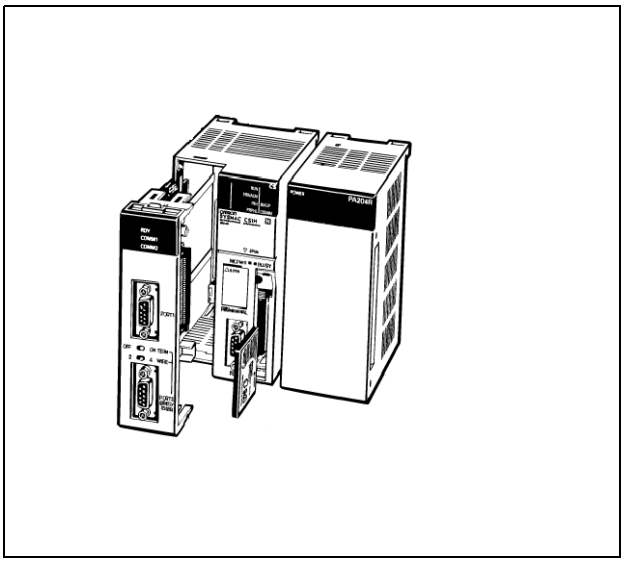
CS1 CPUs Mean Ultimate Performance



■ Features

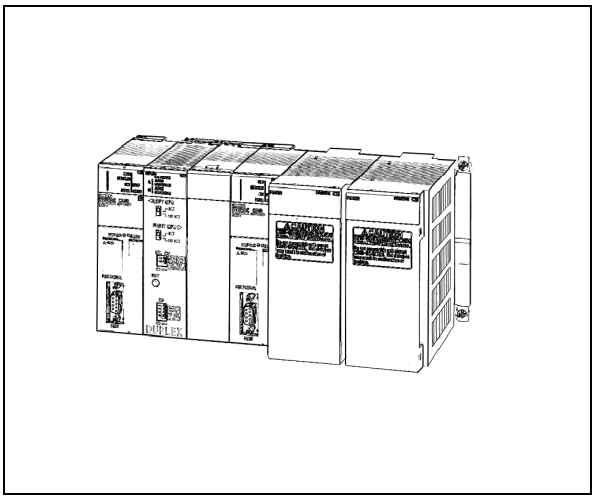
- 0.02 μs execution time per basic instruction.
- Up to 250K steps of program memory capacity.
- Up to 448K words of built-in data memory.
- Up to 64 MB of auxiliary compact flash memory available.
- Built-in peripheral and RS-232 port.
- Inner board compartment for additional communication ports.

■ CPUs — Basic Specifications

Model	No. of I/O bits	Program capacity	Data memory capacity (See note.)	LD instruction processing speed	Built-in ports	Options
CS1H-CPU67H	5,120 bits (Up to 7 Expansion Racks)	250K steps	448K words	0.02 μs	Peripheral port and RS-232C port	Memory Cards Inner Board, such as Serial Communications Board
CS1H-CPU66H		120K steps	256K words			
CS1H-CPU65H		60K steps	128K words			
CS1H-CPU64H		30K steps	64K words			
CS1H-CPU63H		20K steps				
CS1G-CPU45H	5,120 bits (Up to 7 Expansion Racks)	60K steps	128K words	0.04 μs		
CS1G-CPU44H	1,280 bits (Up to 3 Expansion Racks)	30K steps	64K words			
CS1G-CPU43H	960 bits (Up to 2 Expansion Racks)	20K steps				
CS1G-CPU42H		10K steps				

Note: The available data memory capacity is the sum of the Data Memory (DM) and the Extended Data Memory (EM).

CS1D Duplex System CPUs for Increased Reliability



■ Features and Functions

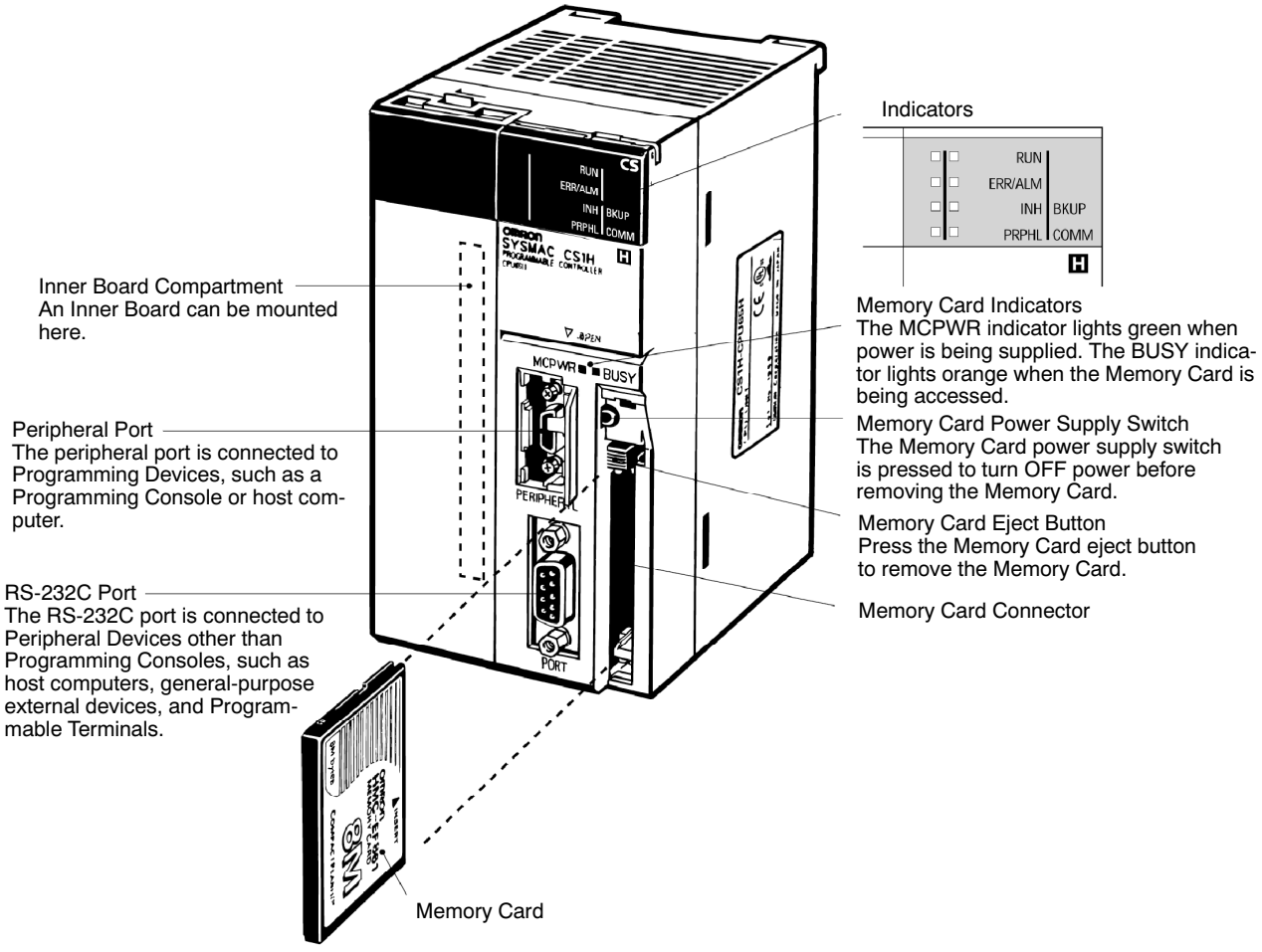
- High reliability for a no-fail redundant system. The CS1D offers redundancy of CPUs, Power Supplies, and Controller Link Network.
- CPUs, Power Supplies, Communication Modules, Basic and Special I/O Modules can be replaced during system operation. Hot standby technology allows easy and fast maintenance.
- Hot standby system adopted for CPU duplexing
- Same support software as CS1 (CX-Programmer).
- Complete compatibility among CS1 I/O Modules.
- Same speed, I/O capacity and memory size as CS1.
- Built-in peripheral and RS-232C port.
- Inner board compartment for additional communications ports.
- Basic specifications for CS1D Duplex CPUs.

■ Basic Specifications for CS1D CPU Models

Model	No. of I/O bits	Program capacity	Data memory capacity	LD Instruction processing speed	Built-in ports	Options
CS1D-CPU65H	5,120 bits	60K steps	128K words	0.02 μs	Peripheral port and RS-232C port	Memory Cards Inner board, such as serial communication board
CS1D-CPU67H		250K steps	448K words			

Note: The available data memory capacity is the sum of the Data Memory (DM) and the Extended Data Memory (EM). With the CS1 PLCs, Memory Cards and specified ranges of the EM Area can be used as file memory. File memory can be used to store the entire user program, I/O memory contents, and/or parameter area contents.

CPU Components
CS1H-CPU□□H, CS1D-CPU□□H



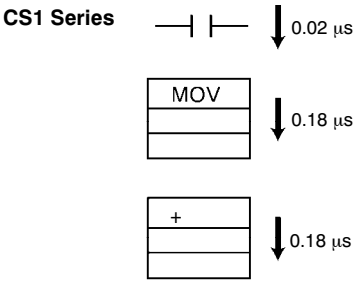
Optimum Speed and Processing Capabilities

■ Ultimate Machine Performance with High-Speed Processing

CS1 PLCs provide ample speed for advanced machine interfaces, communications, and data processing.

Execution Times from 20 ns

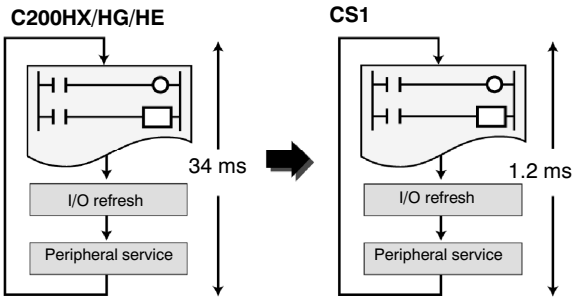
Fast instruction processing includes 0.02 μs for LD and 0.18 μs for MOV. And, special instructions are processed almost as fast as basic ones (e.g., as fast as 0.18 μs for some instructions).



30 Times the Overall Cycle Speed

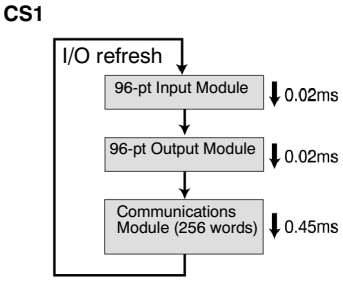
The following examples are for 30K-step programs

- Basic instructions: 50%
- MOV instructions: 30%
- Arithmetic operation instructions: 20%



Extremely Fast Peripheral Servicing and I/O Refresh Speed

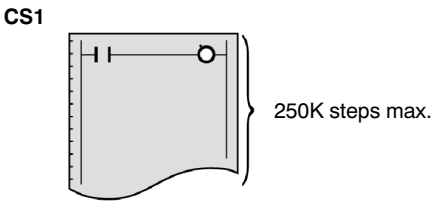
- CS1 refresh time for 96 input points: 0.02 ms (15 times faster)
- For 96 output points: 0.02 ms (10 times faster)
- For 256 words for Communications Module: 0.45 ms (4 times faster)



■ Large Capacities Fit the Application

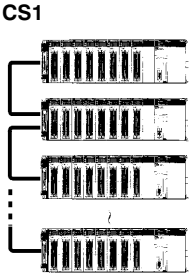
Program Capacity

Create programs with up to 250K steps.



I/O Capacity

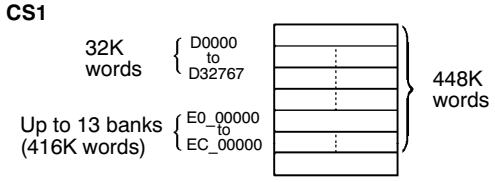
Handle up to 5,120 I/O points.



5,120 I/O points

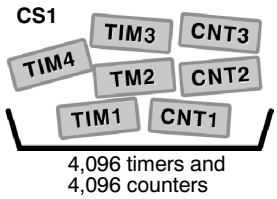
■ Data Memory

Use up to 448K words of data memory (word data).



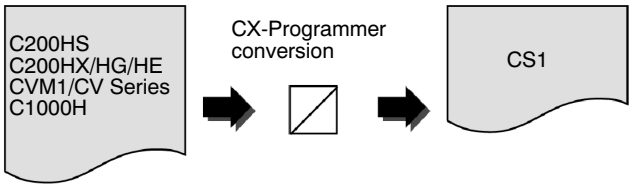
■ Timers/Counters

Program up to 4,096 timers and 4,096 counters.



■ Use Legacy Programs

The CX-Programmer can be used to convert programs from other OMRON PLCs.



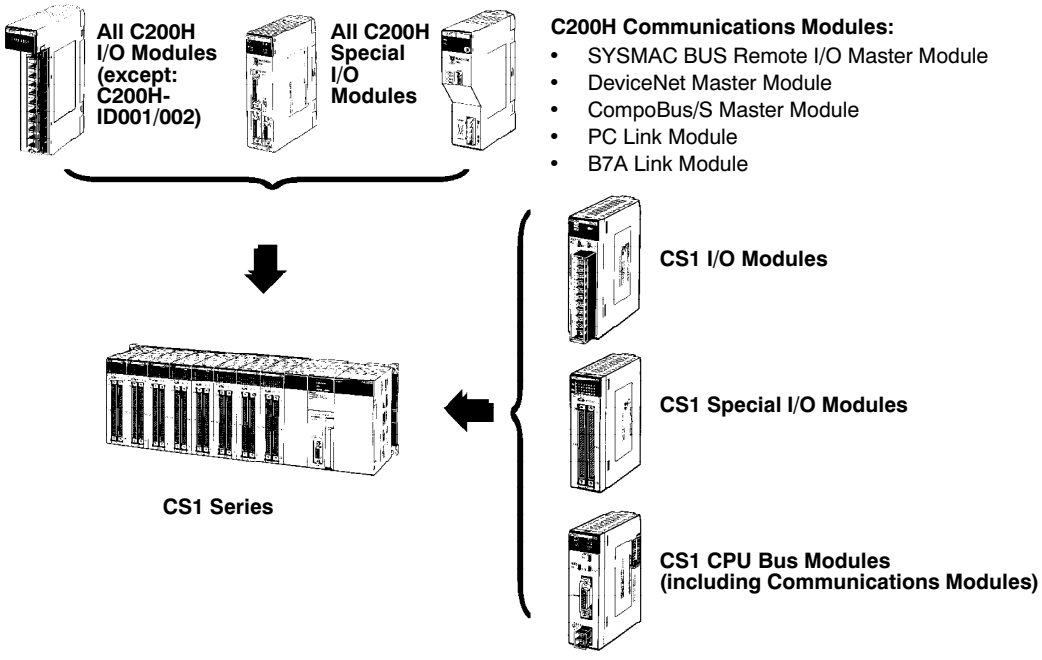
■ Large Capacity Data Handling with Each Instruction

The basic operand specifications have been converted from BCD to binary to increase data handling capacity.

Item	C200HX/HG/HE	CS1
Block transfers	0 to 6655 words	0 to 65535 words
Indirect addressing range	DM 00000 to DM 9999	D00000 to D32767

■ Use C200H Modules

All of the I/O Modules and Special I/O Module and a portion of the Communications Modules used for the C200H, C200HS, and C200HX/HG/HE can be used, as can C200HX/HG/HE Expansion I/O Racks. (Only CS1 Modules can be used on long-distance Expansion I/O Racks using I/O Control Modules or I/O Interface Modules.)



Note: There are restrictions in data transfers with the CPU for CIO and DM Area specifications (e.g., address of transfer source or transfer destination) for the C200H Special I/O Modules, as well as in data transfers programmed from these Modules (e.g., using PC READ or PC WRITE instructions). Refer to CS1 PLC manuals for details (refer to: information on restrictions in using C200H Special I/O Modules).

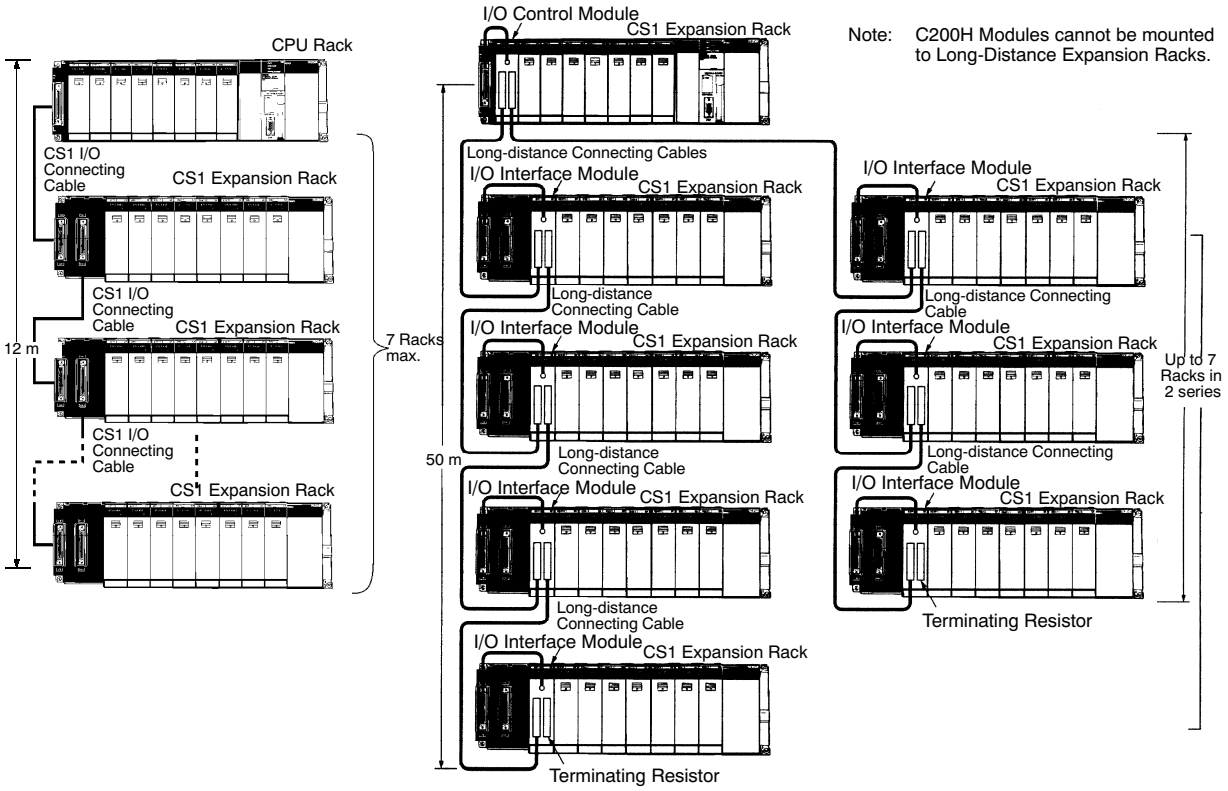
Expansion Capabilities

■ Up to 7 Expansion Racks

System expansion can be achieved by simply connecting the CPU Rack to an Expansion Rack using an I/O Connecting Cable. Up to 7 Expansion Racks can be connected to one CPU with a total distance of 12 m. Long distance expansion of 50 m can be achieved by using an I/O Control Module.

For a complete pattern of Expansion Systems, including combinations with C200H Expansion I/O Racks, please refer to the System Power and Expansion section.

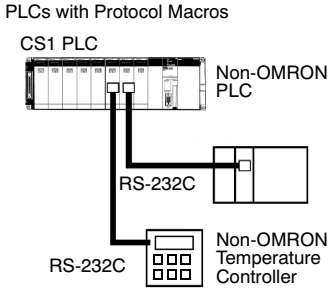
CPU Rack with CS1 Expansion Racks **CPU Rack with CS1 Long-Distance Expansion Racks**



■ CS1 Offers More

More serial communications ports, more protocols. Up to 34 port connections with protocol setting for each port.

■ Protocol Macros



Data transfer protocol for serial communications vary with the manufacturer and with devices. Differences in protocols can make communications between devices by different manufacturers very difficult, even when electrical standards are the same.

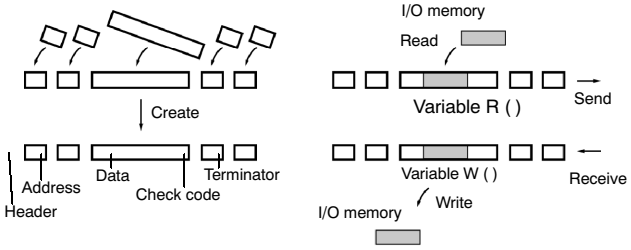
OMRON's protocol macros solve this problem by:

- Enabling easy creation of protocol macros designed to match the protocol of a connected device.
- Allowing you to communicate with essentially any device having an RS-232C, RS-422, or RS-485 port, without having to write a special communications program.

■ The Two Main Functions of Protocol Macros

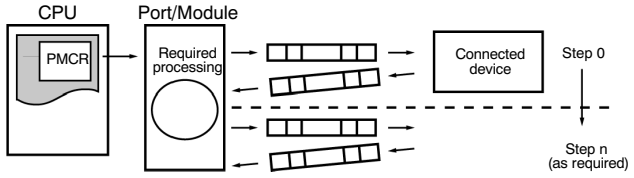
1. Creating Communications Frames

The communications frames can be easily created according to the specifications required by the connected device. Data from I/O memory in the CPU can be easily included as part of a communications frame to read from or write to I/O memory.



2. Creating Frame Send/Receive Procedures

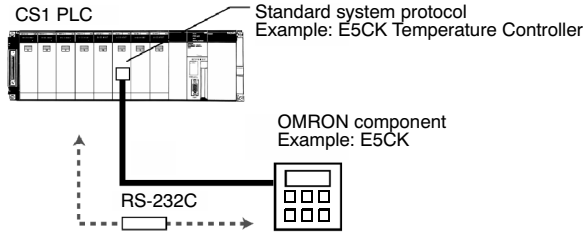
The required processing, including sending and receiving communications frames, can be performed one step at a time according to the results of the previous step, and then CX-Protocol can be used to trace send and receive data.



■ Application Examples

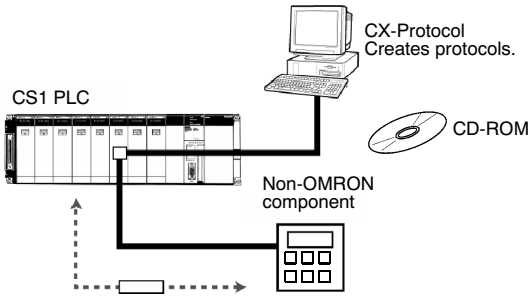
Standard System Protocols

Data transfers with OMRON components can be easily performed using standard system protocols. There is no need to develop your own protocols in this case.



User-Created Protocols

Data transfers with non-OMRON components can be easily created just by defining parameters using the CX-Protocol Windows tool.



Outstanding Connectivity and Compatibility

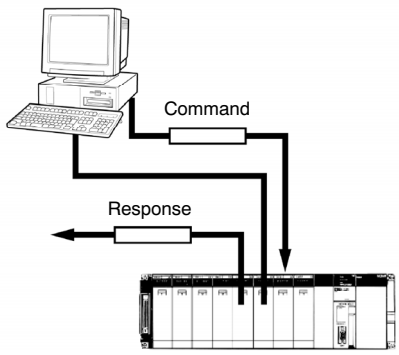
OMRON provides all of the capabilities and capacity you need for the advanced programming required for human-machine interfaces, communications, data processing, and other required applications.

■ Protocols for Advanced Programming

Host Links

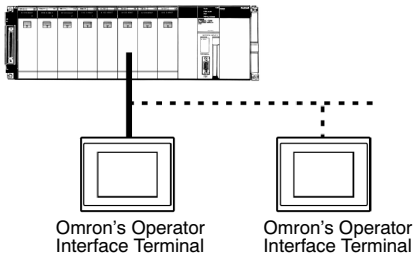
Host Link (C-mode) commands or FINS commands placed within host link headers and terminators can be sent to a host computer to read/write I/O memory, read/control the operating mode, and perform other operations for the PLC.

Unsolicited messages can also be sent from the PLC to the host computer by sending FINS commands from the ladder program using the SEND(090), RECV(098), and CMND(490) instructions.



1:N NT Links

The PLC can be connected to an Operator Interface Terminal via RS-232C or RS422A/485 ports, and I/O memory in the PLC can be allocated to various Operator Interface functions, including status control areas, status notifications areas, touch switches, lamps, memory tables, and other objects.



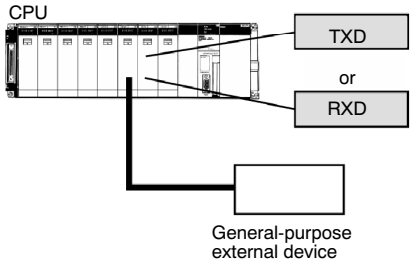
Note: Either one or up to eight Operator Interface Terminals can be connected to a PLC using1:N NT Links.

High-Speed NT Links

High-speed NT Links that are three times faster than standard NT Links are possible with NS-series PTs. This speed is particularly important when connecting to more than one PT.

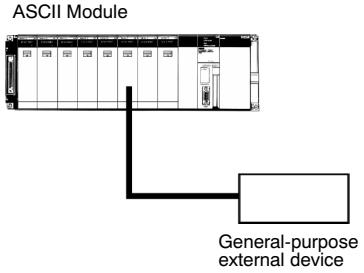
Custom Protocols

I/O instructions for communications ports (TXD(236) and RXD(235)) can be used for simple data transfers (custom protocols), such as to input data from bar code readers or output data to a printer. Start/end codes can be specified, and RS, CS, and other control signals can be handled. (Custom protocols can be used only for the CPU's built-in RS-232C port.)



General-purpose Protocols Using BASIC

An ASCII Module can be used to create essentially any protocol for an external device using the BASIC language, providing the ability to handle applications for which protocol macros cannot be created.



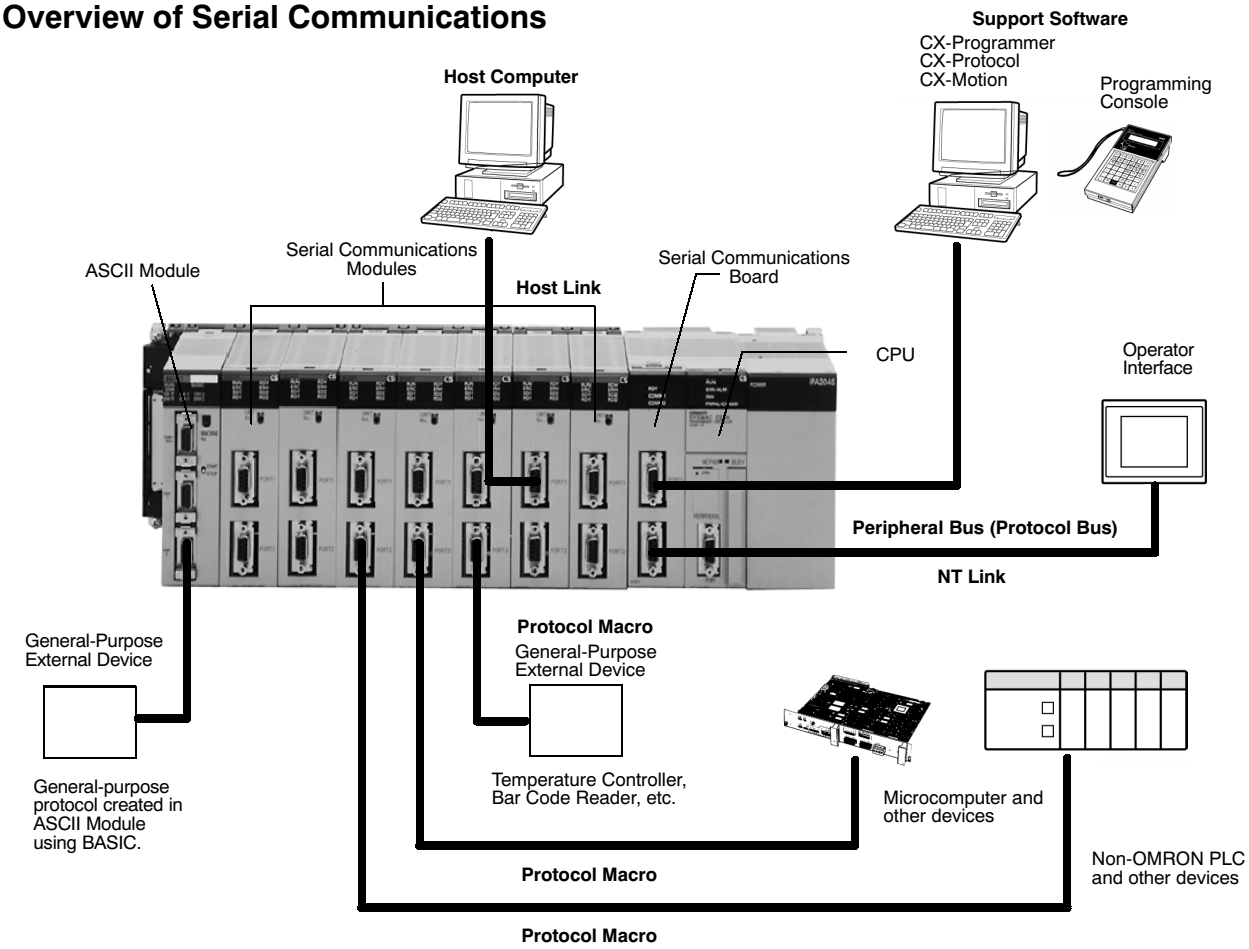
■ Protocol List

The following protocols are supported for serial communications.

Protocol	Main Destinations	Outline	Commands/Instructions
Host Link (SYSMAC WAY)	Computers, OMRON Operator Interface Terminals	Communications between host computers and PLCs.	Host Link commands or FINS commands (unsolicited messages supported)
Custom	General-purpose devices	Custom communications with general-purpose external devices.	TXD and RXD instructions
Protocol Macros	General-purpose devices (including OMRON components)	Sending/receiving messages (communications frames) matched to the communications specifications of external devices.	PMCR instruction
1:N NT Links	OMRON Operator Interface Terminals	High-speed communications with Operator Interface Terminals.	None
Peripheral bus	Support Software	Communications with Support Software tools running on host computers.	None
General (written in BASIC)	General-purpose devices	Unrestricted communications with external devices.	BASIC

Note: Refer to *Serial Communications* in the Industrial Networks and Communications Section for the ports that can be used for each protocol.

■ Overview of Serial Communications



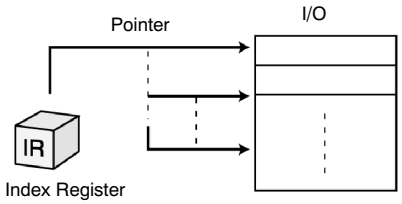
Simple, Easy to Understand Programs

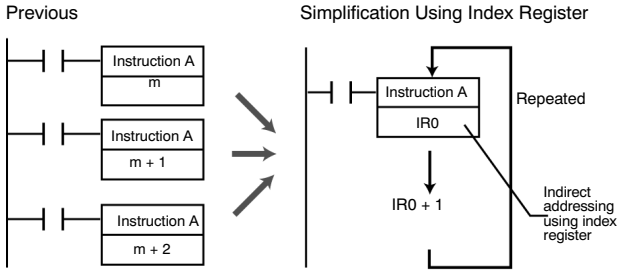
■ CS1 Makes It Effortless

Index registers, table data, repeat instructions, block programs, text strings, and more.

■ Simplify Programs with Index Registers

Index registers can be used as memory pointers to enable easily changing the addresses specified for instructions. Using an index register can often enable one instruction to preform the processing previously performed by many instructions.



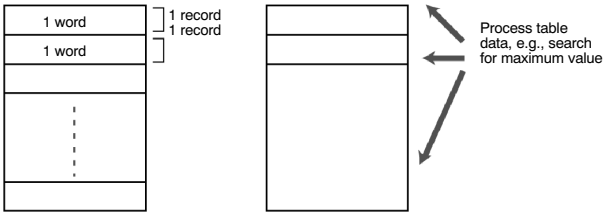


■ Easily Handle Table Data

Table Data Instructions

One-Word Records

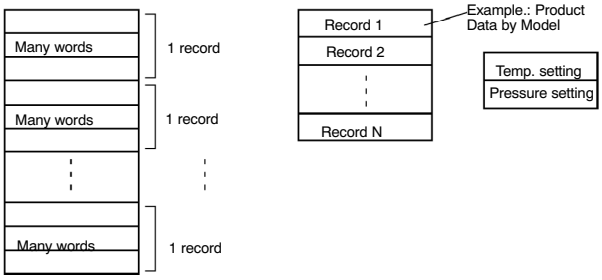
Instructions are provided to find the maximum value, minimum value, and search values.



Multiword Records

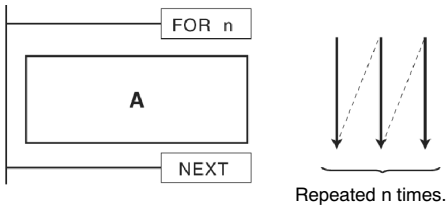
Areas of memory can be defined as tables with the specified record size (words). Index registers can be used with these tables to easily sort records, search for values, or otherwise process the records in the table.

For example, the temperature, pressure, and other settings for each model of a product can be set in separate records and the data handled by record.



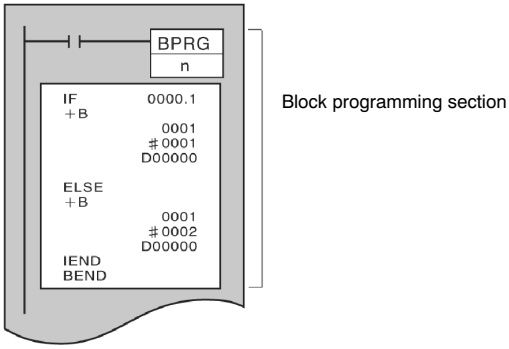
■ Repeat Processing Is Simple

Instructions are provided that let you easily repeat sections of the program. Repeat execution can also be ended for a specified condition.



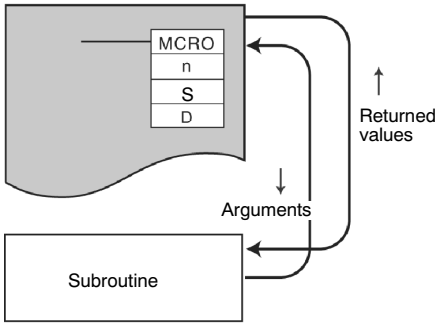
■ Program Logic Flow Control with Block Programming Sections

A block of mnemonic programming instructions can be executed as a group based on a single execution condition. IF/THEN, WAIT, TIMER WAIT, and other instructions can be used inside the block programming section to easily program logic flow control that is difficult to program with ladder diagrams.



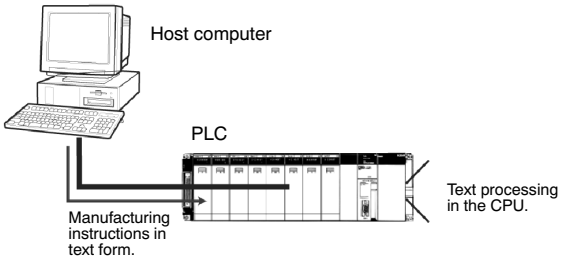
■ Macro (MCRO) Instruction

Macro instructions can be used to execute the same subroutine program with different operands from different locations in the programs (subroutine instruction with argument).



■ Handle Text Strings Quickly

Manufacturing instruction can be obtained from a host computer or other external source, stored in memory, and then manipulated as text strings as required by the applications. The text strings can be searched, fetched, reordered, or other processed in the CPU of the PLC.



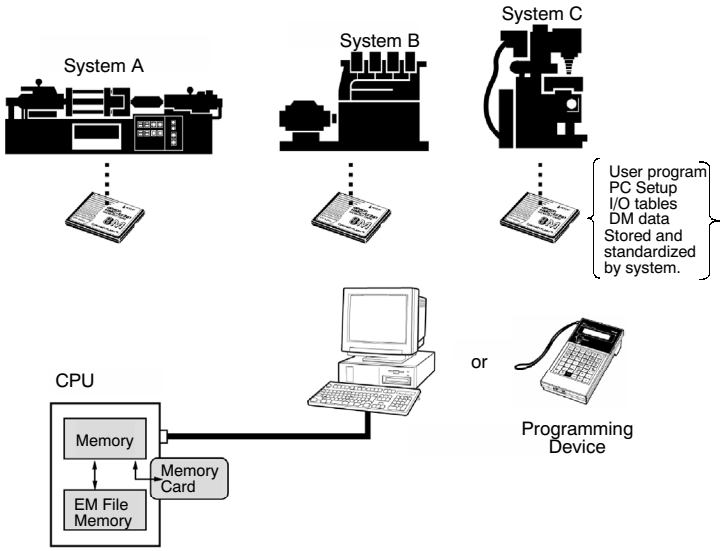
■ File Applications

Use Memory Cards to Handle Files Containing Various Types of Data

Manipulate PLC File Data Using Windows Files

- The user program, parameters, I/O memory, names, I/O comments, and block comments can all be handled as file data. File data can be used to standardize programs and initialization data for each system, and comments can be stored as file data on Memory Cards.
- The CX-Programmer or a Programming Console can be connected to a CS1 PLC to transfer files between the CPU's memory and Memory Cards (or EM File Memory).
- As Windows files, file icons can be dragged and dropped to a Memory Card or computer storage device to easily copy the files.

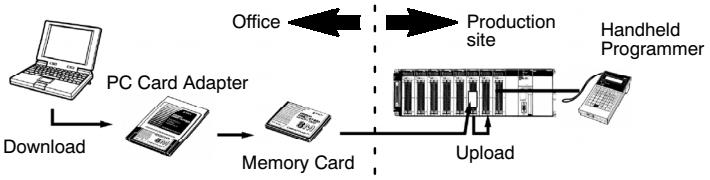
Note: A Memory Card Adapter can be used to mount Memory Cards into a PC card slot on a computer to use them as computer storage devices.



■ Handle File Data Onsite with Programming Consoles

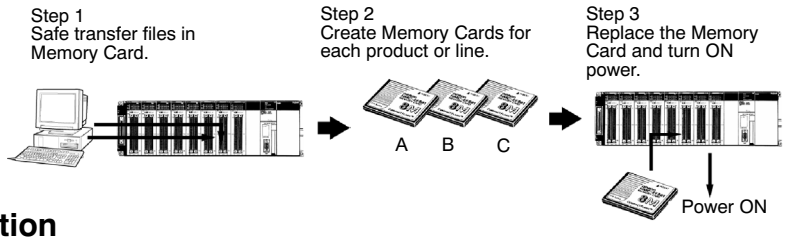
- A Handheld Programmer can be connected to the PLC to transfer files between between the CPU's memory and Memory Cards (or EM File Memory). All you need is a Handheld Programmer and Memory Cards to change data onsite.

Note: Program and setup data can be easily backed up onsite using only the CPU, without a Programming Device. Programmed replacement of programs designated in Memory Cards is also possible without a Programming Device.



■ To Change Program, Simply Change Cards

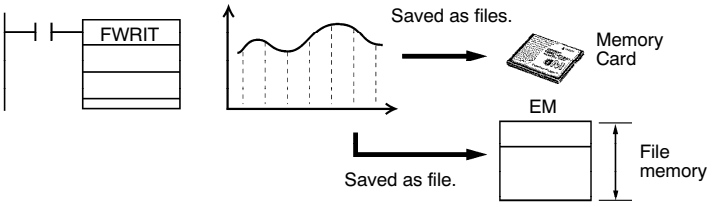
- File data can be automatically transferred from Memory Card to the CPU when power is turned ON, enabling Memory Cards to be used for operation in the same way as is possible with ROM.



■ Manipulate Files During Operation

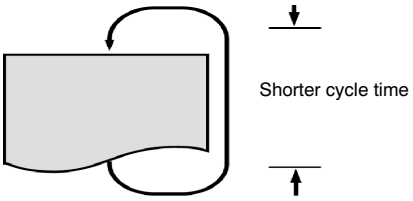
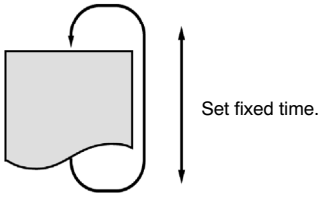
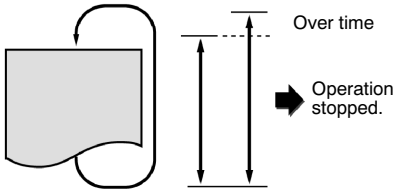
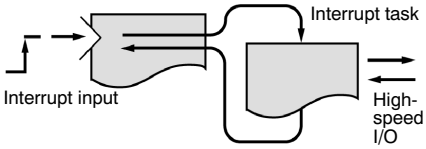
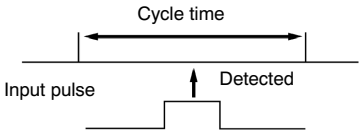
- File read and write instructions can be used during operation to transfer files between the CPU's memory and Memory Cards (or EM File Memory). Trend data, quality control data, other data from memory can be stored during operation in Memory Cards or EM File Memory.

Note: With EV1-version CPU, CSV and text files can be saved, and programmed file operations, such as file name changes and deletions, are also possible.

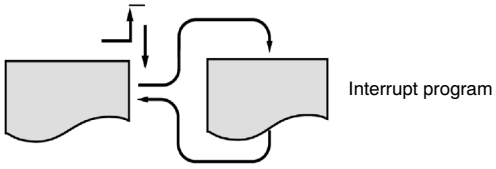
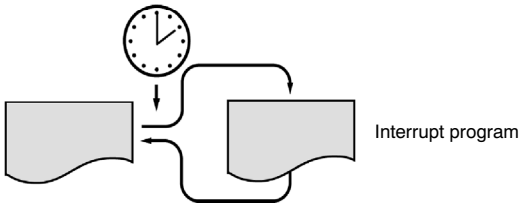
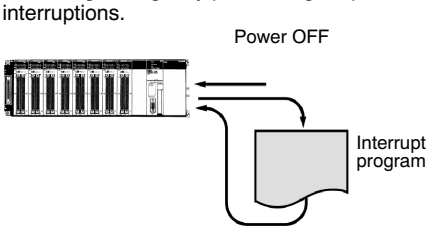
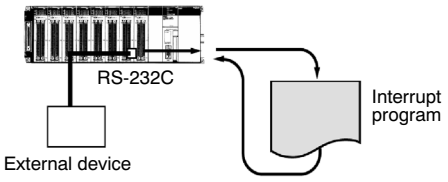


■ A Wide Range of Special Functions

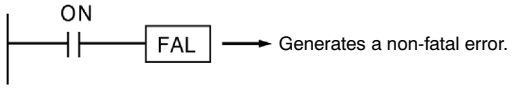
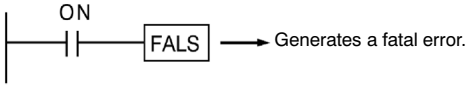
Cycle Time Functions

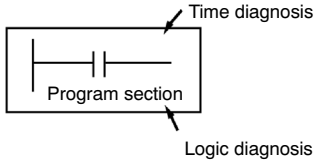
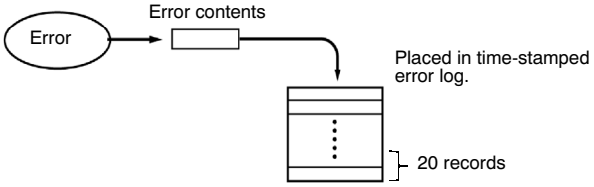
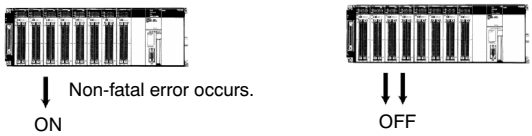
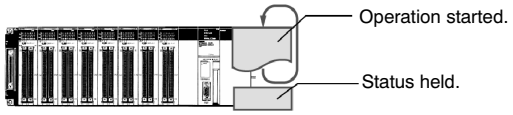
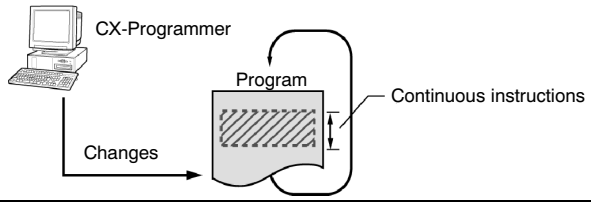
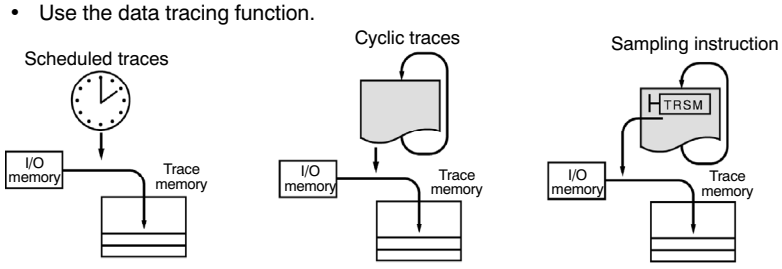
Application	Solutions
Reducing the cycle time. 	• Place tasks that are not being executed on standby. • Create subroutines for portions of tasks executed only under special conditions. • Disable cyclic refreshing for Special I/O Modules when not required each cycle.
Eliminating deviations in I/O response time.	• Set the cycle time to a fixed time. 
Stopping operation for long cycle times. 	• Use the cycle time monitoring function to stop operation when the cycle time is too long.
Reducing I/O response time for specific I/O. 	• Use an I/O interrupt task to execute an interrupt program when a specific input turns ON and then directly refresh external I/O when the appropriate instruction is executed in the interrupt program. External I/O can be directly refreshed, either by using immediate refreshing for instruction operands or by using the IORF instruction to refresh all or a specified portion of external I/O.
Inputting signals (e.g., from photomicrosensors) that are shorter than the cycle time. 	• Use the high-speed pulse input function of the C200H High-Density I/O Modules (C200H Special I/O Modules). These Modules can detect 1-ms or 4-ms pulses (except C200H-OD501/OD215,) • Use the IORF instruction to refresh inputs during program execution to further increase processing speed.

Interrupt Functions

Application	Solutions
Executing programming without being affected by the cycle time.	• Use I/O interrupt tasks to execute interrupt programs when specific inputs turn ON. 
Monitoring operating conditions at a specific interval.	• Use a scheduled interrupt task to execute an interrupt program at a specific interval. 
Executing emergency processing for power interruptions. 	• Use the power OFF interrupt task to execute an interrupt program before the CPU stops. Immediate refreshing can be used inside this interrupt program to refresh specified outputs.
Generating CPU interrupts when data is received from a serial port.	• Use an interrupt from the Serial Communications Board to execute an interrupt program when a specific messages received by the Board. 

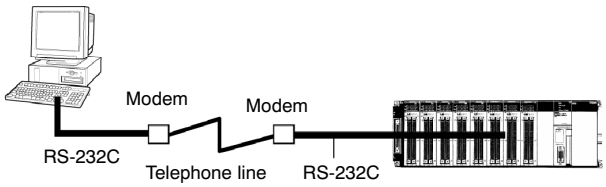
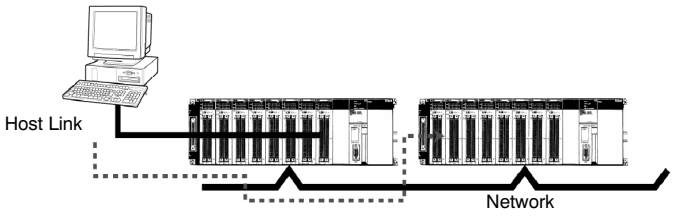
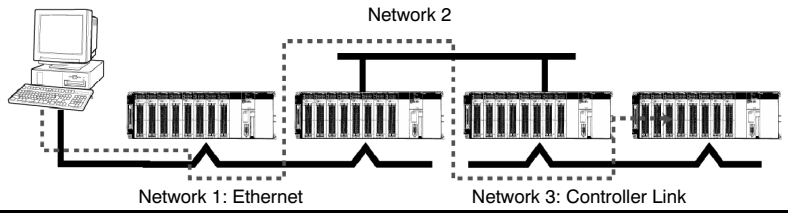
Maintenance and Debugging Functions

Application	Solutions
Creating a user-defined error for specific conditions (e.g., errors or specific signals from the controlled system) but allow the CPU to continue running.	• Use the FAL instruction to create a non-fatal user-defined error. An entry can also be left in the error history when the error occurs.  • FAL can also be used just to leave error history records for specific conditions that are not necessarily errors.
Creating a user-defined error for specific conditions (e.g., errors or specific signals from the controlled system) and stop the CPU as a result.	• Use the FALS instruction to create a fatal user-defined error. An entry can also be left in the error history when the error occurs.  • FALS can also be used to automatically stop operation for specific conditions that are not necessarily errors.

Applications	Solutions
Determining if a specific output turns ON within a specified time after an input turns ON, generating an error if the output does not turn ON, and determining the address in the program responsible for the output not turning ON.	• Use the FPD instruction to perform time or logic diagnosis of a specified portion of the program. 
Creating a history of user-defined and system errors that have occurred.	• Use the error log to record up to 20 time-stamped error records.
Creating an external output when a non-fatal error occurs.	• Use the Non-fatal Error Flag. 
Turning OFF all output from Output Modules for specific conditions. Turning OFF all output from Output Modules during trial system operation.	• Use the Load OFF Bit. 
Maintaining I/O memory status when starting operation.	• Use the I/O memory hold function to start program execution with the same I/O memory status as the last time the program was executed. 
Correcting the program during operation.	• Use the CX-Programmer to change the program as required during operation. 
Sampling specified I/O memory bits or word data. • Scheduled sampling • Sampling once per cycle • User-defined sampling	• Use the data tracing function. 

Maintenance and Management

Remote Programming and Monitoring

Requirements	Solutions
Monitoring and editing online for remote PLCs using telephone lines.	• Perform online programming and monitoring from a CX-Programmer running on a computer connected to the PLC via a modem. 
Monitoring and editing online from the CX-Programmer for a remote PLC connected to a network.	• Use a Serial Communications Board or Unit; connect to a PLC via a modem; use an instruction to switch to host link mode, and then program or monitor from the CX-Programmer. (It's not necessary to cut the connection during the procedure.) • Use the host link gateway function to program or monitor any PLC connected to a Controller Link or Ethernet Network to which the PLC connected to the computer running the CX-Programmer is connected (via RS-232C). 
Programming and editing a PLC on a remote network.	• Use the gateway function to edit any PLC connect to a network up to two networks away (3 networks including the local network). For example, a PLC on the Controller Link Network shown below can be accessed from the CX-Programmer running on a computer connected to a PLC on the Ethernet Network. 

■ Common Specifications

Item			Specification
Control method			Stored program
I/O control method			Cyclic scan and immediate processing are both possible.
Programming			Ladder diagram
Instruction length			1 to 7 steps per instruction
Ladder instructions			Approx. 400 (3-digit function codes)
Execution time			Basic instructions: 0.02 μs min., Special instructions: 0.04 μs min.
Number of tasks			288 (256 of which are also used as interrupt tasks) Cyclic tasks are executed each cycle and are controlled with TKON(820) and TKOF(821) instructions. The following 4 types of interrupt tasks are supported: Power OFF tasks:1 max., Scheduled interrupt tasks: 2 max., I/O interrupt tasks: 32 max., External interrupt tasks: 256 max.
Interrupt types			Scheduled Interrupts: Interrupts generated at a time s'cheduled by CPU's built-in timer. I/O Interrupts: Interrupts from Interrupt Input Modules. Power OFF Interrupts: Interrupts executed when the CPU's power is turned OFF. External I/O Interrupts: Interrupts from Special I/O Modules, CS1 Special Modules, or Inner Board.
CIO (Core I/O) Area (The CIO Area can be used as work bits if not used as shown here.)	I/O Area		5,120 : CIO 000000 to CIO 031915 (320 words from CIO 0000 to CIO 0319) Setting of first rack words can be changed from default (CIO 0000) so that CIO 0000 to CIO 0999 can be used. I/O bits are allocated to Basic I/O Modules, such as CS1 Basic I/O Modules, C200H Basic I/O Modules, and C200H Group-2 High-density I/O Modules.
	Link Area		3,200 (200 words): CIO 10000 to CIO 119915 (words CIO 1000 to CIO 1199) Link bits are used for data links and are allocated to Modules in Controller Link Systems and PC Link Systems.
	CS1 CPU Bus Module Area		6,400 (400 words): CIO 150000 to CIO 189915 (words CIO 1500 to CIO 1899) CS1 CPU Bus Module bits store operating status of CS1 CPU Bus Modules. (25 words per Module, 16 Modules max.)
	Special I/O Module Area		15,360 (960 words): CIO 200000 to CIO 295915 (words CIO 2000 to CIO 2959) Special I/O Module bits are allocated to CS1 Special I/O Modules and C200H Special I/O Modules. (See Note.) (10 words per Module, 96 Modules max.) The maximum number of slots, however, is limited to 80 including expansion slots, so maximum number of Modules is actually 80.) **Note:** Some I/O Modules are classified as Special I/O Modules.
	Inner Board Area		1,600 (100 words): CIO 190000 to CIO 199915 (words CIO 1900 to CIO 1999) Inner Board bits are allocated to Inner Boards. (100 I/O words max.)
	SYSMAC BUS Area		800 (50 words): CIO 300000 to CIO 304915 (words CIO 3000 to CIO 3049) SYSMAC BUS bits are allocated to Slave Racks connected to SYSMAC BUS Remote I/O Master Modules. (10 words per Rack, 5 Racks max.)
CIO (Core I/O) Area, contd. (The CIO Area can be used as work bits if not used as shown here.)	I/O Terminal Area		512 (32 words): CIO 310000 to CIO 313115 (words CIO 3100 to CIO 3131) I/O Terminal bits are allocated to I/O Terminal Modules (but not to Slave Racks) connected to SYSMAC BUS Remote I/O Master Modules. (1 word per Terminal, 32 Terminals max.)
	C200H Special I/O Module Area		8,196 (512 words): CIO 000000 to CIO 051115 (words CIO 0000 to CIO 0511) C200H Special I/O Module bits are allocated to C200H Special I/O Modules and allow access separate from I/O refreshing.
		DeviceNet Area	1,600 (100 words): Outputs: CIO 005000 to CIO 009915 (words CIO 0050 to CIO 0099) Inputs: CIO 035000 to CIO 039915 (words CIO 0350 to CIO 0399) DeviceNet bits are allocated to Slaves according to DeviceNet remote I/O communications.
		PC Link Area	64 bits (4 words): CIO 027400 to CIO 025015 (words CIO 0247 to CIO 0250) When a PC Link Module is used in a PC Link, use these bits to monitor PC Link errors and operating status of other CPUs in PC Link.

(This table continues on the next page.)

CS1 CPU Specifications

Common Specifications (continued)

Item	Specification
Internal I/O Area	4,800 (300 words): CIO 120000 to CIO 149915 (words CIO 1200 to CIO 1499) 37,504 (2,344 words): CIO 380000 to CIO 614315 (words CIO 3800 to CIO 6143) These bits in CIO Area are used as work bits in programming to control program execution. They cannot be used for external I/O.
Work Area	8,192 bits (512 words): W00000 to W51115 (words W000 to W511) Control programs only. (I/O from external I/O terminals is not possible.) Note: When using work bits in programming, use bits in Work Area first before using bits from other areas.
Holding Area	8,192 bits (512 words): H00000 to H51115 (words H000 to H511) Holding bits are used to control execution of program, and maintain their ON/OFF status when PLC is turned OFF or operating mode is changed.
Auxiliary Area	Read only: 7,168 bits (448 words): A00000 to A44715 (words A000 to A447) Read/write: 8,192 bits (512 words): A44800 to A95915 (words A448 to A959) Auxiliary bits are allocated specific functions.
Temporary Area	16 bits (TR00 to TR15) Temporary bits are used to store ON/OFF execution conditions at program branches.
Timer Area	4,096: T0000 to T4095 (used for timers only)
Counter Area	4,096: C0000 to C4095 (used for counters only)
DM Area	32K words: D00000 to D32767 Used as a general-purpose data area for reading and writing data in word units (16 bits). Words in DM Area maintain their status when PLC is turned OFF or operating mode is changed. Internal Special I/O Module DM Area: D20000 to D29599 (100 words × 96 Units). Used to set parameters. CS1 CPU Bus Module DM Area: D30000 to D31599 (100 words × 16 Units). Used to set parameters. Inner Board DM Area: D32000 to D32099. Used to set parameters for Inner Boards.
EM Area	32K words per bank, 13 banks max.: E0_00000 to EC_32767 max. (Not available on some CPU.) Used as a general-purpose data area for reading and writing data in word units (16 bits). Words in EM Area maintain their status when PLC is turned OFF or operating mode is changed. The EM Area is divided into banks, and addresses can be set by either of following methods. Changing current bank using EMBC(281) instruction and setting addresses for current bank. Setting bank numbers and addresses directly. EM data can be stored in files by specifying number of first bank. (EM file memory)
Data Registers	DR0 to DR15. Store offset values for indirect addressing. Data registers can be used independently in each task. One register is 16 bits (1 word).
Index Registers	IR0 to IR15. Store PLC memory addresses for indirect addressing. Index registers can be used independently in each task. One register is 32 bits (2 words).
Task Flag Area	32 (TK0000 to TK0031). Task Flags are read-only flags that are ON when corresponding cyclic task is executable and OFF when corresponding task is not executable or in standby status.
Trace Memory	4,000 words (500 data trace samples at the maximum sample size of 31 bits and 6 words)
File Memory	Memory Cards: Compact flash memory cards can be used (MS-DOS format). EM file memory: Part of EM Area can be converted to file memory (MS-DOS format). OMRON Memory Cards with 8-MB, 15-MB, 30-MB, or 48-MB capacities can be used.

Note: A maximum of 10 or 16 C200H Special I/O Modules can be used depending on the CPU. Some I/O Modules are Special I/O Modules.

■ Function Specifications

Item	Specification
Constant cycle time	1 to 32,000 ms (Unit: 1 ms)
Cycle time monitoring	Possible (Module stops operating if cycle is too long): 1 to 40,000 ms (Unit: 10 ms)
I/O refreshing	Cyclic refreshing, immediate refreshing, refreshing by IORF(097).
I/O memory holding when changing operating modes	Possible (Depends on ON/OFF status of IOM Hold Bit in Auxiliary Area.)
Load OFF	All outputs on Output Modules can be turned OFF.
Input time constant setting	Time constants can be set for inputs from CS1 Basic I/O Modules. The time constant can be increased to reduce influence of noise and chattering or it can be decreased to detect shorter pulses on inputs. (CS1 Basic I/O Modules only)
Mode setting at power-up	Possible
Memory Card functions	Automatic reading programs from Memory Card (autoboot).
	Memory Card Storage Data User program: Program file format (binary) PC System Setup: Data file format (binary) I/O Memory: Data file format (binary), text format, CSV format
	Memory Card Read/Write User program instructions, Peripheral Devices (such as Programming Console), Host Link computer.
Filing	Memory Card data and EM (Extended Data Memory) Area can be handled as files.
Debugging	Force-set/reset, differential monitoring, data tracing (scheduled, each cycle, or when instruction is executed), instruction error tracing.
Online editing	One or more program blocks in user programs can be overwritten when CPU is in PROGRAM or MONITOR mode. This function is not available for block programming areas.
Program protection	Overwrite protection: Set using DIP switch. Copy protection: Password set using Peripheral Device.
Error check	User-defined errors (i.e., user can define fatal errors and non-fatal errors) The FPD(269) instruction can be used to check execution time and logic of each programming block.
Error log	Up to 20 errors are stored in error log. Information includes error code, error details, and time error occurred.
Serial communications	Built-in peripheral port: Peripheral Device (including Programming Console), Host Links, NT Links Built-in RS-232C port: Peripheral Device (excluding Programming Console), Host Links, no-protocol communications, NT Links
	Communications Board (sold separately): Protocol macros, Host Links, NT Links
Clock	Provided on all models. Note: Used to store time when power is turned ON and when errors occur.
Power OFF detection time	10 to 25 ms (not fixed)
Power OFF detection delay time	0 to 10 ms (user-defined, default: 0 ms)
Memory protection	Held Areas: Holding bits, contents of Data Memory and Extended Data Memory, and status of counter Completion Flags and present values. Note: If IOM Hold Bit in Auxiliary Area is turned ON, and PC Setup is set to maintain IOM Hold Bit status when power to PLC is turned ON, contents of CIO Area, Work Area, part of Auxiliary Area, timer Completion Flag and PVs, Index Registers, and Data Registers will be saved.

(This table continues on the next page.)

CS1 CPU Specifications

Function Specifications (continued)

Item	Specification
Sending commands to a Host Link computer	FINS commands can be sent to a computer connected via Host Link System by executing Network Communications Instructions from PLC.
Remote programming and monitoring	Host Link communications can be used for remote programming and remote monitoring through a Controller Link System or Ethernet network.
Three-level communications	Host Link communications can be used for remote programming and remote monitoring from devices on networks up to two levels away (Controller Link Network, Ethernet Network, or other network).
Storing comments in CPU	I/O comments can be stored in CPU in Memory Cards or EM file memory.
Program check	Program checks are performed at beginning of operation for items such as no END instruction and instruction errors. A Peripheral Device (excluding Programming Console) can also be used to check programs.
Control output signals	RUN output: The contacts will turn ON (close) while CPU is operating. These terminals are provided only on C200HW-PA204R and C200HW-PA209R Power Supply Modules.
Battery life	5 years at 25°C (Depending on the ambient operating temperature and communications conditions, 1.1 years min. Battery Set: CS1W-BAT01) Note: Use a replacement battery that is no more than 2 years old from the date of manufacture.
Self-diagnostics	CPU errors (watchdog timer), I/O verification errors, I/O bus errors, memory errors, and battery errors.
Other functions	Storage of number of times power has been interrupted, the times of the interrupts, and system operation time (in Auxiliary Area).

■ System Configuration and Basic Functions

Item	Specification		
Functional equivalence of existing CS1-H CPUs	The following CPUs are equivalent in terms of basic functions (I/O points, program capacity, DM capacity, and instruction execution speed). CS1D-CPU67H: Equivalent to CS1H-CPU67H. CS1D-CPU65H: Equivalent to CS1H-CPU65H.		
Mountable Modules	CS1-Series Basic I/O Modules, CS1-Series Special I/O Modules, CS1-Series CPU Bus Modules C200H Basic I/O Modules C200H Group-2 Multipoint I/O Modules, and C200H Special I/O Modules cannot be mounted.		
Mountable Inner Boards	Non-duplex Inner Boards cannot be used in either Duplex Mode or Simplex Mode.		
System configuration	These system configurations are possible: Duplex System In a Duplex System, two CS1D CPUs, two (or one) CS1D Power Supply Units, and one Duplex Unit are mounted to a CS1D Backplane. Simplex System In a Simplex System, one CS1D CPU, two (or one) CS1D Power Supply Units, and one Duplex Unit are mounted to a CS1D Backplane.		
Duplex Mode	A Duplex System can be operated in either of the following two modes: Duplex Mode The system operates with CS1D CPUs and CS1D Power Supply Units in duplex status. Simplex Mode The system operates with just a single CS1D CPU. In a Simplex System, only the Simplex Mode is possible.		
Duplex CS1D CPUs (Supported only in Duplex Mode in a Duplex System)	Operation of the two CS1D CPUs in Duplex	Operation of the two CS1D CPU in Duplex Mode Hot standby method: One of the two CS1D CPUs actually controls operations, and the other is on standby as a backup. The two CS1D CPUs have the same I/O memory, and parameters (PLC Setup, I/O tables, etc.), and both run the same user's program. Their operations differ in the following points: The active CPU executes I/O refreshing and all event servicing. The standby CPU handles file accessing (read only) and FINS command execution event servicing (read only).	
	Operation switching errors	Power interruptions (CPU operation setting switch: NO USE), CPU errors, memory errors, program errors, cycle time overrun errors, FALS executions	If any of the errors listed on the left occur in the active CPU, stopping operation, the standby CPU automatically switches to active status and takes over control. At the same time, the mode is switched to Simplex Mode. The CPU where the error occurred can be replaced without stopping system operation.
	Duplex errors	Duplex bus errors Duplex verification errors	If either of the errors listed on the left occurs in Duplex Mode, the active CPU remains the same and operation is switched to Simplex Mode.
	Automatic recovery to duplex operation	After operation has been switched from Duplex Mode to Simplex Mode as a result of any of the operation switching errors listed above, operation is automatically returned to Duplex Mode when it is determined that the cause of the error has been cleared. Automatic recovery to duplex operation must first be enabled in the PLC Setup. (The recovery can be repeated up to ten times.)	
	Hardware conditions for the two CS1D CPUs in Duplex Mode	Identical models must be used for the two CS1D CPUs.	
	Software conditions for the two CS1D CPUs in Duplex Mode	The same user program areas must be used.The same parameter areas (PLC Setup, etc.) must be used.	
	CS1D CPU online replacement	The CS1D CPU where the error occurred can be replaced online by turning OFF the power to only that Unit (i.e., setting the CPU operation switch to NO USE).	

(This table continues on the next page.)

CS1D Duplex CPU Specifications

System Configuration and Basic Functions (continued)

Item	Specification	
Duplex CS1D Power Supply Units	Operation with two CS1D Power Supply Units mounted	Power is supplied to the Backplane simultaneously by two CS1D Power Supply Units. (The load for each CS1D Power Supply Unit is approximately one half.) This function is supported in either a Duplex System (in either Duplex or Simplex Mode) or in a Simplex System.
	Operation when one CS1D Power Supply Unit breaks down	If one CS1D Power Supply Unit breaks down (i.e., if the power supply voltage drops), operation is continued using only the other one.
Duplex Communications	When two Optical-ring Controller Link Units for duplex communications (H-PCF cable: CS1W-CLK12-V1; GI cable: CS1W-CLK52-V1) are mounted using the same node address and unit number, and a special cable is used to connect them, one of the Modules will continue communications even if the other one breaks down.	
Online Module replacement	Using the Programming Console, it is possible to mount or remove CS1-Series Basic I/O Modules, CS1-Series Special I/O Modules, and CS1-Series CPU Bus Units while the power is ON and the CPU is operating in any mode (PROGRAM, MONITOR, or RUN).This function is supported in either a Duplex System (in either Duplex or Simplex Mode) or in a Simplex System.	

■ Specifications with Application Restrictions

Item	Specification	
Programming Device operating restrictions	CX-Programmer	PLC model: Select: “CS1H-H.” Cable connection: Connect to peripheral port or RS-232C port of active CPU. If a CX-Programmer is connected to the standby CPU, write processing from the CX-Programmer cannot be executed.
	Programming Console	Cable connection: Connect to peripheral port of active CPU. If a Programming Console is connected to the standby CPU write processing from the Programming Console cannot be executed.
Applications constantly connected to RS-232C port	When a constant monitoring system, such as an Operator Interface or personal computer application, is connected to the CPUs RS-232C port, an RS-232C/RS-422 Adapter can be used to connect to both the active and standby CS1D CPUs. Set the standby CPUs RS-232C port setting in the PLC Setup so that it cannot be used independently.‘	
Restrictions on Memory Card functions	When writing to a Memory Card, the same data is written to not only the Memory Card mounted in the active CPU, but also to the one mounted in the standby CPU. Note: 1. In the PLC Setup, duplex operation must be enabled for Memory Cards. 2. No processing is executed during duplex initialization to match the data on the Memory Cards mounted in the active and standby CPUs even if the data is not the same. Therefore, before enabling duplex operation for Memory Cards, make sure that the contents are the same for both of the Memory Cards. 3. When EM File Memory is set for duplex operation, processing is executed to match the contents of EM File Memory in both CPUs. It is not necessary to enable duplex operation for Memory Cards in the PLC Setup.	
Restrictions on types of interrupts	The CS1D CPUs do not support any interrupt functions. Power OFF interrupt tasks, scheduled interrupt tasks, I/O interrupt tasks, and external interrupt tasks cannot be used in either a Duplex or Simplex System. Interrupt control instructions (MSKS, MSKR, and CLI) are executed as NOP.	
Restrictions on I/O refresh methods	No restrictions.	Cyclic refreshing Refreshing by I/O refresh instruction (IORF(097)) Refreshing by CPU Bus Unit immediate refresh instruction (DLINK(226))
	Cannot be used (disabled).	Immediate refresh option “!” Immediate refresh option “!” will not be used, even if it was specified
Restrictions of CPU processing modes	Only Normal Mode can be used. Parallel Processing Mode and Peripheral Servicing Priority Mode cannot be used	
Restrictions on background execution	Background execution of text string instructions, table data instructions, and data shift instructions cannot be used.	

(This table continues on the next page.)

Specifications with Application Restrictions (continued)

Item	Specification
Accuracy of timer instructions	± (10 ms + cycle time) When operation is switched from duplex to simplex during timer instruction execution, the deviation in the first cycle after switching may exceed the normal time, as shown below. TIM, TIMX, TIMH(015), TIMHX(551), TTIM(087), TTIMX(555), TIML(542), TIMLX(553), MTIM(543), MTIMX(554), TIMW(813), TIMWX(816), TMHW(815), TMHWX(817): (10 ms + cycle time) ± 10 ms or less TMHH(540), TMHHX(552): (10 ms + cycle time) ± 20 ms or less
PV refresh during timer-system instruction jump or while block program is stopped (Different from CS1-H.)	TIM, TIMX, TIMH(015), TIMHX(551), TMHH(540), TMHHX(552), TTIM(087), TTIMX(555): The timer PV is not refreshed when the timer instruction is jumped for JMP, CJMP, or CJPN–JME. The PV will be refreshed for the entire period it was jumped the next time it is executed (i.e., the next time it is not jumped). (With CS1-H CPUs, the PV for these timers were refreshed even when jumped.)
Clock function	Synchronized with active CPU.

■ Common Specifications other than Duplex Specifications

Item	Specification	
Control method	Stored program	
I/O control method	Cyclic scan and immediate processing (by IORF only) are both supported.	
Programming	Ladder diagram	
CPU processing mode	Normal Mode only. Parallel Processing Mode and Peripheral Servicing Priority Mode cannot be used.	
Instruction length	1 to 7 steps per instruction	
Ladder instructions	Approx. 400 (3-digit function codes)	
Instruction execution times	Basic instructions	0.02 μs min.
	Special instructions	0.06 μs min.
Overhead processing time	1.9 ms	
Number of Expansion Racks	7 max. (CS1D Expansion Racks) (C200H Expansion I/O Racks and SYSMAC BUS Remote I/O Slave Racks cannot be connected.)	
Number of Tasks	288 (cyclic tasks: 32; extra cyclic tasks: 256) The extra cyclic tasks can be executed each cycle, just like the cyclic tasks, making a total of 288 tasks that can be executed each cycle. Cyclic tasks are executed each cycle and are controlled with TKON(820) and TKOF(821) instructions.	
Starting subroutines from multiple starts	Supported (by global subroutines).	

(This table continues on the next page.)

CS1D Duplex CPU Specifications

Common Specifications other than Duplex Specifications (continued)

CIO (Core I/O) Area	I/O Area	5,120: CIO 000000 to CIO 031915 (320 words from CIO 0000 to CIO 0319) The setting of the first word can be changed from the default (CIO 0000) so that CIO 0000 to CIO 0999 can be used. I/O bits are allocated to Basic I/O Modules (CS1-Series Basic I/O Modules).
	Data Link Area	3,200 (200 words): CIO 10000 to CIO 119915 (words CIO 1000 to CIO 1199) Link bits are used for data links and are allocated to Modules in Controller Link Systems
	CPU Bus Unit Area	6,400 (400 words): CIO 150000 to CIO 189915 (words CIO 1500 to CIO 1899) CPU Bus Unit bits can be used to store the operating status of CPU Bus Units. (25 words per Unit, 16 Units max.)
	Special I/O Module Area	15,360 (960 words): CIO 200000 to CIO 295915 (words CIO 2000 to CIO 2959) Special I/O Module bits can be allocated to CS1-Series Special I/O Modules. (10 words per Unit, 96 Units max.)
	CS1-Series DeviceNet Area	9,600 (600 words): CIO 320000 to CIO 379915 (words CIO 3200 to CIO 3799) CS1-Series DeviceNet Area bits are allocated to Slaves according to CS1W-DRM21 DeviceNet Module remote I/O communications. Fixed Allocations 1: Output 3200 to 3263 Input: 3300 to 3363 Fixed Allocations 2: Output 3400 to 3463 Input: 3500 to 3563 Fixed Allocations 3:Output 3600 to 3663 Input: 3700 to 3763 The following words are allocated in the Master even when fixed allocations are used for the remote I/O communications Slave functions of a CS1-Series DeviceNet Module (CS1W-DRM21). Fixed Allocations 1: To Slave: Output 3370 To Master: Input: 3270 Fixed Allocations 2: To Slave:Output 3570 To Master: input: 3400 Fixed Allocations 3: To Slave:Output 3770 To Master: input: 3670
(Core I/O) Area, Work Areas	Internal I/O Area	4,800 (300 words): CIO 120000 to CIO 149915 (words CIO 1200 to CIO 1499) 37,504 (2,344 words): CIO 380000 to CIO 614315 (words CIO 3800 to CIO 6143) These bits in the CIO Area are used as work bits in programming to control program execution. They cannot be used for external I/O.
	Work Area	8,192 bits (512 words): W00000 to W51115 (W000 to W511) These bits are used to control the programs only. (I/O from external I/O is not possible.) When using work bits in programming, use the bits in the Work Area first, before using bits from other areas.
Holding Area	8,192 bits (512 words): H00000 to H51115 (H000 to H511) Holding bits are used to control the execution of the program, and maintain their ON/OFF status when the PLC is turned OFF or the operating mode is changed.	
Auxiliary Area	Read only: 7,168 bits (448 words): A00000 to A44715 (words A000 to A447) Read/write: 8,192 bits (512 words): A44800 to A95915 (words A448 to A959) Auxiliary bits are allocated for specific functions.	
Temporary Relay (TR) Area	6 bits (TR0 to TR15) Temporary bits are used to temporarily store the ON/OFF execution conditions at program branches.	
Timer Area	4,096: T0000 to T4095 (used for timers only)	
Counter Area	4,096: C0000 to C4095 (used for counters only)	

(This table continues on the next page.)

Common Specifications other than Duplex Specifications (continued)

Data Memory (DM) Area	32K words: D00000 to D32767 Used as a general-purpose data area for reading and writing data in word units (16 bits). Words in the DM Area maintain their status when the PLC is turned OFF or the operating mode is changed. Special I/O Module DM Area: D20000 to D29599 (100 words x 96 Units) Used to set parameters for Special I/O Modules. CPU Bus Unit DM Area: D30000 to D31599 (100 words x 16 Units) Used to set parameters for CPU Bus Units. Inner Board DM Area: D32000 to D32099 Used to set parameters for Inner Boards.
Extended Data Memory (EM) Area	32K words per bank, 13 banks max.: E0_00000 to EC_32767 max. (Not available on some CPUs.) Used as a general-purpose data area for reading and writing data in word units (16 bits). Words in the EM Area maintain their status when the PLC is turned OFF or the operating mode is changed. The EM Area is divided into banks, and the addresses can be set by either of the following methods. Changing the current bank using the EMBC(281) instruction and setting addresses for the current bank.Setting bank numbers and addresses directly. EM data can be stored in files by specifying the number of the first bank.
Index Registers	IR0 to IR15 Store PLC memory addresses for indirect addressing. One register is 32 bits (2 words).Index registers can be set to be shared by all tasks or to be used independently by each task.
Data Registers	DR0 to DR15 Used to offset the PLC memory addresses in Index Registers when addressing words indirectly. Data registers can be set to be shared by all tasks or to be used independently by each task
Task Flags	32 (TK0000 to TK0031) Task Flags are read-only flags that are ON when the corresponding cyclic task is executable and OFF when the corresponding task is not executable or in standby status.
Trace Memory	4,000 words (trace data: 31 bits, 6 words)
File Memory	Memory Cards: Compact flash memory cards can be used (MS-DOS format). EM file memory: The EM Area can be converted to file memory (MS-DOS format)

CS1D Duplex CPU Specifications

■ Functions

Constant cycle time	1 to 32,000 ms (Unit: 1 ms)	
Cycle time monitoring	Possible (Module stops operating if the cycle is too long): 10 to 40,000 ms (Unit: 10 ms)	
Timing of special refreshing for CPU Bus Units	Data links for Controller Link Modules and SYSMAC LINK Modules, remote I/O for DeviceNet Modules, and other special refreshing for CPU Bus Units is performed at the I/O refresh period and when the CPU Bus Unit I/O REFRESH (DLNK(226)) instruction is executed.	
I/O memory holding when changing operating modes	Depends on the ON/OFF status of the IOM Hold Bit in the Auxiliary Area.	
Load OFF	All outputs on Output Modules can be turned OFF when the CPU is operating in RUN, MONITOR, or PROGRAM mode.	
Input response time setting	Time constants can be set for inputs from Basic I/O Modules. The time constant can be increased to reduce the influence of noise and chattering or it can be decreased to detect shorter pulses on the inputs.	
Startup mode setting	Supported. The CPU will start in RUN mode if the PLC Setup is set to use the Programming Console mode (default) and a Programming Console is not connected.	
Flash memory	The user program and Parameter Area data (e.g., PLC Setup) are always backed up automatically in flash memory.	
Memory Card functions (Accessed for Memory Card mounted in active CPU Bus Unit only.)	Automatically reading programs (autoboot) from the Memory Card when the power is turned ON.	Supported.
	Program replacement during PLC operation	Supported.
	Format in which data is stored in Memory Card	User program:Program file format PLC Setup and other parameters: Data file format I/O memory: Data file format (binary format), text format, or CSV format (except pre-version-1 CS1 CPUs)
	Functions for which Memory Card read/write is supported	User program instructions, Programming Devices (including Programming Consoles), Host Link computers, AR Area control bits, simple backup operation
Filing	Memory Card data and the EM (Extended Data Memory) Area can be handled as files.	
Debugging	Control set/reset, differential monitoring, data tracing (scheduled, each cycle, or when instruction is executed), storing location generating error when a program error occurs	
Online editing	User programs can be overwritten in program-block units when the CPU is in MONITOR or PROGRAM mode. This function is not available for block programming areas. With the CX-Programmer, more than one program block can be edited at the same time.	
Program protection	Overwrite protection: Set using DIP switch. Copy protection: Password set using Programming Device.	
Error check	User-defined errors (i.e., user can define fatal errors and non-fatal errors) The FPD(269) instruction can be used to check the execution time and logic of each programming block. FAL and FALS instructions can be used with the CS1-H CPUs to simulate errors.	
Error log	Up to 20 errors are stored in the error log. Information includes the error code, error details, and the time the error occurred. The CPU can be set so that user-defined FAL errors are not stored in the error log.	
Serial communications	Built-in peripheral port: Programming Device (including Programming Console) connections, Host Links, NT Links Built-in RS-232C port: Programming Device (excluding Programming Console) connections, Host Links, no-protocol communications, NT Links	
	Serial Communications Board (sold separately): Protocol macros, Host Links, NT Links	
Clock	Provided on all models. Accuracy: ± 30 s/mo. at 25°C **Note:** a.) The accuracy varies with the temperature; b.) Used to store the time when power is turned ON and when errors occur.	
Power OFF detection time	10 to 25 ms (AC power supply) 2 to 5 ms (DC power supply)	
Power OFF detection delay time	0 to 10 ms (user-defined, default: 0 ms)	

(This table continues on the next page.)

Functions (continued)

Memory protection	Held Areas: Holding bits, contents of Data Memory and Extended Data Memory, and status of the counter Completion Flags and present values. **Note:** If the IOM Hold Bit in the Auxiliary Area is turned ON, and the PLC Setup is set to maintain the IOM Hold Bit status when power to the PLC is turned ON, the contents of the CIO Area, the Work Area, part of the Auxiliary Area, timer Completion Flags and PVs, Index Registers, and the Data Registers will be saved.
Sending commands to a Host Link computer	FINS commands can be sent to a computer connected via the Host Link System by executing Network Communications Instructions from the PLC.
Program check	Program checks are performed at the beginning of operation for items such as no END instruction and instruction errors. CX-Programmer can also be used to check programs.
Control output signals	RUN output: The internal contacts will turn ON (close) while the CPU is operating.These terminals are provided only on CS1D-PA207R Power Supply Units.
Battery service life	Battery Set: CS1W-BAT01
Self-diagnostics	CPU errors (watchdog timer), I/O verification errors, I/O bus errors, memory errors, and battery errors.
Other functions	Storage of number of times power has been interrupted. (Stored in A514.)