

Integrated Loop Control and Sequence Control

- Incorporate the engine for controlling analog values (e.g. temperature, pressure, flow rate) and the engine for executing sequence control in the CPU Unit.
- Deliver high-speed sequence control and high-speed, advanced analog value control in a single Unit.



CJ1G-CPU45P

Features

- High-speed execution of function blocks for multi-loop control with an operation cycle of 10 ms
- All functions achieved by using only function blocks (operation functions/designation of field input/output)
- Almost all control types freely achieved by combining function blocks
- Function blocks with high-speed execution
- High-speed I/O refreshing with the CPU Unit using user link tables
- Designate I/O memory in the CPU Unit using registered tags
- Simulated software connections between function blocks
- Specify the order of operations in function block diagrams
- Easily create a SCADA interface with the HMI function

Specifications

Item		Specification
Product name		Loop-control CPU Unit
Model numbers		CJ1G-CPU□□P
Data exchange method with CPU Unit	Words in Auxiliary Area in CPU Unit	Loop Controller → CPU Unit: Operation status, PV error input ON, MV error input ON, occurrence of execution error, function block database error, cold start ready for hot start command, flash memory backup in progress, function blocks changed, etc. CPU Unit → Loop Controller: Hot/cold start command at power ON
	User allocations in I/O memory	User memory tables used to allocate function block ITEM data for user-specified memory in the CPU Unit (CIO, Work, HR, DM, or EM Area (bank 0, but also banks 1 to 12 for Ver. 3.0 or later)).
	EM Area (bank number) allocations (for SCADA software)	HMI function used allocate function block ITEM data for Control, Operation, External Controller, and System Common blocks in the specified bank of the EM Area in the CPU Unit. The real PV in calibration mode can be allocated (Ver. 3.0 or later).
Setting		None
Indicators		Loop-control CPU Units: 2 LEDs (RUN and ready)
Super capacitor backup data		All function block data (including Step Ladder Program commands), stored error log data
Super capacitor backup time		CJ Series (CJ1G-CPU□□P): 5 min at 25°C (Backed up by the Battery in the CPU Unit.)
Data stored in flash memory		Function block data
Backup from RAM to flash memory		Executed from CX-Process Tool (as required).
Recovery from flash memory to RAM		Automatic at power ON if startup mode is set for a cold start, or executed from CX-Process Tool (as required).
Influence on CPU Unit cycle time		Loop-control CPU Unit (CJ1G-CPU□□P): 0.8 ms max. (Depends on function block contents.)
Current consumption (supplied from Power Supply Unit)		Loop-control CPU Unit: 1.06 A at 5 VDC Note: Increased by 150 mA when NT-AL001 Link Adapter is used.
Standard accessories		None

Function Specifications

Item		Description						
Operation method		Function block method						
Number of function blocks		Total CJ1G-CPU42P: 71 blocks max., CJ1G-CPU43/44/45P: 501 blocks max.						
		<table border="1"> <tr> <td rowspan="2">Analog operation</td> <td>Control Blocks</td> <td>PID and other control functions</td> <td rowspan="2">LCB01: 50 blocks max., LCB03: 300 blocks max.</td> </tr> <tr> <td>Operation Blocks</td> <td>Alarm, square root operation, time operations, pulse train operation, and other operation functions for various processes</td> </tr> </table>	Analog operation	Control Blocks	PID and other control functions	LCB01: 50 blocks max., LCB03: 300 blocks max.	Operation Blocks	Alarm, square root operation, time operations, pulse train operation, and other operation functions for various processes
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			Operation Blocks	Alarm, square root operation, time operations, pulse train operation, and other operation functions for various processes				
		Sequential Control	Step Ladder Program block Logic sequence and step sequence functions	4,000 commands max. 100 commands/1 block max. Can be divided into 100 steps max. 100 commands/1 step max.				
		I/O block	Field Terminal block	Analog I/O function with Analog I/O Unit, contact I/O function with Basic I/O Unit	80 blocks max.			
			User link tables	Analog data I/O and contact data I/O function for CPU Unit Can be added to CSV tags.	2,400 data max.			
HMI function	I/O function for function block ITEM data for Control, Operation, External Controller, and System Common blocks for CPU Unit		Control/Operation Blocks LCB01: 50 blocks max. + 20 send/receive words LCB03: 300 blocks max. + 20 send/receive words System Common Block 20 send/receive words Real PV Input Monitor Area LCB01: 50 words max. LCB03: 300 words max.					
System Common block	System common operation cycle setting, run/stop command, load rate monitor, etc.	Single block						
Function block data preparation/download		Function block data prepared by CX-Process Tool (sold separately) and downloaded to Loop Controller						
Execution of function blocks		<table border="1"> <tr> <td rowspan="2">Function block execution conditions</td> <td>Common to all function blocks</td> <td> <ul style="list-style-type: none"> Operation of all function blocks by turning power ON to the PLC (Hot or cold start can be specified.) For cold starts, function block data is transferred from flash memory to RAM. Function block operation can be stopped by CX-Process Tool or FINS command. Hot start (state active before Board was stopped is continued before operation is started) or cold start (all state signals and function block internally held values are cleared before operation is started) is possible by CX-Process Tool or FINS command. </td> </tr> <tr> <td>For individual function block</td> <td>Function block operation can be stopped and hot start (state active before Unit was stopped is continued before operation is started) is possible by CX-Process Tool or FINS command.</td> </tr> </table>	Function block execution conditions	Common to all function blocks	<ul style="list-style-type: none"> Operation of all function blocks by turning power ON to the PLC (Hot or cold start can be specified.) For cold starts, function block data is transferred from flash memory to RAM. Function block operation can be stopped by CX-Process Tool or FINS command. Hot start (state active before Board was stopped is continued before operation is started) or cold start (all state signals and function block internally held values are cleared before operation is started) is possible by CX-Process Tool or FINS command. 	For individual function block	Function block operation can be stopped and hot start (state active before Unit was stopped is continued before operation is started) is possible by CX-Process Tool or FINS command.	
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For individual function block	Function block operation can be stopped and hot start (state active before Unit was stopped is continued before operation is started) is possible by CX-Process Tool or FINS command.							
Function block operation cycle	<p>Standard: Operation of all function blocks is executed at the same operation cycle preset to ITEM 004 in the System Common block. Settable operation cycles: 0.1 s, 0.2 s, 0.5 s, 1 s, 2 s (default: 1 s) Note: Cannot be set to the same operation cycle for some function blocks.</p> <p>Option: Operation of individual function blocks is executed at the same operation cycle preset to ITEM 004 in the System Common block. Settable operation cycles: 0.01 seconds, 0.02 seconds, 0.05 seconds, 0.1 seconds, 0.2 seconds, 0.5 seconds, 1 second, and 2 seconds (default: 1 second) Note: The external I/O response cycle on a single control loop does not necessarily match the operation cycle. The response cycle is heavily dependent on the CPU Unit's cycle time. (See the external I/O response cycle item below.)</p>							
Function blocks supporting high-speed operation	The following operation cycles can be set for the blocks listed below: 0.01, 0.02, and 0.05 s. Control/Operation blocks: Block Models 016, 150, 151, 155 to 157, 167, 182 to 184, 186, and 221 to 224 Sequence control and Field Terminal blocks							
Execution of function blocks	LCB load rate	<p>The "LCB load rate" refers to the ratio between the actually applied execution time and preset operation cycle. The maximum value and current value are displayed for each operation cycle group on the CX-Process Tool. A LCB load rate of 80% or less is required in all operation cycle groups. When the load rate exceeds 80% for 6 seconds, the LCB load rate automatically changes to the next longer operation cycle. (This is called the "automatic operation cycle switching function.") Note: The High Load Alarm Flag (A42408) turns ON if the load rate exceeds 80% for 6 seconds consecutively (non-fatal Inner Board error). (If execution is not possible within the operation cycle, the operation cycle will be extended.) If this happens, select the function blocks that can have longer operation cycles and increase their operation cycles. If the load rate is still too high, processing of the function blocks must be separated for processing by additional Loop Control Units.</p>						
External I/O response cycle		The time from external input of analog signals up to external output of analog signals on a single control loop depends on the function block's operation cycle and the CPU Unit's cycle time.						

Item		Description																								
Internal Operation	Number of control loops	<p>The maximum number of loops that can be used if the LCB load rate is 80% for a standard applications (e.g., with each loop consisting of one Ai4 Terminal, Segment Linearizer, Basic PID, and A04 terminal) is shown in the following table. CJ1G-CPU43P/44P/45P (LCB03)</p> <table border="1"> <thead> <tr> <th colspan="3">Operation cycle: Maximum number of loops</th> </tr> </thead> <tbody> <tr> <td>0.01 s: 20 loops</td> <td>0.02 s: 35 loops</td> <td>0.05 s: 70 loops</td> </tr> <tr> <td>0.1 s: 100 loops</td> <td>0.2 s: 150 loops</td> <td>0.5 s: 150 loops</td> </tr> <tr> <td>1 s: 150 loops</td> <td>2 s: 150 loops</td> <td></td> </tr> </tbody> </table> <p>CJ1G-CPU42P (LCB01)</p> <table border="1"> <thead> <tr> <th colspan="3">Operation cycle: Maximum number of loops</th> </tr> </thead> <tbody> <tr> <td>0.01 s: 20 loops</td> <td>0.02 s: 25 loops</td> <td>0.05 s: 25 loops</td> </tr> <tr> <td>0.1 s: 25 loops</td> <td>0.2 s: 25 loops</td> <td>0.5 s: 25 loops</td> </tr> <tr> <td>1 s: 25 loops</td> <td>2 s: 25 loops</td> <td></td> </tr> </tbody> </table>	Operation cycle: Maximum number of loops			0.01 s: 20 loops	0.02 s: 35 loops	0.05 s: 70 loops	0.1 s: 100 loops	0.2 s: 150 loops	0.5 s: 150 loops	1 s: 150 loops	2 s: 150 loops		Operation cycle: Maximum number of loops			0.01 s: 20 loops	0.02 s: 25 loops	0.05 s: 25 loops	0.1 s: 25 loops	0.2 s: 25 loops	0.5 s: 25 loops	1 s: 25 loops	2 s: 25 loops	
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Number of operations for process (excluding control)	LCB01: Max. 50 blocks LCB03: Max. 30 blocks																									
Sequential control (Use only one or the other)	Step ladders	LCB01: Max. 20 blocks per Board and total max. 2,000 commands per Board LCB03: Max. 200 blocks per Board and total max. 4,000 commands per Board Loop Controllers common: Divisible to 100 commands max. per block and 100 steps max. per block (100 commands max. per step)																								
Control method	PID control	PID with 2 degrees of freedom																								
	Possible control type combinations	Basic PID control, cascade control, feedforward control, sample PI control, dead time compensation, PID control with differential gap, override control, program control, time-proportional control and other control types can be achieved by combining function blocks.																								
Alarm	Integrated into PID block	4 PV alarms (high/high limit, high limit, low limit, low/low limit) per PID block, 1 deviation alarm																								
	Alarm block	High/Low Alarm block, Deviation Alarm block																								
Internal analog signal		Min. -320.00% to max. +320.00% Scaling of the engineering units depends on the CX-Process Tool (sold separately).																								
Operating status monitor method		Executed by commercially available SCADA software. In the SCADA software, CSV tags set on the CX-Process Tool are specified.																								
External I/O	External I/O signals	By data exchange with Analog I/O Unit via the Field Terminal block																								
	External contact I/O signals	By data exchange with Basic I/O Unit via the Field Terminal block																								
	CPU Unit analog data I/O	By data exchange with CPU Unit I/O memory via user link tables																								
	CPU Unit contact data I/O	By data exchange with CPU Unit I/O memory via user link tables																								
	Analog/contact I/O with SCADA software	Data transfer between Loop Controller and I/O memory in CPU Unit for Control, Operation, and External Controller blocks using HMI function																								
	FINS command to Loop Controller	Read/write of ITEMS in Loop Controller function blocks and execution of run/stop commands are possible from the CPU Unit (including other networked nodes) or host computer by issuing the following FINS commands to the Loop Controller. <ul style="list-style-type: none"> • READ MULTIPLE ITEMS IN FUNCTION BLOCK (0240 HEX) • WRITE MULTIPLE ITEMS IN FUNCTION BLOCK (0241 HEX) • READ ITEM IN MULTIPLE FUNCTION BLOCKS (0242 HEX) • WRITE ITEM IN MULTIPLE FUNCTION BLOCKS (0243 HEX) • READ UNIT INFORMATION (0501 HEX) • ECHOBACK TEST (0801 HEX) • READ ERROR LOG (2102 HEX) • CLEAR ERROR LOG (2103 HEX) 																								
System common status signals	Status output signal for sequence control	Constantly ON flags, constantly OFF flags, clock pulse (ON/OFF every 0.5 and 1 seconds)																								
	Clock timing output signal	Differential output at 00:00 every day, noon every day, every 10 minutes, every minute and every 10 seconds Note: The CPU Unit's clock data are read as these clock data.																								
	Calendar/clock output signal	Year, year/month, month/hour, day/time, hour/minute and minute/second Note: The CPU Unit's clock data is read as these clock data.																								
Error display		By front panel indicators: hardware test error, function block database error, battery error Storage of function block execution-related error codes to ITEM 003 of each function block: source/destination designation error, illegal function block combination, illegal parameter, etc.																								

Software Specifications

The following software (sold separately) is required to use the Loop Controller:

- CX-Process Tool (included in CX-One): Tool for preparing function block data (essential)

CX-Process Tool Specifications

Item		Specification	
Product name		CX-Process Tool (Included in CX-One Package)	
Applicable PLCs		CS/CJ-series	
Applicable computer	Computer	IBM PC/AT or compatible	
	Operating system (OS) (See Note.1, 2) Japanese or English System	Microsoft Windows XP (Service Pack 3 or higher), Vista or 7	
	CPU	Proceccor recommended by Microsoft.	
	Memory	Memory recommended by Microsoft.	
	Hard disk	Approx. 2.8 GB or more of available memory is required to install all of the CX-One.	
	Display	XGA (1,024 × 768). High Color (16-bit) or higher.	
	Disk Drive	CD-ROM or DVD-ROM drive	
Software that must be installed with the CX-Process Tool		CX-Server or FinsGateway	
Connecting method	Connection with CPU Unit (or Serial Communications Board/Unit)	Using FinsGateway Serial Unit Driver	Communications protocol with PLC: Host Link or Peripheral Bus *2 • Connect the computer to the peripheral port or built-in RS-232C port of the CPU Unit, or the RS-232C port of a Serial Communications Unit/Board. • Connecting cable: When connecting to the CPU Unit peripheral port: CS1W-CN□□□□ (2 m, 6 m) When connecting to the CPU Unit's RS-232C port: XW2Z-□□□□□ (2 m, 5 m)
		Using CX-Server	Communications protocol with PLC: Host Link or Peripheral Bus (The compatible connecting cables are the same as the ones shown above for the FinsGateway connection.)
	Connection via Controller Link	Using FinsGateway CLK (PCI) Driver	Install the driver in a computer equipped with a Controller Link Support Board (PCI slot) to support communications between the computer and PLCs equipped with a Controller Link Unit.
		Using FinsGateway Controller Link Driver or CX-Server	Install the driver in a computer equipped with a Controller Link Support Board (ISA slot) to support communications between the computer and PLCs equipped with a Controller Link Unit.
	Connection via Ethernet	Using FinsGateway ETN_UNIT Driver or CX-Server	Install the driver in a computer equipped with an Ethernet to support communications between the computer and PLCs equipped with an Ethernet Unit.
Offline operation functions		<ul style="list-style-type: none"> • Setting of function block ITEM data (including System Common block settings) • Software wiring of analog signals • Inserting, and printing text-string comments (memos) in block or ladder diagrams. • Describing Step Ladder Program block commands • Creating sequence tables 	
Online operation functions		<ul style="list-style-type: none"> • Downloading of function block data (download/upload to and from Loop Controller) • Run/stop command for Loop Controller (all function blocks) • System monitor run status: Monitoring/manipulation of System Common block (Block Model 000) (including monitoring of LCB load rate) • Loop Controller monitor run status: Confirmation of function block wiring operation (including operation stop/stop cancel on each function block), confirmation of Step Ladder Program operation, and validation of sequence tables • Initializing Loop Controller memory (RAM) • Autotuning PID constants and other parameters. 	

*1. CX-One Operating System Precaution:

- 1) System requirements and hard disk space may vary with the system environment.
- 2) Except for Windows XP 64-bit version.

*2. Peripheral Bus cannot be used when FinsGateway V3 is used.

Note: The CX-Process functions that can be used depend on the version. For details, refer to the operation manuals (Cat.No.: W372-E1-□ and W373-E1-□).

Functional Element Versions and Programming Devices

The Programming Device that supports the functional element version code must be used to enable all the functions in the corresponding functional element.

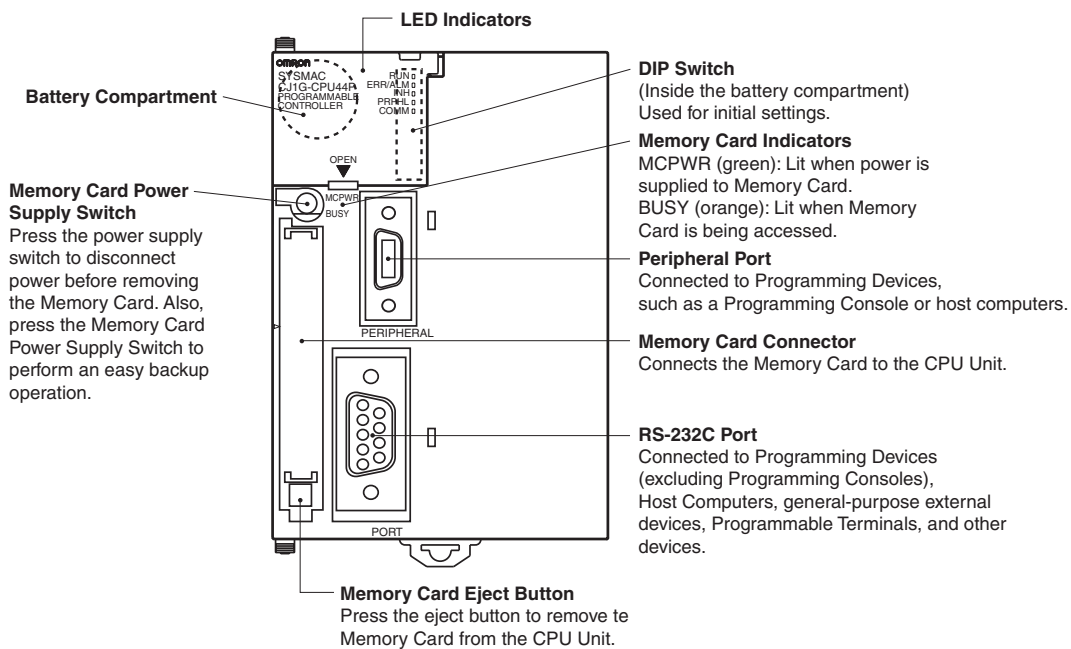
Note: Upgrading versions is not necessary if only the basic functions of the CPU Unit element are required.

Loop Controller Element

Loop Controller		Programming Device	
Functional element name	Functional element version	CX-Process Tool	CX-Programmer (See note.)
LCB01	Ver.1.0	Ver. 3.0 or higher	-
	Ver.1.5	Ver. 3.2 or higher	
	Ver.2.0	Ver. 4.0 or higher	
	Ver.3.0	Ver. 5.0 or higher	
	Ver.3.5	Ver. 5.2 or higher	
	Ver.3.6	Ver. 5.23 or higher	
LCB03	Ver.2.0	Ver. 4.0 or higher	
	Ver.3.0	Ver. 5.0 or higher	
	Ver.3.5	Ver. 5.2 or higher	
	Ver.3.6	Ver. 5.23 or higher	
LCB03-GTC	Ver.3.0	Ver. 5.1 or higher	

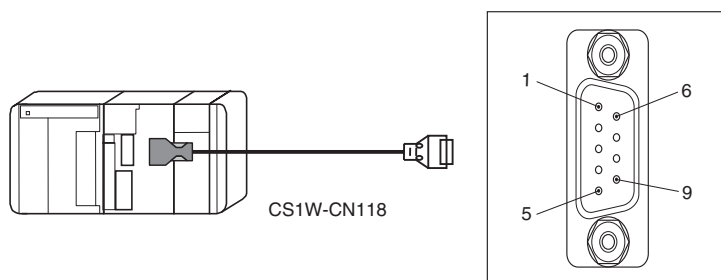
External Interface

A CJ1-series CPU Unit provides two communications ports for external interfaces: a peripheral port and an RS-232C port.



Peripheral port

The peripheral port is used to connect a Programming Device (including a Programming Console) or a host computer. It can also be used as an RS-232C port by connecting a suitable cable, such as the CS1W-CN118 or CS1W-CN□26. The connector pin arrangement when using a connecting cable for an RS-232C port is shown below.



Pin No.	Signal	Name	Direction
1	–	–	–
2	SD (TXD)	Send data	Output
3	RD (RXD)	Receive data	Input
4	RS (RTS)	Request to send	Output
5	CS (CTS)	Clear to send	Input
6	Reserved	None	–
7	–	–	–
8	–	–	–
9	SG (0V)	Signal ground	–
Connector hood	FG	Protection earth	–

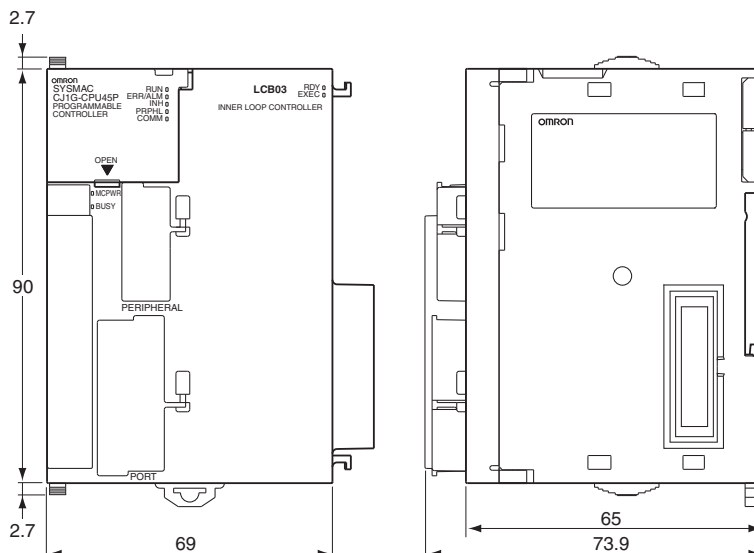
Dimensions

(Unit: mm)

CPU Units

Loop-control CPU Units

- CJ1G-CPU42P
- CJ1G-CPU43P
- CJ1G-CPU44P
- CJ1G-CPU45P



About Manuals

Cat. No.	Name	Contents
W406	SYSMAC CS/CJ Series CS1W-LCB01, CS1W-LCB05, CS1D-CPU□□P, and CJ1G-CPU□□P Operation Manuals	Describes the basic running of the Loop Control Boards (excluding detailed descriptions of the function blocks).
W407	SYSMAC CS/CJ Series CS1W-LCB01, CS1W-LCB05, CS1D-CPU□□P, and CJ1G-CPU□□P Function Block Reference Manual	Provides detailed information on the function blocks.
W444	CXONE-AL□□D-V□ CX-One FA Integrated Tool Package Setup Manual	Provides an overview of the CX-One FA Integrated Tool and installation procedures.
W372	SYSMAC CS/CJ Series CX-Process Tool Operation Manual	Describes operation of the CX-Process Tool.
W418	Faceplate Auto-Builder for NS Operation Manual	Describes operation of the software that generates NS-series PT projects from a SCADA CSV file output by the CX-Process Tool.
W393	SYSMAC CJ Series Programmable Controllers Operation Manual CJ1G/H-CPU□□H, CJ1G-CPU□□P, CJ1MCP□□, CJ1G-CPU□□	Provides an outlines of and describes the design, installation, maintenance, and other basic operations for the CJ-series PLCs.
W394	SYSMAC CS/CJ Series Programmable Controllers Programming Manual CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□HA, CS1D-CPU□□SA, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G/H-CPU□□H, CJ1G-CPU□□P, CJ1M-CPU□□, CJ1G-CPU□□	Describes programming and other methods to use the functions of the CS/CJ-series PLCs.
W474	SYSMAC CS/CJ Series Programmable Controllers Instructions Reference Manual CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□HA, CS1D-CPU□□SA, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G/H-CPU□□H, CJ1G-CPU□□P, CJ1M-CPU□□, CJ1G-CPU□□	Describes programming and other methods to use the functions of the CS/CJ-series PLCs.

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