CJ Series Loop CPU Unit

CJ1G-CPU4□P

CSM_CJ1G-CPU4_P_DS_E_3_1

Integrated Loop Control and Sequence Control

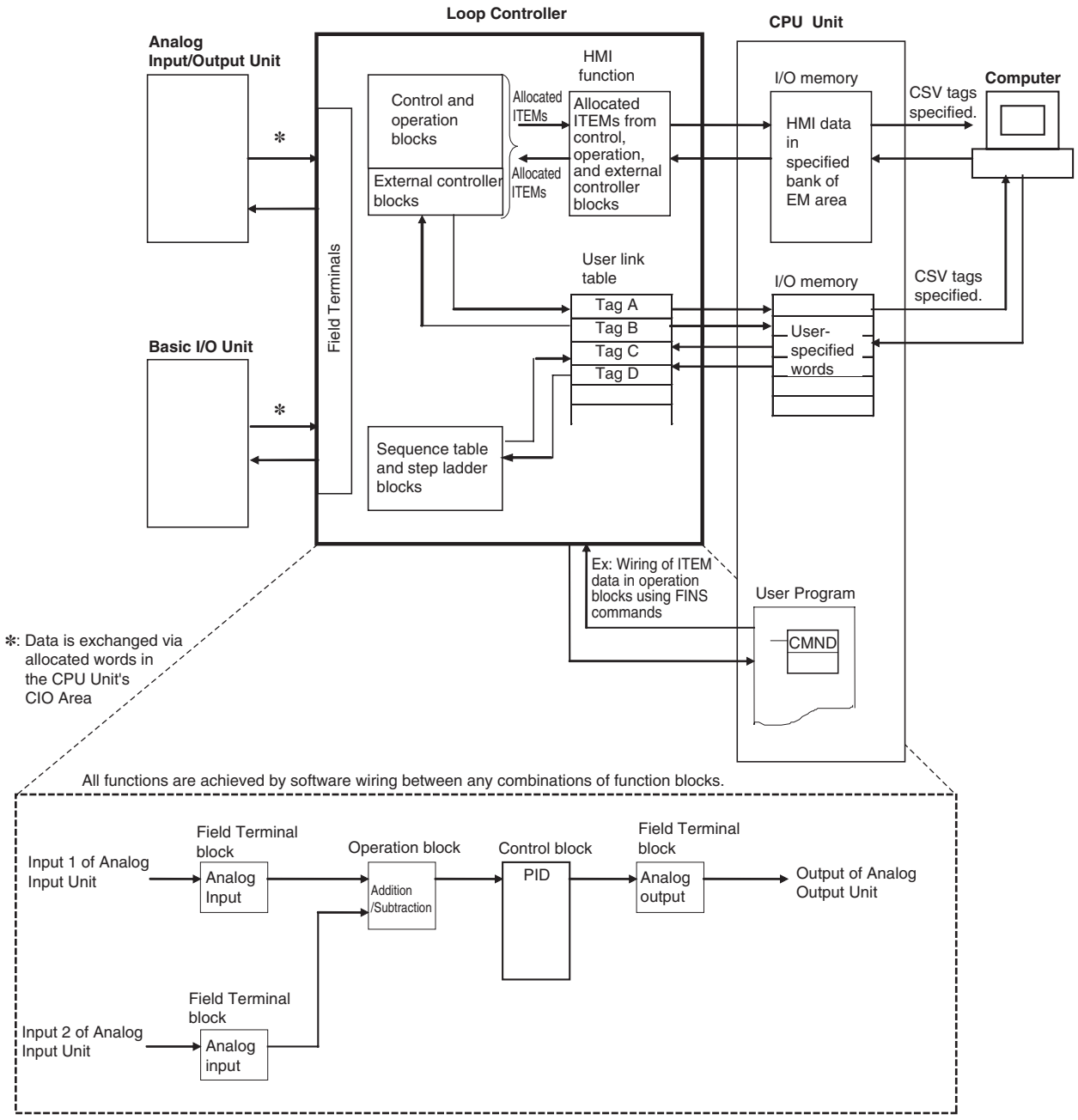
- Incorporate the engine for controlling analog values (e.g. temperature, pressure, flow rate) and the engine for executing sequence control in the CPU Unit.
- Deliver high-speed sequence control and high-speed, advanced analog value control in a single Unit.

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

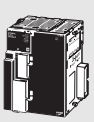
System Configuration



CJ1 Loop Control Units

International Standards

- The standards are abbreviated as follows: U: UL, U1: UL (Class I Division 2 Products for Hazardous Locations), C: CSA, US: cULus, UC1: cULus (Class I Division 2 Products for Hazardous Locations), CU: cUL, N: NK, L: Lloyd, and CE: EC Directives.
- Contact your OMRON representatives for further details and applicable conditions for these standards.

Product name	Specifications		Current consumption (A)		Model	Standards
	CPU Unit	Loop Controller	5 V	24 V		
CJ1G Loop-control CPU Units 	Same as for CJ1G-CPU45H	Number of function blocks: 300 blocks max.	1.06 (See note.)	–	**CJ1G-CPU45P**	UC1, CE
					CJ1G-CPU45P-GTC	
	Same as CJ1G-CPU44H		1.06 (See note.)	–	**CJ1G-CPU44P**	
	Same as CJ1G-CPU43H		1.06 (See note.)	–	**CJ1G-CPU43P**	
	Same as CJ1G-CPU42H	Number of function blocks: 50 blocks max.	1.06 (See note.)	–	**CJ1G-CPU42P**	

Note: Current consumptions include current for a Programming Console. Add 0.15 A per Adapter when using NT-AL001 RS-232C/RS-422A Adapters. Add 0.04 A per Adapter when using CJ1W-CIF11 RS-422A Adapters.

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.	
	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	
	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	**Function block execution conditions**	**Common to all function blocks**	• 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.	
	Function block operation cycle		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. 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.)	
	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**		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.	
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.	

<table>
<tr><th colspan="3">Item</th><th>Description</th></tr>
<tr><td rowspan="3">Internal Operation</td><td colspan="2">Number of control loops</td><td>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)
<table>
<tr><th colspan="3">Operation cycle: Maximum number of loops</th></tr>
<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>
</table>
CJ1G-CPU42P (LCB01)
<table>
<tr><th colspan="3">Operation cycle: Maximum number of loops</th></tr>
<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>
</table></td></tr>
<tr><td colspan="2">Number of operations for process (excluding control)</td><td>LCB01: Max. 50 blocks
LCB03: Max. 30 blocks</td></tr>
<tr><td>Sequential control (Use only one or the other)</td><td>Step ladders</td><td>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)</td></tr>
<tr><td rowspan="2">Control method</td><td colspan="2">PID control</td><td>PID with 2 degrees of freedom</td></tr>
<tr><td colspan="2">Possible control type combinations</td><td>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.</td></tr>
<tr><td rowspan="2">Alarm</td><td colspan="2">Integrated into PID block</td><td>4 PV alarms (high/high limit, high limit, low limit, low/low limit) per PID block, 1 deviation alarm</td></tr>
<tr><td colspan="2">Alarm block</td><td>High/Low Alarm block, Deviation Alarm block</td></tr>
<tr><td colspan="3">Internal analog signal</td><td>Min. −320.00% to max. +320.00%
Scaling of the engineering units depends on the CX-Process Tool (sold separately).</td></tr>
<tr><td colspan="3">Operating status monitor method</td><td>Executed by commercially available SCADA software. In the SCADA software, CSV tags set on the CX-Process Tool are specified.</td></tr>
<tr><td rowspan="6">External I/O</td><td colspan="2">External I/O signals</td><td>By data exchange with Analog I/O Unit via the Field Terminal block</td><td rowspan="2">Total number of I/O points:
(max. 8 points on Analog Input Unit or Analog Output Unit, or max. 96 points on Basic I/O Unit) × 80 blocks</td></tr>
<tr><td colspan="2">External contact I/O signals</td><td>By data exchange with Basic I/O Unit via the Field Terminal block</td></tr>
<tr><td colspan="2">CPU Unit analog data I/O</td><td>By data exchange with CPU Unit I/O memory via user link tables</td><td rowspan="2">Total number of I/O points:
2,400</td></tr>
<tr><td colspan="2">CPU Unit contact data I/O</td><td>By data exchange with CPU Unit I/O memory via user link tables</td></tr>
<tr><td colspan="2">Analog/contact I/O with SCADA software</td><td>Data transfer between Loop Controller and I/O memory in CPU Unit for Control, Operation, and External Controller blocks using HMI function</td><td>CJ1G-CPU42P: 2,040
CJ1G-CPU43/44/45P: 12,040</td></tr>
<tr><td colspan="2">FINS command to Loop Controller</td><td colspan="2">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.
• 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)</td></tr>
<tr><td rowspan="3">System common status signals</td><td colspan="2">Status output signal for sequence control</td><td colspan="2">Constantly ON flags, constantly OFF flags, clock pulse (ON/OFF every 0.5 and 1 seconds)</td></tr>
<tr><td colspan="2">Clock timing output signal</td><td colspan="2">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.</td></tr>
<tr><td colspan="2">Calendar/clock output signal</td><td colspan="2">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.</td></tr>
<tr><td colspan="3">Error display</td><td colspan="2">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.</td></tr>
</table>

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		CJ-series	
Applicable computer	**Computer**	IBM PC/AT or compatible	
	CPU	Intel CPU (Core, Pentium, or Celeron family) For Windows Vista: 1 GHz min. For any other OS: 333 MHz min. required, 1 GHz min. recommended	
	OS	Microsoft Windows Vista Ultimate or Business, XP Professional (up to Service Pack 2), 2000 Professional (Service Pack 3 or higher) ✻1	
	Memory	For Windows Vista: 1 GB min. For any other OS: 256 MB min. required, 512 MB min. recommended	
	Hard disk space	Min. required: 350 Mbytes of free space, Recommended: 450 Mbytes or more of free space (including approx. 280 Mbytes used by communications middleware)	
	Monitor	Min. required: XGA, 256 colors; Recommended: SXGA, 65,536 colors min.	
	CD-ROM drive	At least one	
	Mouse	Recommended: Microsoft mouse or compatible pointing device	
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		• 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		• 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. The Windows Vista 64-bit version and Windows XP x64 Edition are not supported.
✻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.

CPU Unit Element

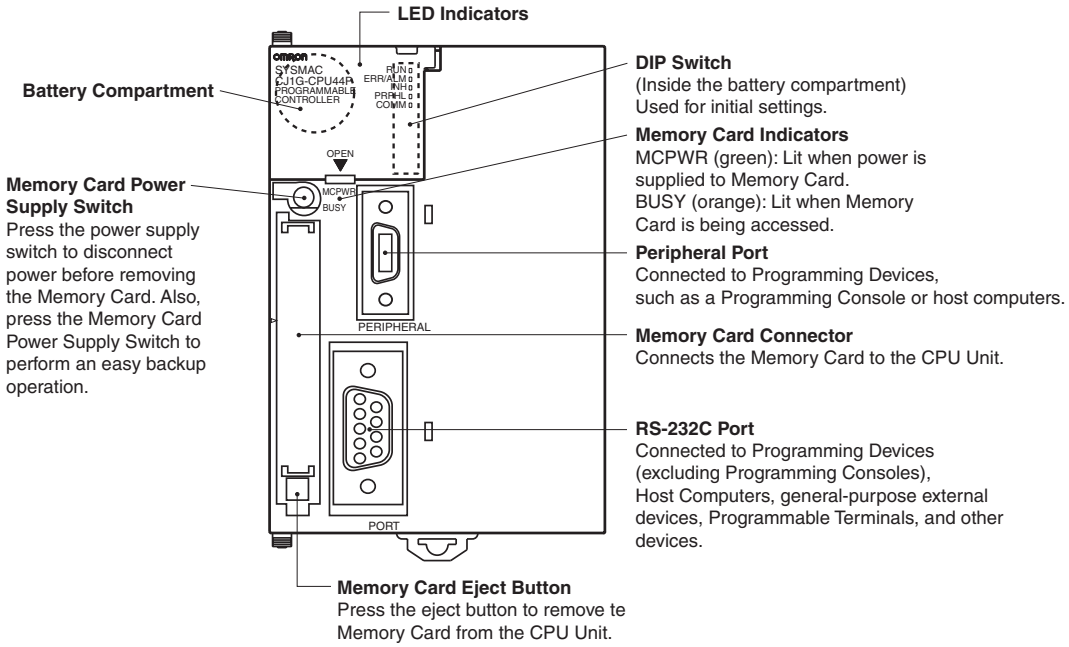
Loop Controller		Programming Device	
Functional element name	**Functional element version**	**CX-Process Tool**	**CX-Programmer (See note.)**
CJ1G-CPU□□H	Ver.3.0	–	Ver. 5.0 or higher
	Ver.4.0		Ver. 7.0 or higher

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	

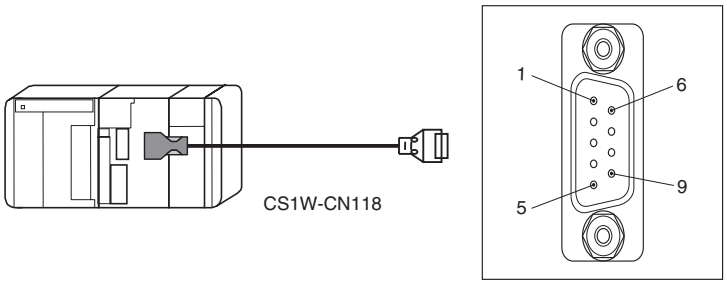
External Interface

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	–

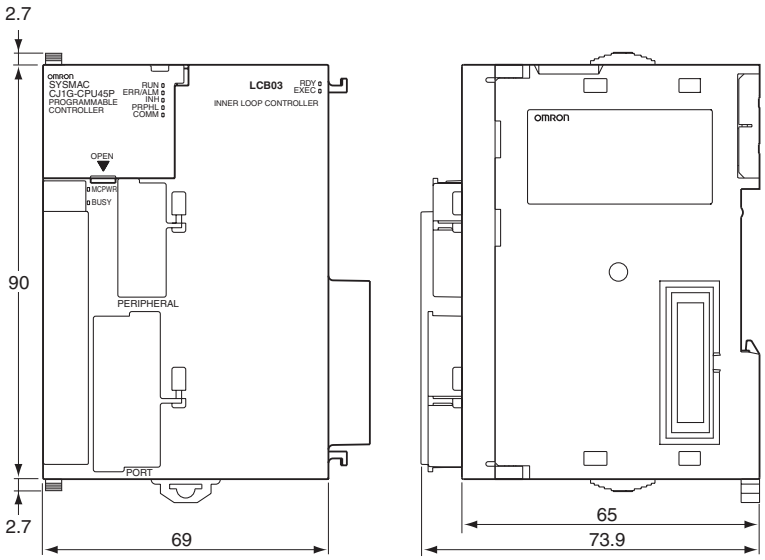
Dimensions

(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□□C-E 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, CJ1MCPU□□, 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, CS1DCPU□□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.
W340	SYSMAC CS/CJ Series Programmable Controllers Instructions Reference Manual CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1DCPU□□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.