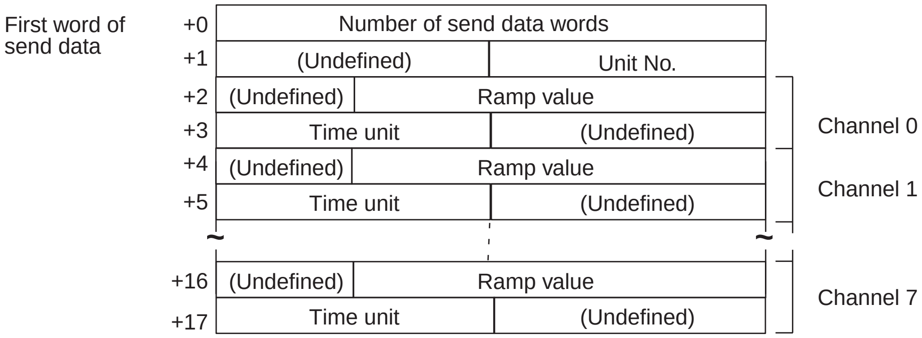
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Ramp Value (Sequence No. 164 (Hex 00A4))

Writes the ramp values.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Ramp value (3 digits BCD)	000 to 999
+3	Channel 0 Time unit (one ASCII character)	S: Seconds; M: Minutes; H: Hours
+4	Channel 1 Ramp value (3 digits BCD)	000 to 999
+5	Channel 1 Time unit (one ASCII character)	S: Second M: Minute H: Hour
	• • •	
+16	Channel 7 Ramp value (3 digits BCD)	000 to 999
+17	Channel 7 Time unit (one ASCII character)	S: Seconds; M: Minutes; H: Hours

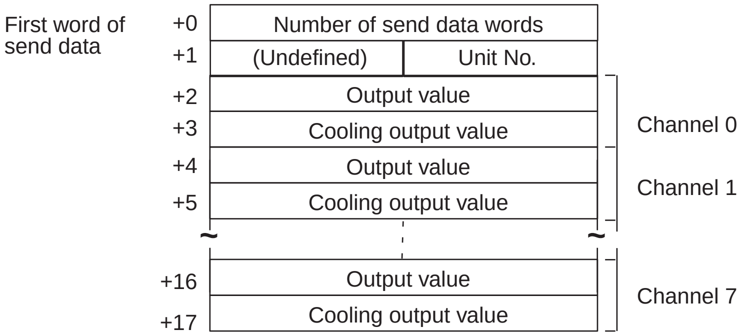
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Manual Output Value (Sequence No. 165 (Hex 00A5))

Writes the manual output values for control output in manual operation.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Output value (4 digits BCD)	0000 to 1000
+3	Channel 0 Cooling output value (4 digits BCD)	0000 to 1000
+4	Channel 1 Output value (4 digits BCD)	0000 to 1000
+5	Channel 1 Cooling output value (4 digits BCD)	0000 to 1000
	• • •	
+16	Channel 7 Output value (4 digits BCD)	0000 to 1000
+17	Channel 7 Cooling output value (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Output Value Limit (Sequence No. 166 (Hex 00A6))

Writes the output value limits that restrict the values of the control outputs.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Output value lower limit		Channel 0
	+3	Output value upper limit		
	+4	Cooling output value lower limit		
	+5	Cooling output value upper limit		
		⋮		
	+30	Output value lower limit		Channel 7
	+31	Output value upper limit		
	+32	Cooling output value lower limit		
	+33	Cooling output value upper limit		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0022 (0034 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Output value lower limit (4 digits BCD)	0000 to 1000
+3	Channel 0 Output value upper limit (4 digits BCD)	0000 to 1000
+4	Channel 0 Cooling output value lower limit (4 digits BCD)	0000 to 1000
+5	Channel 0 Cooling output value upper limit (4 digits BCD)	0000 to 1000
	⋮	
+32	Channel 7 Cooling output value lower limit (4 digits BCD)	0000 to 1000
+33	Channel 7 Cooling output value upper limit (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Output Value Change Rate Limit (Sequence No. 167 (Hex 00A7))

Writes the output value change rate limits that restrict the rates of change in the control value output.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Output change rate limit		Channel 0
	+3	Output change rate limit		Channel 1
	+4	Output change rate limit		Channel 2
	+5	Output change rate limit		Channel 3
	+6	Output change rate limit		Channel 4
	+7	Output change rate limit		Channel 5
	+8	Output change rate limit		Channel 6
	+9	Output change rate limit		Channel 7

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (0010 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Output change rate limit (4 digits BCD)	0000 to 1000
+3	Channel 1 Output change rate limit (4 digits BCD)	0000 to 1000
+4	Channel 2 Output change rate limit (4 digits BCD)	0000 to 1000
	⋮	
+8	Channel 6 Output change rate limit (4 digits BCD)	0000 to 1000
+9	Channel 7 Output change rate limit (4 digits BCD)	0000 to 1000

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Save Settings (Sequence No. 168 (Hex 00A8))

Saves the settings.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Initialize Settings (Sequence No. 169 (Hex 00A9))

Initializes all the settings to the factory defaults.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write HB and HS Alarm Valid Channels (Sequence No. 170 (Hex 00AA))

Writes the valid or invalid channels of HB alarm and HS alarm.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.
+2	(Undefined)	Write code

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Write code (2 digits Hex)	00 to FF

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Heater Burnout and SSR Failure Detection Current (Sequence No. 171 (Hex 00AB))

Writes the currents for detecting heater burnouts and SSR failures.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words		
+1	(Undefined)	Unit No.	
+2	Heater burnout detection current		Channel 0
+3	SSR failure detection current		
+4	Heater burnout detection current		Channel 1
+5	SSR failure detection current		
~			
+16	Heater burnout detection current		Channel 7
+17	SSR failure detection current		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0012 (0018 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Heater burnout detection current (4 digits BCD)	0000 to 0500
+3	Channel 0 SSR failure detection current (4 digits BCD)	0000 to 0500
+4	Channel 1 Heater burnout detection current (4 digits BCD)	0000 to 0500
+5	Channel 1 SSR failure detection current (4 digits BCD)	0000 to 0500
	• • •	
+16	Channel 7 Heater burnout detection current (4 digits BCD)	0000 to 0500
+17	Channel 7 SSR failure detection current (4 digits BCD)	0000 to 0500

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Dead Band/Overlap Band (Sequence No. 172 (Hex 00AC))

Writes the dead bands or overlap bands for control outputs during heating/cooling control.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Dead band/overlap band		Channel 0
	+3	Dead band/overlap band		Channel 1
	+4	Dead band/overlap band		Channel 2
	+5	Dead band/overlap band		Channel 3
	+6	Dead band/overlap band		Channel 4
	+7	Dead band/overlap band		Channel 5
	+8	Dead band/overlap band		Channel 6
	+9	Dead band/overlap band		Channel 7

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (0010 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Dead band/overlap band (4 digits BCD)	0000 to 0999
+3	Channel 1 Dead band/overlap band (4 digits BCD)	0000 to 0999
+4	Channel 2 Dead band/overlap band (4 digits BCD)	0000 to 0999
	• • •	
+8	Channel 6 Dead band/overlap band (4 digits BCD)	0000 to 0999
+9	Channel 7 Dead band/overlap band (4 digits BCD)	0000 to 0999

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Write Cooling Coefficient (Sequence No. 173 (Hex 00AD))

Writes the cooling coefficients for the cooling proportional bands for heating/cooling control.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	Cooling coefficient		Channel 0
	+3	Cooling coefficient		Channel 1
	+4	Cooling coefficient		Channel 2
	+5	Cooling coefficient		Channel 3
	+6	Cooling coefficient		Channel 4
	+7	Cooling coefficient		Channel 5
	+8	Cooling coefficient		Channel 6
	+9	Cooling coefficient		Channel 7

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (0010 decimal) (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F
+2	Channel 0 Cooling coefficient (4 digits BCD)	0000 to 0100
+3	Channel 1 Cooling coefficient (4 digits BCD)	0000 to 0100
+4	Channel 2 Cooling coefficient (4 digits BCD)	0000 to 0100
	• • •	
+8	Channel 6 Cooling coefficient (4 digits BCD)	0000 to 0100
+9	Channel 7 Cooling coefficient (4 digits BCD)	0000 to 0100

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Start Control (Sequence No. 174 (Hex 00AE))

Starts temperature control for all channels in the specified Unit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Stop Operation or Control (Sequence No. 175 (Hex 00AF))

Stops temperature control or manual operation for all channels of the specified Unit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Start Manual Operation (Sequence No. 176 (Hex 00B0))

Starts manual operation based on the output values that were set for all channels of the specified Unit.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits Hex)	00 to 0F

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Appendix G

E5☐J Temperature Controller Protocol

The E5☐J Temperature Controller Protocol performs various settings and controls in remote mode for the Temperature Controller connected to the Serial Communications Unit/Board via RS-232C or RS-422A/485 cable.

Note Negative values cannot be written. All values must be set as unsigned BCD.

Structure of the Protocol

The following table shows the structure of the E5☐J Temperature Controller Protocol.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
200 (00C8)	Select remote mode	Switches the Controller to remote mode.	Yes	No
201 (00C9)	Select local mode	Switches the Controller to local mode.	Yes	No
202 (00CA)	Select backup mode	Switches from set point write mode to backup mode.	Yes	No
203 (00CB)	Select RAM write mode	Switches from set point write mode to RAM write mode.	Yes	No
204 (00CC)	Save set point	Saves the set point.	Yes	No
205 (00CD)	Write parameters 1	Writes the set point, alarm value 1, alarm value 2, and heater burnout alarm value.	Yes	No
206 (00CE)	Write parameters 2	Writes the proportional band, integral time, and derivative time.	Yes	No
207 (00CF)	Write input shift value	Writes the input shift value.	Yes	No
208 (00D0)	Read parameters 1	Reads the set point, alarm value 1, alarm value 2, and heater burnout alarm value.	Yes	Yes
209 (00D1)	Read parameters 2	Reads the proportional band, integral time, and derivative time.	Yes	Yes
210 (00D2)	Read input shift value	Reads the input shift value and writes it in IOM.	Yes	Yes
211 (00D3)	Read output value	Reads the output value and stores it in IOM.	Yes	Yes
212 (00D4)	Read process value	Reads the process value and stores it in IOM.	Yes	Yes
213 (00D5)	Read set point limit	Reads the set point limits and stores them in IOM.	Yes	Yes
214 (00D6)	Read heater current	Reads the heater current and stores it in IOM.	Yes	Yes
215 (00D7)	Read initial status	Reads the initial status and stores it in IOM.	Yes	Yes
216 (00D8)	General-purpose write	Writes the specified parameter by setting a header code.	Yes	No
217 (00D9)	General-purpose read	Reads the specified parameter by setting a header code.	Yes	Yes

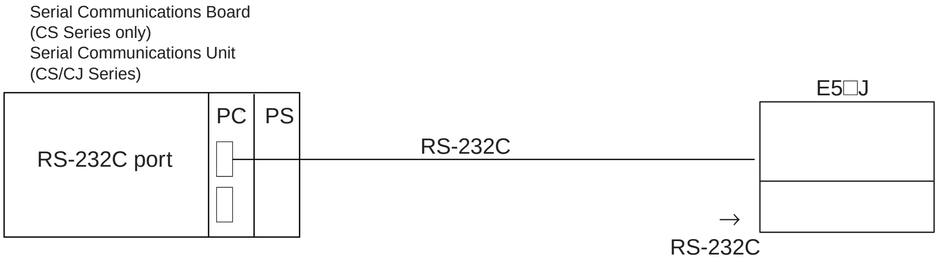
Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

2. **Ladder Interface Settings**
YES: User settings are required for the 3rd or 4th operands of PMCR.
NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
Receive word allocation:Set the constant 0000 for the 4th operand (D).

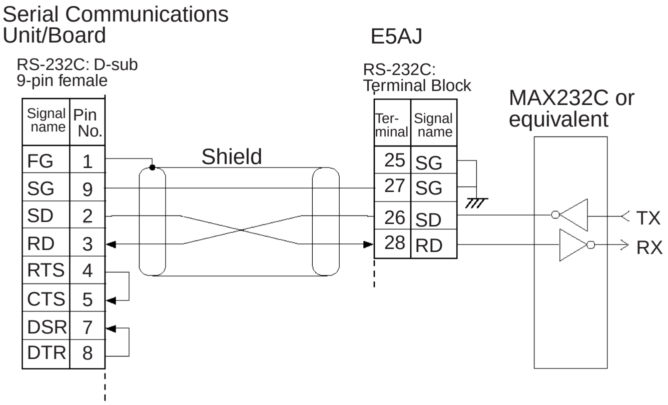
Connections

The connections for using the E5□J Temperature Controller Protocol are shown below.

RS-232C Connections

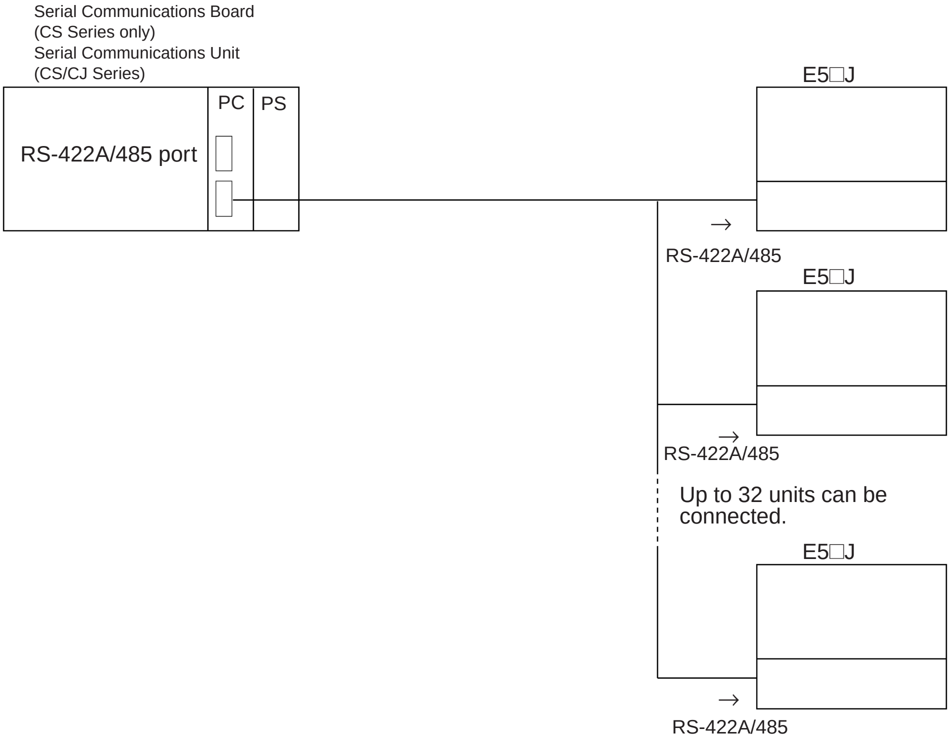


Signal name	Abbreviation	Signal direction	Pin No.
Signal ground or common return line	SG	---	25, 27
Send data	SD	Output	26
Receive data	RD	Input	28



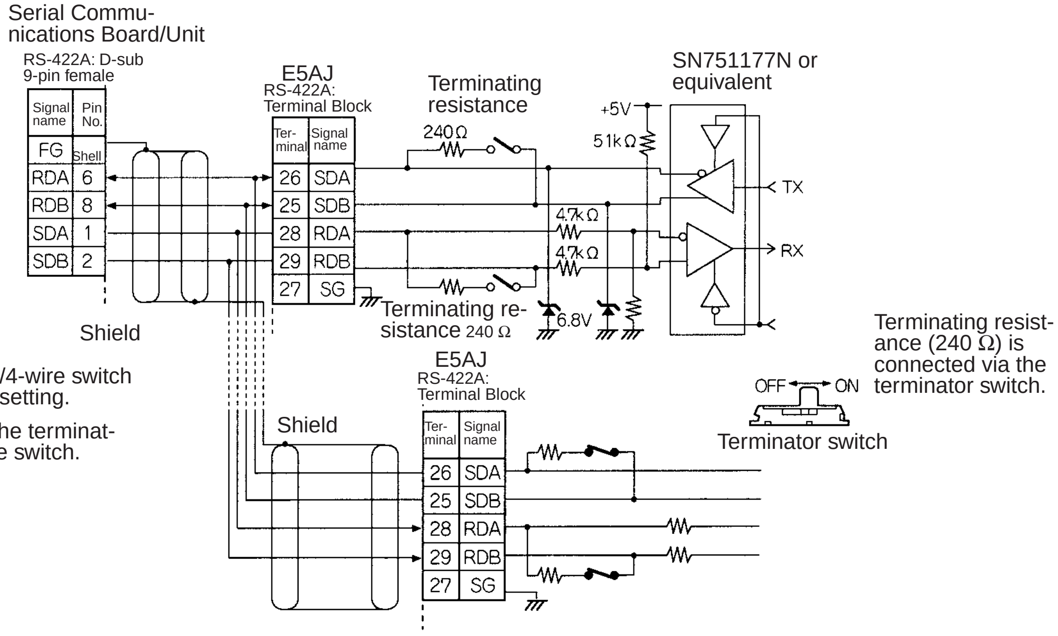
Note 1. The connection configuration is a one-to-one configuration and the maximum cable length is 15 m.
2. Use shielded twisted-pair cable.

RS-422A/485 Connections



- **RS-422A 4-wire connections**

Signal name	Abbreviation	Signal direction	Pin No.
Send data A	SDA	Output	26
Send data B	SDB	Output	25
Receive data A	RDA	Input	28
Receive data B	RDB	Input	29
Signal ground	SG	---	27

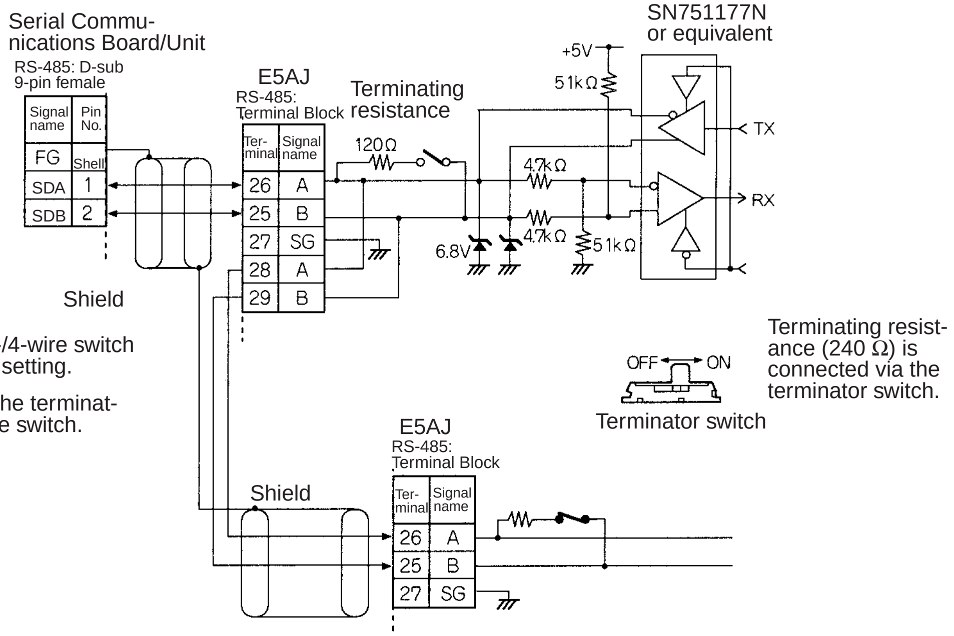


*1: Set the 2-/4-wire switch to the 4-wire setting.

*2: Turn ON the terminating resistance switch.

- **RS-485 2-wire Connections**

Signal name	Abbreviation	Signal direction	Pin No.
Terminal A	A	I/O	26, 28
Terminal B	B	I/O	25, 29
Signal ground	SG	---	27



Terminating resistance (240 Ω) is connected via the terminator switch.

*1: Set the 2-/4-wire switch to the 2-wire setting.

*2: Turn ON the terminating resistance switch.

Note
1. The connection configuration is a one-to-one or a one-to-N configuration. Using a one-to-N configuration, up to 32 units can be connected including the Serial Communications Boards Unit.
2. The maximum cable length is 500 m. Use shielded twisted-pair cable.
3. Connect terminating resistance to the devices only at both ends of the transmission path.
4. The total terminating resistance at both ends must be at least 100 Ω for RS-422A or 54 Ω for RS-485.

Select Remote Mode (Sequence No. 200 (Hex 00C8))

Switches the Controller to remote mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data +0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Select Local Mode (Sequence No. 201 (Hex 00C9))

Switches the Controller to local mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Select Backup Mode (Sequence No. 202 (Hex 00CA))

Switches from the set point write mode to backup mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Select RAM Write Mode (Sequence No. 203 (Hex 00CB))

Switches from set point write mode to RAM write mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Save Set Point (Sequence No. 204 (Hex 00CC))

Saves the set point.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Parameters 1 (Sequence No. 205 (Hex 00CD))

Writes the set point, alarm value 1, alarm value 2, and a heater burnout alarm value to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Set point		
	+4	Alarm value 1		
	+5	Alarm value 2		
	+6	Heater burnout alarm value		
	~		~	
	+122	(Undefined)	Unit No.	25th unit (max.)
	+123	Set point		
	+124	Alarm value 1		
	+125	Alarm value 2		
	+126	Heater burnout alarm value		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 5 + 2
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Set point (4 digits BCD)	0000 to 9999
+4	1st unit Alarm value 1 (4 digits BCD)	0000 to 9999
+5	1st unit Alarm value 2 (4 digits BCD)	0000 to 9999
+6	1st unit Heater burnout alarm value 2 (4 digits BCD)	0000 to 9999
+7	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+126 (max.)	25th unit Heater burnout alarm value 2 (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Parameters 2 (Sequence No. 206 (Hex 00CE))

Writes the proportional bands, integral times, and derivative times to multiple units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Proportional band		
	+4	Integral time		
	+5	Derivative time		
	~			
	+122	(Undefined)	Unit No.	31th unit (max.)
	+123	Proportional band		
	+124	Integral time		
	+125	Derivative time		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 4 + 2
+1	Number of units (4 digits Hex)	0001 to 001F (1 to 31 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Proportional band (4 digits BCD)	0000 to 9999
+4	1st unit Integral time (4 digits BCD)	0000 to 9999
+5	1st unit Derivative time (4 digits BCD)	0000 to 9999
+6	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+125 (max.)	31th unit Derivative time (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Input Shift Value (Sequence No. 207 (Hex 00CF))

Writes the input shift value.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Input shift value	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Input shift value (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Read Parameters 1 (Sequence No. 208 (Hex 00D0))

Reads the set points, alarm values 1, alarm values 2, and heater burnout alarm values for multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	~			
	+26	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+26 (max.)	25th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Set point	1st unit
	+2	Alarm value 1	
	+3	Alarm value 2	
	+4	Heater burnout alarm value	
	~		
	+97	Set point	25th unit (max.)
	+98	Alarm value 1	
	+99	Alarm value 2	
	+100	Heater burnout alarm value	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 4 + 1
+1	1st unit Set point (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+2	1st unit Alarm value 1 (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+3	1st unit Alarm value 2 (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+4	1st unit Heater burnout alarm value (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+5	2nd unit Set point (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
	• • •	
+100 (max.)	25th unit Heater burnout alarm value (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Read Parameters 2 (Sequence No. 209 (Hex 00D1))

Reads the proportional bands, integral times, and derivative times for multiple units and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	~			~
	+32	(Undefined)	Unit No.	(max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 001F (1 to 31 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+32 (max.)	31th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Proportional band	1st unit
	+2	Integral time	
	+3	Derivative time	
		⋮	
	+91	Proportional band	31th unit (max.)
	+92	Integral time	
	+93	Derivative time	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 3 + 1
+1	1st unit Proportional band (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+2	1st unit Integral time (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+3	1st unit Derivative time (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+4	2nd unit Proportional band (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
	• • •	
+93 (max.)	31th unit Derivative time (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Read Input Shift Value (Sequence No. 210 (Hex 00D2))

Reads the input shift value and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Input shift value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Input shift value (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Read Output Value (Sequence No. 211 (Hex 00D3))

Reads the output value and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Output value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Output value (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Read Process Value (Sequence No. 212 (Hex 00D4))

Reads the process value and status data and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Process value
	+2	Status data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Process value (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+2	Status data (4 digits Hex)	0000 to 9999

Read Set Point Limit (Sequence No. 213 (Hex 00D5))

Reads the set point limits and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Set point lower limit
	+2	Set point upper limit

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Set point lower limit (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+2	Set point upper limit (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Read Heater Current (Sequence No. 214 (Hex 00D6))

Reads the heater current and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Heater current
	+2	Status data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Heater current (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.
+2	Status data (4 digits Hex)	0000 to 0011

Read Initial Status (Sequence No. 215 (Hex 00D7))

Reads the initial status and stores the results in the specified word.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words			
	+1	(Undefined)		Status	
	+2	(Undefined)	Alarm 1 type	Alarm 2 type	Input type

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003
+1	Status (2 digits Hex)	00 to 99
+2	Alarm 1 type (1 digit Hex) Alarm 2 type (1 digit Hex) Input type (1 digit BCD)	0 to 9 0 to 9 0 to 9

General-purpose Write (Sequence No. 216 (Hex 00D8))

Writes the parameter specified by setting a header code.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Header code (ASC)	
	+3	(Undefined)	Data code
	+4	Send data	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Header code (two ASCII characters)	Header codes that can be set MB, WS, W%, WW, WB, WN, WV
+3	Data code (2 digits BCD)	01 to 02
+4	Write data (4 digits BCD)	0000 to 9999

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

General-purpose Read (Sequence No. 217 (Hex 00D9))

Reads the parameter specified by setting a header

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Header code (ASC)	
	+3	(Undefined)	Data code

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2	Header code (two ASCII characters)	Header codes that can be set RS, R%, RW, RB, RN, RV, RO
+3	Data code (2 digits BCD)	01 to 02

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Receive data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002
+1	Read data (4 digits BCD)	0000 to 9999 When the left digit is –1, A is set and when it is –, F is set.

Note The completion code is not included in the read data.

Appendix H

ES100☐ Digital Controller Protocol

The ES100☐ Digital Controller Protocol controls in remote mode and reads various settings from the Controller connected to the Serial Communications Unit/Board via RS-232C or RS-422A/485 cable.

Note Negative values cannot be written. All values must be set as unsigned BCD.

Structure of the Protocol

The structure of the ES100☐ Digital Controller Protocol is shown below.

Sequence No.	Transmission sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
250 (00FA)	Read event data	Reads events 1 to 10 in the variable area.	Yes	Yes
251 (00FB)	Read time signals	Reads time signals 1 to 10 in the variable area.	Yes	Yes
252 (00FC)	Read error detection data	Reads error groups 1 to 15 in the variable area.	Yes	Yes
253 (00FD)	Read heater burnout data	Reads the heater burnout alarm.	Yes	Yes
254 (00FE)	Read PV data	Reads PV data in the variable area.	Yes	Yes
255 (00FF)	Read SP data	Reads SP data in the variable area.	Yes	Yes
256 (0100)	Read MV	Reads the MV in the variable area.	Yes	Yes
257 (0101)	Read control monitor data	Reads control monitor data (SP, PV, and MV) in the variable area.	Yes	Yes
258 (0102)	Read adjustment parameters	Reads adjustment parameters in the parameter area.	Yes	Yes
259 (0103)	Write adjustment parameters	Writes adjustment parameters in the parameter area.	Yes	No
260 (0104)	Read PID control parameters 1	Reads PID parameters No. 1 to 4 from the PID control parameters in the parameter area.	Yes	Yes
261 (0105)	Read PID control parameters 2	Reads PID parameters No. 5 to 8 from the PID control parameters in the parameter area.	Yes	Yes
262 (0106)	Write PID control parameters 1	Writes PID parameters No. 1 to 4 from PID control parameters in the parameter area.	Yes	No
263 (0107)	Write PID control parameters 2	Writes PID parameters No. 5 to 8 from PID control parameters in the parameter area.	Yes	No
264 (0108)	Read local SP	Reads the local SP in the program parameter area.	Yes	Yes
265 (0109)	Write local SP	Writes local SP in the program parameter area.	Yes	No
266 (010A)	Read program parameters	Reads local SP, step time, PID No. wait code, and events 1 to 10 set values in the program parameter area.	Yes	Yes
267 (010B)	Write program parameters	Writes the local SP, step time, PID No., wait code, and event 1 to 10 set values in the program parameter area.	Yes	No
268 (010C)	Remote setting mode	Switches the setting mode to remote setting.	Yes	No
269 (010D)	Local setting mode	Switches the setting mode to local setting.	Yes	No
270 (010E)	External setting mode	Switches the setting mode to external setting.	Yes	No

Sequence No.	Transmission sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
271 (010F)	Run command	Starts control.	Yes	No
272 (0110)	Reset (stop)	Stops control.	Yes	No
273 (0111)	Auto mode	Switches the control mode to auto.	Yes	No
274 (0112)	Manual mode	Switches the control mode to a manual.	Yes	No
275 (0113)	Execute A.T.	Executes A.T.	Yes	No
276 (0114)	Cancel A.T.	Cancels A.T.	Yes	No
277 (0115)	Change pattern No.	Changes the pattern No.	Yes	No
278 (0116)	Change bank No.	Changes the bank No.	Yes	No
279 (0117)	Read controller status	Reads the controller status.	Yes	Yes
280 (0118)	General-purpose command	Sends specified data and stores the received data in the specified words.	Yes	Yes

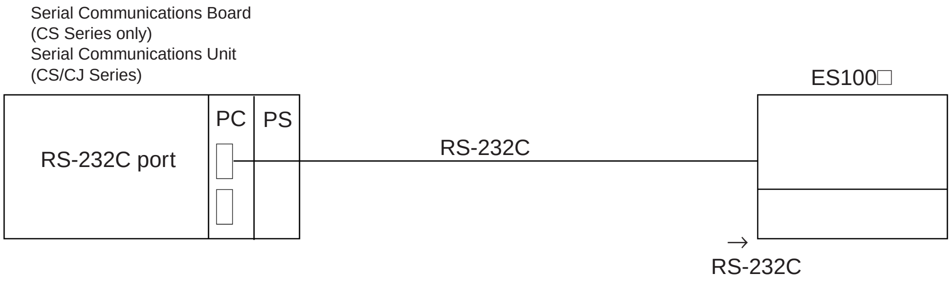
Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

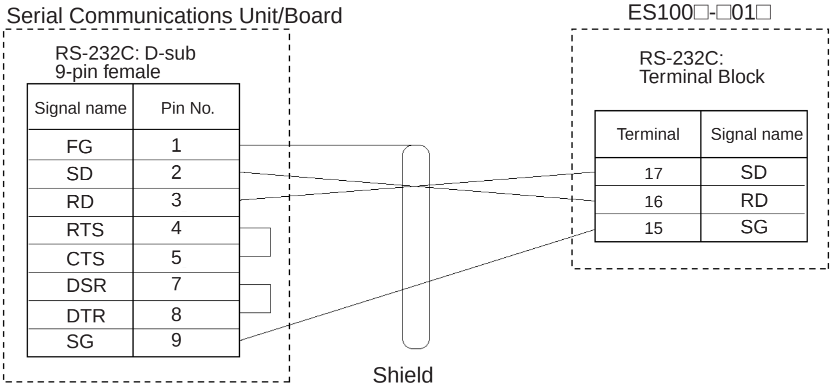
2. **Ladder Interface Settings**
YES: User settings are required for the 3rd and 4th operands of PMCR(260).
NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
Receive word allocation: Set the constant 0000 for the 4th operand (D).

Connections

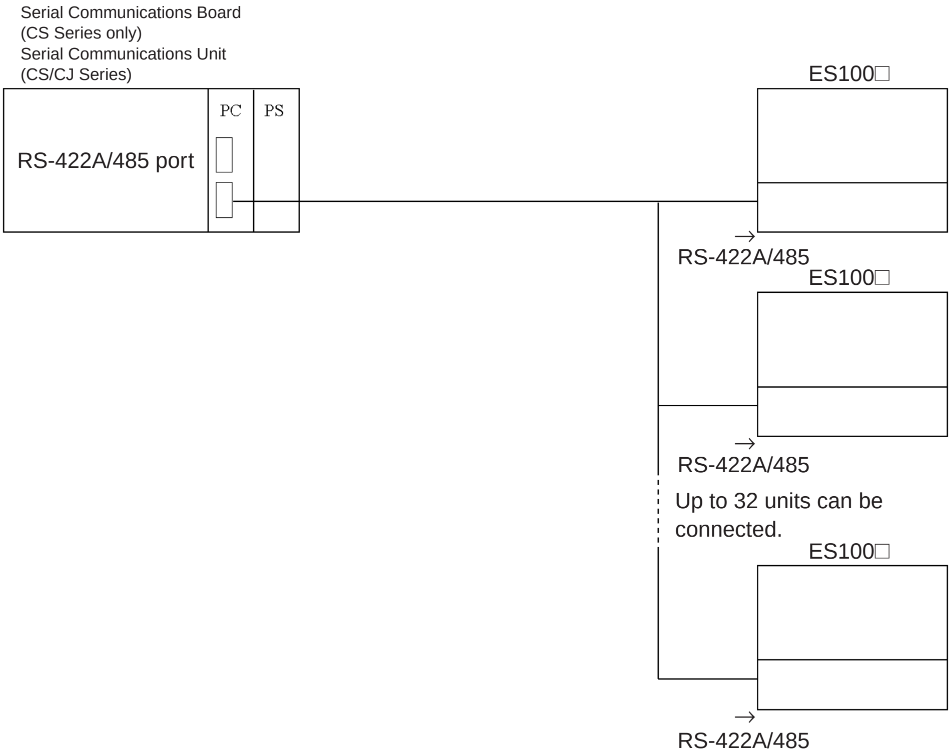
Connections for using the ES100☐ Digital Controller Protocol are shown below.

RS-232C Connections

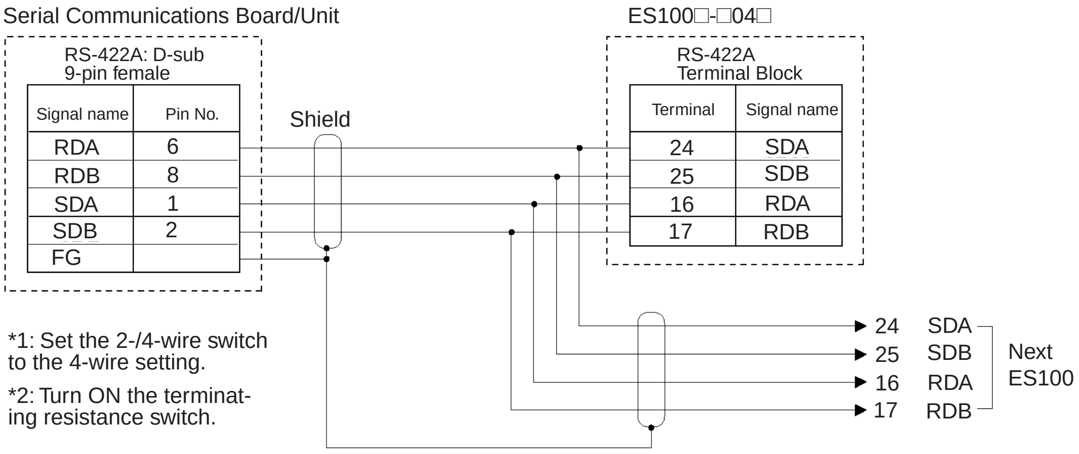




RS-422A/485 Connections



• RS-422A 4-wire Connections



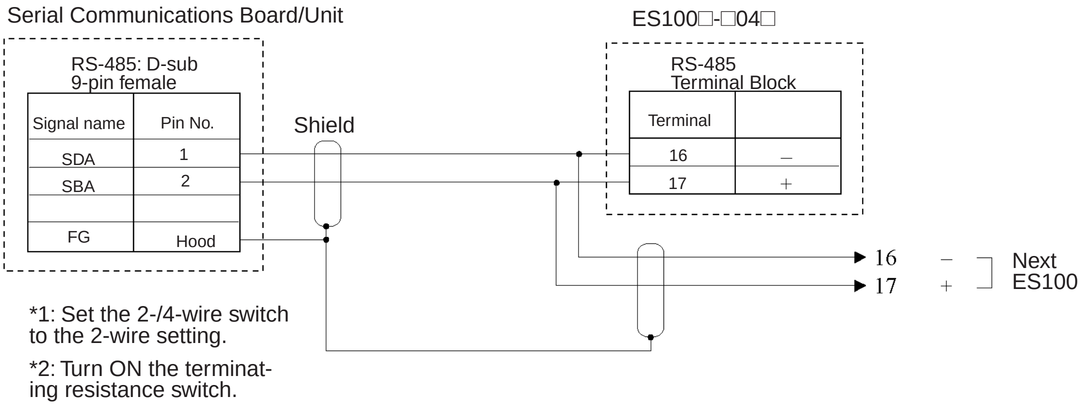
Signal name	Pin No.
RDA	6
RDB	8
SDA	1
SDB	2
FG	

Terminal	Signal name
24	SDA
25	SDB
16	RDA
17	RDB

*1: Set the 2-/4-wire switch to the 4-wire setting.

*2: Turn ON the terminating resistance switch.

• RS-485 2-wire Connections



Signal name	Pin No.
SDA	1
SBA	2
FG	Hood

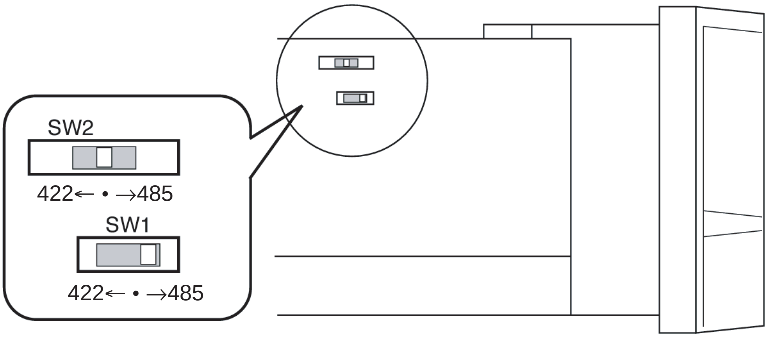
Terminal	
16	−
17	+

*1: Set the 2-/4-wire switch to the 2-wire setting.

*2: Turn ON the terminating resistance switch.

Switch Settings

There are two switches located on the board on the left of the Unit. Set SW1 to the interface: RS-422A or RS-485. Set SW2 to the same setting as SW1 on the terminating Units and to the center on all other Units.



Read Event Data (Sequence No. 250 (Hex 00FA))

Reads events 1 to 10 in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+26	(Undefined)	Unit No.	25th unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+26 (max.)	25th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	Event 1	Event 2	1st unit
	+2	Event 3	Event 4	
	+3	Event 5	Event 6	
	+4	Event 7	Event 8	
	+5	Event 9	Event 10	
	~		~	
	+121	Event 1	Event 2	25th unit (max.)
	+122	Event 3	Event 4	
	+123	Event 5	Event 6	
	+124	Event 7	Event 8	
	+125	Event 9	Event 10	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units x 5 + 1
+1	1st unit Event data 1 (2 digits Hex) Event data 2 (2 digits Hex)	00 to FF 00 to FF
+2	1st unit Event data 3 (2 digits Hex) Event data 4 (2 digits Hex)	00 to FF 00 to FF
+3	1st unit Event data 5 (2 digits Hex) Event data 6 (2 digits Hex)	00 to FF 00 to FF
+4	1st unit Event data 7 (2 digits Hex) Event data 8 (2 digits Hex)	00 to FF 00 to FF
+5	1st unit Event data 9 (2 digits Hex) Event data 10 (2 digits Hex)	00 to FF 00 to FF
	• • •	
+125 (max.)	25th unit Event data 9 (2 digits Hex) Event data 10 (2 digits Hex)	00 to FF 00 to FF

Read Time Signal (Sequence No. 251 (Hex 00FB))

Reads time signals from 1 to 10 in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~		~	
	+26	(Undefined)	Unit No.	25th unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31

Offset	Contents (data format)	Data
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+26 (max.)	25th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	Time signal 1	Time signal 2	1st unit
+2	Time signal 3	Time signal 4	
+3	Time signal 5	Time signal 6	
+4	Time signal 7	Time signal 8	
+5	Time signal 9	Time signal 10	
~			
+121	Time signal 1	Time signal 2	25th unit (max.)
+122	Time signal 3	Time signal 4	
+123	Time signal 5	Time signal 6	
+124	Time signal 7	Time signal 8	
+125	Time signal 9	Time signal 10	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 5 + 1
+1	1st unit Time signal 1 data (2 digits Hex) Time signal 2 data (2 digits Hex)	00 to FF 00 to FF
+2	1st unit Time signal 3 data (2 digits Hex) Time signal 4 data (2 digits Hex)	00 to FF 00 to FF
+3	1st unit Time signal 5 data (2 digits Hex) Time signal 6 data (2 digits Hex)	00 to FF 00 to FF
+4	1st unit Time signal 7 data (2 digits Hex) Time signal 8 data (2 digits Hex)	00 to FF 00 to FF
+5	1st unit Time signal 9 data (2 digits Hex) Time signal 10 data (2 digits Hex)	00 to FF 00 to FF
	• • •	
+125 (max.)	25th unit Time signal 9 data (2 digits Hex) Time signal 10 data (2 digits Hex)	00 to FF 00 to FF

Read Error Detection Data (Sequence No. 252 (Hex 00FC))

Reads error groups from 0 to 15 in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+17	(Undefined)	Unit No.	16th unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0010 (1 to 16 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+17 (max.)	16th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	Error group 0	Error group 1	1st unit
	+2	Error group 2	Error group 3	
	+3	Error group 4	Error group 5	
	+4	Error group 6	Error group 7	
	+5	Error group 8	Error group 9	
	+6	Error group 10	Error group 11	
	+7	Error group 12	Error group 13	
	+8	Error group 14	Error group 15	
	~			~
	+128	Error group 14	Error group 15	16th unit (max.)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 8 + 1
+1	1st unit Error group 0 data (2 digits Hex) Error group 1 data (2 digits Hex)	00 to FF 00 to FF
+2	1st unit Error group 2 data (2 digits Hex) Error group 3 data (2 digits Hex)	00 to FF 00 to FF
	• •	
+7	1st unit Error group 12 data (2 digits Hex) Error group 13 data (2 digits Hex)	00 to FF 00 to FF
+8	1st unit Error group 14 data (2 digits Hex) Error group 15 data (2 digits Hex)	00 to FF 00 to FF
+9	2nd unit Error group 0 data (2 digits Hex) Error group 1 data (2 digits Hex)	00 to FF 00 to FF

Offset	Contents (data format)	Data
	• •	
+128 (max.)	16th unit Error group 14 data (2 digits Hex) Error group 15 data (2 digits Hex)	00 to FF 00 to FF

Read Heater Burnout Data (Sequence No. 253 (Hex 00FD))

Reads the heater burnout alarm in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	(Undefined)	Heater burnout alarm	1st unit
	+2	(Undefined)	Heater burnout alarm	2nd unit
	+3	(Undefined)	Heater burnout alarm	3rd unit
	+4	(Undefined)	Heater burnout alarm	4th unit
	~			~
	+32	(Undefined)	Heater burnout alarm	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units +1
+1	1st unit Heater burnout alarm (2 digits Hex)	00 to FF
+2	2nd unit Heater burnout alarm (2 digits Hex)	00 to FF
+3	3rd unit Heater burnout alarm (2 digits Hex)	00 to FF
+4	4th unit Heater burnout alarm (2 digits Hex)	00 to FF
	• • •	
+32 (max.)	32nd unit Heater burnout alarm (2 digits Hex)	00 to FF

Read PV Data (Sequence No. 254 (Hex 00FE))

Reads the PV data for the variable type “analog data” in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	PV data (rightmost 4 digits)	1st unit
	+2	PV data (leftmost 4 digits)	
	+3	PV data (rightmost 4 digits)	2nd unit
	+4	PV data (leftmost 4 digits)	
	~		~
	+63	PV data (rightmost 4 digits)	32nd unit
	+64	PV data (leftmost 4 digits)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 2 + 1
+1	1st unit PV data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+2	1st unit PV data (leftmost 4 digits) (4 digits BCD)	
+3	2nd unit PV data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+4	2nd unit PV data (leftmost 4 digits) (4 digits BCD)	
	• • •	
+63	32nd unit PV data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+64	32nd unit PV data (leftmost 4 digits) (4 digits BCD)	

Read SP Data (Sequence No. 255 (Hex 00FF))

Reads the SP data for the variable type “analog data” in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words		
+1	Number of units		
+2	(Undefined)	Unit No.	1st unit
+3	(Undefined)	Unit No.	2nd unit
~			
+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	SP data (rightmost 4 digits)	1st unit
+2	SP data (leftmost 4 digits)	
+3	SP data (rightmost 4 digits)	2nd unit
+4	SP data (leftmost 4 digits)	
~		
+63	SP data (rightmost 4 digits)	32nd unit
+64	SP data (leftmost 4 digits)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 2 + 1
+1	1st unit SP data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+2	1st unit SP data (leftmost 4 digits) (4 digits BCD)	
+3	2nd unit SP data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+4	2nd unit SP data (leftmost 4 digits) (4 digits BCD)	
	• • •	
+63	32nd unit SP data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+64	32nd unit SP data (leftmost 4 digits) (4 digits BCD)	

Read MV Data (Sequence No. 256 (Hex 0100))

Reads the MV for the variable type “analog data” in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	MV (rightmost 4 digits)	1st unit
	+2	MV (leftmost 4 digits)	
	+3	MV (rightmost 4 digits)	2nd unit
	+4	MV (leftmost 4 digits)	
	~		~
	+63	MV (rightmost 4 digits)	32nd unit
	+64	MV (leftmost 4 digits)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 2 + 1
+1	1st unit MV (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+2	1st unit MV (leftmost 4 digits) (4 digits BCD)	
+3	2nd unit MV (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+4	2nd unit MV (leftmost 4 digits) (4 digits BCD)	
	• • •	
+63	32nd unit MV (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+64	32nd unit MV (leftmost 4 digits) (4 digits BCD)	

Read Control Monitor Data (Sequence No. 257 (Hex 0101))

Reads the control monitor data (SP/PV/MV) in the variable area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+22	(Undefined)	Unit No.	21st unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0015 (1 to 21 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+22 (max.)	21st unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	SP data (rightmost 4 digits)	1st unit
	+2	SP data (leftmost 4 digits)	
	+3	PV data (rightmost 4 digits)	
	+4	PV data (leftmost 4 digits)	
	+5	MV (rightmost 4 digits)	
	+6	MV (leftmost 4 digits)	
	~		~
	+121	SP data (rightmost 4 digits)	21st unit
	+122	SP data (leftmost 4 digits)	
	+123	PV data (rightmost 4 digits)	
	+124	PV data (leftmost 4 digits)	
	+125	MV (rightmost 4 digits)	
	+126	MV (leftmost 4 digits)	

Offset	Contents (data format)	Data
+0	1st unit Number of receive data words (4 digits Hex)	Number of units × 6 + 1
+1	1st unit SP data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+2	1st unit SP data (leftmost 4 digits) (4 digits BCD)	
+3	1st unit PV data (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+4	1st unit PV data (leftmost 4 digits) (4 digits BCD)	
+5	1st unit MV (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+6	1st unit MV (leftmost 4 digits) (4 digits BCD)	

Offset	Contents (data format)	Data
	• • •	
+125	21st unit MV (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+126	21st unit MV (leftmost 4 digits) (4 digits BCD)	

Read Adjustment Parameters (Sequence No. 258 (Hex 0102))

Reads the adjustment parameters in the parameter area and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data +0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Fixed SP	(rightmost 4 digits)
	+2		(leftmost 4 digits)
	+3	Control output 1 pulse cycle	(rightmost 4 digits)
	+4		(leftmost 4 digits)
	+5	Control output 2 pulse cycle	(rightmost 4 digits)
	+6		(leftmost 4 digits)
	+7	Fuzzy strength	(rightmost 4 digits)
	+8		(leftmost 4 digits)
	+9	Cooling coefficient	(rightmost 4 digits)
	+10		(leftmost 4 digits)
	+11	Heater burnout alarm setting	(rightmost 4 digits)
	+12		(leftmost 4 digits)
	+13	Position-proportional dead band	(rightmost 4 digits)
	+14		(leftmost 4 digits)
	+15	Switching output hysteresis	(rightmost 4 digits)
	+16		(leftmost 4 digits)
	+17	ON/OFF count alarm setting	(rightmost 4 digits)
	+18		(leftmost 4 digits)
	+19	ON/OFF control hysteresis	(rightmost 4 digits)
	+20		(leftmost 4 digits)
	+21	Manual reset	(rightmost 4 digits)
	+22		(leftmost 4 digits)
	+23	SP setting lower limit	(rightmost 4 digits)
	+24		(leftmost 4 digits)
	+25	SP setting upper limit	(rightmost 4 digits)
	+26		(leftmost 4 digits)
	+27	SP rise rate limit	(rightmost 4 digits)
	+28		(leftmost 4 digits)
	+29	SP fall rate limit	(rightmost 4 digits)
	+30		(leftmost 4 digits)
	+31	MV rate-of-change limit	(rightmost 4 digits)
	+32		(leftmost 4 digits)
	+33	Secondary loop fixed SP	(rightmost 4 digits)
	+34		(leftmost 4 digits)
	+35	Secondary loop P	(rightmost 4 digits)
	+36		(leftmost 4 digits)
	+37	Secondary loop I	(rightmost 4 digits)
	+38		(leftmost 4 digits)
	+39	Secondary loop D	(rightmost 4 digits)
	+40		(leftmost 4 digits)
	+41	Secondary loop manual reset	(rightmost 4 digits)
	+42		(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	002B (0043 decimal)
+1 to 2	Fixed SP (8 digits BCD)	00000000 to 09999000 F indicates a negative number.
+3 to 4	Control output 1 pulse cycle (8 digits BCD)	
+5 to 6	Control output 2 pulse cycle (8 digits BCD)	
+7 to 8	Fuzzy strength (8 digits BCD)	
+9 to 10	Cooling coefficient (8 digits BCD)	
+11 to 12	Heater burnout alarm setting (8 digits BCD)	
+13 to 14	Position-proportional dead band (8 digits BCD)	
+15 to 16	Switching output hysteresis (8 digits BCD)	
+17 to 18	ON/OFF count alarm setting (8 digits BCD)	
+19 to 20	ON/OFF control hysteresis (8 digits BCD)	
+21 to 22	Manual reset (8 digits BCD)	
+23 to 24	SP setting lower limit (8 digits BCD)	
+25 to 26	SP setting upper limit (8 digits BCD)	
+27 to 28	SP rise rate limit (8 digits BCD)	
+29 to 30	SP fall rate limit (8 digits BCD)	
+31 to 32	MV rate-of-change limit (8 digits BCD)	
+33 to 34	Secondary loop fixed SP (8 digits BCD)	
+35 to 36	Secondary loop P (8 digits BCD)	
+37 to 38	Secondary loop I (8 digits BCD)	
+39 to 40	Secondary loop D (8 digits BCD)	
+41 to 42	Secondary loop manual reset (8 digits BCD)	

Write Adjustment Parameters (Sequence No. 259 (Hex 0103))

Writes the adjust parameters in the parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	Fixed SP	(rightmost 4 digits)
	+3		(leftmost 4 digits)
	+4	Control output 1 pulse cycle	(rightmost 4 digits)
	+5		(leftmost 4 digits)
	+6	Control output 2 pulse cycle	(rightmost 4 digits)
	+7		(leftmost 4 digits)
	+8	Fuzzy strength	(rightmost 4 digits)
	+9		(leftmost 4 digits)
	+10	Cooling coefficient	(rightmost 4 digits)
	+11		(leftmost 4 digits)
	+12	Heater burnout alarm setting	(rightmost 4 digits)
	+13		(leftmost 4 digits)
	+14	Position-proportional dead band	(rightmost 4 digits)
	+15		(leftmost 4 digits)
	+16	Switching output hysteresis	(rightmost 4 digits)
	+17		(leftmost 4 digits)
	+18	ON/OFF count alarm setting	(rightmost 4 digits)
	+19		(leftmost 4 digits)
	+20	ON/OFF control hysteresis	(rightmost 4 digits)
	+21		(leftmost 4 digits)
	+22	Manual reset	(rightmost 4 digits)
	+23		(leftmost 4 digits)
	+24	SP setting lower limit	(rightmost 4 digits)
	+25		(leftmost 4 digits)
	+26	SP setting upper limit	(rightmost 4 digits)
	+27		(leftmost 4 digits)
	+28	SP rise rate limit	(rightmost 4 digits)
	+29		(leftmost 4 digits)
	+30	SP fall rate limit	(rightmost 4 digits)
	+31		(leftmost 4 digits)
	+32	MV change rate limit	(rightmost 4 digits)
	+33		(leftmost 4 digits)
	+34	Secondary loop fixed SP	(rightmost 4 digits)
	+35		(leftmost 4 digits)
	+36	Secondary loop P	(rightmost 4 digits)
	+37		(leftmost 4 digits)
	+38	Secondary loop I	(rightmost 4 digits)
	+39		(leftmost 4 digits)
	+40	Secondary loop D	(rightmost 4 digits)
	+41		(leftmost 4 digits)
	+42	Secondary loop manual reset	(rightmost 4 digits)
	+43		(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	002C (0044 decimal) (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2 to 3	Fixed SP (8 digits BCD)	00000000 to 09999000
+4 to 5	Control output 1 pulse cycle (8 digits BCD)	
+6 to 7	Control output 2 pulse cycle (8 digits BCD)	
+8 to 9	Fuzzy strength (8 digits BCD)	
+10 to 11	Cooling coefficient (8 digits BCD)	
+12 to 13	Heater burnout alarm setting (8 digits BCD)	
+14 to 15	Position-proportional dead band (8 digits BCD)	
+16 to 17	Switching output hysteresis (8 digits BCD)	
+18 to 19	ON/OFF count alarm setting (8 digits BCD) value	
+20 to 21	ON/OFF control hysteresis (8 digits BCD)	
+22 to 23	Manual reset (8 digits BCD)	
+24 to 25	SP setting lower limit (8 digits BCD)	
+26 to 27	SP setting upper limit (8 digits BCD)	
+28 to 29	SP rise rate limit (8 digits BCD)	
+30 to 31	SP fall rate limit (8 digits BCD)	
+32 to 33	MV rate-of-change limit (8 digits BCD)	
+34 to 35	Secondary loop fixed SP (8 digits BCD)	
+36 to 37	Secondary loop P (8 digits BCD)	
+38 to 39	Secondary loop I (8 digits BCD)	
+40 to 41	Secondary loop D (8 digits BCD)	
+42 to 43	Secondary loop manual reset (8 digits BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Read PID Control Parameters 1 (Sequence No. 260 (Hex 0104))

Reads PID parameters No. 1 to 4 from PID control parameters in the parameter area and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	PID No. 1 P	(rightmost 4 digits)
	+2	PID No. 1 P	(leftmost 4 digits)
	+3	PID No. 1 I	(rightmost 4 digits)
	+4	PID No. 1 I	(leftmost 4 digits)
	+5	PID No. 1 D	(rightmost 4 digits)
	+6	PID No. 1 D	(leftmost 4 digits)
	+7	PID No. 1 MV lower limit	(rightmost 4 digits)
	+8	PID No. 1 MV lower limit	(leftmost 4 digits)
	+9	PID No. 1 MV upper limit	(rightmost 4 digits)
	+10	PID No. 1 MV upper limit	(leftmost 4 digits)
	+11	PID No. 1 PV bias value	(rightmost 4 digits)
	+12	PID No. 1 PV bias value	(leftmost 4 digits)
	+13	PID No. 1 Automatic selection range upper limit	(rightmost 4 digits)
	+14	PID No. 1 Automatic selection range upper limit	(leftmost 4 digits)
	~	⋮	~
	+51	PID No. 4 MV upper limit	(rightmost 4 digits)
	+52	PID No. 4 MV upper limit	(leftmost 4 digits)
	+53	PID No. 4 PV bias value	(rightmost 4 digits)
	+54	PID No. 4 PV bias value	(leftmost 4 digits)
	+55	PID No. 4 Automatic selection range upper limit	(rightmost 4 digits)
	+56	PID No. 4 Automatic selection range upper limit	(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0039 (0057 decimal)
+1 to 2	PID No. 1 P (8 digits BCD)	00000000 to 09999000
+3 to 4	PID No. 1 I (8 digits BCD)	
+5 to 6	PID No. 1 D (8 digits BCD)	
+7 to 8	PID No. 1 MV lower limit (8 digits BCD)	
+9 to 10	PID No. 1 MV upper limit (8 digits BCD)	
+11 to 12	PID No. 1 PV bias value (8 digits BCD)	
+13 to 14	PID No. 1 Automatic selection range upper limit (8 digits BCD)	
	• • •	
+43 to 44	PID No. 4 P (8 digits BCD)	
+45 to 46	PID No. 4 I (8 digits BCD)	
+47 to 48	PID No. 4 D (8 digits BCD)	
+49 to 50	PID No. 4 MV lower limit (8 digits BCD)	
+51 to 52	PID No. 4 MV upper limit (8 digits BCD)	
+53 to 54	PID No. 4 PV bias value (8 digits BCD)	
+55 to 56	PID No. 4 Automatic selection range upper limit (8 digits BCD)	

Read PID Control Parameters 2 (Sequence No. 261 (Hex 0105))

Reads PID parameters No. 5 to 8 from the PID control parameters in the parameter area and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	PID No. 5 P	(rightmost 4 digits)
	+2	PID No. 5 P	(leftmost 4 digits)
	+3	PID No. 5 I	(rightmost 4 digits)
	+4	PID No. 5 I	(leftmost 4 digits)
	+5	PID No. 5 D	(rightmost 4 digits)
	+6	PID No. 5 D	(leftmost 4 digits)
	+7	PID No. 5 MV lower limit	(rightmost 4 digits)
	+8	PID No. 5 MV lower limit	(leftmost 4 digits)
	+9	PID No. 5 MV upper limit	(rightmost 4 digits)
	+10	PID No. 5 MV upper limit	(leftmost 4 digits)
	+11	PID No. 5 PV bias value	(rightmost 4 digits)
	+12	PID No. 5 PV bias value	(leftmost 4 digits)
	+13	PID No. 5 Automatic selection range upper limit	(rightmost 4 digits)
	+14	PID No. 5 Automatic selection range upper limit	(leftmost 4 digits)

+51	PID No. 8 MV upper limit	(rightmost 4 digits)
+52	PID No. 8 MV upper limit	(leftmost 4 digits)
+53	PID No. 8 PV bias value	(rightmost 4 digits)
+54	PID No. 8 PV bias value	(leftmost 4 digits)
+55	PID No. 8 Automatic selection range upper limit	(rightmost 4 digits)
+56	PID No. 8 Automatic selection range upper limit	(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0039 (0057 decimal)
+1 to 2	PID No. 5 P (8 digits BCD)	00000000 to 09999000
+3 to 4	PID No. 5 I (8 digits BCD)	
+5 to 6	PID No. 5 D (8 digits BCD)	
+7 to 8	PID No. 5 MV lower limit (8 digits BCD)	
+9 to 10	PID No. 5 MV upper limit (8 digits BCD)	
+11 to 12	PID No. 5 PV bias value (8 digits BCD)	
+13 to 14	PID No. 5 Automatic selection range upper limit (8 digits BCD)	
	• • •	
+43 to 44	PID No. 8 P (8 digits BCD)	
+45 to 46	PID No. 8 I (8 digits BCD)	
+47 to 48	PID No. 8 D (8 digits BCD)	
+49 to 50	PID No. 8 MV lower limit (8 digits BCD)	
+51 to 52	PID No. 8 MV upper limit (8 digits BCD)	
+53 to 54	PID No. 8 PV bias value (8 digits BCD)	
+55 to 56	PID No. 8 Automatic selection range upper limit (8 digits BCD)	

Write PID Control Parameters 1 (Sequence No. 262 (Hex 0106))

Writes PID parameters No. 1 to 4 to the PID control parameters in the parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	PID No. 1 P		(rightmost 4 digits)
	+3	PID No. 1 P		(leftmost 4 digits)
	+4	PID No. 1 I		(rightmost 4 digits)
	+5	PID No. 1 I		(leftmost 4 digits)
	+6	PID No. 1 D		(rightmost 4 digits)
	+7	PID No. 1 D		(leftmost 4 digits)
	+8	PID No. 1 MV lower limit		(rightmost 4 digits)
	+9	PID No. 1 MV lower limit		(leftmost 4 digits)
	+10	PID No. 1 MV upper limit		(rightmost 4 digits)
	+11	PID No. 1 MV upper limit		(leftmost 4 digits)
	+12	PID No. 1 PV bias value		(rightmost 4 digits)
	+13	PID No. 1 PV bias value		(leftmost 4 digits)
	+14	PID No. 1 Automatic selection range upper limit		(rightmost 4 digits)
	+15	PID No. 1 Automatic selection range upper limit		(leftmost 4 digits)
		⋮		
	+52	PID No. 4 MV upper limit		(rightmost 4 digits)
	+53	PID No. 4 MV upper limit		(leftmost 4 digits)
	+54	PID No. 4 PV bias value		(rightmost 4 digits)
	+55	PID No. 4 PV bias value		(leftmost 4 digits)
	+56	PID No. 4 Automatic selection range upper limit		(rightmost 4 digits)
	+57	PID No. 4 Automatic selection range upper limit		(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	003A (0058 decimal) (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2 to 3	PID No. 1 P (8 digits BCD)	00000000 to 09999000
+4 to 5	PID No. 1 I (8 digits BCD)	
+6 to 7	PID No. 1 D (8 digits BCD)	
+8 to 9	PID No. 1 MV lower limit (8 digits BCD)	
+10 to 11	PID No. 1 MV upper limit (8 digits BCD)	
+12 to 13	PID No. 1 PV bias value (8 digits BCD)	
+14 to 15	PID No. 1 Automatic selection range upper limit (8 digits BCD)	
	• • •	
+44 to 45	PID No. 4 P (8 digits BCD)	
+46 to 47	PID No. 4 I (8 digits BCD)	
+48 to 49	PID No. 4 D (8 digits BCD)	
+50 to 51	PID No. 4 MV lower limit (8 digits BCD)	
+52 to 53	PID No. 4 MV upper limit (8 digits BCD)	
+54 to 55	PID No. 4 PV bias value (8 digits BCD)	
+56 to 57	PID No. 4 Automatic selection range upper limit (8 digits BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write PID Control Parameters 2 (Sequence No. 263 (Hex 0107))

Writes the PID parameters No. 5 to 8 to the PID control parameters in the parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	PID No. 5 P		(rightmost 4 digits)
	+3	PID No. 5 P		(leftmost 4 digits)
	+4	PID No. 5 I		(rightmost 4 digits)
	+5	PID No. 5 I		(leftmost 4 digits)
	+6	PID No. 5 D		(rightmost 4 digits)
	+7	PID No. 5 D		(leftmost 4 digits)
	+8	PID No. 5 MV lower limit		(rightmost 4 digits)
	+9	PID No. 5 MV lower limit		(leftmost 4 digits)
	+10	PID No. 5 MV upper limit		(rightmost 4 digits)
	+11	PID No. 5 MV upper limit		(leftmost 4 digits)
	+12	PID No. 5 PV bias value		(rightmost 4 digits)
	+13	PID No. 5 PV bias value		(leftmost 4 digits)
	+14	PID No. 5 Automatic selection range upper limit		(rightmost 4 digits)
	+15	PID No. 5 Automatic selection range upper limit		(leftmost 4 digits)
	~	⋮		
	+52	PID No. 8 MV upper limit		(rightmost 4 digits)
	+53	PID No. 8 MV upper limit		(leftmost 4 digits)
	+54	PID No. 8 PV bias value		(rightmost 4 digits)
	+55	PID No. 8 PV bias value		(leftmost 4 digits)
	+56	PID No. 8 Automatic selection range upper limit		(rightmost 4 digits)
	+57	PID No. 8 Automatic selection range upper limit		(leftmost 4 digits)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	003A (0058 decimal) (fixed)
+1	Unit No. (2 digits BCD)	00 to 31
+2 to 3	PID No. 5 P (8 digits BCD)	00000000 to 09999000
+4 to 5	PID No. 5 I (8 digits BCD)	
+6 to 7	PID No. 5 D (8 digits BCD)	
+8 to 9	PID No. 5 MV lower limit (8 digits BCD)	
+10 to 11	PID No. 5 MV upper limit (8 digits BCD)	
+12 to 13	PID No. 5 PV bias value (8 digits BCD)	
+14 to 15	PID No. 5 Automatic selection range upper limit (8 digits BCD)	
	• • •	
+44 to 45	PID No. 8 P (8 digits BCD)	
+46 to 47	PID No. 8 I (8 digits BCD)	
+48 to 49	PID No. 8 D (8 digits BCD)	
+50 to 51	PID No. 8 MV lower limit (8 digits BCD)	
+52 to 53	PID No. 8 MV upper limit (8 digits BCD)	
+54 to 55	PID No. 8 PV bias value (8 digits BCD)	
+56 to 57	PID No. 8 Automatic selection range upper limit (8 digits BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Read Local SP (Sequence No. 264 (Hex 0108))

Reads the local SP in the program parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Pattern No.	Step No.	
	+4	(Undefined)	Unit No.	2nd unit
	+5	Pattern No.	Step No.	
	~			
	+64	(Undefined)	Unit No.	32nd unit
	+65	Pattern No.	Step No.	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	 00 to 63 00 to 63
	• • •	
+64	32nd unit Unit No. (2 digits BCD)	00 to 31
+65 (max.)	32nd unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	 00 to 63 00 to 63

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Local SP (rightmost 4 digits)	1st unit
	+2	Local SP (leftmost 4 digits)	
	+3	Local SP (rightmost 4 digits)	2nd unit
	+4	Local SP (leftmost 4 digits)	
	~		~
	+63	Local SP (rightmost 4 digits)	32nd unit
	+64	Local SP (leftmost 4 digits)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 2 + 1
+1	1st unit Local SP (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000 F indicates a negative number.
+2	1st unit Local SP (leftmost 4 digits) (4 digits BCD)	
+3	2nd unit Local SP (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000
+4	2nd unit Local SP (leftmost 4 digits) (4 digits BCD)	
	• • •	
+63	32nd unit Local SP (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000
+64	32nd unit Local SP (leftmost 4 digits) (4 digits BCD)	

Write Local SP (Sequence No. 265 (Hex 0109))

Writes the local SP to the program parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Pattern No.	Step No.	
	+4	Local SP (rightmost 4 digits)		
	+5	Local SP (leftmost 4 digits)		
	+6	(Undefined)	Unit No.	2nd unit
	+7	Pattern No.	Step No.	
	+8	Local SP (rightmost 4 digits)		
	+9	Local SP (leftmost 4 digits)		
	~			
	+122	(Undefined)	Unit No.	31st unit
	+123	Pattern No.	Step No.	
	+124	Local SP (rightmost 4 digits)		
	+125	Local SP (leftmost 4 digits)		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 4 + 2
+1	Number of units (4 digits Hex)	0001 to 001F (1 to 31 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	00 to 63 00 to 63
+4	1st unit Local SP (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000
+5	1st unit Local SP (leftmost 4 digits) (4 digits BCD)	
	• • •	
+122	31st unit Unit No. (2 digits BCD)	00 to 31
+123	31st unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	00 to 63 00 to 63
+124	31st unit Local SP (rightmost 4 digits) (4 digits BCD)	00000000 to 09999000
+125	31st unit Local SP (leftmost 4 digits) (4 digits BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Read Program Parameters (Sequence No. 266 (Hex 010A))

Reads the local SP, step time, PID set No., wait code, and events from 1 to 10 set values in the program parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Pattern No.	Step No.	
	+4	(Undefined)	Unit No.	2nd unit
	+5	Pattern No.	Step No.	
	+6	(Undefined)	Unit No.	3rd unit
	+7	Pattern No.	Step No.	
	+8	(Undefined)	Unit No.	4th unit
	+9	Pattern No.	Step No.	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0004
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	00 to 63 00 to 63
	• • •	
+8	4th unit Unit No. (2 digits BCD)	00 to 31
+9 (max.)	4th unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	00 to 63 00 to 63

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Local SP (rightmost)	1st unit
	+2	Local SP (leftmost)	
	+3	Step bank time (rightmost)	
	+4	Step bank time (leftmost)	
	+5	PID set No. (rightmost)	
	+6	PID set No. (leftmost)	
	+7	Wait code (rightmost)	
	+8	Wait code (leftmost)	
	+9	Event 1 setting (rightmost)	
	+10	Event 1 setting (leftmost)	
		⋮	
	+27	Event 10 setting (rightmost)	
	+28	Event 10 setting (leftmost)	
		⋮	
	+85	Local SP (rightmost)	4th unit (max.)
	+86	Local SP (leftmost)	
	+87	Step bank time (rightmost)	
	+88	Step bank time (leftmost)	
	+89	PID set No. (rightmost)	
	+90	PID set No. (leftmost)	
	+91	Wait code (rightmost)	
	+92	Wait code (leftmost)	
	+93	Event 1 setting (rightmost)	
	+94	Event 1 setting (leftmost)	
		⋮	
	+111	Event 10 setting (rightmost)	
	+112	Event 10 setting (leftmost)	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 28 + 1
+1 to 2	1st unit Local SP (8 digits BCD)	00000000 to 09999000 F indicates a negative number.
+3 to 4	1st unit Step time) (8 digits BCD)	
+5 to 6	1st unit PID set No. (8 digits BCD)	
+7 to 8	1st unit Wait code (8 digits BCD)	
+9 to 10	1st unit Event 1 setting (8 digits BCD)	
+11 to 12	1st unit Event 2 setting (8 digits BCD)	
	• •	
+27 to 28	1st unit Event 10 setting (8 digits BCD)	
+29 to 30	1st unit Local SP (8 digits BCD)	
	• •	
+109 to 110	4th unit Event 9 setting (8 digits BCD)	
+111 to 112 (max.)	4th unit Event 10 setting (8 digits BCD)	

Write Program Parameters (Sequence No. 267 (Hex 010B))

Writes the local SP, step time, PID set No., wait code, and events from 1 to 10 settings in the program parameter area.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	
	+3	Pattern No.	Step No.	
	+4	Local SP (rightmost)		1st unit
	+5	Local SP (leftmost)		
	+6	Step bank time (rightmost)		
	+7	Step bank time (leftmost)		
	+8	PID set No. (rightmost)		
	+9	PID set No. (leftmost)		
	+10	Wait code (rightmost)		
	+11	Wait code (leftmost)		
	+12	Event 1 setting (rightmost)		
	+13	Event 1 setting (leftmost)		
	~		~	
	+30	Event 10 setting (rightmost)		
	+31	Event 10 setting (leftmost)		
	~		~	
	+92	(Undefined)	Unit No.	4th unit (max.)
	+93	Pattern No.	Step No.	
	~		~	
	+120	Event 10 setting (rightmost)		
	+121	Event 10 setting (leftmost)		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 30 + 2
+1	Number of units (4 digits BCD)	0001 to 0004
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No. (2 digits BCD) Step No. (2 digits BCD)	00 to 63 00 to 63
+4 to 5	1st unit Local SP (8 digits BCD)	00000000 to 09999000
+6 to 7	1st unit Step time (8 digits BCD)	
+8 to 9	1st unit PID set No. (8 digits BCD)	
+10 to 11	1st unit Wait code (8 digits BCD)	
+12 to 13	1st unit Event 1 setting (8 digits BCD)	
+14 to 15	1st unit Event 2 setting (8 digits BCD)	
	• •	
+30 to 31	1st unit Event 10 setting (8 digits BCD)	
+32 to 33	2nd unit Unit No. (2 digits BCD)	
	• •	
+111 to 112	4th unit Event 9 setting (8 digits BCD)	
+120 to 121 (max.)	4th unit Event 10 setting (8 digits BCD)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Remote Setting Mode (Sequence No. 268 (Hex 010C))

Switches the setting mode to the remote setting mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
		~	~	
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Local Setting Mode (Sequence No. 269 (Hex 010D))

Switches the setting mode to the local setting mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

External Setting Mode (Sequence No. 270 (Hex 010E))

Switches the setting mode to the external setting mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

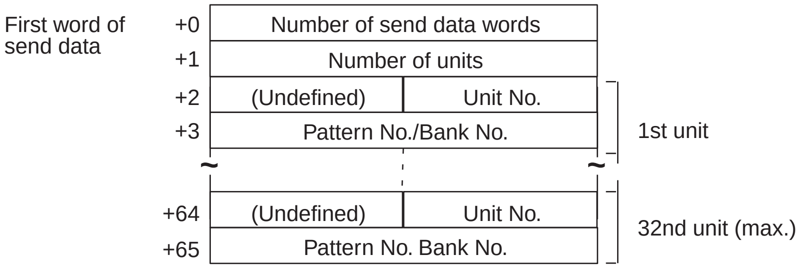
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Run Command (Sequence No. 271 (Hex 010F))

Starts control.

Send Data Word Allocation (3rd Operand of PMCR(260))



First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	Pattern No./Bank No.		
	~		~	
	+64	(Undefined)	Unit No.	32nd unit (max.)
	+65	Pattern No. Bank No.		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No./Bank No. (4 digits BCD)	0000 to 0063
+24	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+64	32nd unit Unit No. (2 digits BCD)	00 to 31
+65 (max.)	32nd unit Pattern No./Bank No. (4 digits BCD)	0000 to 0063

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Reset (Stop) (Sequence No. 272 (Hex 0110))

Stops control.

Send Data Word Allocation (2nd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Auto Mode (Sequence No. 273 (Hex 0111))

Switches the control mode to the auto mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Manual Mode (Sequence No. 274 (Hex 0112))

Switches the control mode to the manual mode.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
	~			~
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Execute A.T. (Sequence No. 275 (Hex 0113))

Executes A.T.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	PID set No.		
	~			~
	+64	(Undefined)	Unit No.	32nd unit (max.)
	+65	PID set No.		

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit PID set No. (4 digits BCD)	0000 to 0008
+4	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+64	32nd unit Unit No. (2 digits BCD)	00 to 31
+65 (max.)	32nd unit PID set No. (4 digits BCD)	0000 to 0008

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Cancel A.T. (Sequence No. 276 (Hex 0114))

Cancels A.T.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	+3	(Undefined)	Unit No.	2nd unit
		~	~	
	+33	(Undefined)	Unit No.	32nd unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+33 (max.)	32nd unit Unit No. (2 digits BCD)	00 to 31

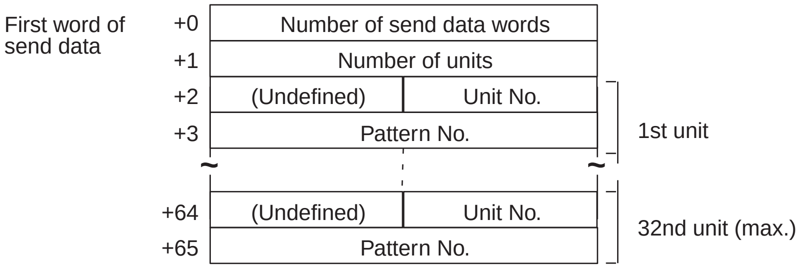
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Change Pattern No. (Sequence No. 277 (Hex 0115))

Changes the pattern number.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Pattern No. (4 digits BCD)	0001 to 0063
+4	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+64	32nd unit Unit No. (2 digits BCD)	00 to 31
+65 (max.)	32nd unit Pattern No. (4 digits BCD)	0001 to 0063

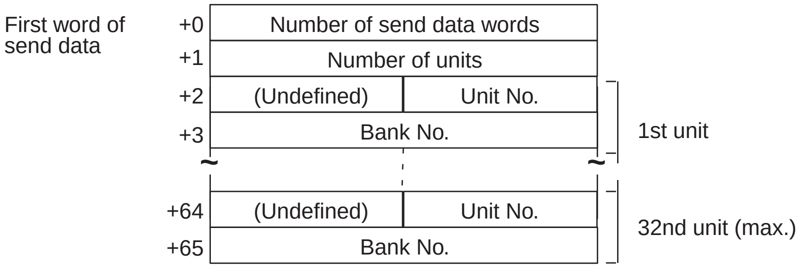
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Change Bank No. (Sequence No. 278 (Hex 0116))

Changes the bank number.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units × 2 + 2
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
+3	1st unit Bank No. (4 digits BCD)	0000 to 0007
+4	2nd unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+64	32nd unit Unit No. (2 digits BCD)	00 to 31
+65 (max.)	32nd unit Bank No. (4 digits BCD)	0000 to 0007

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Read Controller Status (Sequence No. 279 (Hex 0117))

Reads the Controller status.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Unit No.	1st unit
	~		~	
	+26	(Undefined)	Unit No.	25th unit (max.)

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	Number of units + 2
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	1st unit Unit No. (2 digits BCD)	00 to 31
	• • •	
+26 (max.)	25th unit Unit No. (2 digits BCD)	00 to 31

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	Operation status	Hold	1st unit
	+2	Auto/manual	SP mode	
	+3	Setting mode	Valid pattern No.	
	+4	A.T.	Valid PID set No.	
	+5	Wait	Operation mode	
	~		~	
	+121	Operation status	Hold	25th unit (max.)
	+122	Auto/manual	SP mode	
	+123	Setting mode	Valid pattern No.	
	+124	A.T.	Valid PID set No.	
	+125	Wait	Operation mode	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	Number of units × 5 + 1
+1	1st unit Operation status (2 digits BCD) Hold (2 digits BCD)	00: Reset 01: Run 00: Not hold 01: Hold
+2	1st unit Auto/manual (2 digits BCD) SP mode (2 digits BCD)	00: Auto mode 01: Manual mode 00: Local SP mode 01: Remote SP mode 02: Fixed SP mode
+3	1st unit Setting mode (2 digits BCD) Valid pattern No. (2 digits BCD)	00: Local setting mode 01: Remote setting mode 02: External setting mode 00 to 63
+4	1st unit A.T. (2 digits BCD) Valid PD set No. (2 digits Hex)	00: Not A.T. 01: A.T. 01 to 08
+5	1st unit Wait (2 digits BCD) Operation mode (2 digits BCD)	00: Not waiting 01: Waiting 02: Wait alarm output 00: Setting level 1 (without technical mode) 01: Setting level 1 (with technical mode) 02: Setting level 2 (without technical mode) 03: Setting level 2 (with technical mode)
	⋮	
+125 (max.)	25th unit Wait (2 digits BCD) Operation mode (2 digits BCD)	00: Not waiting 01: Waiting 02: Wait alarm output 00: Setting level 1 (without technical mode) 01: Setting level 1 (with technical mode) 02: Setting level 2 (without technical mode) 03: Setting level 2 (with technical mode)

General-purpose Command (Sequence No. 280 (Hex 0118))

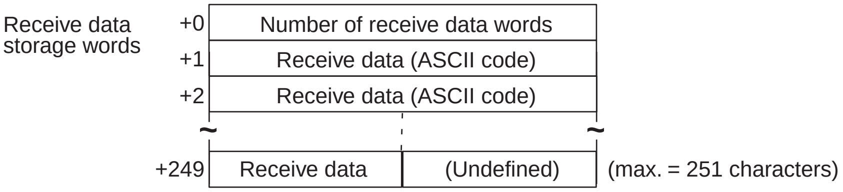
Sends the specified data and stores the received data in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of send data bytes	
	+2	Send data (ASCII code)	
	+3	Send data (ASCII code)	
		⋮	
	+249	Send data	(max. = 496 characters)

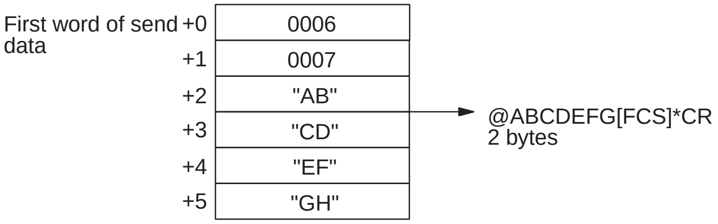
Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Number of send data bytes (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The number of send bytes not including @, the FCS, or the terminator.
+2	Send data (2 characters ASCII)	Refer to the manual for the ES100☐. Use ASCII (Up to 496 characters total.)
	• • •	
+249 (max.)	Send data (1 character ASCII)	

Receive Data Word Allocation (4th Operand of PMCR(260))

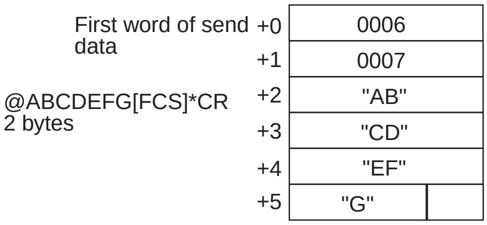


Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0001 to 00FA (1 to 250 decimal)
+1	Receive data (2 characters ASCII)	Refer to the manual for the ES100☐. Returned as ASCII (Up to 498 characters total.)
	• • •	
+249 (max.)	Receive data (1 character ASCII)	

Note 1. At transmission, a header code “@” is attached before the data and the FCS and a terminator “*”CR are attached following the send data.



2. At reception, data excluding the header code “@” at the beginning of the receive data and the FCS and terminator “*”CR at the end of the data is stored in the receive data storage words.



3. Refer to the manual for the ES100☐ for the contents of send data and receive data.

Appendix I

K3T☐ Intelligent Signal Processor Protocol

The K3T☐ Intelligent Signal Processor Protocol is used to make various settings or control remotely the Intelligent Signal Processor connected to the Serial Communications Unit/Board via RS-232C or RS-422/485 cable.

Protocol Configuration

The configuration of the K3T☐ Intelligent Signal Processor Protocol is shown as follows:

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
300 (012C)	Reset (by unit number)	Performs the same processing as when an input is received on the reset terminal.	Yes	No	
301 (012D)	Reset (continuous units)	Performs the same processing as when an input is received on the reset terminal.	Yes	No	
302 (012E)	Write set value (by unit number)	Writes the set value HH, H, L, or LL.	Yes	No	See Note1
303 (012F)	Write set value HH (continuous units)	Writes the set value HH.	Yes	No	See Note1
304 (0130)	Write set value H (continuous units)	Writes the set value H.	Yes	No	See Note1
305 (0131)	Write set value L (continuous units)	Writes the set value L.	Yes	No	See Note1
306 (0132)	Write set value LL (continuous units)	Writes the set value LL.	Yes	No	See Note1
307 (0133)	Write set value with bank (by unit number)	Writes the set value to a bank which is not in use (K3TR: HH to LL, K3TC: O1 to O5).	Yes	No	See Note2
308 (0134)	Write set value HH with bank (continuous units)	Writes the set value HH to a bank which is not in use.	Yes	No	See Note1
309 (0135)	Write set value H with bank (continuous units)	Writes the set value H to a bank which is not in use.	Yes	No	See Note1
310 (0136)	Write set value L with bank (continuous units)	Writes the set value L to a bank which is not in use.	Yes	No	See Note1
311 (0137)	Write set value LL with bank (continuous units)	Writes the set value LL to a bank which is not in use.	Yes	No	See Note1
312 (0138)	Write set value O5 with bank (continuous units)	Writes the set value O5 to a bank which is not in use.	Yes	No	See Note1
313 (0139)	Write set value O4 with bank (continuous units)	Writes the set value O4 to a bank which is not in use.	Yes	No	See Note1
314 (013A)	Write set value O3 with bank (continuous units)	Writes the set value O3 to a bank which is not in use.	Yes	No	See Note1
315 (013B)	Write set value O2 with bank (continuous units)	Writes the set value O2 to a bank which is not in use.	Yes	No	See Note1
316 (013C)	Write set value O1 with bank (continuous units)	Writes the set value O1 to a bank which is not in use.	Yes	No	See Note1
317 (013D)	Read set value (by unit number)	Reads the set value HH, H, L, or LL.	Yes	Yes	See Note1
318 (013E)	Read set value HH (continuous units)	Reads the set value HH.	Yes	Yes	See Note1

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
319 (013F)	Read set value H (continuous units)	Reads the set value H.	Yes	Yes	See Note1
320 (0140)	Read set value L (continuous units)	Reads the set value L.	Yes	Yes	See Note1
321 (0141)	Read set value LL (continuous units)	Reads the set value LL.	Yes	Yes	See Note1
322 (0142)	Read set value with bank (by unit number)	Reads set value of a bank which is not in use (K3TR: HH to LL, K3TC: O1 to O5).	Yes	Yes	See Note2
323 (0143)	Read set value HH with bank (continuous units)	Reads the set value HH of a bank which is not in use.	Yes	Yes	See Note1
324 (0144)	Read set value H with bank (continuous units)	Reads the set value H of a bank which is not in use.	Yes	Yes	See Note1
325 (0145)	Read set value L with bank (continuous units)	Reads the set value L of a bank which is not in use.	Yes	Yes	See Note1
326 (0146)	Read set value LL with bank (continuous units)	Reads the set value LL of a bank which is not in use.	Yes	Yes	See Note1
327 (0147)	Read set value O5 with bank (continuous units)	Reads the set value O5 of a bank which is not in use.	Yes	Yes	See Note1
328 (0148)	Read set value O4 with bank (continuous units)	Reads the set value O4 of a bank which is not in use.	Yes	Yes	See Note1
329 (0149)	Read set value O3 with bank (continuous units)	Reads the set value O3 of a bank which is not in use.	Yes	Yes	See Note1
330 (014A)	Read set value O2 with bank (continuous units)	Reads the set value O2 of a bank which is not in use.	Yes	Yes	See Note1
331 (014B)	Read set value O1 with bank (continuous units)	Reads the set value O1 of a bank which is not in use.	Yes	Yes	See Note1
332 (014C)	Read holding data (by unit number)	Reads the peak/bottom data (maximum, minimum).	Yes	Yes	See Note3
333 (014D)	Read holding data PH (continuous units)	Reads the peak data (maximum).	Yes	Yes	See Note3
334 (014E)	Read holding data BH (continuous units)	Reads the bottom data (minimum).	Yes	Yes	See Note3
335 (014F)	Read display value (PV) (by unit number)	Reads the display value (PV).	Yes	Yes	
336 (0150)	Read display value (PV) (continuous units)	Reads the display value (PV).	Yes	Yes	
337 (0151)	Read model (by unit number)	Reads the model data.	Yes	Yes	
338 (0152)	Read model (continuous units)	Reads the model data.	Yes	Yes	
339 (0153)	General-purpose command	Send specified data or receives specified data and writes it to the receive data words.	Yes	Yes	

Note

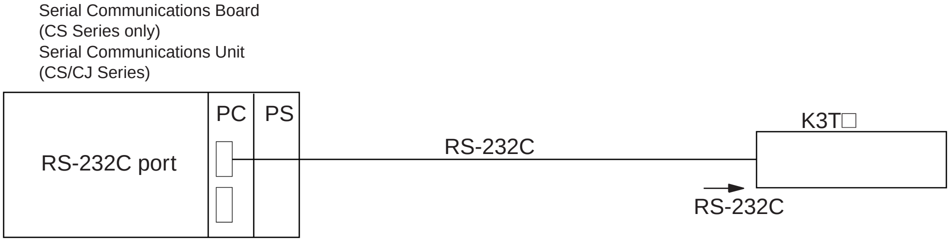
1. Special specifications are required to use communications + comparison output.
2. Special specifications are required to use communications + comparison output for the K3TR and K3TC. The operands HH, H, L, and LL are for the K3TR, and the operands O5, O4, O3, O2, and O1 are for the K3TC.
3. Not available for the K3TC.
4. The hexadecimal equivalents of sequences numbers are given in parentheses.

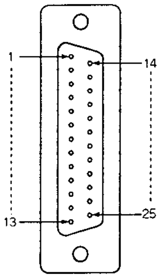
5. **Ladder Interface Settings**
   YES: User settings are required for the 3rd and 4th operands of PMCR(260).
   NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
   Receive word allocation: Set the constant 0000 for the 4th operand (D).

Connections

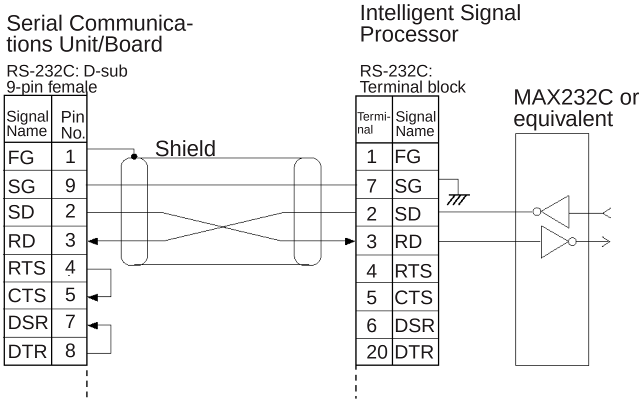
The connections used for the K3T□ Intelligent Signal Processor Protocol are shown below.

RS-232C Connections



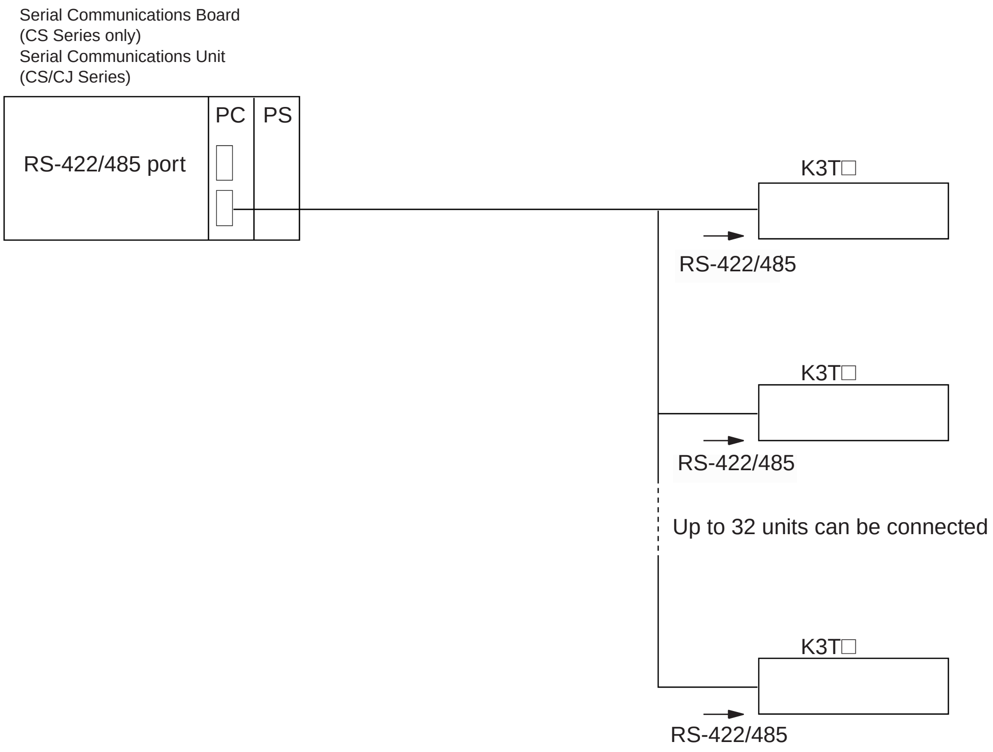


Signal name	Abbreviation	Signal direction	Pin No.
Protective ground or earth	FG	---	1
Signal ground or common return line	SG	---	7
Send data	SD	Output	2
Receive data	RD	Input	3
Request to send	RS	Output	4
Clear to send	CS	Input	5
Data set ready	DR	Input	6
Data terminal ready	ER	Output	20

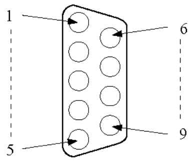


Note 1. The connection configuration is a one-to-one configuration and the maximum cable length is 15 m.
2. Use shielded twisted-pair cable.

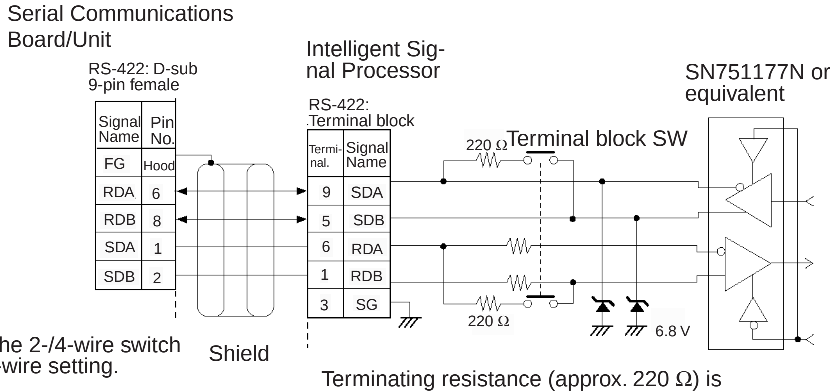
RS-422/485 Connections



• RS-422 4-wire Connections



Signal name	Abbreviation	Signal direction	Pin No.
Send data A	SDA	Output	9
Send data B	SDB	Output	5
Receive data A	RDA	Output	6
Receive data B	RDB	Input	1
Signal ground	SG	---	3
Protective ground	FG	---	7



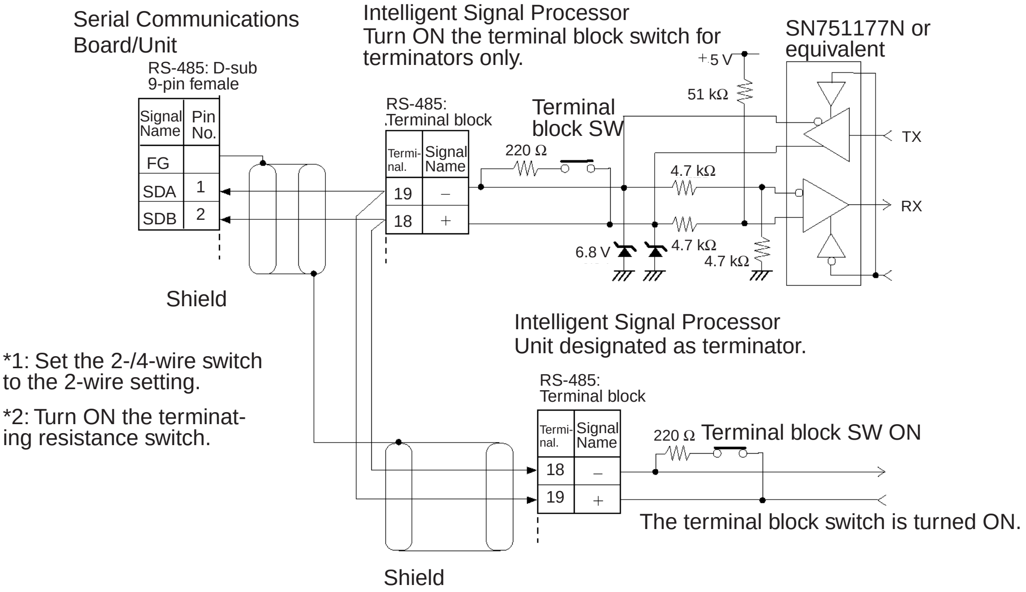
*1: Set the 2-/4-wire switch to the 4-wire setting.

*2: Turn ON the terminating resistance switch.

Terminating resistance (approx. 220 Ω) is connected via the terminal block switch.

- **RS-485 2-wire Connections**

Signal name	Abbreviation	Signal direction	Terminal
Inverting output	–	Input or output	19
Non-inverting output	+	Input or output	18



*1: Set the 2-/4-wire switch to the 2-wire setting.

*2: Turn ON the terminating resistance switch.

Note 1. The connection configuration is a one-to-one or a 1-to-N configuration. For 1-to-N connections, up to 32 units including the Serial Communications Boards/Units can be connected.

2. The maximum cable length is 500 m. Use shielded twisted-pair cables (AWG28i or greater).
3. Connect terminating resistance at both ends of the transmission path.
4. Turn the terminal block switch ON at the terminators.
5. Turn the terminal block switches OFF for units that are not terminators.

Reset (by Unit Number) (Sequence No. 300 (Hex 012C))

This sequence performs the same processing as when an input is received on the reset terminal.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of units	
	+2	(Undefined)	Relevant unit No.
	~		~
	+33	(Undefined)	Relevant unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits BCD)	0003 to 0022 (3 to 34 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
	• • •	
+33	Relevant unit No. (2 digits BCD)	00 to 99

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Reset Control (Continuous Units) (Sequence No. 301 (Hex 012D))

This sequence performs reset control for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)

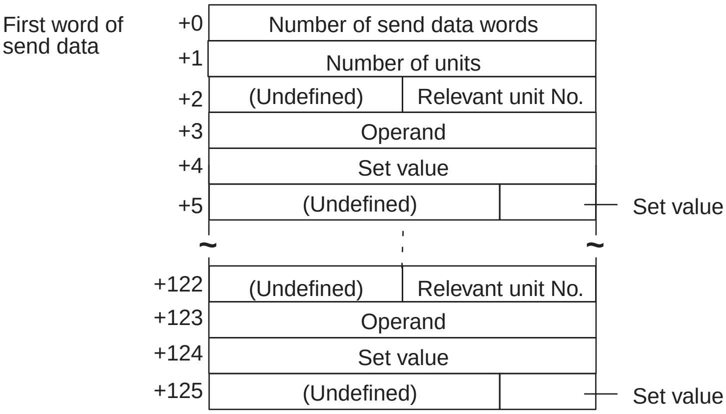
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Set Value (by Unit Number) (Sequence No. 302 (Hex 012E))

This sequence writes each set value (HH, H, L, LL).

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits BCD)	0006 to 007E (6 to 126 decimal)
+1	Number of units (4 digits Hex)	0001 to 001F (1 to 31 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
+3	Operand (ASCII 2 characters)	4848 (“HH”), 4C4C (“LL”) 4820 (“H”), 4C20 (“L”)
+4 to +5	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +4 2345, +5 0001 **Example** –1234: +4 1234, +5 000F
	• • •	
+124 to +125	Set value (5 digits BCD)	Same as above

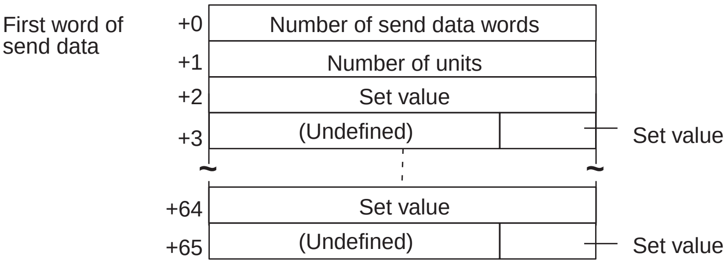
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Set Value HH (Continuous Units) (Sequence No. 303 (Hex 012F))

This sequence writes set value HH for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 to 0042 (4 to 66 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2 to +3	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +2 2345, +3 0001 **Example** –1234: +2 1234, +3 000F
	• • •	
+64 to +65	Set value (5 digits BCD)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Set Value H (Continuous Units) (Sequence No. 304 (Hex 0130))

This sequence writes set value H for continuous units. The word allocation is identical to that of sequence No. 303 (Write Set Value HH (Continuous Units)).

Write Set Value L (Continuous Units) (Sequence No. 305 (Hex 0131))

This sequence writes set value L for continuous units. The word allocation is identical to that of sequence No. 303 (Write Set Value HH (Continuous Units)).

Write Set Value LL (Continuous Units) (Sequence No. 306 (Hex 0132))

This sequence writes set value LL for continuous units. The word allocation is identical to that of sequence No. 303 (Write Set Value HH (Continuous Units)).

Write Set Value with Bank (by Unit Number) (Sequence No. 307 (Hex 0133))

This sequence writes set value of a bank which is not in use (K3TR: HH to LL, K3TC:O1 to O5).

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of units		
	+2	(Undefined)	Relevant unit No.	
	+3	(Undefined)	Bank No.	
	+4	Operand		
	+5	Set value		
	+6	(Undefined)		Set value
	~	:	~	
	+122	(Undefined)	Relevant unit No.	
	+123	(Undefined)	Bank No.	
	+124	Operand		
	+125	Set value		
	+126	(Undefined)		Set value

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 007F (7 to 127 decimal)
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
+3	Bank No. (2 digits BCD)	01 to 04
+4	Operand (Two ASCII characters)	4848 (“HH”), 4F31 (“O1”) 4820 (“H ”), 4F32 (“O2”) 4C20 (“L ”), 4F33 (“O3”) 4C4C (“LL”), 4F34 (“O4”) 4F35 (“O5”)
+5 to +6	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345 **Example** –1234 +5 2345 +5 1234 +6 0001 +6 000F
	• • •	
+125 to +126	Set value (5 digits BCD)	Same as above

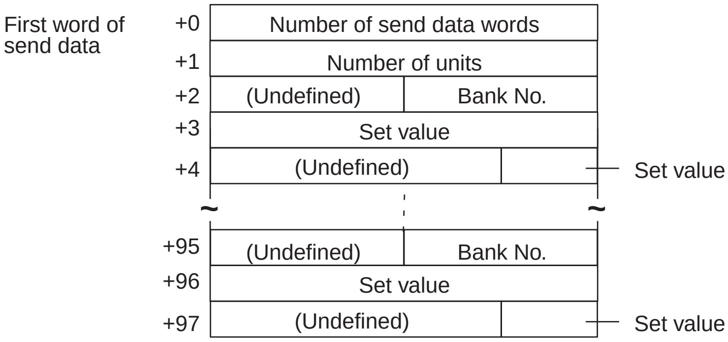
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Set Value HH with Bank (Continuous Units) (Sequence No. 308 (Hex 0134))

This sequence writes set value HH of a bank not in use for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 to 0062 (5 to 98 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Bank No. (2 digits BCD)	01 to 04
+3 to +4	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +2 2345, +3 0001 **Example** –1234: +2 1234, +3 000F
	• • •	
+96 to +97	Set value (5 digits BCD)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Write Set Value H with Bank (Continuous Units) (Sequence No. 309 (Hex 0135))

This sequence writes set value H of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value L with Bank (Continuous Units) (Sequence No. 310 (Hex 0136))

This sequence writes set value L of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value LL with Bank (Continuous Units) (Sequence No. 311 (Hex 0137))

This sequence writes set value LL of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value O5 with Bank (Continuous Units) (Sequence No. 312 (Hex 0138))

This sequence writes set value O5 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value O4 with Bank (Continuous Units) (Sequence No. 313 (Hex 0139))

This sequence writes set value O4 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value O3 with Bank (Continuous Units) (Sequence No. 314 (Hex 013A))

This sequence writes set value O3 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value O2 with Bank (Continuous Units) (Sequence No. 315 (Hex 013B))

This sequence writes set value O2 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Write Set Value O1 with Bank (Continuous Units) (Sequence No. 316 (Hex 013C))

This sequence writes set value O1 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 308 (Write Set Value HH with Bank (Continuous Units)).

Read Set Value (by Unit Number) (Sequence No. 317 (Hex 013D))

Reads set value HH, H, L, or LL.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of units	
	+2	(Undefined)	Relevant unit No.
	+3	Operand	
	~		~
	+64	(Undefined)	Relevant unit No.
	+65	Operand	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 to 0042 (4 to 66 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
+3	Operand (ASCII 2 characters)	4848 (“HH”), 4C4C (“LL”) 4F31 (“01”) 4820 (“H”), 4C20 (“L”) 4F35 (“05”)

Offset	Contents (data format)	Data
	• • •	
+64 to +65	Operand (ASCII 2 characters)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	(Undefined)	End code	
+2	Set value		
+3	(Undefined)		Set value
~			
+94	(Undefined)	End code	
+95	Set value		
+96	(Undefined)		Set value

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004 to 0061 (4 to 97 decimal)
+1	End code (2 digits Hex)	00 to 22
+2 to +3	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +2 2345, +3 0001 **Example** –1234: +2 1234, +3 000F
	• • •	
+95 to +96	Set value (5 digits BCD)	Same as above

Read Set Value HH (Continuous Units) (Sequence No. 318 (Hex 013E))

This sequence reads set value HH for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words
+1	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)

Receive Data Word Allocation (4th Operand of PMCR(260))

This sequence is similar to sequence No. 317 (Read Set Value (by Unit Number)).

Read Set Value H (Continuous Units) (Sequence No. 319 (Hex 013F))

This sequence reads set value H for continuous units. The word allocation is identical to that of sequence No. 318 (Read Set Value HH (Continuous Units)).

Read Set Value L (Continuous Units) (Sequence No. 320 (Hex 0140))

This sequence reads set value L for continuous units. The word allocation is identical to that of sequence No. 318 (Read Set Value HH (Continuous Units)).

Read Set Value LL (Continuous Units) (Sequence No. 321 (Hex 0141))

This sequence reads set value LL for continuous units. The word allocation is identical to that of sequence No. 318 (Read Set Value HH (Continuous Units)).

Read Set Value with Bank (by Unit Number) (Sequence No. 322 (Hex 0142))

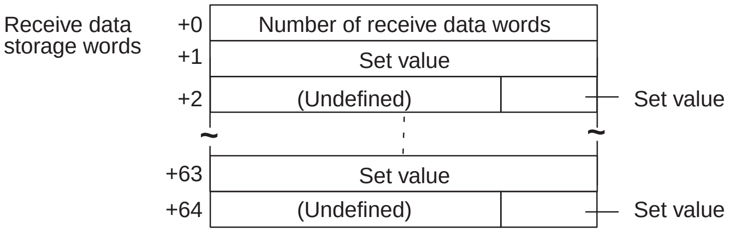
Reads the set value of a bank which is not in use (K3TR: HH to LL, K3TC:01 to 05) and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Number of units
	+2	(Undefined)	Relevant unit No.
	+3	(Undefined)	Bank No.
	+4	Operand	
	~		~
	+95	(Undefined)	Relevant unit No.
	+96	(Undefined)	Bank No.
	+97	Operand	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 to 0062 (5 to 98 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
+3	Bank No. (2 digits BCD)	01 to 04
+4	Operand (ASCII 2 characters)	4848 (“HH”), 4F31 (“O1”) 4820 (“H ”), 4F32 (“O2”) 4C20 (“L ”), 4F33 (“O3”) 4C4C (“LL”), 4F34 (“O4”) 4F35 (“O5”)
	• • •	
+ 97	Operand (ASCII 2 characters)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

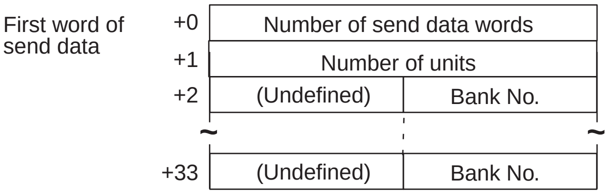


Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003 to 0041 (3 to 65 decimal)
+1 to +2	Set value (5 digits BCD)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +1 2345, +2 0001 **Example** –1234: +1 1234, +2 000F
	• • •	
+63 to +64	Set value (5 digits BCD)	Same as above

Read Set Value HH with Bank (Continuous Units) (Sequence No. 323 (Hex 0143))

This sequence reads set value HH of a bank not in use for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 0022 (3 to 34 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Bank No. (2 digits BCD)	01 to 04
	• • •	
+ 33	Bank No. (2 digits BCD)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

The word allocation is similar to sequence No. 322 (Read Set Value with Bank (by Unit Number)).

Read Set Value H with Bank (Continuous Units) (Sequence No. 324 (Hex 0144))

This sequence reads set value H of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value L with Bank (Continuous Units) (Sequence No. 325 (Hex 0145))

This sequence reads set value L of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value LL with Bank (Continuous Units) (Sequence No. 326 (Hex 0146))

This sequence reads set value LL of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value O5 with Bank (Continuous Units) (Sequence No. 327 (Hex 0147))

This sequence reads set value O5 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value O4 with Bank (Continuous Units) (Sequence No. 328 (Hex 0148))

This sequence reads set value O4 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value O3 with Bank (Continuous Units) (Sequence No. 329 (Hex 0149))

This sequence reads set value O3 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value O2 with Bank (Continuous Units) (Sequence No. 330 (Hex 014A))

This sequence reads set value O2 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Set Value O1 with Bank (Continuous Units) (Sequence No. 331 (Hex 014B))

This sequence reads set value O1 of a bank not in use for continuous units. The word allocation is identical to that of sequence No. 323 (Read Set Value HH with Bank (Continuous Units)).

Read Holding Data (Sequence No. 332 (Hex 014C))

Reads the peak/bottom data (maximum, minimum) and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	Number of units	
+2	(Undefined)	Relevant unit No.
+3	Operand	
~		~
+64	(Undefined)	Relevant unit No.
+65	Operand	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 to 0042 (4 to 66 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
+3	Operand (ASCII 2 characters)	5048 (“PH”) 4248 (“BH”)
	• • •	
+65	Operand (ASCII 2 characters)	Same as above

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	Peak/bottom data		
+2	(Undefined)		Peak/bottom data
+3	(Undefined)	Status	
~		~	
+94	Peak/bottom data		
+95	(Undefined)		Peak/bottom data
+96	(Undefined)	Status	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004 to 0061 (4 to 97 decimal)
+1 to +2	Peak/bottom data (5 digits BCD)	00000 to 99999 Negative sign: F (most significant digit) **Example** 12345 +1 2345 +2 0001 **Example** –1234 +1 1234 +2 F000
+3	Status (2 digits Hex)	d0 bit: If overflow:1 Others: 0
		d1 bit: If underflow:1 Others: 0
		d2 bit: Not used
		d3 bit: During forced zero operation:1 Others: 0 (K3TH,K3TR: 0)
		d4 bit: Not used
		d5 bit: During hold input:1 Others: 0
		d6 bit: Bank input 1:1 Others: 0 (K3TH, K3TX: 0)
		d7 bit: Bank input 2:1 Others: 0 (K3TH, K3TX: 0)

Offset	Contents (data format)	Data
	• • •	
+96	Status	Same as above

Read Holding Data PH (Continuous Units) (Sequence No. 333 (Hex 014D))

This sequence reads peak holding data for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)

Receive Data Word Allocation (4th Operand of PMCR(260))

The data allocation is similar to sequence No. 332 (Read Holding Data (by Unit Number)).

Read Holding Data BH (Continuous Units) (Sequence No. 334 (Hex 014E))

This sequence reads bottom holding data for continuous units. The word allocation is identical to that of sequence No. 333 (Read Holding Data PH (Continuous Units)).

Read Display Value (PV) (by Unit Number) (Sequence No. 335 (Hex 014F))

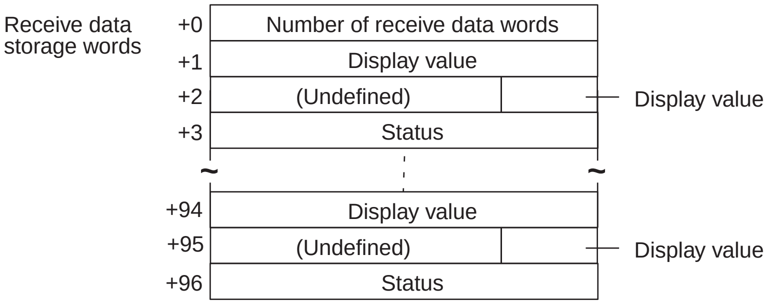
Reads the display value (PV) and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of units	
	+2	(Undefined)	Relevant unit No.
	~		~
	+33	(Undefined)	Relevant unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 0022 (3 to 34 decimal)
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
	• • •	
+ 33	Relevant unit No. (2 digits BCD)	00 to 99

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004 to 0061 (4 to 97 decimal)
+1 to +2	Display value (5 digits Hex)	00000 to 99999 Negative sign: F (5th digit in BCD) **Example** 12345: +1 2345, +2 0001 **Example** –1234: +1 1234, +2 000F
+3	Status (4 digits Hex)	d0 bit: If overflow:1 Others: 0
		d1 bit: If underflow:1 Others: 0
		d2 bit: Not used
		d3 bit: During forced zero operation:1 Others: 0 (K3TH, K3TR, K3TC: 0)
		d4 bit: In test mode: Others: 0
		d5 bit: While holding input:1 Others: 0
		d6 bit: Bank input 1:1 Others: 0 (K3TH, K3TX: 0)
		d7 bit: Bank input 2:1 Others: 0 (K3TH, K3TX: 0)
		d8 bit: LL comparison output:1 Others: 0 OUT1 comparison output: 1 (K3TC)
		d9 bit: L comparison output:1 Others: 0 OUT2 comparison output:1 (K3TC)
		d10 bit: H comparison output:1 Others: 0 OUT4 comparison output:1 K3TC)
		d11 bit: HH comparison output:1 Others: 0 OUT5 comparison output:1 (K3TC)
		d12 bit: PASS comparison output:1 Others: 0 OUT3 comparison output:1 (K3TC)
		d13 bit: Not used d14 bit: Not used d15 bit: Not used
	• • •	
+96	Status (4 digits BIN)	Same as above

Read Display Value (PV) (Continuous Units) (Sequence No. 336 (Hex 0150))

This sequence reads display value (PV) for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Number of units (4 digits Hex)	0001 to 0020 (1 to 32 decimal)

Receive Data Word Allocation (4th Operand of PMCR(260))

This sequence is similar to sequence No. 335 (Read Display Value (PV) (Continuous Units)).

Model Data Read (by Unit Number) (Sequence No. 337 (Hex 0151))

Reads model data and stores the results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Number of units	
	+2	(Undefined)	Relevant unit No.
	~		~
	+26	(Undefined)	Relevant unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 001B (3 to 27 decimal)
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)
+2	Relevant unit No. (2 digits BCD)	00 to 99
	• • •	
+ 26	Relevant unit No. (2 digits BCD)	Same as above

Note The number of Units can be up to 25 maximum.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Input specifications	
+2	Input specifications	Display specifications
+3	Output specifications	
+4	Input contents	
+5	Operation mode	
	⋮	
+121	Input specifications	
+122	Input specifications	Display specifications
+123	Output specifications	
+124	Input contents	
+125	Operation mode	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006 to 007E (6 to 126 decimal)
+1 to + 2	Input specifications (ASCII 3 characters)	544131 (“TA1”) (K3TH) 544231 (“TB1”) (K3TH) 564432 (“VD2”) (K3TX) 414432 (“AD2”) (K3TX) 564132 (“VA2”) (K3TX) 414132 (“AA2”) (K3TX) 524231 (“RB1”) (K3TR, K3TC)
+2	Display specifications (ASCII 1 character)	41 (“A”) (common) 42 (“B”) (K3TH, K3TX) 43 (“C”) (K3TR, K3TC)
+3	Output specifications (ASCII 2 characters)	5331 (“S1”) (RS-232C) 5332 (“S2”) (RS-485) 5333 (“S3”) (RS-422) 5335 (“S5”) (RS-485 + comparison output) 5336 (“S6”) (RS-422 + comparison output)
+4	Input contents (ASCII 2 characters)	Leftmost digit: 30 (“0”) to 31 (“1”)
		Rightmost digit: 31 (“1”) to 45 (“E”)
+5	Operation mode (ASCII 2 characters)	3030 (“00”) (K3TH, K3TX) 3031 (“00”) to 3133 (“12”) (K3TR) 5542 (“UB”) (K3TC) 5543 (“UC”) (K3TC)
	• • •	
+125	Operation mode (ASCII 2 characters)	Same as above

Model Data Read (Continuous Units) (Sequence No. 338 (Hex 0152))

This sequence reads model data for continuous units.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words
+1	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Number of units (4 digits Hex)	0001 to 0019 (1 to 25 decimal)

Note The number of Units can be up to 25 maximum.

Receive Data Word Allocation (4th Operand of PMCR(260))

The work allocation is similar to sequence No. 337 (Model Data Read (by Unit Number)).

General-purpose Command (Sequence No. 339 (Hex 0153))

Sends the specified data and writes the receive data to the receive data words. The characters such as “@”, FCS, terminators need not be set in the send and receive data words. These characters will be automatically added for transmission and automatically removed before saving data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Send data byte length
	+2	Send data
	+3	Send data
	~	~
	+249	Send data

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits BCD)	0001 to 01F0 (1 to 496 decimal) Number of bytes of send data not including @, the FCS, and the terminator.
+2 to +249	Send data (ASCII)	ASCII code Send data: 496 characters max.

Receive Data Word Allocation (3rd Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Receive data
	+2	Receive data
	+3	Receive data
	~	~
	+249	Receive data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0001 to 00FA (1 to 250 decimal)
+1 to +249	Receive data (ASCII)	ASCII code Receive data: 498 characters max.

Appendix J

V500/V520 Bar Code Reader Protocol

The V500/V520 Bar Code Reader Protocol is used to make various settings or control remotely the Bar Code Reader connected the Serial Communications Unit/Board via RS-232C cable.

Protocol Configuration

The configuration of the V500/V520 Bar Code Reader Protocol is shown below.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
350 (015E)	BCR read start	Instructs the Reader to start a BCR read.	No	No
351 (015F)	BCR read stop	Instructs the Reader to stop a BCR read.	No	No
352 (0160)	Data read	Data read by the Reader is received and saved in the receive words.	No	Yes
353 (0161)	Complete data read	Instructs the Reader to start a read. After the data read by the Reader is received and saved to the receive words, reading is stopped.	No	Yes
354 (0162)	BCR function write (V500)	Writes the operation mode and read functions.	Yes	No
355 (0163)	BCR function read (V500)	Reads the operation mode and read functions.	No	Yes
356 (0164)	Log data output request (V500)	Requests output of log data sent to host.	Yes	Yes
357 (0165)	Preset data set (V500)	Writes preset data.	Yes	No
358 (0166)	BCR connection confirmation (V500)	Confirms if the Reader is correctly set.	No	No
359 (0167)	Log data clear (V500)	Clear log data.	No	No
360 (0168)	Continuous data read (scan) (V500)	Performs the following operations repeatedly: starts reading, receives data read by the Reader, saves the data to the receive words by the scan method.	No	Yes
361 (0169)	Continuous data read (interrupt) (V500)	Performs the following operations repeatedly: starts reading, receives data read by the Reader, saves the data to the receive words by the interrupt method (interrupt No.100).	No	Yes
362 (016A)	BCR initialize	Clears the log, confirms BCR connection, and sets BCRs.	Yes	No
363 (016B)	Continuous data read (scan) (V520)	Performs the following operations repeatedly: starts reading, receives data read by the Reader, saves the data to the receive words by the scan method.	No	Yes
364 (016C)	Continuous data read (interrupt) (V520)	Performing the following operations repeatedly: starts reading, receives data read by the Reader, saves the data to the receive words by the interrupt method (interrupt No.100).	No	Yes
365 (016D)	General-purpose command 1	Used to send data of a specified data length, and receive only ACK as the receive data.	Yes	No
366 (016E)	General-purpose command 2	Used to send data of a specified data length, and receive ACK together with the return of other receive data. The frame format of the receive data, however, has to contain STX and ETX.	Yes	Yes

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

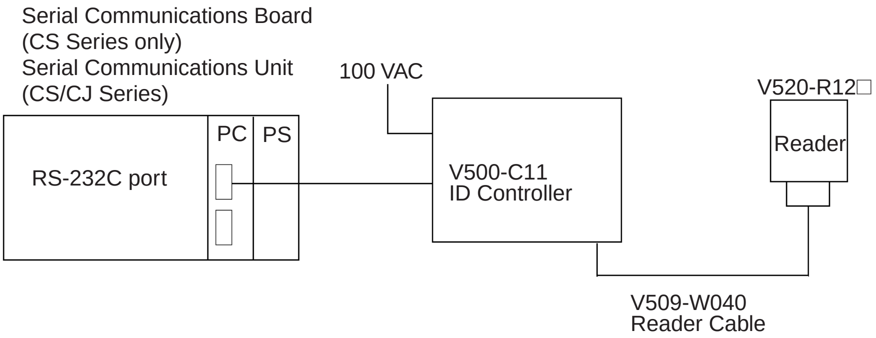
2. **Ladder Interface Settings**
   YES: User settings are required for the 3rd and 4th operands of PMCR(260).
   NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
   Receive word allocation: Set the constant 0000 for the 4th operand (D).

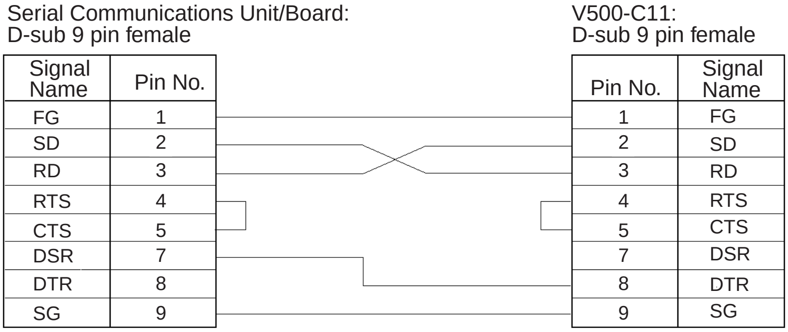
3. Sequences No. 361 and No. 364 (Continuous Data Read with Interrupt) are not supported by the CS1W-SCU21-V1 Serial Communications Unit. A protocol syntax error will occur if an attempt is made to execute either sequence with the Serial Communications Unit.

Connections

The connections for using the V500/V520 Bar Code Reader Protocol are shown below.

V500 Connections





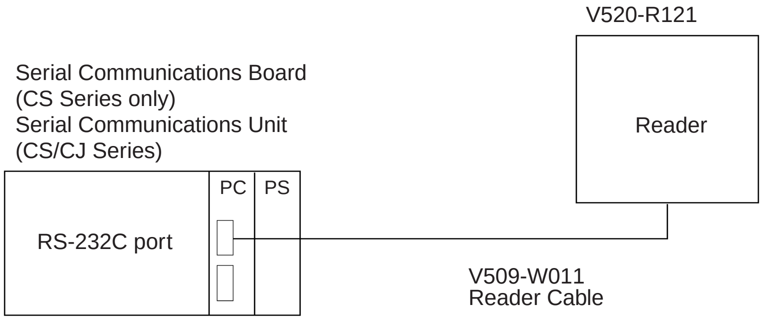
Serial Communications Unit/Board:
D-sub 9 pin female

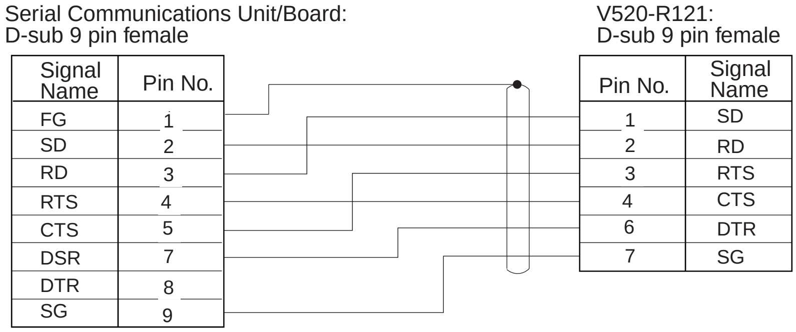
Signal Name	Pin No.
FG	1
SD	2
RD	3
RTS	4
CTS	5
DSR	7
DTR	8
SG	9

V500-C11:
D-sub 9 pin female

Pin No.	Signal Name
1	FG
2	SD
3	RD
4	RTS
5	CTS
7	DSR
8	DTR
9	SG

V520 Connections





System Setting

Shown below are the system settings of the V500-C11 and V520-R121 when this protocol is used.

Note The portions enclosed by in boxes are used for this protocol.

V500-C11

- **BCR Functions**

Read trigger	"READ SIGNAL INPUT", "ONLINE READ COMMAND"
Read control method	"SINGLE READ", "CONTINUOUS READ"

- **Host Interface**

Prefix	NONE, "STX"
Suffix	"ETX" , "CR "
Bar code output	"OUTPUT" , "NO OUTPUT"

V520-R121

Start code	NONE, "STX"
Stop code	"ETX", "CR"
Operation mode	External trigger, host trigger
Data output mode	1-shot, continuous

BCR Read Start (Sequence No. 350 (Hex 015E))

This sequence instructs the Bar Code Reader to start reading.

Send Data Word Allocation 3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

BCR Read Stop (Sequence No. 351 (Hex 015F))

This sequence instructs the Bar Code Reader to stop reading.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Data Read (Sequence No. 352 (Hex 0160))

This sequence receives read data and saves it to the receive data storage words.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Read data
	+2	Read data
	+3	Read data
	+4	Read data
		⋮
	+15	Read data
	+16	Read data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 0011 (2 to 17 decimal)
+1 to +16	Read data (ASCII)	30 (‘0’) to 39 (‘9’), 41 (‘A’) to 5A (‘Z’), 3F (‘?’) Up to 32 characters in ASCII

Note The reception wait time is not set for this sequence.

Complete Data Read (Sequence No. 353 (Hex 0161))

This sequence instructs the Bar Code Reader to start reading, receives the data read by the Bar Code Reader, stores the data in the receive data storage words, and then instructs the Reader to stop reading.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
It is similar to sequence No. 352 (Data read).

Note The reception wait time is not set for this sequence.

BCR Function Write (V500) (Sequence No. 345 (Hex 0162))

This sequence sets the operation mode and read functions in the Bar Code Reader.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

<table>
<tr><td>+0</td><td colspan="3">Number of send data words</td></tr>
<tr><td>+1</td><td>Operation mode</td><td colspan="2">In-zone control</td></tr>
<tr><td>+2</td><td>Types of bar code</td><td colspan="2">(Undefined)</td></tr>
<tr><td>+3</td><td>(Undefined)</td><td colspan="2">Number of digits</td></tr>
<tr><td>+4</td><td>Modulus check</td><td colspan="2">(Undefined)</td></tr>
<tr><td>+5</td><td>(Undefined)</td><td>Number of matches</td><td>Multistep labels</td></tr>
<tr><td>+6</td><td>Buzzer</td><td colspan="2">Horizontal control</td></tr>
</table>

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 (fixed)
+1	Operation mode (ASCII 1 character)	41 (‘A’): ONLINE *42 (‘B’): ONLINE CONTROL
	In-zone control (ASCII 1 character)	*41 (‘A’): ON 42 (‘B’): OFF
+2	Bar code type (ASCII 1 character)	41 (‘A’): JAN 42 (‘B’): NW7 NORMAL 43 (‘C’): NW7 SMALL 44 (‘D’): NW7 HEX 45 (‘E’): CODE39 NORMAL 46 (‘F’): CODE39 ST/SP OUTPUT 47 (‘G’): 2 of 5 (ITF) 48 (‘H’): CODE128 49 (‘I’): CODE93 4A (‘J’): 2 of 5 (3BAR) 4B (‘K’): 2 of 5 (5BAR)
+3	Number of digits (2 digits BCD)	00 to 32 00: Any number of digits allowed.
+4	Modulus check (ASCII 1 character)	41 (‘A’): No-check 42 (‘B’): Modulus 10 (all bar codes) 43 (‘C’): Modulus 11 (except JAN) 44 (‘D’): Modulus 16 (NW7 only) 45 (‘E’): Modulus 43 (CODE39 only) 46 (‘F’): Modulus 47 (CODE93 only) 47 (‘G’): Modulus 103 (CODE128 only)
+5	Number of matches (1 digit BCD)	1 to 5
	Multistep labels (1 digit BCD)	1 to 4
+6	Buzzer (ASCII 1 character)	41 (‘A’): ON for normal read 42 (‘B’): ON for no-read 43 (‘C’): OFF
	Horizontal control mode (ASCII 1 character)	41 (‘A’): Normal (continuous rotating) 42 (‘B’): In-zone startup

Note Selecting the values marked with asterisks is required for this protocol.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

BCR Function Read (V500) (Sequence No. 355 (Hex 0163))

This sequence reads the settings of functions in the Bar Code Reader.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

<table>
<tr><td>+0</td><td colspan="3">Number of receive data words</td></tr>
<tr><td>+1</td><td>Operation mode</td><td colspan="2">In-zone control</td></tr>
<tr><td>+2</td><td>Types of bar code</td><td colspan="2">(Undefined)</td></tr>
<tr><td>+3</td><td>(Undefined)</td><td colspan="2">Number of digits</td></tr>
<tr><td>+4</td><td>Modulus check</td><td colspan="2">(Undefined)</td></tr>
<tr><td>+5</td><td>(Undefined)</td><td>Number of matches.</td><td>Multistep labels.</td></tr>
<tr><td>+6</td><td>Buzzer</td><td colspan="2">Horizontal control</td></tr>
</table>

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0007 (fixed)
+1	Operation mode (ASCII 1 character)	41 (‘A’): ONLINE 42 (‘B’): ONLINE CONTROL
	In-zone control (ASCII 1 character)	41 (‘A’): ON 42 (‘B’): OFF
+2	Bar code type (ASCII 1 character)	41 (‘A’): JAN 42 (‘B’): NW7 NORMAL 43 (‘C’): NW7 SMALL 44 (‘D’): NW7 HEX 45 (‘E’): CODE39 NORMAL 46 (‘F’): CODE39 ST/SP Output 47 (‘G’): 2 of 5 (ITF) 48 (‘H’): CODE128 49 (‘I’): CODE93 4A (‘J’): 2 of 5 (3BAR) 4B (‘K’): 2 of 5 (5BAR)
+3	Number of digits (2 digits BCD)	00 to 32
+4	Modulus check (ASCII 1 character)	41 (‘A’): No-check 42 (‘B’): Modulus 10 (all bar codes) 43 (‘C’): Modulus 11 (except JAN) 44 (‘D’): Modulus 16 (NW7 only) 45 (‘E’): Modulus 43 (CODE39 only) 46 (‘F’): Modulus 47 (CODE93 only) 47 (‘G’): Modulus 103 (CODE128 only)
+5	Number of matches (1 digit BCD)	1 to 5
	Multistep labels (1 digit BCD)	1 to 4
+6	Buzzer (ASCII 1 character)	41 (‘A’): ON for normal read 42 (‘B’): ON for no-read 43 (‘C’): OFF
	Horizontal control mode (ASCII 1 character)	41 (‘A’): Normal (continuous rotating) 42 (‘B’): In-zone startup

Log Data Output Request (V500) (Sequence No. 356 (Hex 0164))

This sequence requests output of the log data sent to host.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Number of units

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Number of units (2 digits BCD)	01 to 99

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Log data
	+2	Log data
		~ ~
	+248	Log data
	+249	Log data

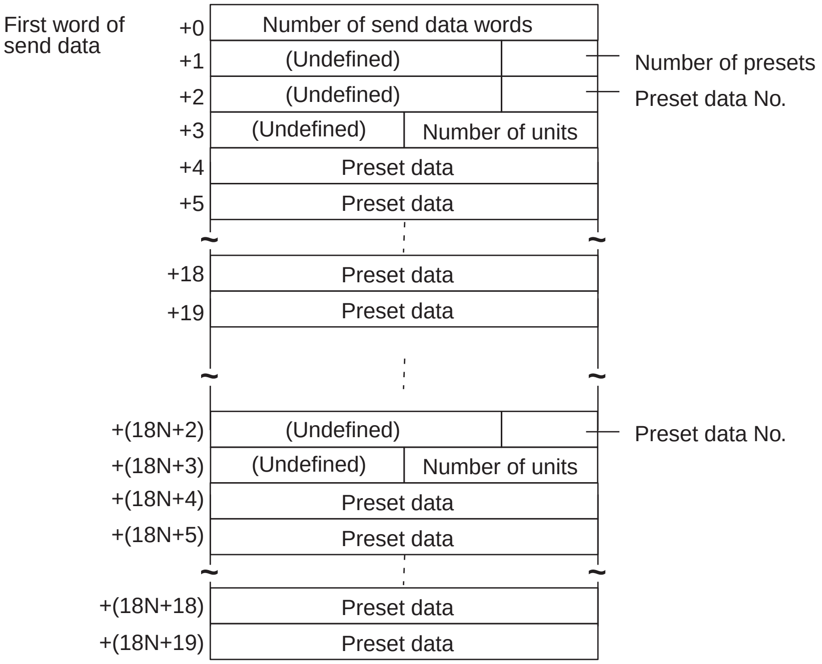
Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0001 to 00FA (1 to 250 decimal)
+1 to +249	Log data (ASCII)	Log data with the number of designated data is stored including the separator GS (1D). If the log data (including separator) exceeds 498 bytes, only 498 bytes are stored.

Note No retries are performed for this sequence.

Preset Data Set (V500) (Sequence No. 357 (Hex 0165))

This sequence sets preset data.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	18N+2 (N is number of presets 1 to 5)
+1	Number of presets (1 digit BCD)	1 to 5
+2	Preset data No. (1 digit BCD)	1 to 5
+3	Data length (2 digits BCD)	01 to 32
+4 to +19	Preset data (ASCII)	Combination of the following ASCII characters and up to 32 characters maximum: 30 ('0') to 39 ('9') 41 ('A') to 5A ('Z'), 3F ('?') The area that is not used is undefined
+20 to +91		Store repeatedly the contents of words with offsets +2 to +19 the same number of times as the number of presets (N)

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

BCR Connection Confirmation (V500) (Sequence No. 358 (Hex 0166))

This sequence confirms whether the Bar Code Reader is connected correctly or not.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Log Data Clear (V500) (Sequence No. 359 (Hex 0167))

This sequence clears the log data.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Data Continuous Read (Scan) (V500) (Sequence No. 360 (Hex 0168))

This sequence performs the following operations repeatedly: Instructs the Bar Code Reader to start reading and receives the data read by the Bar Code Reader. The scan notification method is used for the receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
Receive data word allocation is similar to that of sequence No. 352 (Data read).

Note
1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.
2. Even if execution is cancelled, the Bar Code Reader still keeps reading. Execute sequence No. 351 (BCR read stop) to end the sequence.

Note The reception wait time is not set for this sequence.

Data Continuous Read (Interrupt) (V500) (Sequence No. 361 (Hex 0169))

This sequence performs the following operations repeatedly: Instruct the Bar Code Reader to start reading and receives the data read by the Bar Code Reader. The interrupt notification method is used for the receive data and the interrupt No. is 100.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation similar to that of sequence No. 352 (data read).

Note
1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.
2. Even if execution is cancelled, the Bar Code Reader keeps reading. Execute sequence No. 351 (BCR read stop) to end the sequence.
3. The reception wait time is not set for this sequence.
4. Sequences No. 361 and No. 364 (Continuous Data Read with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit.

BCR Initialize (V500) (Sequence No. 362 (Hex 016A))

This sequence clears the log data, confirms BCR connection and sets the BCR functions.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of sequence No. 354 (BCR Function Set).

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Data Continuous Read (Scan) (V520) (Sequence No. 363 (Hex 016B))

This sequence performs the following operations repeatedly: instructs the Bar Code Reader to start reading and receives the data read by the Bar Code Reader. The scan notification method is used for the receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of sequence No. 352 (Data Read).

Note 1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.

2. Even if execution is cancelled, the bar code still keeps reading. Execute sequence No. 351 (BCR Read Stop) to end the sequence.
3. The reception wait time is not set for this sequence.

Data Continuous Read (Interrupt) (V520) (Sequence No. 364 (Hex 016C))

This sequence performs the following operations repeatedly: Instructs the Bar Code Reader to start reading and receives the data read by the Bar Code Reader. The interrupt notification method is used for the receive data and the interrupt No. is 100.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

The send data word allocation is similar to that of sequence No. 352 (Data Read).

Note 1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.

2. Even if execution is cancelled, the bar code still keeps reading. Execute sequence No. 351 (BCR Read Stop) to end the sequence.
3. The reception wait time is not set for this sequence.
4. Sequences No. 361 and No. 364 (Continuous Data Read with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur is an attempt is made to execute either sequence with a Serial Communications Unit.

General-purpose Command 1 (Sequence No. 365 (Hex 016D))

This general-purpose command is used to send data with a specified data length, and receive back only ACK. STX and ETX are automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Send data byte length
	+2	Send data
	+3	Send data
	+248	Send data
	+249	Send data

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The byte length of the send data excluding STX and ETX.
+2 to +249	Send data (ASCII)	Inscribe send data up to 496 bytes (max.) by ASCII.

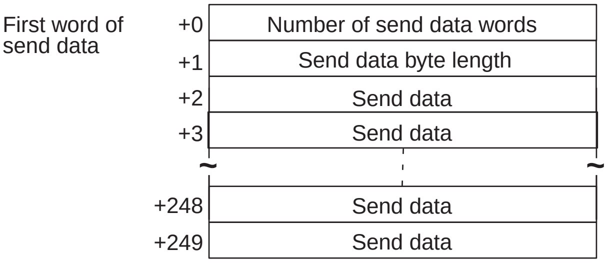
Receive Data Word Allocation (4th Operand of PMCR(260))

None.

General-purpose Command 2 (Sequence No. 366 (Hex 016E))

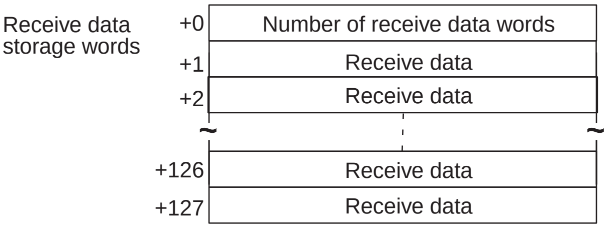
This general-purpose command is used to send data with a specified data length, and receive back ACK in addition to other receive data. The frame format of the receive data, however, has to contain STX and ETX. STX and ETX are automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))



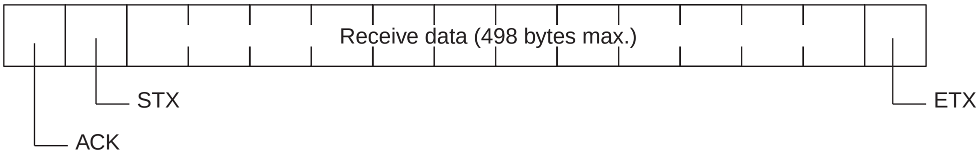
Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The byte length of the send data excluding STX and ETX.
+2 to +128	Send data (ASCII)	Set send data up to 496 bytes (max.) by ASCII.

Receive Data Storage Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0001 to 00FA (1 to 250 decimal)
+1 to +127	Receive data (ASCII)	Up to 498 bytes of ASCII receive data are stored.

Note Shown below is the receive data frame format. The reception data without ACK, STX, and ETX is stored.



Appendix K

3Z4L Laser Micrometer Protocol

The 3Z4L Laser Micrometer Protocol is used to make various settings or control remotely the Laser Micrometer connected to the Serial Communications Unit/Board via RS-232C cable.

Protocol Configuration

The configuration of the 3Z4L Laser Micrometer Protocol is shown below.

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
400 (0190)	3Z4L clear	Resets errors, data, analog output, decision result and places the Laser Micrometer into standby.	No	No	
401 (0191)	Memory switch set	Sets memory switches and the area for the work position LED.	Yes	No	
402 (0192)	mm unit set	Sets the display unit to mm.	No	No	
403 (0193)	E unit set	Sets the display unit to E.	No	No	
404 (0194)	Calibration set	Calibrates the Laser Micrometer. Calibration setting release.	Yes	No	
405 (0195)	Calibration release	Releases the calibration of the Laser Micrometer.	No	No	
406 (0196)	Program number set (3000-series)	Switches the program number to a specified number.	Yes	No	
407 (0197)	Measurement condition set (3000-series)	Sets measurement conditions.	Yes	No	
408 (0198)	Measurement condition release (3000-series)	Releases measurement conditions that have been set.	Yes	No	
409 (0199)	Measurement condition list request (3000-series)	Requests the measurement conditions that have been set and other settings.	No	Yes	
410 (019A)	Single run measurement start (3000-series)	When the sample measurement condition is from 1 to 999, performs a single run measurement and requests the measurement results.	No	Yes	
411 (019B)	Zero run measurement start (3000-series)	If the sample measurement condition is zero, starts a zero run measurement.	No	No	
412 (019C)	Continuous measurement start (scan) (3000-series)	Starts a continuous measurement. The scan notification method is used for receive data.	No	Yes	
413 (019D)	Continuous measurement start (interrupt) (3000-series)	Starts a continuous measurement. The interrupt notification method is used for receive data. Measurement termination (3000-series)	No	Yes	See Note 2
414 (019E)	Measurement termination (3000-series)	Terminates a continuous measurement.	No	No[*1]	
415 (019F)	Data request (3000-series)	Requests display data in the idle measurement status or the latch data generated by the measurement command.	No	Yes	

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
416 (01A0)	Statistic processing execution (3000-series)	Lights the statistic processing LED and processes the statistics.	No	No	
417 (01A1)	Statistic processing non-execution (3000-series)	Turns OFF the statistic processing LED. Statistics are not processed.	No	No	
418 (01A2)	All statistic memory clear (3000-series)	Clears statistic processing memories of all programs.	No	No	
419 (01A3)	Statistic memory clear (3000-series)	Clears statistic processing memories of program under display.	No	No	
420 (01A4)	Statistic result request (3000-series)	Requests statistic processing result.	No	Yes	
421 (01A5)	Memory switch set 1 (3000-series)	Sets memory switches.	Yes	No	
422 (01A6)	Memory switch set 2 (3000-series)	Sets memory switches.	Yes	No	
423 (01A7)	Simple AVG times set (3000-series)	Taking the simple average as the averaging method, sets the averaging times per measurement interval 4.	Yes	No	
424 (01A8)	AVG move interval set (3000-series)	Taking the average move as the averaging method, sets the measurement interval number.	Yes	No	
425 (01A9)	AVG move (H) times set (3000-series)	Taking the average move and high-speed data output as the averaging method, sets the averaging times per measurement interval 4.	Yes	No	
426 (01AA)	AVG move (L) times set (3000-series)	Taking the average move and low-speed data output as the averaging method, sets the averaging times per measurement interval 4.	Yes	No	
427 (01AB)	Automatic detection set (3000-series)	Sets work automatic detection function.	Yes	No	
428 (01AC)	Automatic detection release (3000-series)	Releases the settings of work automatic detection function.	No	No	
429 (01AD)	Automatic detection list request (3000-series)	Requests the settings of work automatic detection function.	No	Yes	
430 (01AE)	3Z4L initialize (3000-series)	Clears the 3Z4L, sets the mm unit, sets the memory unit, does not processes statistics, and clears all statistic memory.	Yes	No	
431 (01AF)	Measurement condition set (4000-series)	Sets measurement conditions.	Yes	No	
432 (01B0)	Measurement condition release (4000-series)	Releases measurement conditions that have been set.	Yes	No	
433 (01B1)	Measurement condition list request (4000-series)	Requests the measurement conditions that have been set and other settings.	No	Yes	
434 (01B2)	Single run measurement start (4000-series)	When the sample measurement condition is from 1 to 999, performs a single run measurement and requests the measurement results.	No	Yes	
435 (01B3)	Deflection measurement start (4000-series)	Starts a deflection measurement.	No	No	
436 (01B4)	Continuous measurement start (scan) (4000-series)	Starts a continuous measurement. The scan notification method is used for receive data.	No	Yes	

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
437 (01B5)	Continuous measurement start (interrupt) (4000-series)	Starts a continuous measurement. The interrupt notification method is used for receive data.	No	Yes	See Note 2
438 (01B6)	Measurement termination (4000-series)	Terminates continuous measurement.	No	No *1	
439 (01B7)	Data request (4000-series)	Requests measurement data in the idle measurement status or the latch data generated by the measurement command.	No	Yes	
440 (01B8)	Forced positive zero (4000-series)	Sets the forced zero direction to positive (+).	No	No	
441 (01B9)	Forced negative zero (4000-series)	Sets the forced zero direction to negative (–).	No	No	
442 (01BA)	Forced zero release (4000-series)	Releases the forced zero direction.	No	No	
443 (01BB)	3Z4L initialize (4000-series)	Clears the 3Z4L, sets the mm unit, and clears the memory unit settings.	Yes	No	
444 (01BC)	General-purpose command 1	Used to send data of a specified data length, and receive only OK as the receive data.	Yes	No	
445 (01BD)	General-purpose command 2	Used to send data of a specified data length, and receive data other than OK.	Yes	Yes	
446 (01BE)	High calibration set	Sets the Laser Micrometer's high calibration.	Yes	No	
447 (01BF)	Low calibration set	Sets the Laser Micrometer's low calibration.	Yes	No	

*1 Depends on the measurement contents.

Note 1. Sequences with interrupt notification are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit.
Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

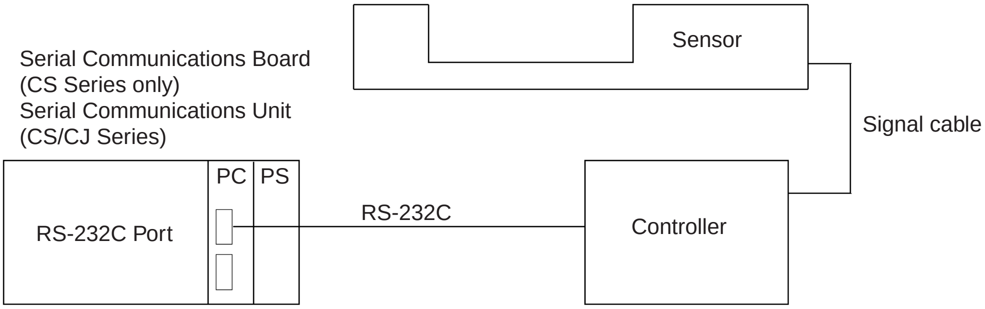
2. **Ladder Interface Settings**
YES: User settings are required for the 3rd and 4th operands of PMCR(260).
NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
Receive word allocation: Set the constant 0000 for the 4th operand (D).

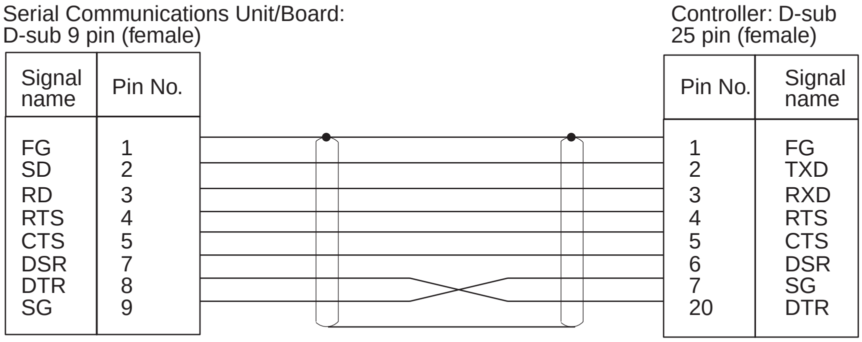
3. The hexadecimal equivalents of sequences numbers are given in parentheses.

Connections

The connections for the 3Z4L Laser Micrometer Protocol are shown below.

RS-232C Connection





DIP Switch Settings

Shown below are the settings of 3Z4L-3000, 3Z4L-4000-series DIP switches required to use the system protocol sequences.

3Z4L-3000 Series

- **DIP Switch 1**

No.	Setting	Status
1	Baud rate	ON/OFF
2		ON/OFF
3	Handshaking procedure	ON/OFF
4	RS-232C interface use selection	ON/OFF
5		ON/OFF
6		ON/OFF

- **DIP Switch 2**

No.	Setting	Status
1	Selection for measurement section	ON/OFF
2		ON/OFF
3		ON/OFF
4		ON/OFF
5	Setting of minimum read value	ON/OFF
6		ON/OFF
7	Setting of transparent body measurement function	ON/OFF
8	Setting of simultaneous measurement function	ON/OFF

Set these settings according to the sensor connected.

Set these settings for 4 digits in the decimal portion.

- **DIP Switch 3**

No.	Setting	Status
1	Setting of measurement function by 2 measurement instruments	ON/OFF
2		ON/OFF
3		ON/OFF
4		ON/OFF
5	Error data exclusion function	ON/OFF
6	Multistep selection function	ON/OFF

This protocol does not support the error data exclusion function

3Z4L-4000 Series

- **DIP Switch 1**

No.	Setting	Status
1	Baud rate	ON/OFF
2		ON/OFF
3	Hand-shake procedure	ON/OFF
4	Delimiter	ON/OFF
5		ON/OFF
6	RS-232C interface use selection	ON/OFF
7		ON/OFF
8		ON/OFF

- **DIP Switch 2**

No.	Setting	Status
1	Selection for measurement section	ON/OFF
2		ON/OFF
3		ON/OFF
4		ON/OFF
5	Setting of minimum read value	ON/OFF
6		ON/OFF
7	Display unit	ON/OFF
8	External command setting	ON/OFF

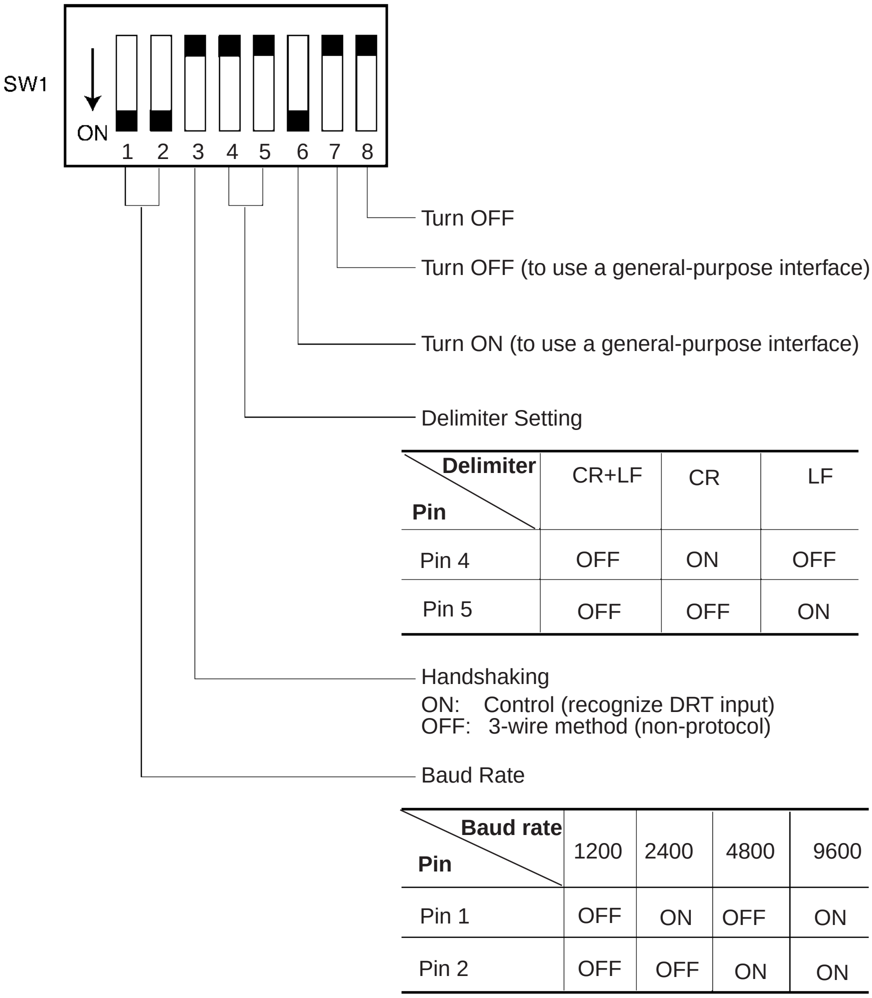
Set these settings according to the sensor connected.

Set these settings for 4 digits in the decimal portion.

Delimiter Control Code Setting

3Z4L-4000 Series

The delimiter control codes must be set on DIP switch SW1 for the 3Z4L-4000 Series. Turn off pins 4 and 5, set the delimiter codes to CR+LF, and set the delimiter code control setting in the sequence to CR+LF. See the setting for CR+LF in the following diagram.

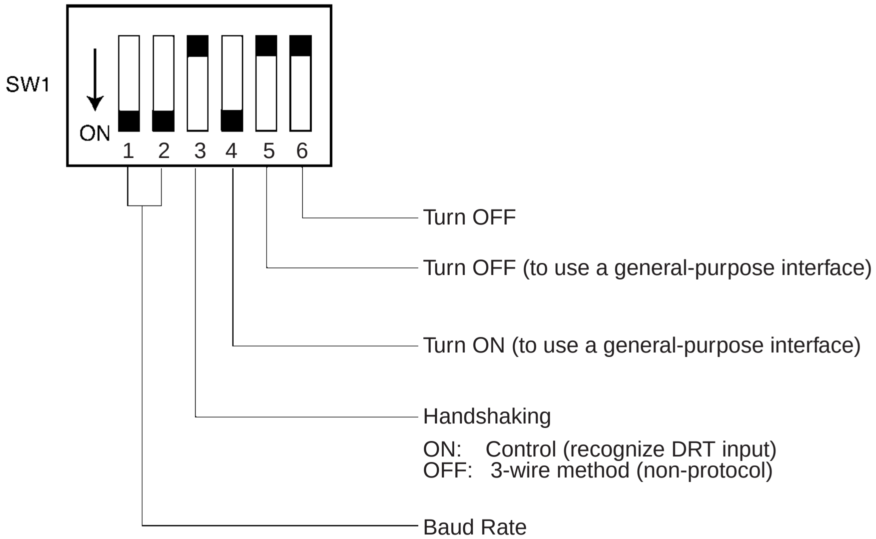


Delimiter / Pin	CR+LF	CR	LF
Pin 4	OFF	ON	OFF
Pin 5	OFF	OFF	ON

Baud rate / Pin	1200	2400	4800	9600
Pin 1	OFF	ON	OFF	ON
Pin 2	OFF	OFF	ON	ON

3Z4L-3000 Series

The delimiter control code does not need to be set on the DIP switch for the 3Z4L-3000 Series. Set the delimiter control codes in the sequence to CR+LF for the send code and to CR or CR+LF for the receive code. See the settings in the following diagram.



Baud rate Pin	1200	2400	4800	9600
Pin 1	OFF	ON	OFF	ON
Pin 2	OFF	OFF	ON	ON

The High-speed 3Z4L-3000-series Meters must have the delimiter control codes set using the memory switches. Set both the send and receive codes to CR+LF.

Protocol Configuration

The configuration of the 3Z4L Laser Micrometer Protocol for the 5000 and 6000 Series is shown below.

Sequence No.	Communications sequence name	Operation	
		5000 Series	6000 Series
400 (0190)	3Z4L clear	Yes	Yes
401 (0191)	Memory switch set	No*1	No*1
402 (0192)	mm unit set	Yes	Yes
403 (0193)	E unit set	Yes	Yes
404 (0194)	Calibration set	No	No
405 (0195)	Calibration release	Yes	Yes
406 (0196)	Program number set (3000-series)	No*1	Yes
407 (0197)	Measurement condition set (3000-series)	No	No
408 (0198)	Measurement condition release (3000-series)	No	No
409 (0199)	Measurement condition list request (3000-series)	No	No
410 (019A)	Single run measurement start (3000-series)	No	Yes
411 (019B)	Zero run measurement start (3000-series)	Yes	Yes
412 (019C)	Continuous measurement start (scan) (3000-series)	No	Yes
413 (019D)	Continuous measurement start (interrupt) (3000-series)	No	Yes
414 (019E)	Measurement termination (3000-series)	No	Yes
415 (019F)	Data request (3000-series)	No	Yes

Sequence No.	Communications sequence name	Operation	
		5000 Series	6000 Series
416 (01A0)	Statistic processing execution (3000-series)	Yes	Yes
417 (01A1)	Statistic processing non-execution (3000-series)	Yes	Yes
418 (01A2)	All statistic memory clear (3000-series)	Yes	Yes
419 (01A3)	Statistic memory clear (3000-series)	Yes	Yes
420 (01A4)	Statistic result request (3000-series)	No	No
421 (01A5)	Memory switch set 1 (3000-series)	No*1	No*1
422 (01A6)	Memory switch set 2 (3000-series)	No*1	No*1
423 (01A7)	Simple AVG times set (3000-series)	Yes	Yes
424 (01A8)	AVG move interval set (3000-series)	Yes	Yes
425 (01A9)	AVG move (H) times set (3000-series)	Yes	Yes
426 (01AA)	AVG move (L) times set (3000-series)	Yes*2	No
427 (01AB)	Automatic detection set (3000-series)	No	No
428 (01AC)	Automatic detection release (3000-series)	Yes	Yes
429 (01AD)	Automatic detection list request (3000-series)	Yes	Yes
430 (01AE)	3Z4L initialize (3000-series)	Yes*3	Yes*3
431 (01AF)	Measurement condition set (4000-series)	No	No
432 (01B0)	Measurement condition release (4000-series)	No	No
433 (01B1)	Measurement condition list request (4000-series)	No	No
434 (01B2)	Single run measurement start (4000-series)	Yes	No
435 (01B3)	Deflection measurement start (4000-series)	Yes*4	No
436 (01B4)	Continuous measurement start (scan) (4000-series)	Yes	No
437 (01B5)	Continuous measurement start (interrupt) (4000-series)	Yes	No
438 (01B6)	Measurement termination (4000-series)	Yes	No
439 (01B7)	Data request (4000-series)	Yes	No
440 (01B8)	Forced positive zero (4000-series)	Yes	Yes
441 (01B9)	Forced negative zero (4000-series)	Yes	Yes
442 (01BA)	Forced zero release (4000-series)	Yes	Yes
443 (01BB)	3Z4L initialize (4000-series)	Yes*3	Yes*3
444 (01BC)	General-purpose command 1	Yes	Yes
445 (01BD)	General-purpose command 2	Yes	Yes
446 (01BE)	High calibration set	No	No
447 (01BF)	Low calibration set	No	No

Note 1. *Normal responses will be returned for these sequences for 5000-series and 6000-series Laser Micrometers, but no processing will be performed.

2. *This sequence will be processed the same as sequence No. 425 AVG move (H) times set for 5000-series Laser Micrometers.

3. *Memory switch settings will be ignored for these sequences for 5000-series and 6000-series Laser Micrometers.

4. *This sequence will be processed the same as sequence No. 411 Zero run measurement start for 5000-series Laser Micrometers.

3Z4L Clear (Sequence No. 400 (Hex 0190))

This sequence resets errors, data, analog output, and decision result, and puts the Laser Micrometer into standby.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Memory Switch Set (Sequence No. 401 (Hex 0191))

This sequence sets memory switches and the area for the work position LED.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words			
	+1	W	X	Y	Z
	+2	(Undefined)			V

Offset	Contents (data format)	Data	
		3000-series	4000-series
+0	Number of send data words (4 digits Hex)	0003 (fixed)	0003 (fixed)
+1	w (1 digit BCD)	Using buzzer sound: 0 to 3	Number of digits for extinguishing indicator: 0 to 2
	x (1 digit BCD)	Automatic latch release time: 0 to 9	I/O IF RUN Input: 0 or 1
	y (1 digit BCD)	Using print timer, the setting for simultaneous measurement: 0 to 3 (high-speed), 0 to 1 (other)	Display of Err–0: 0 or 1
	z (1 digit BCD)	Display of the comma for 1/1000s digit, number of display digits: 0 to 5 (high-speed), 0 to 3 (other)	Averaging method: 0 to 2 (high-speed), 0 (other)
+2	v (1 digit BCD)	Measurement interval 4: 0 to 6	Use of comma: 0 or 1

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

mm Unit Set (Sequence No. 402 (Hex 0192))

This sequence sets the display unit to mm.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence can be used for the 3Z4L-4000 Series only when pin 8 on DIP switch SW2 is turned ON.

E Unit Set (Sequence No. 403 (Hex 0193))

This sequence sets the display unit to E.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence can be used for the 3Z4L-4000 Series only when pin 8 on DIP switch SW2 is turned ON.

Calibration Set (Sequence No. 404 (Hex 0194))

This sequence calibrates the Laser Micrometer.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Decimal portion		High calibration gauge dimension
	+2	(Undefined)	Decimal integer portion	
	+3	Sign	(Undefined)	
	+4	Decimal portion		Low calibration gauge dimension
	+5	(Undefined)	(Decimal integer portion)	
	+6	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of send data words (4 digits Hex)	0007 (fixed)	
+1	HC gauge dimension (Decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +1 4 5 6 7 +2 0 1 2 3 +3 2 D 0 0
+2	HC gauge dimension (integer portion) (3 digits BCD)	000 to 999	**Example** -123.4567 +1 4 5 6 7 +2 0 1 2 3 +3 2 D 0 0
+3	HC gauge dimension (Sign) (ASCII 1 character)	if +: 20(‘ ’) if –: 2D(‘–’)	
+4 to +6	LC gauge dimensions	Same as HC gauge dimensions	

Note 1. Use sequences No. 446 (High calibration set) and No. 447 (Low calibration set) to calibrate the Laser Micrometer. If this sequence (No. 404) is used, both the high and low calibration gauges must be set, and the high calibration and low calibration gauges cannot be exchanged.

2. The HC gauge dimension and LC gauge dimension must be set with 3 digits for the integer portion and 4 digits for the decimal portion.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Calibration Release (Sequence No. 405 (Hex 0195))

This sequence releases the calibration of the Laser Micrometer.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

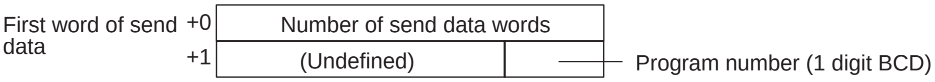
None.

Note This sequence releases both the high and low calibration.

Program Number Set (3000-series) (Sequence No. 406 (Hex 0196))

This sequence switches the program number to a specified number.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Program number (1 digit BCD)	0 to 9

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Retry processing is not performed for this sequence.

Measurement Condition Set (3000-series) (Sequence No. 407 (Hex 0197))

This sequence sets measurement conditions. Conditions to be set can be selected by setting Yes/No flags.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Unused)		
	+2			Segment number (SG)
	+3			
	+4			
	+5	(Undefined)		Measurement interval number (M)
	+6	Decimal portion		Lower limit value (LL)
	+7	(Undefined)	Integer portion	
	+8	Sign	(Undefined)	
	+9	Decimal portion		Upper limit value (LH)
	+10	(Undefined)	Integer portion	
	+11	Sign	(Undefined)	
	+12	Decimal portion		Multistep selection limit value (L1)
	+13	(Undefined)	Integer portion	
	+14	Sign	(Undefined)	
	+15	Decimal portion		Multistep selection limit value (L2)
	+16	(Undefined)	Integer portion	
	+17	Sign	(Undefined)	
	+18	Decimal portion		Multistep selection limit value (L3)
	+19	(Undefined)	Integer portion	
	+20	Sign	(Undefined)	
	+21	Decimal portion		Multistep selection limit value (L4)
	+22	(Undefined)	Integer portion	
	+23	Sign	(Undefined)	
	+24	Decimal portion		Multistep selection limit value (L5)
	+25	(Undefined)	Integer portion	
	+26	Sign	(Undefined)	
	+27	Decimal portion		Multistep selection limit value (L6)
	+28	(Undefined)	Integer portion	
	+29	Sign	(Undefined)	

+30	Decimal portion		Reference value (REF)
+31	(Undefined)	Integer portion	
+32	Sign	(Undefined)	
+33	(Undefined)		Analog output scale number (SCL)
+34			Offset classification (OF)
+35		(Undefined)	
+36	Decimal portion		Offset value
+37	(Undefined)	Integer portion	
+38	Sign	(Undefined)	
+39	(Undefined)		Data output conditions (PR)
+40	(Undefined)	Schedule output timer	(PRT)
+41	(Undefined)	Sample measurement pulse	(SMP)
+42			Sample measurement classification
+43		(Undefined)	
+44	(Unused)		
+45	(Unused)		
+46	0		Setting Yes/No flags
+47	0		
+48	0		
+49	0		
+50	0		
+51	0		
+52	0		
+53	0		

Offset	Contents (data format)	Data	
+0	Number of send data words (4 digits Hex)	0054 (fixed)	
+1	Unused	Undefined	
+2 to +4	Segment number (ASCII 6 characters)	Combination of 31(‘1’) to 36(‘6’), 20(‘ ’)	
+5	Measurement interval number (1 digit BCD)	1 to 4	
+6	Lower limit value (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +6 4 5 6 7 +7 0 1 2 3 +8 2 D 0 0
+7	Lower limit value (Integer portion) (3 digits BCD)	000 to 999	
+8	Lower limit value (Sign) (ASCII 1 character)	if +: 20(‘ ’) if –: 2D(‘–’)	
+9 to +11	Upper limit value	Same as lower limit values	
+12 to +14	Multistep selection limit value (L1)	Same as lower limit values	
+15 to +17	Multistep selection limit value (L2)	Same as lower limit values	
+18 to +20	Multistep selection limit value (L3)	Same as lower limit values	
+21 to +23	Multistep selection limit value (L4)	Same as lower limit values	
+24 to +26	Multistep selection limit value (L5)	Same as lower limit values	
+27 to +29	Multistep selection limit value (L6)	Same as lower limit values	
+30 to +32	Reference value	Same as lower limit values	

Offset	Contents (data format)	Data
+33	Analog output scale number (1 digit BCD)	1 to 3
+34 to +35	Offset classification (ASCII 3 characters)	4F4620 (“OF”), 4F4D20 (“OM”)
+36 to +38	Offset value	Same as lower limit values
+39	Data output conditions (1 digit BCD)	0 to 6
+40	Scheduled output timer (3 digits BCD)	000 to 999
+41	Sample measurement pulse (3 digits BCD)	000 to 999
+42 to +43	Sample measurement classification (ASCII 3 characters)	415647 (“AVG”), 4D4158 (“MAX”) 4D494E (“MIN”), 524E47 (“RNG”)
+44 to +45	Unused	Undefined
+46	Yes/No for segment setting (1 digit BCD)	Set: 1 (SG) Don’t set: 0
+47	Yes/No for measurement interval number setting (1 digit BCD)	Set: 1 (M) Don’t set: 0
+48	Yes/No for upper/lower limit value setting (1 digit BCD)	Set: 1 (LL,LH) Don’t set: 0
+49	Yes/No for multistep selection limit value (1 digit BCD)	Set: 1 (L1,L2,L3,L4,L5,L6) Don’t set: 0
+50	Yes/No for reference setting (1 digit BCD)	Set: 1 (REF,SCL) Don’t set: 0
+51	Yes/No for offset value setting (1 digit BCD)	Set: 1 (OF or OM) Don’t set: 0
+52	Yes/No for data output condition setting (1 digit BCD)	Set: 1 (PR,PRT) Don’t set: 0
+53	Yes/No for sample measurement pulse setting (1 digit BCD)	Set: 1 (SMP, MAX or MIN or RNG or AVG) Don’t set: 0

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note

1. This sequence cannot be used to set the error lower limit (EL), error upper limit (EH), error exclusion counter (CNT) of the error data exclusion function (centerless grinder function).
2. The following settings must be made together with this sequence; they cannot be set separately.
   Lower limit, upper limit
   Multistep selection limit
   Reference value, analog output scale number
   Data output conditions, scheduled print timer
3. The limit value, reference value, and offset value can be set to 3 digits for the integer portion and to 4 digits for the decimal portion.

Measurement Condition Release (3000-series) (Sequence No. 408 (Hex 0198))

This sequence releases the measurement conditions that have been set.

Send Data Word Allocation (3rd Operand of PMCR(260))

Send data word allocation is similar to that of sequence No. 407 (Measurement Condition Set). However, only the setting Yes/No flags at +46 to +53 from the send data leading word can be used.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note

1. The following conditions are used when the measurement conditions are released: Segment becomes 1, measurement interval becomes 1, the number of sample measurement pulses becomes 1.
2. The following conditions cannot be released with this sequence: error lower limit (EL), error upper limit (EH), error exclusion counter (CNT) of the error data exclusion function (centerless grinder function).
3. The following settings cannot be released separately using this sequence.
   Lower limit, Upper limit
   Multistep selection limit
   Reference value, analog output scale number
   Data output conditions, scheduled print timer

Measurement Condition List Request (3000-series) (Sequence No. 409 (Hex 0199))

This sequence requests the measurement condition settings that have been set and other settings.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

First word of send data	+0	Number of receive data words		
	+1	(Undefined)		Program number (P)
	+2			Segment number (SG)
	+3			
	+4			
	+5	(Undefined)		Measurement interval number (M)
	+6	Decimal portion		Lower limit value (LL)
	+7	(Undefined)	Integer portion	
	+8	Sign	(Undefined)	
	+9	Decimal portion		Upper limit value (LH)
	+10	(Undefined)	Integer portion	
	+11	Sign	(Undefined)	
	+12	Decimal portion		Multistep selection limit value (L1)
	+13	(Undefined)	Integer portion	
	+14	Sign	(Undefined)	
	+15	Decimal portion		Multistep selection limit value (L2)
	+16	(Undefined)	Integer portion	
	+17	Sign	(Undefined)	
	+18	Decimal portion		Multistep selection limit value (L3)
	+19	(Undefined)	Integer portion	
	+20	Sign	(Undefined)	
	+21	Decimal portion		Multistep selection limit value (L4)
	+22	(Undefined)	Integer portion	
	+23	Sign	(Undefined)	
	+24	Decimal portion		Multistep selection limit value (L5)
	+25	(Undefined)	Integer portion	
	+26	Sign	(Undefined)	
	+27	Decimal portion		Multistep selection limit value (L6)
	+28	(Undefined)	Integer portion	
	+29	Sign	(Undefined)	
	+30	Decimal portion		Reference value (REF)
	+31	(Undefined)	Integer portion	
	+32	Sign	(Undefined)	
	+33	(Undefined)		Analog output scale number (SCL)
	+34			Offset classification (OF)
	+35		(Undefined)	
	+36	Decimal portion		Offset value (LH)
	+37	(Undefined)	Integer portion	
	+38	Sign	(Undefined)	
	+39			Data output condition (PR)
	+40	(Undefined)	Scheduled output timer	(PRT)
	+41	(Undefined)	Sample measurement pulse	(SMP)
	+42			Sample measurement classification
	+43		(Undefined)	
	+44			Statistical processing calculation classification
	+45		(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digits Hex)	002E (0046 decimal) (fixed)	
+1	Program number (1 digit BCD)	0 to 9	
+2 to +4	Segment number (ASCII 6 characters)	Combination of 31(‘1’) to 36(‘6’), 20(‘ ’)	
+5	Measurement interval number (1 digit BCD)	1 to 4	
+6	Lower limit value (Decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +6 4 5 6 7 +7 0 1 2 3 +8 F 0 0 0
+7	Lower limit value (Integer portion) (3 digits BCD)	000 to 999	
+8	Lower limit value (Sign) (BIN)	If +: 0 If – : F	
+9 to +11	Upper limit value	Same as lower limit values	
+12 to +14	Multistep selection limit value (L1)	Same as lower limit values	
+15 to +17	Multistep selection limit value (L2)	Same as lower limit values	
+18 to +20	Multistep selection limit value (L3)	Same as lower limit values	
+21 to +23	Multistep selection limit value (L4)	Same as lower limit values	
+24 to +26	Multistep selection limit value (L5)	Same as lower limit values	
+27 to +29	Multistep selection limit value (L6)	Same as lower limit values	
+30 to +32	Reference value	Same as lower limit values	
+33	Analog output scale number (1 digit BCD)	1 to 3	
+34 to +35	Offset classification (ASCII 3 characters)	4F4620 (“OF”), 4F4D20 (“OM”)	
+36 to +38	Offset value	Same as lower limit values	
+39	Data output condition (1 digit BCD)	0 to 6	
+40	Scheduled output timer (3 digits BCD)	000 to 999	
+41	Sample measurement pulse (3 digits BCD)	000 to 999	
+42 to +43	Sample measurement classification (ASCII 3 characters)	415647 (“AVG”), 4D4158 (“MAX”) 4D494E (“MIN”), 524E47 (“RNG”)	
+44 to +45	Statistical processing calculation classification (ASCII 3 characters)	535420 (“ST”), 4E5354 (“NST”)	

Note This sequence cannot be used to request the lower limit (EL), error upper limit (EH), error exclusion counter (CNT) of the error data exclusion function (centerless grinder function).

Single Run Measurement Start (3000-series) (Sequence No. 410 (Hex 019A))

When the sample measurement condition is from 1 to 999, this sequence performs a single run measurement and requests the measurement results

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	(Undefined)		Program number
	+2	Decision result		
	+3	Decimal portion		Measurement value
	+4	(Undefined)	Integer portion	
	+5	Sign	(Undefined)	
	+6	Decimal portion		Deviation value
	+7	(Undefined)	Integer portion	
	+8	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digit Hex)	With no reference setting: 0006 With reference setting: 0009	
+1	Program number (1 digit BCD)	0 to 9	
+2	Decision result (ASCII 2 characters)	With no limit setting: 0000 With limit setting: 2B4E (“+N”), 4F4B (“OK”), 2D4E (“–N”)	
+3	Measurement value (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +3 4 5 6 7 +4 0 1 2 3 +5 F 0 0 0
+4	Measurement value (integer portion) (3 digits BCD)	000 to 999	
+5	Measurement value (Sign) (BIN)	If +: 0 If –: F	
+6 to +8	Deviation value	Same as measurement value *The deviation will be stored in this area only when reference setting is made.	

Zero Run Measurement Start (3000-series) (Sequence No. 411 (Hex 019B))

If the sample measurement condition is zero, a zero run measurement is started.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note The zero run measurement keeps measuring until sequence No. 414 (Measurement Termination) is executed.

Continuous Measurement Start (Scan) (3000-series) (Sequence No. 412 (Hex 019C))

A continuous measurement is started. The scan notification method is used for the receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of sequence No. 410 (Single Run Measurement Start).

Note 1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.

2. Even if execution is cancelled, the Laser Micrometer still keeps measuring. Execute sequence No. 414 (Measurement Termination) to end the sequence.

Continuous Measurement Start (Interrupt) (3000-series) (Sequence No. 413 (Hex 019D))

A continuous measurement is started. The interrupt notification method is used for the receive data and the interrupt No. is 101.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of sequence No. 410 (Single Run Measurement Start).

Note 1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.

2. Even if execution is cancelled, the Laser Micrometer still keeps measuring. Execute sequence No. 414 (Measurement Termination) to end the sequence.

3. Sequences No. 413 and No. 437 (Continuous Measurement Start with Interrupt) not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit.
Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

Measurement Termination (3000-series) (Sequence No. 414 (Hex 019E))

This sequence terminates a continuous measurement.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
For continuous measurement: Not available

For Zero Run Measurement

The receive data word allocation is similar to that of sequence No. 410 (Single Run Measurement Start).

Note This sequence may be aborted it is executed during continuous measurements. Measurements will be terminated even if the sequence is aborted. The sequence will be aborted if executed when the Laser Micrometer is sending measurement results. The chances that the sequence will be aborted are higher if the scheduled data output value is set to a lower value.

Data Request (3000-series) (Sequence No. 415 (Hex 019F))

This sequence requests display data in the idle measurement status or the latch data generated by the measurement command.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of sequence No. 410 (Single Run Measurement Start).

Statistic Processing Execution (3000-series) (Sequence No. 416 (Hex 01A0))

This sequence lights the statistic processing LED and implements the statistic processing.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Statistic Processing Non-execution (3000-series) (Sequence No. 417 (Hex 01A1))

This sequence turns the statistic processing LED off and does not carry out the statistic processing.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

All Statistic Memory Clear (3000-series) (Sequence No. 418 (Hex 01A2))

This sequence clears statistic processing memories of all programs.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Statistic Processing Memory Clear (3000-series) (Sequence No. 419 (Hex 01A3))

This sequence clears statistic processing memories of the program under display.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Statistic Result Request (3000-series) (Sequence No. 420 (Hex 01A4))

This sequence requests the statistic processing results.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	(Undefined)		Program number (P)
+2			Number of statistic data (N)
+3	(Undefined)		
+4	Decimal portion		Average value (AVG)
+5	(Undefined)	Integer portion	
+6	Sign	(Undefined)	
+7	Decimal portion		Maximum value (MAX)
+8	(Undefined)	Integer portion	
+9	Sign	(Undefined)	
+10	Decimal portion		Minimum value (MIN)
+11	(Undefined)	Integer portion	
+12	Sign	(Undefined)	
+13	Decimal portion		Range (R)
+14	(Undefined)	Integer portion	
+15	Sign	(Undefined)	
+16	Decimal portion		Standard deviation (SD)
+17	(Undefined)	Integer portion	
+18	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digits Hex)	0013 (0019 decimal) (fixed)	
+1	Program number (1 digit BCD)	0 to 9	
+2 to +3	Number of statistic data (6 digits BCD)	000000 to 999999	
+4	Average value (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +4 4 5 6 7 +5 0 1 2 3 +6 F 0 0 0
+5	Average value (integer portion) (4 digits BCD)	000 to 999	
+6	Average value (Sign) (BIN)	If +: 0 If –: F	
+7 to +9	Maximum value	Same as average value	
+10 to +12	Minimum value	Same as average value	
+13 to +15	Range	Same as average value	
+16 to +18	Standard deviation	Same as average value	

Note The number of digits of the Decimal portion is fixed to 4 digits. If a deviation calculation results in a value with 5 decimal places, it will be stored with one digit overflowing into the integer portion.
Examples: The value -0.1234 is stored as follows:

Area of decimal portion: 1234; Area of integer portion: 0000; Sign area: F000

The value -0.12345 is stored as follows:
Area of decimal portion: 2345; Area of integer portion: 0001; Sign area: F000

Memory Switch Set 1 (3000-series, High-speed Type) (Sequence No. 421 (Hex 01A5))

This sequence sets memory switches.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words			
	+1	W	X	Y	Z
	+2	(Undefined)			V

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	w (1 digits BCD)	0: For single run or zero run measurement start displaying '---.' 1: For single run or zero run measurement start displaying the previous measured value
	x (1 digit BCD)	0: Perform single run measurement to the RUN signal of I/O IF 1: Repeat measurement while the RUN signal of I/O IF is input
	y (1 digit BCD)	*0: RS-232C Delimiter CR+LF 1: RS-232C Delimiter CR 2: RS-232C Delimiter LF
	z (1 digit BCD)	0: RS-232C no parity check 1: RS-232C odd parity check 2: RS-232C even parity check
+2	v (1 digit BCD)	0: Displaying 'Err-0' 1: Displaying '0'

Note Settings marked with asterisks are required for this protocol.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Memory switches cannot be set when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

2. The setting (y, z) of RS-232C takes effect when the power supply is turned back on.

Memory Switch Set 2 (3000-series, High-speed Type) (Sequence No. 422 (Hex 01A6))

This sequence sets memory switches.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words			
	+1	W	X	Y	Z
	+2	(Undefined)			V

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	w (1 digit BCD)	0: Work automatic detection is not performed 1: Work automatic detection is performed Diameter detection method (1 scan) 2: Work automatic detection is performed Diameter detection method (8 scan) 3: Work automatic detection is performed Position detection method (1 scan)
	x (1 digit BCD)	For expansion 0 (fixed)
	y (1 digit BCD)	For expansion 0 (fixed)
	z (1 digit BCD)	For expansion 0 (fixed)
+2	v (1 digit BCD)	*0: Error data exclusion function is not used 1: Error data exclusion function is used

Note Settings marked with asterisks are required for this protocol.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Memory switches cannot be set when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

Simple AVG Times Set (3000-series, High-speed Type) (Sequence No. 423 (Hex 01A7))

This sequence uses the simple average as the averaging method and sets the averaging times per measurement interval 4.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of averaging times

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Number of averaging times (4 digits BCD)	1 to 2048

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

AVG Move Interval Set (3000-series, High-speed Type) (Sequence No. 424 (Hex 01A8))

This sequence uses the average move as the averaging method and sets the measurement interval number.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)		Measurement interval number

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Measurement interval number (1 digit BCD)	1 to 4

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

AVG Move (H) Times Set (3000-series, High-speed Type) (Sequence No. 425 (Hex 01A9))

This sequence uses the average move and high-speed data output as the averaging method and sets the averaging times per measurement interval 4.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of averaging times

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Number of averaging times (4 digits BCD)	16 to 2048 (32 to 2048 for 5000/6000 Series)

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

AVG Move (L) Times Set (3000-series, High-speed Type) (Sequence No. 426 (Hex 01AA))

This sequence uses the average move and low-speed data output as the averaging method and sets the averaging times per measurement interval 4.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Number of averaging times

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Number of averaging times (4 digits BCD)	32 to 2048

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

2. This sequence will be processed the same as sequence No. 425 AVG move (H) times set for 5000-series Laser Micrometers.

Automatic Detection Set (3000-series, High-speed Type) (Sequence No. 427 (Hex 01AB))

This sequence sets the work automatic detection function.

Send Data Word Allocation (3rd Operand of PMCR(260))

Receive data storage words	+0	Number of send data words		
	+1	(Undefined)	The number of measuring times	
	+2	Invalid time		
	+3	Decimal portion		Detection lower limit
	+4	(Undefined)	Integer portion	
	+5	Sign	(Undefined)	
	+6	Decimal portion		Detection upper limit
	+7	(Undefined)	Integer portion	
	+8	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of send data words (4 digits Hex)	0009 (fixed)	
+1	Number of measurements (3 digits BCD)	001 to 999	
+2	Invalid time (4 digits BCD)	0001 to 9999	
+3	Detection lower limit (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +3 4 5 6 7 +4 0 1 2 3 +5 2 D 0 0
+4	Detection lower limit (integer portion) (3 digits BCD)	000 to 999	
+5	Detection lower limit (Sign) (ASCII 1 character)	If +: 20 (‘ ’) If –: 2D (‘–’)	
+6 to +8	Detection upper limit	Same as detection lower limit	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

2. The detection lower and upper limit must be set with 3 digits for the integer portion and 4 digits for the decimal portion.

Automatic Detection Release (3000-series, High-speed Type) (Sequence No. 428 (Hex 01AC))

This sequence releases the setting of work automatic detection function.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

Automatic Detection List Request (3000-series, High-speed Type) (Sequence No. 429 (Hex 01AD))

This sequence requests the settings of work automatic detection function.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	(Undefined)	The number of measuring times	
+2	Invalid time		
+3	Decimal portion		Detection lower limit
+4	(Undefined)	Integer portion	
+5	Sign	(Undefined)	
+6	Decimal portion		Detection upper limit
+7	(Undefined)	Integer portion	
+8	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digits Hex)	0009 (fixed)	
+1	The number of measuring times (3 digits BCD)	000 to 999	
+2	Invalid time (4 digits BCD)	0001 to 9999	
+3	Detection lower limit (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +3 4 5 6 7 +4 0 1 2 3 +5 F 0 0 0
+4	Detection lower limit (integer portion) (3 digits BCD)	000 to 999	
+5	Detection lower limit (Sign) (BIN)	If +: 0 If –: F	
+6 to +8	Detection upper limit	Same as detection lower limit	

Note This sequence cannot be used when DIP switch SW3, pin 5 of the Laser Micrometer is not turned ON.

3Z4L Initialize (3000-series) (Sequence No. 430 (Hex 01AE))

This sequence clears the 3Z4L, sets the mm unit, sets memory switches, does not process statistics, and clears the statistic memory.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of sequence No. 401 (Memory Switch Setting)

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Memory switch settings will be ignored for this sequence for 5000-series and 6000-series Laser Micrometers.

Measurement Condition Set (4000-series) (Sequence No. 431 (Hex 01AF))

This sequence sets measurement conditions. Conditions to be set can be selected by setting Yes/No flags.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)		Segment number (SG)
	+2	(Undefined)		Measurement interval number (M)
	+3	Decimal portion		Lower limit value (LL)
	+4	(Undefined)	Integer portion	
	+5	Sign	(Undefined)	
	+6	Decimal portion		Upper limit value (LH)
	+7	(Undefined)	Integer portion	
	+8	Sign	(Undefined)	
	+9	Decimal portion		Reference value (REF)
	+10	(Undefined)	Integer portion	
	+11	Sign	(Undefined)	
	+12	(Undefined)		Analog output scale number (SCL)
	+13	(Unused)		
	+14	(Unused)		
	+15	(Unused)		
	+16	(Undefined)		Data output conditions (PR)
	+17	(Undefined)	Data output timer (BCD 3 digits)	(PRT)
	+18	(Undefined)		Number of seconds for latch timer (RLT)
	+19	0		Setting Yes/No flags
	+20	0		
	+21	0		
	+22	0		
	+23	0		
	+24	0		

Offset	Contents (data format)	Data	
+0	Number of send data words (4 digits Hex)	0019 (0025 decimal) (fixed)	
+1	Segment number (1 digit BCD)	1 to 5	
+2	Measurement interval number (1 digit BCD)	1 to 7	
+3	Lower limit value (Decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +3 4 5 6 7
+4	Lower limit value (integer portion) (3 digits BCD)	000 to 999	+4 0 1 2 3
+5	Lower limit value (Sign) (ASCII 1 character)	If +: 20 (‘ ’) If –: 2D (‘–’)	+5 2 D 0 0
+6 to +8	Upper limit value	Same as lower limit value	
+9 to +11	Reference value	Same as lower limit value	
+12	Analog output scale number (1 digit BCD)	0 to 3	
+13 to +15	Unused		
+16	Data output conditions (1 digit BCD)	0 to 6	
+17	Data output timer value (3 digits BCD)	000 to 999	
+18	Number of seconds for latch timer (2 digits BCD)	00 to 99	
+19	Yes/No for segment setting (1 digit BCD)	Set: 1(SG) Don’t set: 0	
+20	Yes/No for measurement interval number setting (1 digit BCD)	Set: 1(M) Don’t set: 0	
+21	Yes/No for upper/lower limit value setting (1 digit BCD)	Set: 1(LL, LH) Don’t set: 0	
+22	Yes/No for reference setting (1 digit BCD)	Set: 1(REF, SCL) Don’t set: 0	
+23	Yes/No for data output condition setting (1 digit BCD)	Set: 1(PR, PRT) Don’t set: 0	
+24	Yes/No for latch timer setting (1 digit BCD)	Set: 1(RLT) Don’t set: 0	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. The following settings must be made together with this sequence; they cannot be set separately.

Lower limit, upper limit
Reference value, data output timer
Data output conditions, scheduled print timer

2. The limit value and reference value can be set to 3 digits for the integer portion and to 4 digits for the decimal portion.

Measurement Condition Release (4000-series) (Sequence No. 432 (Hex 01B0))

This sequence clears the measurement conditions that have been set.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of sequence No. 431 (Measurement Condition Setting). However, only the setting Yes/No flags at +19 to +24 from the send data leading word can be used.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. The following conditions are used when the measurement conditions are released: Segment becomes 1 and the measurement interval becomes 1.

2. The following settings cannot be cleared separately using this sequence. They all must be cleared at the same time.
    Lower limit, Upper limit
    Data output conditions, Scheduled print timer

   The scale (SCL) and data output timer (PRT) cannot be cleared.

3. This sequence can be used for the 3Z4L-4000 Series only when pin 8 on DIP switch SW2 is turned ON.

Measurement Condition List Request (4000-series) (Sequence No. 433 (Hex 01B1))

This sequence requests the measurement condition settings that have been set and other settings.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words		
+1	(Undefined)		Segment number (SG)
+2	(Undefined)		Measurement interval number (M)
+3	Decimal portion		Lower limit value (LL)
+4	(Undefined)	Integer portion	
+5	Sign	(Undefined)	
+6	Decimal portion		Upper limit value (LH)
+7	(Undefined)	Integer portion	
+8	Sign	(Undefined)	
+9	Decimal portion		Reference value (REF)
+10	(Undefined)	Integer portion	
+11	Sign	(Undefined)	
+12	(Undefined)		Analog output scale number (SCL)
+13			Forced zero number (ZERO+)
+14			
+15		(Undefined)	
+16	(Undefined)		Data output condition (PR)
+17	(Undefined)	Data output timer (BCD 3 digits)	(PRT)
+18	(Undefined)		Number of seconds for latch timer (RLT)

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digits Hex)	0013 (0019 decimal) (fixed)	
+1	Segment number (1 digit BCD)	1 to 5	
+2	Measurement interval number (1 digit BCD)	1 to 7	
+3	Lower limit value (Decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +3 4 5 6 7 +4 0 1 2 3 +5 F 0 0 0
+4	Lower limit value (Integer portion) (3 digits BCD)	000 to 999	
+5	Lower limit value (Sign) (BIN)	If +: 0 If –: F	
+6 to +8	Upper limit value	Same as lower limit value	
+9 to +11	Reference value	Same as lower limit value	
+12	Analog output scale number (1 digit BCD)	0 to 3	
+13 to +15	Forced zero number (ASCII 5 characters)	5A45524F2B (“ZERO+”) 4E4F524D20 (“NORM ”) 5A45524F2D (“ZERO–”)	
+16	Data output condition (1 digit BCD)	0 to 6	
+17	Data output timer value (3 digits BCD)	000 to 999	
+18	Number of seconds for latch timer (2 digits BCD)	00 to 99	

Note This sequence can be used for the 3Z4L-4000 Series only when pin 8 on DIP switch SW2 is turned ON.

Single Run Measurement Start (4000-series) (Sequence No. 434 (Hex 01B2))

When the sample measurement condition is from 1 to 999, this sequence performs a single run measurement and requests the measurement results.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	Decision result		
	+2	Decimal portion		Measurement value
	+3	(Undefined)	Integer portion	
	+4	Sign	(Undefined)	
	+5	Decimal portion		Deviation value
	+6	(Undefined)	Integer portion	
	+7	Sign	(Undefined)	

Offset	Contents (data format)	Data	
+0	Number of receive data words (4 digits Hex)	With no reference setting: 0005 With reference setting: 0008	
+1	Decision result (ASCII 2 characters)	With no limit setting: 0000 With limit setting: 2B4E (“+N”), 4F4B (“OK”), 2D4E (“–N”)	
+2	Measurement value (decimal portion) (4 digits BCD)	0000 to 9999	**Example** –123.4567 +2 4 5 6 7 +3 0 1 2 3 +4 F 0 0 0
+3	Measurement value (integer portion) (3 digits BCD)	000 to 999	
+4	Measurement value (Sign) (BIN)	If +: 0 If –: F	
+5 to +7	Deviation value	Same as measurement value *The deviation will be stored in this area only when reference setting is made.	

Deflection Measurement Start (4000-series) (Sequence No. 435 (Hex 01B3))

This sequence starts a deflection measurement.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. The deflection measurement keeps measuring until sequence No. 438 (Measurement Termination) is executed.

2. This sequence will be processed the same as sequence No. 411 Zero run measurement start for 5000-series Laser Micrometers.

Continuous Measurement Start (Scan) (4000-series) (Sequence No. 436 (Hex 01B4))

This sequence starts a continuous measurement. The scan notification method is used for the receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of sequence No. 434 (Single Run Measurement Start).

Note 1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.

2. Even if execution is cancelled, the Laser Micrometer still keeps measuring. Execute sequence No. 438 (Measurement Termination) to end the sequence.

Continuous Measurement Start (Interrupt) (4000-series) (Sequence No. 437 (Hex 01B5))

This sequence starts a continuous measurement. The interrupt notification method is used for the receive data and the interrupt No. is 101.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of sequence No. 434 (Single Run Measurement Start).

Note
1. Since this sequence repeats itself within the sequence, once it is executed, it remains in the execution state until cancelled.
2. Even if execution is cancelled, the Laser Micrometer still keeps measuring. Execute sequence No. 438 (Measurement Termination) to end the sequence.
3. Sequences No. 413 and No. 437 (Continuous Measurement Start with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit.
   Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

Continuous Measurement Termination (4000-series) (Sequence No. 438 (Hex 01B6))

This sequence terminates continuous measurement.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

For continuous measurement: None.

For Deflection Measurement

The receive data word allocation is similar to that of sequence No. 434 (Single Run Measurement Start).

Note This sequence may be aborted if it is executed during continuous measurements. Measurements will be terminated even if the sequence is aborted. The sequence will be aborted if executed when the Laser Micrometer is sending measurement results. The chances that the sequence will be aborted are higher if the scheduled data output value is set to a lower value.

Data Request (4000-series) (Sequence No. 439 (Hex 01B7))

This sequence requests display data in the idle measurement status or latch data generated by the measurement command.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of sequence No. 434 (Single Run Measurement Start).

Forced Positive Zero (4000-series) (Sequence No. 440 (Hex 01B8))

This sequence sets the forced zero direction to positive (+)

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Forced Negative Zero (4000-series) (Sequence No. 441 (Hex 01B9))

This sequence sets the forced zero direction to negative (–)

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Forced Zero Release (4000-series) (Sequence No. 442 (Hex 01BA))

This sequence releases the forced zero direction.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

3Z4L Initialize (4000-series) (Sequence No. 443 (Hex 01BB))

This sequence clears the 3Z4L, sets the mm unit, and sets memory switches.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of sequence No. 401 (Memory Switch Setting).

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note Memory switch settings will be ignored for this sequence for 5000-series and 6000-series Laser Micrometers.

General-purpose Command 1 (4000-series) (Sequence No. 444 (Hex 01BC))

This general-purpose command is used to send data with a specified data length, and receive back only OK. The terminator (CR) is automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Send data byte length	
	+2	Send data	
	+3	Send data	
		⋮	
	+248	Send data	
	+249	Send data	CR

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The number of bytes of send data excluding the terminator (CR)
+2 to +249	Send data (ASCII)	Send data up to 496 bytes maximum Specify in ASCII.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

General-purpose Command 2 (4000-series) (Sequence No. 445 (Hex 01BD))

This general-purpose command is used to send data with a specified data length, and receive back receive data other than OK. The terminator (CR) is automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Send data byte length	
	+2	Send data	
	+3	Send data	
		• •	
	+128	Send data	
	+249	Send data	CR

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The number of bytes of send data excluding the terminator (CR)
+2 to +249	Send data (ASCII)	Send data up to 496 bytes maximum Specify in ASCII.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Receive data
	+2	Receive data
		• •
	+126	Receive data
	+249	Receive data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits BCD)	0001 to 00FA (1 to 250 decimal)
+1 to +249	Receive data (ASCII)	When the receive data exceed 498 bytes, only 498 bytes are stored.

High Calibration Set (Sequence No. 446 (Hex 01BE))

This sequence sets the Laser Micrometer’s high calibration.

Send Data Word Allocation (3rd Operand of PMCR(260))

Allocations are the same as for sequence No. 404 (Calibration Set) except that the LC gauge dimension in words +4 to +5 are not used.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Use sequences No. 446 (High calibration set) and No. 447 (Low calibration set) to calibrate the Laser Micrometer. If sequence No. 404 (Calibration Set) is used, both the high and low calibration gauges must be set, and the high calibration and low calibration gauges cannot be exchanged.

2. The HC gauge dimension must be set with 3 digits for the integer portion and 4 digits for the decimal portion.

Low Calibration Set (Sequence No. 447 (Hex 01BF))

This sequence sets the Laser Micrometer’s low calibration.

Send Data Word Allocation (3rd Operand of PMCR(260))

Allocations are the same as for sequence No. 404 (Calibration Set) except that the HC gauge dimension in words +1 to +3 are not used.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Use sequences No. 446 (High calibration set) and No. 447 (Low calibration set) to calibrate the Laser Micrometer. If sequence No. 404 (Calibration Set) is used, both the high and low calibration gauges must be set, and the high calibration and low calibration gauges cannot be exchanged.

2. The LC gauge dimension must be set with 3 digits for the integer portion and 4 digits for the decimal portion.

Appendix L

Visual Inspection System Protocol

The Visual Inspection System Protocol is used to make various settings or control remotely the Visual Recognition Device connected to the Serial Communications Unit/Board via RS-232C cable.

Protocol Configuration

The configuration of the Visual Inspection System Protocol is shown below.

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
450 (01C2)	Measurement execution (F200)	Carries out one measurement one and stores the measurement results in the specified words.	No	Yes	
451 (01C3)	Continuous measurement execution (scan) (F200)	Carries out continuously setting the F200 and storing the measurement results in the specified words.	No	Yes	
452 (01C4)	Continuous measurement execution (interrupt) (F200)	Carries out continuously setting the F200 and storing the measurement results in the specified words.	No	Yes	See Note 3
453 (01C5)	Reference object registration (group) (F200)	Performs reference position registration and evaluation criterion registration at the same time.	No	No	
454 (01C6)	Reference object registration (reference position) (F200)	Registers the reference position for measuring the amount of position displacement when a position displacement compensation is used.	No	No	
455 (01C7)	Reference object registration (evaluation criterion) (F200)	Registers the reference value to discriminate the output format.	No	No	
456 (01C8)	Evaluation condition change (F200)	Changes the upper and lower limit values of the evaluation condition of the designated output No.	Yes	No	
457 (01C9)	Arbitrary measurement value acquisition (F200)	Stores the measurement values of arbitrary measurement item regardless of output format in the specified words.	Yes	Yes	
460 (01CC)	Measurement execution (F300)	Carries out one measurement and stores the measurement results in the specified words.	No	Yes	
461 (01CD)	Continuous measurement execution (scan) (F300)	Carries out continuously setting the F300 and storing the measurement results in the specified words.	No	Yes	
462 (01CE)	Continuous measurement execution (interrupt) (F300)	Carries out continuously setting the F300 and storing the measurement results in the specified words.	No	Yes	See Note 3
463 (01CF)	Reference object registration command 1 execution (F300)	Performs a measurement for the input image and updates the reference object data of the full window.	No	No	
464 (01D0)	Reference object registration command 2 execution (F300)	Performs a measurement for the input image and updates the reference object data of the full window	Yes	No	
465 (01D1)	Illumination fluctuation follow execution (F300)	Executes an illumination fluctuation follow.	No	No	
470 (01D6)	Measurement execution and positioning (F350)	Carries out one measurement and stores the measurement results in the specified words.	No	Yes	

Sequence No.	Communications sequence name	Function	Ladder interface		Notes
			Send word allocation	Receive word allocation	
471 (01D7)	Camera designation and positioning (F350)	Designates the camera for measurement.	Yes	No	
472 (01D8)	Scene switching and positioning (F350)	Switches to a designated scene No.	Yes	No	
473 (01D9)	Inspection execution and character inspection (F350)	Carries out one inspection and outputs inspection results to the video monitor.	No	No	
474 (01DA)	Character string inspection and character inspection (F350)	Changes the inspection character string of a designated inspection area No. to a designated character string.	Yes	No	
480 (01E0)	Camera change (decrease by 1) (F200/300)	Decreases the display camera No. by 1.	No	No	
481 (01E1)	Camera change (increase by 1) (F200/300)	Increases the display camera No. by 1.	No	No	
482 (01E2)	Binary level modification (F200/300)	Modifies the binary levels (upper limit and lower limit values) of a designated window number No.	Yes	No	
483 (01E3)	Reset (F200/300)	Resets the F200/F300.	No	No	
490 (01EA)	Scene switch (decrease by 1)	Decreases the scene No. by 1.	No	No	
491 (01EB)	Scene switch (increase by 1)	Increases the scene No. by 1.	No	No	
492 (01EC)	Scene switch (arbitrary)	Switches to a designated scene No.	Yes	No	
493 (01ED)	Measurement, inspection termination	Terminates the measurement and returns to the home menu.	No	No	
494 (01EE)	General-purpose command (send)	Sets and executes commands that are otherwise not supported.	Yes	No	
495 (01EF)	General-purpose command send/(receive)	Sets and executes commands that are otherwise not supported.	Yes	Yes	

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses.

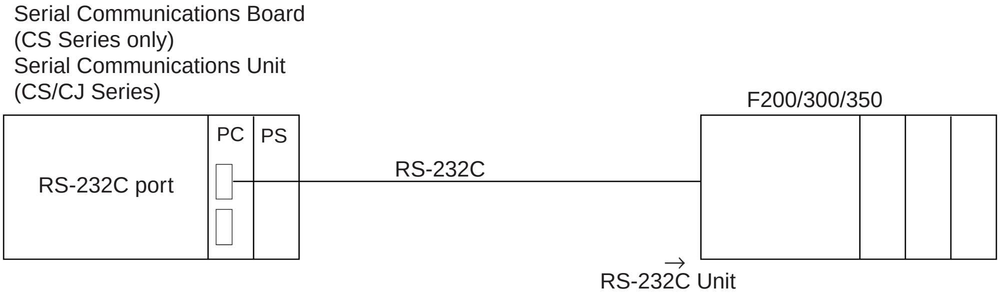
2. **Ladder Interface Settings**
   YES: User settings are required for the 3rd and 4th operands of PMCR(260).
   NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
   Receive word allocation: Set the constant 0000 for the 4th operand (D).

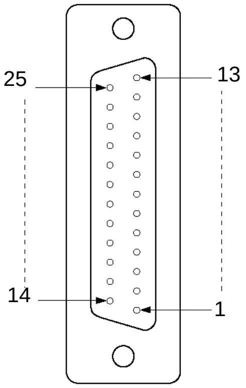
3. Sequences No. 452 and No. 462 (Continuous Measurement Execution with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit. Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

Connections

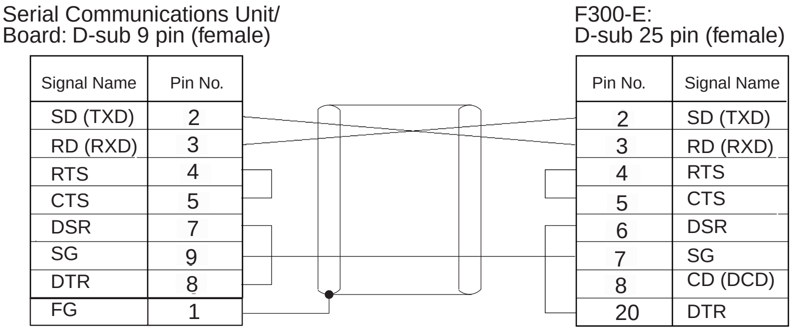
The connections for using the Visual Inspection System Protocol are shown below.

RS-232C Connections

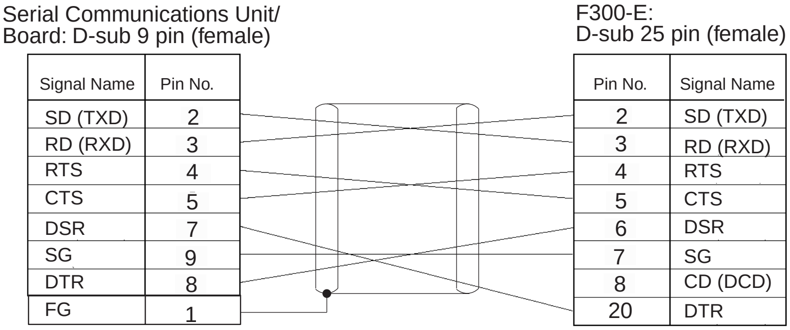




Pin No.	Signal name	Abbreviation
1	Protective ground or earth	FG (GND)
2	Send data	SD (TXD)
3	Receive data	RD (RXD)
4	Request to send	RS (RTS)
5	Clear to send	CS (CTS)
6	Data set ready	DR (DSR)
7	Signal ground	SG (GND)
8	Carrier detection (Data word receive)	CD (DCD)
20	Data terminal ready	ER (DTR)



- **For RS/CS Flow Control**



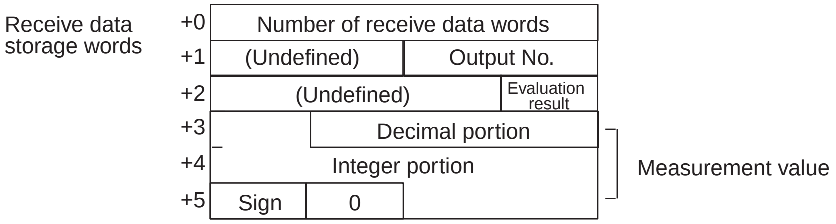
Measurement Execution (F200) (Sequence No. 450 (Hex 01C2))

This sequence carries out one measurement and stores the measurement results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006
+1	Output No. (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
	Measurement value (integer portion) (7 digits BCD)	
	Measurement value (sign) (1 digit)	

Note 1. Only one output No. can be stored.

2. The ranges of measurement values are as follows:
   For calibration OFF setting: –2147483.648 to 2147483.647
   For calibration ON setting: –9999999.999 to 9999999.999
3. If a measurement value exceeds the range of measurement values when calibration is turned off, undefined data is stored in the specified words.

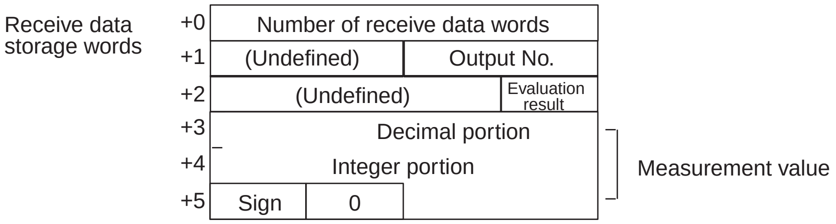
Continuous Measurement Execution (Scan) (F200) (Sequence No. 451 (Hex 01C3))

This sequence carries out continuously the setting of the F200 and stores measurement results in the specified words. The scan notification method is used for the receive data.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006
+1	Output No. (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
	Measurement value (integer portion) (7 digits BCD)	
	Measurement value (sign) (1 digit)	

Note 1. Only one output No. can be designated.

2. Turn ON the Abort Switch to end this sequences. Abort Switches for port 1 are CIO 190003 for the Serial Communications Board and CIO 1500 + 25 x unit number, bit 03 for Serial Communications Units. Abort Switches for port 2 are CIO 190011 for the Serial Communications Board and CIO 1500 + 25 x unit number, bit 11 for Serial Communications Units.

3. The ranges of measurement values are as follows:
For calibration OFF setting:–2147483.648 to 2147483.647
For calibration ON setting: –9999999.999 to 9999999.999

4. If a measurement value exceeds the range of measurement values when calibration is turned off, undefined data is stored in the specified words.

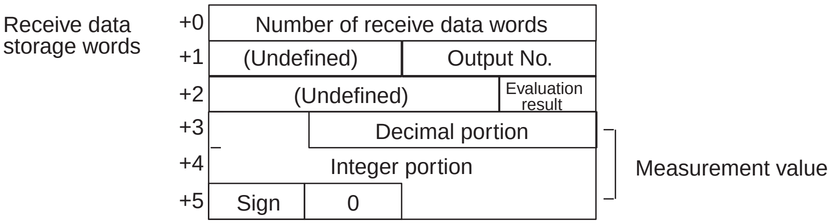
Continuous Measurement Execution (Interrupt) (F200) (Sequence No. 452 (Hex 01C4))

This sequence carries out continuously setting the F200 and stores measurement results in the specified words. The interrupt notification method is used for the receive data. The interrupt No. is 102.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Content (data format)	Data
+0	Number of receive data words (4 digits BCD)	0006
+1	Output No. (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
	Measurement value (integer portion) (7 digits BCD)	
	Measurement value (sign) (1 digit)	

Note

1. Only one output No. can be designated.
2. Turn ON the Abort Switch to end this sequences. Abort Switches for port 1 are CIO 190003 for the Serial Communications Board and CIO 1500 + 25 x unit number, bit 03 for Serial Communications Units. Abort Switches for port 2 are CIO 190011 for the Serial Communications Board and CIO 1500 + 25 x unit number, bit 11 for Serial Communications Units.
3. The ranges of measurement values are as follows:
   For calibration OFF setting:–2147483.648 to 2147483.647
   For calibration ON setting:–9999999.999 to 9999999.999
4. If a measurement value exceeds the range of measurement values when calibration is turned off, undefined data is stored in the specified words.
5. Sequences No. 452 and No. 462 (Continuous Measurement Execution with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit. Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

Reference Object Registration (Group) (F200) (Sequence No. 453 (Hex 01C5))

This sequence performs reference position registration and criterion registration at the same time.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Reference Object Registration (Reference Position) (F200) (Sequence No. 454 (Hex 01C6))

This sequence registers the reference position for measuring the amount of position displacement when a position displacement compensation is used.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Reference Object Registration (Criterion) (F200) (Sequence No. 455 (Hex 01C7))

This sequence registers a reference value to discriminate the output format.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Evaluation Condition Change (F200) (Sequence No. 456 (Hex 01C8))

This sequence changes the upper and lower limit values of evaluation condition of the designated output No.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Output No.	
	+2	(Undefined)	Decimal portion	Upper limit value
	+3	Integer portion		
	+4	(Undefined)		
	+5	Sign	(Undefined)	
	+6	(Undefined)	Decimal portion	Lower limit value
	+7	Integer portion		
	+8	(Undefined)		
	+9	Sign	(Undefined)	

Offset	Content (data format)	Data
+0	Number of send data words (4 digits Hex)	000A (0010 decimal)
+1	Output No. (2 digits BCD)	00 to 07
+2 to +5	Upper limit value (decimal portion) (3 digits BCD)	**Example** –123.456 +2 0567 +3 1234 +4 0000 +5 2D00 **Example** +123.456 +2 0678 +3 2345 +4 0001 +5 3000
	Upper limit value (integer portion) (7 digits BCD)	
	Upper limit value (sign) (ASCII 2 digits)	
+6 to +9	Lower limit value (decimal portion) (3 digits BCD)	Same as upper limit.
	Lower limit value (integer portion) (7 digits BCD)	
	Lower limit value (sign) (ASCII 2 digits)	

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Only one output No. can be designated.
2. Enter values so that upper limit ≥ lower limit.
3. Enter upper limit and lower limit values within the range –2147483.648 to 2147483.648.

Arbitrary Measurement Value Acquisition (F200) (Sequence No. 457 (Hex 01C9))

This sequence stores measurement values of arbitrary measurement items regardless of output format in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Data 1
	+2	(Undefined)	Data 2

Offset	Content (data format)	Data
+0	Number of send data words (4 digits Hex)	0003
+1	Data 1 (2 digits BCD)	00: Area 01: Center of gravity x 02: Center of gravity y 03: Main axis angle 04: Output format 05: Reference value of output format 06: X displacement 07: Y displacement 08: Angle displacement 09: X reference position 10: Y reference position 11: Angle reference position
+2	Data 2 (2 digits BCD)	When 00 to 03 is set to data 1 Window No.: 00 to 07 When 04 to 05 is set to data 1 Output No.: 00 to 07 When 06 to 11 is set to data 1 Camera No.: 00 to 01

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words		
	+1	(Undefined)	Decimal portion	Measurement value
	+2	Integer portion		
	+3	Sign	0	

Offset	Content (data format)	Data
+0	Number of receive data words (4 digits BCD)	0004
+1 to +3	Measurement value (decimal portion) (3 digits BCD)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
	Measurement value (integer portion) (7 digits BCD)	
	Measurement value (sign) (1 digit)	

Note 1. Only one output No. can be designated.

2. Measurement is not performed with this command. The measurement results of the last measurement will be stored in the specified words.

3. This command can acquire only the measurement value of the window No. set by output format.

4. For data 1 and 2, the receive data is compared with the send data. If the receive data is not the same as the send data, the following flags will be turned ON: The flags for port 1 are CIO 190914 for the Serial Communications Board and CIO 1500 + 25 x unit number +9, bit 14 for Serial Communications Units. The flags for port 2 are CIO 1919114 for the Serial Communications Board and CIO 1500 + 25 x unit number +19, bit 14 for Serial Communications Units.

5. The ranges of measurement values are as follows:
For calibration OFF setting: –2147483.648 to 2147483.647
For calibration ON setting: –9999999.999 to 9999999.999

6. If a measurement value exceeds the range of measurement values when calibration is turned off, unexpected data is stored in the specified words.

Measurement Execution (F300) (Sequence No. 460 (Hex 01CC))

This sequence carries out one measurement and stores measurement results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words			
	+1	(Undefined)		Window No.	
	+2	(Undefined)		Evaluation result	
	+3		Decimal portion		Data 1
	+4	Integer portion			
	+5	Sign	0		
	+6		Decimal portion		Data 2
	+7	Integer portion			
	+8	Sign	0		
	+9		Decimal portion		Data 3
	+10	Integer portion			
	+11	Sign	0		
	+12		Decimal portion		Data 4
	+13	Integer portion			
	+14	Sign	0		
	+15		Decimal portion		Data 5
	+16	Integer portion			
	+17	Sign	0		

Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006: 1 measurement item 0009: 2 measurement items 000C: 3 measurement items 000F: 4 measurement items 0012: 5 measurement items
+1	Window number (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD) Measurement value (integer portion) (7 digits BCD) Measurement value (sign) (1 digit)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
+6 to +8	Same as +3 to +5.	Same as +3 to +5.
+9 to +11	Same as +3 to +5.	Same as +3 to +5.
+12 to +14	Same as +3 to +5.	Same as +3 to +5.
+15 to +17	Same as +3 to +5.	Same as +3 to +5.

Note 1. Exponential expressions are used for numbers larger than 9999999.999 and smaller than –999999.9.

2. The number of measurement items is up to 5, but only one window number can be read.
3. The ranges of measurement values are as follows:
   For calibration OFF setting: –2147483.648 to 2147483.648
   For calibration ON setting: –9999999.999 to 9999999.999

4. The priority of measurement items being output are as follows:
   Area
   Center of gravity X, Center of gravity Y
   Displacement in center of gravity X (reserved), displacement in center of gravity Y (reserved)
   Main axis angle
   Main axis angle aberration (reserved)
   Edge angle
   Edge angle (reserved)
   Center X, center Y
   Center X aberration (reserved), center Y aberration (reserved)
   Inclination
   Inclination aberration (reserved)
   Intersecting point X, intersecting point Y
   Intersecting point X aberration (reserved), intersecting point Y aberration (reserved)

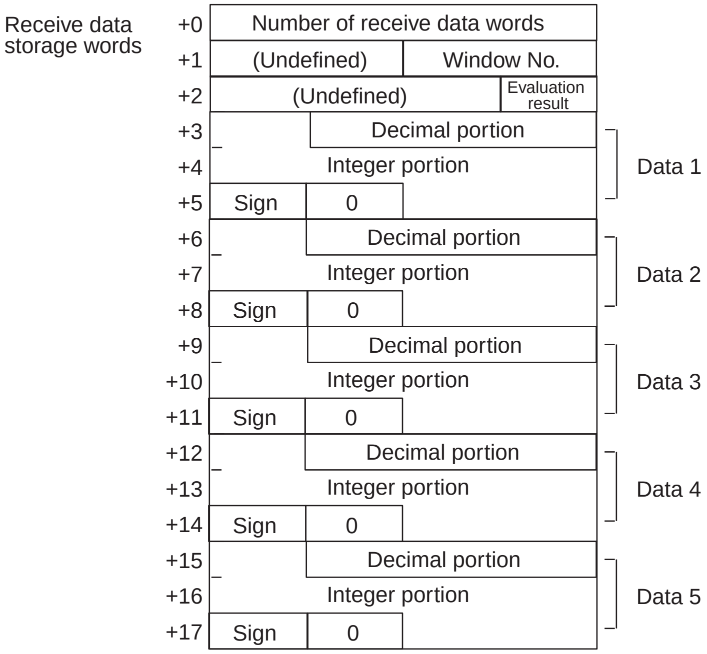
Continuous Measurement Execution (Scan) (F300) (Sequence No. 461 (Hex 01CD))

This sequence carries out continuously the settings of F300 and stores measurement results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006: 1 measurement item 0009: 2 measurement items 000C: 3 measurement items 000F: 4 measurement items 0012: 5 measurement items
+1	Window No. (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
	Measurement value (integer portion) (7 digits BCD)	
	Measurement value (sign) (1 digit)	
+6 to +8	Same as +3 to +5.	Same as +3 to +5.
+9 to +11	Same as +3 to +5.	Same as +3 to +5.
+12 to +14	Same as +3 to +5.	Same as +3 to +5.
+15 to +17	Same as +3 to +5.	Same as +3 to +5.

Note 1. Exponential expressions are used for numbers larger than 9999999.999 and smaller than –999999.9.

2. The number of measurement items are up to 5, but only one window number can be read.
3. The range of measurement values are as follows:
   For calibration OFF setting: –2147483.648 to 2147483.648
   For calibration ON setting: –9999999.999 to 9999999.999
4. The priority order of measurement items being output are as follows:
   Area
   Center of gravity X, Center of gravity Y
   Displacement in center of gravity X (reserved), displacement in center of gravity Y (reserved)
   Main axis angle
   Main axis angle aberration (reserved)
   Edge angle
   Edge angle (reserved)
   Center X, center Y
   Center X displacement (reserved), center Y displacement (reserved)
   Inclination
   Inclination displacement (reserved)
   Intersecting point X, intersecting point Y
   Intersecting point X displacement (reserved), intersecting point Y displacement (reserved)

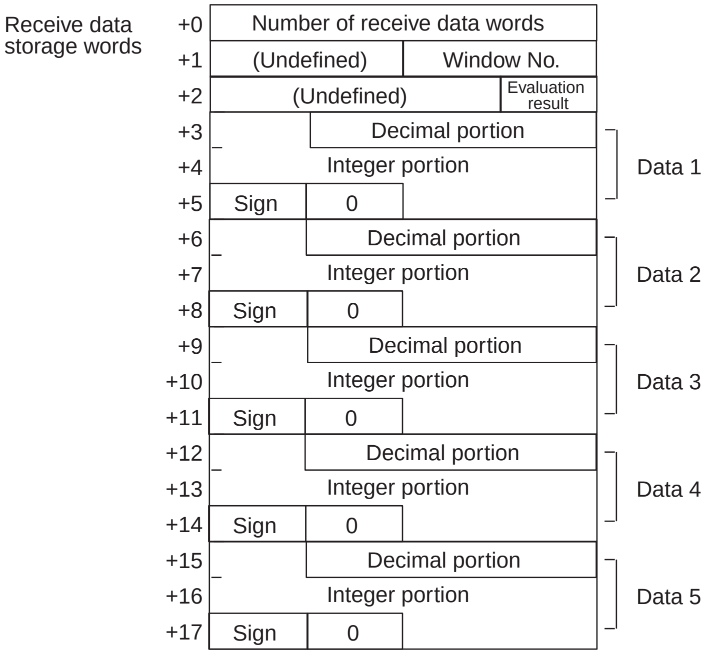
Continuous Measurement Execution (Interrupt) (F300) (Sequence No. 462 (Hex 01CE))

This sequence carries out continuously setting the F300 and stores measurement results in the specified words. The interrupt notification method is used for the receive data. The interrupt No. is 102.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0006: 1 measurement item 0009: 2 measurement items 000C: 3 measurement items 000F: 4 measurement items 0012: 5 measurement items
+1	Window No. (2 digits BCD)	00 to 07
+2	Evaluation result (1 digit BCD)	0: OK 1: NG
+3 to +5	Measurement value (decimal portion) (3 digits BCD) Measurement value (integer portion) (7 digits BCD) Measurement value (sign) (1 digit)	**Example** –123.456 +3 3456 +4 0012 +5 F000 **Example** +123.456 +3 3456 +4 0012 +5 0000 F is stored for negative values.
+6 to +8	Same as +3 to +5.	Same as +3 to +5.
+9 to +11	Same as +3 to +5.	Same as +3 to +5.
+12 to +14	Same as +3 to +5.	Same as +3 to +5.
+15 to +17	Same as +3 to +5.	Same as +3 to +5.

Note 1. Exponential expressions are used for numbers larger than 9999999.999 and smaller than –999999.9.

2. The number of measurement items is up to 5, but only one window number can be read.

3. The ranges of measurement values are as follows:
   For calibration OFF setting:–2147483.648 to 2147483.648
   For calibration ON setting:–9999999.999 to 9999999.999
4. The priority of measurement items being output are as follows:
   Area
   Center of gravity X, Center of gravity Y
   Displacement in center of gravity X (reserved), displacement in center of gravity Y (reserved)
   Main axis angle
   Main axis angle displacement (reserved)
   Edge angle
   Edge angle (reserved)
   Center X, center Y
   Center X displacement (reserved), center Y displacement (reserved)
   Inclination
   Inclination displacement (reserved)
   Intersecting point X, intersecting point Y
   Intersecting point X displacement (reserved), intersecting point Y displacement (reserved)
5. Sequences No. 452 and No. 462 (Continuous Measurement Execution with Interrupt) are not supported by the CS1W-SCU21-V1 and CJ1W-SCU41 Serial Communications Units. A protocol syntax error will occur if an attempt is made to execute either sequence with a Serial Communications Unit. Do not set an EM bank as the receive storage word for interrupt notification. A protocol syntax error will occur if an EM banks is set.

Reference Object Registration Command 1 Execution (F300) (Sequence No. 463 (Hex 01CF))

This sequence performs a measurement for the input image and updates reference object data of the full window.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Reference Object Registration Command 2 Execution (F300) (Sequence No. 464 (Hex 01D0))

This sequence performs a measurement for the input image and updates the reference object data of a designated window.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Window No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Window No. (1 digit BCD)	0 to 7

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Illumination Fluctuation Follow Execution (F300) (Sequence No. 465 (Hex 01D1))

This sequence executes an illumination fluctuation follow.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Measurement Execution and Positioning (F350) (Sequence No. 470 (Hex 01D6))

This sequence carries out one measurement and stores the measurement results in the specified words.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words			
+1		Decimal portion		X displacement
+2	Sign	Integer portion		
+3		Decimal portion		Y displacement
+4	Sign	Integer portion		
+5		Decimal portion		Correlation value
+6	Sign	0	Integer portion	

Offset	Content (data format)	Data
+0	Number of receive data words (4 digits Hex)	0007
+1 to +2	X displacement (decimal portion) (3 digits BCD) X displacement (integer portion) (3 digits BCD) X displacement (sign) (1 digit) (See note.)	**Example** –123.456: +1 3456, +2 F012 **Example** +123.456: +1 3456, +2 0012 F is stored for negative values.
+3 to +4	Y displacement (decimal portion) (3 digits BCD) Y displacement (integer portion) (3 digits BCD) Y displacement (sign) (1 digit) (See note.)	**Example** –123.456: +1 3456, +2 F012 **Example** +123.456: +1 3456, +2 0012 F is stored for negative values.
+5 to +6	Correlation value (decimal portion) (3 digits BCD) Correlation value (integer portion) (3 digits BCD) Correlation value (sign) (1 digit) (See note.)	**Example** –12.345: +1 2345, +2 F001 **Example** +12.345: +1 2345, +2 0001 F is stored for negative values.

Note 1. The number of models that can be stored in a designated word is 1.

2. If a measurement is carried out without executing a camera designation, a measurement is executed for all cameras in which the measurement model is registered.

3. When the correlation value is less than 70 and the measurement value overflows, the following flags will be turned ON. The flags for port 1 are CIO 190914 for the Serial Communications Board and CIO

1500 + 25 x unit number +9, bit 14 for Serial Communications Units. The flags for port 2 are CIO 1919114 for the Serial Communications Board and CIO 1500 + 25 x unit number +19, bit 14 for Serial Communications Units.

4. Data to be output is within the range 999.999 (upper limit) to –999.999 (lower limit).
5. Retry processing is not performed for this sequence.
6. Turn the Abort Bit ON and then OFF to end this sequence.

Camera Designation and Positioning (F350) (Sequence No. 471 (Hex 01D7))

This sequence designates the cameras for measurement.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	First camera No.
+2	(Undefined)	Last camera No.

Offset	Content (data format)	Data
+0	Number of send data words (4 digit Hex)	0003
+1	First camera No. (1 digit BCD)	0 to 7
+2	Last camera No. (1 digit BCD)	0 to 7

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Set values so that the first camera No.< last camera No.

2. If a designated camera No. is abnormal, the following flags will be turned ON. The flags for port 1 are CIO 190914 for the Serial Communications Board and CIO 1500 + 25 x unit number +9, bit 14 for Serial Communications Units. The flags for port 2 are CIO 191914 for the Serial Communications Board and CIO 1500 + 25 x unit number +19, bit 14 for Serial Communications Units.

Scene Switching and Positioning (F350) (Sequence No. 472 (Hex 01D8))

This sequence switches to a designated scene No.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Scene No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002
+1	Scene No. (2 digits BCD)	00 to 15

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. If a scene No. is abnormal, the following flags will be turned ON. The flags for port 1 are CIO 190914 for the Serial Communications Board and CIO 1500 + 25 x unit number +9, bit 14 for Serial Communications Units. The flags for port 2 are CIO 191914 for the Serial Communications Board and CIO 1500 + 25 x unit number +19, bit 14 for Serial Communications Units.

2. Retry processing is not performed for this sequence.

3. Turn ON the Abort Switch to end this sequence.

Inspection Execution and Character Inspection (F350) (Sequence No. 473 (Hex 01D9))

This sequence carries out one inspection and outputs the inspection results to a video monitor.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Character String Inspection and Character Inspection (F350) (Sequence No. 474 (Hex 01DA))

This sequence changes the inspection character string of a designated inspection area No. to a designated character string.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Inspection area No.	
	+2	(Undefined)	Number of designated character strings
	+3	Designated character string	
	~		
		Designated character string	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 to 000F (0004 to 0015 decimal)
+1	Number of designated character strings (4 digits Hex)	0000 to 0018 (0000 to 0024 decimal)
+2	Inspection area No. (1 digit BCD)	0 to 7
+3 to	Number of designated character strings (ASCII)	

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Camera Change (Decrease by 1) (F200/300) (Sequence No. 480 (Hex 01E0))

This sequence decreases the display camera No. by 1.

Send Data Word Allocation (3rd Operand of PMCR(260))
None.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Camera Change (Increase by 1) (F200/300) (Sequence No. 481 (Hex 01E1))

This sequence increases the display camera No. by 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Binary Level Modification (F200/300) (Sequence No. 482 (Hex 01E2))

This sequence modifies the binary levels (upper limit and lower limit values) of a designated output No. (F200) or window number No. (F300).

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Window No.	or Output No.
	+2	(Undefined)	Upper limit value	
	+3	(Undefined)	Lower limit value	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004
+1	Window No. (1 digit BCD)	0 to 7
+2	Upper limit value (3 digits BCD)	000 to 255
+3	Lower limit value (3 digits BCD)	000 to 255

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Enter values so that the upper limit ≥ lower limit.

Reset (F200/300) (Sequence No. 483 (Hex 01E3))

This sequence resets the F200/F300 (to starting status).

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Scene Switching (Decrease by 1) (Sequence No. 490 (Hex 01EA))

This sequence decreases the scene No. by 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Scene Switching (Increase by 1) (Sequence No. 491 (Hex 01EB))

This sequence increases the scene No. by 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Scene Switching (Arbitrary) (Sequence No. 492 (Hex 01EC))

This sequence switches to a designated scene No.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Scene No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits BCD)	0002
+1	Scene No. (2 digits BCD)	00 to 15

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Measurement, Inspection Termination (Sequence No. 493 (Hex 01ED))

This sequence terminates the measurement and returns to the home menu.

Send Data Word Allocation (3rd Operand of PMCR(260))

None.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

General-purpose Command (Send) (Sequence No. 494 (Hex 01EE))

This sequence can set and execute commands that are not otherwise supported. The delimiter (CR+LF) is automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	Command length	
	+2	Command	(Undefined)
		~	~

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Command length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal)
+2 to	Command (ASCII)	Specify ASCII data.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. The processing depends on the command.

2. For a command with a response, use sequence #495.

General-purpose Command (Send/Receive) (Sequence No. 495 (Hex 01EF))

This sequence can set and execute commands that are not otherwise supported. The delimiter (CR+LF) is automatically attached to the send data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	Command length	
+2	Command	(Undefined)
~		~

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Command length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal)
+2 to	Command (ASCII)	Specify ASCII data.

Receive Data Word Allocation (4th Operand of PMCR(260))

The reception data is stored in the reception data words without the delimiter (CR+LF),

Receive data storage words

+0	Number of receive data words	
+1	Command length	
+2	Command	(Undefined)
~		~

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Command length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal)
+2 to	Command (ASCII)	ASCII data is returned.

Note 1. The processing depends on the command.

2. For a command without a response, use sequence #495.

Appendix M

V600/V620 ID Controller Protocol

The V600/V620 ID Controller Protocol is used to make various settings or control remotely the ID Controller Connected to the Serial Communications Unit/Board via RS-232C or RS-422 cable.

Protocol Configuration

The configuration of the V600/V620 ID Controller Protocol is shown below.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
500 (01F4)	Read (ASCII/1)	Used when the number of Heads to be read from the Carrier is 1.	Yes	Yes
501 (01F5)	Read (ASCII/2)	Used when the number of Heads to be read from the Carrier is 2.	Yes	Yes
502 (01F6)	Read (ASCII/4)	Used when the maximum number of Heads to be read from the Carrier is 4.	Yes	Yes
503 (01F7)	Read (ASCII/8)	Used when the maximum number of Heads to be read from the Carrier is 8.	Yes	Yes
504 (01F8)	Read (Hex/1)	Used when the number of Heads to be read from the Carrier is 1.	Yes	Yes
505 (01F9)	Read (Hex/2)	Used when the number of Heads to be read from the Carrier is 2.	Yes	Yes
506 (01FA)	Read (Hex/4)	Used when the maximum number of Heads to be read from the Carrier is 4.	Yes	Yes
507 (01FB)	Read (Hex/8)	Used when the maximum number of Heads to be read from the Carrier is 8.	Yes	Yes
508 (01FC)	Auto-read (ASCII/1)	Used when the number of Heads to be read from the Carrier is 1.	Yes	Yes
509 (01FD)	Auto-read (Hex/1)	Used when the number of Heads to be read from the Carrier is 1.	Yes	Yes
510 (01FE)	Polling Auto-read (ASCII)	Used when the number of Heads to be read from the Carrier is from 1 to 8.	Yes	No
511 (01FF)	Polling Auto-read Subcommand (ASCII/2)	Used when the number of Heads to be read from the Carrier is 2.	Yes	Yes
512 (0200)	Polling Auto-read Subcommand (ASCII/4)	Used when the maximum number of Heads to be read from the Carrier is 4.	Yes	Yes
513 (0201)	Polling Auto-read Subcommand (ASCII/8)	Used when the maximum number of Heads to be read from the Carrier is 8.	Yes	Yes
514 (0202)	Polling Auto-read (Hex)	Used when the number of Heads to be read from the Carrier is from 1 to 8.	Yes	No
515 (0203)	Polling Auto-read Subcommand (Hex/2)	Used when the number of Heads to be read from the Carrier is 2.	Yes	Yes
516 (0204)	Polling Auto-read Subcommand (Hex/4)	Used when the maximum number of Heads to be read from the Carrier is 4.	Yes	Yes
517 (0205)	Polling Auto-read Subcommand (Hex/8)	Used when the maximum number of Heads to be read from the Carrier is 8.	Yes	Yes
518 (0206)	Write (ASCII/1)	Used when the number of Heads to be written to the Carrier is 1.	Yes	No

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
519 (0207)	Write (ASCII/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
520 (0208)	Write (ASCII/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
521 (0209)	Write (ASCII/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
522 (020A)	Write (Hex/1)	Used when the number of Heads to be written to the Carrier is 1.	Yes	No
523 (020B)	Write (Hex/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
524 (020C)	Write (Hex/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
525 (020D)	Write (Hex/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
526 (020E)	Auto-write (ASCII/1)	Used when the number of Heads to be written to the Carrier is 1.	Yes	No
527 (020F)	Auto-write (Hex/1)	Used when the number of Heads to be written to the Carrier is 1.	Yes	No
528 (0210)	Polling Auto-write (ASCII/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
529 (0211)	Polling Auto-write Subcommand (ASCII/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
530 (0212)	Polling Auto-write (ASCII/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
531 (0213)	Polling Auto-write Subcommand (ASCII/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
532 (0214)	Polling Auto-write (ASCII/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
533 (0215)	Polling Auto-write Subcommand (ASCII/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
534 (0216)	Polling Auto-write (Hex/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
535 (0217)	Polling Auto-write Subcommand (Hex/2)	Used when the number of Heads to be written to the Carrier is 2.	Yes	No
536 (0218)	Polling Auto-write (Hex/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
537 (0219)	Polling Auto-write Subcommand (Hex/4)	Used when the maximum number of Heads to be written to the Carrier is 4.	Yes	No
538 (021A)	Polling Auto-write (Hex/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
539 (021B)	Polling Auto-write Subcommand (Hex/8)	Used when the maximum number of Heads to be written to the Carrier is 8.	Yes	No
540 (021C)	Data check	Writes and verify the CRC code for the check blocks designated by the user.	Yes	Yes
541 (021D)	Control management	Performs I/O or an I/O read.	Yes	Yes
542 (021E)	Error information read	Reads information from the latest error log.	Yes	Yes
543 (021F)	Command processing cancel	Cancels command processing except polling command processing and returns to the command waiting status.	Yes	Yes

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
544 (0220)	Polling auto-read command processing cancel	Cancels polling auto-read processing.	Yes	Yes
545 (0221)	Polling auto-write command processing cancel	Cancels polling auto-write processing.	Yes	Yes
546 (0222)	General-purpose command	Sends arbitrary data and stores receive data to receive data words.	Yes	Yes

Note 1. The hexadecimal equivalents of sequences numbers are given in parentheses

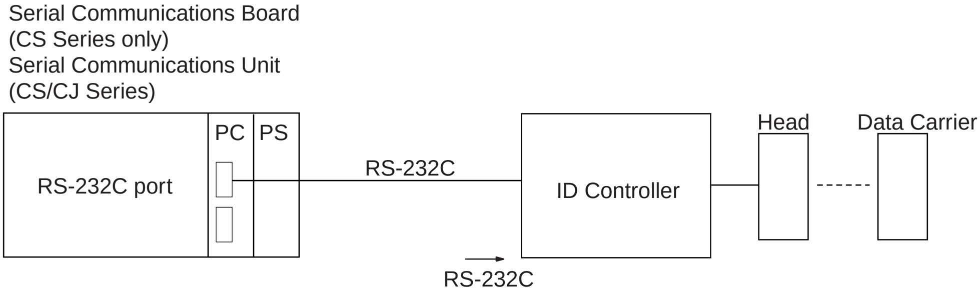
2. **Ladder Interface Settings**
YES: User settings are required for the 3rd and 4th operands of PMCR(260).
NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
Receive word allocation: Set the constant 0000 for the 4th operand (D).

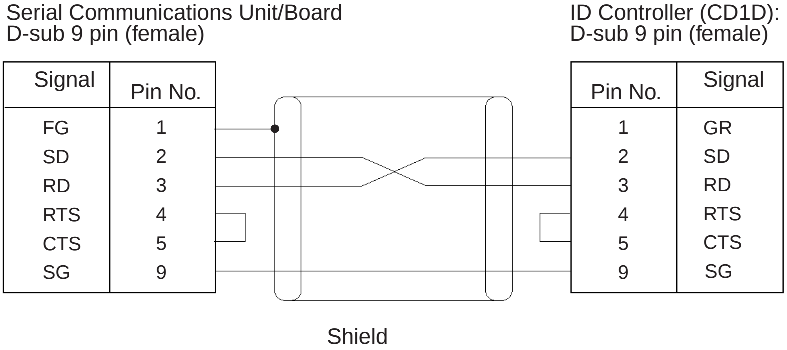
3. The Read/Write Head is abbreviated as R/W Head and the Data Carrier is abbreviated as simply Carrier in this appendix.

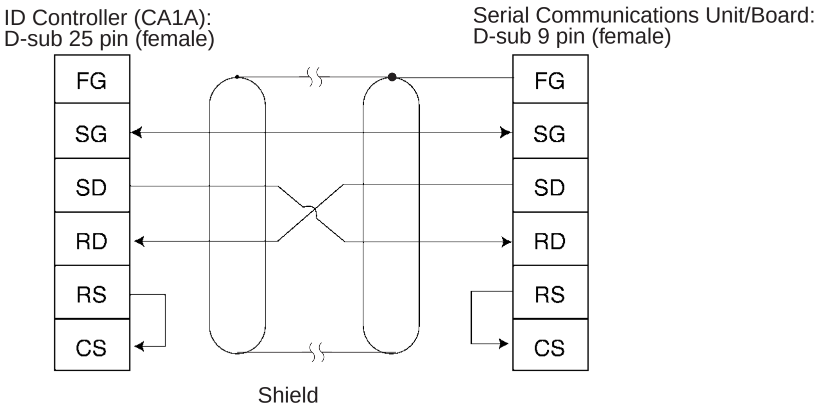
Connections

Connections when using the V600/V620 ID Controller Protocol are shown below.

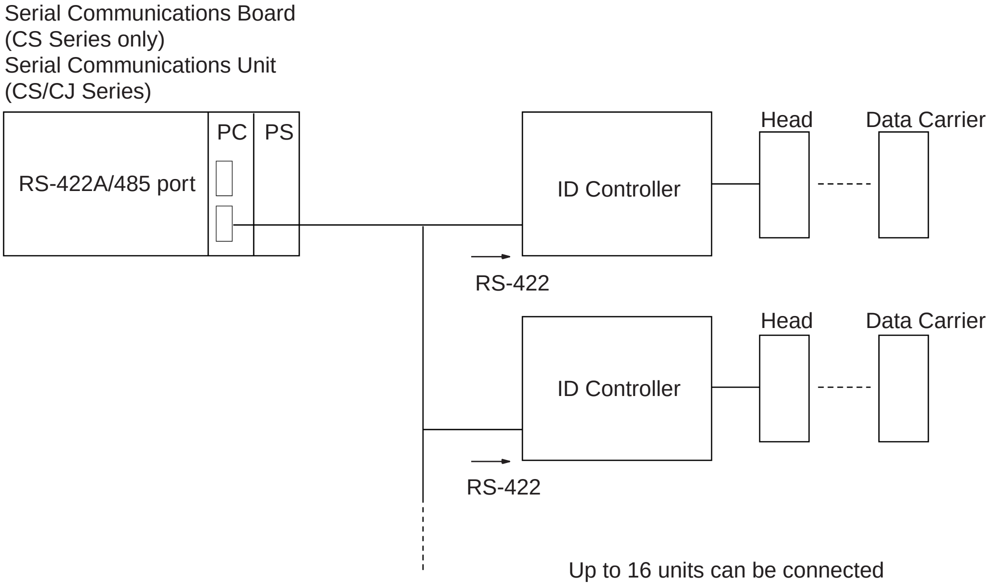
RS-232C Connections

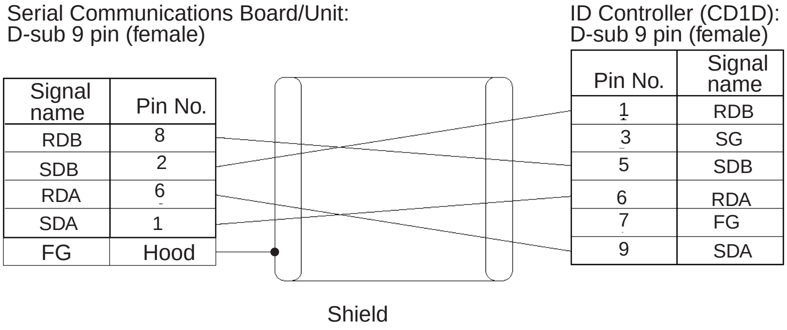






RS-422 Connections





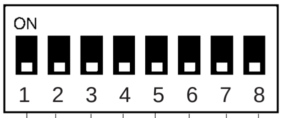
Note 1. Ground the cable shield at either the ID Controller or the Serial Communications Unit/Board to prevent malfunction.

2. Turn ON the pin 6 on DIP switch SW6 to set the host communications procedure to the 1-to-N procedure for 1-to-N connections.

DIP Switch Settings

V600/620-CD1D DIP Switches

DIP Switch 1



Not used (Always keep it OFF.)

SW7	Local communications mode setting
1	Speed priority setting
0	Distance priority setting

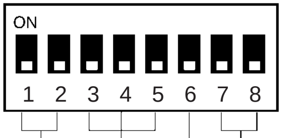
- SW7 Setting
  This setting is only valid if the EEPROM-type (batteryless-type) Data Carrier (DC) is accessed. The setting of SW7 does not work with the SRAM-type (battery-type) DC. SW7 must be set to OFF when the V620 is used.

SW4	SW5	SW6	Data length (bit)	STOP bits (bit)	Parity type
0	0	0	7	2	E
0	0	1	7	2	O
0	1	0	7	1	E
0	1	1	7	1	O
1	0	0	8	2	N
1	0	1	8	1	N
1	1	0	8	1	E
1	1	1	8	1	O

SW2	SW3	Baud rate (bps)
0	0	2,400
0	1	4,800
1	0	9,600
1	1	19,200

SW1	Display mode
0	Error display mode
1	I/O display mode

DIP Switch 2



Not used (Always keep it OFF.)

SW6	Communications protocol setting with host devices
1	1-to-N protocol
0	1-to-1 protocol

Note When selecting the "1-to-N" protocol, setting is limited to N=1. In this case, the FCS check code may be added.

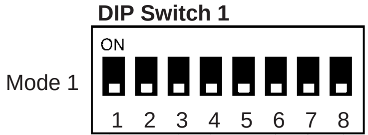
- ID Controller Unit Number Setting (Valid Only for 1-to-N Protocol)

SW3	SW4	SW5	Unit No.
0	0	0	No. 0
0	0	1	No. 1
0	1	0	No. 2
0	1	1	No. 3
1	0	0	No. 4
1	0	1	No. 5
1	1	0	No. 6
1	1	1	No. 7

Note 1. Be careful not to set to the same unit number twice.
2. Set them to OFF for the 1-to-1 protocol.

SW1	SW2	Synchronous condition
0	0	OFF (LL level)
0	1	ON (HL level)
1	0	Trailing edge
1	1	Leading edge

V600-CA□A DIP Switches



Note Factory Setting: All OFF

SW7 and SW8: Be sure to set to OFF.

- Baud Rate Setting

SW1	SW2	SW3	Baud rate (bps)
0	1	1	1,200
1	0	0	2,400
1	0	1	4,800
1	1	0	9,600
1	1	1	19,200

1=ON, 0=OFF

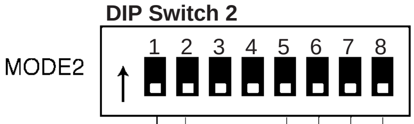
- Communications Format

SW4	SW5	SW6	Data length (bit)	STOP bit (bit)	Parity type
0	0	0	7	2	E
0	0	1	7	2	O
0	1	0	7	1	E
0	1	1	7	1	O
1	0	0	8	2	N
1	0	1	8	1	N
1	1	0	8	1	E
1	1	1	8	1	O

1 = ON, 0 = OFF (See note 1) (See note 2)

Note 1. Data length setting
7 bits: ASCII code
8 bits: JIS8 unit code

2. Parity setting
E: Even parity
O: Odd parity
N: No parity designation



- SW8: Receive Side Terminating Resistance Setting (Valid Only for the V600-CA2A)

1	Connected (ID Controller send side)
0	Not connected

- SW7: Receive Side Terminating Resistance Setting (Valid Only for the V600-CA2A)

1	Connected (ID Controller receive side)
0	Not connected

- SW6: Communications Protocol Setting

1	1-to-N protocol
0	1-to-1 protocol

- ID Controller Unit Number Setting (Valid Only for the 1-to-N Protocol)

SW2	SW3	SW4	SW5	Unit No.
0	0	0	0	No. 0
0	0	0	1	No. 1
0	0	1	0	No. 2
0	0	1	1	No. 3
0	1	0	0	No. 4
0	1	0	1	No. 5
0	1	1	0	No. 6
0	1	1	1	No. 7
1	0	0	0	No. 8
1	0	0	1	No. 9
1	0	1	0	No. 10
1	0	1	1	No. 11
1	1	0	0	No. 12
1	1	0	1	No. 13
1	1	1	0	No. 14
1	1	1	1	No. 15

Note 1. Be careful not to set to the same unit number twice.
2. Set them to OFF for the 1-to-1 protocol.

- Local Communications Mode Setting

1	Speed priority setting
0	Distance priority setting

- SW1 Setting
  This setting is only valid if the EEPROM-type (battery-less-type) Data Carrier (DC) is accessed. The setting of SW7 does not work with the SRAM-type (battery-type) DC.

- SW6 Setting
  When selecting the 1-to-N protocol for the V600-CA1A/RS-232C interface, the setting is limited to N=1. In this case, the FCS check code may be added.

Read (ASCII/1) (Sequence No. 500 (Hex 01F4))

This sequence is used when the number of Heads to be read from the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Undefined)	Head CH No.
	+3	Leading address No.	
	+4	(Undefined)	Read bytes

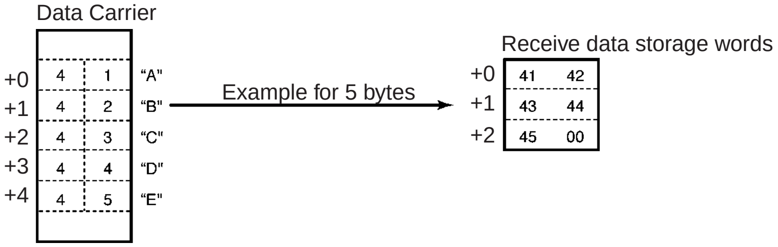
Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 (fixed)
+1	Unit No. (2 digits BCD)	00 to 07 (CD1D) 00 to 15 (CA☐A)
+2	R/W Head channel (CH) No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+3	Leading address No. (4 digits Hex)	0000 to FFFF
+4	Read bytes (2 digits Hex)	01 to F4 (1 to 244 bytes)

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Read data
	+2	Read data
	~	~
	+122	Read data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 007B (2 to 123 decimal)
+1 to +122	Read data (ASCII)	Number of read bytes stored in ASCII

Note Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words, as shown in the following diagram.

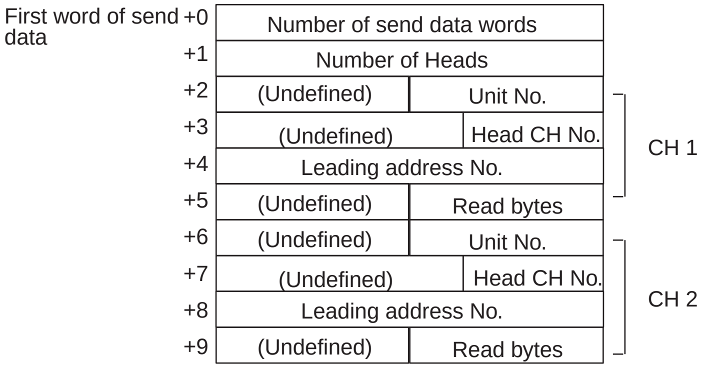


Each byte (address) in the Data Carrier contains the code for one ASCII character.

Read (ASCII/2) (Sequence No. 501 (Hex 01F5))

This sequence is used when the number of Heads to be read from the Carrier is 2. Up to 118 bytes of data can be read for each Read/Write Head.

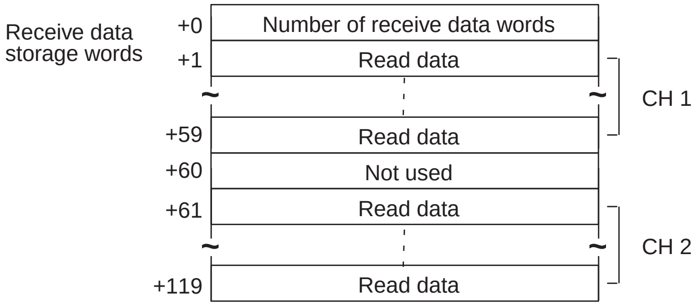
Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 000A (6 to 10 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0002
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 76 (1 to 118 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 0120
+(60(N–1)+1) to +(60(N–1)+59)	Read data (ASCII)	Number of read bytes store in ASCII

N: Number of Heads

Note Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.

Read (ASCII/4) (Sequence No. 502 (Hex 01F6))

This sequence is used when the maximum number of Heads to be read from the Carrier is 4. Up to 48 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of Heads		
	+2	(Undefined)	Unit No.	CH 1
	+3	(Undefined)	Head CH No.	
	+4	Leading address No.		
	+5	(Undefined)	Read bytes	
	+6	(Undefined)	Unit No.	CH 2
	+7	(Undefined)	Head CH No.	
	+8	Leading address No.		
	+9	(Undefined)	Read bytes	
	~	⋮		
	+14	(Undefined)	Unit No.	4 CH
	+15	(Undefined)	Head CH No.	
	+16	Leading address No.		
	+17	(Undefined)	Read bytes	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0012 (6 to 18 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0004
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 30 (1 to 48 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	Read data	CH 1
	~	⋮	
	+24	Read data	
	+25	Read data	CH 2
	~	⋮	
	+48	Read data	
	~	⋮	
	+73	Read data	4 CH
	~	⋮	
	+96	Read data	

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 0097
+(24(N–1)+1) to +(24(N–1)+24)	Read data (ASCII)	Number of read bytes stored in ASCII

N: Number of Heads

Note Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.

Read (ASCII/8) (Sequence No. 503 (Hex 01F7))

This sequence is used when the maximum number of Heads to be read from the Carrier is 8. Up to 20 bytes of data can be read for each Read/Write Head.

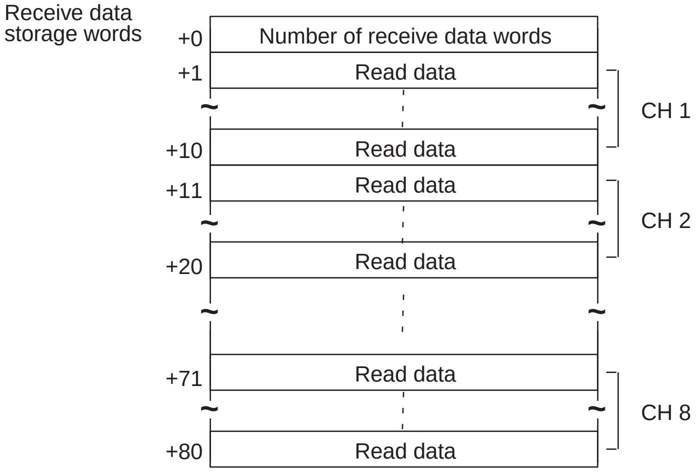
Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of Heads		
	+2	(Undefined)	Unit No.	CH 1
	+3	(Undefined)	Head CH No.	
	+4	Leading address No.		
	+5	(Undefined)	Read bytes	
	+6	(Undefined)	Unit No.	CH 2
	+7	(Undefined)	Head CH No.	
	+8	Leading address No.		
	+9	(Undefined)	Read bytes	
	~		~	
	+30	(Undefined)	Unit No.	8 CH
	+31	(Undefined)	Head CH No.	
	+32	Leading address No.		
	+33	(Undefined)	Read bytes	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0022 (6 to 34 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0008
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 14 (1 to 20 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 0081
+(10(N–1)+1) to +(10(N–1)+10)	Read data (ASCII)	Number of read bytes stored in ASCII

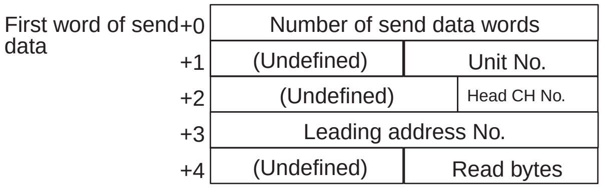
N: Number of Heads

Note Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.

Read (Hex/1) (Sequence No. 504 (Hex 01F8))

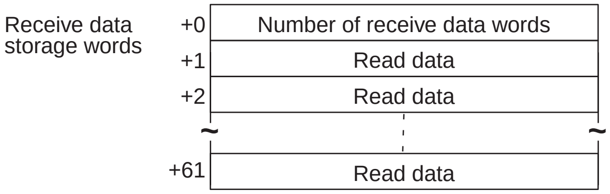
This sequence is used when the number of Heads to be read from the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))



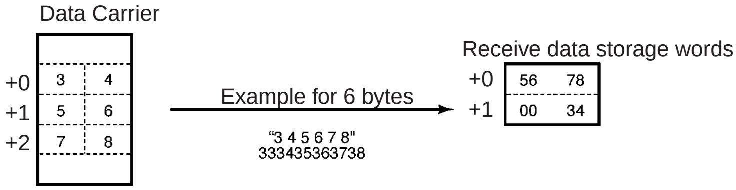
Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0005 (fixed)
+1	Unit No. (2 digits BCD)	00 to 07 (CD1D) 00 to 15 (CA☐A)
+2	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+3	Leading address No. (4 digits Hex)	0000 to FFFF
+4	Read bytes (2 digits Hex)	01 to 7A (1 to 122 bytes)

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 003E (6 to 62 decimal)
+1 to +61	Read data (Hex)	Number of read bytes stored in hexadecimal data

Note Data for Data Carriers designated for hexadecimal is stored beginning with the largest offset from the receive data words, as shown in the following diagram.

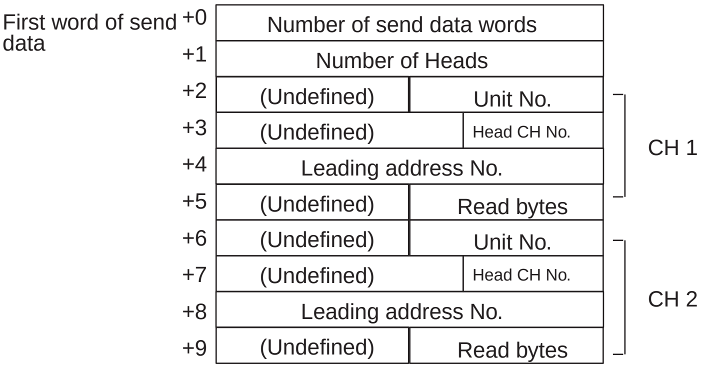


Each byte (address) in the Data Carrier contains 2 digits.

Read (Hex/2) (Sequence No. 505 (Hex 01F9))

This sequence is used when the maximum number of Heads to be read from the Carrier is 2. Up to 60 bytes of data can be read for each Read/Write Head.

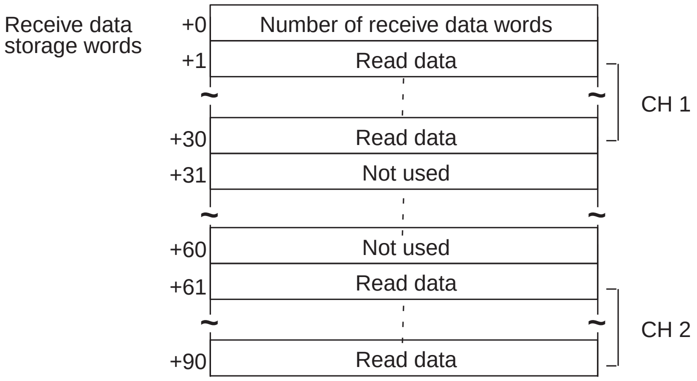
Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 000A (6 to 10 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0002
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 3C (1 to 60 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 005B (2 to 91 decimal)
+(60(N–1)+1) to +(60(N–1)+30)	Read data (Hex)	Number of read bytes stored in hexadecimal code

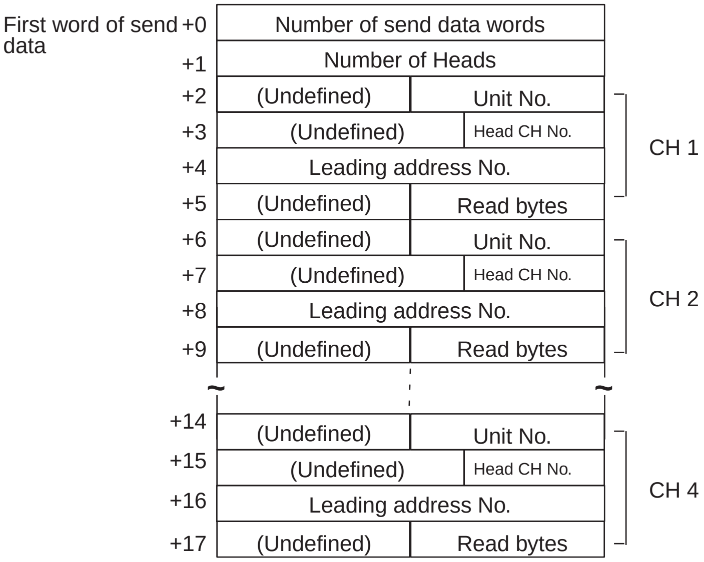
N: Number of Heads

Note Data for Data Carriers designated for hexadecimal is stored beginning with the largest offset from the receive data words.

Read (Hex/4) (Sequence No. 506 (Hex 01FA))

This sequence is used when the maximum number of Heads to be read from the Carrier is 4. Up to 24 bytes of data can be read for each Read/Write Head.

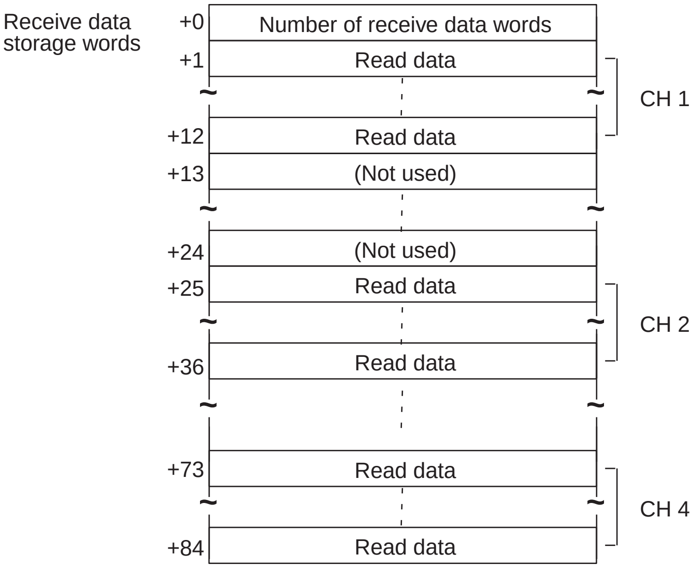
Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0012 (6 to 18 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0004
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 18 (1 to 24 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 0055 (2 to 85 decimal)
+(24(N–1)+1) to +(24(N–1)+12)	Read data (Hex)	Number of read bytes stored in hexadecimal data

Note Data for Data Carriers designated for hexadecimal is received beginning with the largest offset from the receive data words.

Read (Hex/8) (Sequence No. 507 (Hex 01FB))

This sequence is used when the maximum number of Heads to be read from the Carrier is 8. Up to 10 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

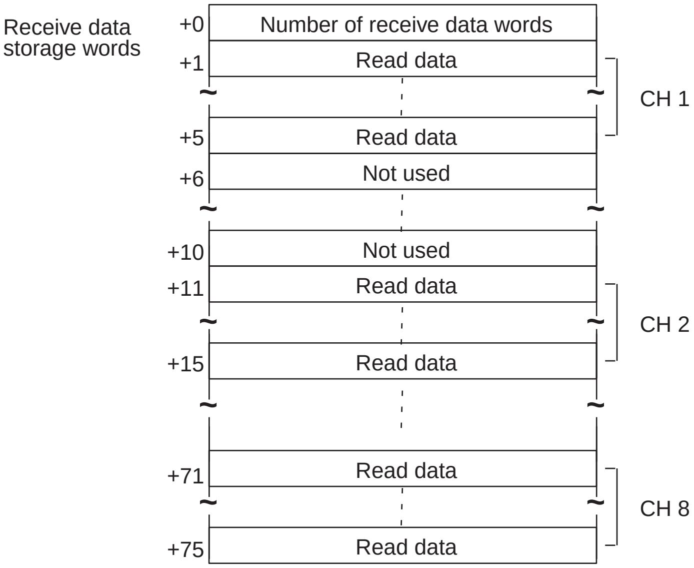
First word of send data

+0	Number of send data words		
+1	Number of Heads		
+2	(Undefined)	Unit No.	CH 1
+3	(Undefined)	Head CH No.	
+4	Leading address No.		
+5	(Undefined)	Read bytes	
+6	(Undefined)	Unit No.	CH 2
+7	(Undefined)	Head CH No.	
+8	Leading address No.		
+9	(Undefined)	Read bytes	
~			
+30	(Undefined)	Unit No.	CH 8
+31	(Undefined)	Head CH No.	
+32	Leading address No.		
+33	(Undefined)	Read bytes	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0022 (6 to 34 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0008
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	01 to 0A (1 to 10 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 004C (2 to 76 decimal)
+(10(N–1)+1) to +(10(N–1)+5)	Read data (CH 1) (Hex)	Number of read bytes stored in hexadecimal data

N: Number of Heads

Note Data for Data Carriers designated for hexadecimal is sent beginning with the largest offset from the receive data words.

Auto-read (ASCII/1) (Sequence No. 508 (Hex 01FC))

This sequence is used when the maximum number of Heads to be read from the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 500 (Read (ASCII/1)).

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 500 (Read (ASCII/1)).

Note For auto-read (AR), a response is not returned if the number of Heads is not read by the Carrier, the Abort Bit must be turned OFF to terminate the sequence.

Auto-read (Hex/1) (Sequence No. 509 (Hex 01FD))

This sequence is used when the maximum number of Heads to be read from the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 504 (Read (Hex/1)).

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 504 (Read (Hex/1)).

Note For auto-read (AR), a response is not returned if the number of Heads is not read by the Carrier, the Abort Bit must be turned OFF to terminate the sequence.

Polling Auto-read (ASCII) (Sequence No. 510 (Hex 01FE))

This sequence is used when the number of Heads to be read from the Carrier is from 1 to 8.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data +0	Number of send data words		
+1	Number of Heads		
+2	(Undefined)	Unit No.	CH 1
+3	(Undefined)	Head CH No.	
+4	Leading address No.		
+5	(Undefined)	Read bytes	
~		~	
+(4(N–1)+2)	(Undefined)	Unit No.	CH N * N: Number of Heads
+(4(N–1)+3)	(Undefined)	Head CH No.	
+(4(N–1)+4)	Leading address No.		
+(4(N–1)+5)	(Undefined)	Read bytes	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0022 (6 to 34 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0008
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	If number of Heads is 2 or less 01 to 76 (1 to 118 bytes)
		If number of Heads is 4 or less 01 to 30 (1 to 48 bytes)
		If number of Heads is 8 or less 01 to 20 (1 to 20 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note
1. Execute Sequence No. 510 before executing Sequence No. 511, 512, 513.
2. Execute Sequence No. 544 (Polling Auto-read Command Processing Cancel) to cancel the polling auto-read.
3. Retry processing is not performed for this sequence.

Polling Auto-read Sub-command (ASCII/2) (Sequence No. 511 (Hex 01FF))

This sequence is used when the maximum number of Heads to be read from the Carrier is 2. Up to 118 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 501 (Read (ASCII/2)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #510.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 501 (Read (ASCII/2)).

Note 1. Execute Sequence No. 510 before executing Sequence No. 511.
2. Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.
3. Retry processing is not performed for this sequence.

Polling Auto-read Sub-command (ASCII/4) (Sequence No. 512 (Hex 0200))

This sequence is used when the maximum number of Heads to be read from the Carrier is 4. Up to 48 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 502 (Read (ASCII/4)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #510.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 502 (Read (ASCII/4)).

Note 1. Execute Sequence No. 510 before executing Sequence No. 512.
2. Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.
3. Retry processing is not performed for this sequence.

Polling Auto-read Sub-command (ASCII/8) (Sequence No. 513 (Hex 0201))

This sequence is used when the maximum number of Heads to be read from the Carrier is 8. Up to 20 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 503 (Read (ASCII/8)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #510.

Receive Data Word Allocation (4th Operand of PMCR(260))

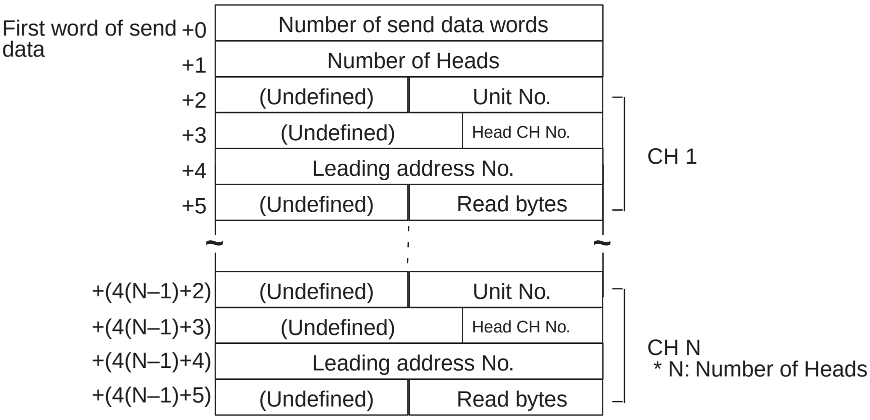
The receive data word allocation is similar to that of Sequence No. 503 (Read (ASCII/8)).

Note 1. Execute Sequence No. 510 before executing Sequence No. 513.
2. Data from Data Carriers designated for ASCII is stored beginning with the smallest offset from the receive data words.
3. Retry processing is not performed for this sequence.

Polling Auto-read (Hex) (Sequence No. 514 (Hex 0202))

This sequence is used when the number of Heads to be read from the Carrier is from 1 to 8.

Send Data Word Allocation (3rd Operand of PMCR(260))



First word of send data +0	Number of send data words		
+1	Number of Heads		
+2	(Undefined)	Unit No.	CH 1
+3	(Undefined)	Head CH No.	
+4	Leading address No.		
+5	(Undefined)	Read bytes	
~			
+(4(N–1)+2)	(Undefined)	Unit No.	CH N
+(4(N–1)+3)	(Undefined)	Head CH No.	* N: Number of Heads
+(4(N–1)+4)	Leading address No.		
+(4(N–1)+5)	(Undefined)	Read bytes	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0022 (6 to 34 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0008
+(4(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(4(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2
+(4(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(4(N–1)+5)	Read bytes (2 digits Hex)	If number of Heads is 2 or less 01 to 3C (1 to 60 bytes)
		If number of Heads is 4 or less 01 to 18 (1 to 24 bytes)
		If number of Heads is 8 or less 01 to 0A (1 to 10 bytes)

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Execute Sequence No. 514 before executing Sequence No. 515, 516, 517.

2. Execute Sequence No. 544 (Polling Auto-read Command Processing Cancel) to cancel the polling auto-read.

Polling Auto-read Sub-command (Hex/2) (Sequence No. 515 (Hex 0203))

This sequence is used when the maximum number of Heads to be read from the Carrier is 2. Up to 60 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 505 (Read (Hex/2)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #514.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 505 (Read (Hex/2)).

Note 1. Execute Sequence No. 514 before executing Sequence No. 515.

2. Data from Data Carrier designated for hexadecimal is stored beginning with the largest offset from the receive data words.
3. Retry processing is not performed for this sequence.

Polling Auto-read Sub-command (Hex/4) (Sequence No. 516 (Hex 0204))

This sequence is used when the maximum number of Heads to be read from the Carrier is 4. Up to 24 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 506 (Read (Hex/4)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #514.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 506 (Read (Hex/4)).

Note

1. Execute Sequence No. 514 before executing Sequence No. 516.
2. Data from Data Carrier designated for hexadecimal is stored beginning with the largest offset from the receive data words.

Polling Auto-read Sub-command (Hex/8) (Sequence No.517 (Hex 0205))

This sequence is used when the maximum number of Heads to be read from the Carrier is 8. Up to 10 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation 3rd Operand of PMCR(260))

The send data word allocation is similar to that of sequence No.507 (Read (Hex/8)). However, the leading address No. and number of read bytes are not used and will be the value specified for sequence #514.

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of sequence No.507 (Read (Hex/8)).

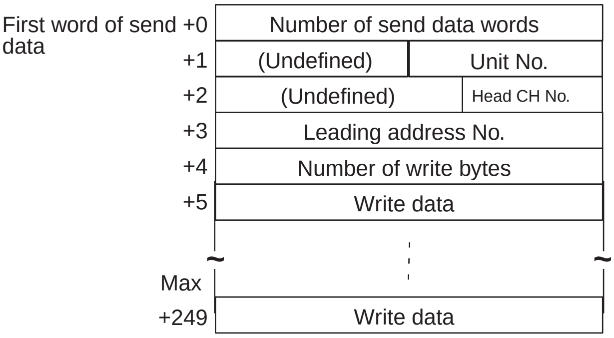
Note

1. Execute sequence No.514 before executing sequence No.517.
2. Data from Data Carriers designated for hexadecimal is stored beginning with the largest offset from the receive data words.
3. Retry processing is not performed for this sequence.

Write (ASCII/1) (Sequence No.518 (Hex 0206))

This sequence is used when the number of Heads to be written to the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))

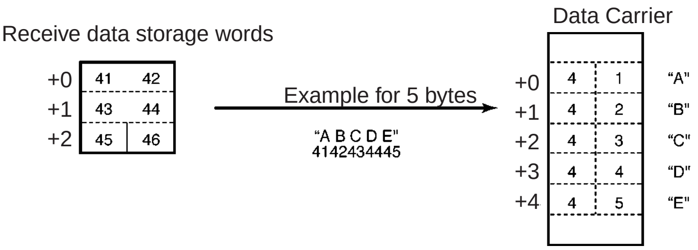


Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 00FA (6 to 250 decimal)
+1	Relevant Unit No. (2 digits BCD)	00 to 07 (CD1D) 00 to 15 (CA2A)
+2	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+3	Leading address No. (4 digits Hex)	0000 to FFFF
+4	Number of write bytes (4 digits Hex)	0001 to 01EA (1 to 490 decimal)
+5to +249	Write data (ASCII)	Input in ASCII Up to 248 bytes (max.) can be set

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note Write data designated for ASCII is sent beginning with the smallest offset from the send data words, as shown in the following diagram.

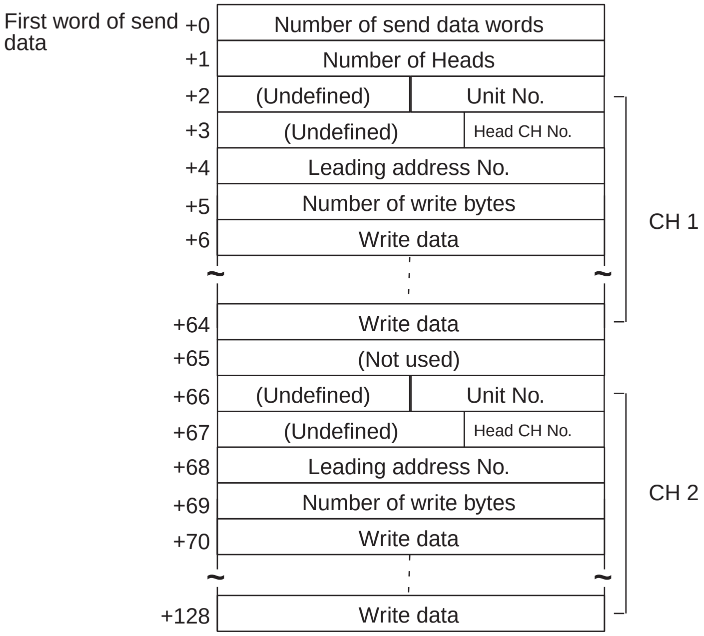


Each byte (address) in the Data Carrier contains the code for one ASCII character.

Write (ASCII/2) (Sequence No. 519 (Hex 0207))

This sequence is used when the number of Heads to be written to the Carrier is 2. Up to 118 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 0081 (7 to 129 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0002
+(64(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(64(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(64(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(64(N–1)+5)	Number of write bytes (4 digits Hex)	0001 to 0076 (1 to 118 decimal)
+(64(N–1)+6) to (64(N–1)+64)	Write data (ASCII)	Input in ASCII. Up to 118 bytes (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

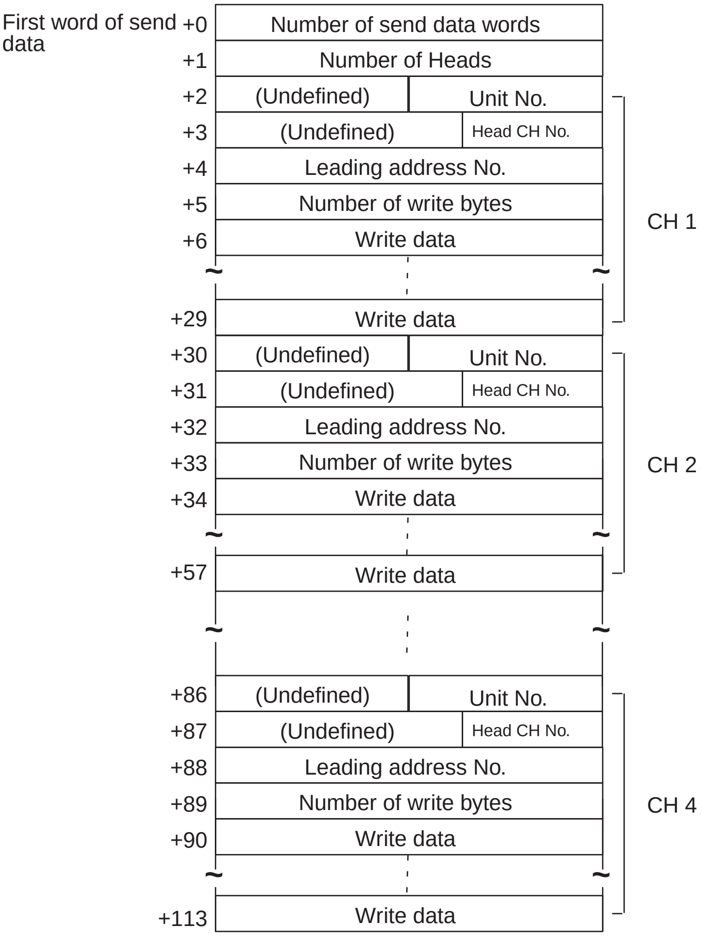
None.

Note Write data designated for ASCII is sent beginning with the smallest offset from the send data words.

Write (ASCII/4) (Sequence No. 520 (Hex 0208))

This sequence is used when the number of Heads to be written to the Carrier is 4. Up to 48 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 0072 (7 to 114 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0004
+(28(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(28(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(28(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(28(N–1)+5)	Number of write bytes (4 digits Hex)	0001 to 0030 (1 to 48 decimal)
+(28(N–1)+6) to (28(N–1)+29)	Write data (ASCII)	Input in ASCII. Up to 48 bytes (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

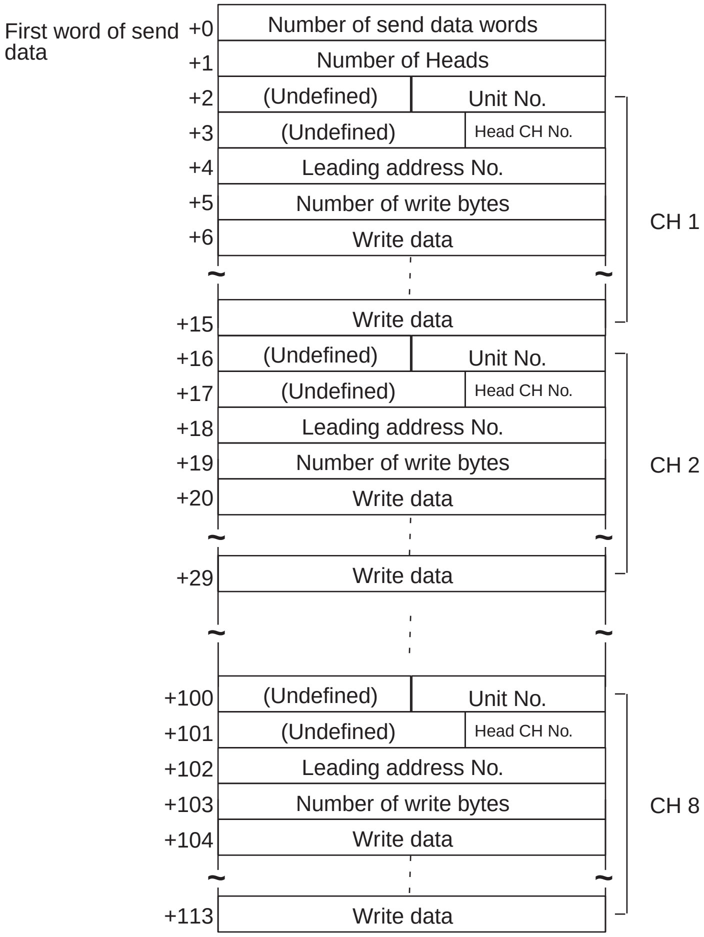
None.

Note Write designated for ASCII is sent beginning with the smallest offset from the send data words.

Write (ASCII/8) (Sequence No. 521 (Hex 0209))

This sequence is used when the number of Heads to be written to the Carrier is 8. Up to 20 bytes of data can be read for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words(4 digits Hex)	0007 to 0072 (7 to 114 decimal)
+1	Number of Heads (4 digits BCD)	0001 to 0008
+(14(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(14(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(14(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(14(N–1)+5)	Number of write bytes (4 digits Hex)	0001 to 0014 (1 to 20 decimal)
+(14(N–1)+6) to (14(N–1)+15)	Write data (ASCII)	Input in ASCII Up to 20 bytes (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

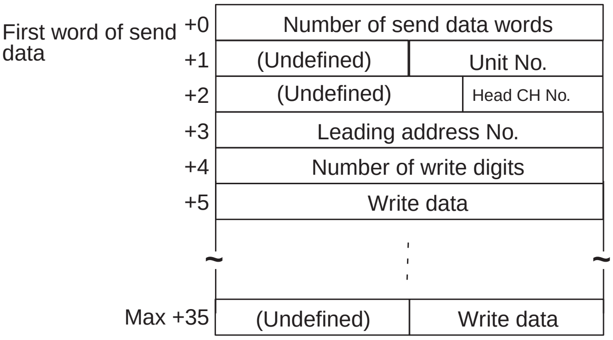
None.

Note Write data designated for ASCII is sent beginning with the smallest offset from the send data words.

Write (Hex/1) (Sequence No. 522 (Hex 020A))

This sequence is used when the number of Heads to be written to the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))



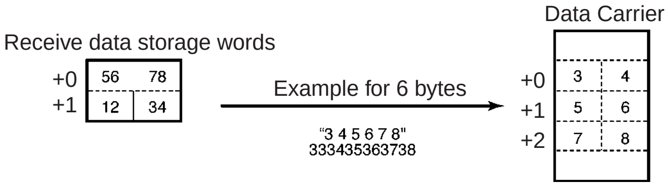
Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 to 0024 (6 to 36 decimal)
+1	Relevant Unit No. (2 digits BCD)	00 to 07 (CD1D) 00 to 15 (CA2A)
+2	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+3	Leading address No. (4 digits Hex)	0000 to FFFF
+4	Number of write digits (4 digits Hex)	0002 to 007A (2 to 122 decimal)
+5 to 35	Write data (Hex)	Input in hexadecimal Up to 122 digits (max.)

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Data of which Data Carrier designated for hexadecimal is sent beginning with the largest offset from the send data words, as shown in the following diagram.

2. Always set an even number of digits for the write data.

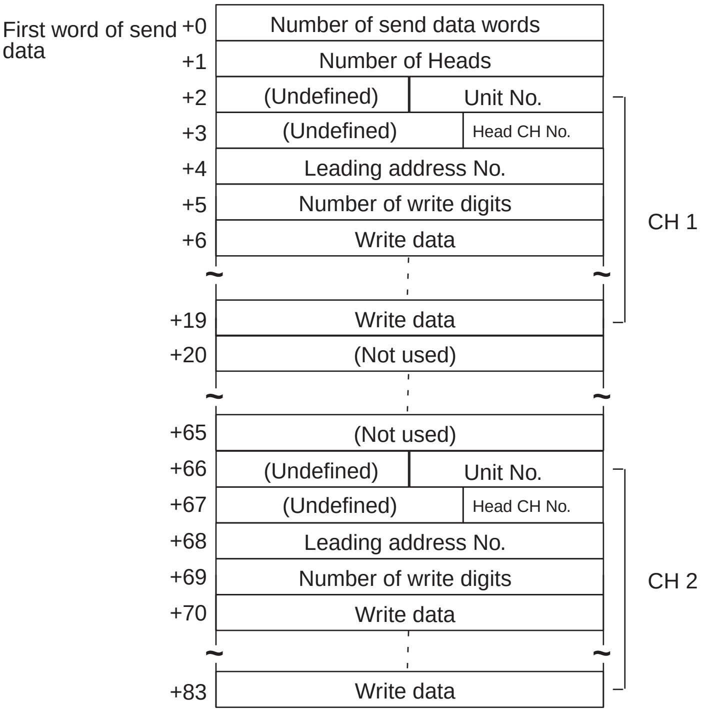


Each byte (address) in the Data Carrier contains 2 digits.

Write (Hex/2) (Sequence No. 523 (Hex 020B))

This sequence is used when the number of Heads to be written to the Carrier is 2. Up to 56 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 0054 (7 to 84 decimal)
+1	Number of Heads (4 digits Hex)	0002 to 0002
+(64(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(64(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(64(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(64(N–1)+5)	Number of write digits (4 digits Hex)	0002 to 0038 (2 to 56 decimal)
+(64(N–1)+6) to (64(N–1)+19)	Write data (Hex)	Input in hexadecimal Up to 56 digits (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

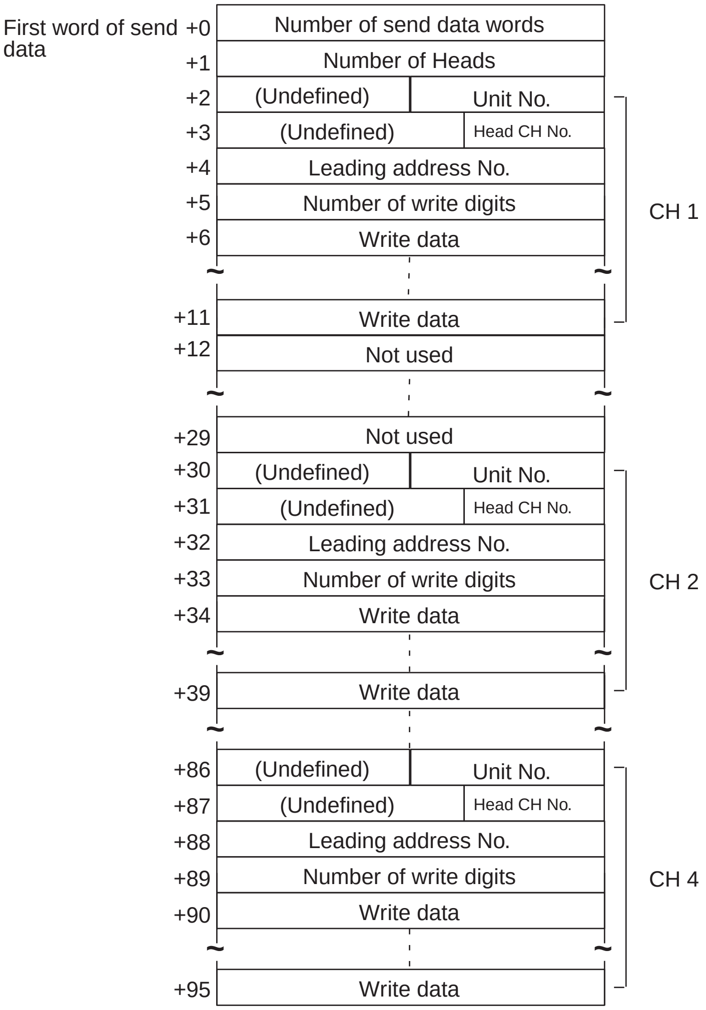
None.

Note
1. Write data designated for hexadecimal is sent beginning with the largest offset from the send data words.
2. Always set an even number of digits for the write data.

Write (Hex/4) (Sequence No. 524 (Hex 020C))

This sequence is used when the number of Heads to be written to the Carrier is 4. Up to 24 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))



Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 0060 (7 to 96 decimal)
+1	Number of Heads (4 digits Hex)	0001 to 0004
+(28(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(28(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(28(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(28(N–1)+5)	Number of write digits (4 digits Hex)	0002 to 0018 (2 to 24 decimal)
+(28(N–1)+6) to (28(N–1)+11)	Write data (Hex)	Input in hexadecimal code Up to 24 digits (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Write data designated for hexadecimal is sent beginning with the largest offset from the send data words.

2. Always set an even number of digits for the write data.

Write (Hex/8) (Sequence No. 525 (Hex 020D))

This sequence is used when the number of Heads to be written to the Carrier is 8. Up to 10 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	Number of Heads		
	+2	(Undefined)	Unit No.	CH 1
	+3	(Undefined)	Head CH No.	
	+4	Leading address No.		
	+5	Number of write digits		
	+6	Write data		
	~			
	+8	(Undefined)	Write data	
	+9	Not used		
	~			
	+15	Not used		
	+16	(Undefined)	Unit No.	CH 2
	+17	(Undefined)	Head CH No.	
	+18	Leading address No.		
	+19	Number of write digits		
	+20	Write data		
	~			
	+22	(Undefined)	Write data	
	~			
	+100	(Undefined)	Unit No.	CH 8
	+101	(Undefined)	Head CH No.	
	+102	Leading address No.		
	+103	Number of write digits		
	+104	Write data		
	~			
	+106	(Undefined)	Write data	

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0007 to 006B (7 to 107 decimal)
+1	Number of Heads (4 digits Hex)	0001 to 0004
+(14(N–1)+2)	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+(14(N–1)+3)	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.
+(14(N–1)+4)	Leading address No. (4 digits Hex)	0000 to FFFF
+(14(N–1)+5)	Number of write digits (4 digits Hex)	0002 to 000A (2 to 10 decimal)
+(14(N–1)+6) to (14(N–1)+8)	Write data (Hex)	Input in hexadecimal code Up to 10 digits (max.) can be set

N: Number of Heads

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. Write data designated for hexadecimal is sent beginning with the largest offset from the send data words.

2. Always set an even number of digits for the write data.

Auto-write (ASCII/1) (Sequence No. 526 (Hex 020E))

This sequence is used when the number of Heads to be written to the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 518 (Write (ASCII/1)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 518 (Write (ASCII/1)).

Note For auto-write (AW), a response is not returned if the number of Heads is not written by the Carrier, the Abort Bit must be turned OFF to terminate the sequence.

Auto-write (Hex/1) (Sequence No. 527 (Hex 020F))

This sequence is used when the number of Heads to be written to the Carrier is 1.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 522 (Write (Hex/1)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 522 (Write (Hex/1)).

Note For auto-write (AW), a response is not returned if the number of Heads is not written by the Carrier, the Abort Bit must be turned OFF to terminate the sequence.

Polling Auto-write (ASCII/2) (Sequence No. 528 (Hex 0210))

This sequence is used when the number of Heads to be written to the Carrier is 2.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 519 (Write (ASCII/2)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 519 (Write (ASCII/2)).

Note 1. Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.

2. Retry processing is not performed for this sequence.

Polling Auto-write Subcommand (ASCII/2) (Sequence No. 529 (Hex 0211))

This sequence is used when the number of Heads to be written to the Carrier is 2. Up to 118 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 519 (Write (ASCII/2)). However, the leading address No., number of write, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. Execute Sequence No. 528 before executing Sequence No. 529.
2. Retry processing is not performed for this sequence.

Polling Auto-write (ASCII/4) (Sequence No. 530 (Hex 0212))

This sequence is used when the number of Heads to be written to the Carrier is 4.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 520 (Write (ASCII/4)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 520 (Write (ASCII/4)).

Note Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.

Polling Auto-write Subcommand (ASCII/4) (Sequence No. 531 (Hex 0213))

This sequence is used when the number of Heads to be written to the Carrier is 4. Up to 48 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 520 (Write (ASCII/4)). However, the leading address No., number of write, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. Execute Sequence No. 530 before executing Sequence No. 531.
2. Retry processing is not performed for this sequence.

Polling Auto-write (ASCII/8) (Sequence No. 532 (Hex 0214))

This sequence is used when the number of Heads to be written to the Carrier is 8.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 521 (Write (ASCII/8)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 521 (Write (ASCII/8)).

Note 1. Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.
2. Retry processing is not performed for this sequence.

Polling Auto-write Subcommand (ASCII/8) (Sequence No. 533 (Hex 0215))

This sequence is used when the number of Heads to be written to the Carrier is 8. Up to 20 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 521 (Write (ASCII/8)). However, the leading address No., number of write, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. Execute Sequence No. 532 before executing Sequence No. 533.
2. Retry processing is not performed for this sequence.

Polling Auto-write (Hex/2) (Sequence No. 534 (Hex 0216))

This sequence is used when the number of Heads to be written to the Carrier is 2.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 523 (Write (Hex/2)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 523 (Write (Hex/2)).

Note 1. Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.
2. Retry processing is not performed for this sequence.

Polling Auto-write Subcommand (Hex/2) (Sequence No. 535 (Hex 0217))

This sequence is used when the number of Heads to be written to the Carrier is 2. Up to 56 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 523 (Write (Hex/2)). However, the leading address No., number of write digits, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))
None.

Note 1. Execute Sequence No. 534 before executing Sequence No. 535.
2. Retry processing is not performed for this sequence.

Polling Auto-write (Hex/4) (Sequence No. 536 (Hex 0218))

This sequence is used when the number of Heads to be written to the Carrier is 4.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 524 (Write (Hex/4)).

Receive Data Word Allocation (4th Operand of PMCR(260))
The receive data word allocation is similar to that of Sequence No. 524 (Write (Hex/4)).

Note 1. Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.
2. Retry processing is not performed for this sequence.

Polling Auto-write Subcommand (Hex/4) (Sequence No. 537 (Hex 0219))

This sequence is used when the number of Heads to be written to the Carrier is 2. Up to 24 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))
The send data word allocation is similar to that of Sequence No. 524 (Write (Hex/4)). However, the leading address No., number of write, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Execute Sequence No. 536 before executing Sequence No. 537.
2. Retry processing is not performed for this sequence.

Polling Auto-write (Hex/8) (Sequence No. 538 (Hex 021A))

This sequence is used when the number of Heads to be written to the Carrier is 8.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 525 (Write (Hex/8)).

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 525 (Write (Hex/8)).

Note 1. Execute Sequence No. 545 (Polling Auto-write Command Processing Cancel) to cancel the polling auto-write.
2. Retry processing is not performed for this sequence.

Polling Auto-write Subcommand (Hex/8) (Sequence No. 539 (Hex 021B))

This sequence is used when the number of Heads to be written to the Carrier is 8. Up to 10 digits of data can be written for each Read/Write Head.

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 525 (Write (Hex/8)). However, the leading address No., number of write, and write data are not used and become undefined.

Receive Data Word Allocation (4th Operand of PMCR(260))

None.

Note 1. Execute Sequence No. 538 before executing Sequence No. 539.
2. Retry processing is not performed for this sequence.

Data Check (Sequence No. 540 (Hex 021C))

This sequence writes and verifies the CRC code for check blocks designated by the user.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Undefined)	Head CH No.
	+3	Processing designation	(Undefined)
	+4	Leading address of check object	
	+5	(Undefined)	Number of check block bytes

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0006 (fixed)
+1	Unit No. (2 digits BCD)	00 to 07 (CD1D) 00 to 15 (CA2A)
+2	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation:1 R/W Head CH 2 designation:2 The CD1D must be set to 1.
+3	Processing designation (2 digits Hex)	Verification: 43 (C) Calculation: 4B (K) Management of number of write times: 4C (L)
+4	Leading address of check object (4 digits Hex)	0000 to FFFF (If management of number of write times is designated, H’ □□□0 to H’ □□□5 or H’ □□□8 to H’ □□□D)
+5	Number of check block bytes (2 digits Hex)	If verification, calculation is designated: 03 to FF (set 00 for 256 bytes) If management of number of write times is designated: 00 to FF

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	(Undefined)	Completion code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 (fixed)
+1	Completion code (2 digits Hex)	(Verification, calculation designation) 00: Normal completion for calculation processing 75: Data in normal condition for verification processing 76: Error Data alarm for verification processing (If management of number of write times is designated) 75: Number of write times is under those which is specified 76: alarm for number of write times is over those which is specified.

Note If L (management of number of write times) is designated by processing designation, management of number of write times for Data Carrier of EEPROM is performed.

Control (Sequence No. 541 (Hex 021D))

This sequence performs I/O operations or I/O reads.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words		
	+1	(Undefined)	Unit No.	
	+2	(Undefined)	OUT1 operation	OUT2 operation

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 (fixed)
+1	Unit No. (2 digits BCD)	00 to 07 (CD1D)
+2	OUT1 operation (1 digit BCD)	0: No operation 1: turned ON 2: turned OFF
	OUT2 operation (1 digit BCD)	0: No operation 1: turned ON 2: turned OFF

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words	
+1	Current input status	Output status after operation

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 (fixed)
+1 Leftmost 1 byte	Current input status Leftmost 4 bits: IN1 operation Rightmost 4 bits: IN2 operation	1: ON status 0: OFF status
	Output status after operation Leftmost 4 bits: OUT1 operation Rightmost 4 bits: OUT2 operation	1: ON status 0: OFF status

Note 1. The V600/620-CA☐A does not support this command.

2. This sequence executes the equivalent of the CONTROL command.

Error Information Read (Sequence No. 542 (Hex 021E))

This sequence reads information from the latest error log.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	00 to 07 (CD1D)

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words

+0	Number of receive data words
+1	Error log
~	⋮
+75	Error log

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0004 to 004C (4 to 76 decimal)
+1 to +75	Error log (ASCII)	One item of data is stored with 5 characters of generated command, generated Head No., generated error code.

Note 1. The V600/620-CA☐A does not support this command.

2. Up to 30 error records can be stored.
3. The most resent error records are stored first.

Command Processing Cancel (Sequence No. 543 (Hex 021F))

This sequence cancels command processing except for polling command processing. The command waiting status is entered.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data

+0	Number of send data words	
+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0002 (fixed)
+1	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	(Undefined)	Unit No.

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 (fixed)
+1	Completion code (2 digits Hex)	00: Normal termination 14: Auto or communications command processing not executed 75: Cancelled before the end of expansion command receive or before sync input went active or before detection of the existence of Data Carrier 76: Cancelled during read/write processing for Data Carrier

Polling Auto-read Command Processing Cancel (Sequence No. 544 (Hex 0220))

This sequence cancels polling auto-read processing.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words	
	+1	(Undefined)	Unit No.
	+2	(Not used)	
	+3	(Undefined)	Head channel No.

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0004 (fixed)
+1	Unit No. (2 digits BCD)	Arbitrary (However, there is a limit for the maximum Unit No. depending on the model)
+2	Not used	
+3	R/W Head CH No. (1 digit BCD)	R/W Head CH 1 designation: 1 R/W Head CH 2 designation: 2 The CD1D must be set to 1.

Receive Data Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words	
	+1	(Undefined)	Completion code

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 (fixed)
+1	Completion code (2 digits Hex)	75: Cancelled before communications processing with Data Carrier 76: Cancelled after communications processing with Data Carrier

Polling Auto-write Command Processing Cancel (Sequence No. 545 (Hex 0221))

This sequence cancels polling auto-write processing

Send Data Word Allocation (3rd Operand of PMCR(260))

The send data word allocation is similar to that of Sequence No. 544 (Polling Auto-read Command Processing Cancel)

Receive Data Word Allocation (4th Operand of PMCR(260))

The receive data word allocation is similar to that of Sequence No. 544 (Polling Auto-read Command Processing Cancel)

General-purpose Command (Sequence No. 546 (Hex 0222))

This sequence transmits arbitrary data and stores receive data to the receive data words. The characters “@”, FCS (terminator) are not required in the send data words and receive data words. These characters will be automatically added for transmission and automatically removed before saving data.

Send Data Word Allocation (3rd Operand of PMCR(260))

First word of send data	+0	Number of send data words
	+1	Send data byte length
	+2	Send data
	~	~
	+249	Send data

Offset	Contents (data format)	Data
+0	Number of send data words (4 digits Hex)	0003 to 00FA (3 to 250 decimal)
+1	Send data byte length (4 digits Hex)	0001 to 01F0 (1 to 496 decimal) The number of bytes in the send data except for @, the FCS, and the terminator.
+2 to +249	Send data (ASCII)	Input send data up to 496 characters (max.) in ASCII

Receive Data Storage Word Allocation (4th Operand of PMCR(260))

Receive data storage words	+0	Number of receive data words
	+1	Receive data
	~	~
	+249	Receive data

Offset	Contents (data format)	Data
+0	Number of receive data words (4 digits Hex)	0002 to 00FA (2 to 250 decimal)
+1 to +249	Receive data (ASCII)	Receive data is stored in ASCII. Up to 498 characters (max.)

Appendix N

Hayes Modem AT Command Protocol

The Hayes Modem AT Command Protocol is used to make various settings or control remotely a Hayes modem connected to the Serial Communications Unit/Board via RS-232C cable.

Protocol Configuration

The configuration of the Hayes Modem AT Command Protocol is shown below.

Sequence No.	Communications sequence name	Function	Ladder interface	
			Send word allocation	Receive word allocation
550 (0226)	Initialize modem (general-purpose)	Initializes the modem connected to the Serial Communications Unit/Board. The initialization command is set in the words specified for the second operand of PMCR(260).	Yes	No
560 (0230) 570 (023A) 580 (0244)	Initialize modem (specialized)	Initializes certain OMRON Modems.	No	No
561 (0231) 571 (023B) 581 (0245)	Dial	Dials from the modem connected to the Serial Communications Unit/Board. AT commands and telephone numbers are set set in the words specified for the 3rd operand of PMCR(260). This sequence can be used only for certain OMRON modems.	Yes	No
552 (0228)	Password	After the line is connected, the password sent from the other exchange is verified to confirm that the line is connected to the desired exchange. The normal value of a password is set in the words specified for the 3rd operand of PMCR(260).	Yes	No
553 (0229)	Data send/receive (general purpose sequence)	Sends arbitrary data to the exchange which the line is connected. Send data is set in the words specified for the 2nd operand of PMCR(260). Receive data is stored in the words specified for the fourth operand of PMCR(260).	Yes	Yes
554 (022A)	Escape	Shifts the modem to escape mode (the condition in which command input is available during data communications). The escape code is fixed to “+++”	No	No
555 (022B)	Hang up	After shifting to escape mode, the line is disconnected.	No	No
562 (0232) 572 (023C) 582 (0246)	Initialize and dial	Executes continuously from initialization to dialling operations for certain OMRON Modems.	Yes*[1]	No
590 (024E)	Escape to hang up	Executes continuously from shifting to the escape mode to hanging up.	No	No

Note 1. Refer to sequences No. 561, No. 571, and No. 581 for dialing operations.

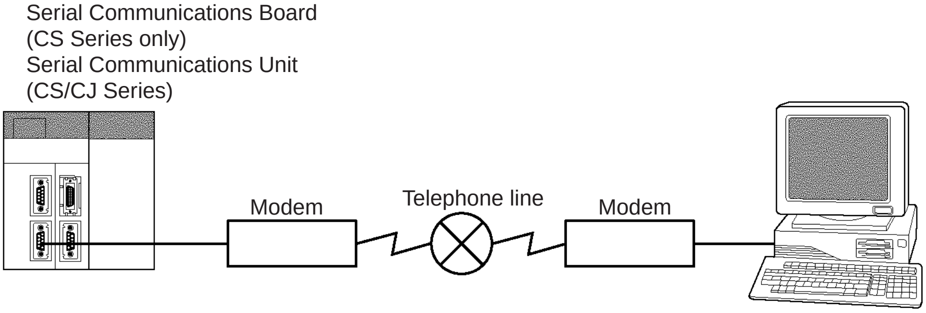
2. **Ladder Interface Settings**
   YES: User settings are required for the 3rd and 4th operands of PMCR(260).
   NO: Send word allocation: Set the constant 0000 for the 3rd operand (S).
   Receive word allocation: Set the constant 0000 for the 4th operand (D).

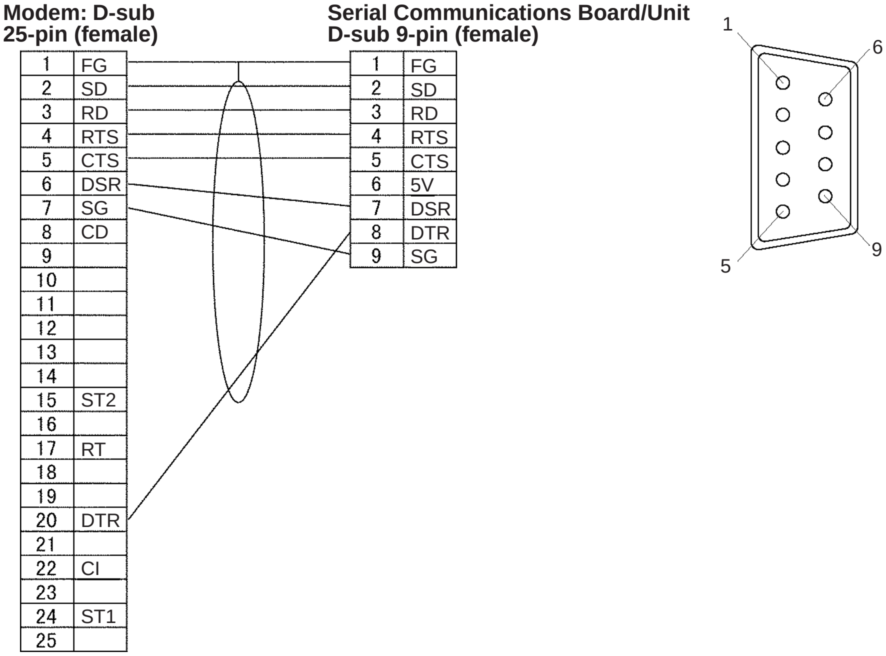
3. The hexadecimal equivalents of sequences numbers are given in parentheses.

Connections

The connections when using the Hayes Modem AT Command Protocol is shown below.

RS-232C Connection





Compatible Modems

Although most of the sequences in this protocol can be used regardless of modem, the sequences Initialize Modem (specialized) and Dial sequences can be used only for the following Modems:

- MD24FB10V (OMRON Modem)
- MD144FB5V (OMRON Intelligent Modem)
- ME1414BIII, ME2814BII (OMRON FAX/DATA Modem)

For other modems, create a modem initialization sequence using the general-purpose Initialize Modem sequence and dial using the Data Send/Receive sequence (Sequence No. 553).

Modem Settings

When this protocol is used, it is required that the modem connected to the Serial Communications Unit/Board be initialized to the following conditions:

Command echo	No
Result code display format	Numeric format
Speed display, busy/dialling tone detection at connection	Baud rate display enabled, busy and dialling tone detection enabled.
Error correction data compression display	Error correction/data compression display enabled
MNP setting	Error correction provided (auto-reliable mode)
MNP class setting	MNP class 4
V.42 compression, Error correction	Not enabled
Flow control between terminal modems	Not enabled
ER signal control	Always ON
Escape code	+

Note 1. It is recommended that, in addition to the above settings, the abort timer should be set so that communications are cut off if a communications error happened due to incidents such as cable disconnection between the Serial Communications Unit/Board and modem. The abort timer is set to 10 minutes for the modem initialization (specialized) (Sequences No. 560, No. 570, No. 580: Initialize Modem (Specialized)). Refer to modem's manual for further information about abort timers.

2. The data format of the modem (baud rate, data length, parity, stop bit) is set by AT commands issued from a device connected to the modem. Its settings should conform to communications conditions of the device which issues AT commands. Therefore when communications are made between the modem and Serial Communications Unit/Board, it is required that communications conditions should be set by issuing AT commands from the Serial Communications Unit/Board.

3. Modem settings become invalid if the power supply is turned off and must be set again. However, a memory backup function can be used to protect settings so that even after the power supply to the modem is turned off, it can communicate with the previous setting conditions.

For Initialize Modem (specialized), the modem initialization command is built in as message data. However, for Initialize Modem (general-purpose), the command must be specified in the send data for PMCR(260).

OPR 1	(Communications port settings)
OPR 2	#0226 (Sequence No. 550)
OPR 3	Address for first word containing initialization command character string S
OPR 4	None (Set #0000)

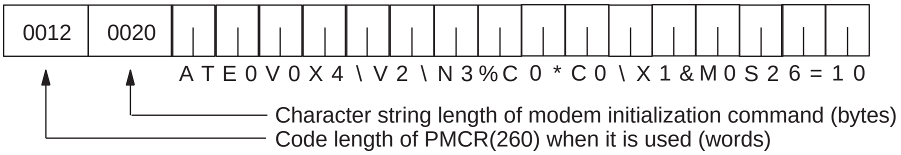
S+0	Number of words from address set for operand 2 to end of data	4 digits Hex
S+1	Number of bytes for send data (initialization command)	4 digits Hex
S+2 : S+n	Send data (initialization command) (Fill data to left for odd numbers of bytes)	ASCII

Setting Example for Modem Initialization Command

- **MD24FB10V Using Sequence #550 (OMRON)**

The following command is set in the words specified by the 3rd operand of PMCR(260).

ATE0V0X4\V2\N3%C0*C0\X1&M0S26=10



Note Turn ON pin 4 of DIP switches SW3 on for this Modem (ER signal always ON).

MD144FB5V (OMRON, No longer manufactured.)

The following command is set in the words specified by the second operand of PMCR(260).

ATE0V0X4\V2\N3%C0*C0\Q0&M0&D0%B9600S26=10

0017	0029	A T	E 0	V 0	X 4	\ V	2 \	N 3	%C	0 *	C 0	\ Q	0 &	M 0	& D	0 %	B 9	6 0	0 S	2 6	= 1	0

Character string length of modem initialization command (bytes)
Code length of PMCR(260) when it is used (words)

ME1414BIII/ME2814BII (OMRON)

The following command is set in the words specified by the second operand of PMCR(260).

AT\J1B8E0V0S0=1X4\V2\N3&M0%C0&D0&E0\X1S26=10

0018	002C	A T	\ J	1 B	8 E	0 V	0 S	0 =	1 X	4 \	V 2	\ N	3 &	M 0	%C	0 &	D 0	& E	0 \	X 1	S 2	6 =	1 0

Character string length of modem initialization command (bytes)
Code length of PMCR(260) when it is used (words)

Note Turn ON DIP switch SW3 on in the rear of the Modem.

Dialling (Sequences No. 561 (Hex 0231), No. 571 (Hex 023B), and No. 581 (Hex 0245))

To dial a telephone numbers for the OMRON ME1414BIII/ME2814BII Modems using sequences No. 561, 571, 581, set the dialling command and telephone number in the words specified by the 3rd operand of PMCR(260). However, for other Modems, make the following settings for the Data Send/Receive sequence.

This is an example of telephone number settings for the above mentioned 4 OMRON Modems.

Operand and Send Data Word Settings of PMCR(260)

OPR 2	MD24FB10V MD144FB5V ME1414BIII/ME2814BII	#0231 #023B #0245
OPR 3	First address S of send data (dialling operation)	
OPR 4	None (Set #0000)	

S+0	Number of words from address set for operand 2 to end of data	4 digits Hex
S+1	Number of bytes of send data (dialling operation)	4 digits Hex
S+2 : S+n	Send data (dialling operation) (Fill data to left for odd numbers of bytes)	ASCII

Setting Example

If telephone number is 03-0123-4567

000A	0010	4154	4454	3033	2D30	3132	332D	3435	3637
		A T	D T	0 3	– 0	1 2	3 –	4 5	6 7

Character string length of dialling operation sent to modem (bytes)
Code length of PMCR(260) when it is used (words)

Note 1. This example uses a tone line. Change ATDT to ATDP for pulse lines.

2. Fill the telephone number to the left in the words if the character string length of the dialling operation is an odd number of bytes.

0008	000B	4154	4454	3031	2D32	3334	3500
		A T	D T	0 1	– 2	3 4	5 □

Character string length of dialling operation sent to modem (bytes)
Code length of PMCR(260) when it is used (words)

Password Verification (Sequence No. 552 (Hex 0228))

A password can be verified by executing sequence No. 552 of this protocol. It is required to set in advance the value of the password in the words specified by the second operand of PMCR(260).

Operand and Send Data Word Settings of PMCR(260)

OPR 2	#0228
OPR 3	Address of first word where the password is set S
OPR4	None (Set #0000)

S+0	Number of words from address set for operand 3 to end of data	4 digits Hex
S+1	Number of bytes of comparison data (normal value of password)	4 digits Hex
S+2 : S+n	Comparison value (password normal value) (Fill data to left for odd numbers of bytes)	ASCII

Setting Example

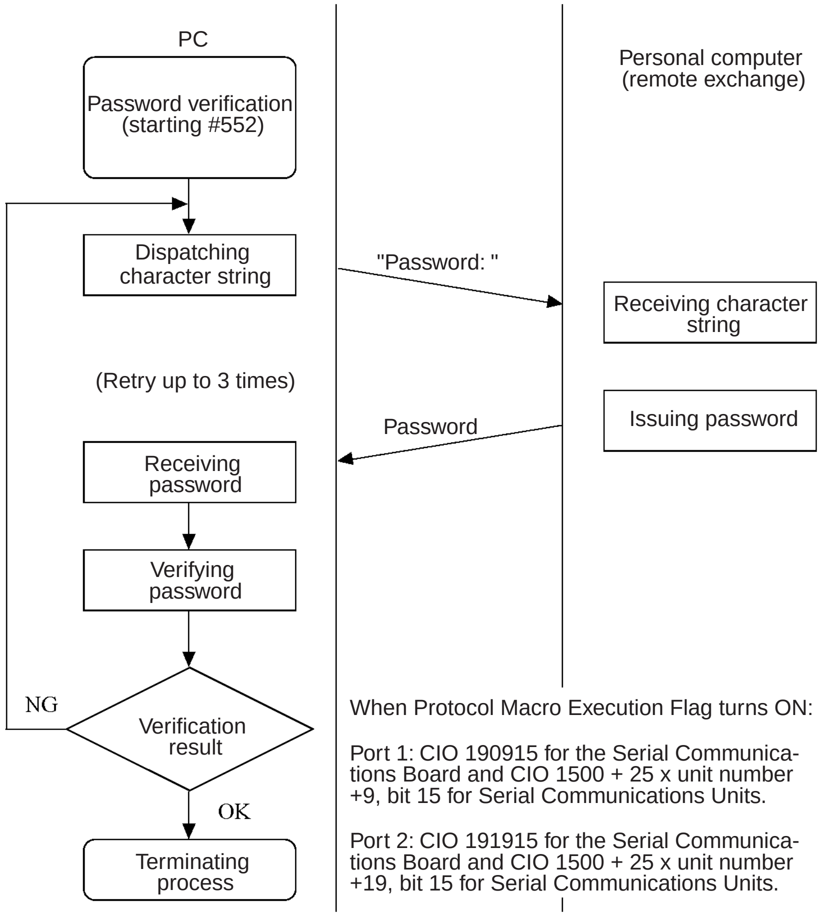
When password is OMRON-CO.

0006	0008	4F4D	524F	4E2D	434F
		O M	R O	N –	C O

Character string length of password sent to modem (bytes)
Code length of PMCR(260) when it is used (words)

Password Verification Operation

The number of retries is 3 for password verification.



When Protocol Macro Execution Flag turns ON:

Port 1: CIO 190915 for the Serial Communications Board and CIO 1500 + 25 x unit number +9, bit 15 for Serial Communications Units.

Port 2: CIO 191915 for the Serial Communications Board and CIO 1500 + 25 x unit number +19, bit 15 for Serial Communications Units.

Data Send/Receive (Sequence No. 553 (Hex 0229))

Data Send/Receive can be executed using sequence No. 553. The send data sent to another exchange is set in the words specified by the 3rd operand of PMCR(260). Data received by the PC is stored in the words specified by the 4th operand of PMCR(260).

Operand and Send/Receive Data Word Settings of PMCR(260)

OPR 2	#0229
OPR 3	First address C1 of the words where send data is set
OPR 4	First address C2 of the words where receive data is stored

- **Send Data Words**

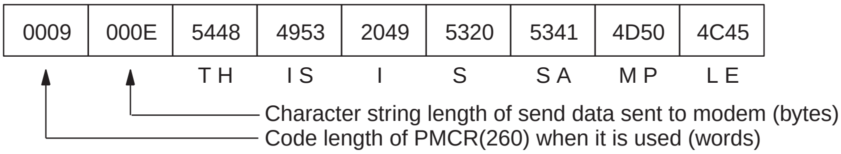
C1+0	Number of words from address set for operand 2 to end of data	4 digits Hex
C1+1	Number of bytes of send data	4 digits Hex
C1+2 : C1+n	Send data (dialling operation) (Fill data to left for odd numbers of bytes)	ASCII

- **Receive Data Storage Words**

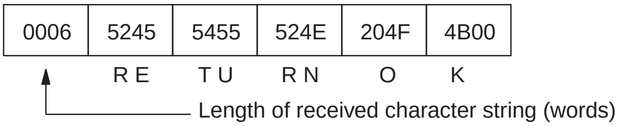
C2+0	Number of bytes of receive data	4 digits Hex
C2+1 : C2+n	Receive data (dialling operation) (Fill data to left for odd numbers of bytes)	ASCII

Setting Example

When send data is THIS IS SAMPLE.



A maximum of 200 bytes (including the CR) can be received. When the received data is RETURN OK, the content stored in the receive words is as follows:



Note An error will occur is the reception data is not received within 90 seconds after the data is sent.

Escape Mode (Sequence No. 554 (Hex 022A))

Shifting to the escape mode can be made using sequence No. 554. No setting is necessary for this sequence.

Note The character string to shift the online mode to the escape mode (i.e., the escape code) is '+' for modem settings.

Hang Up Command (Sequence No. 555 (Hex 022B))

The hang up command (to disconnect the line) can be executed using sequence No. 555. No setting is necessary for this sequence.

Communication Errors

Three result codes are monitored after an AT command is sent to the modem. When a result code is returned, it will be checked. If the code is not the normal result code (“OK”, “CONNECT 9600/REL4”, “CONNECT 2400/REL4”, in words), after a fixed time of waiting to send, the following retry processing will be repeated 2 times to send the AT command again and waiting for another result code.

The receive monitoring time and send wait time for each sequence are shown below.

Sequence No.	Sequence name	Receive monitoring time	Send wait time for retries
550 (0226)	Initialize modem (general-purpose)	10 s	1 s
560 (0230)	Initialize modem (specialized)	10 s	1 s
570 (023A)			
580 (0244)			
561 (0231)	Dial	90 s	90 s
571 (023B)			
581 (0245)			
552 (0228)	Password	None	3 s
553 (0229)	Data send/receive (general-purpose)	90 s	None
554 (022A)	Escape	10 s	1.5 s (after first try)
555 (022B)	Hang up	10 s	1.5 s (after first try)
562 (0232)	Initialize and dial	90s	Initializing: 1 s Dialling: 90 s
572 (023C)			
582 (0246)			
590 (024E)	Escape and hang up	10 s	1.5 s (after first try)

Note The hexadecimal equivalents of sequences numbers are given in parentheses.

Appendix O

Changing Communications Port Settings Using STUP(237)

The STUP(237) instruction can be used to change the serial communications mode, communications specifications, and other settings for each port of the Serial Communications Board/Unit during CPU Unit operation.

Executing the STUP(237) Instruction

Use the STUP(237) instruction to change the communications port settings. For example, the STUP(237) instruction can be used to switch the protocol to Host Link mode without leaving RUN mode and allow the user to monitor and program the CPU Unit from the host computer when the specified conditions are met while send/receive sequences for modem and line connections are being executed in protocol macro mode.

STUP Instruction Specifications

(@)STUP(237)	
C	Control data (serial port number, remote unit address)
S	First words of port settings

Control Data (C)

15 12	11 08	07 00
0	Serial port number	Remote unit address

Set the following items.

Serial Port Number
Set the serial port number (physical port number) of the Serial Communications Board or Unit to which the remote node is connected. PORT1: 1 (hex)/PORT2: 2 (hex)

Remote Unit Address
Specify the unit address of the Serial Communications Board/Unit for which the serial port is to be changed.

Serial Communications Board: E1 (hex)
Serial Communications Unit: Unit number + 10 (hex)
Setting: 10 to 1F (hex)

Note The CPU Bus Unit number (0 to F) is set using the rotary switch on the front panel of the Unit.

First Word of Port Settings (S)

Set the address of the first word containing the serial port settings. The data is stored starting from word S in the say way as the port settings in the 10-word area allocated in the DM Area for each port. For details on the Setup Area, see *2-3 I/O Memory Allocations* or *4-2*, *5-2*, *6-2*, and *7-2 Setup Area Allocations*.

	15 00	
S	Serial port system setting	10 words per port
S+1		
:		
S+9		

When the STUP(237) instruction is executed, the CPU Unit changes the contents of the relevant DM Area in the Unit, then automatically turns ON the Port Settings Change Bit (words A620 to A635) in the Auxiliary Area.

A620 + unit number

Port 1 Port Settings Change Bit: Bit 1
Port 2 Port Settings Change Bit: Bit 2

When the cyclic service finishes changing the communications port settings in the Serial Communications Board or Unit, the Board or Unit automatically restarts the port and turns OFF the Port Settings Change Bit.

Data Contents

Area	C	S
CIO Area	0000 to 6143	0000 to 6134
Work Area	W000 to W511	W000 to W502
Holding Area	H000 to H511	H000 to H502
Auxiliary Area	A000 to A959	A000 to A950
Timer Area	T0000 to T4095	T0000 to T4086
Counter Area	C0000 to C4095	C0000 to C4086
Data Memory (DM) Area	D00000 to D32767	D00000 to D32758
Extended Data Memory (EM) Area	E00000 to D32767	E00000 to E32758
Extended Data Memory (EM) Area (including bank specification)	En_00000 to En_32767 (n = 0 to C)	En_00000 to En_32758 (n = 0 to C)
Indirect DM/EM address, Binary	@D00000 to @D32767, @E00000 to @E32767, @En_00000 to @En_32767	
Indirect DM/EM address, BCD	*D00000 to *D32767, *E00000 to *E32767, *En_00000 to *En_32767	
Constants	See *Control Data (C)*.	#0000 to FFFF (Binary data)
Data Registers	DR0 to DR15	---
Index Registers, Direct	---	
Index Registers, Indirect	,IR0 to ,IR15 –2048 to +2047 ,IR0 to –2048 to +2047,IR15 DR0 to DR15 ,IR0 to IR15 ,IR0+(++) to ,IR15+(++) ,–(– –)IR0 to ,–(– –)IR15	

Error Flags (ER)

The Error Flag will turn ON in the following cases:

- The data specified in S is outside the allowable range.
- The Port Settings Change Bit is already ON when the instruction is executed.

Ladder Program Example

When CIO 000000 turns ON, the settings for port 2 for the Serial Communications Board will be changed to the values set in the 10 words from D00200 to D00209. In the following example, the protocol is changed to Host Link mode.

Ladder Program

Settings

S:	D00200	0500
S+1:	D00201	0000
S+2:	D00202	0000
S+3:	D00203	0000
:	:	:
S+9:		

Port setting: Defaults
Protocol mode: 1 hex (Host Link)
Baud rate: Default (9,600 bps)
Transmission delay time: 0 ms
CTS control: None
Unit number: 00

	Transmit
D32010	0500
D32011	0000
D32012	0000
D32013	0000
:	:
D32019	

Settings for port 2 of Serial Communications Board (D32010 to D32019)

Index

Revision History

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

Cat. No. W336-E1-04

Revision code

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

Revision code	Date	Revised content
1	February 1999	Original production
2	April 2000	Changes were made on the following pages. **Page 4:** “Boards” corrected to “Unit” in “Connectable Devices.” **Pages 23-24:** Information on 1: N NT link added. **Page 29:** “1694” corrected to “1699” in “Unit No. 7” row of table on right. **Page 31:** “RS-422” changed to “RS-422A” in “Connections.” **Page 33:** Information on NT link changed. **Pages 41-42:** Information about high-speed NT link added. **Page 50:** Information on NT link removed from “Note 4.” **Page 97:** “1694” corrected to “1699” in “Unit No. 7” row. **Page 118:** “Note 3” removed from bottom right box in table. Information on RS/CS flow added. **Page 138:** Note added. **Page 151:** Information on D32001 added. Information on high-speed NT link added. **Page 154:** Information on baud rate and note added. **Page 163:** “Execution error” changed to “syntax error” in table. **Page 171:** Information added to “cause” column. **Page 347, 348, 349, 350, 352, 353, 358:** “Negative sign” information changed.
3	May 2001	CJ1W-SCU41 Serial Communications Unit added, “CS1” changed to “CS” or CS/CJ” according to context, and “CS Series only” added to distinguish functions for Serial Communications Boards. **Page xiv:** Added terminal block precaution, section name changed to “this manual,” change precaution on locking devices, and precaution added on terminal blocks. **Pages 105 and 114:** Note added on retry processing. **Pages 171 and 181:** Information added on retry processing.
04	December 2001	Information on the Simple Backup Function added. The CS1W-SCB21-V1, CS1W-SCB41-V1, CS1W-SCU21-V1, and CJ1W-SCB41 support this function. **Page 5:** Overview of the “-V1” upgrades. **Pages 21 and 22:** Added CS1-H CPU Units, CJ1-H CPU Units, and Simple Backup Function to Specifications. **Page 32:** Simple Backup Function added to table. **Page 149:** Modified the Error Flag’s ON conditions. **Pages 158 to 161:** Simple Backup Function description added. **Pages 177 and 179:** Added Indicator Displays related to the protocol data restore operation. **Pages 205 to 207:** Added Board/Unit replacement procedure that uses the Simple Backup Function to restore protocol data in the new Board/Unit.

OMRON CORPORATION
FA Systems Division H.Q.
66 Matsumoto
Mishima-city, Shizuoka 411-8511
Japan
Tel: (81)559-77-9181/Fax: (81)559-77-9045

Regional Headquarters

OMRON EUROPE B.V.
Wegalaan 67-69, NL-2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC
1 East Commerce Drive, Schaumburg, IL 60173
U.S.A.
Tel: (1)847-843-7900/Fax: (1)847-843-8568

OMRON ASIA PACIFIC PTE. LTD.
83 Clemenceau Avenue,
#11-01, UE Square,
Singapore 239920
Tel: (65)835-3011/Fax: (65)835-2711

Authorized Distributor:

Cat. No. W336-E1-04 Note: Specifications subject to change without notice Printed in Japan