



## Automatización Eléctrica

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## SYSMAC CP Series CP1L-J\_D\_ CP1L-L\_D\_ CP1L-M\_D\_

## **CP1L CPU Unit**

# **OPERATION MANUAL**



## CP1L-J14D ---CP1L-J20D ---CP1L-L10D ---CP1L-L14D ---CP1L-L20D ---CP1L-M30D ---CP1L-M40D ---CP1L-M60D ---

## **CP1L CPU Unit**

## **Operation Manual**

Revised August 2008

## Notice:

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

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

- **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.
- **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
- **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

## **OMRON Product References**

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

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

The abbreviation "PLC" means Programmable Controller. "PC" is used, however, in some CX-Programmer displays to mean Programmable Controller.

## Visual Aids

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

- **Note** Indicates information of particular interest for efficient and convenient operation of the product.
- *1,2,3...* 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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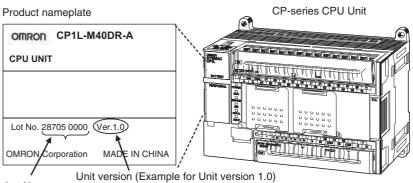
No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

## Unit Versions of CP-series CPU Units

### **Unit Versions**

Notation of Unit Versions on Products A "unit version" has been introduced to manage CPU Units in the CP Series according to differences in functionality accompanying Unit upgrades.

The unit version is given to the right of the lot number on the nameplate of the products for which unit versions are being managed, as shown below.



Lot No.

Confirming Unit Versions with Support Software

CX-Programmer version 7.3 or higher can be used to confirm the unit version of the CP1L-L CPU Unit with 10 I/O points.

CX-Programmer version 7.22 or higher can be used to confirm the unit version of the CP1L-J CPU Unit.

CX-Programmer version 7.1 or higher can be used to confirm the unit version of the CP1L-L and CP1L-M CPU Unit with 14, 20, 30, 40 or 60 I/O points.

Note CX-Programmer version 7.2 or lower cannot be used to confirm unit versions for CP1L-L CPU Units with 10 I/O points.

CX-Programmer version 7.21 or lower can be used to confirm the unit version of the CP1L-J CPU Unit.

CX-Programmer version 7.0 or lower cannot be used to confirm unit versions for CP1L-L and CP1L-M CPU Units with 14, 20, 30, 40 or 60 I/O points.

#### ■ Confirmation Procedure

#### Procedure When the Device Type and CPU Type Are Known

*1,2,3...* 1. Set the *Device Type* Field in the Change PLC Dialog Box to *CP1L*.

Change PLC	×
Device Name	
NewPLC1	
Device Type	
CP1L	Settings
CP1L CPM1(CPM1A) CPM2* CPM2*.S* CQM1 CQM1H CS1D-H CS1D-H CS1D-S	Settings
OK Cancel	Help

2. Click the **Settings** Button by the *Device Type* Field and, when the Device Type Settings Dialog Box is displayed, set the *CPU Type* Field to *J*, *L*, *L10* or *M*.

Devid	ce Type Settings [CP1L]	
Gener	ral	
	СРИ Туре	
	M	
	T LIO L M Read Only	
	Expansion Memory None - Read Only	
	File Memory None Read Only	
	Timer / Clock	
	Make Default	
	OK Cancel <u>H</u> el	p

Untitled - CX-Programme			tion1 [Diagram]]		_ & ×
🦻 File Edit View Insert			1 million		_ & ×
직 옷 Q	Work Online     Work Online     Work Online     Simulation     Auto Ogline     Operating Mode     Mgnitor     Comple All PLC Programs     Program Check Options	F7	Name : NewProgram11		
e) Settings (b) Error log (c) PLC Clock → Memory E ← NewProgram → Symbo ⊕ Symbo ⊕ END ↓ Function Blocke	Program Assignments Program Assignments Function Block Memory Transfer Partial Transfer Protection Clear All Memory Areas				
	Edit		Information     Information     Settings     Memory Cassette/DM     De Error Log     Memory     Memory     Memory     Memory     Memory     Memory     Memory     Memory		vī
Project /		× Name	e:      Clock	alue: Comment:	
	LC1/NewProgram1] gs. ccked with the program check				
	nd Report 入 Transfer /				1 <u>+</u>
nows details of the online PLC		NewPLC1(	Net:0,Node:0) - Stop/Program Mod	le rung 0 (0, 0) - 100%	
🚺 Start 📄 💺 🌺 🥭	» 📃 Untitled - CX	-Progra DE:\		.bmp - Paint	« 🧐 4:20 PM

3. Go online and select PLC - Edit - Information

The PLC Information Dialog Box will be displayed.

PLC Information - Ne	wPLC1		×
Project PLC type:	CP1L M		Close
- Actual Characteristic:			0.000
Type:	, CP1L M		
Unit Ver.:	1.0 <b>•</b>	Uni	it version
Program memory:	11264	Steps	
Useable:	10646		
		Steps	
Protected:	No		
Memory type:	•		
File/memory card:	No		
Data memory:	32768	Words	
Extension:	0	KWords	
EM banks:	0		
Bank size:		Words	
IO memory:	11.5	KWords	
Timer/counters:	8	KWords	
Manufacturing Detail	s		
Revision	А		
PCB Revision	AA-		
Software Revision	AA 0		
Lot Number	070323		
Manufacturing	_		
Serial Number			

Use the above display to confirm the unit version of the CPU Unit.

#### Procedure When the Device Type and CPU Type Are Not Known

This procedure is possible only when connected directly to the CPU Unit with a serial connection.

If you don't know the device type and CPU type that are connected directly to the CPU Unit on a serial line, select *PLC - Auto Online* to go online, and then select *PLC - Edit - Information* from the menus.

The PLC Information Dialog Box will be displayed and can be used to confirm the unit version of the CPU Unit.

LC Information - New	PLC1			X
Project PLC type:	CP1L M		Close	
-Actual Characteristics			1	
Туре:	CP1L M	_		
Unit Ver.:	1.0 ┥ 🗕	Ur	it version	
Program memory:	11264	Steps		
Useable:	10646	Steps		
Protected:	No			
Memory type:				
File/memory card:	No			
Data memory:	32768	Words		
Extension:	0	KWords		
EM banks:	0			
Bank size:		Words		
10 memory:	11.5	KWords		
Timer/counters:	8	KWords		
- Manufacturing Details			-	
Revision	A			
PCB Revision	AA-			
Software Revision	AA O			
Lot Number	070323			
Manufacturing	_			
Serial Number				

## Using the Unit Version Labels

The following unit version labels are provided with the CPU Unit.



These labels can be attached to the front of previous CPU Units to differentiate between CPU Units of different unit versions.

#### Functions Supported by Unit Version for CP-series CPU Units

#### Functions Supported by Unit Version 1.0 and 1.1

Functionality is the same as that for CS/CJ-series CPU Units with unit version 3.0. The functionality added for CS/CJ-series CPU Unit unit version 4.0 is not supported.

#### CP1H CPU Units

- CX-Programmer version 6.11 or higher is required to use CP1H-X
- CX-Programmer version 6.20 or higher is required to use CP1H-Y

CPU Unit		CP1H CPU Unit		
Model		CP1H-000-0		CP1H-Y
		CP1H-XA		
		(See note 1.)		(See note 2.)
	Unit version	Ver. 1.1 or later	Ver. 1.0	Ver. 1.1
Function				
Pulse outputs	Allocated built- in I/O terminals	4 axes at 100 kHz	2 axes at 100 kHz	2 axes at 100 kHz
			2 axes at 30 kHz	
	Special pulse output terminals	None		2 axes at 1 MHz

**Note** 1. The unit version for the CP1H-X

- 2. The unit version for the CP1H-Y
- 3. CX-Programmer version 7.11 or higher is required to use CP1L CPU Units with unit version 1.0.
- 4. CX-Programmer version 7.3 or higher is required to use CP1L CPU Units with 10 I/O points.

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## About this Manual:

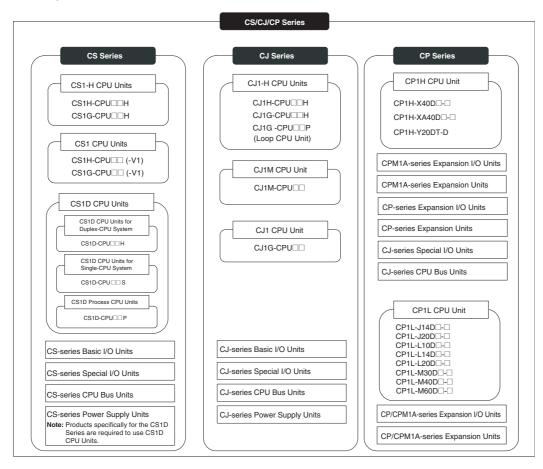
This manual describes installation and operation of the CP-series Programmable Controllers (PLCs) and includes the sections described below. The CP Series provides advanced package-type PLCs based on OMRON's advanced control technologies and vast experience in automated control.

Please read this manual carefully and be sure you understand the information provided before attempting to install or operate a CP-series PLC. Be sure to read the precautions provided in the following section.

#### **Definition of the CP Series**

The CP Series is centered around the CP1H and CP1L CPU Units and is designed with the same basic architecture as the CS and CJ Series. Always use CP-series Expansion Units and CP-series Expansion I/O Units when expanding I/O capacity.

I/O words are allocated in the same way as the CPM1A/CPM2A PLCs, i.e., using fixed areas for inputs and outputs.



*Precautions* provides general precautions for using the Programmable Controller and related devices.

**Section 1** introduces the features of the CP1L and describes its configuration. It also describes the Units that are available and connection methods for Programming Devices and other peripheral devices.

Section 2 describes the names and functions of CP1L parts and provides CP1L specifications.

Section 3 describes how to install and wire the CP1L.

Section 4 describes the structure and functions of the I/O Memory Areas and Parameter Areas.

Section 5 describes the CP1L's interrupt and high-speed counter functions.

*Section 6* describes all of the advanced functions of the CP1L that can be used to achieve specific application needs.

Section 7 describes how to use CP-series Expansion Units and Expansion I/O Units

*Section 8* describes the processes used to transfer the program to the CPU Unit and the functions that can be used to test and debug the program.

*Section 9* provides information on hardware and software errors that occur during CP1L operation *Section 10* provides inspection and maintenance information.

The *Appendices* provide product lists, dimensions, tables of Auxiliary Area allocations, and a memory map.

## **Related Manuals**

The following manuals are used for the CP1L CPU Units	s. Refer to these manuals as required.

Cat. No.	Model numbers	Manual name	Description
W462	CP1L-J14D CP1L-J20D CP1L-L10D CP1L-L14D CP1L-L20D CP1L-M30D CP1L-M40D CP1L-M60D CP1L-M60D	SYSMAC CP Series CP1L CPU Unit Oper- ation Manual	<ul> <li>Provides the following information on the CP Series:</li> <li>Overview, design, installation, maintenance, and other basic specifications</li> <li>Features</li> <li>System configuration</li> <li>Mounting and wiring</li> <li>I/O memory allocation</li> <li>Troubleshooting</li> <li>Use this manual together with the CP1L Programmable Controllers Programming Manual (W451).</li> </ul>
W451	CP1H-X40D CP1H-XA40D CP1H-Y20DT-D CP1L-J14D CP1L-J20D CP1L-L10D CP1L-L10D CP1L-L14D CP1L-L20D CP1L-M30D CP1L-M40D CP1L-M6	SYSMAC CP Series CP1H /CP1L CPU Unit Programming Manual	<ul> <li>Provides the following information on programming the CP Series:</li> <li>Programming methods</li> <li>Tasks</li> <li>Programming instructions</li> </ul>
W461	CP1L-J14D CP1L-J20D CP1L-L10D CP1L-L14D CP1L-L20D CP1L-L20D CP1L-M30D CP1L-M40D CP1L-M40D CP1L-M60D -	SYSMAC CP Series CP1L CPU Unit Intro- duction Manual	<ul> <li>Describes basic setup methods of CP1L PLCs:</li> <li>Basic configuration and component names</li> <li>Mounting and wiring</li> <li>Programming, data transfer, and debugging using the CX-Programmer</li> <li>Application program examples</li> </ul>
W446	WS02-CXPC1-E-V73	SYSMAC CX-Pro- grammer Ver. 7.2 Operation Manual	Provides information on installing and operating the CX-Programmer for all functions except for function blocks.
W447	WS02-CXPC1-E-V73	SYSMAC CX-Pro- grammer Ver. 7.1 Operation Manual Function Blocks	Provides specifications and operating procedures for function blocks. Function blocks can be used with CX-Programmer Ver. 7.1 or higher and a CP1L CPU Unit. Refer to W446 for operating procedures for functions other than function blocks.
W463	CXONE-AL C-EV2	CX-One Setup Man- ual	Provides an overview of and describes how to install the CX-One FA Integrated Tool Package.
W464		CX-Integrator Opera- tion Manual	Describes operating the CX-Integrator, including operations to build networks (e.g., setting data links, routing tables, and Communications Units.

Cat. No.	Model numbers	Manual name	Description
W344	WS02-PSTC1-E	CX-Protocol Opera- tion Manual	Provides operating procedures for creating protocol macros (i.e., communications sequences) with the CX-Protocol and other information on protocol macros.
			The CX-Protocol is required to create protocol mac- ros for user-specific serial communications or to customize the standard system protocols.
W342	CS1G/H-CPU H CS1G/H-CPUV1 CS1D-CPU H	NSJ-series Communi- cations Commands	Describes commands addressed to CS-series, CJ- series, and CP-series CPU Units, including C-mode commands and FINS commands.
	CS1D-CPU S CS1W-SCUV1 CS1W-SCBV1 CJ1G/H-CPU H CJ1G-CPU P CJ1M-CPU C CJ1G-CPU C CJ1W-SCUV1		Note This manual describes on commands address to CPU Units regardless of the com- munications path. (CPU Unit serial ports, Serial Communications Unit/Board ports, and Communications Unit ports can be used.) Refer to the relevant operation manuals for information on commands addresses to Spe- cial I/O Units and CPU Bus Units.

## Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

## Warranty and Limitations of Liability

### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

### LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

## **Application Considerations**

### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

### **PROGRAMMABLE PRODUCTS**

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

## Disclaimers

### CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

### PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

### ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

## PRECAUTIONS

This section provides general precautions for using the CP-series Programmable Controllers (PLCs) and related devices. The information contained in this section is important for the safe and reliable application of Programmable Controllers. You must read this section and understand the information contained before attempting to set up or operate a PLC system.

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### 1 Intended Audience

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

1

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

### 2 General Precautions

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

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

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

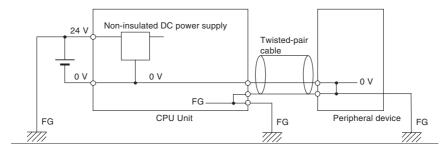
This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

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

### 3 Safety Precautions

- **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.
- WARNING Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.
- **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.
- **WARNING** Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another external factor affecting the PLC operation. Not doing so may result in serious accidents.
  - Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

- The PLC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
- The PLC or outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-V DC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- **WARNING** Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents.
- WARNING Do not apply the voltage/current outside the specified range to this unit. It may cause a malfunction or fire.
  - **Caution** Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.
  - Caution Confirm safety at the destination node before transferring a program to another node or editing the I/O area. Doing either of these without confirming safety may result in injury.
  - Caution Tighten the screws on the terminal block of the AC power supply to the torque specified in this manual. The loose screws may result in burning or malfunction.
  - Caution Do not touch anywhere near the power supply parts or I/O terminals while the power is ON, and immediately after turning OFF the power. The hot surface may cause burn injury.
  - **Caution** Pay careful attention to the polarities (+/-) when wiring the DC power supply. A wrong connection may cause malfunction of the system.
  - ▲ Caution When connecting the PLC to a computer or other peripheral device, either ground the 0 V side of the external power supply or do not ground the external power supply at all. Otherwise the external power supply may be shorted depending on the connection methods of the peripheral device. DO NOT ground the 24 V side of the external power supply, as shown in the following diagram.



- **Caution** After programming (or reprogramming) using the IOWR instruction, confirm that correct operation is possible with the new ladder program and data before starting actual operation. Any irregularities may cause the product to stop operating, resulting in unexpected operation in machinery or equipment.
- ▲ Caution The CP1L CPU Units automatically back up the user program and parameter data to flash memory when these are written to the CPU Unit. I/O memory (including the DM Area, counter present values and Completion Flags, and HR Area), however, is not written to flash memory. The DM Area, counter present values and Completion Flags, and HR Area can be held during power interruptions with a battery. If there is a battery error, the contents of these areas may not be accurate after a power interruption. If the contents of the DM Area, counter present values and Completion Flags, and Completion Flags, and HR Area are used to control external outputs, prevent inappropriate outputs from being made whenever the Battery Error Flag (A402.04) is ON.

### 4 **Operating Environment Precautions**

**Caution** Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.
- **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:
  - Locations subject to static electricity or other forms of noise.
  - Locations subject to strong electromagnetic fields.
  - · Locations subject to possible exposure to radioactivity.
  - Locations close to power supplies.
- ▲ Caution The operating environment of the PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. Make sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

## 5 Application Precautions

Observe the following precautions when using the PLC System.

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

- Always connect to 100  $\Omega$  or less when installing the Units. Not connecting to a ground of 100  $\Omega$  or less may result in electric shock.
- Always turn OFF the power supply to the PLC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting Expansion Units or any other Units
  - · Connecting or removing the Memory Cassette or Option Board
  - Setting DIP switches or rotary switches
  - · Connecting or wiring the cables
  - Connecting or disconnecting the connectors
- **Caution** Failure to abide by the following precautions could lead to faulty operation of the PLC or the system, or could damage the PLC or PLC Units. Always heed these precautions.
  - Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
  - Mount the Unit only after checking the connectors and terminal blocks completely.
  - Be sure that all the terminal screws and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
  - Wire all connections correctly according to instructions in this manual.
  - Always use the power supply voltage specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
  - Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
  - Leave the label attached to the Unit when wiring. Removing the label may result in malfunction.
  - Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
  - Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
  - Do not apply voltages to the input terminals in excess of the rated input voltage. Excess voltages may result in burning.
  - Do not apply voltages or connect loads to the output terminals in excess of the maximum switching capacity. Excess voltage or loads may result in burning.

- Be sure that the terminal blocks, connectors, Option Boards, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Wire correctly and double-check all the wiring or the setting switches before turning ON the power supply. Incorrect wiring may result in burning.
- Check that the DIP switches and data memory (DM) are properly set before starting operation.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Resume operation only after transferring to the new CPU Unit the contents of the DM, HR, and CNT Areas required for resuming operation. Not doing so may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
  - Changing the operating mode of the PLC (including the setting of the startup operating mode).
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables. Doing so may break the cables.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching the Unit, be sure to first touch a grounded metallic object in order to discharge any static buildup. Not doing so may result in malfunction or damage.
- Do not touch the Expansion I/O Unit Connecting Cable while the power is being supplied in order to prevent malfunction due to static electricity.
- Do not turn OFF the power supply to the Unit while data is being transferred.
- When transporting or storing the product, cover the PCBs and the Units or put there in the antistatic bag with electrically conductive materials to prevent LSIs and ICs from being damaged by static electricity, and also keep the product within the specified storage temperature range.
- Do not touch the mounted parts or the rear surface of PCBs because PCBs have sharp edges such as electrical leads.
- Double-check the pin numbers when assembling and wiring the connectors.
- Wire correctly according to specified procedures.
- Do not connect pin 6 (+5V) on the RS-232C Option Board (CP1W-CIF01) on the CPU Unit to any external device other than the NT-AL001 or CJ1W-CIF11 Conversion Adapter. The external device and the CPU Unit may be damaged.

- Use the dedicated connecting cables specified in this manual to connect the Units. Using commercially available RS-232C computer cables may cause failures in external devices or the CPU Unit.
- The user program and parameter area data in the CPU Unit is backed up in the built-in flash memory. The BKUP indicator will light on the front of the CPU Unit when the backup operation is in progress. Do not turn OFF the power supply to the CPU Unit when the BKUP indicator is lit. The data will not be backed up if power is turned OFF.
- Do not turn OFF the power supply to the PLC while the Memory Cassette is being written. Doing so may corrupt the data in the Memory Cassette. The BKUP indicator will light while the Memory Cassette is being written. Wait for the BKUP indicator to go out before turning OFF the power supply to the PLC.
- Before replacing the battery, supply power to the CPU Unit for at least 5 minutes and then complete battery replacement within 5 minutes of turn OFF the power supply. Memory data may be corrupted if this precaution is not observed.
- Always use the following size wire when connecting I/O terminals: AWG22 to AWG18 (0.32 to 0.82 mm<sup>2</sup>).
- Dispose of the product and batteries according to local ordinances as they apply.

Have qualified specialists properly dispose of used batteries as industrial waste.



- UL standards required that batteries be replaced only by experienced technicians. Do not allow unqualified persons to replace batteries. Also, always follow the replacement procedure provided in the manual.
- Never short-circuit the positive and negative terminals of a battery or charge, disassemble, heat, or incinerate the battery. Do not subject the battery to strong shocks or deform the barry by applying pressure. Doing any of these may result in leakage, rupture, heat generation, or ignition of the battery. Dispose of any battery that has been dropped on the floor or otherwise subjected to excessive shock. Batteries that have been subjected to shock may leak if they are used.
- Always construct external circuits so that the power to the PLC it turned ON before the power to the control system is turned ON. If the PLC power supply is turned ON after the control power supply, temporary errors may result in control system signals because the output terminals on DC Output Units and other Units will momentarily turn ON when power is turned ON to the PLC.
- Fail-safe measures must be taken by the customer to ensure safety in the event that outputs from Output Units remain ON as a result of internal circuit failures, which can occur in relays, transistors, and other elements.
- If the I/O Hold Bit is turned ON, the outputs from the PLC will not be turned OFF and will maintain their previous status when the PLC is switched from RUN or MONITOR mode to PROGRAM mode. Make sure that the external loads will not produce dangerous conditions when this occurs. (When operation stops for a fatal error, including those produced with the FALS(007) instruction, all outputs from Output Unit will be turned OFF and only the internal output status will be maintained.)

### 6 Conformance to EC Directives

#### 6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

#### 6-2 Concepts

#### **EMC Directives**

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

6

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

Note The applicable EMC (Electromagnetic Compatibility) standard is EN61131-2.

#### Low Voltage Directive

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

#### 6-3 Conformance to EC Directives

The CP1L PLCs comply with EC Directives. To ensure that the machine or device in which the CP1L PLC is used complies with EC Directives, the PLC must be installed as follows:

- 1,2,3... 1. The CP1L PLC must be installed within a control panel.
  - 2. You must use reinforced insulation or double insulation for the DC power supplies used for I/O Units and CPU Units requiring DC power. The output holding time must be 10 ms minimum for the DC power supply connected to the power supply terminals on Units requiring DC power.
  - 3. CP1L PLCs complying with EC Directives also conform to EN61131-2. Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.

#### 6-4 Relay Output Noise Reduction Methods

The CP1L PLCs conforms to the Common Emission Standards (EN61131-2) of the EMC Directives. However, noise generated by relay output switching may not satisfy these Standards. In such a case, a noise filter must be connected to the load side or other appropriate countermeasures must be provided external to the PLC.

Countermeasures taken to satisfy the standards vary depending on the devices on the load side, wiring, configuration of machines, etc. Following are examples of countermeasures for reducing the generated noise.

#### **Countermeasures**

Countermeasures are not required if the frequency of load switching for the whole system with the PLC included is less than 5 times per minute.

Countermeasures are required if the frequency of load switching for the whole system with the PLC included is more than 5 times per minute.

**Note** Refer to EN61131-2 for more details.

#### **Countermeasure Examples**

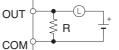
When switching an inductive load, connect an surge protector, diodes, etc., in parallel with the load or contact as shown below.

Circuit Cur		rent	Characteristic	Required element	
	AC	DC			
CR method	Yes	Yes	If the load is a relay or solenoid, there is a time lag between the moment the cir- cuit is opened and the moment the load is reset. If the supply voltage is 24 or 48 V, insert the surge protector in parallel with the load. If the supply voltage is 100 to 200 V, insert the surge protector between the contacts.	The capacitance of the capacitor must be 1 to 0.5 $\mu$ F per contact current of 1 A and resistance of the resistor must be 0.5 to 1 $\Omega$ per contact voltage of 1 V. These values, however, vary with the load and the characteristics of the relay. Decide these values from experi- ments, and take into consideration that the capacitance suppresses spark dis- charge when the contacts are sepa- rated and the resistance limits the current that flows into the load when the circuit is closed again.	
				The dielectric strength of the capacitor must be 200 to 300 V. If the circuit is an AC circuit, use a capacitor with no polarity.	
Diode method	No	Yes	The diode connected in parallel with the load changes energy accumulated by the coil into a current, which then flows into the coil so that the current will be converted into Joule heat by the resistance of the inductive load.	The reversed dielectric strength value of the diode must be at least 10 times as large as the circuit voltage value. The forward current of the diode must be the same as or larger than the load current.	
			This time lag, between the moment the circuit is opened and the moment the load is reset, caused by this method is longer than that caused by the CR method.	The reversed dielectric strength value of the diode may be two to three times larger than the supply voltage if the surge protector is applied to electronic circuits with low circuit voltages.	
Varistor method	Yes	Yes	The varistor method prevents the impo- sition of high voltage between the con- tacts by using the constant voltage characteristic of the varistor. There is time lag between the moment the cir- cuit is opened and the moment the load is reset. If the supply voltage is 24 or 48 V, insert		
			the varistor in parallel with the load. If the supply voltage is 100 to 200 V, insert the varistor between the con- tacts.		

When switching a load with a high inrush current such as an incandescent lamp, suppress the inrush current as shown below.

#### Countermeasure 1

lamp



k current of

Providing a dark current of approx. one-third of the rated value through an incandescent

## 

**Countermeasure 2** 

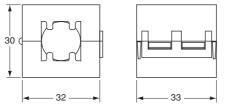
Providing a limiting resistor

#### 6-5 Conditions for Meeting EMC Directives when Using CP/CPM1A Relay Expansion I/O Units

EN61131-2 immunity testing conditions when using the CP1W-40EDR, CPM1A-40EDR, CP1W-32ER, CP1W-16ER, or CPM1A-16ER with a CP1W-CN811 I/O Connecting Cable are given below.

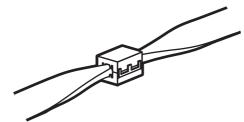
#### **Recommended Ferrite Core**

Ferrite Core (Data Line Filter): 0443-164151 manufactured by Nisshin Electric Minimum impedance: 90  $\Omega$  at 25 MHz, 160  $\Omega$  at 100 MHz



#### **Recommended Connection Method**

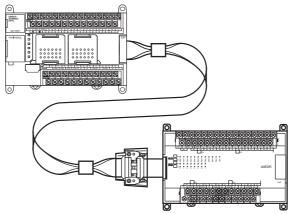
1,2,3... 1. Cable Connection Method



6

2. Connection Method

As shown below, connect a ferrite core to each end of the CP1W-CN811 I/O Connecting Cable.



## SECTION 1 Features and System Configuration

This section introduces the features of the CP1L and describes its configuration. It also describes the Units that are available and connection methods for the CX-Programmer and other peripheral devices.

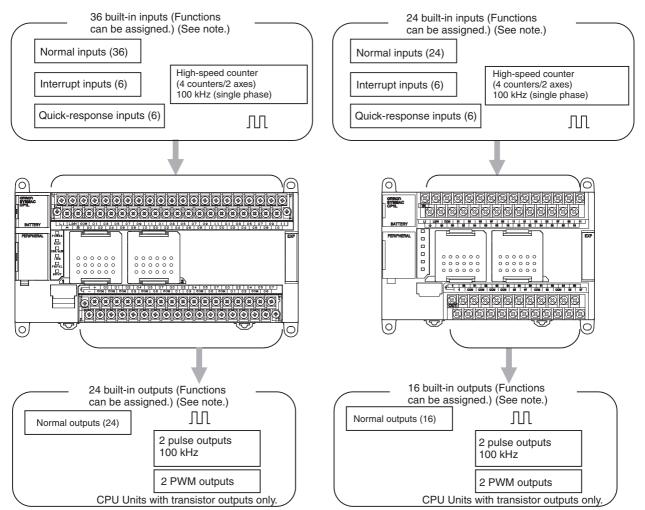
1-1	1 Features and Main Functions				
	1-1-1	CP1L Overview	2		
	1-1-2	Features	7		
1-2	System Configuration				
	1-2-1	Basic System	15		
	1-2-2	System Expansion	18		
	1-2-3	Restrictions on System Configuration	21		
1-3	Connecting the CX-Programmer				
	1-3-1	Connecting with a Commercially Available USB Cable	24		
	1-3-2	Connecting to a Serial Port	31		
1-4	Function	n Charts	33		
1-5	Function Blocks				
	1-5-1	Overview of Function Blocks	34		
	1-5-2	Advantages of Function Blocks	34		

### 1-1-1 CP1L Overview

The SYSMAC CP1L PLCs are the low end PLCs in the SYSMAC CP Series of package-type Programmable Controllers. They have the smallest program and I/O capacity. The CP1L PLCs are the same size as the CPM1A and CPM2A PLCs, but offer many more features and high performance.

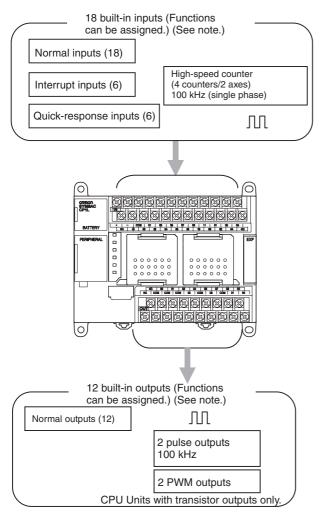
### CPU Units with 60 I/O Points: CP1L-M60D ----

- The CPU Unit has 36 inputs and 24 outputs built in.
- The PLC can be expanded to a maximum total of 180 I/O points by using CP-series Expansion I/O Units.
- The CPU Unit has 24 inputs and 16 outputs built in.
- The PLC can be expanded to a maximum total of 160 I/O points by using CP-series Expansion I/O Units.



### CPU Units with 30 I/O Points: CP1L-M30D -----

- The CPU Unit has 18 inputs and 12 outputs built in.
- The PLC can be expanded to a maximum total of 150 I/O points by using CP-series Expansion I/O Units.



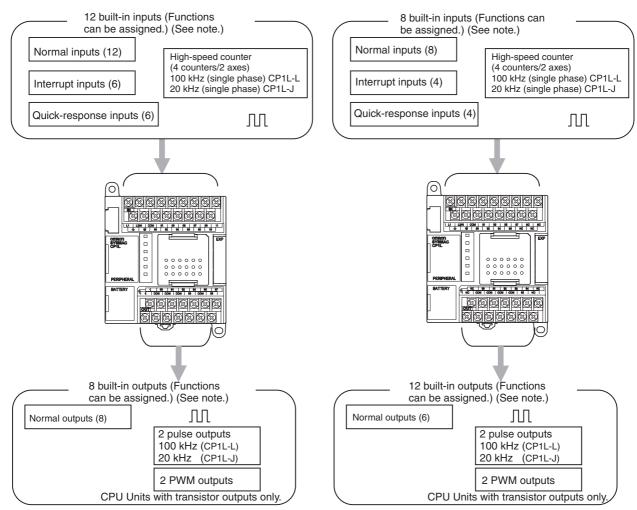
- Four high-speed counters for two axes and two pulse outputs for two axes can be used with the CPU Unit alone.
- Using CP-series Expansion Units also allows extra functions (such as temperature sensor inputs) to be added.
- Installing an Option Board enables RS-232C and RS-422A/485 communications for Programmable Terminals, Bar Code Readers, Inverters, etc.
- **Note** Settings in the PLC Setup determine whether each input point is to be used as a normal input, interrupt input, quick-response input, or high-speed counter. The instruction used to control each output point determines whether it is used as a normal output, pulse output, or PWM output.

#### CPU Units with 20 I/O Points: CP1L-L20D -- and CPU Units with 14 I/O Points: CP1L-L14D -- and CP1L-J20D

- The CPU Unit has 12 inputs and 8 outputs built in.
- The PLC can be expanded to a maximum total of 60 I/O points by using CP-series Expansion I/O Units.

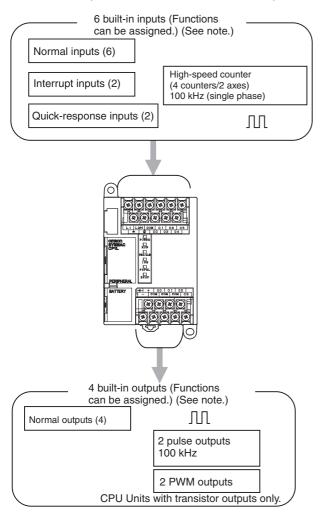
# CP1L-J14D

- The CPU Unit has 8 inputs and 6 outputs built in.
- The PLC can be expanded to a maximum total of 54 I/O points by using CP-series Expansion I/O Units.



### 

- The CPU Unit has 6 inputs and 4 outputs built in.
- The PLC cannot use CP-series Expansion I/O Units to expand the maximum total of I/O points.



- Four high-speed counters for two axes and two pulse outputs for two axes can be used with the CPU Unit alone.
- Using CP-series Expansion Units also allows extra functions (such as temperature sensor inputs) to be added.
- Installing an Option Board enables RS-232C and RS-422A/485 communications for Programmable Terminals, Bar Code Readers, Inverters, etc.
- **Note** Settings in the PLC Setup determine whether each input point is to be used as a normal input, interrupt input, quick-response input, or high-speed counter. The instruction used to control each output point determines whether it is used as a normal output, pulse output, or PWM output.

### CP1L CPU Units

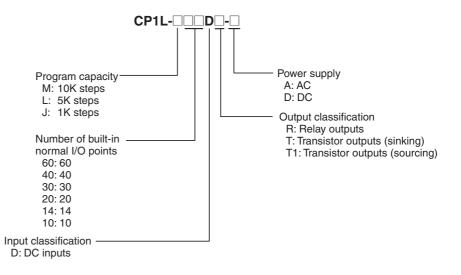
	Туре	M CPU Units			L CPU Units			
Model Power supply		CP1L-M60DR-A         CP1L-M40DR-A         CP1L-M30DR-A         CP1L- CP1L-M60DR-D         CP1L-M40DR-D         CP1L-M30DR-D         CP1L- CP1L-M60DT-A         CP1L-M40DT-A         CP1L-M30DT-A         CP1L- CP1L-M60DT-D         CP1L-M40DT-D         CP1L-M30DT-D         CP1L- CP1L-M30DT-D         CP1L- CP1L-M30DT-D         CP1L- CP1L- CP1L-M30DT-D         CP1L- CP1L- CP1L- CP1L-           Models with AC power (model numbers ending in "-A"         CML         CML         CML				CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT1-D CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DT1-D	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT1-E	
		100 to 240	V AC, 50/60 Hz					
Program	capacity	10K steps			5K steps J models : 1K steps			
Maximum I/O points	n number of	180 (See note 1.)	160 (See note 1.)	150 (See note 1.)	60 (See note 2.)	54 (See note 2.)	10 (See note 3.)	
Normal	I/O points	60	40	30	20	14	10	
I/O	Input points	36	24	18	12	8	6	
	Input specifications	24 VDC	24 VDC					
	Interrupt or quick-response inputs	6 max			4 max	2 max		
	Output points	24	16	12	8	6	4	
	Output	Relay outputs: Model numbers with "R" before the final suffix						
specifications		Transistor outputs, sinking: Model numbers with "T" before the final suffix Transistor outputs, sourcing:Model numbers with "T1" before the final suffix						
High-speed counter inputs		4 counters/2 axes, 100 kHz (single-phase), 100 kHz for up/down pulses or pulse plus direction, 50 kHz for differential phases J models: 4 counters/2 axes, 20kHz (single-phase), 20kHz for up/down pulses or pulse plus direction, 10kHz for differential phases.						
Pulse outputs			z (transistor out ces, 20kHz (tran					

Note

 (1) Three Expansion I/O Units connected to a CP-series CPU Unit with 60, 40 or 30 I/O Points.

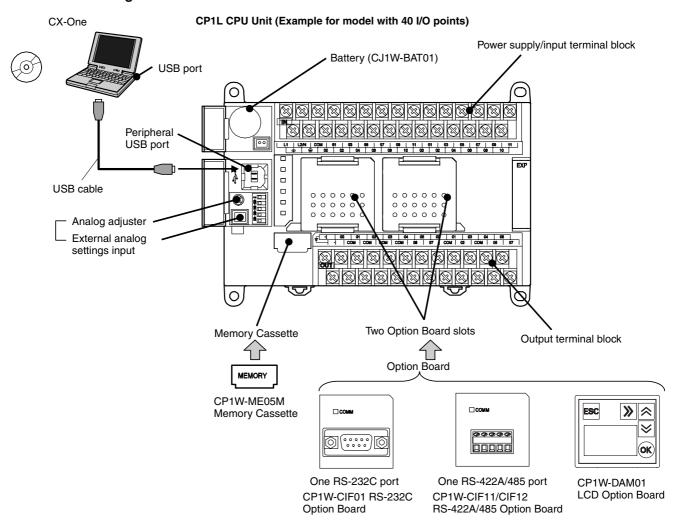
(2) One Expansion I/O Unit connected to a CP-series CPU Unit with 20 or 14 I/O Points.

### Interpreting CP1L CPU Unit Model Numbers



### 1-1-2 Features

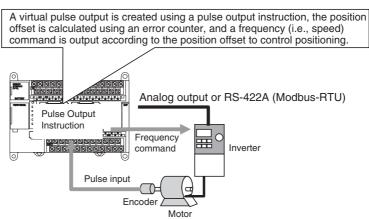
This section describes the main features of the CP1L.



### **Basic CP1L Configuration**

# Positioning with an Inverter

Positioning can be controlled using an inverter. Previously, an internal pulse output with trapezoidal acceleration/deceleration is created using the PULSE OUTPUT instruction. The position offset is calculated using an error counter for the feedback pulse input from a rotary encoder connected to an inductive motor and the internal pulse output. The error counter is then used to output a speed command to the inverter to control positioning. This enables positioning with high-capacity motors, as well as low-cost positioning with small-capacity motors (in comparison to using a servo).



Note

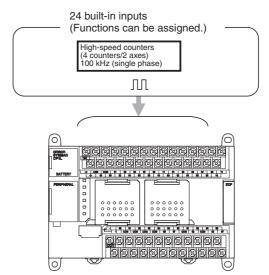
vector control.

### Full Complement of High-speed Counter Functions

High-speed counter inputs can be enabled by connecting rotary encoders to the built-in inputs. The ample number of high-speed counter inputs makes it possible to control a multi-axis device with a single PLC.

If high-precision positioning is required, we recommend using an inverter with

- Four 100-kHz (single phase)/50-kHz (differential phases) high-speed counter inputs (4 counters/2 axes) are provided as a standard feature. (See note.)
- For CP1L-J PLCs, four 20-kHz (single phase)/10-kHz (differential phases) high-speed counter inputs (4 counters/2 axes) are provided as a standard feature. (See note.)



**Note** Settings in the PLC Setup determine whether each input point is to be used as a normal input, interrupt input, quick-response input, or high-speed counter.

Full Complement of Highspeed Counter Functions

#### High-speed Processing for High-speed Counter Present Value (PV) Target Values or Range Comparison Interrupts

An interrupt task can be started when the count reaches a specified value or falls within a specified range.

### High-speed Counter Input Frequency (Speed) Monitoring

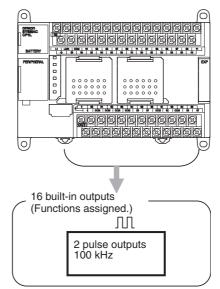
The input pulse frequency can be monitored using the PRV instruction (one point (counter 0) only, and you must select whether to use input frequency monitoring or counter 3; you cannot use both).

### High-speed Counter PV Holding/Refreshing

It is possible to toggle between holding and refreshing the high-speed counter PV by turning ON and OFF the High-speed Counter Gate Flag from the ladder program.

Positioning and speed control by a pulse-input servo driver is enabled by outputting fixed duty ratio pulse output signals from the CPU Unit's built-in outputs.

- Pulse outputs for 2 axes at 100 kHz maximum are provided as standard features. (See note.)
- For CP1L-J PLCs, pulse outputs for 2 axes at 20 kHz maximum are provided as standard features. (See note.)



**Note** The instruction used to control each output point determines whether it is used as a normal output, pulse output, or PWM output.

# Full Complement of PulseSelect CW/CCW Pulse Outputs or Pulse Plus Direction Outputs for the<br/>Pulse OutputsOutput FunctionsPulse Outputs

The pulse outputs can be selected to match the pulse input specifications of the motor driver.

### Easy Positioning with Absolute Coordinate System Using Automatic Direction Setting

For operations in an absolute coordinate system (i.e., when the origin is established or when the PV is changed by the INI instruction), the CW/CCW direction can be automatically set when PULSE OUTPUT instructions are executed according to whether the specified number of output pulses is more or less than the pulse output PV.

Versatile Pulse Control (CPU Units with Transistor Outputs Only)

### **Triangular Control**

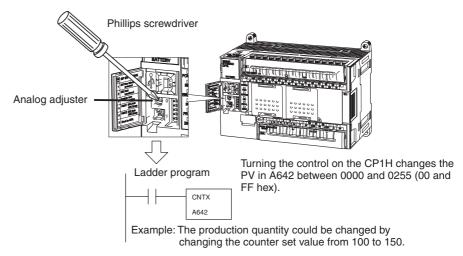
		If the amount of output pulses required for acceleration and deceleration (the target frequency times the time to reach the target frequency) exceeds the preset target number of output pulses during positioning (when the ACC instruction in independent mode or the PLS2 instruction is executed), the acceleration and deceleration will be shortened and triangular control will be executed instead of trapezoidal control. In other words, the trapezoidal pulse output will be eliminated, with no period of constant speed.
		Target Position Changes during Positioning (Multiple Start) While positioning using a PULSE OUTPUT (PLS2) instruction is in progress, the target position, target speed, acceleration rate, and deceleration rate can be changed by executing another PLS2 instruction.
		<b>Positioning Changes during Speed Control (Interrupt Feeding)</b> While speed control in continuous mode is in effect, it is possible to change to positioning in independent mode by executing a PULSE OUTPUT (PLS2) instruction. By this means, interrupt feeding (moving a specified amount) can be executed under specified conditions.
		Target Speed, Acceleration Rate, and Deceleration Rate Changes duringAcceleration or DecelerationWhen a PULSE OUTPUT instruction with trapezoidal acceleration and deceleration is executed (for speed control or positioning), the target speed and acceleration and deceleration rates can be changed during acceleration or deceleration.
		Lighting and Power Control by Outputting Variable Duty Ratio Pulses Operations, such as lighting and power control, can be handled by outputting variable duty ratio pulse (PWM) output signals from the CPU Unit's built-in outputs.
Origin Searches		<b>Origin Search and Origin Return Operations Using a Single Instruction</b> An accurate origin search combining all I/O signals (origin proximity input sig- nal, origin input signal, positioning completed signal, error counter reset out- put, etc.) can be executed with a single instruction. It is also possible to move directly to an established origin using an origin return operation.
Input Interrupts		In direct mode, an interrupt task can be started when a built-in input turns ON or OFF. In counter mode, the rising or falling edges of built-in inputs can be counted, and an interrupt task started when the count reaches a specified value. The maximum number of interrupt input points is 6 for CPU Units with 20, 30, 40 or 60 I/O points and 4 for CPU Units with 14 I/O points and 2 for CPU Units with 10 I/O points.
	Note	For each input point, a selection in the PLC Setup determines whether it is to be used as a normal input, interrupt input, quick-response input, or high- speed counter. The interrupt input response frequency in counter mode must be 5 kHz or less total for all interrupts.
<u>Quick-response</u> Inputs		By using quick-response inputs, built-in inputs up to a minimum input signal width of 50 $\mu$ s can be read regardless of the cycle time. The maximum number of quick-response input points is 6 for CPU Units with 20, 30, 40 or 60 I/O points and 4 for CPU Units with 14 I/O points and 2 for CPU Units with 10 I/O points.

#### Note

For each input, a PLC Setup parameter determines whether it is to be used as a normal input, interrupt input, quick-response input, or high-speed counter.

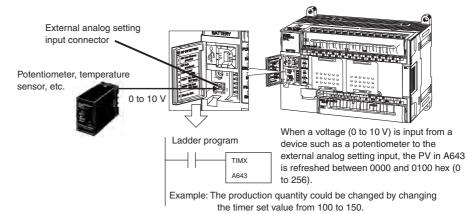
### Analog Settings

Changing Settings Using Analog Adjustment By adjusting the analog adjuster with a Phillips screwdriver, the value in the Auxiliary Area can be changed to any value between 0 and 255. This makes it easy to change set values such as timers and counters without Programming Devices.



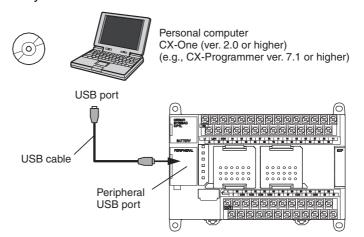
#### Changing Settings Using External Analog Setting Inputs

External analog values of 0 to 10 V (resolution: 256) are converted to digital values and stored in a word in the AR Area. This enables applications that require on-site adjustment of settings that do not demand a particularly high degree of accuracy, such as for example, a setting based on changes in outdoor temperatures or potentiometer inputs.



### **Connectability with Various Components**

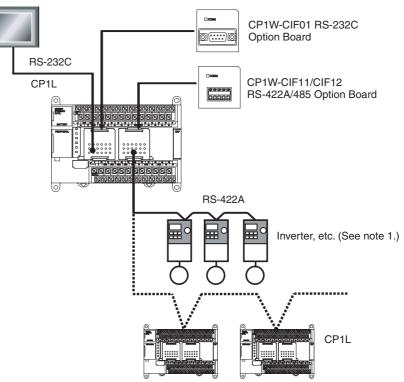
USB Port for Programming Devices CX-One Support Software, such as the CX-Programmer, connects from the USB port on a computer to the CP1L built-in peripheral USB port via commercially available USB cable.



# Expansion Capability for Serial Ports

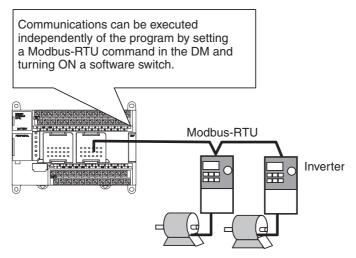
Up to two Serial Communications Boards each with one RS-232C port or one RS-422A/485 port can be added to a CPU Unit with 30, 40 or 60 I/O points. One Serial Communications Boards can be added to a CPU Unit with 20 or 14 I/O points. With a total of up to three ports, including the USB port, this makes it possible to simultaneously connect a computer, PT, CP1L, and/or various components, such as an Inverter, Temperature Controller, or Smart Sensor.

NS-series PT, personal computer, bar code reader, etc.

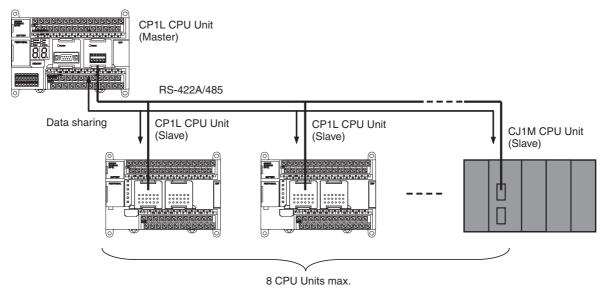


Note (1) The Modbus-RTU easy master (available for all models) makes it easy to control Modbus Slaves (such as Inverters) with serial communications. After the Modbus Slave address, function, and data have been preset in

a fixed memory area (DM), messages can be sent or received independently of the program by turning software switches.



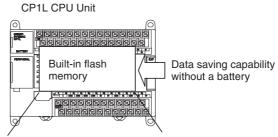
(2) By using the serial PLC Links, a maximum of 10 words of data per CPU Unit can be shared independently of the program among a maximum of nine CPU Units (CP1L-CP1L-CP1H/CJ1M) using RS-422A/485 Option Boards.



### **No-battery Operation**

Programs, the PLC Setup, and other data can be automatically saved to the CPU Unit's built-in flash memory. Moreover, DM Area data can be saved to the flash memory and then used as initial data when the power is turned ON.

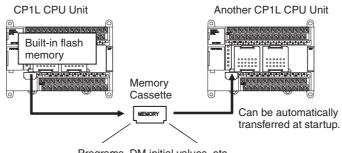
This allows programs and initial values (such as recipe setup data) in the DM Area to be saved in the CPU Unit without the need to maintain a backup battery.



Programs, DM initial values, etc.

### Memory Cassettes

Built-in flash memory data, such as programs and DM initial-value data, can be stored on a Memory Cassette (optional) as backup data. In addition, programs and initial-value data can be easily copied to another CPU Unit using the Memory Cassette to recreate the same system.



Programs, DM initial values, etc.

Note

Memory Cassette cannot be used in CP1L-J CPU Unit.

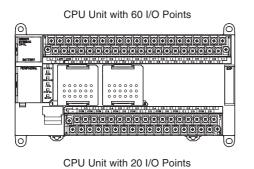
**Security** 

A password registration function is provided for the CPU Unit to prevent unauthorized copy of ladder programs. If an attempt is made to read a ladder program from a CX-Programmer, access to the program is denied if the password that is entered does not match the registered password. If incorrect passwords are entered for five consecutive attempts, the CPU Unit does not accept any more passwords for two hours.

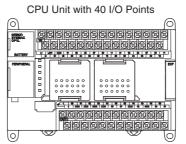
### Section 1-2

# 1-2 System Configuration

### 1-2-1 Basic System



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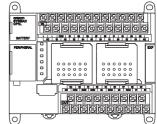


CPU Unit with 14 I/O Points

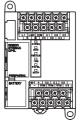
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CPU Unit with 30 I/O Points



CPU Unit with 10 I/O Points



### Maximum Number of Normal I/O Points

Туре	I/O capacity	Power supply voltage	Model	Normal built- in inputs	Normal built-in outputs	Weight
М	60 points	100 to 240 VAC	CP1L-M60DR-A	36 DC inputs	24 relay outputs	820 g max.
		24 VDC	CP1L-M60DR-D			730 g max.
		100 to 240 VAC	CP1L-M60DT-A		24 transistor (sinking) outputs	765 g max.
		24 VDC	CP1L-M60DT-D			680 g max.
			CP1L-M60DT1-D		24 transistor (sourcing) outputs	675 g max.
	40 points	100 to 240 VAC	CP1L-M40DR-A	24 DC inputs	16 relay outputs	675 g max.
		24 VDC	CP1L-M40DR-D			590 g max.
		100 to 240 VAC	CP1L-M40DT-A		16 transistor (sinking) outputs	645 g max.
		24 VDC	CP1L-M60DT-D			550 g max.
			CP1L-M40DT1-D		16 transistor (sourcing) outputs	550 g max.
	30 points	100 to 240 VAC	CP1L-M30DR-A	18 DC inputs	12 relay outputs	610 g max.
		24 VDC	CP1L-M30DR-D			525 g max.
		100 to 240 VAC	CP1L-M30DT-A		12 transistor (sinking) outputs	590 g max.
		24 VDC	CP1L-M30DT-D			495 g max.
			CP1L-M30DT1-D		12 transistor (sourcing) outputs	495 g max.

Туре	I/O capacity	Power supply voltage	Model	Normal built- in inputs	Normal built-in outputs	Weight
L	20 points 100 to 240 V		CP1L-L20DR-A	12 DC inputs	8 relay outputs	380 g max.
		24 VDC	CP1L-L20DR-D			350 g max.
		100 to 240 VAC	CP1L-L20DT-A	-	8 transistor (sinking) outputs	360 g max.
		24 VDC	CP1L-L20DT-D	-		335 g max.
			CP1L-L20DT1-D	-	8 transistor (sourcing) outputs	335 g max.
	14 points	100 to 240 VAC	CP1L-L14DR-A	8 DC inputs	6 relay outputs	380 g max.
		24 VDC	CP1L-L14DR-D	-		350 g max.
		100 to 240 VAC	CP1L-L14DT-A	-	6 transistor (sinking) outputs	360 g max.
		24 VDC	CP1L-L14DT-D			335 g max.
			CP1L-L14DT1-D	-	6 transistor (sourcing) outputs	335 g max.
	10 points	100 to 240 VAC	CP1L-L10DR-A	6 DC inputs	4 relay outputs	300 g max.
		24 VDC	CP1L-L10DR-D	-		275 g max.
		100 to 240 VAC	CP1L-L10DT-A		4 transistor (sinking) outputs	290 g max.
		24 VDC	CP1L-L10DT-D	-		270 g max.
			CP1L-L10DT1-D		4 transistor (sourcing) outputs	270 g max.
J	20 points	100 to 240 VAC	CP1L-J20DR-A	12 DC inputs	8 relay outputs	380 g max.
		24 VDC	CP1L-J20DR-D	-		350 g max.
			CP1L-J20DT1-D	-	8 transistor (sourcing) outputs	335 g max.
	14 points	100 to 240 VAC	CP1L-J14DR-A	8 DC inputs	6 relay outputs	380 g max.
		24 VDC	CP1L-J14DR-D	1		350 g max.
			CP1L-J14DT1-D		6 transistor (sourcing) outputs	335 g max.

### **Optional Products**

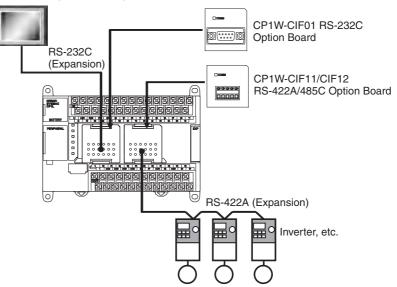
Item	Model	Specifications	Weight
Memory Cassette	CP1W-ME05M	Can be used to store user programs in flash memory, parameters, DM initial values, comment memory, FB pro- grams, and data in RAM.	10 g max.
LCD Option board	CP1W-DAM01	Can be used to monitor and change user-specified messages, time or other data of the PLC.	20 g max.

### <u>Serial</u> <u>Communications</u> <u>Expansion</u>

When serial communications are required for a CP1L CPU Unit, an RS-232C or RS-422A/485 Option Board can be added.

Two Option Boards can be mounted with a CPU Units with 30, 40 or 60 I/O points and one Option Board can be mounted with a CPU Units with 20 or 14 I/O points.

This enables connection by serial communications to NS-series PTs, Bar Code Readers, components such as Inverters, and computers without USB ports (such as when using the CX-Programmer).



NS-series PT, personal computer, bar code reader, etc.

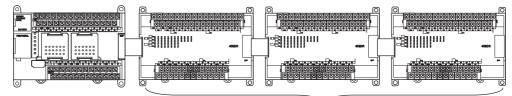
### **Option Boards for Serial Communications**

Appearance	Name	Model	Port	Serial communications modes
	RS-232C Option Board	CP1W-CIF01	One RS-232C port (D-Sub, 9 pins, female)	Host Link, NT Link (1: N or 1:1 Link Master, 1:1 Link Slave), No-protocol, Serial PLC Link Slave, Serial PLC Link Master, Serial Gateway (conversion to CompoWay/F, conversion to Mod- bus-RTU), peripheral bus
	RS-422A/485 Option Board	CP1W-CIF11/CIF12	One RS-422A/485 port (terminal block for ferrules)	

### 1-2-2 System Expansion

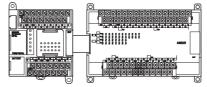
CP-series Expansion Units or Expansion I/O Units can be connected to a CP1L CPU Unit. Up to three Expansion Units or Expansion I/O Units can be connected to a CPU Unit with 30, 40 or 60 I/O points and one Expansion Unit or Expansion I/O Unit can be connected to a CPU Unit with 20 or 14 I/O points. This allows for the expansion of various functions such as I/O points or temperature sensor inputs.

CP1L CPU Unit with 30, 40 or 60 I/O Points



A maximum of three CP-series Expansion I/O Units or Expansion Units can be added.

CP1L CPU Unit with 20 or 14 I/O Points



One CP-series Expansion I/O Unit or Expansion Unit can be added.

CP1L CPU Unit with 10 I/O Points



No CP-series Expansion I/O Unit or Expansion Unit can be added.

### Maximum I/O Points

Up to three Expansion Units or Expansion I/O Units can be connected to a CPU Unit with 30, 40 or 60 I/O points and one Expansion Unit or Expansion I/O Unit can be connected to a CPU Unit with 20 or 14 I/O points. The maximum I/O capacity is thus achieved by connecting either one or three Expansion Units or Expansion I/O Units.

Туре	I/O capacity	Model	Built-in inputs	Built-in outputs	Maximum number of Expansion I/O Units or Expansion Units	Maximum total I/O points
М	60 points	CP1L-M60DR-A CP1L-M60DR-D CP1L-M60DT-A CP1L-M60DT-D CP1L-M60DT1-D	36	24	3 Units max. Inputs: $24 \times 3$ Outputs: $16 \times 3$	Max.: 180 points Inputs: 108 points Outputs: 72 points
	40 points	CP1L-M40DR-A CP1L-M40DR-D CP1L-M40DT-A CP1L-M40DT-D CP1L-M40DT1-D	24	16	3 Units max. Inputs: 24 × 3 Outputs: 16 × 3	Max.: 160 points Inputs: 96 points Outputs: 64 points
	30 points	CP1L-M30DR-A CP1L-M30DR-D CP1L-M30DT-A CP1L-M30DT-D CP1L-M30DT1-D	18	12	3 Units max. Inputs: 24 × 3 Outputs: 16 × 3	Max.: 150 points Inputs: 90 points Outputs: 60 points

### System Configuration

# Section 1-2

Туре	I/O capacity	Model	Built-in inputs	Built-in outputs	Maximum number of Expansion I/O Units or Expansion Units	Maximum total I/O points
L	20 points	CP1L-L20DR-A CP1L-L20DR-D CP1L-L20DT-A CP1L-L20DT-D CP1L-L20DT-D CP1L-L20DT1-D	12	8	1 Unit max. Inputs: 24 Outputs: 16	Max.: 60 points Inputs: 36 points Outputs: 24 points
	14 points	CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT-D CP1L-L14DT1-D	8	6	1 Unit max. Inputs: 24 Outputs: 16	Max.: 54 points Inputs: 32 points Outputs: 22 points
	10 points	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT-D CP1L-L10DT1-D	6	4	0 Unit max. Inputs: 0 Outputs: 0	Max.: 10 points Inputs: 6 points Outputs: 4 points
J	20 points	CP1L-J20DR-A CP1L-J20DR-D CP1L-J20DT1-D	12	8	1 Unit max. Inputs: 24 Outputs: 16	Max.: 60 points Inputs: 36 points Outputs: 24 points
	14 points	CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DT1-D	8	6	1 Unit max. Inputs: 24 Outputs: 16	Max.: 54 points Inputs: 32 points Outputs: 22 points

## **CP-series Expansion I/O Units**

Appearance	Model	Normal inputs	Normal outputs	Weight
	CP1W-40EDR CPM1A-40EDR	24 VDC: 24 inputs	16 relay outputs	380 g max.
	CP1W-40EDT CPM1A-40EDT		16 transistor outputs (sinking)	320 g max.
	CP1W-40EDT1 CPM1A-40EDT1		16 transistor outputs (sourcing)	
	CP1W-32ER	None	32 relay outputs	465 g max.
	CP1W-32ET		32 transistor outputs (sinking)	325 g max.
	CP1W-32ET1		32 transistor outputs (sourcing)	
	CP1W-20EDR1 CPM1A-20EDR1	24 VDC: 12 inputs	8 relay outputs	300 g max.
	CP1W-20EDT CPM1A-20EDT		8 transistor outputs (sinking)	
	CP1W-20EDT1 CPM1A-20EDT1		8 transistor outputs (sourcing)	
	CP1W-16ER CPM1A-16ER	None	16 relay outputs	280 g max.
	CP1W-16ET		16 transistor outputs (sinking)	225 g max.
	CP1W-16ET1		16 transistor outputs (sourcing)	
۵	CP1W-8ED CPM1A-8ED	24 VDC: 8 inputs	None	200 g max.
	CP1W-8ER CPM1A-8ER	None	8 relay outputs	250 g max.
	CP1W-8ET CPM1A-8ET		8 transistor outputs (sinking)	
	CP1W-8ET1 CPM1A-8ET1		8 transistor outputs (sinking)	

### **CP-series Expansion Units**

Name and appearance	Model		Specifications		Weight
Analog I/O Units	CPM1A-MAD01	2 analog inputs	0 to 10 V/1 to 5 V/4 to 20 mA	Resolu- tion: 256	150 g max.
		1 analog output	0 to 10 V/–10 to +10 V/4 to 20 mA		
	CP1W-MAD11 CPM1A-MAD11	2 analog inputs	0 to 5 V/1 to 5 V/0 to 10 V/–10 to +10 V/0 to 20 mA/4 to 20 mA	Resolu- tion: 6,000	
		1 analog output	1 to 5/0 to 10 V/–10 to +10 V/0 to 20 mA/4 to 20 mA		
Analog Input Units	CP1W-AD041 CPM1A-AD041	4 analog inputs	0 to 5 V/1 to 5 V/0 to 10 V/-10 to +10 V/ 0 to 20 mA/ 4 to 20 mA		200 g max.
Analog Output Units	CP1W-DA041 CPM1A-DA041	4 analog outputs	1 to 5 V/0 to 10 V/ -10 to +10 V/ 0 to 20 mA/ 4 to 20 mA		
Temperature Sensor Units	CP1W-TS001 CPM1A-TS001	2 inputs	Thermocouple input K, J		250 g max.
	CP1W-TS002 CPM1A-TS002	4 inputs			
66101169	CP1W-TS101 CPM1A-TS101	2 inputs	Platinum resistance th		
	CP1W-TS102 CPM1A-TS102	4 inputs	Pṫ100, JPt100		
DeviceNet I/O Link Unit	CPM1A-DRT21	As a DeviceNet Slave, 32 inputs and 32 out- puts are allocated.			
CompoBus/S I/O Link Unit	CP1W-SRT21 CPM1A-SRT21	As a CompoBus/S slave, 8 inputs and 8 out- puts are allocated.			

## **1-2-3** Restrictions on System Configuration

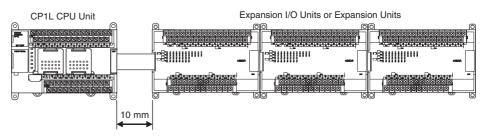
The following restrictions apply to the CP-series Expansion Units and CP-series Expansion I/O Units that can be connected to CP1L CPU Units.

### ■ Number of Expansion Units and Expansion I/O Units Connected

A maximum of three Units can be connected to a CPU Unit with 30, 40 or 60 I/O points and one Unit can be connected to a CPU Unit with 20 or 14 I/O points.

### Mounting Restriction

When connecting CP-series or CPM1A-series Expansion Units or Expansion I/O Units to a CPU Unit with AC power, provide a space of approximately 10 mm between the CPU Unit and the first Expansion Unit or Expansion I/O Unit.



If sufficient space cannot be provided between the CPU Unit and the first Expansion Unit or Expansion I/O Unit, use the PLC in an ambient temperature of 0 to  $50^{\circ}$ C.

### Restrictions in the External Power Supply Capacity

The following restrictions apply when using the external power supply from a CPU Unit with AC power.

### <u>CPU Units with 30, 40 or 60 I/O Points and AC Power (CP1L-M</u>DR-A and CP1L-MDTD-A)

When CP1W or CPM1A Expansion Units or Expansion I/O Units are connected to a CPU Unit with 30, 40 or 60 I/O Points and AC Power (CP1L- $M \square DR$ -A and CP1L- $M \square DT$ -A), it may not be possible to use the entire 300 mA from the external power supply due to restrictions in the power supply capacity. The entire 300 mA from the external power supply can be used if Expansion Units and Expansion I/O Units are not connected.

### Calculation Examples of Restrictions in External Power Supply Capacity

Calculate the external power supply capacity using the following calculation example.

Item	CPU Unit Expansion Unit			Total	Restriction	
		1st Unit	2nd Unit	3rd Unit		
	CP1L-M40DR-A	CP1W-DA041	CP1W-DA041	CP1W-DA041		
5 V	0.22 A	0.08 A	0.08 A	0.08 A	0.46 A	
24 V	0.08 A	0.124 A	0.124 A	0.124 A	0.452 A	
Power con- sumption	5 V × 0.46 A = 2.3 24 V × 0.452 A =			13.148 W	≤ 18.5 W	
Applicable external power	18.5 W (total external power supply capacity) - 13.148 W = 5.352 W       0.223 A $\leq$ 0.3 A         5.352 W/24V = $0.223 A$ $\leq$ 0.3 A					≤ 0.3 A
supply capacity	Note If the result	.3 A or less.				

# <u>CPU Units with 14 or 20 I/O Points and AC Power (CP1L-L</u>DR-A and <u>CP1L-L</u>DT-A)

When CP1W or CPM1A Expansion Units or Expansion I/O Units are connected to a CPU Unit with 14 or 20 I/O Points and AC Power (CP1L-L DR-A and CP1L-L DT-A), the external power supply cannot be used. If no Expansion Units or Expansion I/O Units are connected, up to 200 mA can be used.

### **CPU Units with DC Power**

CPU Units with DC power do not have an external power supply.

#### ■ Restrictions on the number of simultaneously ON output points

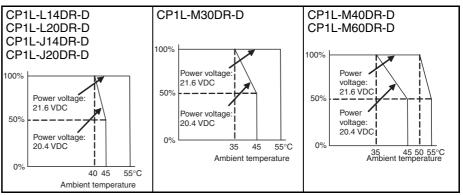
CP1W-32ER/32ET/32ET1's maximum number of simultaneously ON points is 24 (75%).

### Restrictions Imposed by Ambient Temperature

There are restrictions in the power supply voltage and output load current imposed by the ambient temperature for CPU Units with DC power. Use the CPU Unit within the following ranges of power supply voltage and output load current.

#### CPU Units with Relay Outputs (CP1L-DDR-D)

Relay Output Load Current Derating Curves for CPU Units and Expansion I/O Units

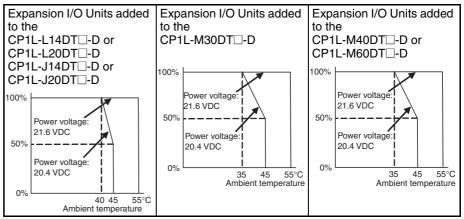




e The above restrictions, apply to the relay output load current from the CPU Unit even if Expansion I/O Units are not connected.

#### Using CP1W-8ER/16ER/20EDR1/32ER/40EDR or CPM1A-8ER/16ER/20EDR1/40EDR Expansion I/O Units with CPU Units with Transistor Outputs (CP1L-\_\_\_\_DT\_-D)

Relay Output Load Current Derating Curves for Expansion I/O Units



**Note** There are no restrictions on the transistor output load current from the CPU Unit.

### **CPU Units with AC Power**

There are no restrictions on the output load current from CPU Units with AC power.

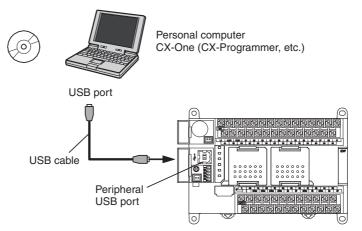
# **1-3 Connecting the CX-Programmer**

The CX-Programmer (version 7.3 or higher), which runs on Windows, can be used with CP-series CP1L L model PLCs with 10 I/O points. The CX-Programmer (Version 7.22 or higher), which runs on Windows, can be used in CP-series CP1L J model PLCs. The CX-Programmer (version 7.1 or higher), which runs on Windows, can be used with CP-series CP1L L or M model PLCs with 14, 20, 30, 40 or 60 I/O points. Computers running Support Software (e.g., the CX-Programmer) can be connected to the USB port or to a serial port.

**Note** A Programming Console cannot be used with CP1L PLCs.

### **1-3-1** Connecting with a Commercially Available USB Cable

Connect the computer running the CX-One Support Software (e.g., the CX-Programmer) using a commercially available USB cable to the peripheral USB port on the CPU Unit.



### Restrictions when Connecting by USB

In conformity with USB specifications, the following restrictions apply when connecting a computer running Support Software.

- A USB connection is possible for only one CP-series PLC from a single computer. It is not possible to connect multiple PLCs simultaneously.
- Do not disconnect the USB cable while the Support Software is connected online. Before disconnecting the USB cable, be sure to place the application in offline status. If the USB cable is disconnected while online, the situations described below will occur as a result of OS error.
  - Windows Me, 2000, or XP:

The Support Software cannot be returned to online status by simply reconnecting the USB cable. First return the Support Software to offline status, and then reconnect the USB cable. Then perform the online connection procedure for the Support Software.

• Windows 98:

If the USB cable is disconnected while online, an error message may be displayed on a blue screen. If that occurs, it will be necessary to reboot the computer.

The peripheral USB port (conforming to USB 1.1, B connector) is a dedicated port for connecting Support Software, such as the CX-Programmer.

### **Items Required for USB Connection**

Operating system	Windows 98, Me, 2000, or XP
Support Software	CX-Programmer Ver. 6.1 (CX-One Ver. 1.1)
USB driver	Included with above Support Software.
USB cable	USB 1.1(or 2.0) cable (A connector-B connector), 5 m max.

Installing the USB Driver The procedure for first connecting a computer to the CP1L peripheral USB port is described below.

It is assumed that the Support Software has already been installed in the computer.

### Windows XP

Turn ON the power supply to the CP1L, and connect USB cable between the USB port of the computer and the peripheral USB port of the CP1L.

After the cable has been connected, the computer will automatically recognize the device and the following message will be displayed.



*1,2,3...* 1. If the following window appears, select the *No, not this time* Option and then click the **Next** Button. This window is not always displayed.



2. The following window will be displayed. Select the *Install from a list of specific location* Option and then click the **Next** Button.



3. The following window will be displayed. Click the **Browse** Button for the *Include this location in the search* Field, specify C:\Program Files\ OMRON\CX-Server\USB\win2000\_XP\Inf, and then click the **Next** Button. The driver will be installed. ("C:\" indicates the installation drive and may be different on your computer.)

lease choose your search and insta	llation options.	EV.
③ Search for the best driver in these lo	cations.	
Use the check boxes below to limit of paths and removable media. The be	r expand the default search, which inclu st driver found will be installed.	udes local
🔲 Search removable media (flop	oy, CD-RDM)	
Include this location in the se	rch:	
C:\Program Files\OMRON\C	Server\USB\win2000_w	se
Don't search. I will choose the drive	to install	
Choose this option to select the dev the driver you choose will be the bes	ce driver from a list. Windows does not I match for your hardware.	guarantee
		_

4. Ignore the following window if it is displayed and click the **Continue Any**way Button.

-	ire Installation
1	The software you are installing for this hardware:
	OMRON SYSMAC PLC Device
	has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
	Continuing your installation of this software may impain or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
-	Continue Anyway STOP Installation

5. The following window will be displayed if the installation is completed normally. Click the **Finish** Button.

Found New Hardware Wiz	ard
	Completing the Found New Hardware Wizard The wizard has finished installing the software for: OMRON SYSMAC PLC Device
	Click Finish to close the wizard.

#### Windows 2000

Turn ON the power supply to the CP1L, and connect USB cable between the USB port of the computer and the peripheral USB port of the CP1L.

After the cable has been connected, the computer will automatically recognize the device and the following message will be displayed.

Found Ne	w Hardware	the second s
\$	OMRON-PLC	

*1,2,3...* 1. The following message will be displayed. Click the **Next** Button.

ound New Hardware Wiza	Welcome to the Found New
	Hardware Wizard
1	This wizard helps you install a device driver for a hardware device.
	To continue, click Next.
-	Back Next> Cancel

2. The following window will be displayed.



3. Select the *Search for a suitable driver for the device (recommended)* Option and then click the **Next** Button. The following window will be displayed. From the list in the window, select the *Specify location* Checkbox and then click the **Next** Button.

ware device:
ts driver database on your computer and in 1s that you specify.
earching on a floppy disk or CD-RDM drive. Next

4. Click the **Browse** Button, specify C:\Program Files\OMRON\CX-Server\USB\win2000\_XP\Inf, and then click the **Next** Button. ("C:\" indicates the installation drive and may be different on your computer.)

und Ne	w Hardware Wizard Insert the manufacturer's installation disk into the drive	-
	selected, and then click DK.	Cancel
	Copy manufacturer's files from:	
	C:\Program Files\OMRON\CX-Server\USB\win200	Browse

5. A search will be made for the driver and the following window will be displayed. Click the Next Button. The driver will be installed.



6. After the driver has been successfully installed, the following window will be displayed. Click the Finish Button.



### **Connection Setup Using the CX-Programmer**

1,2,3...

1. Select CP1L as the device type in the Change PLC Dialog Box and confirm that USB is displayed in the Network Type Field.

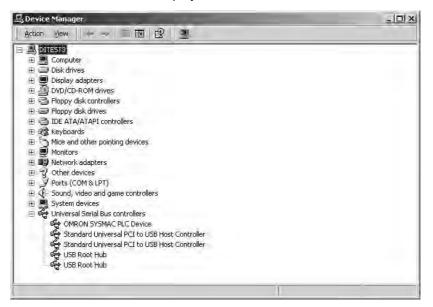
Change PLC	×
Device Name	
NewPLC1	
Device Type	
CP1L 💌	Settings
Network Type	
USB	Settings
Comment	
	<u></u>
OK Cancel	Help

### Connecting the CX-Programmer

2. Click the **OK** Button to finish setting the PLC model. Then connect to the CP1L by executing the CX-Programmer's online connection command.

### **Checking after Installation**

- 1,2,3... 1. Display the Device Manager at the computer.
  - 2. Click USB (Universal Serial Bus) Controller, and confirm that OMRON SYSMAC PLC Device is displayed.



### Re-installing the USB Driver

Checking USB Driver Status

1,2,3...

1. Display the Device Manager on the computer.

the USB driver must be reinstalled.

2. If *USB Device* is displayed for *Other devices*, it means that the USB driver installation has failed.

If the USB driver installation fails for some reason or is cancelled in progress,

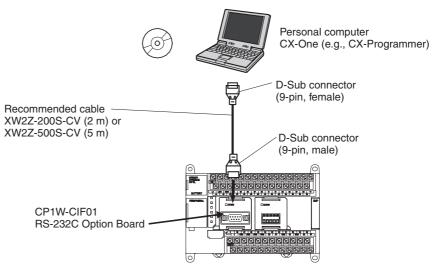


### **Reinstalling the USB Driver**

- *1,2,3...* 1. Right-click *USB Device* and select *Delete* from the pop-up menu to delete the driver.
  - 2. Reconnect the USB cable. The USB Driver Installation Window will be displayed.
  - 3. Reinstall the USB driver.

### 1-3-2 Connecting to a Serial Port

Mounting a CP1W-CIF01 RS-232C Option Board in a CP1L Option Board slot makes it possible to connect Support Software with serial communications, just as with previous models.



Connect the CX-Programmer to the RS-232C port of the CP1W-CIF01 Option Board by XW2Z-200S-CV/500S-CV RS-232C cable.

### **Connection Method**

Connect the Programming Device using the Connecting Cable that is appropriate for the serial communications mode of the computer and CPU Unit.

Computer		Connecting Cable		CP1L CPU Unit	
Model	Connector	Model	Length	Connector	Serial communications mode
IBM PC/AT or	D-Sub 9 pin,	XW2Z-200S-CV	2 m	D-Sub 9 pin, female	Peripheral bus or Host
compatible	male	XW2Z-500S-CV	5 m	(With a CP1W-CIF01 RS- 232C Option Board mounted in Option Board Slot 1 or 2.)	Link (SYSWAY)

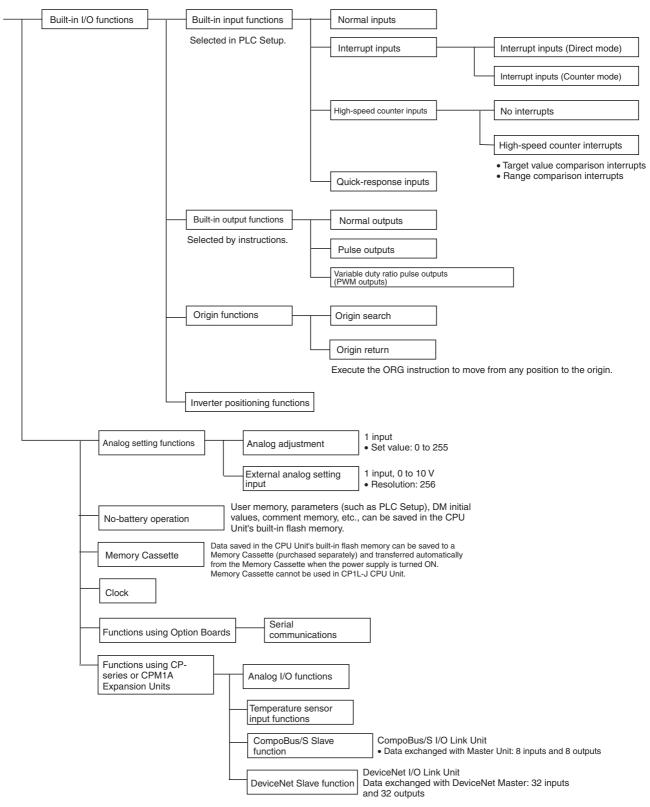
### **Serial Communications Mode**

Serial communications mode	Features	CPU Unit setting method
Peripheral bus (toolbus)	<ul> <li>This is the faster mode, so it is generally used for CX-Programmer connections.</li> <li>Only 1: 1 connections are possible.</li> <li>When a CP1L CPU Unit is used, the baud rate is automatically detected by the Support Software.</li> </ul>	Turn ON pins SW4 (Serial Port 1) and SW5 (Serial Port 2) on the DIP switch on the front panel of the CPU Unit. These settings enable connection by peripheral bus regardless of the serial port settings in the PLC Setup.
Host Link (SYSWAY)	<ul> <li>A standard protocol for host computers with either 1: 1 or 1: N connections.</li> <li>Slower than the peripheral bus mode.</li> <li>Allows modem or optical adapter connections, or long- distance or 1: N connections using RS-422A/485.</li> </ul>	Turn OFF pins SW4 (Serial Port 1) and SW5 (Serial Port 2) on the DIP switch on the front panel of the CPU Unit. The mode will then be deter- mined by the serial port set- tings in the PLC Setup. The default settings are for Host Link with a baud rate of 9,600 bits/s, 1 start bit, data length of 7 bits, even parity, and 2 stop bits.

**Note** When a Serial Communications Option Board is mounted in Option Board Slot 1, it is called "Serial Port 1." When mounted in Option Board Slot 2, it is called "Serial Port 2."

### Section 1-4

# 1-4 Function Charts



# 1-5 Function Blocks

Function blocks can be used in programming SYSMAC CP-series PLCs.

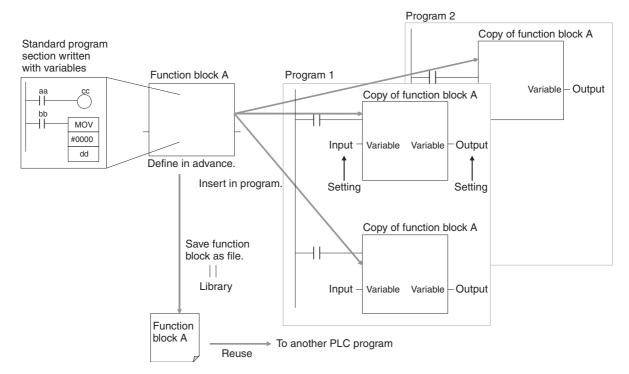
**Note** Function blocks cannot be used in CP1L-J PLCs.

### 1-5-1 Overview of Function Blocks

A function block is a basic program element containing a standard processing function that has been defined in advance. Once the function block has been defined, the user just has to insert the function block in the program and set the I/O in order to use the function.

As a standard processing function, a function block is not created with actual physical addresses, but local variables. The user sets parameters (addresses or values) in those variables to use the function block. The addresses used for the variables themselves are automatically assigned by the system (CX-Programmer) each time they are placed in the program.

In particular, each function block is saved by the CX-Programmer as an individual file that can be reused with programs for other PLCs. This makes it possible to create a library of standard processing functions.



### 1-5-2 Advantages of Function Blocks

Function blocks allow complex programming units to be reused easily. Once standard program sections have been created as function blocks and saved in files, they can be reused just by placing a function block in a program and setting the parameters for the function block's I/O. Reusing standardized function blocks reduces the time required for programming/debugging, reduces coding errors, and makes programs easier to understand.

### Structured Programming

Structured programs created with function blocks have better design quality and required less development time.

Easy-to-read "Block Box" Design	The I/O operands are displayed as local variable names in the program, so the program is like a "black box" when entering or reading the program and no extra time is wasted trying to understand the internal algorithm.
Different Processes Easily Created from a Single Function Block	Many different processes can be created easily from a single function block by using input variables for the parameters (such as timer SVs, control constants, speed settings, and travel distances) in the standard process.
Reduced Coding Errors	Coding mistakes can be reduced, because blocks that have already been debugged can be reused.
Data Protection	The local variables in the function block cannot be accessed directly from the outside, so the data can be protected. (Data cannot be changed unintentionally.)
Improved Reusability through Programming with Variables	The function block's I/O is entered as local variables, so the data addresses in the function block do not have to be changed as they do when copying and reusing a program section.
<u>Creating Libraries</u>	Processes that are independent and reusable (such as processes for individ- ual steps, machinery, equipment, or control systems) can be saved as func- tion block definitions and converted to library functions. The function blocks are created with local variable names that are not tied to physical addresses, so new programs can be developed easily just by reading the definitions from the file and placing them in a new program.
<u>Nesting Multiple</u> <u>Languages</u>	Mathematical expressions can be entered in structured text (ST) language. Nesting function blocks is supported for CX-Programmer Ver. 6.0 or higher. For example, it is possible to express only special operations in ST language within a function block in a ladder diagram. Function block (ladder language)

For details on using function blocks, refer to the CX-Programmer Ver. 7.0 Operation Manual: Function Blocks (Cat. No. W447).

Function block (ST language)

Call (Nesting)

RESULT:=0.0; IF M =TRUE THEN RESULT:=SIN(data); ENDIF;

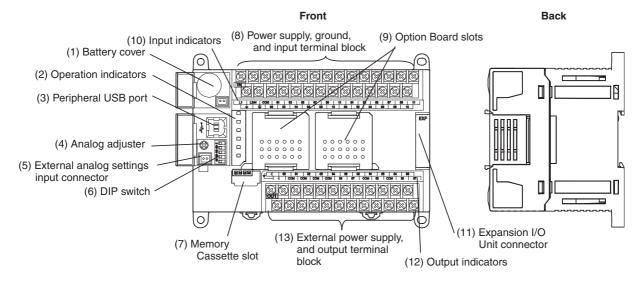
# SECTION 2 Nomenclature and Specifications

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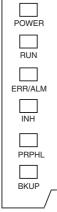
### 2-1 Part Names and Functions

### 2-1-1 CP1L CPU Units



- (1) Battery Cover
- Covers the location where the battery is stored.
- (2) Operation Indicators Show CP1L operation status.

	-	
POWER	Lit	Power is ON.
(Green)	Not lit	Power is OFF.
RUN (Green)	Lit	The CP1L is executing a program in either RUN or MONITOR mode.
	Not lit	Operation is stopped in PROGRAM mode or due to a fatal error.
ERR/ALM (Red)	Lit	A fatal error (including FALS execution) or a hard- ware error (WDT error) has occurred. CP1L opera- tion will stop and all outputs will be turned OFF.
	Flashing	A non-fatal error has occurred (including FAL execution). CP1L operation will continue.
	Not lit	Operation is normal.
INH (Yellow)	Lit	The Output OFF Bit (A500.15) has turned ON. All outputs will be turned OFF.
	Not lit	Operation is normal.
		Communications (either sending or receiving) are in progress through the peripheral USB port.
	Not lit	Other than the above.
(Yellow) being written or accessed in the		A user program, parameters, or Data Memory is being written or accessed in the built-in flash memory (backup memory).
		A user program, parameters, Data Memory, DM ini- tial values, or comment memory is being written or accessed in a Memory Cassette.
		The BKUP indicator also lights while user programs, parameters, and Data Memory are being restored when the PLC power supply is turned ON.
		<b>Note</b> Do not turn OFF the PLC power supply while this indicator is lit.
	Not lit	Other than the above.



- (3) Peripheral USB Port Used for connecting to a personal computer for programming and monitoring by the CX-Programmer.
- (4) Analog Adjuster By turning the analog adjuster, it is possible to adjust the value of A642 within a range of 0 to 255. (Refer to 6-4 Analog Adjuster and External Analog Setting Input.)
- (5) External Analog Setting Input Connector By applying 0 to 10 V of external voltage, it is possible to adjust the value of A643 within a range of 0 to 256. This input is not isolated. (Refer to *6-4 Analog Adjuster and External Analog Setting Input.*)
- (6) DIP Switch

2

345

No.	Setting	Description	Application	Default
SW1	ON	User memory write- protected (See note.)	Used to prevent pro- grams from being inad-	OFF
	OFF	User memory not write-protected.	vertently overwritten.	
SW2	ON	Data automatically transferred from Memory Cassette at startup.	Used to enable pro- grams, Data Memory, or parameters saved on a Memory Cassette to be	OFF
	OFF	Data not transferred.	opened by the CPU Unit at startup.	
	ON	A395.12 ON	This pin enables control-	OFF
	OFF	A395.12 OFF	ling a bit in memory with- out using an input relay.	
SW4 ON		Used for peripheral bus.	Used to enable a Serial Communications Option	OFF
	OFF	According to PLC Setup.	Board mounted in Option Board Slot 1 to be used by the peripheral bus.	
SW5	ON	Used for peripheral bus.	Used to enable a Serial Communications Option	OFF
	OFF	According to PLC Setup.	Board mounted in Option Board Slot 2 to be used by the peripheral bus.	
SW6	OFF	Keep turned OFF.		OFF

CPU Units with 30, 40 or 60 I/O Points

**Note** The following data will be write-protected if pin SW1 is turned ON:

- The entire user program (all tasks)
- All data in parameter areas (such as the PLC Setup)

When SW1 is turned ON, the user program and the data in the parameter areas will not be cleared even if the All Clear operation is performed from a Peripheral Device (i.e., the CX-Programmer).

CPU Units with 10,14 or 20 I/O Points

-	0 N
N	
ω	
4	

No.	Setting	Description	Application	Default
SW1	ON	User memory write- protected (See note.)	Used to prevent pro- grams from being inad- vertently overwritten.	OFF
	OFF	User memory not write-protected.		

No.	Setting	Description	Application	Default
SW2	ON	Data automatically transferred from Memory Cassette at startup.	Used to enable pro- grams, Data Memory, or parameters saved on a Memory Cassette to be	OFF
	OFF	Data not transferred.	opened by the CPU Unit at startup. Memory Cassette cannot be used in CP1L-J CPU Unit.	
SW3	ON	A395.12 ON	This pin enables control-	OFF
	OFF	A395.12 OFF	ling a bit in memory with- out using an input relay.	
SW4	ON	Used for peripheral bus.	Used to enable a Serial Communications Option	OFF
	OFF	According to PLC Setup.	Board mounted in Option Board Slot 1 to be used by the peripheral bus. This SW should be always OFF for CPU Units with 10 I/O points, because there is no option slot in CPU Units with 10 I/O points.	

Note The following data will be write-protected if pin SW1 is turned ON:

- The entire user program (all tasks)
- All data in parameter areas (such as the PLC Setup)

When SW1 is turned ON, the user program and the data in the parameter areas will not be cleared even if the All Clear operation is performed from a Peripheral Device (i.e., the CX-Programmer).

(7) Memory Cassette Slot

Used for mounting a CP1W-ME05M Memory Cassette. When mounting a Memory Cassette, remove the dummy cassette.

Data, such as CP1L CPU Unit programs, parameters, and data memory, can be transferred to the Memory Cassette to be saved.

Note Memory Cassette cannot be used in CP1L-J CPU Unit.

(8) Power Supply, Ground, and Input Terminal Block

Power supply ter- minals	Used to provide a 100- to 240-VAC or 24-VDC power supply.
Ground terminals	Functional ground ( (소): Connect this ground to strengthen noise immunity and to prevent electric shock. (AC power supply models only.)
	Protective ground ( $$ ): To prevent electric shock, ground to 100 $\Omega$ or less.
Input terminals	Used to connect input devices.

(9) Option Board Slots

The following Option Boards can be mounted in either slot 1 or slot 2.

- CP1W-CIF01 RS-232C Option Board
- CP1W-CIF11/CIF12 RS-422A/485 Option Board
- CP1W-DAM01 LCD Option Board
- **Caution** Always turn OFF the power supply to the PLC before mounting or removing an Option Board.

- (10) Input Indicators
  - The input indicators light when input terminal contacts turn ON.
- (11) Expansion I/O Unit Connector CP-series Expansion I/O Units and Expansion Units (Analog I/O Units, Temperature Sensor Units, CompoBus/S I/O Link Units, or DeviceNet I/O Link Units) can be connected. Up to three Expansion Units or Expansion I/O Units can be connected to a CPU Unit with 30, 40 or 60 I/O points and one Expansion Unit or Expansion I/O Unit can be connected to a CPU Unit with 20 or 14 I/O points. (For details on using Expansion Units and Expansion I/O Units, refer to SECTION 7 Using Expansion Units and Expansion I/O Units.)
- (12) Output Indicators
- The output indicators light when output terminal contacts turn ON.
- (13) External Power Supply and Output Terminal Block

External power supply terminals	CPU Units with AC power supply specifications have external 24-VDC, 300-mA, power supply terminals. (except for the CP1L-L DR-A, which has a 200-mA power supply terminals). They can be used as service power supplies for input devices.
Output terminals	Used for connecting output devices.

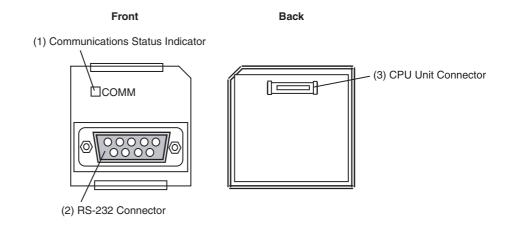
### 2-1-2 CP1W-CIF01 RS-232C Option Boards

An RS-232C Option Board can be mounted to an Option Board slot on the CPU Unit. With a CPU Unit with 30, 40 or 60 I/O points, either Option Board slot may be used.

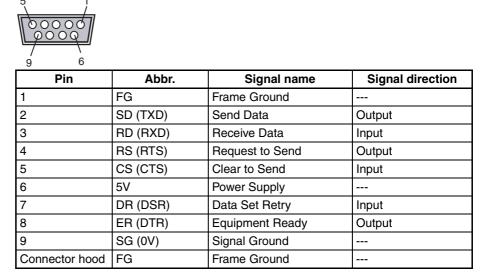
When mounting an Option Board, first remove the slot cover. Grasp both of the cover's up/down lock levers at the same time to unlock the cover, and then pull the cover out.

Then to mount the Option Board, check the alignment and firmly press it in until it snaps into place.

Caution Always turn OFF the power supply to the PLC before mounting or removing an Option Board.



#### **RS-232C Connector**



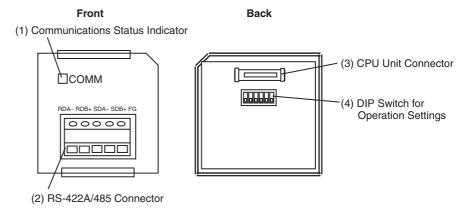
### 2-1-3 CP1W-CIF11/CIF12 RS-422A/485 Option Boards

An RS-422A/485 Option Board can be mounted to an Option Board slot on the CPU Unit. With a CPU Unit with 30, 40 or 60 I/O points, either Option Board slot may be used.

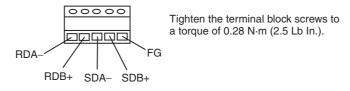
When mounting an Option Board, first remove the slot cover. Grasp both of the cover's up/down lock levers at the same time to unlock the cover, and then pull the cover out.

Then to mount the Option Board, check the alignment and firmly press it in until it snaps into place.

# Caution Always turn OFF the power supply to the PLC before mounting or removing an Option Board.



#### **RS-422A/485 Terminal Block**



#### **DIP Switch for Operation Settings**

Pin		Setti	ngs
1	ON	ON (both ends)	Terminating resistance selection
	OFF	OFF	
2	ON	2-wire	2-wire or 4-wire selection (See
	OFF	4-wire	note 1.)
3	ON	2-wire	2-wire or 4-wire selection (See
	OFF	4-wire	note 1.)
4			Not used.
5	ON	RS control enabled	RS control selection for RD (See
OFF		RS control disabled (Data always received.)	note 2.)
6	ON	RS control enabled	RS control selection for SD (See
	OFF	RS control disabled (Data always sent.)	note 3.)

Note

- (1) Set both pins 2 and 3 to either ON (2-wire) or OFF (4-wire).
  - (2) To disable the echo-back function, set pin 5 to ON (RS control enabled).
  - (3) When connecting to a device on the N side in a 1: N connection with the 4-wire method, set pin 6 to ON (RS control enabled).Also, when connecting by the 2-wire method, set pin 6 to ON (RS control enabled).

### 2-2 Specifications

### 2-2-1 CP1L CPU Units

#### **General Specifications**

P	ower supply	AC power supply	DC power supply
Model numbers	60 I/O points	CP1L-M60DR-A, CP1L-M60DT-A	CP1L-M60DR-D, CP1L-M60DT-D, or CP1L-M60DT1-D
-	40 I/O points	CP1L-M40DR-A, CP1L-M40DT-A	CP1L-M40DR-D, CP1L-M40DT-D, or CP1L-M40DT1-D
-	30 I/O points	CP1L-M30DR-A, CP1L-M30DT-A	CP1L-M30DR-D, CP1L-M30DT-D, or CP1L-M30DT1-D
	20 I/O points	CP1L-L20DR-A, CP1L-L20DT-A, or CP1L-J20DR-A	CP1L-L20DR-D, CP1L-L20DT-D, CP1L-L20DT1-D, CP1L-J20DR-D, or CP1L-J20DT1-D
	14 I/O points	CP1L-L14DR-A, CP1L-L14DT-A, or CP1L-J14DR-A,	CP1L-L14DR-D, CP1L-L14DT-D, CP1L-L14DT1-D, CP1L-J14DR-D, or CP1L-J14DT1-D
-	10 I/O points	CP1L-L10DR-A, CP1L-L10DT-A	CP1L-L10DR-D, CP1L-L10DT-D, or CP1L-L10DT1-D
Power supply		100 to 240 VAC 50/60 Hz	24 VDC
Operating vol	tage range	85 to 264 VAC	20.4 to 26.4 VDC

P	ower supply	AC power supply	DC power supply	
Model numbers	60 I/O points	CP1L-M60DR-A, CP1L-M60DT-A	CP1L-M60DR-D, CP1L-M60DT-D, or CP1L-M60DT1-D	
	40 I/O points	CP1L-M40DR-A, CP1L-M40DT-A	CP1L-M40DR-D, CP1L-M40DT-D, or CP1L-M40DT1-D	
	30 I/O points	CP1L-M30DR-A, CP1L-M30DT-A	CP1L-M30DR-D, CP1L-M30DT-D, or CP1L-M30DT1-D	
	20 I/O points	CP1L-L20DR-A, CP1L-L20DT-A, or CP1L-J20DR-A	CP1L-L20DR-D, CP1L-L20DT-D, CP1L-L20DT1-D, CP1L-J20DR-D, or CP1L-J20DT1-D	
14 I/O points		CP1L-L14DR-A, CP1L-L14DT-A, or CP1L-J14DR-A,	CP1L-L14DR-D, CP1L-L14DT-D, CP1L-L14DT1-D, CP1L-J14DR-D, or CP1L-J14DT1-D	
	10 I/O points	CP1L-L10DR-A, CP1L-L10DT-A	CP1L-L10DR-D, CP1L-L10DT-D, or CP1L-L10DT1-D	
Power consu	mption	50 VA max. (CP1L-M_DR-A) 50 VA max. (CP1L-M_DT-A) 30 VA max. (CP1L-L_DR-A) 30 VA max. (CP1L-L_DT-A) 30 VA max. (CP1L-J_DR-A)	See note 3. 20 W max. (CP1L-M_DR-D) 20 W max. (CP1L-M_DTD) 13 W max. (CP1L-L_DR-D) 13 W max. (CP1L-L_DTD) 13 W max. (CP1L-J_DTD)	
Inrush curren (See note 1.)		100 to 120 VAC inputs: 20 A max.(for cold start at room temperature.) 8 ms max. 200 to 240 VAC inputs:	30 A max.(for cold start.) 20 ms max.	
		40 A max.(for cold start at room temperature.) 8 ms max.		
External pow	ver supply (See note 2.)	300 mA at 24 VDC (CP1L-M_DR-A) 300 mA at 24 VDC (CP1L-M_DT-A) 200 mA at 24 VDC (CP1L-L_DR-A) 200 mA at 24 VDC (CP1L-L_DT-A)	None	
Insulation re-	sistance	20 $M\Omega$ min. (at 500 VDC) between the external AC terminals and GR terminals	No insulation between primary and sec- ondary DC power supplies.	
Dielectric str	ength	2,300 VAC 50/60 Hz for 1 min between the external AC and GR terminals, leak- age current: 5 mA max.		
Noise resista	ance	Conforms to IEC 61000-4-4 2 kV (power supply line)		
Vibration res	istance	10 to 57 Hz, 0.075-mm amplitude, 57 to 1 Z directions for 80 minutes each (time co of $10 =$ total time of 80 minutes)		
Shock resista	ance	147 m/s <sup>2</sup> three times each in X, Y, and Z	directions	
Ambient ope	-	0 to 55°C		
Ambient hun	nidity	10% to 90% (with no condensation)		
Atmosphere		No corrosive gas.		
Ambient storage		-20 to 75°C (excluding battery)		
Terminal screw size		M3 10 ms min.	2 ms min.	
Power interrupt time Weight		CP1L-M60D: 820g max.         CP1L-M40D: 675 g max.         CP1L-M30D: 610 g max.         CP1L-L20D: 380 g max.         CP1L-L14D: 380 g max.         CP1L-L14D: 300 g max.         CP1L-J20D: 380 g max.         CP1L-L10D: 380 g max.         CP1L-J10D: 380 g max.         CP1L-J20D: 380 g max.	2 110 11111.	

Note	(1) The above values are for a cold start at room temperature for an AC pow-
	er supply, and for a cold start for a DC power supply.

- A thermistor (with low-temperature current suppression characteristics) is used in the inrush current control circuitry for the AC power supply. The thermistor will not be sufficiently cooled if the ambient temperature is high or if a hot start is performed when the power supply has been OFF for only a short time, so in those cases the inrush current values may be higher (as much as two times higher) than those shown above.
- A capacitor delay circuit is used in the inrush current control circuitry for the DC power supply. The capacitor will not be charged if a hot start is performed when the power supply has been OFF for only a short time, so in those cases the inrush current values may be higher (as much as two times higher) than those shown above.

Always allow for this when selecting fuses and breakers for external circuits.

- (2) Use the external power supply to power input devices. Do not use it to drive output devices.
- (3) This is the rated value for the maximum system configuration. Use the following formula to calculate DC power consumption for CPU Units with DC power.

Formula:

DC-powered CP1L power consumption = 5-V current consumption  $\times$  5 V/ 70% (CP1L internal power efficiency) + 24-V current consumption  $\times$  1.1 (current fluctuation factor)

Calculation Example

	CPU Unit	Expansion	Expansion Unit or Expansion I/O Unit		
		1st Unit	2nd Unit	3rd Unit	
System	CP1L-M40DR-D	CP1W-20EDT	CP1W-TS001	CP1W-DA041	
5 V	0.220 A	0.130 A	0.040 A	0.080 A	0.470 A
24 V	0.080 A	0.000 A	0.059 A	0.124 A	0.263A

CP1L Power Consumption

 $= (0.47 \text{ A} \times 5 \text{ V}/70\% + 0.263 \text{ A} \times 24 \text{ V}) \times 1.1$ 

= 10.64 W

The above calculation results show that a power supply with a capacity of 7 W or greater is required.

### **Current Consumption**

#### **CPU Units**

Туре	I/O capacity	Model	Curren	t consumption	External power supply
			5 V DC	24 V DC	24 V DC
М	60 I/O points	CP1L-M60DR-A	0.25 A	0.14 A	0.3 A max.
		CP1L-M60DR-D	0.25 A	0.14 A	
		CP1L-M60DT-A	0.39 A	0.03 A	0.3 A max.
		CP1L-M60DT-D	0.39 A	0.03 A	
		CP1L-M60DT1-D	0.39 A	0.03 A	
	40 I/O points	CP1L-M40DR-A	0.22 A	0.08 A	0.3 A max.
		CP1L-M40DR-D	0.22 A	0.08 A	
		CP1L-M40DT-A	0.31 A	0.03 A	0.3 A max.
		CP1L-M40DT-D	0.31 A	0.03 A	
		CP1L-M40DT1-D	0.31 A	0.03 A	
	30 I/O points	CP1L-M30DR-A	0.21 A	0.07 A	0.3 A max.
		CP1L-M30DR-D	0.21 A	0.07 A	
		CP1L-M30DT-A	0.28 A	0.03 A	0.3 A max.
		CP1L-M30DT-D	0.28 A	0.03 A	
		CP1L-M30DT1-D	0.28 A	0.03 A	
L	20 I/O points	CP1L-L20DR-A	0.20 A	0.05 A	0.2 A max.
		CP1L-L20DR-D	0.20 A	0.05 A	
		CP1L-L20DT-A	0.24 A	0.03 A	0.2 A max.
		CP1L-L20DT-D	0.24 A	0.03 A	
		CP1L-L20DT1-D	0.24 A	0.03 A	
	14 I/O points	CP1L-L14DR-A	0.18 A	0.04 A	0.2 A max.
		CP1L-L14DR-D	0.18 A	0.04 A	
		CP1L-L14DT-A	0.21 A	0.03 A	0.2 A max.
		CP1L-L14DT-D	0.21 A	0.03 A	
		CP1L-L14DT1-D	0.21 A	0.03 A	
	10 I/O points	CP1L-L10DR-A	0.16 A	0.03 A	0.2 A max.
		CP1L-L10DR-D	0.16 A	0.03 A	
		CP1L-L10DT-A	0.18 A	0.03 A	0.2 A max.
		CP1L-L10DT-D	0.18 A	0.03 A	
		CP1L-L10DT1-D	0.18 A	0.03 A	
J	20 I/O points	CP1L-J20DR-A	0.20 A	0.05 A	0.2 A max.
		CP1L-J20DR-D	0.20 A	0.05 A	
		CP1L-J20DT1-D	0.24 A	0.03 A	
	14 I/O points	CP1L-J14DR-A	0.18 A	0.04 A	0.2 A max.
		CP1L-J14DR-D	0.18 A	0.04 A	
		CP1L-J14DT1-D	0.21 A	0.03 A	

Note

(1) The current consumption of the CP1W-ME05M Memory Cassette and CP1W-CIF01/11 Option Boards are included in the current consumption of the CPU Unit.

(2) The current consumption of the following is not included with the current consumption of the CPU Unit: CP1W-CIF12.

Unit	Model	Current co	nsumption	External power
		5 V DC	24 V DC	supply
Interface Unit	CP1W-CIF12	0.075 A		

(3) CPU Units with DC power do not provide an external power supply.

(4) The current consumptions given in the following table must be added to the current consumption of the CPU Unit if an Expansion Unit or Expansion I/O Unit is connected.

(5) The external power supply cannot be used if an Expansion Unit or Expansion I/O Unit is connected to a CPU Unit with 14 or 20 I/O points.

# Expansion Units and Expansion I/O Units

ι	Jnit name		Model	Current c	onsumption
				5 VDC	24 VDC
Expansion I/	O Units	40 I/O points	CP1W/CPM1A-40EDR	0.080 A	0.090 A
		24 inputs	CP1W/CPM1A-40EDT	0.160 A	
		16 outputs	CP1W/CPM1A-40EDT1		
		32 outputs	CP1W-32ER	0.049 A	0.131 A
			CP1W-32ET	0.113 A	
			CP1W-32ET1		
		20 I/O points	CP1W/CPM1A-20EDR1	0.103 A	0.044 A
		12 inputs	CP1W/CPM1A-20EDT	0.130 A	
		8 outputs	CP1W/CPM1A-20EDT1		
		16 outputs	CP1W/CPM1A-16ER	0.042 A	0.090 A
			CP1W-16ET	0.076 A	
			CP1W-16ET1		
		8 inputs	CP1W/CPM1A-8ED	0.018 A	
		8 outputs	CP1W/CPM1A-8ER	0.026 A	0.044 A
			CP1W/CPM1A-8ET	0.075 A	
			CP1W/CPM1A-8ET1		
Expansion	Analog Input Unit	4 inputs	CP1W/CPM1A-AD041	0.100 A	0.090 A
Units	Analog Output Unit	4 outputs	CP1W/CPM1A-DA041	0.080 A	0.124 A
	Analog I/O Units	2 inputs	CP1W/CPM1A-MAD01	0.066 A	0.066 A
		1 output	CP1W/CPM1A-MAD11	0.083 A	0.110 A
	Temperature Sen-	K or J thermocou-	CP1W/CPM1A-TS001	0.040 A	0.059 A
	sor Units	ples	CP1W/CPM1A-TS002		
		Pt or JPt platinum	CP1W/CPM1A-TS101	0.054 A	0.073 A
		resistance ther- mometers	CP1W/CPM1A-TS102		
	CompoBus/S I/O Link Unit	8 inputs	CP1W/CPM1A-SRT21	0.029 A	
		8 outputs			
	DeviceNet I/O Link	32 inputs	CPM1A-DRT21	0.048 A	
	Unit	32 outputs			

Note

CP1W-32ER/32ET/32ET1's maximum number of simultaneously ON points is 24 (75%).

### **Characteristics**

Туре		M CPU Units			L CPU Units	
Model	CP1L-M60DR-A CP1L-M60DR-D CP1L-M60DT-A CP1L-M60DT-D CP1L-M60DT1-D	CP1L-M40DR-A CP1L-M40DR-D CP1L-M40DT-A CP1L-M40DT-D CP1L-M40DT1-D	CP1L-M30DR-A CP1L-M30DR-D CP1L-M30DT-A CP1L-M30DT-D CP1L-M30DT1-D	CP1L-L20DR-A CP1L-L20DR-D CP1L-L20DT-A CP1L-L20DT-D CP1L-L20DT1-D CP1L-J20DR-A CP1L-J20DR-D CP1L-J20DT1-D	CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT1-D CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DT1-D	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT1-D
Program capacity	10 Ksteps			5 Ksteps (J mod	dels : 1K steps)	
Control method	Stored program	method				
I/O control method	Cyclic scan with	n immediate refre	eshing			
Program language	Ladder diagram	l				

	Туре			M CPU Units			L CPU Units	
	Model		CP1L-M60DR-A CP1L-M60DR-D CP1L-M60DT-A CP1L-M60DT-D CP1L-M60DT1-D	CP1L-M40DR-A CP1L-M40DR-D CP1L-M40DT-A CP1L-M40DT-D CP1L-M40DT1-D	CP1L-M30DR-A CP1L-M30DR-D CP1L-M30DT-A CP1L-M30DT-D CP1L-M30DT1-D	CP1L-L20DR-A CP1L-L20DR-D CP1L-L20DT-A CP1L-L20DT-D CP1L-L20DT1-D CP1L-J20DR-A CP1L-J20DR-D CP1L-J20DT1-D	CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT1-D CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DT1-D	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT1-D
Functio	on blocks	3	Maximum numb Languages usa	ber of function blo ber of instances: ble in function blo cannot be used	256 ock definitions: L	.adder diagrams,	structured text (	ST)
Instruct	tion leng	ith	1 to 7 steps per			onna		
Instruct				nction codes: 3 d	digits)			
Instruct executi	tion on time		Basic instruction		•			
-	sing time	e	0.38 ms					
	table Ex		3 Units (CP Ser	·		1 Unit (CP Serie	es or CPM1A)	0 Unit
Maximi I/O poir	um num nts	ber of	180 points (60 built in, $40 \times 3$ expansion)	160 points (40 built in, $40 \times 3$ expansion)	150 points (30 built in, $40 \times 3$ expansion)	60 points (20 built in, $40 \times 1$ expansion)	54 points (14 built in, $40 \times 1$ expansion)	10 points (10 built in)
Built-in terminals (Func-	Built-in	I/O	60 terminals (36 inputs and 24 outputs)	40 terminals (24 inputs and 16 outputs)	30 terminals (18 inputs and 12 outputs)	20 terminals (12 inputs and 8 outputs)	14 terminals (8 inputs and 6 outputs)	10 terminals (6 inputs and 4 outputs)
tions can be	Inter-	Direct	6 inputs			•	4 inputs	2 inputs
assigned.)	rupt inputs	mode	Response time:	0.3 ms				•
-	inputo	Counter	6 inputs				4 inputs	2 inputs
		mode		ency: 5 kHz tota				
	Quick-		6 points				4 points	2 points
	respon inputs			width: 50 μs ma	ax.			
	High-sp counte		Differential pha Value range: 32	, ,	z (J models : 10ł le or ring mode		Iz (J models : 20	kHz)
Pulse outputs (Tran- sistor	Pulse o	outputs	(CCW/CW or pu	z to 100 kHz (J r ulse plus directio S-curve accelera	n)	20kHz) ation (Duty ratio:	50% fixed)	
output models only)	PWM c	outputs	•			ts of 0.1% or 1%	)	
Analog settings	Analog adjuste		1 (Setting range	e: 0 to 255)				
	Externa analog setting	al	1 input (Resolut	tion: 1/256, Input	range: 0 to 10 V	/)		

### Section 2-2

### Section 2-2

	Туре		M CPU Units			L CPU Units	
	Model	CP1L-M60DR-A CP1L-M60DR-D CP1L-M60DT-A CP1L-M60DT-D CP1L-M60DT1-D	CP1L-M40DR-A CP1L-M40DR-D CP1L-M40DT-A CP1L-M40DT-D CP1L-M40DT1-D	CP1L-M30DR-A CP1L-M30DR-D CP1L-M30DT-A CP1L-M30DT-D CP1L-M30DT1-D	CP1L-L20DR-A CP1L-L20DR-D CP1L-L20DT-A CP1L-L20DT-D CP1L-L20DT1-D CP1L-J20DR-A CP1L-J20DR-D CP1L-J20DR1-D	CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT1-D CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DT1-D	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT1-D
Serial port	Peripheral USB port	grammer. (Set t	ort USB connec he network class nications standar	tor, type B): Spec sification to USB rd: USB 1.1	cial for a Periphe in the Peripheral	ral Device such I Device's PLC n	as the CX-Pro- nodel setting.)
	RS-232C port, RS-422A/485 port	L-type CPU Uni The following O • CP1W-CIF01: • CP1W-CIF11// Applicable comi NT Link (1: N m	t: 1 port) ption Boards car One RS-232C p CIF12: One RS-4 munications moc ode), No-protoco (conversion to C	ort	of the above por k Slave, Serial P	ts): Host Link, LC Link Master,	Not Support
Numbe	er of tasks		,	nd 256 interrupt t	asks)		
	Scheduled	1 (interrupt task					
	Input interrupt tasks		s 140 to 145, fix			4 (interrupt tasks 140 to 143, fixed)	2 (interrupt tasks 140 to 141, fixed)
		can also be exe		and interrupt task	s specified by ex	xternal interrupts	;
Maxim numbe	um subroutine r	256					
Maxim numbe	um jump r	256					
Schedu	uled interrupts	1					
Clock f	unction	Supported. Accuracy (mont	- · ·	4.5 min to –0.5 n –2.0 min to +2.0 –2.5 min to +1.5	min (ambient ter	mperature: 25°C	
Memory Backup	Built-in flash memory	memory. It is als The data is auto	so possible to sa matically transfe	(such as the PLC ve and read data rred to RAM whe not be transferre	a memory initial open the power sup	data. ply is turned ON	. (Data memory
	Battery backup	Battery model: Maximum batte Guaranteed (an	CJ1W-BAT01 (Br ry service life: 5 nbient temperatu	unter values (flag uilt into the CP1L years ire: 55°C): 13,00 ature: 25°C): 43,	CPU Unit.) 0 hours (approx.	1.5 years)	у.
Memor function	ry Cassette n	A CP1W-ME05 back up the follo • Data saved on Area, data me ments, program • Writing to Men • Reading from	M Memory Cass owing data on the Memory Casse mory initial data, n indices), and F mory Cassette: B Memory Cassett	ette (512K words e CPU Unit's RA tte: User progran comment memo B program mem y operations fror e: At startup, or l sed in CP1L-J Cl	s, optional) can b M and to transfe ns, parameters (s ory (CX-Program lory. n the CX-Progra by operations fro	be mounted. It can r the data at star such as the PLC mer conversion mmer.	tup. Setup), DM tables, com-

**Note** Can be used as Modbus-RTU easy master function.

## 2-2-2 I/O Memory Details

	Туре		M CPU Units		ĺ	L CPU Units	
N	Model	CP1L-M60DR-A CP1L-M60DR-D CP1L-M60DT-A CP1L-M60DT-D CP1L-M60DT1-D	CP1L-M40DR-A CP1L-M40DR-D CP1L-M40DT-A CP1L-M40DT-D CP1L-M40DT1-D	CP1L-M30DR-A CP1L-M30DR-D CP1L-M30DT-A CP1L-M30DT-D CP1L-M30DT1-D	CP1L-L20DR-A CP1L-L20DR-D CP1L-L20DT-A CP1L-L20DT-D CP1L-L20DT1-D CP1L-J20DR-A CP1L-J20DR-D CP1L-J20DR1-D	CP1L-L14DR-A CP1L-L14DR-D CP1L-L14DT-A CP1L-L14DT-D CP1L-L14DT1-D CP1L-J14DR-A CP1L-J14DR-D CP1L-J14DR-D	CP1L-L10DR-A CP1L-L10DR-D CP1L-L10DT-A CP1L-L10DT-D CP1L-L10DT1-D
I/O Areas	Input bits	36 bits CIO 0.00 to CIO 0.11 CIO 1.00 to CIO 1.11 CIO 2.00 to CIO 2.11	24 bits CIO 0.00 to CIO 0.11 CIO 1.00 to CIO 1.11	18 bits CIO 0.00 to CIO 0.11 CIO 1.00 to CIO 1.05	12 bits CIO 0.00 to CIO 0.11	8 bits CIO 0.00 to CIO 0.07	6 bits CIO 0.00 to CIO 0.05
	Output bits	24 bits CIO 100.00 to CIO 100.07 CIO 101.00 to CIO 101.07 CIO 102.00 to CIO 102.07	16 bits CIO 100.00 to CIO 100.07 CIO 101.00 to CIO 101.07	12 bits CIO 100.00 to CIO 100.07 CIO 101.00 to CIO 100.03	8 bits CIO 100.00 to CIO 100.07	6 bits CIO 100.00 to CIO 100.05	4 bits CIO 100.00 to CIO 100.03
	1:1 Link Bit Area	1,024 bits (64 w	ords): CIO 3000.0	00 to CIO 3063.1	5 (words CIO 300	0 to CIO 3063)	Not Support
	Serial PLC Link Area	1,440 bits (90 w	ords): CIO 3100.0	00 to CIO 3189.1	5 (words CIO 310	00 to CIO 3189)	Not Support
	Work bits	6,400 bits (400 v 15,360 bits (960 9,600 bits (600 v	vords): CIO 1500 words): CIO 200 vords): CIO 3200	0.00 to CIO 1499. 0.00 to CIO 1899. 0.00 to CIO 2959 0.00 to CIO 3799. 300.00 to CIO 614	15 (words CIO 15 .15 (words CIO 2 15 (words CIO 32	00 to CIO 1899) 000 to CIO 2959 00 to CIO 3799)	
Work b	oits		,	to W511.15 (word		3800 10 010 014	-5)
TR Are		16 bits: TR0 to T	1	X	, ,		
HR Are				to H1535.15 (wo			
AR Are	ea	-		8 bits (448 words			A447)
Time area				s): A448.00 to A9	59.15 (words A44	8 to A959)	
Timers Counte		4,096 bits: T0 to 4,096 bits: C0 to					
DM Are		32 Kwords: D0 t			10 Kwords: D0 t	o D9999 and D32	2000 to D32767
		Note Initial data Unit's buil memory ir ting in the the data ir RAM at st	t can be transferr t-in flash memory nitial data transfe PLC Setup can t n flash memory is artup.	r using the data r function. A set- be used so that a transferred to	Note Initial data Unit's buil memory in ting in the the data in RAM at st	a can be transferr t-in flash memory nitial data transfe PLC Setup can I n flash memory is tartup.	ed to the CPU v using the data r function. A set- be used so that s transferred to
		Master	ion words for Moo 2249 for Serial Po rial Port 2	-	Master	ion words for Moo 2349 for Serial Po	-
Data R Area	legister	16 registers (16	bits): DR0 to DR	15			
Index F Area	Register	16 registers (16	bits): IR0 to IR15				
Task F	lag Area	32 flags (32 bits)					
Trace I	Memory	4,000 words (50	0 samples for the	e trace data maxir	num of 31 bits an	d 6 words.)	

### 2-2-3 I/O Specifications

### I/O Terminal Blocks of CPU Units with 60 I/O Points

#### Input Terminal Block (Top Block)

AC Power Supply Models

_				-							_																
L	.1	L2/N	СОМ	0.	1 0	3 (	05	07	09	1	1	01	03	0	5 0	07	09	1	1	01	03	3 0	)5	07	09	1	1
	A			0	02	04	06	0	8	10	00	0	2	04	06	0	8	10	00	0	2	04	0	6 (	08	10	$\square$
			In	puts	(CIO	0)					Inpu	ts (C	IO 1	)					Inpu	ts (C		2)					
DC	Pc	ower S	Supply	Mo	dels																						
4	÷	-	СОМ	0	1 0	3	05	07	09	1	1	01	03	0	5	07	09	1	1	01	03	3 0	)5	07	09	1	1
	N	с (		00	02	04	06	0	8	10	00	0	2	04	06	0	8	10	00	0	2	04	0	6 0	)8	10	
			In	pute	s (CIO	0)					Inpu	ts (C	CIO 1	)					Inpu	ts (C		2)					

#### Setting Input Functions Using PLC Setup

Address Word Bit		Inp	ut operation	settings	High-s	Origin searches	
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-speed	ation settings: d counters enabled ase-Z reset	Origin searches enabled for pulse outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 0	00	Normal input 0			Counter 0, incre- ment input	Counter 0, A phase, up, or count input	
	01	Normal input 1			Counter 1, incre- ment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2			Counter 2, incre- ment input	Counter 1, A phase, up, or count input	
	03	Normal input 3			Counter 3, incre- ment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Interrupt input 2	Quick- response input 2	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Interrupt input 3	Quick- response input 3	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Interrupt input 4	Quick- response input 4			
	09	Normal input 9					
	10	Normal input 10					Pulse output 0: Origin proximity input signal
	11	Normal input 11					Pulse output 1: Origin proximity input signal

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Addre	ess	Inp	ut operation	settings	High-s	speed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs	Quick- response	Opera	ation settings: d counters enabled	Origin searches enabled for pulse
			(See note.)	inputs	Ph	ase-Z reset	outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 1	00	Normal input 12					
	01	Normal input 13					
	02	Normal input 14					
	03	Normal input 15					
	04	Normal input 16					
	05	Normal input 17					
	06	Normal input 18					
	07	Normal input 19					
	08	Normal input 20					
	09	Normal input 21					
	10	Normal input 22					
	11	Normal input 23					
CIO 2	00	Normal input 24					
	01	Normal input 25					
	02	Normal input 26					
	03	Normal input 27					
	04	Normal input 28					
	05	Normal input 29					
	06	Normal input 30					
	07	Normal input 31					
	08	Normal input 32					
	09	Normal input 33					
	10	Normal input 34					
	11	Normal input 35					

#### **Output Terminal Block (Bottom Block)**

AC Power Supply Models

AC Po	AC Power Supply Models							-															_			_		
	+	00		01	02	2	04	0	5	07	0	0	02		)4	05		)7	00	0	2	04		05	07			
_	со	м	CON		ОМ	03	С	MO	06	С	ом	01		03	СС	м	06	со	М	01	0	3	COM	0	6	_		
		) 10	0	_			-			 C	10 10	01							) 102	>								
										0		51						010	102	-								
DC Po		supp		odels							1			1												٦		
	NC	00		01	02	2	04	0	5	07	00	0	02	0	)4	05		)7	00	0	)2	04		05	07			
NC	со	м	CON	1 CC	DM	03	С	MO	06	С	ом	01		03	СС	M	06	со	М	01	0	3	сом	0	06	_		
		0 10	0	-							10 10	11							) 102									
									_					<b>.</b> .				CIC	/ 102	2								
		out					ng	g Instructions and PLC Setup																				
Addr	ess		-	Nher truct		-		When a pulse output         When origin searches are           instruction (SPED, ACC,         enabled in the PLC Setup,													he PV							
			the r	right	are	not							ecute			and a	an o	rigin	sea	arch	is	'			uted			
			e	exec	uteo											exe		ed w struc		ORG 1								
Word	Bi	t	Nor	mal o	outp	outs	;				Fixe	ed c	luty	ratio	o pu	lse c	outp	ut				v			duty			
																							pulse output					
								CW/	CC	N			e plu ctior		+	Whe fu		ne or ion i			rch		P١	νм	outpu	Jt		
CIO 100	00	1	Norr	nal o	outpu	ut O		ulse ( W)	outp	ut 0		se c Ise)	outpu	t O								-						
	01	1	Norr	nal o	outpu	ut 1		ulse ( CW)		ut 0	Pulse output 0 (direction)										Ρ	WM	out	out 0				
	02	1	Norr	nal o	outpu	ut 2		ulse o W)	outp	ut 1	Pulse output 1 (pulse)																	
	03	1	Norr	nal o	outpu	ut 3		ulse ( CW)		ut 1		se c ecti	outpu on)	t 1								Ρ	PWM output 1					
	04	١	Norr	nal o	outpu	ut 4										gin s et ou			Erro	or cou	inte	r	-					
	05	ſ	Norr	nal o	outpu	ut 5										gin s et ou			Erro	or cou	inte	r	-					
	06	1	Norn	nal o	outpu	ut 6																	-					
	07										-																	
CIO 101				nal o																			-					
	01			nal o																			-					
	02			nal o																			-					
	03			nal o																			-					
	04			nal o																			-					
	05			nal o																		-						
	06			nal o																								
	07	1	Norn	nal o	utp	ut 15	5																-					

### Section 2-2

Addre	SS	When the instructions to the right are not executed	instruction	ulse output (SPED, ACC, G) is executed	When origin searches are enabled in the PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word	Bit	Normal outputs		Fixed duty ratio	o pulse output	Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 102	O 102 00 Normal output 16					
	01	Normal output 17				
	02	Normal output 18				
	03	Normal output 19				
	04	Normal output 20				
	05 Normal output 21					
	06	Normal output 22				
	07	Normal output 23				

### I/O Terminal Blocks of CPU Units with 40 I/O Points

#### Input Terminal Block (Top Block)

AC Power Supply Models

							_	_					-			_			_		_		-
	L1	L2/N		ОМ	D1	03	C	)5	07	0	9	11	(	01	0	3	05	5 0	7	09	э	11	
-	Ę	) (	€	00	02	2	04	0	6 (	28	10		00	C	)2	0	4	06	0	8	1(	)	
Inputs (CIO 0) Inputs (CIO 1											1)												

DC Power Supply Models

20	10	100	0	up	Jiy	WIO	uci	3																			
4	-	_	-	С	DM	0	1	0	3	)5	0	7	09	9	1	1	0	1	0	3	05	0	7	0	9	11	1
	N	С	¢		0	0	02	2	04	C	6	08	3	1(	0	C	00	02	2	04	Ļ	06	0	8	1	0	
					In		~ (0	- D	0)							In	Suto			1)							

Inputs (CIO 0)

Inputs (CIO 1)

### Setting Input Functions Using PLC Setup

Addre	ess	Inp	ut operation	settings	High-s	peed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-speed	ation settings: d counters enabled ase-Z reset	Origin searches enabled for pulse outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 0	00	Normal input 0			Counter 0, incre- ment input	Counter 0, A phase, up, or count input	
	01	Normal input 1			Counter 1, incre- ment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2			Counter 2, incre- ment input	Counter 1, A phase, up, or count input	
	03	Normal input 3			Counter 3, incre- ment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Interrupt input 2	Quick- response input 2	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Interrupt input 3	Quick- response input 3	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Interrupt input 4	Quick- response input 4			
	09	Normal input 9	Interrupt input 5	Quick- response input 5			
	10	Normal input 10					Pulse output 0: Origin proximity input signal
	input 10						Pulse output 1: Origin proximity input signal

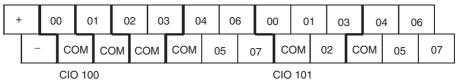
<b>Specifications</b>
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### Section 2-2

Addr	ess	Inp	ut operation	settings	High-s	peed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-spee	ation settings: d counters enabled ase-Z reset	Origin searches enabled for pulse outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 1	00	Normal input 12					
	01	Normal input 13					
	02	Normal input 14					
	03	Normal input 15					
	04	Normal input 16					
	05	Normal input 17					
	06	Normal input 18					
	07	Normal input 19					
	08	Normal input 20					
	09	Normal input 21					
	10	Normal input 22					
	11	Normal input 23					

### **Output Terminal Block Arrangement (Bottom Block)**

AC Power Supply Models



DC Power Supply Models

Ν	IC	0	0	0	1	0	2	0	3	04	4	06	3	00	D	0.	1	03	3	0	4	06	6	
	N	С	СС	М	СС	ЭМ	СС	М	СС	ЭМ	0	5	0	7	С	ОМ	0	2	С	DM	0	5	0	7
CIO 100										(	CIO	101												

#### Setting Output Functions Using Instructions and PLC Setup

Addre	ess	When the instructions to the right are not executed	instruction	Ilse output (SPED, ACC, 3) is executed	When origin searches are enabled in the PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word	Bit	Normal outputs		Fixed duty ratio	o pulse output	Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW)	Pulse output 0 (pulse)		
	01	Normal output 1	Pulse output 0 (CCW)	Pulse output 0 (direction)		PWM output 0
	02	Normal output 2	Pulse output 1 (CW)	Pulse output 1 (pulse)		
	03	Normal output 3	Pulse output 1 (CCW)	Pulse output 1 (direction)		PWM output 1
	04	Normal output 4			Origin search 0 (Error counter reset output)	
	05	Normal output 5			Origin search 1 (Error counter reset output)	
	06	Normal output 6				
	07	Normal output 7				
CIO 101	00	Normal output 8				
	01	Normal output 9				
	02	Normal output 10				
	03	Normal output 11				
	04	Normal output 12				
0	05	Normal output 13				
	06	Normal output 14				
	07	Normal output 15				

#### I/O Terminal Blocks of CPU Units with 30 I/O Points

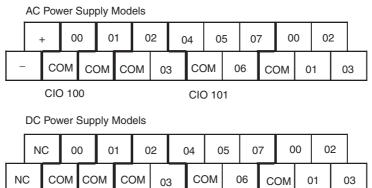
#### Input Terminal Block (Top Block)

AC	Powe	r Su	pply	/ M	ode	ls															
L	_1 L:	2/N	СС	ОМ	0.	1	03	0	5	0	7	0	9	11	1	0	1	0	3	0	5
	ŧ		Ð	0	0	02	0	4	0	6	C	8	1	0	0	0	C	)2	0	4	NC
	Inputs (CIO 0) Inputs (CIO 1)																				
DC	Powe	r Su	ppl	y M	ode	ls															
+		-	СС	M	01	(	03	0	5	0	7	09	9	11		01	1	03	3	0	5
	NC	Ć	Ð	00	)	02	0	)4	0	6	0	3	1(	)	00	0	0	2	04	4	NC
				Inp	uts	(CIO	0)								Inpu	uts	(CI	01	)		

### Setting Input Functions Using PLC Setup

Addr	ess	Inp	ut operation	settings	High-s	speed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-spee Ph	ation settings: d counters enabled ase-Z reset	Origin searches enabled for pulse outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 0	00	Normal input 0			Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1			Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2			Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3			Counter 3, increment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Interrupt input 2	Quick- response input 2	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Interrupt input 3	Quick- response input 3	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Interrupt input 4	Quick- response input 4			
	09	Normal input 9	Interrupt input 5	Quick- response input 5			
	10	Normal input 10					Pulse output 0: Origin proximity input signal
	11	Normal input 11					Pulse output 1: Origin proximity input signal
CIO 1	00	Normal input 12					
	01	Normal input 13					
	02	Normal input 14					
	03	Normal input 15					
	04	Normal input 16					
	05	Normal input 17					

#### **Output Terminal Block (Bottom Block)**



CIO 101

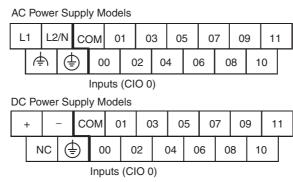
CIO 100

### Setting Output Functions Using Instructions and PLC Setup

Addre	ess	When the instructions to the right are not executed	instruction (SP	Ilse output ED, ACC, PLS2, s executed	When origin searches are enabled in the PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word	Bit	Normal outputs		Fixed duty ratio	pulse output	Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW)	Pulse output 0 (pulse)		
	01	Normal output 1	Pulse output 0 (CCW)	Pulse output 0 (direction)		PWM output 0
	02	Normal output 2	Pulse output 1 (CW)	Pulse output 1 (pulse)		
	03	Normal output 3	Pulse output 1 (CCW)	Pulse output 1 (direction)		PWM output 1
	04	Normal output 4			Origin search 0 (Error counter reset output)	
	05	Normal output 5			Origin search 1 (Error counter reset output)	
	06	Normal output 6				
	07	Normal output 7				
CIO 101	00	Normal output 8				
	01	Normal output 9				
	02	Normal output 10				
	03	Normal output 11				

#### I/O Terminal Blocks of CPU Units with 20 I/O Points

#### Input Terminal Block (Top Block)

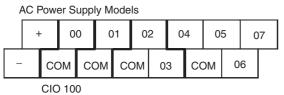


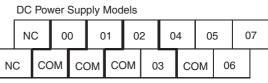
#### Setting Input Functions Using PLC Setup

Addr	ess	In	put operation	settings	High-s	speed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-spee	ation settings: d counters enabled ase-Z reset	Origin searches enabled for pulse outputs 0 and 1
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 0	00	Normal input 0			Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1			Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2			Counter 2, increment input	Counter 1, A phase, up, or count input	
	03 Normal input 3 04 Normal Interrupt			Counter 3, increment input	Counter 1, B phase, down, or direction input		
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Interrupt input 2	Quick- response input 2	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Interrupt input 3	Quick- response input 3	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Interrupt input 4	Quick- response input 4			
	09	Normal input 9	Interrupt input 5	Quick- response input 5			
	10	Normal input 10					Pulse output 0: Origin proximity input signal
	11	Normal input 11					Pulse output 1: Origin proximity input signal

### Section 2-2

#### **Output Terminal Block (Bottom Block)**





CIO 100

#### Setting Output Functions Using Instructions and PLC Setup

Addre	SS	When the instructions to the right are not executed	instruction	Ilse output (SPED, ACC, G) is executed	When origin searches are enabled in PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word	Bit	Normal outputs		Fixed duty rat	o pulse output	Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW)	Pulse output 0 (pulse)		
	01	Normal output 1	Pulse output 0 (CCW)	Pulse output 0 (direction)		PWM output 0
	02	Normal output 2	Pulse output 1 (CW)	Pulse output 1 (pulse)		
	03	Normal output 3	Pulse output 1 (CCW)	Pulse output 1 (direction)		PWM output 1
	04	Normal output 4			Origin search 0 (Error counter reset output)	
	05	Normal output 5			Origin search 1 (Error counter reset output)	
	06	Normal output 6				
l	07	Normal output 7				

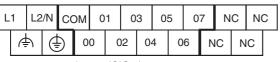
### Section 2-2

### I/O Terminal Blocks of CPU Units with 14 I/O Points

#### Input Terminal Block (Top Block)



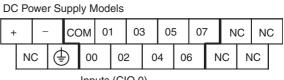
**Specifications** 



Inputs (CIO 0)

#### Setting Input Functions Using PLC Setup

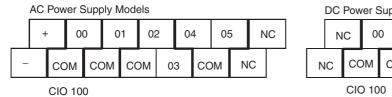
Addro	ess	Inp	out operation	settings	High-s	peed counters	Origin searches
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-speed	Operation settings: High-speed counters enabled Phase-Z reset	
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	
CIO 0	00	Normal input 0			Counter 0, incre- ment input	Counter 0, A phase, up, or count input	
	01	Normal input 1			Counter 1, incre- ment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2			Counter 2, incre- ment input	Counter 1, A phase, up, or count input	Pulse output 0: Ori- gin proximity input signal
	03	Normal input 3			Counter 3, incre- ment input	Counter 1, B phase, down, or direction input	Pulse output 1: Ori- gin proximity input signal
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z or reset input	
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z or reset input	
	06	Normal input 6	Interrupt input 2	Quick- response input 2	Counter 2, phase-Z reset input		Pulse output 0: Ori- gin input signal
	07	Normal input 7	Interrupt input 3	Quick- response input 3	Counter 3, phase-Z reset input		Pulse output 1: Ori- gin input signal

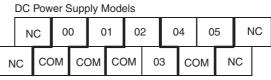


Inputs (CIO 0)

#### Section 2-2

#### **Output Terminal Block (Bottom Block)**





CIO 100

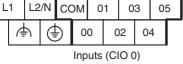
#### Setting Functions Using Instructions and PLC Setup

Address		When the instructions to the right are not executed	When a pulse output instruction (SPED, ACC, PLS2, or ORG) is executed		When origin searches are enabled in PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word	Bit	Normal outputs		Fixed duty ra	atio pulse output	Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW)	Pulse output 0 (pulse)		
	01	Normal output 1	Pulse output 0 (CCW)	Pulse output 0 (direction)		PWM output 0
	02	Normal output 2	Pulse output 1 (CW)	Pulse output 1 (pulse)		
	03	Normal output 3	Pulse output 1 (CCW)	Pulse output 1 (direction)		PWM output 1
	04	Normal output 4			Origin search 0 (Error counter reset output)	
	05	Normal output 5			Origin search 1 (Error counter reset output)	

#### I/O Terminal Blocks of CPU Units with 10 I/O Points

#### Input Terminal Block (Top Block)

AC Power Supply Models L1 L2/N COM 01 03



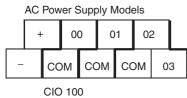
DC Power Supply Models											
+	+ –		-	СОМ		0.	1	03	3	0	5
	N	ic (‡		00 02				2	0	4	
	Inputs (CIO 0)										

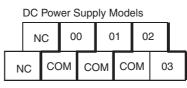
#### Setting Input Functions Using PLC Setup

Addr	ess	Inp	out operation	settings	High-s	High-speed counters		
Word	Bit	Normal inputs	Interrupt inputs (See note.)	Quick- response inputs	High-speed	Operation settings: High-speed counters enabled Phase-Z reset		
					Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)		
CIO 0	00	Normal input 0			Counter 0, incre- ment input	Counter 0, A phase, up, or count input		
	01	Normal input 1			Counter 1, incre- ment input	Counter 0, B phase, down, or direction input		
	02	Normal input 2			Counter 2, incre- ment input	Counter 1, A phase, up, or count input		
	03	Normal input 3			Counter 3, incre- ment input	Counter 1, B phase, down, or direction input	Pulse output 0: Ori- gin proximity input signal	
	04	Normal input 4	Interrupt input 0	Quick- response input 0	Counter 0, phase-Z/reset input	Counter 0, phase-Z or reset input		
	05	Normal input 5	Interrupt input 1	Quick- response input 1	Counter 1, phase-Z reset input	Counter 1, phase-Z or reset input	Pulse output 0: Ori- gin input signal	

### I/O Terminal Blocks of CPU Units with 10 I/O Points

#### **Output Terminal Block (Bottom Block)**





CIO 100

#### Setting Functions Using Instructions and PLC Setup

Address		When the instructions to the right are not executed	When a pulse output instruction (SPED, ACC, PLS2, or ORG) is executed		When origin searches are enabled in PLC Setup, and an origin search is executed with ORG instruction	When the PWM instruction is executed
Word Bit		Normal outputs	Fixed duty ratio pulse output			Variable duty ratio pulse output
			CW/CCW	Pulse plus direction	+ When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW)	Pulse output 0 (pulse)		
	01	Normal output 1	Pulse output 0 (CCW)	Pulse output 0 (direction)		PWM output 0
	02	Normal output 2	Pulse output 1 (CW)	Pulse output 1 (pulse)		
	03	Normal output 3	Pulse output 1 (CCW)	Pulse output 1 (direction)	Origin search 0 (Error counter reset output)	PWM output 1

### **Input Specifications**

#### **Normal Inputs**

Item	Specification					
	High-speed Counter Inputs	Interrupt Inputs and Quick-response Inputs	Normal inputs			
	CIO 0.00 to CIO 0.03	CIO 0.04 to CIO 0.09 (See note 1.)	CIO 0.10 to CIO 0.11 and CIO 1.00 to 1.11 (See note 2.)			
Input voltage	24 VDC <sup>+10%</sup> / <sub>-15%</sub>					
Applicable inputs	2-wire and 3-wire sensors					
Input impedance	3.0 kΩ	3.0 kΩ	4.7 kΩ			
Input current	7.5 mA typical	7.5 mA typical	5 mA typical			
ON voltage	17.0 VDC min.	17.0 VDC min.	14.4 VDC min.			
OFF voltage/current	1 mA max. at 5.0 VDC max.	1 mA max. at 5.0 VDC max.	1 mA max. at 5.0 VDC max.			
ON delay	2.5 μs max.	50 μs max.	1 ms max. (See note 3.)			

### Section 2-2

Item		Specification	
	High-speed Counter Inputs	Interrupt Inputs and Quick-response Inputs	Normal inputs
	CIO 0.00 to CIO 0.03	CIO 0.04 to CIO 0.09 (See note 1.)	CIO 0.10 to CIO 0.11 and CIO 1.00 to 1.11 (See note 2.)
OFF delay	2.5 μs max.	50 μs max.	1 ms max. (See note 3.)
Circuit configuration		Input LED	
		ts: CIO 1.04 to CIO 1.11	

Note

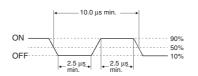
- e (1) HIgh-speed counter inputs, interrupt inputs, and quick-response inputs can also be used as normal inputs.
  - (2) The bits that can be used depend on the model of CPU Unit.
  - (3) The response time is the hardware delay value. The delay set in the PLC Setup (0 to 32 ms, default: 8 ms) must be added to this value.

#### **High-speed Counter Inputs**

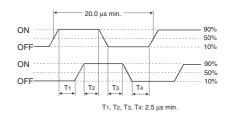
Bit	Differential phase mode	Pulse plus direction input mode	Up/down input mode	Increment mode	
CIO 0.00, CIO 0.02	A-phase pulse input	Pulse input	Increment pulse input	Increment pulse input	
CIO 0.01, CIO 0.03	B-phase pulse input	Direction input	Decrement pulse input	Normal input	
CIO 0.04, CIO 0.05	Z-phase pulse input or hardware reset input (Can be used as ordinary inputs when high-speed counter is not being used.)				
Max. count frequency	50 kHz (4×)	100 kHz			

Counter	Single phase	Phase A	Phase B	Phase Z
High-speed counter 0	CIO 0.00	CIO 0.00	CIO 0.01	CIO 0.04
High-speed counter 1	CIO 0.01	CIO 0.02	CIO 0.03	CIO 0.05
High-speed counter 2	CIO 0.02			
High-speed counter 3	CIO 0.03			

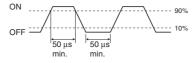
Pulse plus direction input mode, Increment mode Up/down input mode



#### Differential phase mode



Input bits: CIO 0.04 to CIO 0.09



#### Interrupt Inputs and Quick-response Inputs

With CPU Units with 20, 30, 40 or 60 I/O points, the six input bits from CIO 0.04 to CIO 0.09 can be used as either normal inputs or as interrupt or quick-response inputs depending on the settings in the PLC Setup. With CPU Units with 14 I/O points, the four input bits from CIO 0.04 to CIO 0.07 can be used as either normal inputs or as interrupt or quick-response inputs. With CPU Units with 10 I/O points, the two input bits from CIO 0.04 to CIO 0.05 can be used as either normal inputs or as interrupt or quick-response inputs.

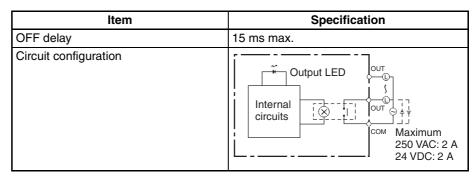
	Input bit		Interrupt	Quick-response
CPU Units with 20, 30, 40 or 60 I/O points	CPU Units with 14 I/O points	CPU Units with 10 I/O points	inputs	inputs
CIO 0.04	CIO 0.04	CIO 0.04	Interrupt input 0	Quick-response input 0
CIO 0.05	CIO 0.05	CIO 0.05	Interrupt input 1	Quick-response input 1
CIO 0.06	CIO 0.06		Interrupt input 2	Quick-response input 2
CIO 0.07	CIO 0.07		Interrupt input 3	Quick-response input 3
CIO 0.08			Interrupt input 4	Quick-response input 4
CIO 0.09			Interrupt input 5	Quick-response input 5

#### **Output Specifications**

#### **Relay Outputs**

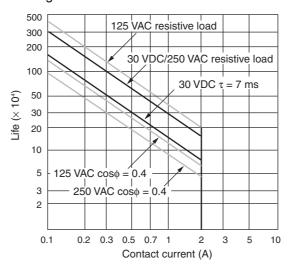
	ltem		Specification
Max. switching capacity			2 A, 250 VAC (cosφ = 1) 2 A, 24 VDC (4 A/common)
Min. switchir	ng capacity		10 mA, 5 VDC
Service life of relay	Electrical	Resistive load	100,000 operations (24 VDC)
		Inductive load	48,000 operations (250 VAC, $\cos\phi = 0.4$ )
	Mechanical		20,000,000 operations
ON delay			15 ms max.

#### Section 2-2



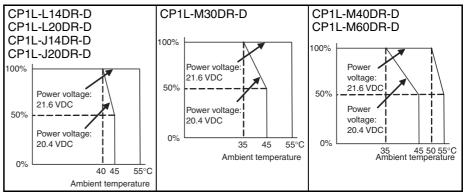
Note

(1) Under the worst conditions, the service life of output contacts is as shown above. The service life of relays is as shown in the following diagram as a guideline.



CPU Units with Relay Outputs (CP1L-□□DR-D)

Relay Output Load Current Derating Curves for CPU Units and Expansion I/O Units



**Note** The above restrictions, apply to the relay output load current from the CPU Unit even if Expansion I/O Units are not connected.

### Transistor Outputs (Sinking or Sourcing)

#### **Normal Outputs**

Item	Specification				
	CIO 100.00 to CIO 100.03	CIO 100.04 to CIO 100.07 (See note 3.)			
Max. switching capac- ity		M60D D 5.4 A/Unit M40D D 3.6 A/Unit M30D D 2.7 A/Unit L20D D 1.8 A/Unit L14D D 1.5 A/Unit (See note 2.) L10D D 0.9 A/Unit (See note 2.) J20D D 1.8 A/Unit J14D D 1.4 A/Unit			
Min. switching capacity	4.5 to 30 VDC, 1 mA				
Leakage current	0.1 mA max.				
Residual voltage	0.6 V max.	1.5 V max.			
ON delay	0.1 ms max.				
OFF delay	0.1 ms max.	1 ms max.			
Fuse	1 fuse/output (See note 1.)				
Circuit configuration	<ul> <li>Normal outputs CIO 100.00 to CIO 100.03 (Sinking Outputs)</li> <li>Internal Internal Circuits</li> <li>Normal outputs CIO 100.00 to CIO 100.03 (Sourcing Outputs)</li> <li>Normal outputs CIO 100.00 to CIO 100.03 (Sourcing Outputs)</li> </ul>	<ul> <li>Normal outputs CIO 100.04 to CIO 101.07 (Sinking Outputs)</li> <li>Internal circuits</li> <li>Normal outputs CIO 100.04 to CIO 101.07 (Sourcing Outputs)</li> <li>Normal outputs CIO 100.04 to CIO 101.07 (Sourcing Outputs)</li> </ul>			

Note

(1) The fuse cannot be replaced by the user.

(2) Also do not exceed 0.9 A for the total for CIO 100.00 to CIO 100.03.

(3) The bits that can be used depend on the model of the CPU Unit.

**Caution** Do not connect a load to an output terminal or apply a voltage in excess of the maximum switching capacity.

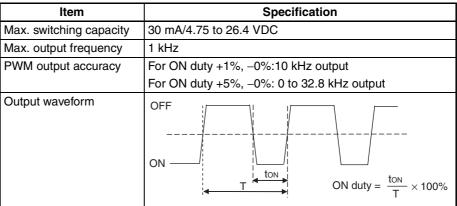
#### Pulse Outputs (CIO 100.00 to CIO 100.03)

Item	Specification		
Max. switching capacity	30 mA/4.75 to 26.4 VDC		
Min. switching capacity	7 mA/4.75 to 26.4 VDC		
Max. output frequency	100 kHz		
Output waveform	OFF 90% ON 10%		

Note

- (1) The load for the above values is assumed to be the resistance load, and does not take into account the impedance for the connecting cable to the load.
  - (2) Due to distortions in pulse waveforms resulting from connecting cable impedance, the pulse widths in actual operation may be smaller than the values shown above.

#### PWM Outputs (CIO 100.01 and CIO 100.03)



### 2-2-4 CP/CPM1A-series Expansion I/O Unit I/O Specifications

# Input Specifications (CP1W-40EDR/40EDT/40EDT1/20EDR1/20EDT/20EDT1/8ED and CPM1A-40EDR/40EDT/20EDR1/20EDT1/20EDT1/8ED)

Item	Specification		
Input voltage	24 VDC <sup>+10%</sup> / <sub>-15%</sub>		
Input impedance	4.7 kΩ		
Input current	5 mA typical		
ON voltage	14.4 VDC min.		
OFF voltage	5.0 VDC max.		
ON delay	1 ms max. (See note 1.)		
OFF delay	1 ms max. (See note 1.)		
Circuit configuration	Input LED		

Note

- (1) The response time is the hardware delay value. The delay set in the PLC Setup (0 to 32 ms, default: 8 ms) must be added to this value. For the CP1W-40EDR/EDT/EDT1 and CPM1A-40EDR/EDT/EDT1, a fixed value of 16 ms must be added.
  - (2) Do not apply voltage in excess of the rated voltage to the input terminal.

#### **Output Specifications**

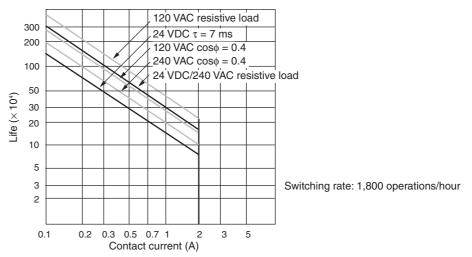
Relay Outputs (CP1W-40EDR/32ER/20EDR1/16ER/8ER and CPM1A-40EDR/20EDR1/16ER/8ER)

Item	Specification		
Max. switching capacity	2 A, 250 VAC (cos∳ = 1),		
	2 A, 24 VDC (4 A/common)		
Min. switching capacity	5 VDC, 10 mA		

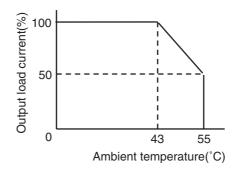
Item			Specification		
Service life of relay	Electrical	Resistive load	150,000 operations (24 VDC)		
(See note.)		Inductive load	100,000 operations (240 VAC, $\cos\phi = 0.4$ )		
	Mechanical	•	20,000,000 operations		
ON delay	•	15 ms max.			
OFF delay			15 ms max.		
Circuit configuration			Output LED Output LED Internal circuits Com Maximum 250 VAC: 2 A 24 VDC: 2 A		

Note

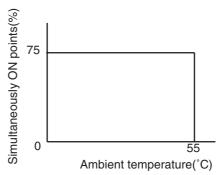
(1) Under the worst conditions, the service life of output contacts is as shown above. The service life of relays is as shown in the following diagram as a guideline.



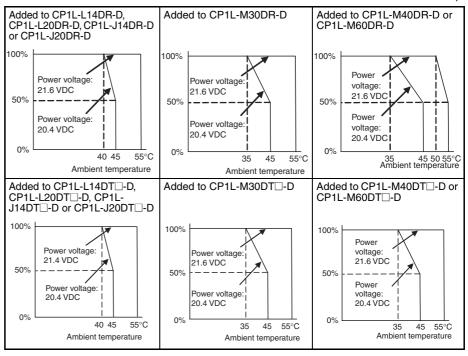
(2) With the CPM1A-16ER/CP1W-32ER/CP1W-16ER, the load current is restricted depending on the ambient temperature. Design the system considering the load current based on the following graph.



(3) CP1W-32ER's maximum number of simultaneously ON output points is 24 (75%). Design the system considering the simultaneously ON points and load current based on the following curve.



- (4) There are restrictions imposed by the ambient temperature.
- Relay Output Load Current Derating Curves for Expansion I/O Units (CP1W-8ER/16ER/20EDR1/32ER/40EDR and CPM1A-8ER/16ER/20EDR1/40EDR)



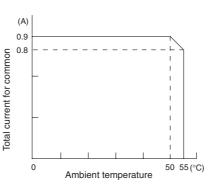
#### Transistor Outputs (Sinking or Sourcing)

Item	Specification				
	CP1W-40EDT CPM1A-40EDT CP1W-40EDT1 CPM1A-40EDT1	CP1W-32ET CP1W-32ET1	CP1W-20EDT CPM1A-20EDT CP1W-20EDT1 CPM1A-20EDT1	CP1W-16ET CP1W-16ET1	CP1W-8ET CPM1A-8ET CP1W-8ET1 CPM1A-8ET1
Max. switching capacity (See note2.)	4.5 to 30 VDC 0.3 A/output	4.5 to 30 VDC 0.3 A/output	24 VDC <sup>10%</sup> / <sub>-5%</sub> 0.3 A/output	4.5 to 30 VDC 0.3 A/output	<ul> <li>OUT00/01 4.5 to 30 VDC, 0.2 A/ output</li> <li>OUT02 to 07 4.5 to 30 VDC, 0.3 A/output</li> </ul>
	0.9 A/common 3.6 A/Unit	0.9 A/common 7.2 A/Unit	0.9 A/common 1.8 A/Unit	0.9 A/common 3.6 A/Unit	0.9 A/common 1.8 A/Unit
Leakage current	0.1 mA max.	0.1 mA max.	0.1 mA max.	0.1 mA max.	0.1 mA max.
Residual voltage	1.5 V max.	1.5 V max.	1.5 V max.	1.5 V max.	1.5 V max.
ON delay	0.1 ms max.	0.1 ms max.	0.1 ms.	0.1 ms max.	0.1 ms max.
OFF delay	1 ms max. 24 VDC <sup>+10%</sup> / <sub>-5%</sub> 5 to 300 mA	1 ms max. 24 VDC <sup>+10%</sup> / <sub>-5%</sub> 5 to 300 mA	1 ms max. 24 VDC <sup>+10%</sup> / <sub>-5%</sub> 5 to 300 mA	1 ms max. 24 VDC <sup>+10%</sup> / <sub>-5%</sub> 5 to 300 mA	1 ms max. 24 VDC <sup>+10%</sup> / <sub>-5%</sub> 5 to 300 mA
Max. number of Simultaneously ON Points of Output	16 pts (100%)	24 pts (75%)	8 pts (100%)	16 pts (100%)	8 pts (100%)
Fuse (See note 1.)	1 fuse/common				
Circuit configuration	Sinking Outputs Output LED UT Com (-) Sourcing Outputs Output LED Output LED Internal COM (+) COM (+)				

Note

(1) The fuse cannot be replaced by the user.

(2) If the ambient temperature is maintained below 50°C, up to 0.9 A/common can be used.



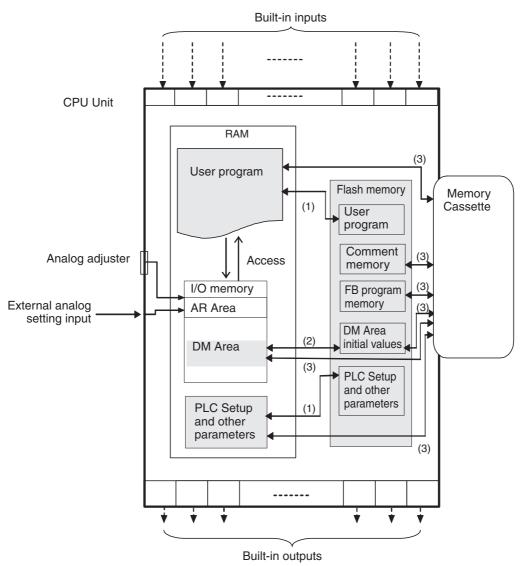


Caution Do not connect a load to an output terminal or apply a voltage in excess of the maximum switching capacity.

### 2-3 CP1L CPU Unit Operation

### 2-3-1 Overview of CPU Unit Configuration

The CP1L CPU Unit memory consists of the following blocks.



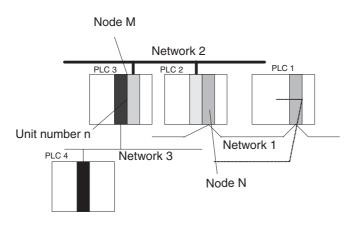
- (1) Data is backed up from RAM to the built-in flash memory when changes are made, e.g., from the CX-Programmer.
  - When the power supply is turned ON, data is transferred from the builtin flash memory to RAM.
- (2) A CX-Programmer operation can be used to transfer DM Area initial values from RAM to the built-in flash memory.
  - The PLC Setup can be set so that DM Area initial values are transferred from the built-in flash memory to RAM when the power supply is turned ON.
- (3) CX-Programmer operations can be used to transfer data from RAM to the Memory Cassette or from the built-in flash memory to the Memory Cassette.

CP1L CPU Unit Operation	Section 2-3
	• When the power supply is turned ON, data is transferred from the Memory Cassette to the built-in flash memory and RAM. Data can also be transferred from the Memory Cassette to the built-in flash memory and RAM using the CX-Programmer.
<u>User Program</u>	The user program consists of up to 288 tasks, including interrupt tasks. Each task is programmed from the CX-Programmer and then transferred to the CPU Unit.
	There are two types of tasks: cyclic tasks and interrupt tasks. Cyclic tasks are executed once each cycle and interrupt tasks are executed only when the interrupt conditions are met. There can be up to 32 cyclic tasks and up to 256 interrupt tasks. Cyclic tasks are executed in the order of the task numbers.
	Instructions programmed in the tasks are executed in order from the first instruction and then I/O memory is refreshed. When all cyclic tasks have been executed, I/O refreshing with PLC Units is performed and then the cyclic tasks are executed again starting from the one with the lowest task number. This is called the cyclic scan method.
I/O Memory	The I/O memory area is a RAM area read and written by the user. Some parts of the I/O memory are cleared when the power is interrupted. Other parts are maintained. There are parts that used for data exchange with PLC Units and parts that are used internally.
	There are two ways to refresh the parts of I/O memory used for data exchange with PLC Units: Once each program execution cycle and immediately when needed when executing specific instructions.
Parameter Area	In addition to the I/O memory used as instructions operands by the user, there is also a separate memory area that can be manipulated only from the CX- Programmer. This area, called the parameter area, contains the following. • PLC Setup • Routing tables
PLC Setup	The PLC Setup contains configuration parameters that can be set by the user to define the basic specifications of the CPU Unit. Included are serial port settings, a minimum cycle time setting, and other parameters. For details, refer to the <i>CX-Programmer Operation Manual.</i>

#### **Routing Tables**

Tables specifying the communications paths from the Communications Units on the local PLC to remote PLCs connected on other networks must be registered in all the CPU Units in network PLCs to send and receive data between networks. These tables are called the routing tables. The routing tables consist of the relay network table and local network table.

Routing tables are created from the CX-Programmer or Support Software for Communications Units (e.g., CX-Integrator) and then transferred to each CPU Unit.



Relay Netw	ork lable to	r PLC 1
Remote network	Relay network	Relay node
3	1	Ν

Relay Network Table for PLC 2

-		
Remote network	Relay network	Relay node
3	2	М

Local Network Table for PLC 3

Local	Unit
network	number
3	n

#### **Remote Network Table**

The remote network tables lists the node number and network address of the first relay node that must be passed through to reach any remote network to which the PLC is not directly connected. Once the routing tables have been registered, any remote network can be reached by passing through relay nodes.

#### **Local Network Table**

The local network table contains the unit number and network address of all Communications Units that are part of the local PLC.

#### **Built-in Flash Memory**

Flash memory is built into the CP1L CPU Units. Data in the following areas is automatically backed up to the flash memory whenever it is written in any way other than by instructions in the user program, e.g., when the CX-Programmer or PT is used to transfer or edit data, edit the program online, or transfer data from a Memory Cassette.

- User program area
- Parameter area (PLC Setup and routing tables)

The next time the power supply is turned ON, the data in the built-in flash memory is automatically transferred to user memory (i.e., the user program area and parameter area).

It is also possible to save data from data areas in I/O memory in the built-in flash memory using operations from the CX-Programmer.

The symbol table, comment file, and program index file can be stored in the comment memory in flash memory. When the program is transferred from the CX-Programmer to the CPU Unit, function block program information is also stored automatically in flash memory.

**Note** The BKUP indicator on the front of the CPU Unit will light whenever the built-in flash memory is being written or the Memory Cassette is being accessed.

Never turn OFF the power supply to the CPU Unit when the BKUP indicator is lit.

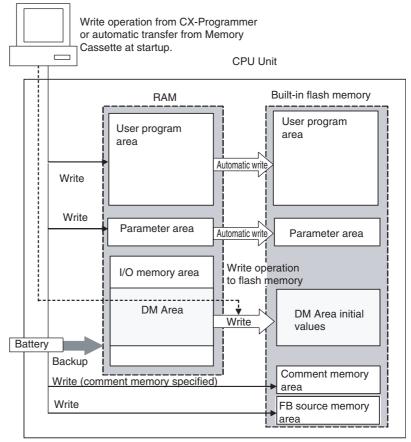
- <u>Memory Cassette</u> Memory Cassettes can be used as required in system operation and maintenance. For example, they can be used to save programs, data memory contents, PLC Setup data, or I/O comments from the CX-Programmer. The contents of a Memory Cassette can also be automatically transferred if desired.
  - **Note** Memory Cassette cannot be used in CP1L-J CPU Unit.

# 2-3-2 Flash Memory Data Transfers

## **Built-in Flash Memory**

Writing to Flash Memory

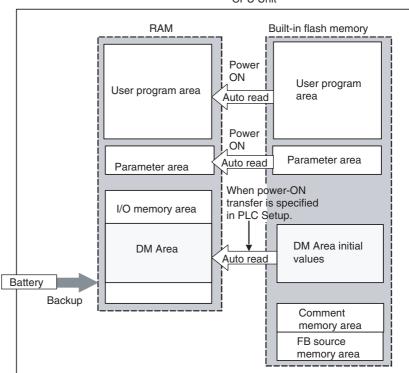
Data	Transfer method
User program and parameter data	This data is automatically transferred from RAM to flash mem- ory when a project is transferred from the CX-Programmer, when the data is written to RAM from a PT or other external device, or when the data is transferred from a Memory Cas- sette.
DM Area data	This data is transferred to flash memory only when the trans- fer is specified from the CX-Programmer.
Comment memory data	This data is written to flash memory when a project is trans- ferred from the CX-Programmer and transferring comment memory is specified.
Function block source data	This data is written to flash memory when a project containing one or more function blocks is transferred from the CX-Pro- grammer.



FB = Function block

#### Reading from Flash Memory

Data	Read method
User program and parameter data	This data is automatically read to RAM when power is turned ON.
DM Area data	Reading this data when power is turned ON can be enabled or disabled in the PLC Setup.
Comment memory data	When the project is transferred from the CX-Programmer, comment memory can be specified as a destination to transfer the comment memory data to built-in flash memory.
Function block source data	When a project that contains function blocks is transferred from the CX-Programmer, the function block source data is transferred to built-in flash memory.



CPU Unit

FB = Function block

# 2-3-3 Memory Cassette Data Transfers

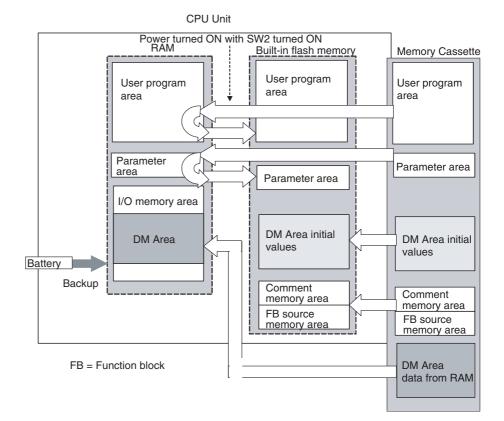
**Note** Memory Cassette cannot be used in CP1L-J CPU Unit.

## Writing to a Memory Cassette

		<b>.</b>		
Data	Metl		Source	
User program and parameter data	Data is written to a Memory Cassette using write opera- tions from the CX-Program-		Data in the built-in flash mem- ory is written to the Memory Cassette.	
Comment memory and function block source data	mer.		Either of both of the following can be transferred to the Memory Cassette.	
DM Area data			<ul> <li>Data in the built-in flash memory.</li> <li>Data in RAM.</li> </ul>	
	CPU Un	iit Built-in flash m	Memory Cassette write operation from CX-Programmer emory	
User area	program	User progra	am User program area	
I/O mu area	emory // Area	DM Area ir values		
Battery		Comment memory are FB source memory are	EB source	
FB = Function b	block		DM Area data from RAM	

## **Reading from a Memory Cassette**

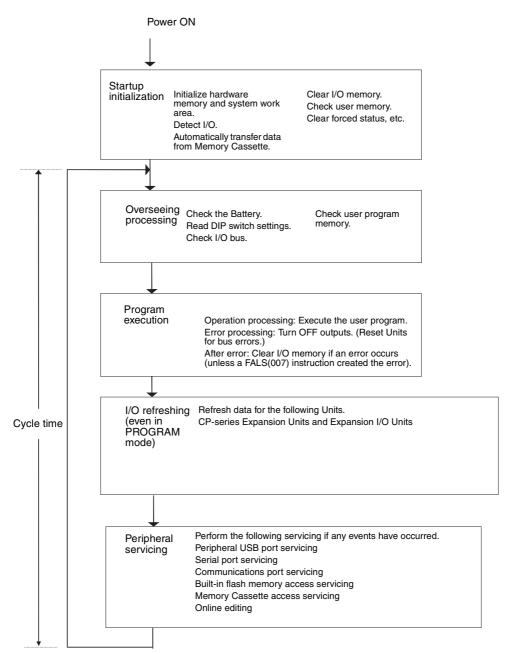
Data	Method	Destination
User program and parameter data	This data is transferred by turning SW2 on the DIP switch to ON and turning ON the power supply.	Data in the Memory Cassette is transferred to RAM and then automatically transferred to the built-in flash memory.
Comment memory and function block source data		Data is transferred to the built- in flash memory.
DM Area data		DM Area data originally from the built-in flash memory is transferred back to the flash memory and DM Area data originally from RAM is trans- ferred to RAM.



# 2-4 CPU Unit Operation

## 2-4-1 General Flow

The following flowchart shows the overall operation of the CPU Unit. First the user program is executed and then I/O is refreshed and peripheral servicing is performed. These processes are then repeated in cyclic fashion.



# 2-4-2 I/O Refreshing and Peripheral Servicing

## I/O Refreshing

I/O refreshing involves cyclically transferring data with external devices using preset words in memory. I/O refreshing includes the following:

• Refreshing between I/O words in the CIO Area and CPU Unit built-in I/O, CP/CPM1A-series Expansion Units, and CP/CPM1A-series Expansion I/O Units

All I/O refreshing is performed in the same cycle (i.e., time slicing is not used). I/O refreshing is always performed after program execution.

Units	Max. data exchange	Data exchange area
CPU Unit built-in I/O	2 input words	I/O Bit Area
	2 output words	
CP/CPM1A-series Expansion Units and Expansion I/O Units	Fixed depending on Units	I/O Bit Area

**Peripheral Servicing** 

Peripheral servicing involves servicing non-scheduled events for external devices. This includes both events from external devices and service requests to external devices.

Most peripheral servicing involves FINS commands. The specific amount of time set in the system is allocated to each type of servicing and executed every cycle. If all servicing cannot be completed within the allocated time, the remaining servicing is performed the next cycle.

Service	Description
USB port servicing	Non-scheduled servicing for FINS or Host Link
Communications port servic- ing	commands received via a USB port or serial port from the CX-Programmer, PTs, or host computers (e.g., requests for program transfers, monitoring, forced-set/reset operations, or online editing)
	<ul> <li>Non-scheduled servicing from the CPU Unit trans- mitted from a serial port (non-solicited communica- tions)</li> </ul>
Communications port servic- ing	<ul> <li>Servicing to execute network communications or serial communications for the SEND, RECV, CMND or PMCR instructions using communications ports 0 to 7 (internal logical ports)</li> </ul>
	<ul> <li>Servicing to execute background execution using communications ports 0 to 7 (internal logical ports)</li> </ul>
Built-in flash memory access servicing	<ul> <li>Read/write processing for built-in flash memory</li> </ul>
Memory Cassette access ser- vicing	<ul> <li>Read/write processing for a Memory Cassette</li> </ul>

**Note** Peripheral USB port, serial port, and communications port servicing is allocated 8% of the previous cycle time by default (the default can be changed) for each service. If servicing is separated over many cycles, delaying completion of the servicing, set the same allocated time (same time for all services) rather than a percentage under execute time settings in the PLC Setup.

# 2-4-3 I/O Refresh Methods

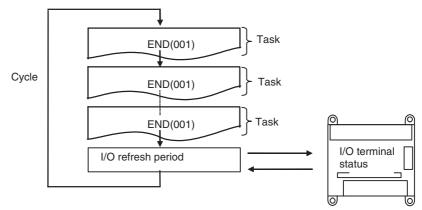
I/O for CPU Unit built-in I/O and I/O on CP/CPM1A-series Expansion Units and Expansion I/O Units is performed at the following times.

- 1,2,3... 1. Cyclic refresh period
  - 2. When instructions with an immediate refresh variation are executed
  - 3. When IORF(097) is executed

## Section 2-4

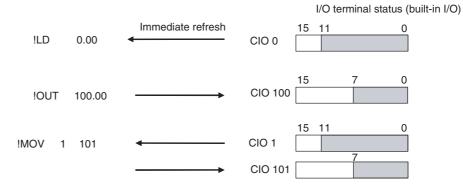
#### **Cyclic Refreshing**

 $\ensuremath{\mathsf{I/O}}$  is refreshed after all the instructions in executable tasks have been executed.



#### Immediate Refreshing

When the immediate refreshing variation of an instruction is specified and the instruction's operand is an input bit or word in the Built-in I/O Area, the word containing the bit or the word itself will be refreshed.



Note

- (1) Immediate refreshing is possible only for the Built-in I/O Area. Use IORF(097) for I/O on CP/CPM1A-series Expansion Units and Expansion I/O Units.
  - (2) Refreshing Range
    - Bit Operands The ON/OFF status of the 16 I/O points allocated to the word containing the specified bit will be refreshed.
    - Word Operands The ON/OFF status of the 16 I/O points allocated to the specified word will be refreshed.
  - (3) Refresh Timing
    - Input or source operands are read just before the instruction is executed.
    - Output or destination (results) operands are written just after the instruction is executed.
  - (4) Using instructions with the immediate refresh option, instruction execution time will be increased, increasing the overall cycle time. Be sure to confirm that this will not adversely affect system operation.

**IORF(097) Refreshing** When IORF(097) (I/O REFRESH) is executed, the I/O bits in the specified range of words are refreshed. IORF(097) can be used for CP/CPM1A-series Expansion Units and CP/CPM1A-series Expansion I/O Units.

## Section 2-4



St: Starting word E: End word All the words from St to E, inclusive are refreshed.

Example



Here, the four words from CIO 2 to CIO 5 are refreshed.

If high-speed response is required from input to output, execute IORF(097) before and after the relevant instructions.

**Note** IORF(097) has a relatively long execution time which increases with the number of words being refreshed. Be sure to consider the affect of this time on the overall cycle time. Refer to the *CP Series Programmable Controllers Programming Manual* for instruction execution times.

## 2-4-4 Initialization at Startup

The following initializing processes will be performed once each time the power is turned ON.

- Confirm mounted Units and I/O allocations.
- Clear the non-holding areas of I/O memory according to the status of the IOM Hold Bit. (See note 1.)
- Clear forced status according to the status of the Forced Status Hold Bit. (See note 2.)
- Automatically transfer data from the Memory Cassette if one is mounted and automatic transfer at startup is specified.
- Perform self-diagnosis (user memory check).
- Restore the user program. (See note 3.)

#### Note

(1) The I/O memory is held or cleared according to the status of the IOM Host Bit and the setting for IOM Hold Bit Status at Startup in the PLC Setup (read only when power is turned ON).

Auxiliary bit		IOM Hold Bit (A500.12)	
PLC Setup setting		Clear (OFF)	Hold (ON)
IOM Hold Bit Status at Startup	Clear (OFF)	At power ON: Clear At mode change: Clear	At power ON: Clear At mode change: Hold
	Hold (ON)		At power ON: Hold At mode change: Hold

- **Note** When the mode is changed between PROGRAMMING mode and RUN or MONITOR mode, I/O memory initialization is according to the status of the IOM Hold Bit at that time.
- (2) The forced status held or cleared according to the status of the Force Status Hold Bit and the setting for Forced Status Hold Bit Status at Startup in the PLC Setup (read only when power is turned ON).

Auxiliary bit		Forced Status Hold Bit (A500.13)	
PLC Setup setting	_	Clear (OFF)	Hold (ON)
Forced Status Hold Bit Status at Startup		At power ON: Clear At mode change: Clear	At power ON: Clear At mode change: Hold
	Hold (ON)		At power ON: Hold At mode change: Hold

- **Note** When the mode is changed between PROGRAMMING mode and RUN or MONITOR mode, forced status initialization is according to the status of the Forced Status Hold Bit at that time.
- (3) User program recovery is performed if online editing is performed but the power supply to the PLC is turned OFF before the CPU Unit can complete backup processing. The BKUP indicator will light during backup processing.

# 2-5 CPU Unit Operating Modes

## 2-5-1 Operating Modes

The CPU Unit has three operating modes that control the entire user program and are common to all tasks.

PROGRAM:	Programs are not executed and preparations, such as initial- izing the PLC Setup and other settings, transferring pro- grams, checking programs, force-setting and force-resetting can be executed prior to program execution.
MONITOR:	Programs are executed, but some operations, such as online editing, forced-set/reset, and changes to present values in I/O memory, are enabled for trial operation and other adjustments.
RUN:	Programs are executed and some operations are disabled.

# 2-5-2 Status and Operations in Each Operating Mode

The following table lists status and operations for each mode.

Operation			PROGRAM mode	RUN mode	MONITOR mode	
Program execution		Stopped	Executed	Executed		
I/O refreshing			Executed	Executed	Executed	
External I/O status	S		OFF	According to program	According to program	
I/O memory	Non-holdir	ng memory	Cleared	According to program	According to program	
	Holding m	emory	Held			
CX-Programmer	I/O memo	ry monitoring	ОК	ОК	ОК	
operations	Program n	nonitoring	ОК	ОК	ОК	
	Program	From CPU Unit	ОК	ОК	ОК	
	transfers	To CPU Unit	ОК	X	Х	
	Checking program		ОК	X	Х	
	Setting PLC Setup		ОК	X	Х	
	Changing program		ОК	X	ОК	
	Force-setting/resetting		ОК	Х	ОК	
Changing timer/counter SV		ОК	Х	ОК		
	Changing	timer/counter PV	ОК	Х	ОК	
	Change I/	O memory PV	ОК	X	ОК	

Note The following table shows the relationship of operating modes to tasks.

Mode	Cyclic task status	Interrupt task status
PROGRAM	Disabled status (INI)	Stopped

# CPU Unit Operating Modes

RUN	A task will go to READY status if the task is set to go to READY status at star-	Executed if inter- rupt condition is met.
MONITOR	• A task in READY status will be executed (RUN status) when it obtains the right to execute.	
	• A status will go to Standby status (WAIT) if a READY task is put into Standby status by a TASK OFF (TKOF) instruction.	

# 2-5-3 Operating Mode Changes and I/O Memory

## **Operating Mode Changes and I/O Memory**

Mode Changes	Non-holding areas	Holding Areas
	I/O bits	HR Area
	Data Link bits	DM Area
	Work bits	Counter PV and Completion Flags
	Timer PV/Completion Flags	Auxiliary Area bits/words are holding or
	Index Registers	non-holding depending on the address.
	Data Registers	
	Task Flags	
	Auxiliary Area bits/words are holding or non-holding depending on the address.	
RUN or MONITOR to PROGRAM	Cleared (See note 1.)	Held
PROGRAM to RUN or MONITOR	Cleared (See note 1.)	Held
RUN to MONITOR or MONITOR to RUN	Held (See note 2.)	Held

Note 1. The following processing is performed if the I/O Memory Hold Bit is ON. Outputs from Output Units will be turned OFF when operation stops even if I/O bit status is held in the CPU Unit.

2. The cycle time will increase by approximately 10 ms when the operating mode is changed from MONITOR to RUN mode. This will not, however, cause an error for exceeding the maximum cycle time limit.

I/O Memory	I/O Memory			Output bits allocated to Output Units		
Hold Bit status (A500.12)	Mode changed	Operation stopped		Mode changed	Operation stopped	
(A300.12)	between PROGRAM and RUN/ MONITOR	Fatal error other than FALS	FALS executed	between PROGRAM and RUN/ MONITOR	Fatal error other than FALS	FALS executed
OFF	Cleared	Cleared	Held	OFF	OFF	OFF
ON	Held	Held	Held	Held	OFF	OFF

Note Refer to SECTION 4 I/O Memory Allocation.

# 2-5-4 Startup Mode Setting

This setting in the PLC Setup determines the operating mode that will be used by the CPU Unit when the power supply is turned ON.

### PLC Setup

Name	Description	Settings	Default
Startup Mode	Specifies the CPU Unit oper- ating mode at startup	<ul> <li>Program (See note.)</li> <li>Monitor</li> <li>Run</li> <li>Use programming console</li> </ul>	Use program- ming console (See note.)

Note

A Programming Console cannot be connected to the CP1L.



PLC Settings - NewPLC1		_ 🗆 X
File Options Help		
Startup   Settings   Timings   Input constant   Serial Port 1   Serial Port 2   Peripheral Service   Bu	uilt-in Input	F4 ►
Startup Hold Force Status Hold Bit IDM Hold Bit Startup Data Read Read DM from flash memory Use programming console(Run)		
	CP1L-M	Offline

**Note** A Programming Console cannot be connected to a CP1L CPU Unit. If *Use programming console* is set, the CPU Unit will start in RUN mode.

# 2-6 Power OFF Operation

## 2-6-1 Overview

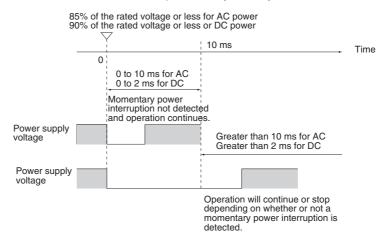
The following processing is performed when CPU Unit power is turned OFF. Power OFF processing will be performed if the power supply voltage falls below the specified value while the CPU Unit is in RUN or MONITOR mode.

- 1,2,3... 1. The CPU Unit will stop.
  - 2. Outputs from all Output Units will be turned OFF.
  - Note (1) All outputs will turn OFF despite the status of the I/O Memory Hold Bit or I/O Memory Hold Bit at power ON settings in the PLC Setup.
    - (2) AC Power 85% of the rated voltage: 85 V or less for a 100 to 240 V AC system
    - (3) DC Power
      - 90% of rated voltage: 20.4 V DC or less

The following processing will be performed if power drops only momentarily (momentary power interruption).

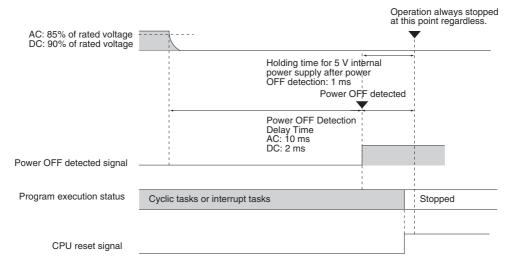
The system will continue to run unconditionally if the momentary power interruption lasts less than 10 ms for AC power or 2 ms for DC power, i.e., the time it takes the rated voltage at 85% or less to return to 85% or higher is less than 10 ms for AC power or the time it takes the rated voltage at 90% or less to return to 90% or higher is less than 2 ms for DC power.

2. A momentary power interruption that lasts more than 10 ms for AC power or more than 2 ms for DC power may or may not be detected.



The following timing chart shows the CPU Unit power OFF operation in more detail.

#### **Power OFF Timing Chart**



Power OFF detection time:

The time from when the power supply voltages drops to 85% or less of the rated voltage for AC power or 90% for DC power until the power OFF condition is detected.

Holding time for 5 V internal power supply after power OFF detection: The maximum time that the 5 V internal power supply voltage will be maintained after the power OFF condition is detected. The holding time is fixed at 1 ms.

### **Description of Operation**

Power OFF will be detected if the 100 to 240 V AC power supply falls below 85% of the rated voltage or the DC power supply falls below 90% of the rated voltage for the power OFF detection time (10 ms minimum for AC power and 2 ms minimum for DC power). The CPU reset signal will turn ON while the internal power supply is being held and the CPU Unit will be reset.

## 2-6-2 Instruction Execution for Power Interruptions

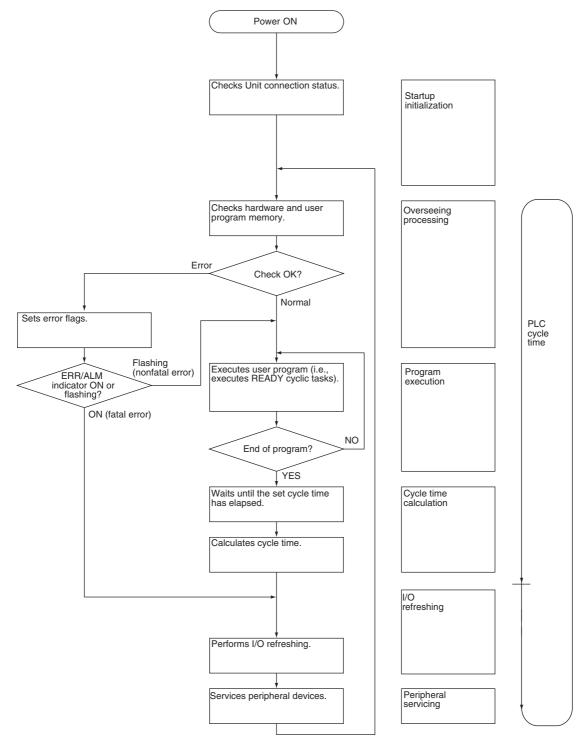
If power is interrupted and the interruption is detected when the CPU Unit is operating in RUN or MONITOR mode, the instruction currently being executed will be completed and then the CPU Unit will be reset.

## Section 2-7

# 2-7 Computing the Cycle Time

# 2-7-1 CPU Unit Operation Flowchart

The CPU Unit processes data in repeating cycles from the overseeing processing up to peripheral servicing as shown in the following diagram.



## 2-7-2 Cycle Time Overview

The cycle time depends on the following conditions.

- Type and number of instructions in the user program (in all cyclic tasks that are executed during a cycle, and within interrupt tasks for which the execution conditions have been satisfied)
- Type and number of CP/CPM1A-series Expansion Units and Expansion I/ O Units
  - Use of protocol macros and the largest communications message
- Fixed cycle time setting in the PLC Setup
- Use of USB and serial ports
- Fixed peripheral servicing time in the PLC Setup
- Note 1. The cycle time is not affected by the number of tasks that are used in the user program. The tasks that affect the cycle time are those cyclic tasks that are READY in the cycle.
  - 2. When the mode is switched from MONITOR mode to RUN mode, the cycle time will be extended by 10 ms (this will not, however, take the cycle time over its limit).

The cycle time is the total time required for the PLC to perform the five operations given in the following tables.

Cycle time = (1) + (2) + (3) + (4) + (5)

#### 1: Overseeing

Details	Processing time and fluctuation cause
Checks the I/O bus and user program memory, checks for battery errors, etc.	0.4 ms

#### 2: Program Execution

Details	Processing time and fluctuation cause
Executes the user program, and calculates the total time time taken for the instructions to execute the program.	Total instruction execution time

#### 3: Cycle Time Calculation

Details	Processing time and fluctuation cause
Waits for the specified cycle time to elapse when a minimum (fixed) cycle time has been set in the PLC Setup. Calculates the cycle time.	When the cycle time is not fixed, the time for step 3 is approximately 0. When the cycle time is fixed, the time for step 3 is the preset fixed cycle time minus the actual cycle time $((1) + (2) + (4) + (5))$ .

#### 4: I/O Refreshing

	Details	Processing time and fluctuation cause
CPU Unit built- in I/O and I/O on CP/ CPM1A-series Expansion Units and Expansion I/O Units	Outputs from the CPU Unit to the actual outputs are refreshed first for each Unit, and then inputs.	I/O refresh time for each Unit multiplied by the number of Units used.

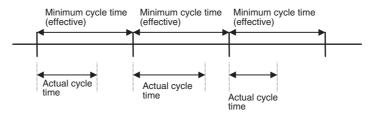
#### 5: Peripheral Servicing

Details	Processing time and fluctuation cause	
Services USB port.	If a uniform peripheral servicing time hasn't been set in the PLC Setup for	
Services serial ports	this servicing, 8% of the previous cycle's cycle time (calculated in step (3)) will be allowed for peripheral servicing.	
	If a uniform peripheral servicing time has been set in the PLC Setup, servic- ing will be performed for the set time. Servicing will be performed for at least 0.1 ms, however, whether the peripheral servicing time is set or not.	
	If the ports are not connected, the servicing time is 0 ms.	
Services communications ports.	If a uniform peripheral servicing time hasn't been set in the PLC Setup this servicing, 8% of the previous cycle's cycle time (calculated in step will be allowed for peripheral servicing.	
	If a uniform peripheral servicing time has been set in the PLC Setup, servic- ing will be performed for the set time. Servicing will be performed for at least 0.1 ms, however, whether the peripheral servicing time is set or not.	
	If no communications ports are used, the servicing time is 0 ms.	
Services built-in flash memory access.	If a uniform peripheral servicing time hasn't been set in the PLC Setup for	
Serves Memory Cassette access.	this servicing, 8% of the previous cycle's cycle time (calculated in step (3)) will be allowed for peripheral servicing.	
	If a uniform peripheral servicing time has been set in the PLC Setup, servic- ing will be performed for the set time. Servicing will be performed for at least 0.1 ms, however, whether the peripheral servicing time is set or not.	
	If there is no access, the servicing time is 0 ms.	

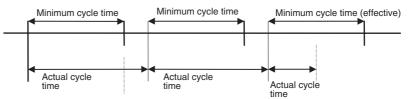
# 2-7-3 Functions Related to the Cycle Time

## Minimum Cycle Time

Set the minimum cycle time to a non-zero value to eliminate inconsistencies in I/O responses. A minimum cycle time can be set in the PLC Setup between 1 and 32,000 ms in 1-ms increments.



This setting is effective only when the actual cycle time is shorter than the minimum cycle time setting. If the actual cycle time is longer than the minimum cycle time setting, the actual cycle time will remain unchanged.



#### PLC Setup

Name	Settings	Default
,	0000 to 7D00 hex (1 to 32,000 ms in 1-ms incre- ments)	0000 hex: Variable cycle time

### Watch Cycle Time

If the cycle time exceeds the watch (maximum) cycle time setting, the Cycle Time Too Long Flag (A401.08) will be turned ON and PLC operation will be stopped.

### **PLC Setup**

Name	Settings	Default
Enable Watch Cycle Time Setting	0: Default (1 s) 1: User setting	0000 hex: Watch cycle time of 1 s
Watch Cycle Time	001 to FA0: 10 to 40,000 ms (10-ms increments)	

#### **Related Flags**

Name	Address	Description
Cycle Time Too Long Flag		Turns ON if the present cycle time exceeds the Watch Cycle Time set in the PLC Setup.

#### Cycle Time Monitoring

#### **Related Words**

The maximum cycle time is stored in A262 and A263 and the present cycle time is stored in A264 and A265 every cycle.

Name	Addresses	Description
Maximum Cycle Time	A262 and A263	These words contain the maximum cycle time in increments of 0.1 ms. The time is updated every cycle and is recorded in 32-bit binary (0 to FFFF FFFF hex, or 0 to 429,496,729.5 ms). (A263 is the leftmost word.)
Present Cycle Time	A264 and A265	These words contain the present cycle time in increments of 0.1 ms. The time is updated every cycle and is recorded in 32-bit binary (0 to FFFF FFFF, or 0 to 429,496,729.5 ms). (A265 is the leftmost word.)

The average cycle time for the past eight cycles can be read from the CX-Programmer.

Note The following methods are effective in reducing the cycle time.

- Place tasks that do not need to be executed on standby.
- Use JMP-JME instructions to skip instructions that do not need to be executed.

# 2-7-4 I/O Refresh Times for PLC Units

#### CP-series Expansion Unit and Expansion I/O Unit I/O Refresh Times

Name	Model	I/O refresh time per Unit
Expansion I/O Units	CP1W-40EDR CPM1A-40EDR	0.39 ms
	CP1W-40EDT CPM1A-40EDT	0.39 ms
	CP1W-40EDT1 CPM1A-40EDT1	0.39 ms
	CP1W-32ER	0.33 ms
	CP1W-32ET CP1W-32ET1	0.33 ms
	CP1W-20EDT CPM1A-20EDT	0.18 ms
	CP1W-20EDT1 CPM1A-20EDT1	0.18 ms
	CP1W-16ER CPM1A-16ER	0.25 ms
	CP1W-16ET CP1W-16ET1	0.25 ms
	CP1W-8ED CPM1A-8ED	0.13 ms
	CP1W-8ER CPM1A-8ER	0.08 ms
	CP1W-8ET CPM1A-8ET	0.08 ms
	CP1W-8ET1 CPM1A-8ET1	0.08 ms
Analog Input Units	CP1W-AD041 CPM1A-AD041	0.61 ms
Analog Output Units	CP1W-DA041 CPM1A-DA041	0.33 ms
Analog I/O Units	CPM1A-MAD01	0.29 ms
	CP1W-MAD11 CPM1A-MAD11	0.32 ms
Temperature Sensor Units	CP1W-TS001 CPM1A-TS001	0.25 ms
	CP1W-TS002 CPM1A-TS002	0.52 ms
	CP1W-TS101 CPM1A-TS101	0.25 ms
	CP1W-TS102 CPM1A-TS102	0.52 ms
DeviceNet I/O Link Unit	CPM1A-DRT21	0.38 ms
CompoBus/S I/O Link Unit	CP1W-SRT21 CPM1A-SRT21	0.21 ms

Note

te The I/O refresh time for CPU Unit built-in I/O is included in overhead processing.

# 2-7-5 Cycle Time Calculation Example

The following example shows the method used to calculate the cycle time when CP-series Expansion I/O Units only are connected to a CP1L CPU Unit.

### Computing the Cycle Time

#### Conditions

Item	Details	
CP1L	CP1W-40EDR 40-pt I/O Unit	1 Unit
User program	5 K steps	LD instructions: 2.5 Ksteps, OUT instructions: 2.5 Ksteps
USB port connection	Yes and no	
Fixed cycle time processing	No	
Serial port connection	No	
Other peripheral servicing	No	

#### **Calculation Example**

Process name	Calculation	Processing time	
		USB port connected	USB port not connected
(1) Overseeing		0.4 ms	0.4 ms
(2) Program execution	0.55 μs × 2,500 + 1.1 μs × 2,500	4.1 ms	4.1 ms
(3) Cycle time calculation	(Minimum cycle time not set)	0 ms	0 ms
(4) I/O refreshing	0.39 ms	0.39 ms	0.39 ms
(5) Peripheral servicing	(Only USB port con- nected)	0.1 ms	0 ms
Cycle time	(1) + (2) + (3) + (4) + (5)	4.99 ms	4.89 ms

## 2-7-6 Online Editing Cycle Time Extension

When online editing is executed to change the program from the CX-Programmer while the CPU Unit is operating in MONITOR mode, the CPU Unit will momentarily suspend operation while the program is being changed. The period of time that the cycle time is extended is determined by the following conditions.

- Number of steps changed
- Editing operations (insert/delete/overwrite)
- Types of instructions

The cycle time extension for online editing is negligibly affected by the size of task programs. If the maximum program size for a task is 10 Ksteps, the online editing cycle time extension will be as follows:

CPU Unit	Increase in cycle time for online editing	
CP1L CPU Unit	Maximum: 16 ms, Normal: 12 ms	
	(for a program size of 10 Ksteps)	

When editing online, the cycle time will be extended by according to the editing that is performed. Be sure that the additional time will not adversely affect system operation.

**Note** When there is one task, online editing is processed all in the cycle time following the cycle in which online editing is executed (written). When there are multiple tasks (cyclic tasks and interrupt tasks), online editing is separated, so that for n tasks, processing is executed over n to n ×2 cycles max.

## 2-7-7 I/O Response Time

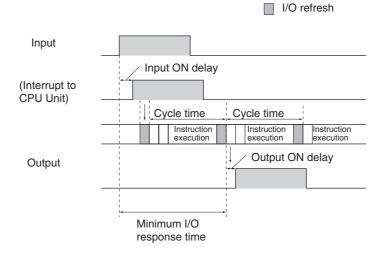
The I/O response time is the time it takes from when an input turns ON, the data is recognized by the CPU Unit, and the user program is executed, up to the time for the result to be output to an output terminal. The length of the I/O response time depends on the following conditions.

- Timing of Input Bit turning ON.
- Cycle time.

<u>Minimum I/O</u> <u>Response Time</u> The I/O response time is shortest when data is retrieved immediately before I/ O refresh of the CPU Unit. The minimum I/O response time is calculated as follows:

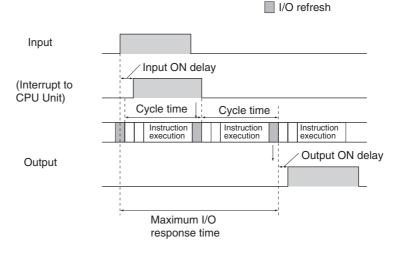
Minimum I/O response time = Input ON delay + Cycle time + Output ON delay

**Note** The input and output ON delays depend on the type of terminals used on the CPU Unit or the model number of the Unit being used.



Maximum I/O Response Time The I/O response time is longest when data is retrieved immediately after I/O refresh period of the CPU Unit. The maximum I/O response time is calculated as follows:

Maximum I/O response time = Input ON delay + (Cycle time  $\times$  2) + Output ON delay



## Section 2-7

#### **Calculation Example**

Output ON delay

Cycle time

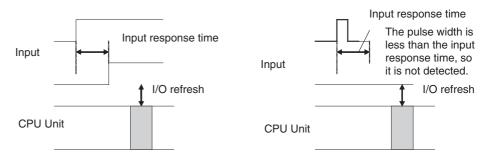
1 ms (normal input with input constant set to 0 ms) 0.1 ms (transistor output) 20 ms

Minimum I/O response time = 1 ms + 20 ms + 0.1 ms = 21.1 ms

Maximum I/O response time = 1 ms +  $(20 \text{ ms} \times 2) + 0.1 \text{ ms} = 41.1 \text{ ms}$ 

## Input Response Times

Input response times can be set in the PLC Setup. Increasing the response time reduces the effects of chattering and noise. Decreasing the response time allows reception of shorter input pulses, (but the pulse width must be longer than the cycle time).



#### **PLC Setup**

Name	Description	Settings	Default
Input constants	Input response times	00 hex: 8 ms 10 hex: 0 ms 11 hex: 0.5 ms 12 hex: 1 ms 13 hex: 2 ms 14 hex: 4 ms 15 hex: 8 ms 16 hex: 16 ms 17 hex: 32 ms	00 hex (8 ms)

## 2-7-8 Interrupt Response Times

**Input Interrupt Tasks** 

The interrupt response time for I/O interrupt tasks is the time taken from when a built-in input has turned ON (or OFF) until the I/O interrupt task has actually been executed. The length of the interrupt response time for I/O interrupt tasks depends on the following conditions.

Item	Interrupt response time	Counter interrupts
Hardware response	Rise time: 50 μs	
	Fall time: 50 µs	
Software interrupt	Minimum: 134 μs	Minimum: 236 µs
response	Maximum: 234 μs + Wait time (See note 1.)	Maximum: 336 μs + Wait time (See note1.)

Note

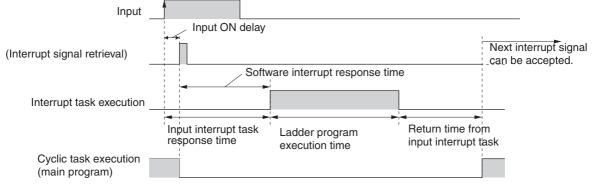
- (1) The wait time occurs when there is competition with other interrupts. As a guideline, the wait time will be 6 to  $169 \,\mu$ s.
- (2) I/O interrupt tasks can be executed during execution of the user program (even while an instruction is being executed by stopping the execution of an instruction), I/O refresh, peripheral servicing, or overseeing. The interrupt response time is not affected by which of the above processing operations during which the interrupt inputs turns ON. I/O interrupts, however, are not executed during execution of other interrupt tasks even if the I/O interrupt conditions are satisfied. Instead, the I/O interrupts are

### Computing the Cycle Time

executed in order of priority after the current interrupt task has completed execution and the software interrupt response time has elapsed.

The interrupt response time of input interrupt tasks is calculated as follows:

Interrupt response time = Input ON delay + Software interrupt response time

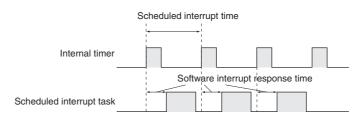


The time from completing the ladder program in the input interrupt task until returning to cyclic task execution is 60 µs.

Scheduled Interrupt Tasks

S The interrupt response time of scheduled interrupt tasks is the time taken from after the scheduled time specified by the MSKS(690) instruction has elapsed until the interrupt task has actually been executed. The length of the interrupt response time for scheduled interrupt tasks is 1 ms max. There is also an error of 80 µs in the time to the first scheduled interrupt (0.5 ms min.).

**Note** Scheduled interrupt tasks can be executed during execution of the user program (even while an instruction is being executed by stopping the execution of an instruction), I/O refresh, peripheral servicing, or overseeing. The interrupt response time is not affected by which of the above processing operations during which the scheduled interrupt time occurs. Scheduled interrupts, however, are not executed during execution of other interrupt tasks even if the interrupt conditions are satisfied. Instead, the interrupts are executed in order of priority after the current interrupt task has completed execution and the software interrupt response time has elapsed.



# 2-7-9 Serial PLC Link Response Performance

The response times for CPU Units connected via a Serial PLC Link (master to slave or slave to master) can be calculated as shown below. If a PT is in the Serial PLC Link, however, the amount of communications data will not be fixed and the values will change.

- Maximum I/O response time (not including hardware delay) = Master cycle time + Communications cycle time + Slave cycle time + 4 ms
- Minimum I/O response time (not including hardware delay) = Slave communications time + 0.8 ms

Here,

nere,	
Number of partici- pating slave nodes	The number of slaves to which links have been established within the maximum unit number set in the master.
Number of non-par- ticipating slave nodes	The number of slaves not participating in the links within the maximum unit number set in the master
Communications cycle time (ms)	Slave communications time $\times$ Number of participating slave nodes + 10 $\times$ Number of non-participating slave nodes
Slave communica- tions time (ms)	• Communications time set to <i>Standard</i> $0.4 + 0.286 \times ((No. of slaves + 1) \times No. of link words \times 2 + 12)$ • Communications time set to <i>Fast</i> $0.4 + 0.0955 \times ((No. of slaves + 1) \times No. of link words \times 2 + 12)$

# 2-7-10 Pulse Output Start Time

The pulse output start time is the time required from executing a pulse output instruction until pulses are output externally. This time depends on the pulse output instruction that is used and operation that is performed.



Pulse output instruction	Start time
SPED: continuous	86 µs
SPED: independent	98 µs
ACC: continuous	103 μs
ACC: independent, trapezoidal	122 μs
ACC: independent, triangular	123 μs
PLS2: trapezoidal	145 μs
PLS2: triangular	146 μs

# 2-7-11 Pulse Output Change Response Time

The pulse output change response time is the time for any change made by executing an instruction during pulse output to actually affect the pulse output operation.

Pulse output instruction	Change response time
INI: immediate stop	63 $\mu$ s + 1 pulse output time
SPED: immediate stop	106 $\mu$ s + 1 pulse output time
ACC: deceleration stop	1 control cycle (4 ms) minimum,
PLS2: deceleration stop	2 control cycles (8 ms) maximum
SPED: speed change	
ACC: speed change	
PLS2: target position change in reverse direction	
PLS2: target position change in same direction at same speed	
PLS2: target position change in same direction at different speed	

# SECTION 3 Installation and Wiring

This section describes how to install and wire the CP1L.

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Managing CPU Unit

**Errors** 

# 3-1 Fail-safe Circuits

Always set up safety circuits outside of the PLC to prevent dangerous conditions in the event of errors in the CP1L CPU Unit or external power supply. In particular, be careful of the following points.

Supply Power to the<br/>CP1L CPU Unit before<br/>the Controlled<br/>SystemIf the PLC's power supply is turned ON after the controlled system's power<br/>supply, outputs in Units such as DC Output Units may malfunction momen-<br/>tarily. To prevent any malfunction, add an external circuit that prevents the<br/>power supply to the controlled system from going ON before the power supply<br/>to the PLC itself.

When any of the following errors occurs, PLC operation (program execution) will stop and all outputs from Output Units will be turned OFF.

- A CPU error (watchdog timer error) or CPU on standby
- A fatal error (memory error, I/O bus error, duplicate number error, too many I/O points error, I/O setting error, program error, cycle time too long error, or FALS(007) error) (See note.)

Always add any circuits necessary outside of the PLC to ensure the safety of the system in the event of an error that stops PLC operation.

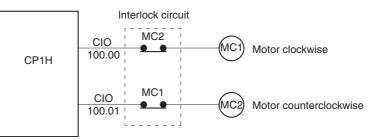
**Note** When a fatal error occurs, all outputs from Output Units will be turned OFF even if the IOM Hold Bit has been turned ON to protect the contents of I/O memory. (When the IOM Hold Bit is ON, the outputs will retain their previous status after the PLC has been switched from RUN/MONITOR mode to PRO-GRAM mode.)

Managing Output<br/>MalfunctionsIt is possible for an output to remain ON due to a malfunction in the internal<br/>circuitry of the Output Unit, such as a relay or transistor malfunction. Always<br/>add any circuits necessary outside of the PLC to ensure the safety of the sys-<br/>tem in the event that an output fails to go OFF.

Interlock Circuits

When the PLC controls an operation such as the clockwise and counterclockwise operation of a motor and if there is any possibility of an accident or mechanical damage due to faulty PLC operation, provide an external interlock such as the one shown below to prevent both the forward and reverse outputs from turning ON at the same time.

#### Example



This circuit prevents outputs MC1 and MC2 from both being ON at the same time even if both PLC outputs CIO 100.00 and CIO 100.01 are both ON, so the motor is protected even if the PLC is programmed improperly or malfunctions.

# 3-2 Installation Precautions

## 3-2-1 Installation and Wiring Precautions

Always consider the following factors when installing and wiring the PLC to improve the reliability of the system and make the most of the CP1L functions.

## **Ambient Conditions**

Do not install the PLC in any of the following locations.

- Locations subject to ambient temperatures lower than 0°C or higher than 55°C.
- Locations subject to drastic temperature changes or condensation.
- Locations subject to ambient humidity lower than 10% or higher than 90%.
- Locations subject to corrosive or flammable gases.
- Locations subject to excessive dust, salt, or metal filings.
- Locations that would subject the PLC to direct shock or vibration.
- Locations exposed to direct sunlight.
- Locations that would subject the PLC to water, oil, or chemical reagents.

Always enclose or protect the PLC sufficiently in the following locations.

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

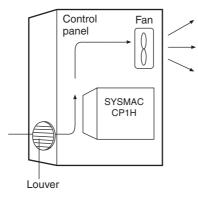
Installation in Cabinets or Control Panels

Temperature Control

When the CP1L is being installed in a cabinet or control panel, always provide proper ambient conditions as well as access for operation and maintenance.

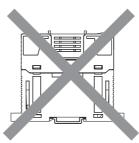
The ambient temperature within the enclosure must be within the operating range of  $0^{\circ}$ C to 55°C. When necessary, take the following steps to maintain the proper temperature.

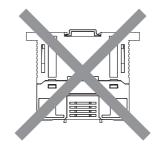
- Provide enough space for good air flow.
- Do not install the PLC above equipment that generates a large amount of heat, such as heaters, transformers, or high-capacity resistors.
- If the ambient temperature exceeds 55°C, install a cooling fan or air conditioner.

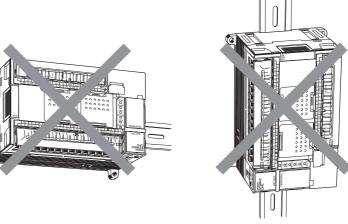


Installation Precautions	Section 3-2
Accessibility for Operation and Maintenance	<ul> <li>To ensure safe access for operation and maintenance, separate the PLC as much as possible from high-voltage equipment and moving machinery.</li> <li>The PLC will be easiest to install and operate if it is mounted at a height of about 1,000 to 1,600 mm.</li> </ul>
<u>∕</u> !∖Cautio	<b>n</b> Do not touch the power supply or the area around the I/O terminals while power is being supplied or immediately after power has been turned OFF. Doing so may result in burns.
<u>∕</u> ⊡Cautio	After the power supply has been turned OFF, wait until the PLC has sufficiently cooled before touching it.
Improving Noise Resistance	<ul> <li>Do not mount the PLC in a control panel containing high-voltage equipment.</li> <li>Install the PLC at least 200 mm from power lines.</li> </ul>
	Power lines
	Power lines
	200 mm min. SYSMAC CP1L 200 mm min.
	<ul> <li>Ground the mounting plate between the PLC and the mounting surface.</li> </ul>
Mounting in a Panel	<ul> <li>The CP1L must be installed in the orientation shown below to ensure ade- quate cooling.</li> </ul>

• Do not install the CP1L in any of the following orientations.







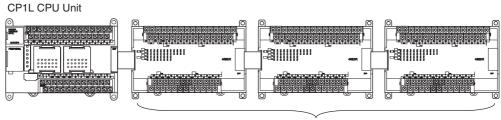
# 3-3 Mounting

# 3-3-1 Mounting in a Panel

When mounting the CP1L CPU Unit in a panel, use either surface installation or DIN Track installation.

# Surface Installation

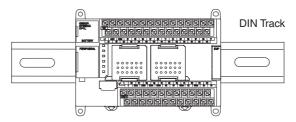
Even if a DIN Track is not used, a CP1L CPU Unit and CP/CPM1A-series Expansion Units or Expansion I/O Units can be mounted using M4 screws. For restrictions on the number of Expansion Units and Expansion I/O Units that can be connected, refer to *1-2 System Configuration*.



Expansion I/O Units or Expansion Units

### **DIN Track Installation**

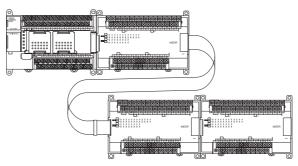
The CP1L CPU Unit, Expansion Units, and Expansion I/O Units can be mounted to DIN Track. Secure the DIN Track with screws in at least three places.



### Using I/O Connecting Cable

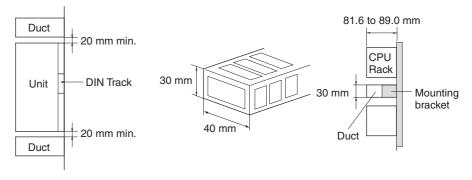
When using Expansion Units and Expansion I/O Units, it is possible to use CP1W-CN811 Connecting Cable to arrange the Units in upper and lower rows. The following restrictions apply:

• I/O Connecting Cable can be used in one place only, and not in multiple places.



### Wiring Ducts

Whenever possible, route I/O wiring through wiring ducts. Install the duct so that it is easy to wire from the I/O Units through the duct. It is handy to have the duct at the same height as the PLC.

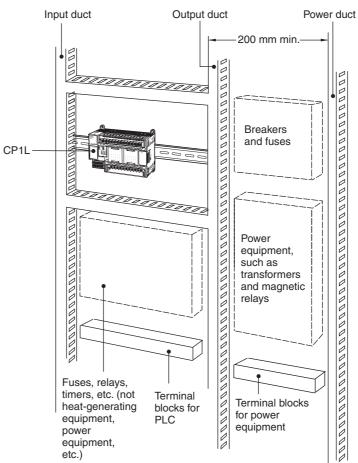


Note Tighten terminal block screws and cable screws to the following torque. M4: 1.2 N·m

M3: 0.5 N⋅m

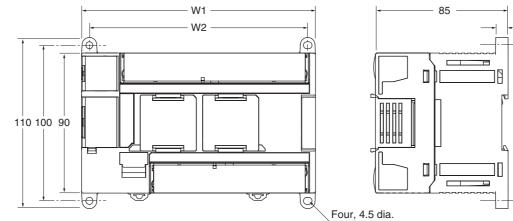
#### **Routing Wiring Ducts**

Install the wiring ducts at least 20 mm between the tops of the PLC and any other objects, (e.g., ceiling, wiring ducts, structural supports, devices, etc.) to provide enough space for air circulation and replacement of Units.



## **Dimensions**

## **External Dimensions**



Model	W1	W2
CP1L-M60D	195	185
CP1L-M40D	150	140
CP1L-M30D	130	120
CP1L-L20D	86	76

8

Model	W1	W2
CP1L-L14D	86	76
CP1L-L10D	66	56

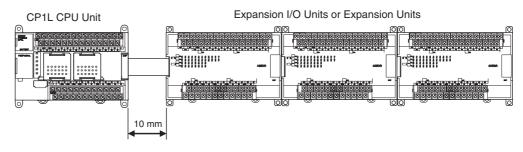
# Mounting Height

The mounting height is approximately 90 mm.

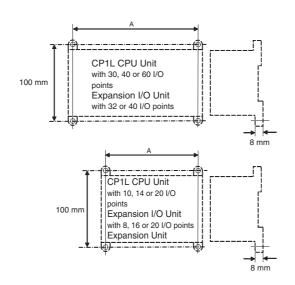
When a cable is connected to an Option Board, however, the additional height must be factored in. Always allow for the additional height when considering the depth of the control panel in which the PLC is to be mounted.

# 3-3-2 Connecting Expansion Units and Expansion I/O Units

Leave approximately 10 mm of space between the CPU Unit and the Expansion Units or Expansion I/O Units.

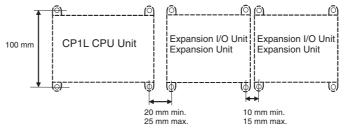


#### **Mounting Method**

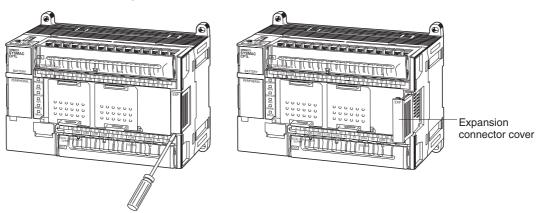


Unit		A (mm)
CP1L CPU Unit	60 I/O points	185 ±0.5
	40 I/O points	140 ±0.5
	30 I/O points	120 ±0.5
	20 I/O points	76 ±0.5
	14 I/O points	76 ±0.5
	10 I/O points	56 ±0.5
Expansion I/O Unit	40 I/O points	140 ±0.2
	32 outputs	140 ±0.2
	20 I/O points	76 ±0.2
	16 outputs	76 ±0.2
	8 inputs	56 ±0.2
	8 outputs	56 ±0.2
Analog I/O Unit	MAD01	56 ±0.2
	MAD11 AD041 DA041	76 ±0.2
Temperature Sensor Unit		76 ±0.2
CompoBus/S I/O Link Unit		56 ±0.2
DeviceNet I/O Link Unit		56 ±0.2

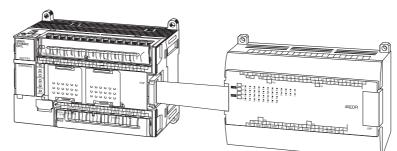
#### Space between Units When Expansion I/O Units Are Connected



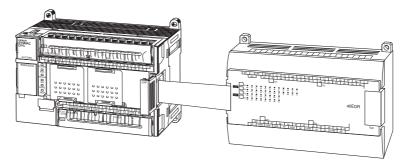
1. Remove the cover from the CPU Unit's or the Expansion I/O Unit's expansion connector. Use a flat-blade screwdriver to remove the cover from the Expansion I/O Connector.



2. Insert the Expansion I/O Unit's connecting cable into the CPU Unit's or the Expansion I/O Unit's expansion connector.

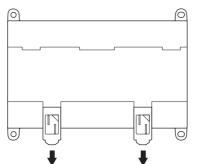


3. Replace the cover on the CPU Unit's or the Expansion I/O Unit's expansion connector.

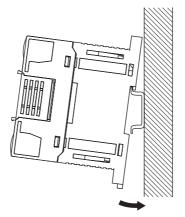


# 3-3-3 DIN Track Installation

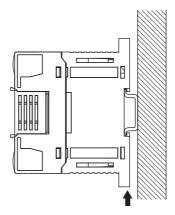
*1,2,3...* 1. Use a screwdriver to pull down the DIN Track mounting pins from the back of the Units, and mount the Units to the DIN Track.



2. Lower the Units so that they catch on the top of the DIN Track, and then press them forward all the way to the DIN Track at the bottom.



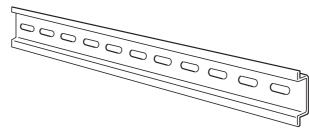
3. Press in all of the DIN Track mounting pins to securely lock the Units in place.



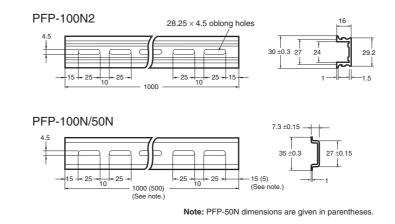
### **DIN Track**

Mount the DIN Track in the control panel with screws in at least three places.

• DIN Track: PFP-50N (50 cm), PFP-100N (100 cm), or PFP-100N2 (100 cm)



Secure the DIN Track to the control panel using M4 screws separated by 210 mm (6 holes). The tightening torque is  $1.2 \text{ N} \cdot \text{m}$ .



# 3-4 Wiring CP1L CPU Units

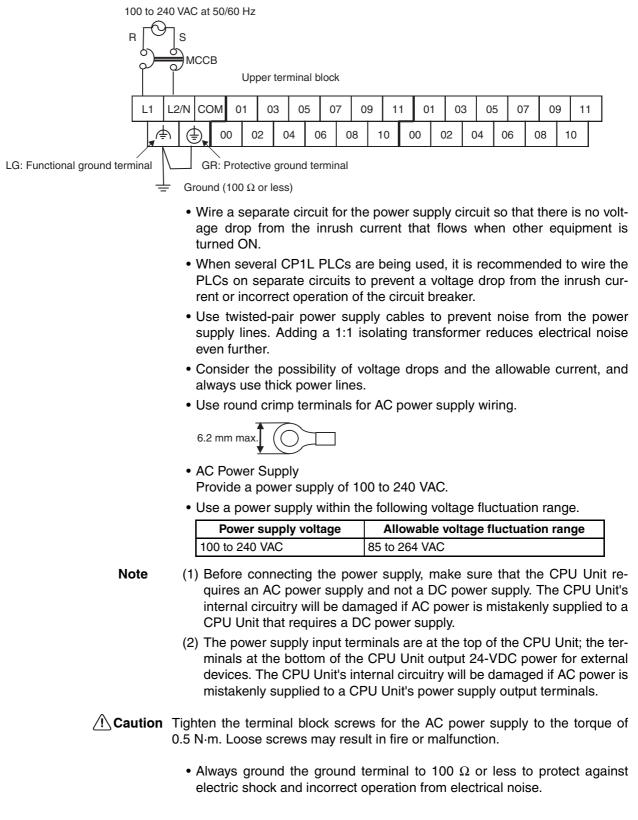
Note

- (1) Do not remove the protective label from the top of the Unit until wiring has been completed. This label prevents wire strands and other foreign matter from entering the Unit during wiring procedures.
- (2) Remove the label after the completion of wiring to ensure proper heat dissipation.

# 3-4-1 Wiring Power Supply and Ground Lines

## CPU Units with AC Power Supply

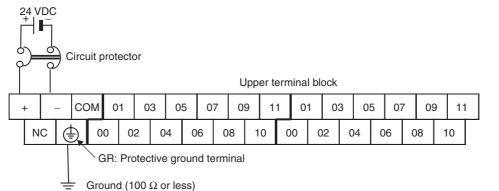
#### Wiring the AC Power Supply and Ground Lines



- If one phase of the power supply is grounded, connect the grounded phase to the L2/N terminal.
- The GR terminal is a ground terminal. To prevent electrical shock, use a dedicated ground line (2 mm<sup>2</sup> min.) of 100  $\Omega$  or less.
- The line ground terminal (LG) is a noise-filtered neutral terminal. If noise is a significant source of errors or if electrical shocks are a problem, connect the line ground terminal (LG) to the ground terminal (GR) and ground both with a ground resistance of 100  $\Omega$  or less.
- To prevent electrical shock when short-circuiting between the LG and GR terminals, always use a ground of 100  $\Omega$  or less.
- Do not connect ground lines to other devices or to the frame of a building. Doing so will reverse the effectiveness of the ground and instead have a bad influence.
- **Isolating Transformer** The PLC's internal noise control is sufficient for the general noise to which power supply lines are subjected. Ground noise can be further reduced by providing the power supply through a 1:1 isolating transformer. Leave the isolating transformer's secondary side ungrounded.

## CPU Units with DC Power Supply

#### DC Power Supply Wiring



• Use crimp terminals or solid wire for wiring the power supply. Do not connect bare stranded wires directly to terminals.



- $\bullet$  M3 self-rising terminal screws are used. Tighten the terminal screws to the torque of 0.5 N·m.
- To prevent noise, use a ground of 100  $\Omega$  or less.

#### **DC Power Supply**

- Provide a power supply of 20.4 to 26.4 VDC.
- The maximum current consumption is 20 W for CPU Units with 30, 40 or 60 I/O points and 13 W for CPU Units with 10, 14 or 20 I/O points.
- When the power supply is turned ON, the inrush current is approximately five times the normal current.
- The GR terminal is a ground terminal. To prevent electrical shock, use a dedicated ground line (2 mm<sup>2</sup> min.) of 100  $\Omega$  or less.
- **Note** (1) Never reverse the positive and negative leads when wiring the power supply terminals.

(2) Supply all power to the power supply terminals from the same source.

## 3-4-2 Wiring Built-in I/O

### Wiring Precautions

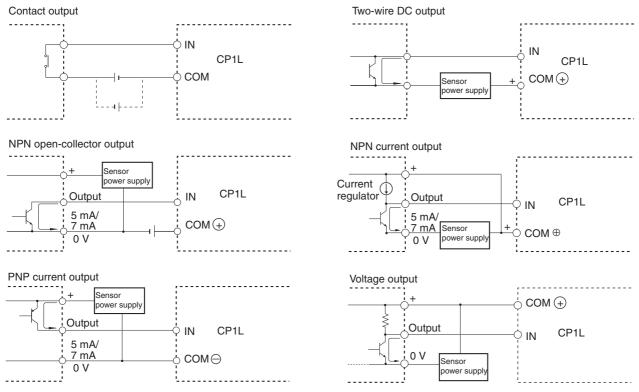
**Double-checking I/O** Double-check the specifications for the I/O Units. In particular, do not apply a **Specifications** voltage that exceeds the input voltage for Input Units or the maximum switching capacity for Output Units. Doing so may result in breakdown, damage, or fire. When the power supply has positive and negative terminals, always wire them correctly. **Electric Wires** • AWG22 to AWG18 (0.32 to 0.82 mm<sup>2</sup>) power lines are recommended. Use cable with a maximum diameter of 1.61 mm including the insulation covering. • The current capacity of electric wire depends on factors such as the ambient temperature and insulation thickness, as well as the gauge of the conductor. • M3 self-rising screws are used for all screw terminals including terminal screws for crimp terminal power supply wiring. · Use crimp terminals or solid wire for wiring. Do not connect bare stranded wires directly to terminals. • Tighten the terminal block screws to the torque of 0.5 N·m. • Use crimp terminals (M3) having the dimensions shown below. 6.2 mm max. 6.2 mm max Wiring · Wire the Units so that they can be easily replaced. Make sure that the I/O indicators are not covered by the wiring. • Do not place the I/O wiring in the same conduits or ducts as high-voltage or power lines. Inductive noise can cause errors or damage. Tighten the terminal screws to the torque of 0.5 N·m. Note (1) Never apply a voltage that exceeds the input voltage for Input Units or the maximum switching capacity for Output Units. (2) When the power supply has positive and negative terminals, always wire them correctly. (3) When required by EC Low Voltage Directive, use reinforced insulation or double insulation on the DC power supply connected to DC-power-supply CPU Units and I/O. For the DC power supply connected to a DC-power-supply CPU Unit, use a power supply with a minimum output holding time of 10 ms. (4) Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.

## Connecting I/O Devices

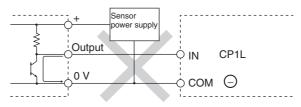
Use the following information for reference when selecting or connecting input devices.

#### **DC Input Devices**

#### Connectable DC Input Devices (for DC Output Models)



• The circuit below should not be used for I/O devices with a voltage output.



Precautions when Connecting a Two-wire DC Sensor When using a two-wire sensor with a 24-V DC input device, check that the following conditions have been met. Failure to meet these conditions may result in operating errors.

**1,2,3...** 1. Relation between voltage when the PLC is ON and the sensor residual voltage:

 $V_{ON} \leq V_{CC} - V_R$ 

2. Relation between current when the PLC is ON and sensor control output (load current):

 $I_{OUT}$  (min)  $\leq I_{ON} \leq I_{OUT}$  (max)

 $I_{ON} = (V_{CC} - V_R - 1.5 [PLC internal residual voltage]^*)/R_{IN}$ 

When  $I_{ON}$  is smaller than  $I_{OUT}$  (min), connect a bleeder resistor R. The bleeder resistor constant can be calculated as follows:

 $R \leq (V_{CC} - V_R) / (I_{OUT} \text{ (min)} - I_{ON})$ 

Power W  $\geq$  (V<sub>CC</sub> - V<sub>R</sub>)<sup>2</sup>/R  $\times$  4 [allowable margin]

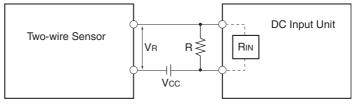
3. Relation between current when the PLC is OFF and sensor leakage current:

 $I_{OFF} \ge I_{leak}$ 

Connect a bleeder resistor if  ${\rm I}_{\rm leak}$  is greater than  ${\rm I}_{\rm OFF}$ . Use the following equation to calculate the bleeder resistance constant.

 $R \le R_{IN} \times V_{OFF} / (I_{leak} \times R_{IN} - V_{OFF})$ 

Power W  $\ge$  (V<sub>CC</sub> - V<sub>R</sub>)<sup>2</sup>/R  $\times$  4 (allowable margin)



Vcc: Power voltage Von: PLC ON voltage Voff: PLC OFF voltage Ion: PLC ON current Ioff: PLC OFF current Rin: PLC input impedance Vr: Sensor output residual current lout: Sensor control output (load current)

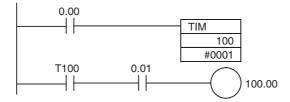
Ileak: Sensor leakage current R: Bleeder resistance

4. Precautions on Sensor Inrush Current

An incorrect input may occur due to sensor inrush current if a sensor is turned ON after the PLC has started up to the point where inputs are possible. Determine the time required for sensor operation to stabilize after the sensor is turned ON and take appropriate measures, such as inserting into the program a timer delay after turning ON the sensor.

#### Program Example

In this example, the sensor's power supply voltage is provided to input bit CIO 0.00 and a 100-ms timer delay (the time required for an OMRON Proximity Sensor to stabilize) is created in the program. After the Completion Flag for the timer turns ON, the sensor input on input bit CIO 0.01 will cause output bit CIO 100.00 to turn ON.



### **Output Wiring Precautions**

Connecting to a TTL

Circuit

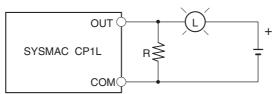
Output Short-circuit<br/>ProtectionIf a load connected to the output terminals is short-circuited, output compo-<br/>nents and the printed circuit boards may be damaged. To guard against this,<br/>incorporate a fuse in the external circuit. Use a fuse with a capacity of about<br/>twice the rated output.

A TTL circuit cannot be connected directly to a transistor output because of the transistor's residual voltage. It is necessary to connect a pull-up resistor and a CMOS IC between the two.

Inrush Current Considerations When connecting a transistor or triac output to a load having a high inrush current (such as an incandescent lamp), steps must be taken to avoid damage to the transistor or triac. Use either of the following methods to reduce the inrush current.

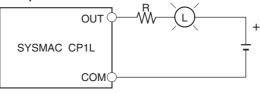
## Wiring CP1L CPU Units

Example Method 1



Use a dark current of approximately 1/3 the rated current of the incandescent lamp.

#### Example Method 2

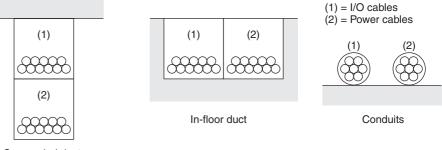


Install a limit resistance.

## 3-4-3 Wiring Safety and Noise Controls

## I/O Signal Wiring

Whenever possible, place I/O signal lines and power lines in separate ducts or conduits both inside and outside of the control panel.

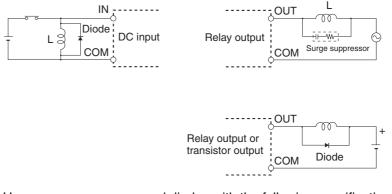


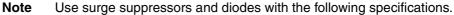
Suspended duct

If the I/O wiring and power wiring must be routed in the same duct, use shielded cables and connect the shields to the GR terminal to reduce noise.

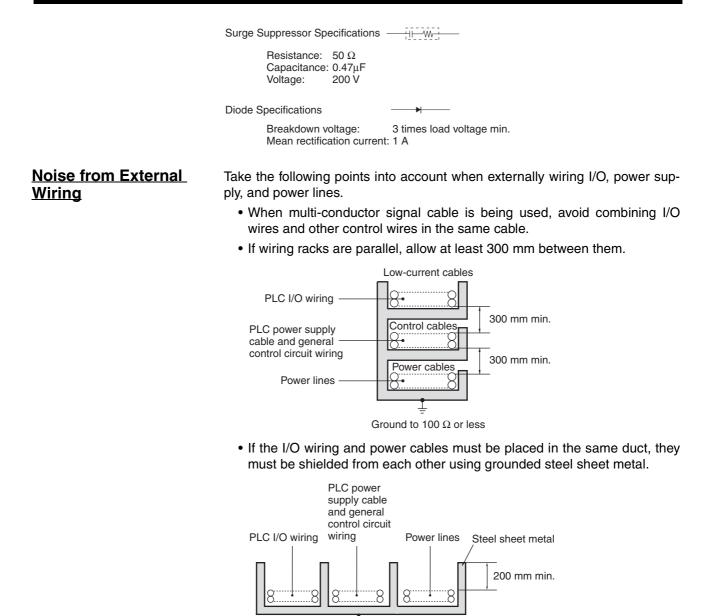
#### **Inductive Loads**

When an inductive load is connected to an I/O Unit, connect a surge suppressor or diode in parallel with the load as shown below.





## Section 3-4



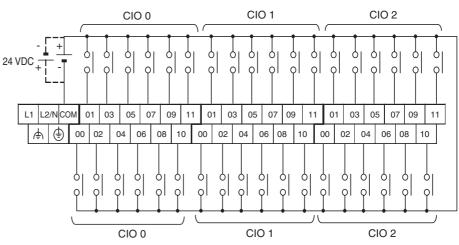
Ground to 100  $\Omega$  or less

# 3-5 Wiring CPU Unit I/O

# 3-5-1 I/O Wiring for CPU Units with 60 I/O Points

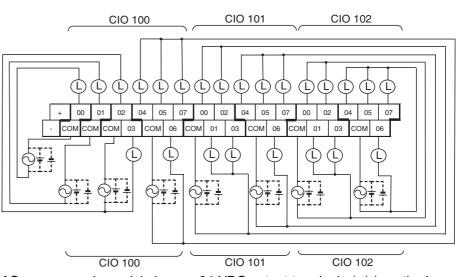
## Input Wiring (Upper Terminal Block)

The input circuits have 36 points/common. Use power lines with sufficient current capacity for the COM terminals.



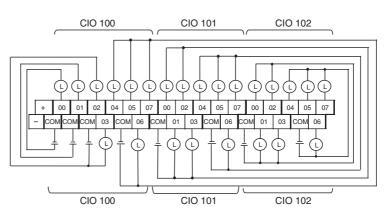
## **Output Wiring (Lower Terminal Block)**

Relay Outputs (CP1L-M60DR-A and CP1L-M60DR-D)



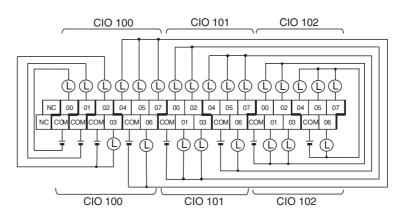
AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

#### Sinking Transistor Outputs (CP1L-M60DT-A and CP1L-M60DT-D)



AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

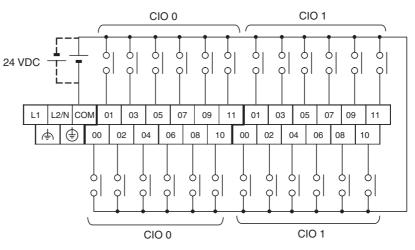
#### Sourcing Transistor Outputs (CP1L-M60DT1-D)



# 3-5-2 I/O Wiring for CPU Units with 40 I/O Points

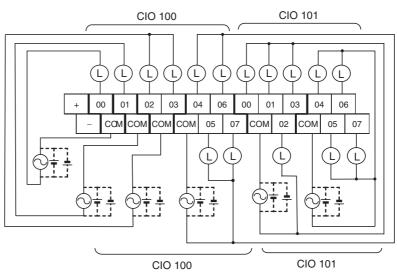
## Input Wiring (Upper Terminal Block)

The input circuits have 24 points/common. Use power lines with sufficient current capacity for the COM terminals.



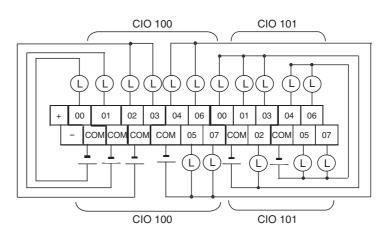
## **Output Wiring (Lower Terminal Block)**



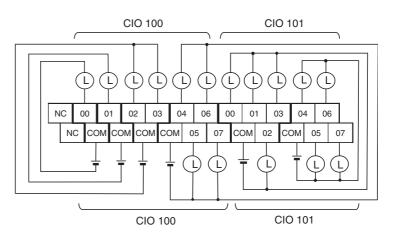


AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

Sinking Transistor Outputs (CP1L-M40DT-A and CP1L-M40DT-D)



AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

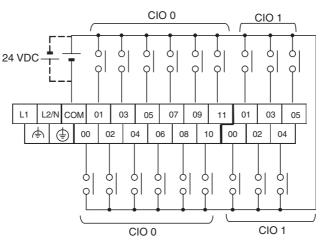


#### Sourcing Transistor Outputs (CP1L-M40DT1-D)

# 3-5-3 I/O Wiring for CPU Units with 30 I/O Points

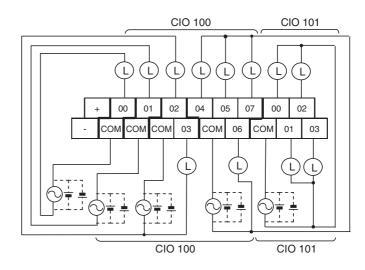
## Input Wiring (Upper Terminal Block)

The input circuits have 18 points/common. Use power lines with sufficient current capacity for the COM terminals.



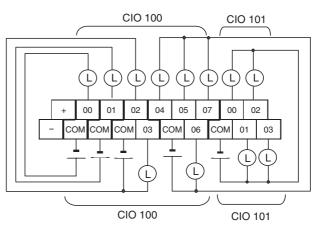
## **Output Wiring (Lower Terminal Block)**

Relay Outputs (CP1L-M30DR-A and CP1L-M30DR-D)



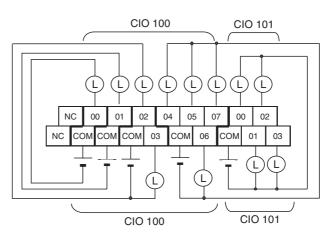
AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

Sinking Transistor Outputs (CP1L-M30DT-A and CP1L-M30DT-D)



AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

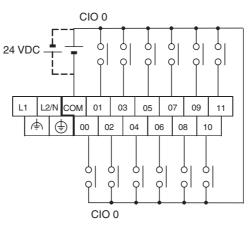
Sourcing Transistor Outputs (CP1L-M30DT1-D)



# 3-5-4 I/O Wiring for CPU Units with 20 I/O Points

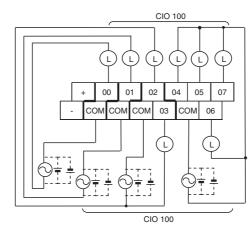
## Input Wiring (Upper Terminal Block)

The input circuits have 12 points/common. Use power lines with sufficient current capacity for the COM terminals.



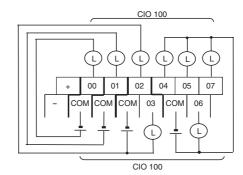
## **Output Wiring (Lower Terminal Block)**





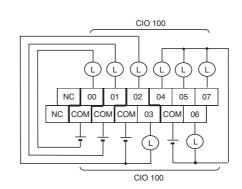
AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

Sinking Transistor Outputs (CP1L-L20DT-A and CP1L-L20DT-D)



AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

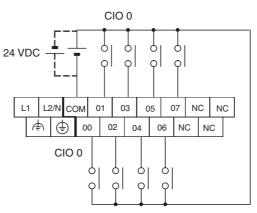
Sourcing Transistor Outputs (CP1L-L20DT1-D and CP1L-J20DT1-D)



# 3-5-5 I/O Wiring for CPU Units with 14 I/O Points

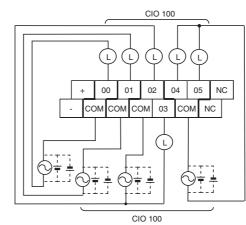
# Input Wiring (Upper Terminal Block)

The input circuits have 8 points/common. Use power lines with sufficient current capacity for the COM terminals.



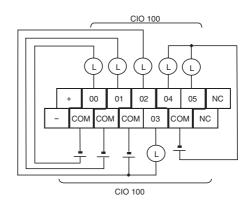
## **Output Wiring (Lower Terminal Block)**

Relay Outputs (CP1L-L14DR-A, CP1L-L14DR-D, CP1L-J14DR-A and CP1L-J14DR-D)



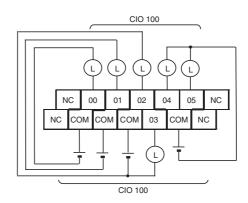
AC-power-supply models have a 24-VDC output terminals (+/–) on the lower terminal block. They can be used as a DC power supply for the input circuit.

Sinking Transistor Outputs (CP1L-L14DT-A and CP1L-L14DT-D)



AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

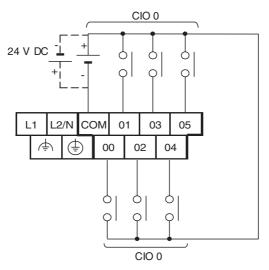
Sourcing Transistor Outputs (CP1L-L14DT1-D and CP1L-J14DT1-D)



# 3-5-6 I/O Wiring for CPU Units with 10 I/O Points

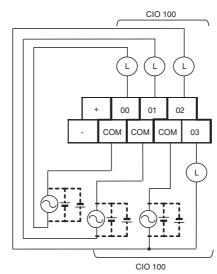
## Input Wiring (Upper Terminal Block)

The input circuits have 6 points/common. Use power lines with sufficient current capacity for the COM terminals.



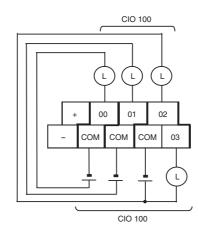
## **Output Wiring (Lower Terminal Block)**

Relay Outputs (CP1L-L10DR-A and CP1L-L10DR-D)



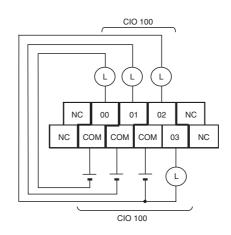
AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

#### Sinking Transistor Outputs (CP1L-L10DT-A and CP1L-L10DT-D)



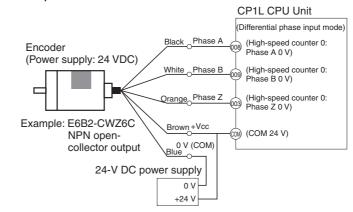
AC-power-supply models have a 24-VDC output terminals (+/-) on the lower terminal block. They can be used as a DC power supply for the input circuit.

#### Sourcing Transistor Outputs (CP1L-L10DT1-D)

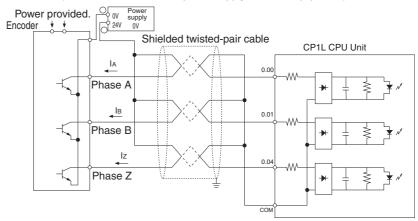


## 3-5-7 Pulse Input Connection Examples

For a 24-VDC Opencollector Encoder This example shows the connections to an encoder with phase-A, phase-B, and phase Z inputs.



(Do not use the same I/O power supply as other equipment.)



## 3-5-8 Pulse Output Connection Examples

This example shows a connection to a motor driver. Always check the specifications of the motor driver before actually connecting it.

For open-collector output, use a maximum of 3 m of wiring between the CP1L CPU Unit and the motor driver.

No pulses are output while the pulse output transistor is OFF. For a direction output, OFF indicates that CCW output is in progress.

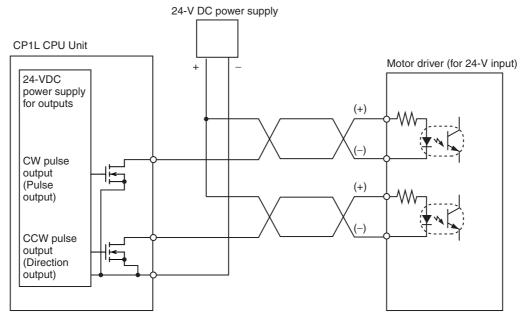
Do not use the same power supply for both pulse output 24-VDC/5-VDC power and other I/O power.

## Wiring CPU Unit I/O

Output transist	ON OFF	Pulse output in progress
CW and CCW	Pulse Outputs	
	CW	CCW
CW		
CCW		
Pulse and Dire	ction Outputs	
Pulses		
Direction	Output ON	Output OFF

## CW/CCW Pulse Output and Pulse Plus Direction Output

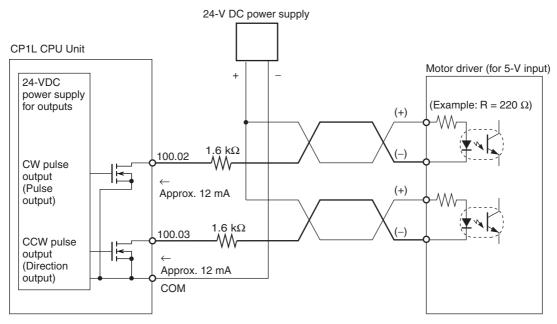
## Using a 24-VDC Photocoupler Input Motor Driver (CP1L-DDT-D)



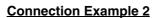
## Section 3-5

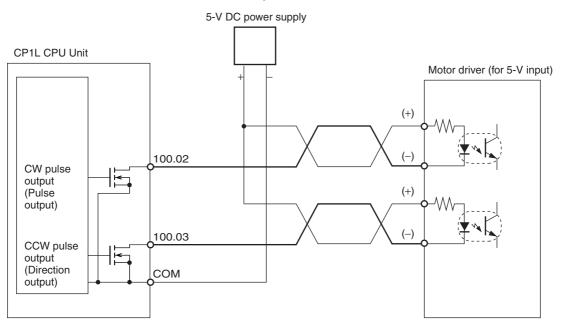
#### Using a 5-VDC Photocoupler Input Motor Driver (CP1L-DDT-D)

#### Connection Example 1



In this example, a 5-V input motor driver is used with a 24-VDC power supply. Be careful to ensure that the Position Control Unit output current does not damage the input circuit at the motor driver and yet is sufficient to turn it ON. Take into account the power derating for the 1.6-k $\Omega$  resistance.





# **3-6 CP/CPM1A-series Expansion I/O Unit Wiring**

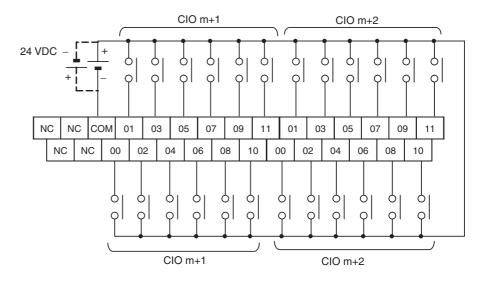
	Model	Inputs	Outputs
40-point I/O Units	CP1W-40EDR CPM1A-40EDR	24 24-VDC inputs	16 relay outputs
	CP1W-40EDT CPM1A-40EDT		16 transistor outputs (sinking)
	CP1W-40EDT1 CPM1A-40EDT1		16 transistor outputs (sourcing)
32-point	CP1W-32ER	None	32 relay outputs
Output Units	CP1W-32ET		32 transistor outputs (sinking)
	CP1W-32ET1		32 transistor outputs (sourcing)
20-point I/O Units	CP1W-20EDT1 CPM1A-20EDR1	12 24-VDC inputs	8 relay outputs
	CP1W-20EDT CPM1A-20EDT		8 transistor outputs (sinking)
	CP1W-20EDT1 CPM1A-20EDT1		8 transistor outputs (sourcing)
16-point Output Units	CP1W-16ER CPM1A-16ER	None	16 relay outputs
	CP1W-16ET		16 transistor outputs (sinking)
	CP1W-16ET1		16 transistor outputs (sourcing)
8-point Input Units	CP1W-8ED CPM1A-8ED	8 24-VDC inputs	None
8-point Out- put Units	CP1W-8ER CPM1A-8ER	None	8 relay outputs
	CP1W-8ET CPM1A-8ET		8 transistor outputs (sinking)
	CP1W-8ET1 CPM1A-8ET1		8 transistor outputs (sourcing)

CP-series Expansion I/O Units

For details on wiring Expansion Units, refer to SECTION 7 Using Expansion Units and Expansion I/O Units.

## 40-point I/O Units (CP1W-40ED //CPM1A-40ED )

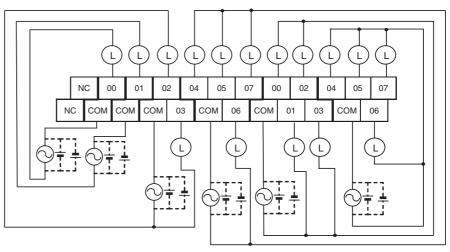
### **Input Wiring**



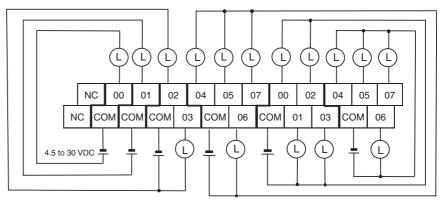
## Section 3-6

## **Output Wiring**

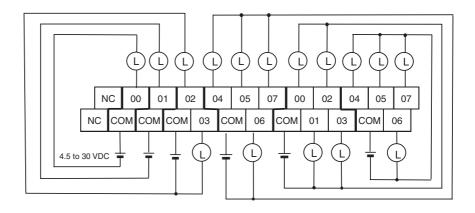
## CP1W-40EDR/CPM1A-40EDR (Relay Outputs)



## CP1W-40EDT/CPM1A-40EDT (Sinking Transistor Outputs)



#### CP1W-40EDT1/CP1A-40EDT1 (Sourcing Transistor Outputs)

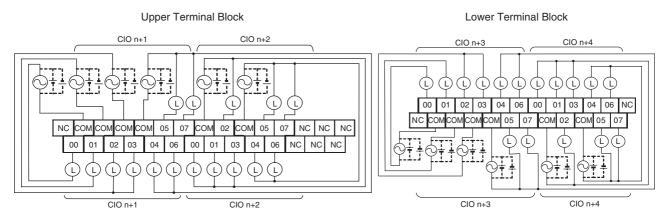


## Section 3-6

## 32-point Output Units (CP1W-32E

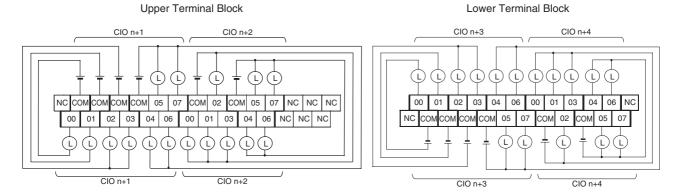


#### CP1W-32ER (Relay Outputs)



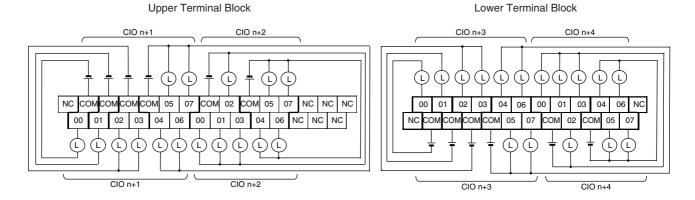
#### **Output Wiring**

#### CP1W-32ET (Sinking Transistor Outputs)



#### **Output Wiring**

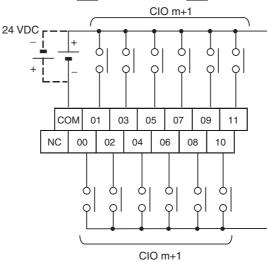
#### CP1W-32ET1 (Sourcing Transistor Outputs)



## 20-point I/O Units (CP1W-20ED //CPM1A-20ED )

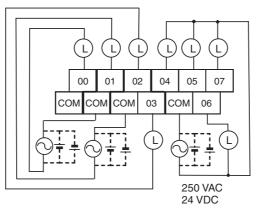
## **Input Wiring**

## CP1W-20ED

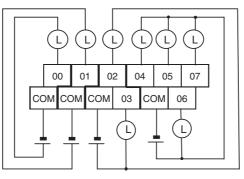


#### **Output Wiring**

## CP1W-20EDR1/CPM1A-20EDR1 (Relay Outputs)



### CP1W-20EDT/CPM1A-20EDT (Sinking Transistor Outputs)



## CP/CPM1A-series Expansion I/O Unit Wiring

## CP1W-20EDT1/CP1A-20EDT1 (Sourcing Transistor Outputs)

(L)L L. Ĺ L L 00 01 02 04 05 07 сом сом сом 03 СОМ 06 L Ľ

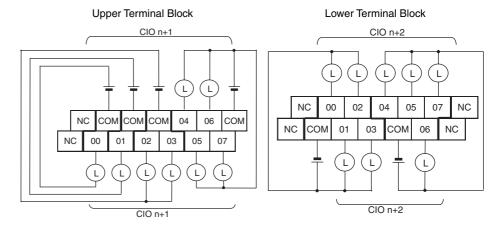
## <u>16-point Output Units (CP1W-16E</u>/CPM1A-16E)

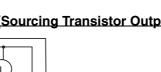
**Output Wiring** 

## CP1W-16ER/CPM1A-16ER (Relay Outputs)



### CP1W-16ET (Sinking Transistor Outputs)





Unit Lower Terminal Block

L

L

L

NC 00 02 04 05 07

NC COM 01

L)(L)

06

L

NC

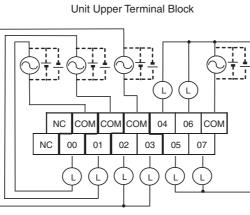
NC

L

03 COM

L

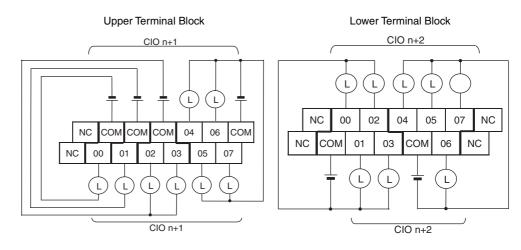
Section 3-6



## Section 3-6

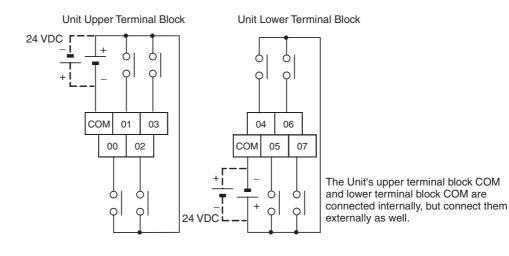
#### **Output Wiring**

#### CP1W-16ET1 (Sourcing Transistor Outputs)



# 8-point Input Units (CP1W-8ED/CPM1A-8ED)

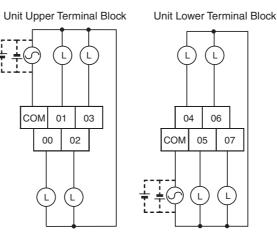
**Input Wiring** 



# 8-point Output Units (CP1W-8E // CPM1A-8E )

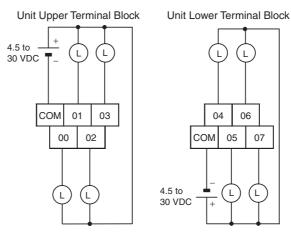
## **Output Wiring**

#### CP1W-8ER/CPM1A-8ER (Relay Outputs)



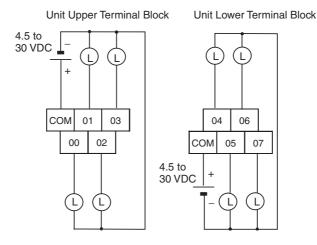
#### **Output Wiring**

#### CP1W-8ET/CPM1A-8ET (Sinking Transistor Outputs)



#### **Output Wiring**

## CP1W-8ET1/CPM1A-8ET1 (Sourcing Transistor Outputs)



# SECTION 4 I/O Memory Allocation

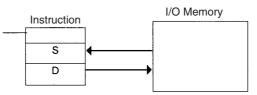
This section describes the structure and functions of the I/O Memory Areas and Parameter Areas.

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# 4-1 Overview of I/O Memory Area

## 4-1-1 I/O Memory Area

This region of memory contains the data areas that can be accessed as instruction operands. I/O memory includes the CIO Area, Work Area, Holding Area, Auxiliary Area, DM Area, Timer Area, Counter Area, Task Flag Area, Data Registers, Index Registers, Condition Flag Area, and Clock Pulse Area.



Area		Size	Range	Task usage	Allocation	Bit	Word	Ace	cess	Change	Forcing	
							access	access	Read	Write	from CX- Programmer	bit status
CIO Area	I/O Area	Input Area	1,600 bits (100 words)	CIO 0 to CIO 99	Shared by all tasks	CP1L CPU Units and CP- series Expan-	ОК	ОК	ОК	ОК	ОК	ОК
		Output Area	1,600 bits (100 words)	CIO 100 to CIO 199		sion Units or Expansion I/O Units	ОК	ОК	ОК	ОК	ок	ОК
	1:1 Link Area	1	1,024 bits (64 words)	CIO 3000 to CIO 3063		1:1 Links	ОК	ОК	ОК	ОК	ОК	ОК
	Serial PLC L	ink Area	1,440 bits (90 words)	CIO 3100 to CIO 3189		Serial PLC Links	ОК	ОК	ОК	ОК	ОК	ОК
	Work Area		14,400 bits (900 words)	CIO 3800 to CIO 6143			ОК	ОК	ОК	ОК	ОК	ОК
Work	Area		8,192 bits (512 words)	W000 to W511			ОК	ОК	ОК	ОК	ок	ОК
Holdir	ng Area		8,192 bits (512 words)	H000 to H511 (Note 6)			ОК	ОК	ОК	ОК	ОК	ОК
Auxilia	ary Area		15,360 bits (960 words)	A000 to A959			ОК		ОК	Note 1	Note 1	No
TR Ar	ea		16 bits	TR0 to TR15			ОК	ОК	ОК	OK	No	No
Data I	Memory Area		32,768 words	D00000 to D32767 (Note 7)			No (Note 2)	OK	ок	ОК	ОК	No
Timer	Completion F	lags	4,096 bits	T0000 to T4095			ОК		ОК	ОК	ОК	ОК
Count	er Completion	Flags	4,096 bits	C0000 to C4095			ОК		ОК	ОК	ОК	ОК
Timer	PVs		4,096 words	T0000 to T4095				ОК	ОК	ОК	ОК	No (Note 4)
Count	er PVs		4,096 words	C0000 to C4095				ОК	ОК	OK	ОК	No (Note 5)
Task F	lag Area		32 bits	TK0 to TK31	]		ОК		ОК	No	No	No
Index	Registers		16 regis- ters	IR0 to IR15	Function separately in each task		ОК	ОК	Indirect address- ing only	Specific instruc- tions only	No	No
Data I	Registers		16 regis- ters	DR0 to DR15	(Note 3)		No	ОК	ОК	OK	No	No

Note

1. A0 to A447 are read only and cannot be written. A448 to A959 are read/write.

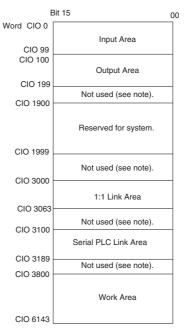
2. Bits can be manipulated using TST(350), TSTN(351), SET, SETB(532), RSTB(533), and OUTB(534).

- 3. Index registers and data registers can be used either individually by task or they can be shared by all the tasks (the default is individual use by task).
- 4. Timer PVs can be refreshed indirectly by force-setting/resetting the Timer Completion Flags.
- 5. Counter PVs can be refreshed indirectly by force-setting/resetting the Counter Completion Flags.
- 6. H512 to H1535 are used as a Function Block Holding Area. These words can be used only for function block instances (internally allocated variable area).
- 7. Data Memory Area for CPU Units with 10, 14 or 20 I/O Points: D0 to D9999 and D32000 to D32767.

## 4-1-2 Overview of the Data Areas

#### CIO Area

It is not necessary to input the "CIO" acronym when specifying an address in the CIO Area. The CIO Area is generally used for data exchanges, such as I/O refreshing with PLC Units. Words that are not allocated to Units may be used as work words and work bits in the program.



**Note** The parts of the CIO Area that are labelled "not used" may be used in programming as work bits. In the future, however, unused CIO Area bits may be used when expanding functions. Always use Work Area bits first.

#### I/O Area (Inputs: CIO 0 to CIO 99, Outputs: CIO 100 to CIO 199)

These words are allocated to built-in I/O terminals of CP1L CPU Units and CP-series Expansion Units or Expansion I/O Units. Input words and output bits that aren't allocated may be used in programming.

#### 1:1 Link Area

These bits are used by the 1:1 Link Master and Slave. They are used for data links between CP1L CPU Units and CPM2 $\square$  CPU Units.

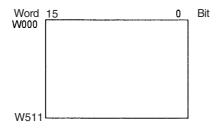
#### Serial PLC Link Area

These words are allocated for use for data links (Serial PLC Links) with other CP1L CPU Units or CP1H CPU Units. Addresses not used for Serial PLC Links can be used in programming.

#### Internal I/O Area

These words can be used in programming; they cannot be used for I/O exchange with external I/O terminals. Be sure to use the work words provided in the Work Area before using words in the Internal I/O Area or other unused words in the CIO Area. It is possible that these words will be assigned to new functions in future versions of the CPU Units. The parts of the CIO Area that are labelled "Not used" are functionally identical to the Internal I/O Area.

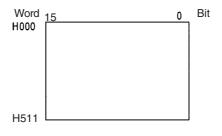
Work Area (W) Words in the Work Area can be used in programming; they cannot be used for I/O exchange with external I/O terminals. Use this area for work words and bits before any words in the CIO Area.



**Note** These words should be used first in programming be assigned to new functions in future versions of CP1L CPU Units.

Holding Area (H)

Words in the Holding Area can be used in programming. These words retain their content when the PLC is turned ON or the operating mode is switched between PROGRAM mode and RUN or MONITOR mode.

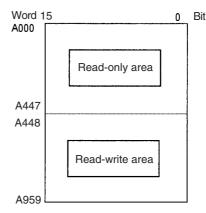


**Note** H512 to H1535 are used as a Function Block Holding Area. These words can be used only for function block instances (internally allocated variable area). These words cannot be specified as instruction operands in the user program.

## Section 4-1

Auxiliary Area (A)

These words are allocated to specific functions in the system. Refer to Appendix C Auxiliary Area Allocations by Function and Appendix D Auxiliary Area Allocations by Address for details on the Auxiliary Area.

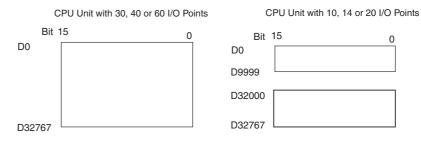


Temporary Relay Area (TR)

Data Memory Area (D)

The TR Area contains bits that record the ON/OFF status of program branches. Refer to the *CP1H/CP1L Programming Manual* for details.

The DM Area is a multi-purpose data area that is normally accessed only in word-units. These words retain their content when the PLC is turned ON or the operating mode is switched between PROGRAM mode and RUN or MON-ITOR mode.



Timer Area (T)

There are two parts to the Timer Area: the Timer Completion Flags and the timer Present Values (PVs). Up to 4,096 timers with timer numbers T0 to T4095 can be used.

#### **Timer Completion Flags**

These flags are read as individual bits. A Completion Flag is turned ON by the system when the corresponding timer times out (i.e., when the set time elapses).

#### Timer PVs

The PVs are read and written as words (16 bits). The PVs count up or down as the timer operates.

Counter Area (C) There are two parts to the Counter Area: the Counter Completion Flags and the Counter Present Values (PVs). Up to 4,096 counters with counter numbers C0 to C4095 can be used.

#### **Counter Completion Flags**

These flags are read as individual bits. A Completion Flag is turned ON by the system when the corresponding counter counts out (i.e., when the set value is reached).

#### Counter PVs

	Counter PVs
	The PVs are read and written as words (16 bits). The PVs count up or down as the counter operates.
Condition Flags	These flags include the Arithmetic Flags, such as the Error Flag and Equals Flag, which indicate the results of instruction execution as well as the Always ON and Always OFF Flags. The Condition Flags are specified with symbols rather than addresses.
Clock Pulses	The Clock Pulses are turned ON and OFF by the CPU Unit's internal timer. These bits are specified with symbols rather than addresses.
Task Flag Area (TK)	A Task Flag will be ON when the corresponding cyclic task is in executable (RUN) status and OFF when the cyclic task hasn't been executed (INI) or is in standby (WAIT) status.
Index Registers (IR)	Index registers (IR0 to IR15) are used to store PLC memory addresses (i.e., absolute memory addresses in RAM) to indirectly address words in I/O memory. The Index Registers can be used separately in each task or they can be shared by all tasks.
Data Registers (DR)	Data registers (DR0 to DR15) are used together with Index Registers. When a Data Register is input just before an Index Register, the content of the Data Register is added to the PLC memory address in the Index Register to offset that address. The Data Registers can be used separately in each task or they can be shared by all tasks.

# 4-1-3 Clearing and Holding I/O Memory

Area		Mode cl	Mode changed <sup>1</sup>		Fatal error generated			PLC power turned ON			
				Executio	n of FALS	Other fa	tal errors	clear IOM	up set to I Hold Bit tus <sup>2</sup>	hold ION	up set to I Hold Bit tus <sup>2</sup>
		IOM Hold Bit OFF	IOM Hold Bit ON	IOM Hold Bit OFF	IOM Hold Bit ON	IOM Hold Bit OFF	IOM Hold Bit ON	IOM Hold Bit OFF	IOM Hold Bit ON	IOM Hold Bit OFF	IOM Hold Bit ON
CIO	I/O Area	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained
Area	Serial PC Link Area										
	Internal I/O Area										
Work	Area (W)	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained
Holdir	ng Area (H)	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained
Auxilia	ary Area (A)	Status trea	tment deper	nds on addre	ess.						
Data I	Memory Area (D)	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained
Timer	Completion Flags (T)	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained
Timer	PVs (T)	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained
Count	er Completion Flags (C)	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained
Count	er PVs (C)	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained	Retained
Task F	Flags (TK)	Cleared	Cleared	Retained	Retained	Cleared	Cleared	Cleared	Cleared	Cleared	Cleared
Index	Registers (IR)	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained
Data I	Registers (DR)	Cleared	Retained	Retained	Retained	Cleared	Retained	Cleared	Cleared	Cleared	Retained

Note

1. Mode changed from PROGRAM to RUN/MONITOR or vice-versa.

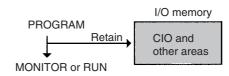
2. The PLC Setup's *IOM Hold Bit Status at Startup* setting determines whether the IOM Hold Bit's status is held or cleared when the PLC is turned ON.

## 4-1-4 Hot Start/Hot Stop Functions

**Operating Mode Changes** 

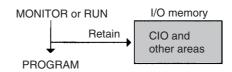
#### Hot Start

Turn ON the IOM Hold Bit to retain all data\* in I/O memory when the CPU Unit is switched from PROGRAM mode to RUN/MONITOR mode to start program execution.



#### Hot Stop

When the IOM Hold Bit is ON, all data\* in I/O memory will also be retained when the CPU Unit is switched from RUN or MONITOR mode to PROGRAM mode to stop program execution.



Note \*The following areas of I/O memory will be cleared during mode changes (between PROGRAM and RUN/MONITOR) unless the IOM Hold Bit is ON: the CIO Area (I/O Area, Data Link Area, CPU Bus Unit Area, Special I/O Unit Area, DeviceNet (CompoBus/D) Area, and Internal I/O Areas), Work Area, Timer Completion Flags, and Timer PVs.

#### **Overview of I/O Memory Area**

**PLC Power ON** 

Name	Address	Description		
IOM Hold Bit	A500.12	Specifies whether the I/O memory will be retained or when the CPU Unit operating mode is changed (between PROGRAM and RUN/MONITOR) or when the power is cycled.		
		OFF: I/O memory is cleared to 0 when the operating mode is changed.		
		ON: I/O memory is retained when the operating mode is changed between PROGRAM and RUN or MONITOR.		

Auxiliary Area Flags and Words

When the IOM Hold Bit is ON, all outputs from Output Units will be maintained when program execution stops. When the program starts again, outputs will have the same status that they had before the program was stopped and instructions will be executed. (When the IOM Hold Bit is OFF, instructions will be executed after the outputs have been cleared.)

In order for all data\* in I/O memory to be retained when the PLC is turned ON, the IOM Hold Bit must be ON and it must be protected in the PLC Setup using the *IOM Hold Bit Status at Startup* parameter.



## Auxiliary Area Flags and Words

Name	Address	Description	
IOM Hold Bit	A500.12	Specifies whether the I/O memory will be retained not when the CPU Unit operating mode is changed (between PROGRAM and RUN/MONITOR) or whe the power is cycled.	
		OFF: I/O memory is cleared to 0 when the operating mode is changed.	
		ON: I/O memory is retained when the operating mode is changed between PROGRAM and RUN or MONITOR.	

#### PLC Setup

Name	Description	Setting	Default
Bit Status	To retain all data in I/O memory when the PLC is turned ON, set the <i>IOM Hold Bit at startup</i> parameter to hold the status of the I/O Hold Bit.	<ul><li>OFF: The IOM Hold Bit is cleared to 0 when power is cycled.</li><li>ON: The status of the IOM Hold Bit is retained when power is cycled.</li></ul>	OFF (Cleared)

# 4-2 I/O Area and I/O Allocations

Input Bits: CIO 0.00 to CIO 99.15 (100 words)

Output Bits: CIO 100.00 to CIO 199.15 (100 words)

The starting words for inputs and outputs are predetermined for CP1L CPU Unit. Input bits in CIO 0 and CIO 1 and output bits in CIO 100 and CIO 101 are automatically allocated to the built-in I/O on the CPU Unit. CP-series Expansion Units and CP-series Expansion I/O Units are automatically allocated input bits in words starting from CIO 2 and output bits in words starting from CIO 102.

Allocated Words and Number of Expansion Units and Expansion I/O Units

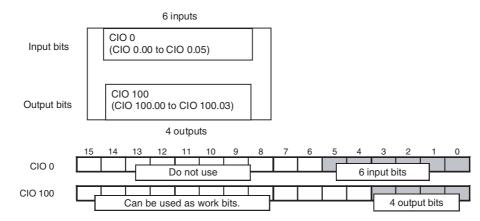
CPU Unit	Alloca	ated words	Number of
	Input bits	Output bits	Expansion Units and Expansion I/O Units connected
CPU Unit with 10 I/O points	CIO 0	CIO 100	0
CPU Unit with 14 I/O points	CIO 0	CIO 100	1
CPU Unit with 20 I/O points	CIO 0	CIO 100	1
CPU Unit with 30 I/O points	CIO 0 and CIO 1	CIO 100 and CIO 101	3
CPU Unit with 40 I/O points	CIO 0 and CIO 1	CIO 100 and CIO 101	3
CPU Unit with 60 I/O points	CIO 0, CIO 1, CIO 2	CIO 100, CIO 101, CIO 102	3

For example, with a CPU Unit with 40 I/O points, the input bits in CIO 0 and CIO 1 and the outputs bits in CIO 100 and CIO 101 would be allocated to the built-in I/O of the CPU Unit. Input bits in CIO 2 and higher and outputs bits in CIO 102 and higher would be automatically allocated in order to any Expansion Units or Expansion I/O Units connected to the CPU Unit.

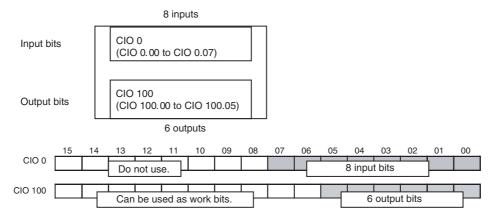
When the power to the CPU Unit is turned ON, the CPU Unit checks for any Expansion Units and Expansion I/O Units connected to it and automatically allocates I/O bits. If the order in which the Units are connected is changed, the the bits used in the ladder program will no longer match the bits allocated to the actual Units. Always review the ladder program whenever changing the order in which Units are connected.

# 4-2-1 I/O Bits Allocated to CPU Units

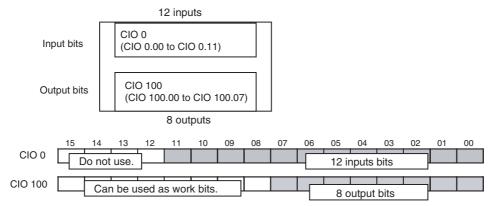
## CPU Unit with 10 I/O Points



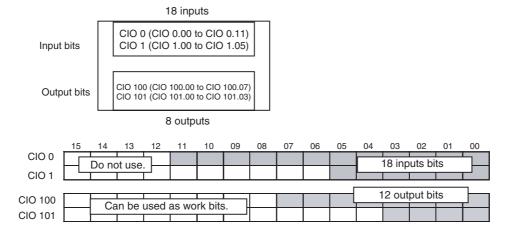
## CPU Unit with 14 I/O Points



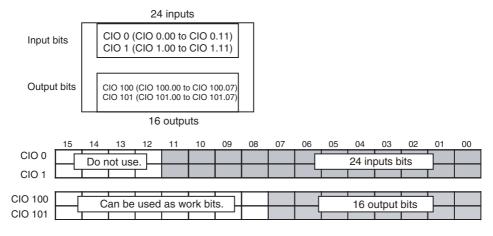
## CPU Unit with 20 I/O Points



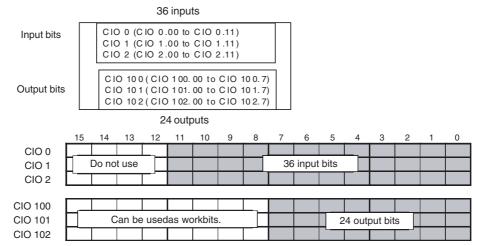
## CPU Unit with 30 I/O Points



## CPU Unit with 40 I/O Points



## CPU Unit with 60 I/O Points



For a CPU Unit with 40 I/O points (shown above), a total of 24 input bits are allocated to the input terminal block. The bits that are allocated are input bits CIO 0.00 to CIO 0.11 (i.e., bits 00 to 11 in CIO 0) and input bits CIO 1.00 to CIO 1.11 (i.e., bits 00 to 11 in CIO 1).

In addition, a total of 16 output bits are allocated to the output terminal block. The bits that are allocated are output bits CIO 100.00 to CIO 100.07 (i.e., bits

00 to 07 in CIO 0) and output bits CIO 101.00 to CIO 101.07 (i.e., bits 00 to 07 in CIO 1).

The upper bits (bits 12 to 15) not used in the input words cannot be used as work bits. Only the bits not used in the output words can be used as work bits.

# 4-2-2 I/O Bits Allocated to Expansion I/O Units

There are Expansion I/O Units for expanding inputs, for expanding outputs, and for expanding both input and outputs. I/O bits starting from bit 00 in the next word after the word allocated to the previous Expansion Unit, Expansion I/O Unit, or CPU Unit are automatically allocated. This word is indicated as "CIO m" for input words and as "CIO n" for output words.

	Unit			lr	nput bits		utput bits	
			No. of bits	No. of words	Addresses	No. of bits	No. of words	Addresses
Unit with 8	3 inputs	CP1W-8ED CPM1A-8ED	8 bits	1 word	CIO m (bits 00 to 07)		None	None
Unit with 8 outputs	Relays	CP1W-8ER CPM1A-8ER		None	None	8 bits	1 word	CIO n (bits 00 to 07)
	Sinking transistors	CP1W-8ET CPM1A-8ET		None	None	8 bits	1 word	CIO n (bits 00 to 07)
	Sourcing transistors	CP1W-8ET1 CPM1A-8ET1		None	None	8 bits	1 word	CIO n (bits 00 to 07)
Unit with 16 out-	Relays	CP1W-16ER CPM1A-16ER		None	None	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)
puts	Sinking transistors	CP1W-16ET		None	None	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)
	Sourcing transistors	CP1W-16ET1		None	None	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)
Unit with 20 I/O	Relays	CP1W-20EDR1 CPM1A-20EDR1	12 bits	1 word	CIO m (bits 00 to 11)	8 bits	1 word	CIO n (bits 00 to 07)
	Sinking transistors	CP1W-20EDT CPM1A-20EDT	12 bits	1 word	CIO m (bits 00 to 11)	8 bits	1 word	CIO n (bits 00 to 07)
	Sourcing transistors	CP1W-20EDT1 CPM1A-20EDT1	12 bits	1 word	CIO m (bits 00 to 11)	8 bits	1 word	CIO n (bits 00 to 07)
Unit with 32 outputs	Relays	CP1W-32ER		None	None	32 bits	4 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07) CIO n+2 (bits 00 to 07) CIO n+3 (bits 00 to 07)
	Sinking transistors	CP1W-32ET		None	None	32 bits	4 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07) CIO n+2 (bits 00 to 07) CIO n+3 (bits 00 to 07)
	Sourcing transistors	CP1W-32ET1		None	None	32 bits	4 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07) CIO n+2 (bits 00 to 07) CIO n+3 (bits 00 to 07)
Unit with 40 I/O	Relays	CP1W-40EDR CPM1A-40EDR	24 bits	2 words	CIO m (bits 00 to 11) CIO m+1 (bits 00 to 11)	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)
	Sinking transistors	CP1W-40EDT CPM1A-40EDT		2 words	CIO m (bits 00 to 11) CIO m+1 (bits 00 to 11)	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)
	Sourcing transistors	CP1W-40EDT1 CPM1A-40EDT1	24 bits	2 words	CIO m (bits 00 to 11) CIO m+1 (bits 00 to 11)	16 bits	2 words	CIO n (bits 00 to 07) CIO n+1 (bits 00 to 07)

#### I/O Bit Addresses

#### Units 8 Input Points (CP1W-8ED/CPM1A-8ED)

Eight input bits are allocated in one word (bits 00 to 07 in CIO m). 12 13 11 10 09 08 07 06 15 14 05 04 03 02 Inputs m Do not use

Only one word (8 bits) is allocated to an 8-input Expansion Input Unit. No output words are allocated. Input bits 08 to 15 are always cleared by the system and cannot be used as work bits.

#### Units with 8 Output Points (CP1W-8E //CPM1A-8E ))

Eight output bits are allocated in one word (bits 00 to 07 in CIO n+1).



Only one word (8 bits) is allocated to an 8-output Expansion Output Unit. No input words are allocated. Output bits 08 to 15 can be used as work bits.

#### Units with 16 Output Points (CP1W-16E //CPM1A-16E )

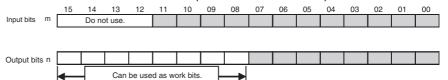
Sixteen output bits in two words are allocated in two words (bits 00 to 07 in CIO n and bits 00 to 07 in CIO n+1).

	_	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Output	n	[		Can be			- 14 -										
bits	n+1		Can be used as work bits.														

Two words (16 bits) are allocated to a 16-output Expansion Output Unit. No input words are allocated. Output bits 08 to 15 can be used as work bits.

#### Units with 20 I/O Points (CPM1A-20ED /20EDT/20ED )

Twelve input bits are allocated in one word (bits 00 to 11 in CIO m). Eight output bits are allocated in one word (bits 00 to 07 in CIO n).



One input word (12 bits) and one output word (8 bits) are allocated for a 20-point Expansion I/O Unit.

Input bits 12 to 15 are always cleared by the system and cannot be used as work bits. Output bits 08 to 15, however, can be used as work bits.

#### Units with 32 Output Points (CP1W-32E

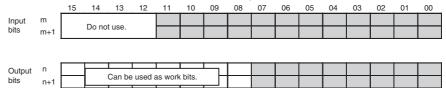
Thirty-two output bits are allocated in four words (bits 00 to 07 in CIO n, bits 00 to 07 in CIO n+1, bits 00 to 07 in CIO n+2 and bits 00 to 07 in CIO n+3).

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Output n																
bits n+1			Can be used as work bits.													
n+2			Can	be used	as wor	K DILS.										
n+3																

Four words (32 bits) are allocated to a 32-output Expansion Output Unit. No input words are allocated. Output bits 08 to 15 can be used as work bits.

#### Units with 40 I/O Points (CPM1A-40ED /40EDT/40ED )

Twenty-four input bits in two words are allocated (bits 00 to 11 in CIO m and bits 00 to 11 CIO m+1). Sixteen output bits in two words are allocated (bits 00 to 07 in CIO n and bits 00 to 07 in CIO n+1).



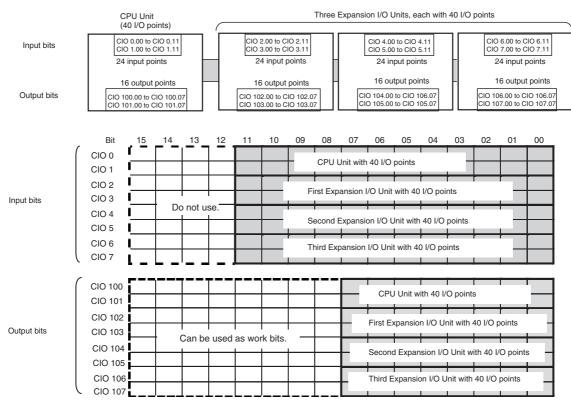
Two input words (24 bits) and two output words (16 bits) are allocated to a 40point Expansion I/O Unit. Input bits 12 to 15 cannot be used as work bits. Output bits 08 to 15, however, can be used as work bits.

# 4-2-3 I/O Allocation Examples with Expansion I/O Units

### Example 1: Maximum I/O Capacity

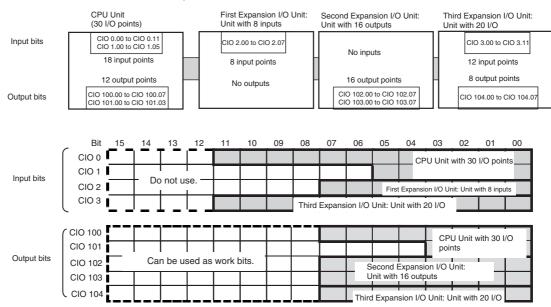
The configuration shown in this example is for the maximum I/O capacity. It consists of a CPU Unit with 40 I/O points and three Expansion I/O Units, each with 40 I/O points. Up to three Expansion I/O Units can be connected to a CPU Unit with either 30, 40 or 60 I/O points.

When Expansion I/O Units with 40 I/O points are connected, control is possible for up to 160 I/O points, including 96 inputs and 64 outputs.



# Example 2: Connecting Expansion I/O Units with Only Inputs or Only Outputs

If Expansion I/O Units with only inputs or only outputs are connected, the input or output word not used by an Expansion I/O Unit is allocated to the next Unit that requires it.

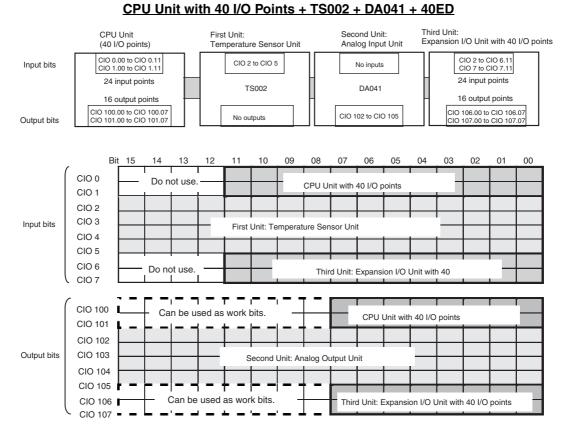


## 4-2-4 I/O Word Allocations to Expansion Units

Unit		I	nput words	0	utput words
Analog I/O Units	CP1W-MAD11	2 words	CIO m to CIO m+1	1 word	CIO n
	CPM1A-MAD11				
	CPM1A-MAD01				
Analog Input Units	CP1W-AD041	4 words	CIO m to CIO m+3	2 words	CIO n to CIO n+1
	CPM1A-AD041				
Analog Output Units	CP1W-DA041	None		4 words	CIO n to CIO n+3
	CPM1A-DA041				
Temperature Sensor Units	CP1W-TS001	2 words	CIO m to CIO m+1	None	
	CPM1A-TS001				
	CP1W-TS002	4 words	CIO m to CIO m+3	None	
	CPM1A-TS002				
	CP1W-TS101	2 words	CIO m to CIO m+1	None	
	CPM1A-TS101				
	CP1W-TS102	4 words	CIO m to CIO m+3	None	
	CPM1A-TS102				
DeviceNet I/O Link Units	CPM1A-DRT21	2 words	CIO m to CIO m+1	2 words	CIO n to CIO n+1
CompoBus/S I/O Link	CP1W-SRT21	1 word	CIO m	1 word	CIO n
Units	CPM1A-SRT21				

m: Indicates the next input word after the input word allocated to the Expansion Unit, Expansion I/O Unit, or CPU Unit to the left of the current Unit.

n: Indicates the next output word after the output word allocated to the Expansion Unit, Expansion I/O Unit, or CPU Unit to the left of the current Unit.

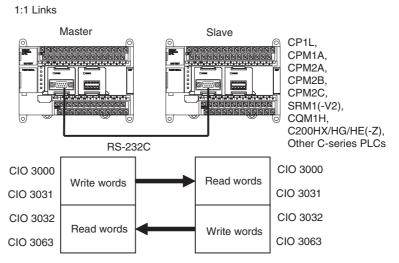


# I/O Word Allocations to Expansion Units

## 4-3 1:1 Link Area

The 1:1 Link Area contains 1,024 bits (64 words) with addresses ranging from CIO 3000.00 to CIO 3063.15 (CIO 3000 to CIO 3063).

These bits are used to create 1:1 links (i.e., shared data link areas) by connecting the RS-232C ports of two PLCs, including the CP1L, CPM1A, CPM2A, CPM2B, CPM2C, SRM1(-V2), CQM1H, and C200HX/HG/HE(-Z).



Refer to 6-3-6 1:1 Links for information on using 1:1 links.

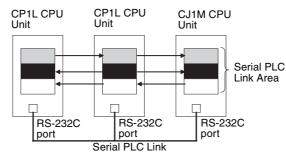
# 4-4 Serial PLC Link Area

The Serial PLC Link Area contains 1,440 bits (90 words) with addresses ranging from CIO 3100.00 to CIO 3189.15 (CIO 3100 to CIO 3189).

Words in the Serial PLC Link Area can be used for data links with other PLCs. Serial PLC Links exchange data among CPU Units via the built-in RS-232C ports, with no need for special programming.

The Serial PLC Link allocations are set automatically by means of the following PLC Setup in the Polling Unit.

- Serial PLC Link Mode
- Number of Serial PLC Link transfer words
- Maximum Serial PLC Link unit number



Addresses not used for Serial PLC Links can be used in programming, the same as the Work Area.

Forcing Bit Status

Serial PLC Link Area Initialization

Bits in the Serial PLC Link Area can be force-set and force-reset.

The contents of the Serial PLC Link Area will be cleared in the following cases:

- 1. When the operating mode is changed from PROGRAM mode to RUN/MONITOR mode or vice-versa and the IOM Hold Bit is OFF
- 2. When the power is cycled
- 3. When the Serial PLC Link Area is cleared from the CX-Programmer
- 4. When PLC operation is stopped when a fatal error other than an FALS(007) error occurs (The contents of the Serial PLC Link Area will be retained when FALS(007) is executed.)

# 4-5 Internal Work Area

The Internal Work Area contains 512 words with addresses ranging from W0 to W511. These words can be used in programming as work words.

There are unused words in the CIO Area (CIO 3800 to CIO 6143) that can also be used in the program, but use any available words in the Work Area first because the unused words in the CIO Area may be allocated to other applications when functions are expanded.

Forcing Bit StatusBits in the Work Area can be force-set and force-reset.

**Work Area Initialization** The contents of the Work Area will be cleared in the following cases:

- 1. When the operating mode is changed from PROGRAM to RUN or MONI-TOR mode or vice-versa and the IOM Hold Bit is OFF
- 2. When the power is cycled
- 3. When the Work Area is cleared from the CX-Programmer.

4. When PLC operation is stopped when a fatal error other than an FALS(007) error occurs. (The contents of the Work Area will be retained when FALS(007) is executed.)

# 4-6 Holding Area (H)

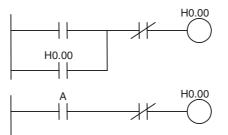
The Holding Area contains 512 words with addresses ranging from H0 to H511 (bits H0.00 to H511.15). These words can be used in programming.

Holding Area Initialization Data in the Holding Area is not cleared when the power is cycled or the PLC's operating mode is changed from PROGRAM mode to RUN or MONITOR mode or vice-versa.

A Holding Area bit will be cleared if it is programmed between IL(002) and ILC(003) and the execution condition for IL(002) is OFF. To keep a bit ON even when the execution condition for IL(002) is OFF, turn ON the bit with the SET instruction just before IL(002).

**Self-maintaining Bits** When a self-maintaining bit is programmed with a Holding Area bit, the self-maintaining bit won't be cleared even when the power is reset.

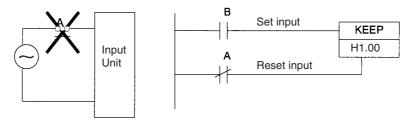
- Note 1. If a Holding Area bit is not used for the self-maintaining bit, the bit will be turned OFF and the self-maintaining bit will be cleared when the power is reset.
  - 2. If a Holding Area bit is used but not programmed as a self-maintaining bit as in the following diagram, the bit will be turned OFF by execution condition A when the power is reset.



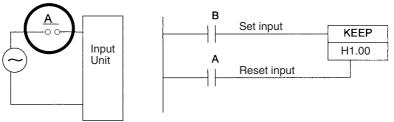
3. H512 to H1535 are used as a Function Block Holding Area. These words can be used only for function block instances (internally allocated variable area). These words cannot be specified as instruction operands in the user program.

#### Precautions

When a Holding Area bit is used in a KEEP(011) instruction, never use a normally closed condition for the reset input if the input device uses an AC power supply. When the power supply goes OFF or is temporarily interrupted, the input will go OFF before the PLC's internal power supply and the Holding Area bit will be reset.



Instead, use a configuration like the one shown below.



There are no restrictions in the order of using bit address or in the number of N.C. or N.O. conditions that can be programmed.

# 4-7 Auxiliary Area (A)

The Auxiliary Area contains 960 words with addresses ranging from A0 to A959). These words are preassigned as flags and control bits to monitor and control operation.

A0 through A447 are read-only, but A448 through A959 can be read or written from the program or the CX-Programmer.

Refer to Appendix C Auxiliary Area Allocations by Function and Appendix D Auxiliary Area Allocations by Address for Auxiliary Area functions.

Forcing Bit Status Read/write bits in the Auxiliary Area cannot be force-set and force-reset continuously.

# 4-8 TR (Temporary Relay) Area

The TR Area contains 16 bits with addresses ranging from TR0 to TR15. These temporarily store the ON/OFF status of an instruction block for branching and are used only with mnemonics. TR bits are useful when there are several output branches and interlocks cannot be used.

The TR bits can be used as many times as required and in any order required as long as the same TR bit is not used twice in the same instruction block.

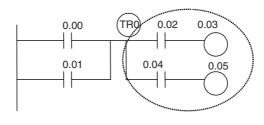
TR bits can be used only with the OUT and LD instructions. OUT instructions (OUT TR0 to OUT TR15) store the ON OFF status of a branch point and LD instructions recall the stored ON OFF status of the branch point.

Forcing Bit Status

us TR bits cannot be changed from the CX-Programmer.

Examples

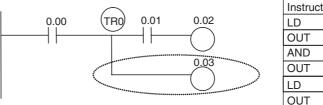
In this example, a TR bit is used when two outputs have been directly connected to a branch point.



Instruction	Operand
LD	0.00
OR	0.01
OUT	TR 0
AND	0.02
OUT	0.03
LD	TR 0
AND	0.04
OUT	0.05

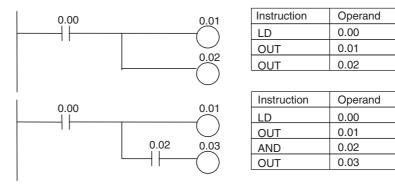
## Section 4-9

In this example, a TR bit is used when an output is connected to a branch point without a separate execution condition.



Instruction	Operand
LD	0.00
OUT	TR 0
AND	0.01
OUT	0.02
LD	TR 0
OUT	0.03

**Note** A TR bit is not required when there are no execution conditions after the branch point or there is an execution condition only in the last line of the instruction block.



# 4-9 Timers and Counters

## 4-9-1 Timer Area (T)

The 4,096 timer numbers (T0000 to T4095) are shared by the TIM, TIMX(550), TIMH(015), TIMHX(551), TMHH(540), TIMHHX(552), TTIM(087), TTIMX(555), TIMW(813), TIMWX(816), TMHW(815), and TIMHWX(817) instructions. Timer Completion Flags and present values (PVs) for these instructions are accessed with the timer numbers.

The TIML(542), TIMLX(553), MTIM(543), and MTIMX(554) instructions do not use timer numbers.

When a timer number is used in an operand that requires bit data, the timer number accesses the Completion Flag of the timer. When a timer number is used in an operand that requires word data, the timer number accesses the PV of the timer. Timer Completion Flags can be used as often as necessary as normally open and normally closed conditions and the values of timer PVs can be read as normal word data.

The refresh method for timer PVs can be set from the CX-Programmer to either BCD or binary.

**Note** It is not recommended to use the same timer number in two timer instructions because the timers will not operate correctly if they are timing simultaneously. (If two or more timer instructions use the same timer number, an error will be generated during the program check, but the timers will operate as long as the instructions are not executed in the same cycle.)

Instruction name	Effect on PV and Completion Flag			Operation in Jumps and Interlocks			
	Mode change <sup>1</sup>	PLC start-up <sup>2</sup>	CNR(545)/CN RX(547)	Jumps (JMP-JME) or Tasks on standby <sup>4</sup>	Interlocks (IL-ILC)		
TIMER: TIM/TIMX(550)	$PV \rightarrow 0$	$PV \rightarrow 0$	$\text{PV} \rightarrow 9999$	PVs refreshed in	$PV\toSV$		
HIGH-SPEED TIMER: TIMH(015)/TIMHX(551)	$Flag\toOFF$	$Flag\toOFF$	$Flag\toOFF$	operating timers	(Reset to SV.) Flag $\rightarrow$ OFF		
ONE-MS TIMER: TMHH(540)/TMHHX(552)							
ACCUMULATIVE TIMER: TTIM(087)/TTIMX(555)				PV Maintained	PV Maintained		
TIMER WAIT: TIMW(813)TIMWX(816)				PVs refreshed in operating timers			
HIGH-SPEED TIMER WAIT: TMHW(815)/TMHWX(817)							

The following table shows when timers will be reset or maintained.

Note 1. If the IOM Hold Bit (A500.12) is ON, the PV and Completion Flag will be retained when a fatal error occurs (including execution of FALS instructions) or the operating mode is changed from PROGRAM mode to RUN or MONITOR mode or vice-versa. The PV and Completion Flag will be cleared when power is cycled.

- 2. If the IOM Hold Bit (A50012) is ON and the PLC Setup's *IOM Hold Bit Status at Startup* setting is set to protect the IOM Hold Bit, the PV and Completion Flag will be retained when the PLC's power is cycled.
- 3. Since the TIML(542), TIMLX(553), MTIM(543), and MTIMX(554) instructions do not use timer numbers, they are reset under different conditions. Refer to the descriptions of these instructions for details.
- 4. The present value of TIM, TIMX(550), TIMH(015), TIMHX(551), TM-HH(540), TMHHX(552), TIMW(813), TIMWX(816), TMHW(815) and TMH-WX(817) timers programmed with timer numbers 0000 to 2047 will be updated even when jumped between JMP and JME instructions or when in a task that is on standby. The present value of timers programmed with timer numbers 2048 to 4095 will be held when jumped or when in a task that is on standby.

Forcing Bit StatusTimer Completion Flags can be force-set and force-reset.<br/>Timer PVs cannot be force-set or force-reset, although the PVs can be<br/>refreshed indirectly by force-setting/resetting the Completion Flag.RestrictionsThere are no restrictions in the order of using timer numbers or in the number

**strictions** There are no restrictions in the order of using timer numbers or in the number of N.C. or N.O. conditions that can be programmed. Timer PVs can be read as word data and used in programming.

## 4-9-2 Counter Area (C)

The 4,096 counter numbers (C0000 to C4095) are shared by the CNT, CNTX(546), CNTR(012), CNTRX(548), CNTW(814), and CNTWX(818) instructions. Counter Completion Flags and present values (PVs) for these instructions are accessed with the counter numbers.

When a counter number is used in an operand that requires bit data, the counter number accesses the Completion Flag of the counter. When a counter number is used in an operand that requires word data, the counter number accesses the PV of the counter.

The refresh method for counter PVs can be set from the CX-Programmer to either BCD or binary. (Refer to the previous page).

It is not recommended to use the same counter number in two counter instructions because the counters will not operate correctly if they are counting simultaneously. If two or more counter instructions use the same counter number, an error will be generated during the program check, but the counters will operate as long as the instructions are not executed in the same cycle.

The following table shows when counter PVs and Completion Flags will be reset.

Instruction name		Effect on PV and Completion Flag					
	Reset	Mode change	PLC startup	Reset Input	CNR(545)/CN RX(547)	Interlocks (IL-ILC)	
COUNTER: CNT/CNTX(546)	$PV \rightarrow 0$ Flag $\rightarrow OFF$	Maintained	Maintained	Reset	Reset	Maintained	
REVERSIBLE COUNTER: CNTR(012)/CNTRX(548)							
COUNTER WAIT: CNTW(814)/CNTWX(818)							

**Forcing Bit Status** 

Counter Completion Flags can be force-set and force-reset.

Counter PVs cannot be force-set or force-reset, although the PVs can be refreshed indirectly by force-setting/resetting the Completion Flag.

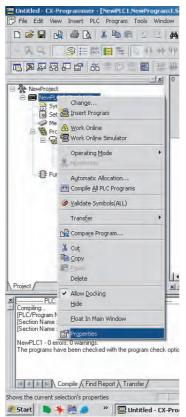
**Restrictions** There are no restrictions in the order of using counter numbers or in the number of N.C. or N.O. conditions that can be programmed. Counter PVs can be read as word data and used in programming.

# 4-9-3 Changing the BCD or Binary Mode for Counters and Timers

The refresh method for set values and present values for timers and counters can be changed from BCD mode (0000 to 9999) to binary method (0000 to FFFF) using the CX-Programmer

This setting is made in common for all tasks for all timers and counters.

1. Right-click New PLC in the project tree and select Properties.

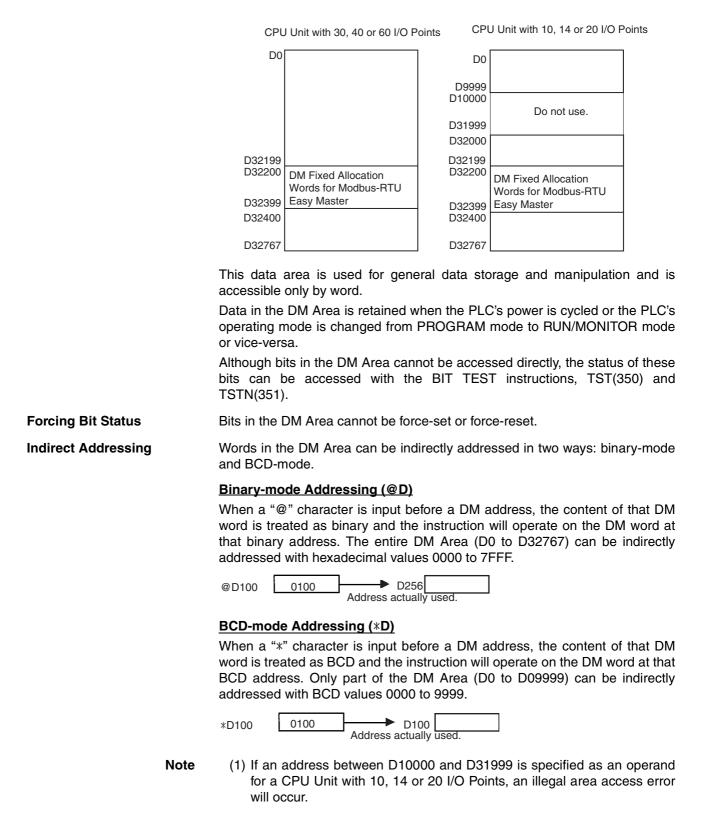


2. Select the *Execute Timer/Counter as Binary* Option in the PLC Properties Dialog Box. The timers and counters for all tasks will be executed in binary mode.

PLC Pr	operties		×
-12	General	Protection	
_	<u>N</u> ame:	NewPLC1 C Program	
	<u>T</u> ype:	CP1L M Verify C Debug	
		comment instructions	
	_	section markers Ilay dialog to show PLC Memory <u>B</u> ackup Status	
		IR/DRs independently per task	
	IM Exe	cute <u>T</u> imer/Counter as Binary	

# 4-10 Data Memory Area (D)

CPU Units with 30, 40 or 60 I/O points: D0 to D32767 CPU Units with 10, 14 or 20 I/O points: D0 to D9999 and D32000 to D32767



(2) If two-word data is accessed from the last address in the DM Area (D9999 for the CP1L-L□D□-□ and D32767 for other CPU Units), the Access Error Flag (P\_AER) will turn ON and the data at D9999 or D32767 will not be read or written.

DM Fixed Allocation Words for Modbus-RTU Easy Master The following DM area words are used as command and response storage areas for the Modbus-RTU Easy Master function.

D32200 to D32299: Serial port 1 on CP1L CPU Unit with M CPU type

D32300 to D32399: Serial port 2 on CP1L CPU Unit with M CPU type and serial port 1 on CP1L CPU Unit with L CPU type

For use of these areas, refer to 6-3-3 Modbus-RTU Easy Master Function.

## 4-11 Index Registers

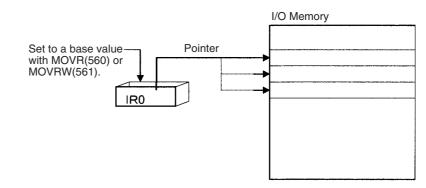
The sixteen Index Registers (IR0 to IR15) are used for indirect addressing. Each Index Register can hold a single PLC memory address, which is the absolute memory address of a word in I/O memory. Use MOVR(560) to convert a regular data area address to its equivalent PLC memory address and write that value to the specified Index Register. (Use MOVRW(561) to set the PLC memory address of a timer/counter PV in an Index Register.)

Note Refer to Appendix E Memory Map for more details on PLC memory addresses.

Indirect Addressing When an Index Register is used as an operand with a "," prefix, the instruction will operate on the word indicated by the PLC memory address in the Index Register, not the Index Register itself. Basically, the Index Registers are I/O memory pointers.

- All addresses in I/O memory (except Index Registers, Data Registers, and Condition Flags) can be specified seamlessly with PLC memory addresses. It isn't necessary to specify the data area. I/O memory addresses for IR, DR, and Condition Flags, however, cannot be held.
- In addition to basic indirect addressing, the PLC memory address in an Index Register can be offset with a constant or Data Register, auto-incremented, or auto-decremented. These functions can be used in loops to read or write data while incrementing or decrementing the address by one each time that the instruction is executed.

With the offset and increment/decrement variations, the Index Registers can be set to base values with MOVR(560) or MOVRW(561) and then modified as pointers in each instruction.



**Note** It is possible to specify regions outside of I/O memory and generate an Illegal Access Error when indirectly addressing memory with Index Registers. Refer to *Appendix E Memory Map* for details on the limits of PLC memory addresses.

#### **Index Registers**

## Section 4-11

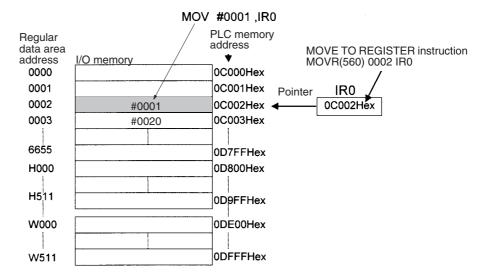
The following table shows the variations available when indirectly addressing I/O memory with Index Registers. (IR represents an Index Register from IR0 to IR15.)

Variation	Function	Syntax		Example
Indirect addressing	The content of IR is treated as the PLC memory address of a bit or word.	,IR□	LD ,IR0	Loads the bit at the PLC memory address contained in IR0.
Indirect addressing with constant offset	The constant prefix is added to the content of IR and the result is treated as the PLC memory address of a bit or word.	Constant ,IR□ (Include a + or – in the constant.)	LD +5,IR0	Adds 5 to the contents of IR0 and loads the bit at that PLC memory address.
	The constant may be any integer from –2,048 to 2,047.			
Indirect addressing with DR offset	The content of the Data Register is added to the content of IR and the result is treated as the PLC memory address of a bit or word.	DR□,IR□	LD DR0,IR0	Adds the contents of DR0 to the contents of IR0 and loads the bit at that PLC memory address.
Indirect addressing with auto-increment	After referencing the content of $IR\square$ as the PLC memory address of a bit or word, the content is incremented by 1 or 2.	Increment by 1: ,IR□+ Increment by 2: ,IR□++	LD , IR0++	Loads the bit at the PLC memory address contained in IR0 and then increments the content of IR0 by 2.
Indirect addressing with auto-decrement	The content of IR $\square$ is decremented by 1 or 2 and the result is treated as the PLC memory address of a bit or word.	Decrement by 1: ,−IR□ Decrement by 2: ,− −IR□	LD ,	Decrements the content of IR0 by 2 and then loads the bit at that PLC memory address.

Example

This example shows how to store the PLC memory address of a word (CIO 2) in an Index Register (IR0), use the Index Register in an instruction, and use the auto-increment variation.

MOVR(560)	2	IR0	Stores the PLC memory address of CIO 2 in IR0.
MOV(021)	#0001	,IR0	Writes #0001 to the PLC memory ad- dress contained in IR0.
MOV(021)	#0020	+1,IR0	Reads the content of IR0, adds 1, and writes #0020 to that PLC memo- ry address.



**Note** The PLC memory addresses are listed in the diagram above, but it isn't necessary to know the PLC memory addresses when using Index Registers.

Since some operands are treated as word data and others are treated as bit
data, the meaning of the data in an Index Register will differ depending on the
operand in which it is used.

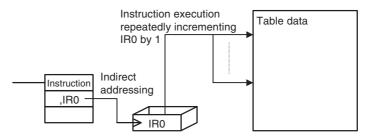
1,2,3	MOVR(560) MOV(021) When the operar are used "as is" a In this example M	as the PLC /IOVR(560)	IR2 , IR2 d as a word, the contents of the memory address of a word. sets the PLC memory address on copies the contents of D0 to	of CIO 2 in IR2
	2. Bit Operand: MOVR(560)	000013 +5 , IR2	,IR2	010 2.
	ister specify the v ber. In this exam (0C00D hex) in If	word addre ple, MOVR R2. The SE	d as a bit, the leftmost 7 digits of ss and the rightmost digit specif (560) sets the PLC memory add T instruction adds +5 from bit 1 turns ON bit CIO 1.02.	fies the bit num- dress of CIO 13
Index Register	The Index Registers	will be clea	red in the following cases:	
Initialization	•	ting mode i	s changed from PROGRAM to	RUN or MONI-
	2. When the power	is cycled		
Setting Index Registers	of an index register v The contents of an in is started. When MOVR(560) (for an	Always set the required value in an index register before using it. The contents of an index register will be unpredictable if it is not set in advance. The contents of an index register is also unpredictable after an interrupt task is started. When using index registers inside an interrupt task, use MOVR(560) (for anything but timer/counter PVs) or MOVRW(561) (for timer/counter PVs) to set the required value.		
		o set the re	quired value.	
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde tions shown in the for Index Registers as por The Index Registers	ster is used the conten ex Registers ollowing ta ointers.	dured value. I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl ble. Use these instructions to e directly addressed in any oth ed for indirect addressing.	(a two-word or y in the instruc- operate on the
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde tions shown in the for Index Registers as por The Index Registers	ster is used the conten x Registers ollowing ta ointers. cannot be sually be us	I as an operand without a "," pre- ts of the Index Register itself s can be directly addressed onl ble. Use these instructions to e directly addressed in any oth	(a two-word or y in the instruc- operate on the
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement	ster is used the conten ex Registers ollowing ta ointers. cannot be sually be us	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl ble. Use these instructions to directly addressed in any oth ed for indirect addressing.	(a two-word or y in the instruc- operate on the ner instructions,
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group	ster is used the conten ex Registers collowing ta cointers. cannot be sually be us MOVE	as an operand without a "," pre- ts of the Index Register itself can be directly addressed onli- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing.	(a two-word or y in the instruc- operate on the ner instructions, Mnemonic
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement	ster is used the conten or Registers following ta ointers. cannot be sually be us MOVE MOVE ISTER	I as an operand without a "," pre- ts of the Index Register itself s can be directly addressed onl- ble. Use these instructions to e directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER	(a two-word or y in the instruc- operate on the ner instructions, MovR(560)
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement	ster is used the conten ex Registers ollowing ta ointers. cannot be sually be us MOVE MOVE ISTER DOUBI	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER TIMER/COUNTER PV TO REG-	(a two-word or y in the instruc- operate on the ner instructions, <u>Mnemonic</u> MOVR(560) MOVRW(561)
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement Instructions	ster is used the conten ex Registers ollowing ta ointers. cannot be sually be us MOVE MOVE ISTER DOUBI DOUBI	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER TIMER/COUNTER PV TO REG- LE MOVE	(a two-word or y in the instruc- operate on the ner instructions, <u>Mnemonic</u> MOVR(560) MOVRW(561) MOVL(498)
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement Instructions	ster is used the conten ex Registers ollowing ta ointers. cannot be sually be us MOVE MOVE ISTER DOUBI DOUBI OUBI GET R	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER TIMER/COUNTER PV TO REG- LE MOVE LE DATA EXCHANGE ECORD LOCATION ECORD NUMBER	(a two-word or y in the instruc- operate on the ner instructions, MOVR(560) MOVR(561) MOVL(498) XCGL(562) SETR(635) GETR(636)
Direct Addressing	When an Index Registion will operate on "double" value). Indections shown in the full Index Registers as provide the Index Registers although they can us Instruction group Data Movement Instructions Table Data Processing Instructions Increment/Decrement	ster is used the conten ex Registers ollowing ta ointers. cannot be sually be us MOVE MOVE ISTER DOUBI DOUBI OUBI GET R	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER TIMER/COUNTER PV TO REG- LE MOVE LE DATA EXCHANGE ECORD LOCATION	(a two-word or y in the instruc- operate on the ner instructions, <u>Mnemonic</u> MOVR(560) MOVRW(561) MOVL(498) XCGL(562) SETR(635) GETR(636) ++L(591)
Direct Addressing	When an Index Regis tion will operate on "double" value). Inde- tions shown in the fe Index Registers as p The Index Registers although they can us Instruction group Data Movement Instructions	ster is used the conten ex Registers ollowing ta oointers. cannot be sually be us MOVE MOVE ISTER DOUBI DOUBI GET R DOUBI	I as an operand without a "," pre- ts of the Index Register itself can be directly addressed onl- ble. Use these instructions to directly addressed in any oth- ed for indirect addressing. Instruction name TO REGISTER TIMER/COUNTER PV TO REG- LE MOVE LE DATA EXCHANGE ECORD LOCATION ECORD NUMBER	(a two-word or y in the instruc- operate on the ner instructions, MOVR(560) MOVR(561) MOVL(498) XCGL(562) SETR(635) GETR(636)

Instruction group	Instruction name	Mnemonic
Comparison Instructions	DOUBLE EQUAL	=L(301)
	DOUBLE NOT EQUAL	<>L(306)
	DOUBLE LESS THAN	< L(311)
	DOUBLE LESS THAN OR EQUAL	<=L(316)
	DOUBLE GREATER THAN	> L(321)
	DOUBLE GREATER THAN OR EQUAL	>=L(326)
	DOUBLE COMPARE	CMPL(060)
Symbol Math Instructions	DOUBLE SIGNED BINARY ADD WITH- OUT CARRY	+L(401)
	DOUBLE SIGNED BINARY SUBTRACT WITHOUT CARRY	-L(411)

The SRCH(181), MAX(182), and MIN(183) instructions can output the PLC memory address of the word with the desired value (search value, maximum, or minimum) to IR0. In this case, IR0 can be used in later instructions to access the contents of that word.

## 4-11-1 Using Index Registers

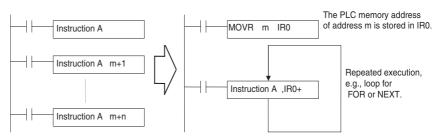
Processing of multiple (identical) instructions such as consecutive addresses for table data can be merged into one instruction by combining repetitive processing (e.g., FOR(513) and NEXT(514)instructions) with indirect addressing using Index Registers, thereby simplifying programming.



The Index operation uses the following procedure.

- 1. PLC memory addresses for the addresses in the Index Registers are stored using a MOVR instruction.
- 2. Operation is then executed by indirectly addressing Index Registers to the operand for Instruction A.
- 3. The addresses are moved using processing such as adding, subtracting, incrementing, or decrementing the Index Register (see note).
- 4. Steps 2 and 3 are processed repeatedly until the conditions are met.
  - **Note** Adding, subtracting incrementing, or decrementing for the Index Register is performed using one of the following methods.
    - Each Type of Indirect Addressing for Index Registers: Auto-increment (,IR□+ or ,IR□++), auto-decrement (,-IR□ or ,--IR□), constant offset (constant ,IR□), and DR offset (DR□,IR□) for Index Registers
    - Instructions for Direct Addressing of Index Registers: DOUBLE SIGNED BINARY ADD WITHOUT CARRY (+L), DOUBLE SIGNED BINARY SUBTRACT WITHOUT CARRY (-L), DOUBLE IN-CREMENT BINARY (++L), DOUBLE DECREMENT BINARY (--L)

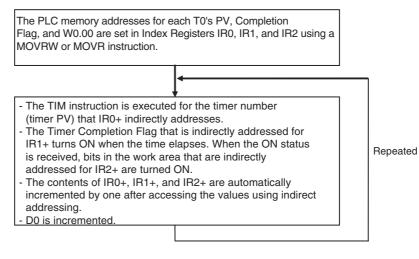
#### Example:



If, for example, instruction A above is a comparison instruction, table data could be read from start to the end of the table to compare all of the data with a specific value. In this way, blocks of user-defined processing can be freely created depending by applying Index Registers.

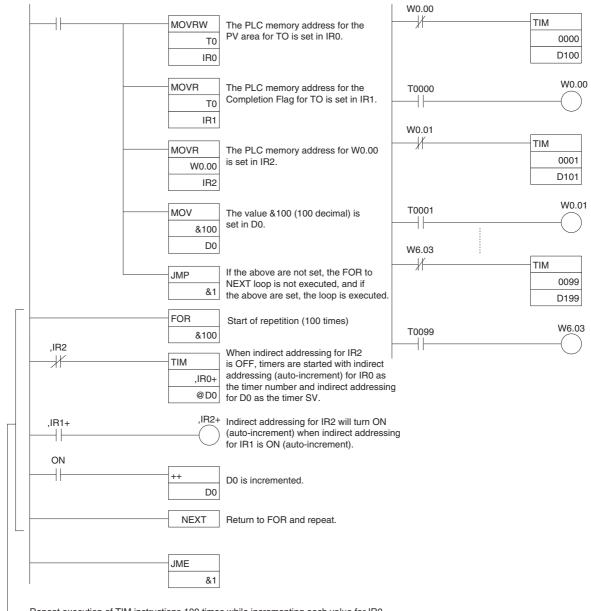
#### Example Using Index Registers

In the following example, TIM instructions for timer numbers 0 to 99 use set values in D100 to D199. This can be achieved by using one TIM instruction, using an index register for the timer number, using another index register for the Completion Flags, and repeatedly executing the TIM instruction to start the timers.



## Index Registers

## Section 4-11



Repeat execution of TIM instructions 100 times while incrementing each value for IR0 (timer number, PV), IR1 (Completion Flag), IR2 (W0.00 on), and @D0, and start T0 to T99.

## 4-11-2 Precautions for Using Index Registers

#### Precautions

Do not use a Index Register until a PLC memory address has been set in the register. The pointer operation will be unreliable if the registers are used without setting their values.

The values in Index Registers are unpredictable at the start of an interrupt task. When an Index Register will be used in an interrupt task, always set a PLC memory address in the Index Register with MOVR(560) or MOVRW(561) before using the register in that task.

Each Index Register task is processed independently, so they do not affect each other. For example, IR0 used in Task 1 and IR0 used in Task 2 are different. Consequently, each Index Register task has 16 Index Registers.

#### **Limitations when Using Index Registers**

- It is only possible to read the Index Register for the last task executed within the cycle from the CX-Programmer. If using Index Registers with the same number to perform multiple tasks, it is only possible with the CX-Programmer to read the Index Register value for the last task performed within the cycle from the multiple tasks, nor is it possible to write the Index Register value from the CX-Programmer.
- It is not possible to either read or write to the Index Registers using Host Link commands or FINS commands.
- A setting can be made from the CX-Programmer to share Index Registers between tasks. This setting will be enabled uniformly for all Index Registers and Data Registers.

#### **Sharing Index Registers**

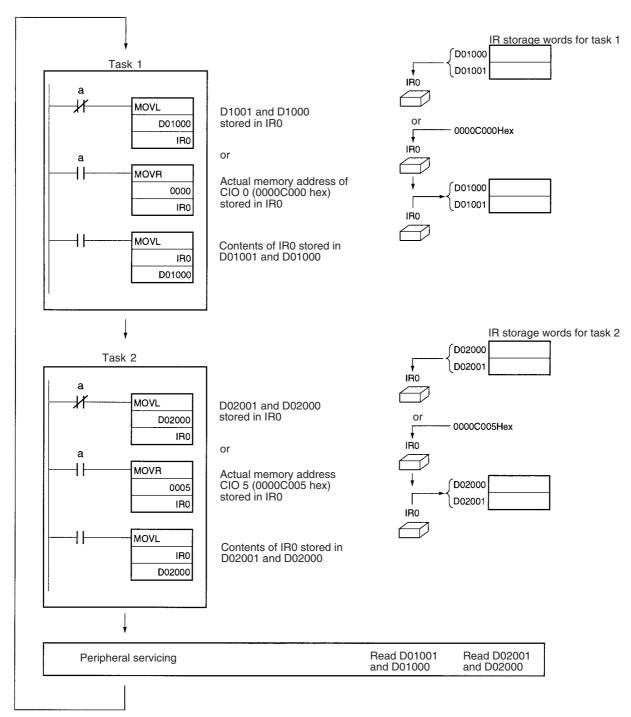
The following setting can be made from the PLC Properties Dialog Box on the CX-Programmer to control sharing Index and Data Registers between tasks.

PLC Pr	operties	×
	General Protection	
_	Name: NewPLC1  Iype: CP1L M Verify	Mode C Erogram C Debug C Monitor
	Use comment instructions Use section markers	C Bun
	Ose section markers      Display dialog to show PLC Memory Backu      Use IR/DRs independently per task      Execute Timer/Counter as Binary	p Status

#### **Monitoring Index Registers**

It is possible to monitor Index Registers as follows:

To use the Programming Devices to monitor the final Index Register values for each task, or to monitor the Index Register values using Host Link commands or FINS commands, write a program to store Index Register values from each task to another area (e.g., DM area) at the end of each task, and to read Index Register values from the storage words (e.g., DM area) at the beginning of each task. The values stored for each task in other areas (e.g., DM area) can then be edited using the CX-Programmer, Host Link commands, or FINS commands.



**Note** Be sure to use PLC memory addresses in Index Registers.

# 4-12 Data Registers

The sixteen Data Registers (DR0 to DR15) are used to offset the PLC memory addresses in Index Registers when addressing words indirectly.

The value in a Data Register can be added to the PLC memory address in an Index Register to specify the absolute memory address of a bit or word in I/O memory. Data Registers contain signed binary data, so the content of an Index Register can be offset to a lower or higher address.

	Normal instructions can be used to store data in Data Registers.
Forcing Bit Status	Bits in Data Registers cannot be force-set and force-reset.
	Set to a base value with MOVR(560) or MOVRW(561). Set with a regular instruction.
Examples	The following examples show how Data Registers are used to offset the PLC memory addresses in Index Registers.
	LD DR0 ,IR0 Adds the contents of DR0 to the contents of IR0 and loads the bit at that PLC memory address.
	MOV(021) #0001 DR0 ,IR1 Adds the contents of DR0 to the contents of IR1 and writes #0001 to that PLC memory address.
Range of Values	The contents of data registers are treated as signed binary data and thus have a range of -32,768 to 32,767.
	Hexadecimal content Decimal equivalent
	8000 to FFFF -32,768 to -1
	0000 to 7FFF 0 to 32,767
Data Register Initialization	<ol> <li>The Data Registers will be cleared in the following cases:</li> <li>When the operating mode is changed from PROGRAM mode to RUN/MONITOR mode or vice-versa and the IOM Hold Bit is OFF</li> </ol>
	<ol> <li>When the power is cycled and the IOM Hold Bit is OFF or not protected in the PLC Setup</li> </ol>
IOM Hold Bit Operation	If the IOM Hold Bit (A500.12) is ON, the Data Registers won't be cleared when a FALS error occurs or the operating mode is changed from PROGRAM mode to RUN/MONITOR mode or vice-versa.
	If the IOM Hold BIt (A500.12) is ON and the PLC Setup's "IOM Hold Bit Status at Startup" setting is set to protect the IOM Hold Bit, the Data Registers won't be cleared when the PLC's power supply is reset (ON $\rightarrow$ OFF $\rightarrow$ ON).
Precautions	Data Registers are normally local to each task. For example, DR0 used in task 1 is different from DR0 used in task 2. (A PLC Setup setting can be made from the CX-Programmer to share Data Registers between tasks.) The content of Data Registers cannot be accessed (read or written) from the CX-Programmer.
	Do not use Data Registers until a value has been set in the register. The reg- ister's operation will be unreliable if they are used without setting their values. The values in Data Registers are unpredictable at the start of an interrupt task. When a Data Register will be used in an interrupt task, always set a value in the Data Register before using the register in that task.

# 4-13 Task Flags

Task Flags range from TK00 to TK31 and correspond to cyclic tasks 0 to 31. A Task Flag will be ON when the corresponding cyclic task is in executable (RUN) status and OFF when the cyclic task hasn't been executed (INI) or is in standby (WAIT) status.
Note These flags indicate the status of cyclic tasks only, they do not reflect the sta-

tus of interrupt tasks.

Task Flag InitializationThe Task Flags will be cleared in the following cases, regardless of the status<br/>of the IOM Hold Bit.

- 1. When the operating mode is changed from PROGRAM mode to RUN/MONITOR mode or vice-versa
- 2. When the power is cycled.

Forcing Bit Status The Task Flags cannot be force-set and force-reset.

# **4-14 Condition Flags**

These flags include the Arithmetic Flags, such as the Error Flag and Equals Flag, which indicate the results of instruction execution.

The Condition Flags are specified with symbols, such as P\_CY and P\_ER, rather than addresses. The status of these flags reflects the results of instruction execution, but the flags are read-only; they cannot be written directly from instructions or the CX-Programmer.

Note The CX-Programmer treats condition flags as global symbols beginning with  $P_-$ .

All Condition Flags are cleared when the program switches tasks, so the status of the ER and AER flags are maintained only in the task in which the error occurred.

Forcing Bit Status The Condition Flags cannot be force-set and force-reset.

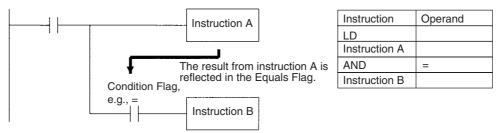
Summary of the ConditionThe following table summarizes the functions of the Condition Flags, although<br/>the functions of these flags will vary slightly from instruction to instruction.<br/>Refer to the description of the instruction for complete details on the operation<br/>of the Condition Flags for a particular instruction.

Name	Symbol	Function
Error Flag	P_ER	Turned ON when the operand data in an instruction is incorrect (an instruction processing error) to indicate that an instruction ended because of an error.
		When the PLC Setup is set to stop operation for an instruction error (Instruction Error Operation), program execution will be stopped and the Instruction Processing Error Flag (A29508) will be turned ON when the Error Flag is turned ON.
Access Error Flag	P_AER	Turned ON when an Illegal Access Error occurs. The Illegal Access Error indicates that an instruction attempted to access an area of memory that should not be accessed.
		When the PLC Setup is set to stop operation for an instruction error (Instruction Error Operation), program execution will be stopped and the Instruction Processing Error Flag (A429510) will be turned ON when the Access Error Flag is turned ON.

Name	Symbol	Function
Carry Flag	P_CY	Turned ON when there is a carry in the result of an arithmetic opera- tion or a "1" is shifted to the Carry Flag by a Data Shift instruction.
		The Carry Flag is part of the result of some Data Shift and Symbol Math instructions.
Greater Than Flag	P_GT	Turned ON when the first operand of a Comparison Instruction is greater than the second or a value exceeds a specified range.
Equals Flag	P_EQ	Turned ON when the two operands of a Comparison Instruction are equal the result of a calculation is 0.
Less Than Flag	P_LT	Turned ON when the first operand of a Comparison Instruction is less than the second or a value is below a specified range.
Negative Flag	P_N	Turned ON when the most significant bit (sign bit) of a result is ON.
Overflow Flag	P_OF	Turned ON when the result of calculation overflows the capacity of the result word(s).
Underflow Flag	P_UF	Turned ON when the result of calculation underflows the capacity of the result word(s).
Greater Than or Equals Flag	P_GE	Turned ON when the first operand of a Comparison Instruction is greater than or equal to the second.
Not Equal Flag	P_NE	Turned ON when the two operands of a Comparison Instruction are not equal.
Less Than or Equals Flag	P_LE	Turned ON when the first operand of a Comparison Instruction is less than or equal to the second.
Always ON Flag	P_On	Always ON. (Always 1.)
Always OFF Flag	P_Off	Always OFF. (Always 0.)

**Using the Condition Flags** 

The Condition Flags are shared by all of the instructions, so their status may change often in a single cycle. Be sure to read the Condition Flags immediately after the execution of instruction, preferably in a branch from the same execution condition.



Since the Condition Flags are shared by all of the instructions, program operation can be changed from its expected course by interruption of a single task. Be sure to consider the effects of interrupts when writing the program. Refer to *SECTION 2 Programming* of *CS/CJ Series Programming Manual* (W394) for more details.

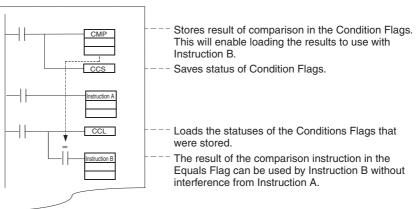
The Condition Flags are cleared when the program switches tasks, so the status of a Condition Flag cannot be passed to another task. For example the status of a flag in task 1 cannot be read in task 2.

## Saving and Loading Condition Flag Status

The CP1-H CPU Units support instructions to save and load the Condition Flag status (CCS(282) and CCL(283)). These can be used to access the status of the Condition Flags at other locations in a task or in a different task.

The following example shows how the Equals Flag is used at a different location in the same task.

Task



# 4-15 Clock Pulses

The Clock Pulses are flags that are turned ON and OFF at regular intervals by the system.

Name	Symbol	Operation	
0.02 s Clock Pulse	P_0_02_s	0.01 s	ON for 0.01 s OFF for 0.01 s
0.1 s Clock Pulse	P_0_1s	→ ← 0.05 s	ON for 0.05 s OFF for 0.05 s
0.2 s Clock Pulse	P_0_2s		ON for 0.1 s OFF for 0.1 s
1 s Clock Pulse	P_1s	→ ← 0.5 s → ← 0.5 s	ON for 0.5 s OFF for 0.5 s
1 min Clock Pulse	P_1min	→ ← 30 s	ON for 30 s OFF for 30 s

The Clock Pulses are specified with symbols rather than addresses.

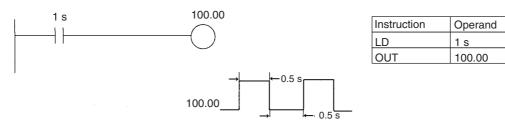
Note The CX-Programmer treats condition flags as global symbols beginning with  $P_{-}$ .

The Clock Pulses are read-only; they cannot be overwritten from instructions or the CX-Programmer.

The Clock Pulses are cleared at the start of operation.

Using the Clock Pulses

The following example turns CIO 100.00 ON and OFF at 0.5 s intervals.



# **SECTION 5 Pulse and Counter Functions**

This section describes the CP1L's interrupt and high-speed counter functions.

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# 5-1 High-speed Counters

## 5-1-1 Overview

- A rotary encoder can be connected to a built-in input to produce a high-speed pulse input.
- The PRV(881) instruction can be used to measure the input pulse frequency (one input only).
- The high-speed counter PVs can be maintained or refreshed.
- The High-speed Counter Gate Bit can be turned ON/OFF from the ladder program to select whether the high-speed counter PVs will be maintained or refreshed.
- Any one of the following input signals can be selected as the counter input mode.

Response Frequencies for 24 VDC Inputs to High-speed Counters 0 and 1:

- Differential phase inputs (4x): 50 kHz
- Pulse + direction inputs: 100 kHz
- Up/Down pulse inputs: 100 kHz
- Increment pulse inputs: 100 kHz

Response Frequencies of CP1L-J show below:

- Differential phase inputs (4x): 10 kHz
- Pulse + direction inputs: 20 kHz
- Up/Down pulse inputs: 20 kHz
- Increment pulse inputs: 20 kHz
- The counting mode can be set to linear mode or circular (ring) mode.
- The counter reset method can be set to Z phase signal + software reset, software reset, Z phase signal + software reset (continue comparing), or software reset (continue comparing).

## **Pulse Input Functions**

Purpose	Function used	Description
Receive incremental rotary encoder inputs to calculate	High-speed counter function	Built-in input terminals can be used for high-speed counter inputs.
length or position.		The PV for the high-speed counters are stored in the Auxiliary Area.
		The counters can be operated in ring mode or linear mode.
Measure a workpiece's length or position.	High-speed Counter Gate Bit	The high-speed counter can be started or stopped (PV held) from the Unit's program by turning ON/OFF the High-speed
(Start counting when a certain condition is established or pause counting when a certain condition is established.)		Counter Gate Bit when the desired condition is met.
Measure a workpiece's speed from its position data (frequency	PRV(881) HIGH- SPEED COUNTER	The PRV(881) instruction can be used to measure the pulse fre- quency.
measurement.)	PV READ	<ul> <li>Range with differential phase inputs: 0 to 50 kHz (Y models: 0 to 500 kHz, J models: 0 to 10kHz)</li> </ul>
		• Range with all other input modes: 0 to 100 kHz (Y models: 0 to 1 MHz, J models : 0 to 20kHz))
	PRV2(883) PULSE FREQUENCY CON- VERT	PRV2(883) reads the pulse frequency and converts it to a rota- tional speed (r/min) or it converts the counter PV to a total num- ber of rotations. Results are calculated by the number of pulses/ rotation.

# 5-1-2 High-speed Counter Specifications

# **Specifications**

	Item	Item Specification				
Number of	high-speed counters	2 (High-speed counters 0 and 1) 4 (High-speed counters 0 to 3		4 (High-speed counters 0 to 3)		
Pulse input Setup)	t modes (Selected in the PLC	Differential phase inputs	Up/down inputs	Pulse + direction inputs	Increment inputs	
Input termi	nal allocation	Phase-A input	Increment pulse input	Pulse input	Increment pulse input	
		Phase-B input	Decrement pulse input	Direction input		
		Phase-Z input	Reset input	Reset input	Reset input	
Input meth	od	Differential phase, 4x (Fixed)	Two single-phase inputs	Single-phase pulse + direction inputs	Single-phase input	
Response	frequency	50 kHz	100 kHz (J models : 20kHz)	100 kHz (J models : 20kHz)	100 kHz (J models : 20kHz)	
Counting m	node	Linear mode or circ	cular (ring) mode (S	elect in the PLC Se	tup.)	
Count valu	es	Linear mode: 8000	0000 to 7FFF FFF	F hex		
	Ring mode: 0000 0000 to Ring SV (The Ring SV (Circular Max. Count) is set in the PLC Setup and the range is 00000001 to FFFFFFF hex.)		ip and the setting			
High-speed	d counter PV storage locations	High-speed counter 0: A271 (leftmost 4 digits) and A270 (rightmost 4 digits)				
		High-speed counter 1: A273 (leftmost 4 digits) and A272 (rightmost 4 digits)				
		High-speed counter 2: A317 (leftmost 4 digits) and A316 (rightmost 4 digits)				
		High-speed counter 3: A319 (leftmost 4 digits) and A318 (rightmost 4 digits)				
		Target value comparison interrupts or range comparison interrupts can be executed based on these PVs.				
		<b>Note</b> The PVs are refreshed in the overseeing processes at the start of each cycle. Use PRV(881) to read the most recent PVs.				
		Data format: 8 digit hexadecimal				
		Range in linear mode: 8000 0000 to 7FFF FFFF hex Range in ring mode: 0000 0000 to Ring SV (Circular Max. Count)				
Control method	Target value comparison	Up to 48 target val istered.	ues and correspond	ling interrupt task nu	umbers can be reg-	
	Range comparison	Up to 8 ranges can interrupt task numb		a separate upper lir	mit, lower limit, and	
Counter re	set method	Select one of the following methods in the PLC Setup.				
		<ul> <li>Phase-Z + Software reset The counter is reset when the phase-Z input goes ON while the Reset Bit is ON.</li> <li>Software reset The counter is reset when the Reset Bit goes ON. (Set the counter reset method in the PLC Setup.)</li> </ul>				
		<b>Note</b> Operation can be set to stop or continue the comparison operation when the high-speed counter is reset.				

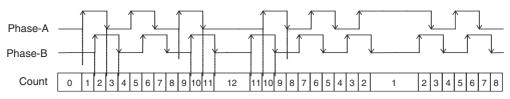
## Auxiliary Area Data Allocation

Function			gh-speed c	ounter nun	nber
		0	1	2	3
PV storage words	Leftmost 4 digits	A271	A273	A317	A319
	Rightmost 4 digits	A270	A272	A316	A318
Range Comparison Con-	Range 1 Comparison Condition Met Flag	A274.00	A275.00	A320.00	A321.00
dition Met Flags	Range 2 Comparison Condition Met Flag	A274.01	A275.01	A320.01	A321.01
	Range 3 Comparison Condition Met Flag	A274.02	A275.02	A320.02	A321.02
	Range 4 Comparison Condition Met Flag	A274.03	A275.03	A320.03	A321.03
	Range 5 Comparison Condition Met Flag	A274.04	A275.04	A320.04	A321.04
	Range 6 Comparison Condition Met Flag	A274.05	A275.05	A320.05	A321.05
	Range 7 Comparison Condition Met Flag	A274.06	A275.06	A320.06	A321.06
	Range 8 Comparison Condition Met Flag	A274.07	A275.07	A320.07	A321.07
Comparison In-progress Flags	ON when a comparison operation is being exe- cuted for the high-speed counter.	A274.08	A275.08	A320.08	A321.08
Overflow/Underflow Flags	ON when an overflow or underflow has occurred in the high-speed counter's PV. (Used only when the counting mode is set to Linear Mode.)	A274.09	A275.09	A320.09	A321.09
Count Direction Flags	0: Decrementing 1: Incrementing	A274.10	A275.10	A320.10	A321.10

## Counter Input Modes

Differential Phase Mode (4x)

The differential phase mode uses two phase signals (phase A and phase B) and increments/decrements the count according to the status of these two signals.

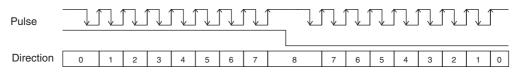


### **Conditions for Incrementing/Decrementing the Count**

Phase A	Phase B	Count value
1	L	Increment
Н	<b>↑</b>	Increment
$\downarrow$	Н	Increment
L	$\downarrow$	Increment
L	$\uparrow$	Decrement
1	Н	Decrement
Н	$\downarrow$	Decrement
$\downarrow$	L	Decrement

#### Pulse + Direction Mode

The pulse + direction mode uses a direction signal input and pulse signal input. The count is incremented or decremented depending on the status (ON or OFF) of the direction signal.



Direction signal	Pulse signal	Count value
$\uparrow$	L	No change
Н	$\uparrow$	Increment
$\downarrow$	Н	No change
L	$\downarrow$	No change
L	$\uparrow$	Decrement
$\uparrow$	Н	No change
Н	$\downarrow$	No change
$\downarrow$	L	No change

#### **Conditions for Incrementing/Decrementing the Count**

- The count is incremented when the direction signal is ON and decremented when it is OFF.
- Only up-differentiated pulses (rising edges) can be counted.

Up/Down Mode

The up/down mode uses two signals, an increment pulse input and a decrement pulse input.

		٦Ĺ	Γ, ´	Ţ,	Ń	Γ, ´	Γ, ´	Ţ,									
Increment pulse										Γ, ´	$\square$	Ń	Ţ,	Ń	Ţ,	Ń	
Decrement pulse	0	1	2	3	4	5	6	7	8	7	6	5	4	3	2	1	0

#### **Conditions for Incrementing/Decrementing the Count**

Decrement pulse	Increment pulse	Count value
$\uparrow$	L	Decrement
Н	<b>↑</b>	Increment
$\downarrow$	Н	No change
L	$\downarrow$	No change
L	<b>↑</b>	Increment
$\uparrow$	Н	Decrement
Н	$\downarrow$	No change
$\downarrow$	L	No change

- The count is incremented for each increment pulse input and decremented for each decrement pulse input.
- Only up-differentiated pulses (rising edges) can be counted.

#### **Increment Mode**

The increment mode counts single-phase pulse signal inputs. This mode only increments the count.

Pulse		

-		-	-		-		_	-								1
0	1 1	2	1 3	4	5	6	7	8	9	10	11	12	13	14	15	161
Ŷ		1	•		•	•		•	U V							

#### **Conditions for Incrementing/Decrementing the Count**

Pulse	Count value
$\uparrow$	Increment
Н	No change
$\downarrow$	No change
L	No change

- Only up-differentiated pulses (rising edges) can be counted.
- **Note** The count of the high-speed counter can be monitored to see if it is currently being incremented or decremented. The count in the current cycle is compared with the count in the previous cycle to determine if it is being incremented or decremented. The results are reflected in the High-speed Counter Count Direction Flags (A274.10 for high-speed counter 0, A275.10 for high-speed Counter 1, A320.10 for high-speed counter 2, and A321.10 for high-speed counter 3.)

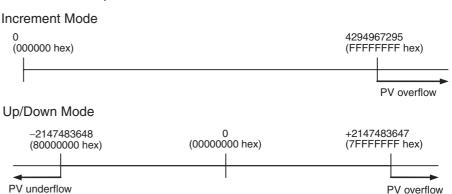
### **Counting Modes**

Linear Mode

Input pulses can be counted in the range between the lower limit and upper limit values. If the pulse count goes beyond the lower/upper limit, an underflow/overflow will occur and counting will stop.

#### Lower and Upper Limits of the Range

The following diagrams show the lower limit and upper limit values for increment mode and up/down mode.

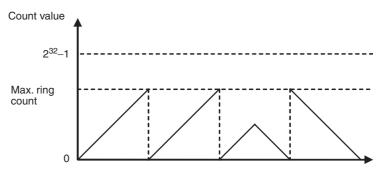


Circular (Ring) Mode

Input pulses are counted in a loop within the set range. The loop operates as follows:

- If the count is incremented from the max. ring count, the count will be reset to 0 automatically and incrementing will continue.
- If the count is decremented from 0, the count will be set to the max. ring count automatically and decrementing will continue.

Consequently, underflows and overflows cannot occur when ring mode is used.



#### Max. Ring Count

Use the PLC Setup to set the max. ring count (Circular Max. Count), which is the max. value of the input pulse counting range. The max. ring count can be set to any value between 00000001 and FFFFFFF hex.

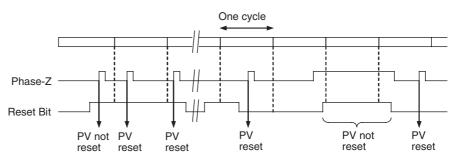
#### **Restrictions**

- There are no negative values in ring mode.
- If the max. ring count is set to 0 in the PLC Setup, the counter will operate with a max. ring count of FFFFFFF hex.

## **Reset Methods**

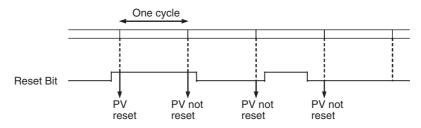
Phase-Z Signal + Software Reset The high-speed counter's PV is reset when the phase-Z signal (reset input) goes from OFF to ON while the corresponding High-speed Counter Reset Bit is ON.

The CPU Unit recognizes the ON status of the High-speed Counter Reset Bit only at the beginning of the PLC cycle during the overseeing processes. Consequently, when the Reset Bit is turned ON in the ladder program, the phase-Z signal does not become effective until the next PLC cycle.



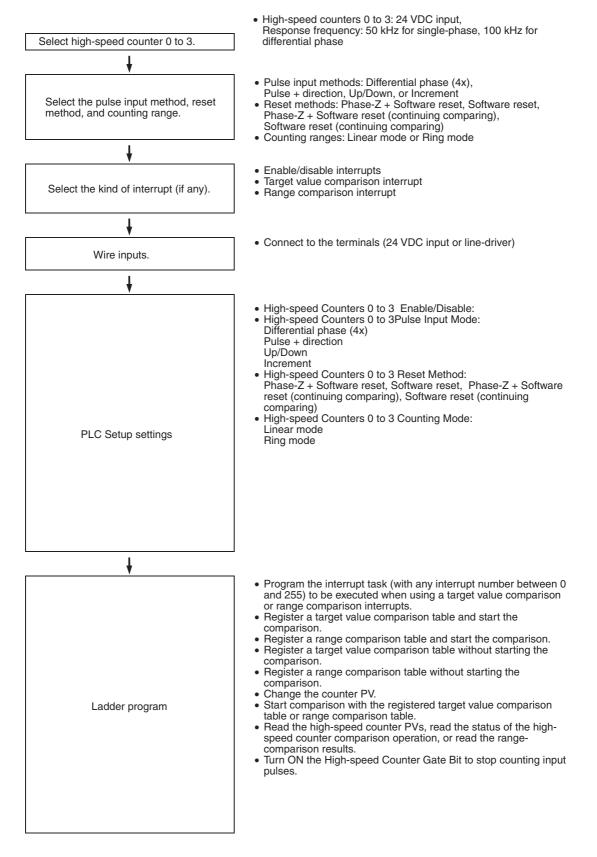
Software Reset The high-speed counter's PV is reset when the corresponding High-speed Counter Reset Bit goes from OFF to ON.

The CPU Unit recognizes the OFF-to-ON transition of the High-speed Counter Reset Bit only at the beginning of the PLC cycle during the overseeing processes. Reset processing is performed at the same time. The OFF-to-ON transition will not be recognized if the Reset Bit goes OFF again within the same cycle.



**Note** The comparison operation can be set to stop or continue when a high-speed counter is reset. This enables applications where the comparison operation can be restarted from a counter PV of 0 when the counter is reset.

## 5-1-3 Procedure



## 5-1-4 PLC Setup

The settings for high-speed counters 0 to 3 are located in the Built-in Input Tab of the CX-Programmer's PLC Settings Window.

artup   Settings   Timings   Input constant   Serial Port 1	1 Serial Port 2 Peripheral Service Built-in Input		
High Speed Counter 0	High Speed Counter 1		
✓ Use high speed counter 0	Use high speed counter 1		
Counting mode 💿 Linear mode 🔿 Circular mode	Counting mode 💿 Linear mode 🔘 Circular mode		
Circular Max. Count 0	Circular Max. Count 0		
Reset Software reset	Reset Software reset		
Input Setting Increment pulse input	Input Setting Increment pulse input		
High Speed Counter 2	High Speed Counter 3		
☑ Use high speed counter 2	☑ Use high speed counter 3		
Counting mode 💿 Linear mode 🔿 Circular mode	Counting mode 💿 Linear mode 🔿 Circular mode		
Circular Max. Count 🛛 🛛	Circular Max. Count 0		
Reset Software reset	Reset Software reset		
Input Setting Increment pulse input	Input Setting Z phase, software reset Software reset		
Interrupt Input	Z phase, software reset(comparin		
	Software reset(comparing)		
IN0 Normal  IN1 Normal	IN2 Normal 💌 IN3 Normal 💌		
IN4 Normal IN5 Normal IN5			

## Settings in the Builtin Input Tab

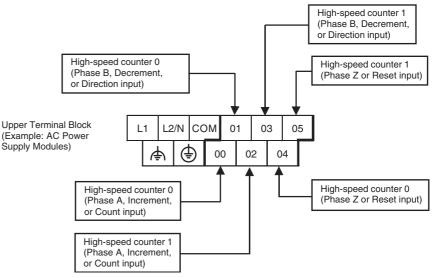
Item	Setting	
Use high speed counter 0 to 3	Use counter	
Counting mode	Linear mode	
	Circular mode (ring mode)	
Circular Max. Count (max. ring count)	0 to 4,294,967,295 (0 to FFFF FFFF hex)	
Reset method	Phase Z and software reset	
	Software reset	
	Phase Z and software reset (continue comparing)	
	Software reset (continue comparing)	
Input Setting	Differential phase inputs (4x)	
	Pulse + direction inputs	
	Up/Down inputs	
	Increment pulse input	

## 5-1-5 High-speed Counter Terminal Allocation

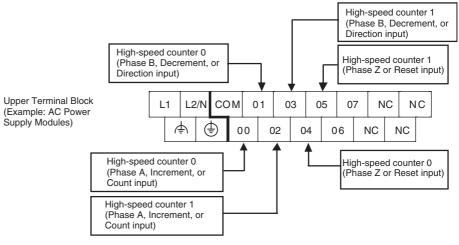
The following diagrams show the input terminals that can be used for highspeed counters in each CPU Unit.

Differential Phases, Up/ Down, or Pulse + Direction

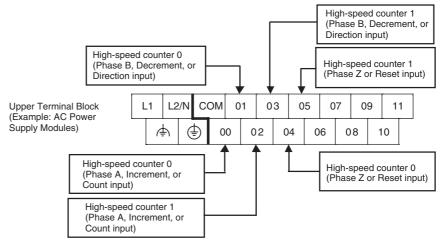
#### Input Terminal Arrangement for CPU Units with 10 I/O Points



### Input Terminal Arrangement for CPU Units with 14 I/O Points



### Input Terminal Arrangement for CPU Units with 20 I/O Points



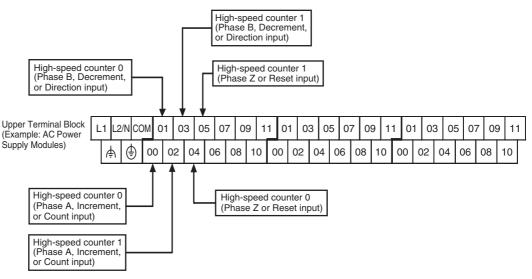
### High-speed Counters

#### High-speed counter 1 (Phase B, Decrement, or Direction input) High-speed counter 0 High-speed counter 1 (Phase B, Decrement, or (Phase Z or Reset input) Direction input) Upper Terminal Block 12/N СОМ 01 03 05 07 09 11 01 03 05 11 (Example: AC Power Supply Modules) Þ ٩ 00 02 04 06 08 10 00 02 04 NC High-speed counter 0 High-speed counter 0 (Phase A, Increment, or (Phase Z or Reset input) Count input) High-speed counter 1 (Phase A, Increment, or Count input) Input Terminal Arrangement for CPU Units with 40 I/O Points High-speed counter 1 (Phase B, Decrement, or Direction input) High-speed counter 0 High-speed counter 1 (Phase B, Decrement, or (Phase Z or Reset input) Direction input) Upper Terminal Block L2/N COM 01 03 05 01 L1 07 09 11 03 05 07 09 11 (Example: AC Power Supply Modules) Þ **(** 00 02 04 06 08 10 00 02 04 06 08 10 High-speed counter 0 High-speed counter 0 (Phase Z or Reset input) (Phase A, Increment, or Count input) High-speed counter 1

#### Input Terminal Arrangement for CPU Units with 30 I/O Points

### Input Terminal Arrangement for CPU Units with 60 I/O Points

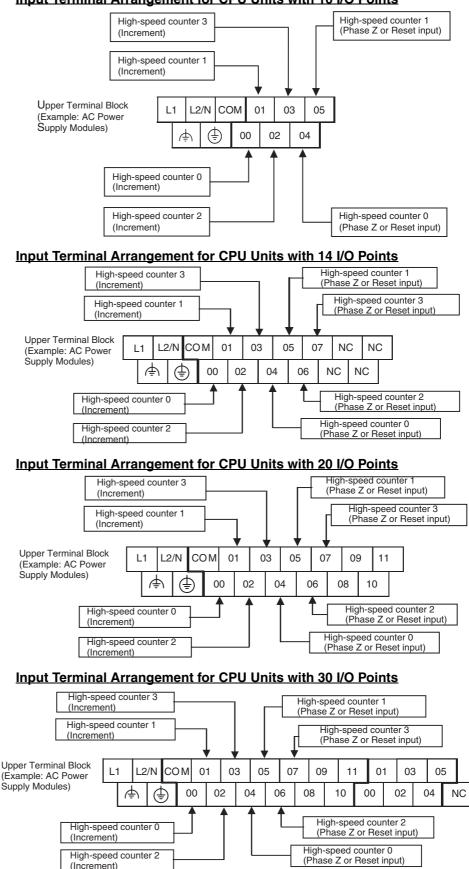
(Phase A, Increment, or Count input)



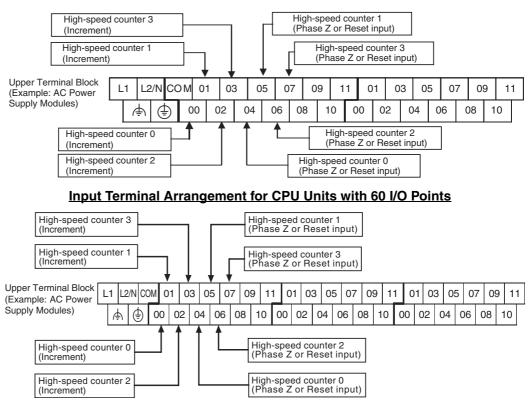
### **Increment Pulse Inputs**

#### Input Terminal Arrangement for CPU Units with 10 I/O Points

Section 5-1



### High-speed Counters



#### Input Terminal Arrangement for CPU Units with 40 I/O Points

#### Input Function Settings in the PLC Setup

The CPU Unit's built-in inputs can be set for use as high-speed counter inputs in the PLC Setup's Built-in Input Tab using the CX-Programmer. (When an input is set for use as a high-speed counter input, the corresponding words and bits cannot be used for general-purpose (normal) inputs, input interrupts, or quick-response inputs.)

Add	lress	Default setting	High-speed counte	Origin searches	
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0
CIO 0	00	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1	Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2	Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3	Counter 3, increment input	Counter 1, B phase, down, or direction input	Pulse output 0: Origin proximity input signal
	04	Normal input 4	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	Pulse output 0: Origin input signal

#### CPU Units with 10 I/O Points

	erminal ock	Default setting	High-speed counte	High-speed counter operation settings		
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0 and 1	
CIO 0	00	Normal input 0	High-speed counter 0 (Increment)	High-speed counter 0 (Phase A, Increment, or Count input)		
	01	Normal input 1	High-speed counter 1 (Increment)	High-speed counter 0 (Phase B, Decrement, or Direction input)		
	02	Normal input 2	High-speed counter 2 (Increment)	High-speed counter 1 (Phase A, Increment, or Count input)	Pulse output 0: Origin proximity input signal	
	03	Normal input 3	High-speed counter 3 (Increment)	High-speed counter 1 (Phase B, Decrement, or Direction input)	Pulse output 1: Origin proximity input signal	
	04	Normal input 4	High-speed counter 0 (Phase Z or reset input)	High-speed counter 0 (Phase Z or reset input)		
	05	Normal input 5	High-speed counter 1 (Phase Z or reset input)	High-speed counter 1 (Phase Z or reset input)		
	06	Normal input 6	High-speed counter 2 (Phase Z or reset input)		Pulse output 0: Origin input signal	
	07	Normal input 7	High-speed counter 3 (Phase Z or reset input)		Pulse output 1: Origin input signal	

### CPU Units with 14 I/O Points

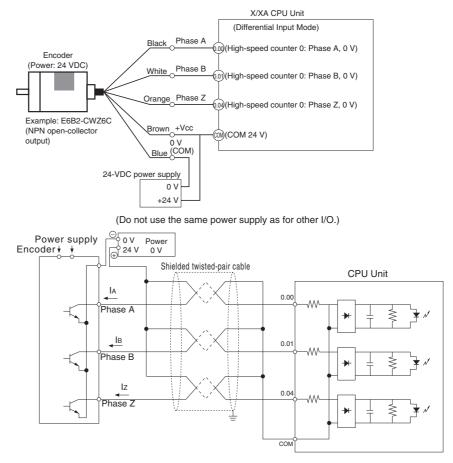
Add	ress		Default	setting	ting High-speed counter operation settings:		Origin searches	
Word	Bit	CPU Units with 60 I/O Points	CPU Units with 40 I/O Points	CPU Units with 30 I/O Points	CPU Units with 20 I/O Points	Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0 and 1
CIO 0	00	Normal input 0	Normal input 0	Normal input 0	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1	Normal input 1	Normal input 1	Normal input 1	Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2	Normal input 2	Normal input 2	Normal input 2	Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3	Normal input 3	Normal input 3	Normal input 3	Counter 3, increment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Normal input 4	Normal input 4	Normal input 4	Counter 0, phase-Z reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Normal input 5	Normal input 5	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Normal input 6	Normal input 6	Normal input 6	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Normal input 7	Normal input 7	Normal input 7	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Normal input 8	Normal input 8	Normal input 8			
	09	Normal input 9	Normal input 9	Normal input 9	Normal input 9			
	10	Normal input 10	Normal input 10	Normal input 10	Normal input 10			Pulse output 0: Origin proxim- ity input signal
	11	Normal input 11	Normal input 11	Normal input 11	Normal input 11			Pulse output 1: Origin proxim- ity input signal
CIO 1	00 to 05	Normal input 12 to 17	Normal input 12 to 17	Normal input 12 to 17				
	06 to 11	Normal input 18 to 23	Normal input 18 to 23					
CIO 2	00 to 11	Normal input 24 to 35						

CPU Units with 20, 30, 40 or 60 I/O Points

## 5-1-6 Pulse Input Connection Examples

## Encoders with 24 VDC Open-collector Outputs

This example shows how to connect an encoder that has phase-A, phase-B, and phase-Z outputs.



## 5-1-7 Ladder Program Example

Inspecting a Dimension by Counting Pulse Inputs

- This example is for a CPU Unit with 40 I/O Points.
- High-speed counter 0 is used.
- When the edge of the workpiece is detected, the counter PV is reset by a phase-Z pulse.
- The workpiece is passes inspection if the final count is between 30,000 and 30,300, otherwise the workpiece fails.
- If the workpiece passes, output CIO 100.00 is turned ON by an interrupt and the indicator PL1 is lit. If the workpiece fails, output CIO 100.01 is turned ON by an interrupt and indicator PL2 is lit.
- The interrupt program is interrupt task 10.

### ■ I/O Allocations

### Input Terminals

Input terminal		Usage
Word	Bit	
CIO 0	00	High-speed counter 0 phase-A input (See note.)
	01	High-speed counter 0 phase-B input (See note.)
	02	Start measurement by pushbutton switch (normal input).
	03	Detect trailing edge of measured object (normal input).
	04	Detect leading edge of measured object for high-speed counter 0 phase-Z/reset input (see note). Bit status is reflected in A531.00.
	05 to 11	Not used. (normal input)
CIO 1	00 to 11	Not used. (normal input)

**Note** The high-speed counter inputs are enabled when the *Use high speed counter* 0 Option is selected in the PLC Setup's Built-in Input Tab.

### **Output Terminals**

Output	terminal	Usage	
Word	Bit		
CIO 100	00	Normal input	PL1: Dimension pass output
	01	Normal input	PL2: Dimension fail output
	02 to 07	Normal input	Not used.
CIO 101	00 to 07	Normal input	Not used.

### Auxiliary Area Addresses for High-speed Counter 0

	Function	Address
PV storage words	Leftmost 4 digits	A271
	Rightmost 4 digits	A270
Range Comparison Condition Met Flag	Range 1 Comparison Condition Met Flag	A274.00
Comparison In- progress Flag	ON when a comparison operation is being exe- cuted for the high-speed counter.	A274.08
Overflow/Underflow Flag	ON when an overflow or underflow has occurred in the high-speed counter's PV. (Used only when the counting mode is set to Linear Mode.)	A274.09
Count Direction Flag	0: Decrementing 1: Incrementing	A274.10
Reset Bit	Used for the PV software reset.	A531.00
High-speed Counter Gate Bit	When ON, the counter's PV will not be changed even if pulse inputs are received for the counter.	A531.08

### Range Comparison Table

The range comparison table is stored in D10000 to D10039.

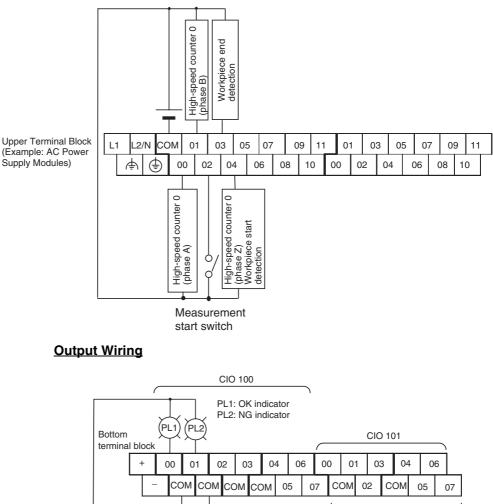
### PLC Setup

Select the *Use high speed counter 0* Option in the PLC Setup's Built-in Input Tab.

Item	Setting
High-speed counter 0	Use high speed counter 0
Counting mode	Linear mode
Circular Max. Count	
Reset method	Software reset
Input Setting	Up/Down inputs

### ■ I/O Wiring





CIO 100

#### Range Comparison Table Settings

The inspection standards data is set in the DM Area with the CX-Programmer. Even though range 1 is the only range being used, all 40 words must still be dedicated to the range comparison table.

CIO 101

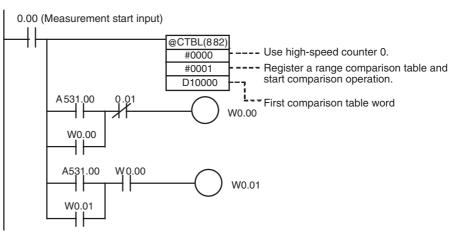
Word	Setting	Function		
D10000	7430	Rightmost 4 digits of range 1 lower limit	Lower limit value:	
D10001	0000	Leftmost 4 digits of range 1 lower limit	30,000	
D10002	765C	Rightmost 4 digits of range 1 upper limit	Upper limit value: 30,300	
D10003	0000	Leftmost 4 digits of range 1 upper limit		
D10004	000A	Range 1 interrupt task number = 10 (A hex)		
D10005 to D10008	All 0000	Range 2 lower and upper limit values (Not used and don't need to be set.)	Range 2 settings	
D10009	FFFF	Disables range 2.		
~				

Word	Setting	Function			
D10014 D10019 D10024 D10029 D10034	FFFF	Set the fifth word for ranges 3 to 7 (listed at left) to FFFF to dis- able those ranges.			
D10035 to D10038	All 0000	Range 8 lower and upper limit values (Not used and don't need to be set.)	Range 8 settings		
D10039	FFFF	Disables range 8.			

### Creating the Ladder Program

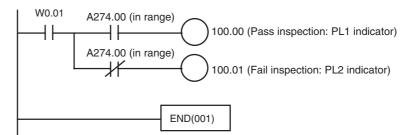
#### Programming in Cyclic Task

Use CTBL(882) to start the comparison operation with high-speed counter 0 and interrupt task 10.



### Programming in Interrupt Task 10

Create the processing performed by interrupt task 10.



## 5-1-8 Additional Capabilities and Restrictions

Restrictions on Highspeed Counter Inputs

- The Phase-Z signal + Software reset method cannot be used when the high speed counters are operating in Differential Phase or Pulse + Direction Input Modes and the origin search function is enabled for the pulse output (in the PLC Setup). The Phase-Z signal + Software reset method can be used when the high speed counters are operating in Incrementing or Up/Down Input Modes.
- When a high-speed counter is being used (enabled in the PLC Setup), the input cannot be used as a general-purpose (normal) input, interrupt input, or quick-response input.

## Starting Interrupt Tasks based on Comparison Conditions

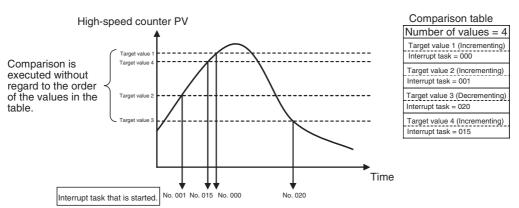
Data registered in advance in a comparison table can be compared with the actual counter PVs during operation. The specified interrupt tasks (registered in the table) will be started when the corresponding comparison condition is met.

There are two comparison methods available: Target value comparison and range comparison.

- Use the CTBL(882) instruction to register the comparison table.
- Use either the CTBL(882) instruction or INI(880) instruction to start the comparison operation.
- Use the INI(880) instruction to stop the comparison operation.

**Target Value Comparison** The specified interrupt task is executed when the high-speed counter PV matches a target value registered in the table.

- The comparison conditions (target values and counting directions) are registered in the comparison table along with the corresponding interrupt task number. The specified interrupt task will be executed when the high-speed counter PV matches the registered target value.
- Up to 48 target values (between 1 and 48) can be registered in the comparison table.
- A different interrupt task can be registered for each target value.
- The target value comparison is performed on all of the target values in the table, regardless of the order in which the target values are registered.
- If the PV is changed, the changed PV will be compared with the target values in the table, even if the PV is changed while the target value comparison operation is in progress.



#### **Restrictions**

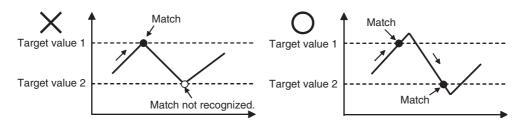
A comparison condition (target value and count direction) cannot appear in the table more than once. An error will occur if a comparison condition is specified two or more times.

**Note** When the count direction (incrementing/decrementing) changes at a PV that matches a target value, the next target value cannot be matched in that direction.

## High-speed Counters

## Section 5-1

Set the target values so that they do not occur at the peak or trough of count value changes.



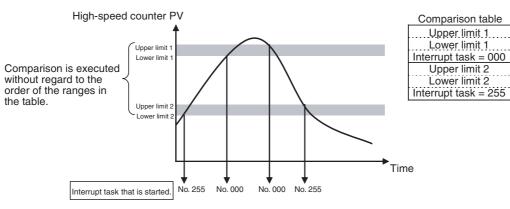
**Range Comparison** 

The specified interrupt task is executed when the high-speed counter PV is within the range defined by the upper and lower limit values.

- The comparison conditions (upper and lower limits of the range) are registered in the comparison table along with the corresponding interrupt task number. The specified interrupt task will be executed once when the high-speed counter PV is in the range (Lower limit ≤ PV ≤ Upper limit).
- A total of 8 ranges (upper and lower limits) are registered in the comparison table.
- The ranges can overlap.
- A different interrupt task can be registered for each range.
- The counter PV is compared with the 8 ranges once each cycle.
- The interrupt task is executed just once when the comparison condition goes from unmet to met.

#### **Restrictions**

When more than one comparison condition is met in a cycle, the first interrupt task in the table will be executed in that cycle. The next interrupt task in the table will be executed in the next cycle.



**Note** The range comparison table can be used without starting an interrupt task when the comparison condition is met. The range comparison function can be useful when you just want to know whether or not the high-speed counter PV is within a particular range.

Use the Range Comparison Condition Met Flags to determine whether the high-speed counter PV is within a registered range.

### Pausing Input Signal Counting (Gate Function)

If the High-speed Counter Gate Bit is turned ON, the corresponding highspeed counter will not count even if pulse inputs are received and the counter PV will be maintained at its current value. Bits A53108 to A53111 are the High-speed Counter Gate Bits for high-speed counters 0 to 3.

	When the High aread (	Counter Cate Pit is turned OFF again, the high anod		
	• •	Counter Gate Bit is turned OFF again, the high-speed nting and the counter PV will be refreshed.		
Restrictions	set to Phase-Z sign	e disabled if the high-speed counter's reset method is al + Software reset and the Reset Bit is ON (waiting it to reset the counter PV.)		
High-speed Counter F	equency Measureme	nt		
-	This function measure pulses.)	s the frequency of the high-speed counter (input		
	The measured frequence	The input pulse frequency can be read by executing the PRV(881) instruction. The measured frequency is output in 8-digit hexadecimal and expressed in Hz. The frequency measurement function can be used with high-speed counter 0 only.		
	operation is in progress same time as functions	measured while a high-speed counter 0 comparison s. Frequency measurement can be performed at the such as the high-speed counter and pulse output with- nance of those functions.		
Procedure				
1,2,3		r Enable/Disable Setting (Required) speed counter 0 Option in the PLC Setup.		
	<ol> <li>Pulse Input Mode S Set the High-speed Setup.</li> </ol>	etting (Required) Counter 0 Pulse Input Mode ( <i>Input Setting</i> ) in the PLC		
	If ring mode countir	ing (Required) Counter 0 <i>Counting Mode</i> in the PLC Setup. Ing is selected, set the High-speed Counter 0 <i>Circular</i> Ing count) in the PLC Setup.		
	4. Reset Method Settir Set the High-speed	ng (Required) Counter 0 Reset Method in the PLC Setup.		
	<ol> <li>PRV(881) Instruction</li> <li>N: Specify the high- C: 0003 (Read frequeries)</li> <li>D: Destination word</li> </ol>	speed counter number. (High-speed counter 0: 0010) uency)		
Restrictions	<ul> <li>The frequency me counter 0 only.</li> </ul>	asurement function can be used with high-speed		
Specifications				
	Item	Specifications		
	Number of frequency measurement inputs	1 input (high-speed counter 0 only)		
	Frequency measurement range	High-speed counter 0: Differential phase inputs: 0 to 50 kHz (J models : 0 to 10kHz) All other input modes: 0 to 100 kHz (J models : 0 to 20kHz) <b>Note:</b> If the frequency exceeds the maximum value, the maximum value will be stored.		
	Measurement method	Execution of the PRV(881) instruction		
	Output data range	Units: Hz Range: Differential phase input: 0000 0000 to 0003 0D40 hex		

(Y models: 0000 0000 to 0007 A120 hex)

All other input modes: 0000 0000 to 0001 86A0 hex (Y models: 0000 0000 to 000F 4240 hex)

### **Pulse Frequency Conversion**

The pulse frequency input to a high-speed counter can be converted to a rotational speed (r/min) or the PV of the counter can be converted to the total number of rotations. The converted value is output as 8-digit hexadecimal. This function is supported only for high-speed counter 0.

#### Frequency–Rotational Speed Conversion

The rotational speed in r/min is calculated from the pulse frequency input to a high-speed counter and the number of pulses per rotation.

#### Counter PV-Total Number of Rotations Conversion

The total number of rotations is calculated from the present value of the counter and the number of pulses per rotation.

Procedure

- 1,2,3...1. High-speed Counter Enable/Disable Setting (Required) Select the Use high speed counter 0 Option in the PLC Setup.
  - Pulse Input Mode Setting (Required) Set the High-speed Counter 0 Pulse Input Mode (*Input Setting*) in the PLC Setup.
  - Counting Mode Setting (Required) Set the High-speed Counter 0 *Counting Mode* in the PLC Setup.
     If ring mode counting is selected, set the *Circular Max. Count* (max. ring count) in the PLC Setup.
  - 4. Reset Method Setting (Required) Set the High-speed Counter 0 Reset Method in the PLC Setup.
  - 5. Execute PRV2(883) as described below (required).

### **Converting the Frequency to a Rotational Speed**

Execute PRV2(883) with the following operands.

- C: Control data (Set to 0000 for frequency-rotational speed conversion.)
- P: Coefficient (pulses/rotation (hex))
- D: First word for result

#### Converting the Counter PV to the Total Number of Rotations

Execute PRV2(883) with the following operands.

C: Control data (Set to 0001 for counter PV-total number of rotations conversion.)

- P: Coefficient (pulses/rotation (hex))
- D: First word for result

Restrictions

Pulse frequency conversion is possible only for high-speed counter 0.

## 5-2 Pulse Outputs

## 5-2-1 Overview

Fixed duty factor pulses can be output from the CPU Unit's built-in outputs to perform positioning or speed control with a servo driver that accepts pulse inputs.

### <u>CW/CCW Pulse Outputs or Pulse + Direction Outputs</u>

The pulse output mode can be set to match the motor driver's pulse input specifications.

### Automatic Direction Selection for Easy Positioning with Absolute <u>Coordinates</u>

When operating in absolute coordinates (origin defined or PV changed with the INI(880) instruction), the CW/CCW direction will be selected automatically when the pulse output instruction is executed. (The CW/CCW direction is selected by determining whether the number of pulses specified in the instruction is greater than or less than the pulse output PV.)

### ■ <u>Triangular Control</u>

Triangular control (trapezoidal control without a constant-speed plateau) will be performed during positioning executed by an ACC(888) instruction (independent) or PLS2(887) instruction if the number of output pulses required for acceleration/deceleration exceeds the specified target pulse Output Amount.

### ■ Change Target Position during Positioning (Multiple Start)

When positioning was started with a PULSE OUTPUT (PLS2(887)) instruction and the positioning operation is still in progress, another PLS2(887) instruction can be executed to change the target position, target speed, acceleration rate, and deceleration rate.

### ■ Switch from Speed Control to Positioning (Fixed Distance Feed Interrupt)

A PLS2(887) instruction can be executed during a speed control (continuous mode) operation to change to positioning mode (independent mode). This feature allows a fixed distance feed interrupt (moving a specified amount) to be executed when specific conditions occur.

### Change Target Speed and Acceleration/Deceleration Rate during Acceleration or Deceleration

When trapezoidal acceleration/deceleration is being executed according to a pulse output instruction (speed control or positioning), the target speed and acceleration/deceleration rate can be changed during acceleration or deceleration.

### ■ <u>Use Variable Duty Factor Pulse Outputs for Lighting, Power Control, Etc.</u>

The PULSE WITH VARIABLE DUTY FACTOR instruction (PWM(891)) can be used to output variable duty factor pulses from the CPU Unit's built-in outputs for applications such as lighting and power control.

## **Controlling Pulse Outputs**

Purpose	Function	Description
Purpose Perform simple posi- tioning by outputting pulses to a motor driver that accepts pulse-train inputs.	Function           Pulse output functions           Single-phase pulse output without acceleration/deceleration Controlled by SPED.           Single-phase pulse output with acceleration/deceleration (equal acceleration and deceleration rates for trapezoidal form) Controlled by ACC.           Single-phase pulse output with trapezoidal acceleration/deceleration/deceleration (Supports a startup frequency and different acceleration/	Description           Built-in outputs can be used as pulse outputs 0 and 1.           Target frequency ranges: 1 Hz to 100 kHz           (J models : 1 Hz to 20kHz)           Duty factor: 50%           The pulse output mode can be set to CW/CCW pulse control or Pulse plus direction control, but the same output mode must be used for pulse outputs 0 and 1.           Note         The pulse output PVs are stored in the Auxiliary Area.
	deceleration rates.) Controlled by PLS2(887).	

Purpose	Function	Description
Perform origin search and origin return opera- tions.	Origin functions (Origin search and origin return)	<ul> <li>Origin search and origin return operations can be executed through pulse outputs.</li> <li>Origin search: To start the origin search, set the PLC Setup to enable the origin search operation, set the various origin search parameters, and execute the ORIGIN SEARCH instruction (ORG(889)). The Unit will determine the location of the origin based on the Origin Proximity Input Signal and Origin Input Signal. The coordinates of the pulse output's PV will automatically be set as the absolute coordinates.</li> <li>Origin return: To return to the predetermined origin, set the various origin return parameters and execute the ORIGIN SEARCH instruction (ORG(889)).</li> </ul>
Change the target posi- tion during positioning. (For example, perform an emergency avoid operation with the Multi- ple Start feature.)	Positioning with the PLS2(887) instruction	When a positioning operation started with the PULSE OUTPUT (PLS2(887)) instruction is in progress, another PLS2(887) instruction can be executed to change the target position, target speed, acceleration rate, and deceleration rate.
Change speed in steps (polyline approxima- tion) during speed con- trol.	Use the ACC(888) instruction (con- tinuous) to change the acceleration rate or deceleration rate.	When a speed control operation started with the ACC(888) instruction (continuous) is in progress, another ACC(888) instruction (continuous) can be exe- cuted to change the acceleration rate or deceleration rate.
Change speed in steps (polyline approxima- tion) during positioning.	Use the ACC(888) instruction (independent) or PLS2(887) to change the acceleration rate or deceleration rate.	When a positioning operation started with the ACC(888) instruction (independent) or PLS2(887) instruction is in progress, another ACC(888) (independent) or PLS2(887) instruction can be executed to change the acceleration rate or deceleration rate.
Perform fixed distance feed interrupt.	Execute positioning with the PLS2(887) instruction during an operation started with SPED(885) (continuous) or ACC(888) (continu- ous).	When a speed control operation started with the SPED(885) instruction (continuous) or ACC(888) instruction (continuous) is in progress, the PLS2(887) instruction can be executed to switch to positioning, output a fixed number of pulses, and stop.
After determining the origin, perform position- ing simply in absolute coordinates without regard to the direction of the current position or target position.	The positioning direction is selected automatically in the absolute coordi- nate system.	When operating in absolute coordinates (with the origin determined or INI(880) instruction executed to change the PV), the CW or CCW direction is selected automatically based on the relationship between the pulse output PV and the pulse Output Amount specified when the pulse output instruction is executed.
Perform triangular con- trol.	Positioning with the ACC(888) instruction (independent) or PLS2(887) instruction.	When a positioning operation started with the ACC(888) instruction (independent) or PLS2(887) instruction is in progress, triangular control (trapezoidal control without the constant-speed plateau) will be performed if the number of output pulses required for acceleration/deceleration exceeds the specified target pulse Output Amount. (The number of pulses required for acceleration/deceleration equals the time required to reach the target fre-
Use variable duty factor outputs for time-propor- tional temperature con- trol.	Control with analog inputs and the variable duty factor pulse output func- tion (PWM(891)).	quency x the target frequency.) Two built-in outputs can be used as PWM(891) outputs 0 and 1 by executing the PWM(891) instruction.

# 5-2-2 Pulse Output Specifications

## **Specifications**

Item	Specifications
Output mode	Continuous mode (for speed control) or independent mode (for position control)
Positioning (independent mode) instructions	PULS(886) and SPED(885), PULS(886) and ACC(888), or PLS2(887)
Speed control (continuous mode) instructions	SPED(885) or ACC(888)
Origin (origin search and origin return) instructions	ORG(889)
Output frequency	Pulse outputs 0, 1: 1 Hz to 100 kHz (1 Hz units) J models : 1Hz to 20kHz (1Hz units)
Frequency acceleration and deceleration rates	Set in 1 Hz units for acceleration/deceleration rates from 1 Hz to 65,635 Hz (every 4 ms). The acceleration and deceleration rates can be set independently only with PLS2(887).
Changing SVs during instruction execution	The target frequency, acceleration/deceleration rate, and target position can be changed.
Duty factor	Fixed at 50%
Pulse output method	CW/CCW inputs or Pulse + direction inputs
	The method is selected with an instruction operand. The same method must be used for pulse outputs 0 and 1.
Number of output pulses	Relative coordinates: 0000 0000 to 7FFF FFFF hex
	(Each direction accelerating or decelerating: 2,147,483,647)
	Absolute coordinates: 8000 0000 to 7FFF FFFF hex
	(-2147483648 to 2147483647)
Pulse output PV's relative/absolute coordinate specification	Absolute coordinates are specified automatically when the origin location has been determined by setting the pulse output PV with INI(880) or performing an origin search with ORG(889). Relative coordinates are used when the origin location is undetermined.
Relative pulse specification/	The pulse type can be specified with an operand in PULS(886) or PLS2(887).
Absolute pulse specification	Note The absolute pulse specification can be used when absolute coordinates are specified for the pulse output PV, i.e. the origin location has been determined. The absolute pulse specification cannot be used when relative coordinates are specified, i.e. the origin location is undetermined. An instruction error will occur.
Pulse output PV's storage location	The following Auxiliary Area words contain the pulse output PVs:
	Pulse output 0: A277 (leftmost 4 digits) and A276 (rightmost 4 digits) Pulse output 1: A279 (leftmost 4 digits) and A278 (rightmost 4 digits) The PVs are refreshed during regular I/O refreshing.
Acceleration/deceleration curve specification	Trapezoidal or S-curve acceleration/deceleration

# Pulse Output Modes

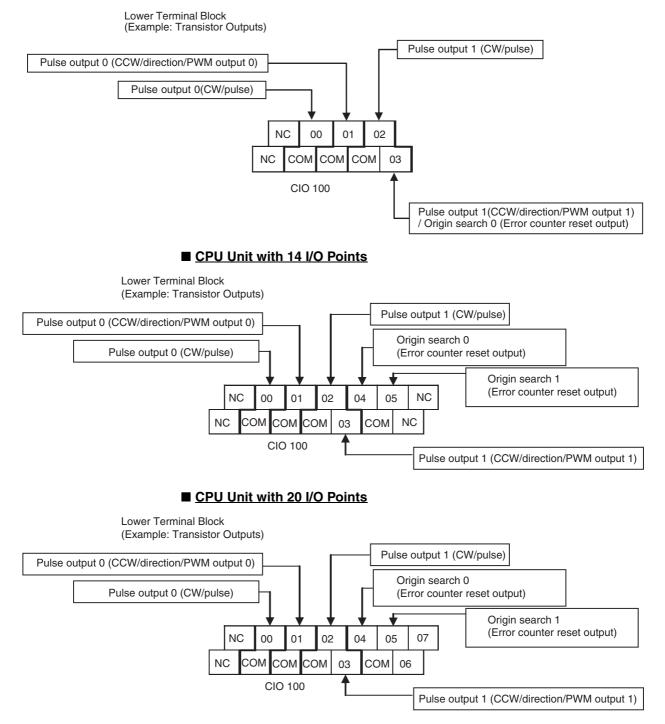
There are two pulse output modes. In independent mode the number of output pulses is specified and in continuous mode the number of output pulses is not specified.

Mode	Description
Independent mode	This mode is used for positioning.
	Operation stops automatically when the preset num- ber of pulses has been output. It is also possible to stop the pulse output early with INI(880).
Continuous mode	This mode is used for speed control.
	The pulse output will continue until it is stopped by executing another instruction or switching the PLC to PROGRAM mode.

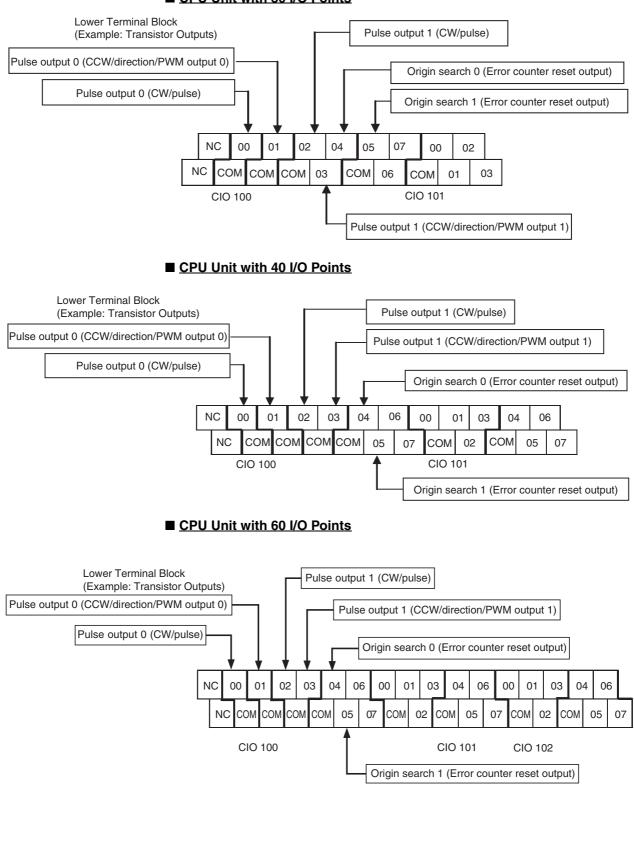
## 5-2-3 Pulse Output Terminal Allocations

The following diagrams show the terminals that can be used for pulse outputs in each CPU Unit.

### CPU Unit with 10 I/O Points



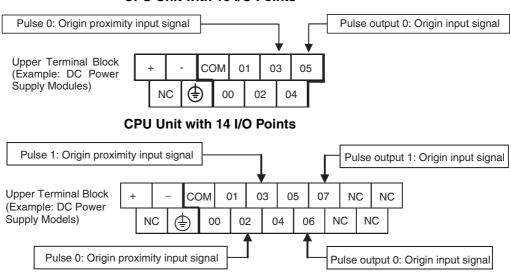
## Section 5-2



Setting Functions	s Usina Instructions	and PLC Setup
	•	

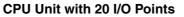
tern	out ninal ock	When the instructions to the right are not executed	When a pulse output instruction (SPED, ACC, PLS2, or ORG) is executed When the origin search function is enabled in the PLC Setup, and an origin search is executed by the ORG instruction		When the PWM instruction is executed	
Word	Bit	Normal output	F	ixed duty factor pulse out	put	Variable duty factor pulse output
			CW/CCW	Pulse plus direction	When the origin search function is used	PWM output
CIO 100	00	Normal output 0	Pulse output 0 (CW) fixed	Pulse output 0 (pulse) fixed		
	01	Normal output 1	Pulse output 0 (CCW) fixed	Pulse output 0 (direction) fixed		PWM output 0
	02	Normal output 2	Pulse output 1 (CW) fixed	Pulse output 1 (pulse) fixed		
	03	Normal output 3	Pulse output 1 (CCW) fixed	Pulse output 1 (direction) fixed		PWM output 1
	04	Normal output 4			Origin search 0 (Error counter reset output)	
	05	Normal output 5			Origin search 1 (Error counter reset output)	
	06	Normal output 6				
	07	Normal output 7				
CIO 101	00 to 07	Normal output 8 to 15				

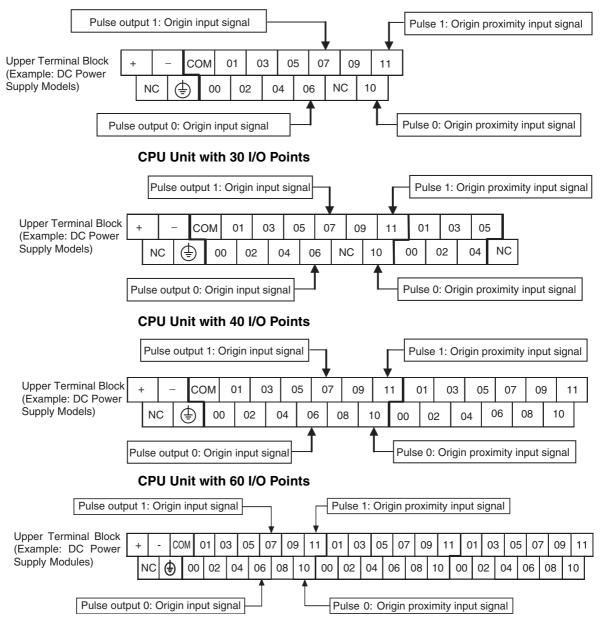
#### ■ Input Terminal Block Arrangements



### CPU Unit with 10 I/O Points

## Section 5-2





## ■ <u>Setting Functions Using Instructions and PLC Setup</u>

Add	lress	Default setting	High-speed counte	r operation settings	Origin searches
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0
CIO 0	00	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01 Normal input 1 Counter 1, increment input Counter 0, B phase, or direction input		Counter 0, B phase, down, or direction input		
	02	Normal input 2	Counter 2, increment input Counter 1, A phase, up, or count input		
	03 Normal input 3 Counter 3, increment input Counter 1, B phase, down, or direction input		Pulse output 0: Origin proximity input signal		
04 Norm		Normal input 4	Counter 0, phase-Z/reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	Pulse output 0: Origin input signal

### CPU Units with 10 I/O Points

	erminal ock	Default setting	High-speed counte	High-speed counter operation settings		
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0 and 1	
CIO 0	0 00 Normal input 0 High-speed counter 0 (Increment) (Phase A, Increment, or Count input)					
	01	Normal input 1	High-speed counter 1 (Increment)	High-speed counter 0 (Phase B, Decrement, or Direction input)		
	(Increment) (Ph		High-speed counter 1 (Phase A, Increment, or Count input)	Pulse output 0: Origin proximity input signal		
		High-speed counter 3 (Increment)	High-speed counter 1 (Phase B, Decrement, or Direction input)	Pulse output 1: Origin proximity input signal		
	04	Normal input 4	High-speed counter 0 (Phase Z or reset input)	High-speed counter 0 (Phase Z or reset input)		
	05	Normal input 5	High-speed counter 1 (Phase Z or reset input)	High-speed counter 1 (Phase Z or reset input)		
	06 Normal input 6 High-speed counter 2 (Phase Z or reset input)			Pulse output 0: Origin input signal		
	07	Normal input 7	High-speed counter 3 (Phase Z or reset input)		Pulse output 1: Origin input signal	

### CPU Units with 14 I/O Points

Add	ress		Default	setting		High-speed counter	r operation settings:	Origin searches
Word	Bit	CPU Units with 60 I/O Points	CPU Units with 40 I/O Points	CPU Units with 30 I/O Points	CPU Units with 20 I/O Points	Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches enabled for pulse outputs 0 and 1
CIO 0	00	Normal input 0	Normal input 0	Normal input 0	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1	Normal input 1	Normal input 1	Normal input 1	Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2	Normal input 2	Normal input 2	Normal input 2	Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3	Normal input 3	Normal input 3	Normal input 3	Counter 3, increment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Normal input 4	Normal input 4	Normal input 4	Counter 0, phase-Z reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Normal input 5	Normal input 5	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Normal input 6	Normal input 6	Normal input 6	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Normal input 7	Normal input 7	Normal input 7	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Normal input 8	Normal input 8	Normal input 8			
	09	Normal input 9	Normal input 9	Normal input 9	Normal input 9			
	10	Normal input 10	Normal input 10	Normal input 10	Normal input 10			Pulse output 0: Origin proxim- ity input signal
	11	Normal input 11	Normal input 11	Normal input 11	Normal input 11			Pulse output 1: Origin proxim- ity input signal
CIO 1	00 to 05	Normal input 12 to 17	Normal input 12 to 17	Normal input 12 to 17				
	06 to 11	Normal input 18 to 23	Normal input 18 to 23					
CIO 2	00 to 11	Normal input 24 to 35						

CPU Units with 20, 30, 4	40 or 60 I/O Points
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## Auxiliary Area Data Allocation

Function			Pulse output number		
		0	1		
Pulse output PV storage words	Leftmost 4 digits	A277	A279		
PV range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Rightmost 4 digits	A276	A278		
Reset Bits	0: Not cleared.	A540.00	A541.00		
The pulse output PV will be cleared when this bit is turned from OFF to ON.	1: Clear PV.				

# Section 5-2

Function		Pulse ou	tput number
		0	1
CW Limit Input Signal Flags	ON when turned ON from an external	A540.08	A541.08
This is the CW limit input signal, which is used in the origin search.	input.		
CCW Limit Input Signal Flags	ON when turned ON from an external	A540.09	A541.09
This is the CCW limit input signal, which is used in the origin search.	input.		
Positioning completed input signals	ON when turned ON from an external	A540.10	A541.10
This is the positioning completed input signal, which is used in the origin search.	input.		
Accel/Decel Flags	0: Constant speed	A280.00	A281.00
ON when pulses are being output according to an ACC(888) or PLS2(887) instruction and the output frequency is being changed in steps (accelerating or decelerating).	1: Accelerating or decelerating		
Overflow/Underflow Flags	0: Normal	A280.01	A281.01
ON when an overflow or underflow has occurred in the pulse output PV.	1: Overflow or underflow		
Output Amount Set Flags	0: No setting	A280.02	A281.02
ON when the number of output pulses has been set with the PULS instruction.	1: Setting made		
Output Completed Flags	0: Output not completed.	A280.03	A281.03
ON when the number of output pulses set with the PULS(886)/PLS2(887) instruction has been output.	1: Output completed.		
Output In-progress Flags	0: Stopped	A280.04	A281.04
ON when pulses are being output from the pulse output.	1: Outputting pulses.		
No-origin Flags	0: Origin established.	A280.05	A281.05
ON when the origin has not been determined for the pulse output.	1: Origin not established.		
At-origin Flags	0: Not stopped at origin.	A280.06	A281.06
ON when the pulse output PV matches the origin (0).	1: Stopped at origin.		
Output Stopped Error Flags	0: No error	A280.07	A281.07
ON when an error occurred while outputting pulses in the origin search function.	1: Stop error occurred.		
Stop Error Codes		A444	A445
When a Pulse Output Stop Error occurs, the error code is stored in that pulse outputs corresponding Stop Error Code word.			

## 5-2-4 Pulse Output Patterns

The following tables show the kinds of pulse output operations that can be performed by combining various pulse output instructions.

## **Continuous Mode (Speed Control)**

### Starting a Pulse Output

Operation	Example	Frequency changes	Description	Proce	edure
	application			Instruction	Settings
Output with specified speed	Changing the speed (frequency) in one step	Pulse frequency Target frequency Target frequency Time Execution of SPED(885)	Outputs pulses at a specified frequency.	SPED(885) (Continuous)	Port "CW/CCW" or "Pulse + direction" •Continuous •Target fre- quency
Output with specified acceleration and speed	Accelerating the speed (frequency) at a fixed rate	Pulse frequency Target frequency	Outputs pulses and changes the fre- quency at a fixed rate.	ACC(888) (Continuous)	Port     "CW/CCW"     or "Pulse +     direction"     Continuous     Accelera-     tion/decel-     eration rate     Target fre-     quency

### **Changing Settings**

Operation	Example applica-	Frequency changes	Description	Procedure	
	tion			Instruction	Settings
Change speed in one step	Changing the speed during oper- ation	Pulse frequency Target frequency Present frequency Execution of SPED(885)	Changes the fre- quency (higher or lower) of the pulse output in one step.	SPED(885) (Continu- ous) ↓ SPED(885) (Continu- ous)	Port     Continuous     Target fre- quency
Change speed smoothly	Changing the speed smoothly during operation	Pulse frequency Target frequency Present frequency Execution of ACC(888)	Changes the fre- quency from the present frequency at a fixed rate. The frequency can be accelerated or decelerated.	ACC(888) or SPED(885) (Continu- ous) ↓ ACC(888) (Continu- ous)	Port     Continuous     Target fre- quency     Accelera- tion/decel- eration rate
	Changing the speed in a polyline curve during opera- tion	Pulse frequency Target frequency Present frequency Execution of ACC(888) Execution of ACC(888) Execution of ACC(888)	Changes the acceleration or decelera- tion rate during acceleration or deceleration or deceleration.	ACC(888) (Continu- ous) ↓ ACC(888) (Continu- ous)	Port     Continuous     Target fre- quency     Accelera- tion/decel- eration rate
Change direction	Not supported.	1	1	1	1
Change pulse out- put method	Not supported.				

# Section 5-2

## Stopping a Pulse Output

Operation	Example	Frequency changes	Description	Proc	edure
	application			Instruction	Settings
Stop pulse output	Immediate stop	Pulse frequency Present frequency Time Execution of INI(880)	Stops the pulse out- put immediately.	SPED(885) or ACC(888) (Continu- ous) ↓ INI(880)	Port     Stop pulse     output
Stop pulse output	Immediate stop	Pulse frequency Present frequency Time Execution of SPED(885)	Stops the pulse out- put immediately.	SPED(885) or ACC(888) (Continu- ous) ↓ SPED(885) (Continu- ous)	Port     Continuous     Target fre- quency=0
Stop pulse output smoothly	Decelerate to a stop	Pulse frequency Present frequency Target frequency = 0 Execution of ACC(888)	Decelerates the pulse output to a stop. Note If ACC(888) started the operation, the original acceleration/ deceleration rate will remain in effect. If SPED(885) started the operation, the acceleration/ deceleration rate will be invalid and the pulse out- put will stop immediately.	SPED(885) or ACC(888) (Continu- ous) ↓ ACC(888) (Continu- ous)	Port     Continuous     Target fre- quency=0

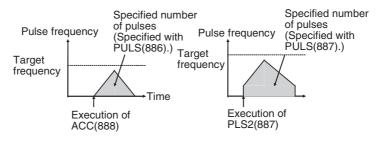
## Independent Mode (Positioning)

### Starting a Pulse Output

Operation	Example	Frequency changes	Description	Proc	edure
	application			Instruction	Settings
Output with specified speed	Positioning without accel- eration or deceleration	Pulse frequency Target frequency Target frequency Target frequency Target frequency Target frequency Target frequency Target frequency Target	Starts outputting pulses at the speci- fied frequency and stops immediately when the specified number of pulses has been output.	PULS(886) ↓ SPED(885)	Number of pulses     Relative or absolute pulse spec- ification     Port     "CW/CCW"
		Execution of SPED(885) and then stops.	vote The target position (specified number of pulses) can- not be changed dur- ing position- ing.		or "Pulse + direction" •Indepen- dent •Target fre- quency
Simple trap- ezoidal con- trol	Positioning with trapezoi- dal accelera- tion and deceleration (Same rate used for acceleration and decelera- tion; no start- ing speed) The number of pulses can- not be changed dur- ing position- ing.	Pulse frequency Target frequency Execution of ACC(888) Specified number of with PULS(886).) Time Time Execution of ACC(888) Specified with PULS(886).)	Accelerates and decelerates at the same fixed rate and stops immediately when the specified number of pulses has been output. (See note.) Note The target position (specified number of pulses) can- not be changed dur- ing position- ing.	PULS(886) ↓ ACC(888) (Indepen- dent)	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Indepen- dent</li> <li>Accelera- tion and decelera- tion rate</li> <li>Target fre- quency</li> </ul>
Complex trapezoidal control	Positioning with trapezoi- dal accelera- tion and deceleration (Separate rates used for acceleration and decelera- tion; starting speed) The number of pulses can be changed during posi- tioning.	Pulse frequency Specified number of pulses Target frequency Starting frequency Execution of PLS2(887) Target Deceleration point frequency reached.	Accelerates and decelerates at a fixed rates. The pulse output is stopped when the specified number of pulses has been output. (See note.) <b>Note</b> The target position (specified number of pulses) can be changed during posi- tioning.	PLS2(887)	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Accelera- tion rate</li> <li>Decelera- tion rate</li> <li>Target fre- quency</li> <li>Starting frequency</li> </ul>



If the specified number of pulses is less than the number required just to reach the target frequency and return to zero, the function will automatically reduce the acceleration/deceleration time and perform triangular control (acceleration and deceleration only.) An error will not occur.



# Section 5-2

## **Changing Settings**

Operation	Example	Frequency changes	Description	Procedure	
	application			Instruction	Settings
Change speed in one step	Changing the speed in one step dur- ing operation	Pulse frequency Original target frequency Original target frequency PULS(886).) Specified with PULS(886).) PULS(886) does not change. Time Execution of SPED(885) (independent mode) SPED(885) (independent mode) executed again to change the target frequency. (The target position is not changed.)	SPED(885) can be executed during positioning to change (raise or lower) the pulse output frequency in one step. The target position (specified number of pulses) is not changed.	PULS(886) ↓ SPED(885) (Indepen- dent) ↓ SPED(885) (Indepen- dent)	Number of pulses     Relative or absolute pulse spec- ification     Port     "CW/CCW"     or "Pulse + direction"     Indepen- dent     Target fre- quency
Change speed smoothly (with accel- eration rate = decelera- tion rate)	Changing the target speed (fre- quency) dur- ing positioning (accelera- tion rate = deceleration rate)	Specified number of pulses frequency (Specified with PULS(886).) Original target frequency Original target frequency Original target frequency Original target frequency Original target frequency Original target frequency (independent mode) ACC(888) (independent mode) ACC(888) (independent ACC(888) (independent ACC(888) (independent ACC(888) (independent ACC(88) (independent ACC	ACC(888) can be executed during positioning to change the acceler- ation/deceleration rate and target fre- quency. The target position (specified number of pulses) is not changed.	PULS(886) ↓ ACC(888) or SPED(885) (Indepen- dent) ↓ ACC(888) (Indepen- dent) PLS2(887) ↓ ACC(888) (Indepen- dent)	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Indepen- dent</li> <li>Accelera- tion and decelera- tion rate</li> <li>Target fre- quency</li> </ul>
Change speed smoothly (with unequal acceleration and deceler- ation rates)	Changing the target speed (fre- quency) dur- ing positioning (different acceleration and deceler- ation rates)	Pulse frequency Original target frequency Creation d frequency Creation d frequency Creation d frequency Creation d ACC(888) (independent mode) Creation d ACC(887) executed to change the target frequen- cy and acceleration/decel- eration rates. (The target position is not changed. The original tar- get position is specified again.)	PLS2(887) can be executed during positioning to change the acceler- ation rate, decelera- tion rate, and target frequency. <b>Note</b> To prevent the target position from being changed intentionally, the original target posi- tion must be specified in absolute coordinates.	PULS(886) ↓ ACC(888) (Indepen- dent) ↓ PLS2(887) ↓ PLS2(887) ↓	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse specification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Acceleration rate</li> <li>Deceleration rate</li> <li>Target frequency</li> <li>Starting frequency</li> </ul>

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Operation	Example	Frequency changes	Description	Procedure	
	application			Instruction	Settings
Change tar- get position	Change the target posi- tion during positioning (multiple start func- tion)	Pulse frequency Target frequency Execution of PLS2(887) PLS2(87) P	PLS2(887) can be executed during positioning to change the target position (number of pulses). Note When the tar- get position cannot be changed without main- taining the same speed range, an error will occur and the original oper- ation will con- tinue to the original tar- get position.	PULS(886) ↓ ACC(888) (Indepen- dent) ↓ PLS2(887) ↓ PLS2(887) ↓ PLS2(887) ↓ PLS2(887) ↓	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Accelera- tion rate</li> <li>Decelera- tion rate</li> <li>Target fre- quency</li> <li>Starting frequency</li> </ul>
Change tar- get position and speed smoothly	Change the target posi- tion and tar- get speed (frequency) during posi- tioning (mul- tiple start function)	Pulse Pulse Number of pulses specified PLS2(887). Changed target frequency Acceleration/ Target frequency Target frequency Acceleration/ Execution of PLS2(887) Time ACC(888) executed to change the target frequency. (The target position is not changed, but the acceleration/ deceleration rates are changed.)	PLS2(887) can be executed during positioning to change the target position (number of pulses), accelera- tion rate, decelera- tion rate, and target frequency. <b>Note</b> When the settings can- not be changed without main- taining the same speed range, an error will occur and the original oper- ation will con- tinue to the original tar- get position.	PULS(886) ↓ ACC(888) (Indepen- dent) ↓ PLS2(887)	<ul> <li>Number of pulses</li> <li>Relative or absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Accelera- tion rate</li> <li>Decelera- tion rate</li> <li>Target fre- quency</li> <li>Starting frequency</li> </ul>
	Change the acceleration and deceler- ation rates during posi- tioning (mul- tiple start function)	Pulse frequency New target frequency Original target frequency Execution of 1 PLS2(887) #1 PLS2(887) #2 Number of pulses specified by PLS2(887) #N. Acceleration Accelerati	PLS2(887) can be executed during positioning (accel- eration or decelera- tion) to change the acceleration rate or deceleration rate.	PULS(886) ↓ ACC(888) (Indepen- dent) ↓ PLS2(887) ↓ PLS2(887) ↓ PLS2(887)	•Number of pulses •Accelera- tion rate •Decelera- tion rate

# Section 5-2

Operation	Example	Frequency changes	Description	Proce	edure
	application			Instruction	Settings
Change direction	Change the direction dur- ing position- ing	Specified number of frequency pulses Target frequency Pulses Change of direction at the specified deceleration rate Number of pulses (position) changed by PLS2(887) Time Execution of PLS2(887)	PLS2(887) can be executed during positioning with rel- ative pulse specifi- cation to change to absolute pulses and reverse direction.	PULS(886) ↓ ACC(888) (Indepen- dent) ↓ PLS2(887) PLS2(887) ↓ PLS2(887)	<ul> <li>Number of pulses</li> <li>Absolute pulse spec- ification</li> <li>Port</li> <li>"CW/CCW" or "Pulse + direction"</li> <li>Accelera- tion rate</li> <li>Decelera- tion rate</li> <li>Target fre- quency</li> <li>Starting frequency</li> </ul>
Change pulse out- put method	Not supported				

### Stopping a Pulse Output

Operation	Example applica-	Frequency changes	Description	Proc	edure
	tion			Instruction	Settings
Stop pulse output (Number of pulses set- ting is not preserved.)	Immediate stop	Pulse frequency Present frequency Execution of SPED(885) Time Execution of INI(880)	Stops the pulse out- put immediately and clears the num- ber of output pulses setting.	PULS(886) ↓ ACC(888) or SPED(885) (Indepen- dent) ↓ INI(880) PLS2(887) ↓ INI(880)	•Stop pulse output
Stop pulse output (Number of pulses set- ting is not preserved.)	Immediate stop	Pulse frequency Present frequency Time Execution of SPED(885) Execution of SPED(885)	Stops the pulse out- put immediately and clears the num- ber of output pulses setting.	PULS(886) ↓ SPED(885) (Indepen- dent) ↓ SPED(885)	Port     Indepen- dent     Target fre- quency = 0
Stop sloped pulse out- put smoothly. (Number of pulses set- ting is not preserved.)	Decelerate to a stop	Pulse frequency Present frequency Target frequency = 0 Execution of ACC(888)	Decelerates the pulse output to a stop. Note If ACC(888) started the operation, the original acceleration/ deceleration rate will remain in effect. If SPED(885) started the operation, the acceleration/ deceleration/ deceleration rate will be invalid and the pulse out- put will stop immediately.	PULS(886) ↓ ACC(888) or SPED(885) (Indepen- dent) ↓ ACC(888) (Indepen- dent) PLS2(887) ↓ ACC(888) (Indepen- dent)	•Port •Indepen- dent •Target fre- quency = 0

Switching from Continuous Mode (Speed Control) to Independent Mode (Positioning)

Example applica-	Frequency changes	Description		Procedure
tion			Instruction	Settings
Change from speed control to fixed dis- tance positioning during operation	Pulse frequency Target frequency Execution of ACC(888) (continuous) Execution of PLS2(887) Outputs the number of pulses specified in PLS2(887) (Both relative and absolute pulse specification can be used.) Time Execution of PLS2(887)	<ul> <li>ified in Both relative a pulse</li> <li>can be used.)</li> <li>Time</li> <li>Time</li> </ul>		<ul> <li>Port</li> <li>Acceleration rate</li> <li>Deceleration rate</li> <li>Target frequency</li> <li>Number of pulses</li> <li>Note The starting frequency is ignored.</li> </ul>
Fixed distance feed interrupt	Pulse frequency Present frequency ACC(888) (continuous) Execution of PLS2(887) with the following settings • Number of pulses = number of pulses until stop • Relative pulse specification • Target frequency = present frequency • Acceleration rate = Not 0 • Deceleration rate = target deceleration rate	be ignored and the previ- ous opera- tion will be continued.		

## **Relative Pulse Outputs and Absolute Pulse Outputs**

Selecting Relative or Absolute Coordinates

The pulse output PV's coordinate system (absolute or relative) is selected automatically, as follows:

- When the origin is undetermined, the system operates in relative coordinates.
- When the origin has been determined, the system operates in absolute coordinates.

Conditions	Origin has been determined by an ori- gin search	Origin has been determined by exe- cuting INI(880) to change the PV	Origin not estab- lished (Origin search has not been per- formed and PV has not been changed with INI(880).)
Pulse output PV's coordi- nate system	Absolute coordinates		Relative coordinates

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### Relationship between the Coordinate System and Pulse Specification

The following table shows the pulse output operation for the four possible combinations of the coordinate systems (absolute or relative) and the pulse output (absolute or relative) specified when PULS(886) or PLS2(887) is executed.

Pulse output	Coordina	te system				
specified in PULS(886) or	Relative coordinate system	Absolute coordinate system				
PLS2(887)	Origin not established:	Origin established:				
	The No-origin Flag will be ON in this case.	The No-origin Flag will be OFF in this case.				
Relative pulse speci-	Positions the system to another position relative	Positions the system to another position relative to the current position.				
fication	Number of movement pulses = number of pulses	setting				
	The pulse output PV after instruction execution = Number of movement pulses = Number of	The pulse output PV after instruction execution = PV + Number of movement pulses.				
	pulses setting	The following example shows the number of pulses setting = 100 counterclockwise.				
	Note The pulse output PV is reset to 0 just before pulses are output. After that, the specified number of pulses is output.	Number of pulses				
	ber of pulses is output. The following example shows the number of pulses setting = 100 counterclockwise. Number of pulses setting I Number of movement pulses U Target position Pulse Output PV Target position=0 Pulse output PV range: 8000 0000 to 7FFF FFFF hex Number of pulses setting range: 0000 0000 to 7FFF FFFF hex	Pulse Pulse Origin position Pulse output PV range: 8000 0000 to 7FFF FFFF hex Number of pulses setting range: 0000 0000 to 7FFF FFFF hex				

### Pulse Outputs

Pulse output	Coordina	ate system
specified in PULS(886) or	Relative coordinate system	Absolute coordinate system
PLS2(887)	Origin not established:	Origin established:
	The No-origin Flag will be ON in this case.	The No-origin Flag will be OFF in this case.
Absolute pulse specification	used when the origin location is undetermined, i.e., when the system is operating in the relative coordinate system. An instruction execution error will occur.	Positions the system to an absolute position rel- ative to the origin. The number of movement pulses and move- ment direction are calculated automatically from the current position (pulse output PV) and target position.
		The following example shows the number of pulses setting = +100.
		Number of pulses setting II Number of movement pulses +100 Pulse output PV Origin position = position number of pulses setting
		Number of movement pulses = Number of pulses setting - Pulse output PV when instruction is executed
		The movement direction is determined automatically.
		Pulse output PV when instruction is executed = Number of pulses setting
		Pulse output PV range: 8000 0000 to 7FFF FFFF hex
		Number of pulses setting range: 8000 0000 to 7FFF FFFF hex

## **Operations Affecting the Origin Status (Established/Not Established Status)**

The following table shows the operations that can affect the origin status (origin established or no-origin), such as changing the operating mode and executing certain instructions.

The No-origin Flag will be ON when the corresponding pulse output's origin is not established and OFF when the origin is established.

Current status		PROGRAM mode		RUN mode or MONITOR mode	
Operation		Origin established	Origin not established	Origin established	Origin not established
Operat- ing mode change	Switch to RUN or MONITOR	Status changes to "Origin not established."	"Origin not established" status contin- ues.		
	Switch to PROGRAM			"Origin established" status contin- ues.	"Origin not established" status contin- ues.

Current status		PROGRAM mode		RUN mode or MONITOR mode	
Operation		Origin established	Origin not established	Origin established	Origin not established
Instruc- tion exe- cution	Origin search performed by ORG(889)			Status changes to "Origin established."	Status changes to "Origin established."
	PV changed by INI(880)			"Origin established" status contin- ues.	Status changes to "Origin established."
The Pulse Output Reset Bit (A54000 or A54100) goes from OFF to ON.		Status changes to "Origin not established."	"Origin not established" status contin- ues.	Status changes to "Origin not established."	"Origin not established" status contin- ues.

## Movement Direction when Using Absolute Pulse Specification

When operating with the absolute pulse specification, the movement direction is selected automatically based on the relationship between the pulse output PV when the instruction is executed and the specified target position. The direction (CW/CCW) specified in an ACC(888) or SPED(885) instruction is not effective.

### Using CW/CCW Limit Inputs for Pulse Output Functions Other than Origin Searches

Pulse outputs will stop when either the CW or CCW limit input signals turns ON. It is also possible to select whether or not the established origin will be cleared when a CW or CCW limit input signal turns ON for an origin search or other pulse output function.

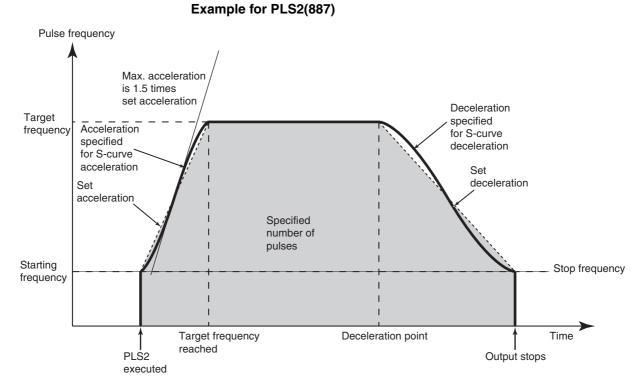
### **S-curve Acceleration/Deceleration**

S-curve acceleration/deceleration can be used for pulse output instructions involving acceleration/deceleration. When there is leeway in the maximum allowable speed, S-curve accelerations/decelerations will help control shock and vibration by reducing the initial acceleration rate in comparison with linear acceleration/deceleration.

**Note** The setting for S-curve acceleration/deceleration applies to all pulse outputs.

#### **Output Pattern**

The output pattern for S-curve acceleration/deceleration is shown below.



The same type of S-curve acceleration/deceleration can be used for ACC(888) as well.

**Note** The curve for S-curve acceleration/deceleration is formed by applying a cubic equation to the straight line of the set acceleration/deceleration rates (a cubic polynomial approximation). The curve's parameters cannot be changed. The maximum acceleration will be 1.5 times that of trapezoidal acceleration/ deceleration for the same acceleration/deceleration rate.

#### Procedure

Make the following settings in the PLC Setup.

#### Pulse Output 0 to 3

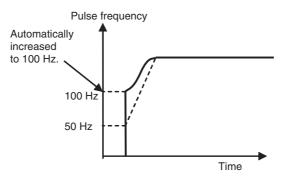
Speed Curve	Trapezium	When a pulse output is executed with accelera-
	0-Shapeu	tion/deceleration, this setting determines whether the acceleration/deceleration rate is lin- ear (trapezium) or S-shaped.

#### Restrictions

The following restrictions apply when using S-curve acceleration/deceleration.

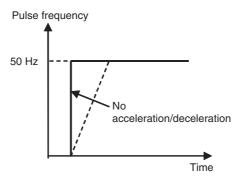
#### **Starting Frequency**

The starting frequency must be 100 Hz or greater. If the starting frequency is set to less than 100 Hz, it will automatically be increased to 100 Hz if S-curve acceleration/deceleration is set.



#### **Target Frequency**

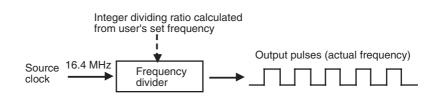
S-curve acceleration/deceleration will not be performed if the target frequency is less than 100 Hz.



#### Precautions when using the Pulse Output Function

**Pulse Output System** 

The CP1L CPU Unit's pulse output frequency is determined by dividing the source clock frequency by an integer ratio. (The source clock frequency for ports 0 and 1 is 20 MHz and the frequency for ports 2 and 3 is 16.4 MHz.) Consequently, there may be a slight difference between the set frequency and the actual frequency, and that difference increases as the frequency increases. The actual frequency can be calculated from the following equations.



#### Equations

Dividing ratio

Dividing ratio = INT 
$$\left(\frac{(\text{Clock frequency x 2}) + \text{Set frequency}}{\text{Set frequency (Hz) x 2}}\right)$$

The INT function extracts an integer from the fraction. The non-integer remainder is rounded.

#### Differences between Set Frequencies and Actual Frequencies

<ul> <li>Source clock frequency: 16.4 MHz</li> </ul>				
Set frequency (kHz)	Actual frequency (kHz)			
99.696 to 100.000	100.000			
99.093 to 99.696	99.393			
98.498 to 99.093	98.795			
:	:			
50.076 to 50.229	50.152			
49.923 to 50.076	50.000			
49.772 to 49.923	49.848			
:	:			
20.012 to 20.036	20.024			
19.987 to 20.012	20.000			
19.963 to 19.987	19.975			
:	:			
10.003 to 10.009	10.006			
9.996 to 10.003	10.000			
9.990 to 9.996	9.993			
:	:			
5.000 to 5.002	5.001			
4.999 to 5.000	5.000			
4.997 to 4.999	4.998			
:	:			
3.001 to 3.001	3.001			
3.000 to 3.000	3.000			
2.998 to 2.999	2.999			

## 5-2-5 Origin Search and Origin Return Functions

The CP1L CPU Units have two functions that can be used to determine the machine origin for positioning.

1,2,3... 1. Origin Search

The ORG instruction outputs pulses to turn the motor according to the pattern specified in the origin search parameters. As the motor turns, the origin search function determines the machine origin from the following 3 kinds of position input signals.

- Origin input signal
- Origin proximity input signal
- CW limit input signal and CCW limit input signal

- 2. Changing the Pulse Output PV
  - When you want to set the current position as the origin, execute INI(880) to reset the pulse output PV to 0.

The origin location can be determined after using either method.

The CP1L CPU Units are also equipped with the origin return function, which can be executed to return the system to the origin after the origin location has been determined by one of the methods above.

Origin Return

If the motor is stopped, ORG(889) can be executed to perform an origin return operation that moves the motor back to the origin position. The origin position must be determined in advance by performing an origin search or changing the pulse output PV.

- **Note** The motor can be moved even if the origin position has not been determined, but positioning operations will be limited as follows:
  - Origin return: Cannot be used.
  - Positioning with absolute pulse specification: Cannot be used.
  - Positioning with relative pulse specification: Outputs the specified number of pulses after setting the current position to 0.

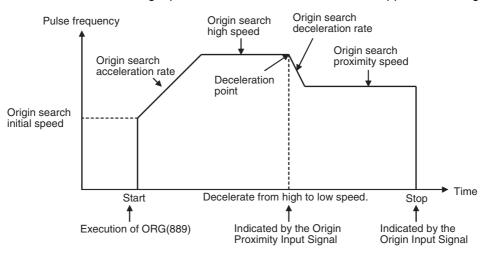
#### 5-2-5-1 Origin Search

When ORG(889) executes an origin search, it outputs pulses to actually move the motor and determines the origin position using the input signals that indicate the origin proximity and origin positions.

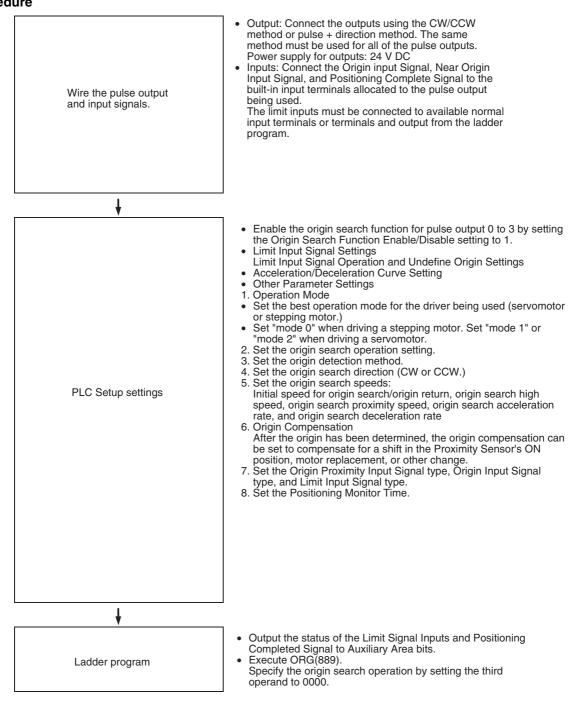
The input signals that indicate the origin position can be received from the servomotor's built-in phase-Z signal or external sensors such as photoelectric sensors, proximity sensors, or limit switches.

Several origin search patterns can be selected.

In the following example, the motor is started at a specified speed, accelerated to the origin search high speed, and run at that speed until the origin proximity position is detected. After the Origin Proximity Input is detected, the motor is decelerated to the origin search low speed and run at that speed until the origin position is detected. The motor is stopped at the origin position.



#### Procedure



#### Restrictions

• The Phase-Z signal + Software reset method cannot be used for a highspeed counter when the origin search function has been enabled in the PLC Setup.

**PLC Setup** 

#### Origin Search Function Enable/Disable Settings

These PLC Setup indicate whether or not the origin search function will be used for each pulse output.

#### Limit Input Signal Setting

Specify in the following PLC Setup whether to use the CW/CCW limit input signals only for origin searches or for all pulse output functions. These settings affect all pulse outputs.

(This setting is called the Limited Input Signal Operation setting.)

#### Pulse Output 0 Undefined Origin Setting

#### Acceleration/Deceleration Curve Settings

**Note** The acceleration/deceleration curve setting applies to all pulse outputs, not just to origin searches. Refer to S-curve Acceleration/Deceleration on page 217 for details.

#### Origin Search Parameters T

The various origin search parameters are set in the PLC Setup.

Name		Settings	Time when read
Operating mode		Operating mode 0, 1, or 2	Start of operation
Origin se setting	arch operation	0: Reversal mode 1 1: Reversal mode 2	Start of operation
Origin de	tection method	0: Read the Origin Input Signal after the Origin Proximity Input Signal goes from OFF→ON→OFF.	Start of operation
		1: Read the Origin Input Signal after the Origin Proximity Input Signal goes from OFF→ON.	
		2: Just read the Origin Input Signal with- out using the Origin Proximity Input Signal.	
Origin se	arch direction	0: CW direction 1: CCW direction	Start of operation
Origin search speed (See note.)	Origin search/ return initial speed	<ul> <li>Pulse outputs 0,1: 00000001 to 000186A0 hex (1 Hz to 100 kHz) J models : 00000001 to 00004E20 hex (1 Hz to 20kHz)</li> </ul>	Start of operation
,	Origin search high speed	Same as above.	Start of operation
	Origin search proximity speed	Same as above.	Start of operation
	Origin search acceleration rate	0001 to FFFF hex (1 to 65,535 Hz/4 ms)	Start of operation
	Origin search deceleration rate	0001 to FFFF hex (1 to 65,535 Hz/4 ms)	Start of operation
Origin co	mpensation	8000 0000 to 7FFF FFFF hex (-2147483648 to 2147483647)	Start of operation
I/O settings		Limit Input Signal type 0: Normally closed (NC) 1: Normally open (NO)	Start of operation
		Origin Proximity Input Signal type 0: Normally closed (NC) 1: Normally open (NO)	Start of operation
		Origin Input Signal type 0: Normally closed (NC) 1: Normally open (NO)	When power is turned ON
Positionir	ng monitor time	0000 to 270F hex (0 to 9,999 ms)	Start of operation

**Note** An origin search will not be started unless the origin search proximity speed is less than the origin search high speed and unless the origin search/return initial speed is less than the origin search proximity speed.

#### **Explanation of the Origin Search Parameters**

#### **Operating Mode**

The operating mode parameter specifies the kind of I/O signals that are used in the origin search. The 3 operating modes indicate whether the Error Counter Reset Output and Positioning Completed Input are used.

Operating		I/O signal		Remarks
mode	Origin Input Signal	Error Counter Reset Output	Positioning Completed Input	Operation when the origin is detected during deceleration from the origin search's high speed
0	The origin position is determined when the Origin Input Signal goes from OFF to ON.	Not used. The origin search operation ends after the origin is detected.	Not used.	The Origin Input Signal will be detected during deceleration. An Ori- gin Input Signal Error (error code 0202) will occur and the motor will decelerate to a stop.
1 2		Goes ON for 20 to 30 ms when the origin is detected.	After the origin is detected, the origin search will not be end until the Positioning Completed Input is received from the driver.	The Origin Input Signal will not be detected during deceleration. When the Origin Input Signal is detected after the motor has reached the prox- imity speed for origin search, the motor will be stopped and the origin search operation will end.

The following table shows the proper operating mode settings for different drivers and applications.

Driver	Remarks	Operating mode	
Stepping motor driver	(See note.)	0	
Servo driver	Use this mode when you want to reduce the processing time, even at the expense of positioning accuracy. (The Servo Driver's positioning complete signal is not used.)	1	
	Use this mode when you want high positioning accuracy. (The Servo Driver's positioning complete signal is used.)	2	

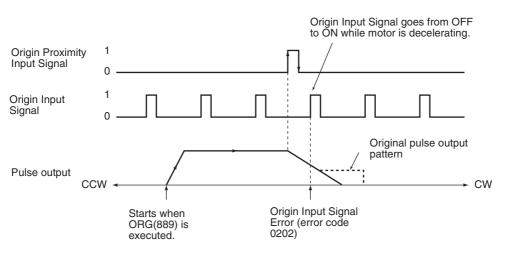
**Note** There are stepping motor drivers that are equipped with a positioning completed signal like a Servo driver. Operating modes 1 and 2 can be used with these stepping motor drivers.

# Remarks: Operations Detecting the Origin During Deceleration from High Speed

#### Operating Mode 0 (without Error Counter Reset Output, without Positioning Completed Input)

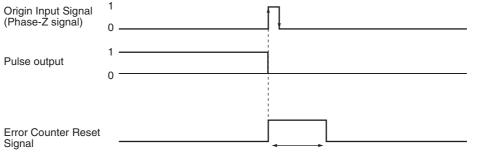
Connect the sensor's open collector output signal to the Origin Input Signal. The Origin Input Signal's response time is 0.1 ms when set as a NO contact.

When the Origin Proximity Input Signal is received, the motor will begin decelerating from the origin search high speed to the origin search proximity speed. In this operating mode, the Origin Input Signal will be detected if it is received during this deceleration and an Origin Input Signal Error (error code 0202) will be generated. In this case, the motor will decelerate to a stop.



#### Operating Mode 1 (with Error Counter Reset Output, without Positioning Completed Input)

Connect the phase-Z signal from the Servo Driver to the Origin Input Signal. When the Origin Input Signal is received, the pulse output will be stopped and the Error Counter Reset Signal will be output for about 20 to 30 ms.

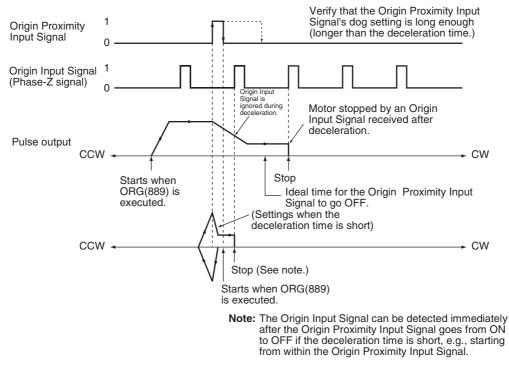


Approx. 20 to 30 ms

When the Origin Proximity Input Signal is received, the motor will begin decelerating from the origin search high speed to the origin search proximity speed. In this operating mode, the motor will stop at the Origin Input Signal after deceleration is completed.

# Operating Mode 1 with Origin Proximity Input Signal Reverse (Origin Detection Method Setting = 0)

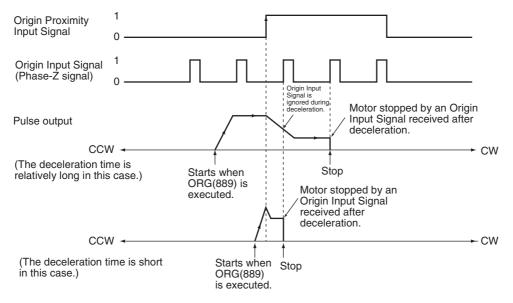
When the deceleration time is short, the Origin Input Signal can be detected immediately after the Origin Proximity Input Signal goes from ON to OFF. Set



a Origin Proximity Input Signal dog setting that is long enough (longer than the deceleration time.)

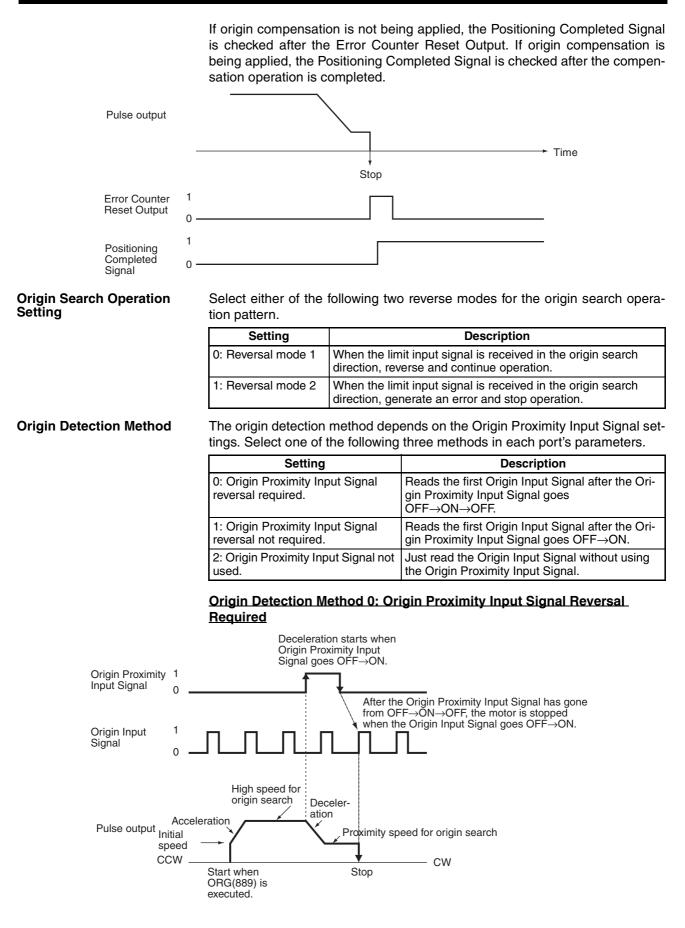
# Operating Mode 1 without Origin Proximity Input Signal Reverse (Origin Detection Method Setting = 1)

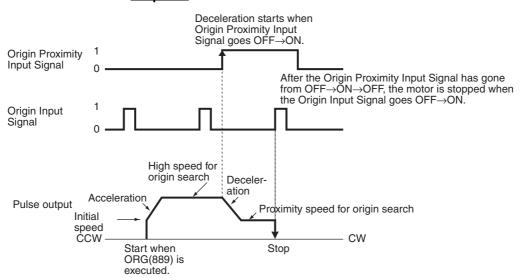
Depending on the length of the deceleration time, the stopping position may change when the Origin Input Signal is detected during deceleration.



# Operating Mode 2 (with Error Counter Reset Output, with Positioning Completed Input)

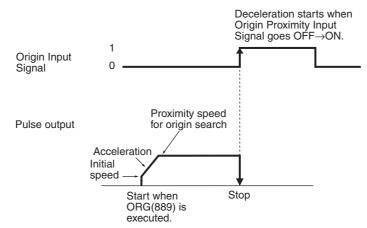
This operating mode is the same as mode 1, except the Positioning Completed Signal (INP) from the Servo Driver is used. Connect the Positioning Completed Signal from the Servo Driver to a normal input (origin search 0 to 3 input).





#### Origin Detection Method 1: Origin Proximity Input Signal Reversal Not Required

#### Origin Detection Method 2: Origin Proximity Input Signal Reversal Not Used

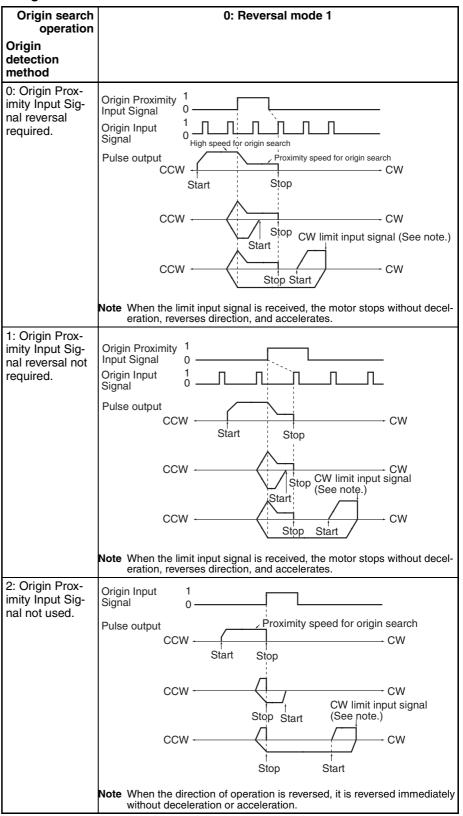


#### Origin Search Operating Mode and Origin Detection Method Settings

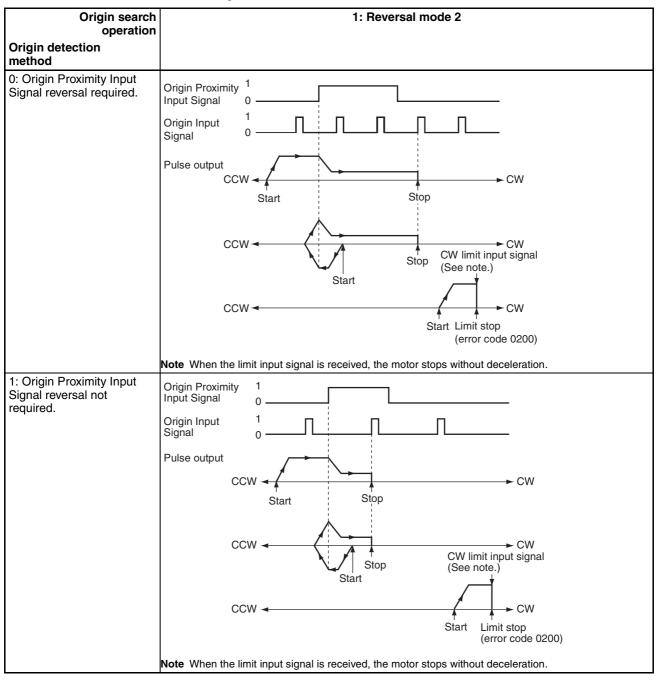
The following examples explain how the operation patterns are affected by the origin search operation and origin detection method settings.

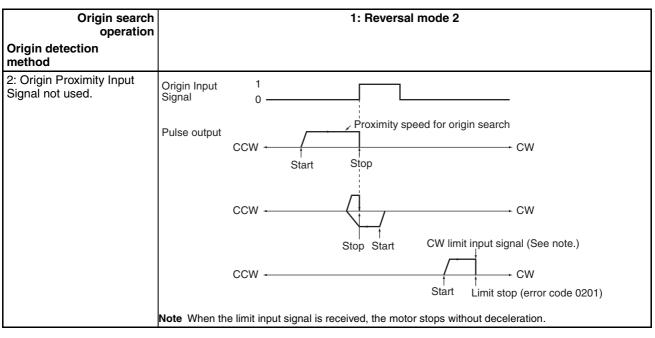
These examples have a CW origin search direction. (The search direction and limit input signal direction would be different for an origin search in the CCW direction.)

#### Using Reversal Mode 1



#### **Using Reversal Mode 2**





Specifying the Origin Search Direction (CW or CCW Direction) Sets the direction to move when detecting the Origin Input Signal.

Typically, the origin search is performed so that the Origin Input Signal's rising edge is detected when moving in the origin search direction.

Setting	Description	
0	CW direction	
1	CCW direction	

Origin Search Speed

Note

These are the motor speed settings used in the origin search.

The origin search will not be performed in these cases:
 Origin search high speed < Origin search proximity speed</li>
 Origin search proximity speed < Origin search initial speed</li>

#### **Origin Search/Return Initial Speed**

Sets the motor's starting speed when the origin search is executed. Specify the speed in the number of pulses per second (pps).

#### **Origin Search High Speed**

Sets the motor's target speed when the origin search is executed. Specify the speed in the number of pulses per second (pps).

#### **Origin Search Proximity Speed**

Sets the motor's speed after the Origin Proximity Input Signal is detected. Specify the speed in the number of pulses per second (pps).

#### **Origin Search Acceleration Rate**

Sets the motor's acceleration rate when the origin search is executed. Specify the amount to increase the speed (Hz) per 4-ms interval.

#### **Origin Search Deceleration Rate**

Sets the motor's acceleration rate when the origin search function is decelerating. Specify the amount to decrease the speed (Hz) per 4-ms interval.

# **Origin Compensation** After the origin has been determined, the origin compensation can be set to compensate for a shift in the Proximity Sensor's ON position, motor replacement, or other change.

I/O Settings	Once the origin has been detected in an origin search, the number of pulses specified in the origin compensation is output, the current position is reset to 0, and the pulse output's No-origin Flag is turned OFF. Setting range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647) pulses Limit Input Signal Type (NC/NO) Specifies the type of input signal (normally closed or normally open) being used for the limit inputs. 0: NC
	1: NO
	Origin Proximity Input Signal Type (NC/NO) Specifies the type of input signal (normally closed or normally open) being used for the Origin Proximity Input Signal. 0: NC 1: NO
	<ul> <li><u>Origin Input Signal Type (NC/NO)</u></li> <li>Specifies the type of input signal (normally closed or normally open) being used for the Origin Input Signal.</li> <li>0: NC</li> <li>1: NO</li> </ul>
Positioning Monitor Time	When the operating mode is set to mode 2, this setting specifies how long to wait (in ms) for the Positioning Completed Signal after the positioning opera- tion has been completed, i.e., the pulse output has been completed. A Posi- tioning Timeout Error (error code 0300) will be generated if the motor driver's Positioning Completed Signal does not come ON within the specified time. Setting range: 0000 to 270F hex (0 to 9,999 ms)
	The actual monitoring time will be the Positioning Monitor Time rounded up to the nearest 10-ms unit + 10 ms max.
	If the Positioning Monitor Time is set to 0, the function will be disabled and the Unit will continue waiting for the Positioning Completed Signal to come ON. (A Positioning Timeout Error will not be generated.)
Executing an Origin Sea	<u>rch</u>

Execute ORG(889) in the ladder program to perform an origin search with the specified parameters.

 ORG(889)	F
Р	F
С	Ċ

P: Port specifier Pulse output 0: #0000 Pulse output 1: #0001 C: Control data; Origin search and CW/CCW method: #0000 Origin search and pulse + direction method: #0001

#### **Restrictions**

The motor can be moved even if the origin position has not been determined with the origin search function, but positioning operations will be limited as follows:

Function	Operation
Origin return	Cannot be used.

Function	Operation
Positioning with absolute pulse specification	Cannot be used.
Positioning with relative pulse specification	Outputs the specified number of pulses after setting the current position to 0.

An origin search will not be started unless the origin search proximity speed is less than the origin search high speed and unless the origin search/return initial speed is less than the origin search proximity speed.

#### **Origin Search Error Processing**

The CP1L CPU Unit's pulse output function performs a basic error check before starting to output pulses (when the instruction is executed) and will not output pulses if the settings are incorrect. There are other errors that can occur with the origin search function during pulse output, which may stop the pulse output.

If an error occurs that stops pulse output, the pulse output's Output Stopped Error Flag will be turned ON and the Pulse Output Stop Error Code will be written to Error Code word. Use these flags and error codes to identify the cause of the error.

The Pulse Output Stop Errors will not affect the CPU Unit's operating status. (The Pulse Output Stop Errors do not cause a fatal or non-fatal error in the CPU Unit.)

#### **Related Auxiliary Area Flags**

Function		Pulse output number	
		0	1
Output Stopped Error Flags	0: No error	A280.07	A281.07
ON when an error occurred while outputting pulses in the origin search function.	1: Stop error occurred.		
Stop Error Codes			A445
When a Pulse Output Stop Error occurs, the error code is stored in that pulse outputs corresponding Stop Error Code word.			

#### Pulse Output Stop Error Codes

Error name	Error code	Likely cause	Corrective action	Operation after error
CW Limit Stop Input Signal	0100	Stopped due to a CW limit signal input.	Move in the CCW direction.	Immediate stop, No effect on
CCW Limit Stop Input Signal	0101	Stopped due to a CCW limit sig- nal input.	Move in the CW direction.	other port
No Origin Proximity Input Signal	0200	The parameters indicate that the Origin Proximity Input Signal is being used, but a Origin Proxim- ity Input Signal was not received during the origin search.	Check the wiring of the Origin Proximity Input Signal as well as the PLC Setup's Origin Proxim- ity Input Signal Type setting (NC or NO) and execute the origin search again. Turn the power supply OFF and then ON if the signal type setting was changed.	No effect on other port
No Origin Input Sig- nal	0201	The Origin Input Signal was not received during the origin search.	Check the wiring of the Origin Input Signal as well as the PLC Setup's Origin Input Signal Type setting (NC or NO) and execute the origin search again. Turn the power supply OFF and then ON if the signal type setting was changed.	

# Section 5-2

Error name	Error code	Likely cause	Corrective action	Operation after error
Origin Input Signal Error	0202	During an origin search in oper- ating mode 0, the Origin Input Signal was received during the deceleration started after the Origin Proximity Input Signal was received.	<ul> <li>Take one or both of the following steps so that the Origin Input Signal is received after deceleration is completed.</li> <li>Increase the distance between the Origin Proximity Input Signal sensor and Origin Input Signal sensor.</li> <li>Decrease the difference between the origin search's high speed and proximity speed settings.</li> </ul>	Decelerates to a stop, No effect on other port
Limit Inputs in Both Directions	0203	The origin search cannot be per- formed because the limit signals for both directions are being input simultaneously.	Check the wiring of the limit sig- nals in both directions as well as the PLC Setup's Limit Signal Type setting (NC or NO) and execute the origin search again. Turn the power supply OFF and then ON if the signal type setting was changed.	Operation will not start. No effect on other port
Simultaneous Origin Proximity and Limit Inputs	0204	The Origin Proximity Input Sig- nal and the Limit Input Signal in the search direction are being input simultaneously during an origin search.	Check the wiring of the Origin Proximity Input Signal and the Limit Input Signal. Also check the PLC Setup's Origin Proxim- ity Input Signal Type and Limit Signal Type settings (NC or NO) and then execute the origin search again. Turn the power supply OFF and then ON if a signal type setting was changed.	Immediate stop, No effect on other port
Limit Input Signal Already Being Input	0205	<ul> <li>When an origin search in one direction is being performed, the Limit Input Signal is already being input in the origin search direction.</li> <li>When a non-regional origin search is being performed, the Origin Input Signal and the Limit Input Signal in the opposite direction (from the search direction) are being input simultaneously.</li> </ul>	Check the wiring of the Limit Input Signal and the PLC Setup's I/O settings. Also check the PLC Setup's Limit Signal Type setting (NC or NO) and then execute the origin search again. Turn the power supply OFF and then ON if the signal type setting was changed.	Immediate stop, No effect on other port
Origin Proximity Input Signal Origin Reverse Error	0206	<ul> <li>When an origin search with reversal at the limit is being per- formed, the Limit Input Signal in the search direction was input while the Origin Proximity Input Signal was reversing.</li> <li>When an origin search with reversal at the limit is being per- formed and the Origin Proximity Input Signal is not being used, the Limit Input Signal in the search direction was input while the Origin Input Signal was reversing.</li> </ul>	Check the installation positions of the Origin Proximity Input Sig- nal, Origin Input Signal, and Limit Input Signal as well as the PLC Setup's I/O settings. Also check the PLC Setup's Signal Type settings (NC or NO) for each input signal and then exe- cute the origin search again. Turn the power supply OFF and then ON if a signal type setting was changed.	Immediate stop, No effect on other port
Positioning Timeout Error	0300	The Servo Driver's Positioning Completed Signal does not come ON within the Positioning Monitor Time specified in the PLC Setup.	Adjust the Positioning Monitor Time setting or Servo system gain setting. Check the Position- ing Completed Signal wiring, correct it if necessary, and then execute the origin search again.	Decelerates to a stop, No effect on other port

#### **Origin Search Examples**

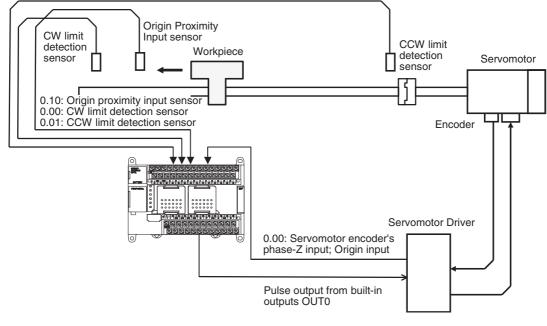
Operation

Connect a Servo Driver and execute an origin search based on the Servomotor's built-in encoder phase-Z signal and a Origin Proximity Input Signal.

Conditions

- Operating mode: 1 (Uses the Servomotor encoder's phase-Z signal as the Origin Input Signal.)
- Origin search operation setting: 0 (Sets reverse mode 1. Reverses direction when the limit input signal is input in the origin search direction.)
- Origin detection method: 0 (Reads the Origin Input Signal after the Origin Input Signal goes OFF→ON→OFF.)
- Origin search direction: 0 (CW direction)

#### System Configuration



Instructions Used

ORG(889)

I/O Allocations (Example: CP1L-M40/30 DT -D, CP1L-L20D -D Units)

#### ■ Inputs

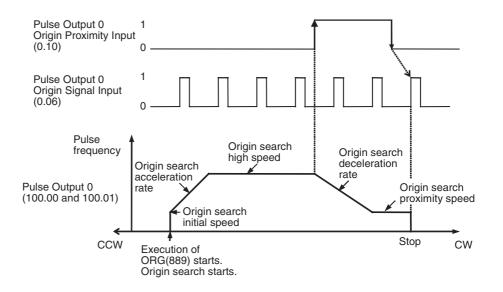
Input terminal		Name	
Word	Word Bit		
CIO 0	00	CW limit detection sensor	
	01	CCW limit detection sensor	
	06	Pulse Output 0 Origin Input Signal	
	10	Pulse Output 0 Origin Proximity Input Signal	

Word	Bit	Name
A540	08	Pulse Output 0 CW Limit Input Signal
	09	Pulse Output 0 CCW Limit Input Signal

#### ■ Outputs

Output terminal		Name
Word Bit		
CIO 100	00	Pulse Output 0 CW output
	01	Pulse Output 0 CCW output

#### **Operation**



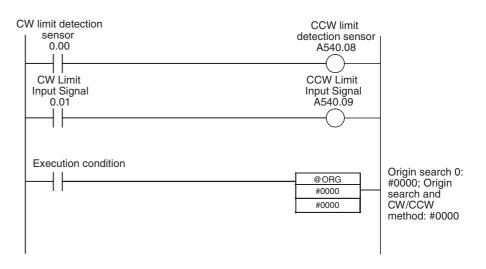
#### PLC Setup

Function	Setting (example)
Pulse Output 0 Origin Search Function Enable/Disable	1 hex: Enabled
Pulse Output 0 Origin Search Operating Mode	1 hex: Mode 1
Pulse Output 0 Origin Search Operation Setting	0 hex: Reverse mode 1
Pulse Output 0 Origin Detection Method	0 hex: Origin detection method 0
Pulse Output 0 Origin Search Direction Setting	0 hex: CW direction
Pulse Output 0 Origin Search/Return Initial Speed	0064 hex (100 pps)
	0000 hex
Pulse Output 0 Origin Search High Speed	07D0 hex (2,000 pps)
	0000 hex

#### Section 5-2

Function	Setting (example)	
Pulse Output 0 Origin Search Proximity Speed	03E8 hex (1,000 pps)	
	0000 hex	
Pulse Output 0 Origin Compensation	0000 hex	
	0000 hex	
Pulse Output 0 Origin Search Acceleration Rate	0032 hex (50 Hz/4 ms)	
Pulse Output 0 Origin Search Deceleration Rate	0032 hex (50 Hz/4 ms)	
Pulse Output 0 Limit Input Signal Type	1: NO	
Pulse Output 0 Origin Proximity Input Signal Type	1: NO	
Pulse Output 0 Origin Input Signal Type	1: NO	

#### Ladder Program

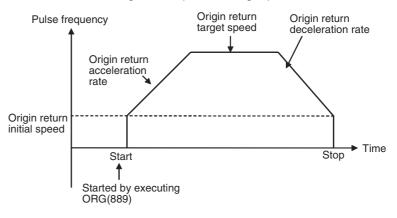


## 5-2-6 Origin Return

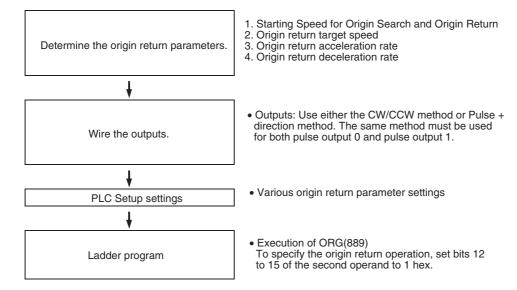
#### **Overview**

Moves the motor to the origin position from any other position. The origin return operation is controlled by ORG(889).

The origin return operation returns the motor to the origin by starting at the specified speed, accelerating to the target speed, moving at the target speed, and then decelerating to a stop at the origin position.



#### **Procedure**



#### PLC Setup

The various origin return parameters are set in the PLC Setup.

#### **Origin Return Parameters**

Name	Settings	Remarks
Origin search/return initial speed	00000001 to 000186A0 hex (1 Hz to 100 kHz) J models : 00000001 to 00004E20 hex (1 Hz to 20 kHz)	Start of operation
Origin return target speed	Same as above.	
Origin return acceleration rate	0001 to FFFF hex (1 to 65,535 Hz/4 ms)	
Origin return deceleration rate	0001 to FFFF hex (1 to 65,535 Hz/4 ms)	

#### **Explanation of the Origin Return Parameters**

Origin Search/Return Initial Speed	Sets the motor's starting speed when the origin return is executed. Specify the speed in the number of pulses per second (pps).
Origin Return Target Speed	Sets the motor's target speed when the origin return is executed. Specify the speed in the number of pulses per second (pps).
Origin Return	Sets the motor's acceleration rate when the origin return operation starts.
Acceleration Rate	Specify the amount to increase the speed (Hz) per 4-ms interval.
Origin Return	Sets the motor's acceleration rate when the origin return function is decelerat-
Deceleration Rate	ing. Specify the amount to decrease the speed (Hz) per 4-ms interval.

#### **Executing an Origin Return**

 ORG(889)	P: Port specifier (Pulse output 0: #0000, Pulse output 1: #0001) Pulse output 0: #0000
Р	Pulse output 1: #0001
С	C: Control data
	(Origin return and CW/CCW method: #1000, Origin search and pulse + direction method: #1100)

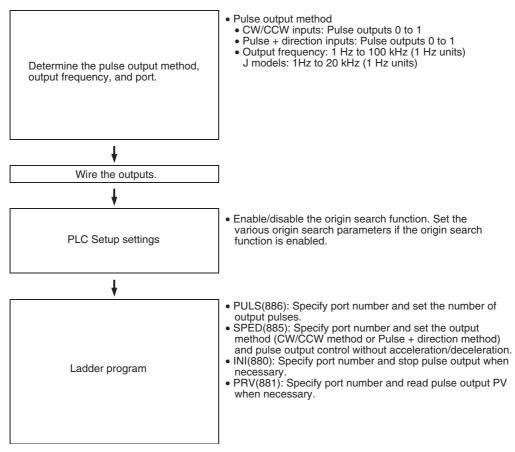
**Note** An instruction execution error will occur if the origin is not determined (relative coordinate system) when ORG(889) is executed to perform an origin return operation.

## 5-2-7 Pulse Output Procedures

#### Single-phase Pulse Output without Acceleration/Deceleration

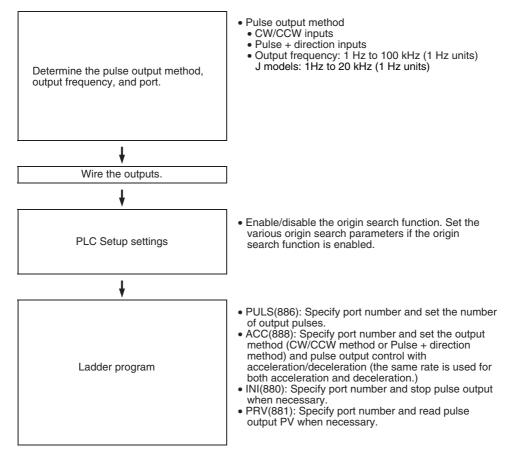
The number of output pulses setting cannot be changed during positioning.

#### ■ PULS(886) and SPED(885)



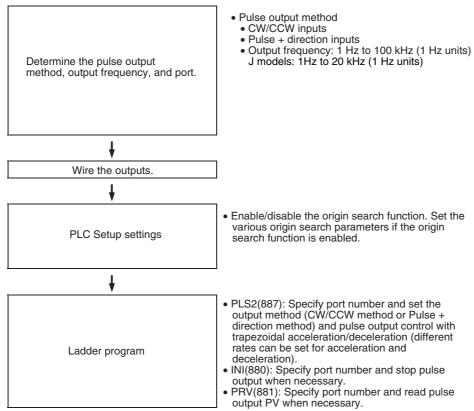
#### Single-phase Pulse Output with Acceleration/Deceleration

#### ■ PULS(886) and ACC(888)



#### Section 5-2

#### Pulse Output with Trapezoidal Acceleration/Deceleration (Using PLS2(887))



### 5-2-8 Instructions Used for Pulse Outputs

The pulse output functions can be used by executing the pulse control instructions in the ladder program. For some instructions, the PLC Setup must be set in advance. The following instructions can be combined for positioning and speed control.

Supported PulseUse the following 8 instructions to control the pulse outputs.Instructions

# Section 5-2

The following	table	shows	the	kinds	of	pulse	outputs	controlled	by	each
instruction.										

Instruction	Instruction Function		ng (independ	lent mode)	Speed (continuo	Origin search	
		output eration/de		t with accel-	Pulse output	Pulse output	
		without accelera- tion/ decelera- tion	Trapezoi- dal, equal accelera- tion/ decel- eration rates	Trapezoi- dal, sepa- rate accelera- tion/ decel- eration rates	without accelera- tion/ decelera- tion	with accelera- tion/ decelera- tion	
PULS(886) SET PULSES	Sets the number of pulses to be output.	Used					
SPED(885) SPEED OUTPUT	Performs pulse output con- trol without acceleration or deceleration. (When positioning, the number of pulses must be set in advance with PULS(886).)	Used			Used		
ACC(888) ACCELERATION CONTROL	Performs pulse output con- trol with acceleration and deceleration. (When positioning, the number of pulses must be set in advance with PULS(886).)		Used			Used	
PLS2(887) PULSE OUTPUT	Performs pulse output con- trol with independent acceleration and decelera- tion rates. (Also sets the number of pulses.)			Used			
ORG(889) ORIGIN SEARCH	Actually moves the motor with pulse outputs and determines the machine origin based on the Origin Proximity Input and Origin Input signals						Used
INI(880) MODE CONTROL	Stops the pulse output. Changes the pulse output PV. (This operation deter- mines the origin location.)	Used	Used	Used	Used	Used	
PRV(881) HIGH-SPEED COUNTER PV READ	Reads the pulse output PV.	Used	Used	Used	Used	Used	
PWM(891) PULSE WITH VARIABLE DUTY FACTOR	Performs pulse output con- trol with variable duty fac- tor pulse output.						

#### Section 5-2

#### SET PULSES: PULS(886)

PULS(886) is used to set the pulse output amount (number of output pulses) for pulse outputs that are started later in the program using SPED(885) or ACC(888) in independent mode.

 PULS(886)	
Р	
Т	
N	

\_

P: Port specifierT: Pulse type

N: Number of pulses

	Operand	Contents
P Port specifier		0000 hex: Pulse output 0 0001 hex: Pulse output 1
Т	Pulse type	0000 hex: Relative pulse output 0001 hex: Absolute pulse output
N	First number of pulses word	N and N+1 contain the number of pulses setting. (N contains the rightmost 4 digits and N+1 contains the leftmost 4 digits.)
		Relative pulse output: 0000 0000 to 7FFF FFFF hex (0 to 2,147,483,647)
		Absolute pulse output: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)

#### SPEED OUTPUT: SPED(885)

SPED(885) can be used to perform pulse output without acceleration or deceleration. Either independent mode positioning or continuous mode speed control is possible. For independent mode positioning, the number of pulses is set using PULS(886).

SPED(885) can also be executed during pulse output to change the output frequency, creating stepwise changes in the speed.



P: Port specifier

T: Output mode

F: First pulse frequency word

	Оре	erand	Contents
Ρ	Port specifier		0000 hex: Pulse output 0 0001 hex: Pulse output 1
Т	Output	Bits 0 to 3	Mode
	mode		0 hex: Continuous 1 hex: Independent
		Bits 4 to 7	Direction
			0 hex: CW 1 hex: CCW
		Bits 8 to 11	Pulse output method (See note.)
			0 hex: CW/CCW 1 hex: Pulse + direction
		Bits 12 to 15	Not used. (Always 0 hex.)
F	F First pulse frequency word		F and F+1 contain the pulse frequency setting, in units of 1 Hz. (F contains the rightmost 4 digits and F+1 contains the leftmost 4 digits.) 0000 0000 to 0001 86A0 hex (0 Hz to 100 kHz) J models: 0000 0000 to 0000 4E20 hex (0Hz to 20kHz)

#### Section 5-2

#### ACCELERATION CONTROL: ACC(888)

Use ACC(888) to set the target frequency and acceleration and deceleration rate and output pulses with acceleration and deceleration. (Acceleration rate is the same as the deceleration rate.)

Either independent mode positioning or constant mode speed control is possible when used in combination with PULS(886). ACC(888) can also be executed during pulse output to change the target frequency or acceleration/ deceleration rate, enabling smooth (sloped) speed changes.



P: Port specifierM: Output mode

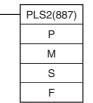
S: First word of settings table

	Оре	erand	Contents
Ρ	Port specifier		0000 hex: Pulse output 0 0001 hex: Pulse output 1
М	Output	Bits 0 to 3	Mode
	mode		0 hex: Continuous 1 hex: Independent
		Bits 4 to 7	Direction
			0 hex: CW 1 hex: CCW
		Bits 8 to 11	Pulse output method (See note.)
			0 hex: CW/CCW 1 hex: Pulse + direction
		Bits 12 to 15	Not used. (Always 0 hex.)
S	First	S	Acceleration/deceleration rate:
	set-		0001 to FFFF hex (1 to 65,535 Hz)
	tings table word		Specify the increase or decrease in the frequency per pulse control period (4 ms).
		S+1 and S+2	S and S+1 contain the target frequency setting, in units of 1 Hz. (S+1 contains the rightmost 4 digits and S+2 contains the leftmost 4 digits.)
			0000 0000 to 0001 86A0 hex (0 Hz to 100 kHz) J models: 0000 0000 to 0000 4E20 hex (0Hz to 20kHz)

# PULSE OUTPUT: PLS2(887)

Use PLS2(887) to set the startup frequency, acceleration rate, and deceleration rate, and output a specified number of pulses. Only independent mode positioning is supported.

PLS2(887) can also be executed during pulse output to change the number of output pulses, target frequency, acceleration rate, or deceleration rate.



P: Port specifier

M: Output mode

S: First word of settings table

F: First word of starting frequency

	Operand		Contents
Ρ	Port spe	cifier	0000 hex: Pulse output 0 0001 hex: Pulse output 1
М	mode		Mode 0000 hex: Relative pulse output 0001 hex: Absolute pulse output
		Bits 4 to 7	Direction 0 hex: CW 1 hex: CCW
		Bits 8 to 11	Pulse output method (See note.) 0 hex: CW/CCW 1 hex: Pulse + direction
		Bits 12 to 15	Not used. (Always 0 hex.)
S	First set- tings table	S	Acceleration rate: 0001 to FFFF hex (1 to 65,535 Hz) Specify the increase or decrease in the frequency per
	word	S+1	pulse control period (4 ms). Deceleration rate: 0001 to FFFF hex (1 to 65,535 Hz)
			Specify the increase or decrease in the frequency per pulse control period (4 ms).
		S+2 and S+3	S+2 and S+3 contain the target frequency setting, in units of 1 Hz. (S+2 contains the rightmost 4 digits and S+3 contains the leftmost 4 digits.)
			0000 0000 to 0001 86A0 hex (0 Hz to 100 kHz)
		S+4 and S+5	J models: 0000 0000 to 0000 4E20 hex (0Hz to 20kHz) S+4 and S+5 contain the number of pulses setting. (S+4 contains the rightmost 4 digits and S+5 contains the left- most 4 digits.)
			Relative pulse output: 0000 0000 to 7FFF FFFF hex (0 to 2,147,483,647)
			Absolute pulse output: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)
F	First sta quency	rting fre- word	F and F+1 contain the starting frequency setting, in units of 1 Hz. (F contains the rightmost 4 digits and F+1 contains the leftmost 4 digits.)
			0000 0000 to 0001 86A0 hex (0 Hz to 100 kHz) J models: 0000 0000 to 0000 4E20 hex (0Hz to 20kHz)

#### ORIGIN SEARCH: ORG(889)

ORG(889) performs an origin search or origin return operation. The required PLC Setup parameters must be set before performing an origin search or origin return operation.

#### **Origin Search**

Positions the system to the origin based on the origin proximity input and origin input signals.

#### **Origin Return**

Returns the system from its present position to the pre-established origin.



P: Port specifier

C: Control data

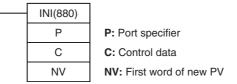
	Operand		Contents
Ρ	Port specifier		0000 hex: Pulse output 0 0001 hex: Pulse output 1
С	Con- Bits 0 to 3		Not used. (Always 0 hex.)
	trol data	Bits 4 to 7	Not used. (Always 0 hex.)
	uala	Bits 8 to 11	Pulse output method (See note.)
			0 hex: CW/CCW 1 hex: Pulse + direction
		Bits 12 to 15	Mode
			0 hex: Origin search 1 hex: Origin return

#### MODE CONTROL: INI(880)

In addition to the various interrupt and high-speed counter functions, INI(880) can be used to change the pulse output PV or stop the pulse output.

Note

This section explains the functions related to pulse outputs only. For details on the INI(880) instruction's high-speed counter or interrupt functions, refer to 6-1 Interrupt Functions or 5-1 High-speed Counters.



Operand		Contents		
Ρ	Port specifier	0000 hex: Pulse output 0 0001 hex: Pulse output 1 1000 hex: PWM output 0 1001 hex: PWM output 1		
С	Control data	0002 hex: Change the PV. 0003 hex: Stop pulse output.		
NV	First word of new PV	NV and NV+1 contain the new PV when changing the PV. (N contains the rightmost 4 digits and N+1 con- tains the leftmost 4 digits.)		
		0000 0000 to FFFFFFF hex		

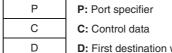
#### **HIGH-SPEED COUNTER** PV READ: PRV(881)

In addition to its interrupt and high-speed counter functions, PRV(881) can be used to read the pulse output PV or pulse output status information.

The status of the following flags is read as status information:

- · Pulse Output Status Flag
- PV Underflow/Overflow Flag
- Pulse Output Amount Set Flag
- Pulse Output Completed Flag
- · Pulse Output Flag
- No-origin Flag
- At Origin Flag
- Pulse Output Stopped Error Flag

PRV(881)
----------



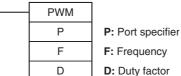
D: First destination word

This section explains the functions related to pulse outputs only. For details on Note the PRV(881) instruction's high-speed counter or interrupt functions, refer to 6-1 Interrupt Functions or 5-1 High-speed Counters.

	Оре	erand		Contents	
Ρ	P Port specifier		0000 hex: Pulse output 0 0001 hex: Pulse output 1 1000 hex: PWM output 0 1001 hex: PWM output 1		
С	C Control data		<ul> <li>0000 hex: Read the PV.</li> <li>0001 hex: Read the status.</li> <li>0003 hex: Read the pulse output frequency.</li> <li>0013 hex: Read the frequency for 10-ms sampling.</li> <li>0023 hex: Read the frequency for 100-ms sampling.</li> <li>0033 hex: Read the frequency for 1-s sampling.</li> </ul>		
D	First desti- nation	Reading PV (D and D+1)	data is store	se output PV is read, the 8-digit hexadecimal ed in D and D+1. (D contains the rightmost 4 +1 contains the leftmost 4 digits.)	
	word	Reading pulse output status	Bit 0	Pulse Output Status Flag 0: Constant speed 1: Accelerating/decelerating	
		(D)	Bit 1	PV Underflow/Overflow Flag 0: Normal 1: Error	
			Bit 2	Pulse Output Amount Set Flag 0: Not set 1: Set	
			Bit 3	Pulse Output Completed Flag 0: Output not completed 1: Output completed	
			Bit 4	Pulse Output Flag 0: Stopped 1: Outputting pulses	
			Bit 5	No-origin Flag 0: Origin established 1: Origin not established	
			Bit 6	At Origin Flag 0: Not stopped at origin 1: Stopped at origin	
			Bit 7	Pulse Output Stopped Error Flag 0: No error 1: Pulse output stopped due to error	
			Bits 8 to 15	Not used.	
		Reading PWM output status (D)	Bit 0	PWM Output Flag 0: Stopped	
			Bits 1 to 15	1: Outputting pulses Not used.	
			013 1 10 13	NOL 4364.	

#### PULSE WITH VARIABLE **DUTY FACTOR: PWM(891)**

PWM(891) is used to output pulses with the specified duty factor.



D: Duty factor

	Operand	Contents
Ρ	Port specifier	0000 hex: Pulse output 0 (duty factor set in 1% units, fre- quency 0.1 Hz units)
		0001 hex: Pulse output 1 (duty factor set in 1% units, fre- quency 0.1 Hz units)
		1000 hex: Pulse output 0 (duty factor set in 0.1% units, frequency 0.1 Hz units)
		1001 hex: Pulse output 1 (duty factor set in 0.1% units, frequency 0.1 Hz units)
		0100 hex: Pulse output 0 (duty factor set in 1% unit, fre- quency 1 Hz units)
		0101 hex: Pulse output 1 (duty factor set in 1% unit, fre- quency 1 Hz units)
		1100 hex: Pulse output 0 (duty factor set in 0.1% unit, frequency 1 Hz units)
		1101 hex: Pulse output 1 (duty factor set in 0.1% unit, frequency 1 Hz units)
Т	Frequency	0001 to FFFF hex (0.1 to 6553.5 Hz, in 0.1 Hz units)
		0001 to 8020 hex (1 to 32,800 Hz, in 1 Hz units)
S	Duty factor	Specify the duty factor of the pulse output, i.e., the percent- age of time that the output is ON.
		0000 to 03E8 hex: 0.0% to 100.0% (in 0.1 units)
		0000 to 0064 hex: 0.0% to 100% (in 1% units)

Combinations of Pulse Control Instructions

The following tables show when a second pulse control instruction can be started if a pulse control operation is already being executed.

Generally, a second independent-mode positioning instruction can be started if an independent-mode positioning instruction is being execute, and a second continuous-mode speed control instruction can be started if a continuous-mode speed control instruction is being executed. Operation cannot be switched between the independent and continuous modes, although PLS2(887) can be started while ACC(888) (continuous mode) is being executed.

It is possible to start another operation during acceleration/deceleration and start another positioning instruction during positioning.

Instruction being executed		Starting instruction (◯: Can be executed., ×: Instruction Error occurs and Error Flag goes ON)						
		INI(880)	SPED(885) (Independent) O (note 1)	SPED(885) (Continuous)	ACC(888) (Independent) (note 3)	ACC(888) (Continuous)	PLS2(887)	ORG(889)
SPED(885) (Inc	dependent)	0						×
SPED(885) (Co	ontinuous)	0	×	O (note 2)	×	O (note 5)	×	×
ACC(888)	Steady speed	0	×	×	O (note 4)	×	O (note 6)	×
(Independent)	Accelerating or decelerating	0	×	×	O (note 4)	×	O (note 6)	×
ACC(888)	Steady speed	0	×	×	×	O (note 5)	O (note 7)	×
(Continuous)	Accelerating or decelerating	0	×	×	×	O (note 5)	O (note 7)	×
PLS2(887)	Steady speed	0	×	×	O (note 4)	×	O (note 8)	×
	Accelerating or decelerating	0	×	×	O (note 4)	×	O (note 8)	×
ORG(889)	Steady speed	0	×	×	×	×	×	х
	Accelerating or decelerating	0	×	×	×	×	×	×
PWM		0	×	×	×	×	×	×

Note (1) SPED(885) (Independent) to SPED(885) (Independent)

- The number of pulses cannot be changed.
- The frequency can be changed.
- The output mode and direction cannot be switched.
- (2) SPED(885) (Continuous) to SPED(885) (Continuous)
  - The frequency can be changed.
  - The output mode and direction cannot be switched.
- (3) SPED(885) (Independent) to ACC(888) (Independent)
  - The number of pulses cannot be changed.
  - The frequency can be changed.
  - The acceleration/deceleration rate can be changed.
  - The output mode and direction cannot be switched.
- (4) ACC(888) (Independent) to ACC(888) (Independent) or PLS2(887) to ACC(888) (Independent)
  - The number of pulses cannot be changed.
  - The frequency can be changed.
  - The acceleration/deceleration rate can be changed. (The rate can even be changed during acceleration or deceleration.)
  - The output mode and direction cannot be switched.
- (5) SPED(885) (Continuous) to ACC(888) (Continuous) or ACC(888) (Continuous) to ACC(888) (Continuous)
  - The frequency can be changed. (The target frequency can even be changed during acceleration or deceleration.)
  - The acceleration/deceleration rate can be changed. (The rate can even be changed during acceleration or deceleration.)
  - The output mode and direction cannot be switched.
- (6) ACC(888) (Independent) to PLS2(887)
  - The number of pulses can be changed. (The setting can even be changed during acceleration or deceleration.)
  - The frequency can be changed. (The target frequency can even be changed during acceleration or deceleration.)
  - The acceleration/deceleration rate can be changed. (The rate can even be changed during acceleration or deceleration.)
  - The output mode and direction cannot be switched.
- (7) ACC(888) (Continuous) to PLS2(887)
  - The frequency can be changed. (The target frequency can even be changed during acceleration or deceleration.)
  - The acceleration/deceleration rate can be changed. (The rate can even be changed during acceleration or deceleration.)
  - The output mode and direction cannot be switched.
- (8) PLS2(887) to PLS2(887)
  - The number of pulses can be changed. (The setting can even be changed during acceleration or deceleration.)
  - The frequency can be changed. (The target frequency can even be changed during acceleration or deceleration.)
  - The acceleration/deceleration rate can be changed. (The rate can even be changed during acceleration or deceleration.)
  - The output mode and direction cannot be switched.

# 5-2-9 Variable Duty Factor Pulse Outputs (PWM(891) Outputs)

#### **Overview**

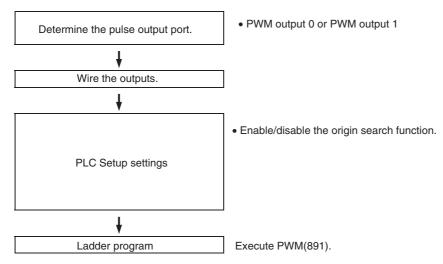
PWM (Pulse Width Modulation) pulse outputs can be output with a specified duty factor. The duty factor is the ratio of the pulse's ON time and OFF time in one pulse cycle. Use the PWM(891) instruction to generate variable duty factor pulses from a built-in output.

The duty factor can be changed while pulses are being output.

#### **Bit Allocations**

Word	Bit	Function
CIO 100	01	PWM output 0
	03	PWM output 1

#### **Procedure**



#### **Specifications**

Item	Specifications
Duty factor	0.0% to 100.0% in 0.1% increments
	(Duty factor accuracy is +1%/–0% at10 kHz, +5%/–0% at 10 to 32.8 kHz .)
Frequency	0.1 Hz to 6,553.5 Hz
	Set in 0.1 Hz units. (See note.)
Output mode	Continuous mode
Instruction	PWM(891)

**Note** The frequency can be set up to 6553.5 Hz in the PWM(891) instruction, but the duty factor accuracy declines significantly at high frequencies because of limitations in the output circuit at high frequencies.

# 5-2-10 Example Pulse Output Applications

#### **Outputting Pulses after a Preset Delay**

This example program waits for a preset time (0.5 ms) after the interrupt input (CIO 0.04) goes ON and then outputs 100,000 pulses at 100 kHz from pulse output 0.

#### Section 5-2

Input interrupt task 0 (interrupt task number 140) starts a scheduled interrupt with a scheduled time of 0.5 ms. The scheduled interrupt task executes the pulse output instructions and stops the scheduled interrupt.

Pulse output 0 (CIO 100.00) —						
	I/O interrupt response time	MSKS	Scheduled interrupt time 500 μs	PULS	SPED	
Interrupt input 0 (CIO 0.04) —						

**Instructions Used** 

MSKS(690)Enables the I/O interrupt. Starts the scheduled interrupt.PULS(886)Sets the number of output pulses.SPED(885)Starts the pulse output.

#### Preparation

#### PLC Setup

#### **Built-in Input Settings**

PLC Setup setting details Use built-in input 0.04 as the interrupt input.

🐺 PLC Settings - NewPLC1				
File Options Help				
Startup Settings Timings Input constant Serial Port 1	Serial Port 2 Peripheral Service Built-in Input			
High Speed Counter 0	High Speed Counter 1			
Counting mode © Linear mode © Circular mode Circular Max. Count	Counting mode ⓒ Linear mode ⓒ Circular mode Circular Max. Count 0			
Reset         Z phase, software reset         Imput Setting           Input Setting         Differential phase input         Imput	Reset         Z phase, software reset         Imput Setting           Input Setting         Differential phase input         Imput Setting			
High Speed Counter 2 Use high speed counter 2 Counting mode C Linear mode C Circular mode Circular Max. Count	High Speed Counter 3 Use high speed counter 3 Counting mode © Linear mode © Circular mode Circular Max. Count			
Reset         Z phase, software reset         Imput Setting           Input Setting         Increment pulse input         Imput Setting	Reset         Z phase, software reset         Image: so			
Interrupt Input INO Interrupt IN1 Normal IN1 IN4 Normal IN5 Normal I	IN2 Normal V IN3 Normal V			
	CP1L-M Offline			

#### Pulse Output 0 Settings

PLC Setup setting details
Do not use high-speed counter 0.
Do not use the pulse output 0 origin search function.
-

imings   Input constar Base Settings	·			ce Built-in Input		tput 0 Pul:
Undefined Origin	Hold	<b></b>	Search/Return Ir	nitial Speed	÷ pps	
Limit Input Signal Op	eration Search	Only 💌	Speed Curve	Trape	ezium 💌	-
Limit Input Signal	NC	•				
Define Origin Operatio	n Settings				– Origin	n Return
Use define origin op	peration				Spee	
Search Direction	CW	💌 Search	High Speed	0 <u>-</u> pp:	s   O	± pps
Detection Method	Methd 0	💌 Search	Proximity Speed	0 <u>-</u> pp:	S Acce	leration Ratio
Search Operation	Invers 1	💌 Search	Compensation Value	0		-
Operation Mode	Mode 0	🔄 Search.	Acceleration Ratio	0	Dece	eleration Ratio
Origin Input Signal	NC	💌 Search	Deceleration Ratio	0 -	0	-
Proximity Input Signal	NC	Position	ing Monitor Time	0 ms		

#### Scheduled Interrupt Time Unit Setting

PLC Setup setting details	Data
Set the scheduled interrupt time units to 0.1 ms.	0002 hex

#### Ladder Program

#### Cyclic Task (Task 0)

P_First_	Cycle_Task
Task St	I

 MSKS(690)
0100
#0000

Built-in interrupt input 0 (IN0.04) Unmask (Enable interrupts.)

#### Built-in Input 0 Interrupt Task (Interrupt Task 140)

A280.04		1
/	MSKS(690)	
Pulse Output 0 Output In-progress	0014	Scheduled interrupt 2 (Reset start)
Flag	#0005	Scheduled interrupt time $(5 \times 0.1 \text{ ms}^* = 0.5 \text{ ms})$

\* Select 0.1 ms for the setting units in the PLC Setup.

#### Scheduled Interrupt Task 0 (Interrupt Task 2)

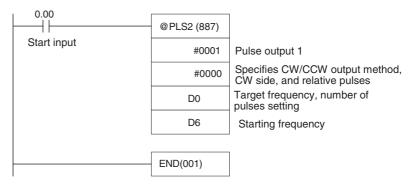
P On		
	PULS(886)	
Always ON Flag	#0000	Pulse output 0
	#0000	Relative pulse specification
	&100000	Number of output pulses (100,000 pulses)
-	 SPED(885)	
	#0000	Pulse output 0
	#0001	Specifies CW/CCW outputs, CW direction, and
	&100000	independent mode. Target frequency (100,000 Hz)
	[]	(,,
L	MSKS(690)	
	0014	Scheduled interrupt 0
	#0000	Stop scheduled interrupt

## Positioning (Trapezoidal Control)

Specifications and When the start input (0.00) goes ON, this example program outputs 600,000 **Operation** pulses from pulse output 0 and turns the motor. 50,000 Hz Acceleration rate Target frequency 300 Hz/4 ms Deceleration rate 200 Hz/4 ms Number of output pulses Starting frequency 600,000 pulses 100 Hz Start input (0.00) Instructions Used PLS2(887) Preparation PLC Setup There are no settings that need to be made in the PLC Setup. **DM Area Settings** PLS2(887) Settings (D00000 to D00007) Setting details Address Data Acceleration rate: 300 Hz/4 ms D0 012C 00C8 Deceleration rate: 200 Hz/4 ms D1

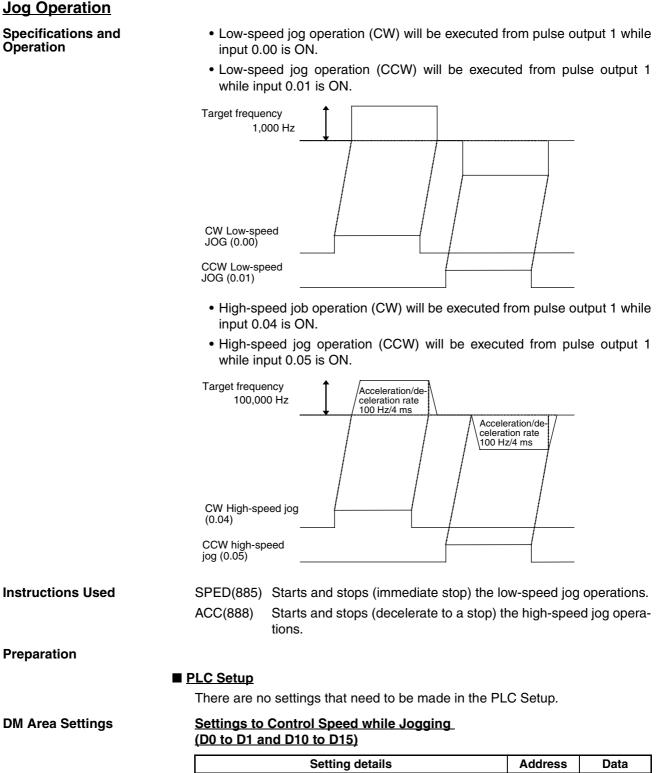
Target frequency: 50,000 Hz	D2	C350
	D3	0000
Number of output pulses: 600,000 pulses	D4	27C0
	D5	0009
Starting frequency: 100 Hz	D6	0064
	D7	0000

#### Ladder Program



#### Remarks

- Absolute pulses can be specified when the origin position has been determined.
- If a target frequency that cannot be reached has been set, the target frequency will be reduced automatically, i.e., triangular control will be performed. In some cases where the acceleration rate is substantially greater than the deceleration rate, the operation won't be true triangular control. The motor will be operated at a constant speed for a short time between the acceleration and deceleration.



Setting details	Address	Data
Target frequency (low speed): 1,000 Hz	D0	03E8
	D1	0000
Acceleration rate: 100 Hz/4 ms	D10	0064

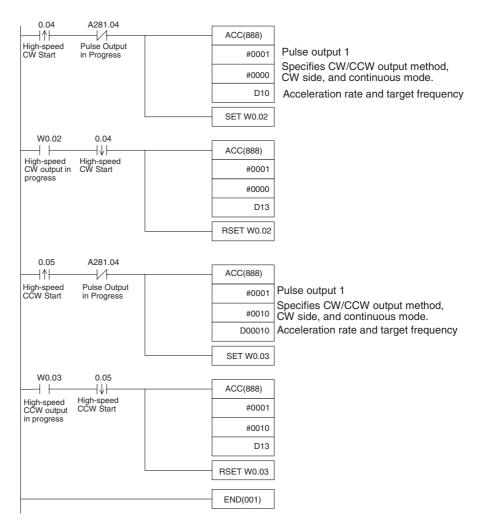
# Section 5-2

Setting details	Address	Data
Target frequency (high speed): 100,000 Hz	D011	86A0
	D12	0001
Deceleration rate: 100 Hz/4 ms (Not used.)	D13	0064
Target frequency (stop): 0 Hz	D14	0000
	D15	0000

## Ladder Program

0.00 A281.04		
	SPED(885)	
Low-speed Pulse Outpu CW Start in Progress	#0001	Pulse output 1
	#0000	Specifies CW/CCW output method, CW side, and continuous mode.
	D0	Target frequency
	SET W0.00	
W0.00 0.00		
↓   ↓	SPED(885)	
Low-speed Low-speed CW output in CW Start progress	#0001	
progress	#0000	
	#0000	
	RSET W0.00	
	L	1
0.01 A281.04		
	SPED(885)	
Low-speed Outputting CCW Start Pulses	#0001	Pulse output 1
	#0010	Specifies CW/CCW output method, CW side, and continuous mode.
	D0	Target frequency
	SET W0.01	
W0.01 0.01		
	SPED(885)	
Low-speed Low-speed CCW output CCW Start	#0001	
in progress	#0010	
	#0000	

## Section 5-2



#### Remarks

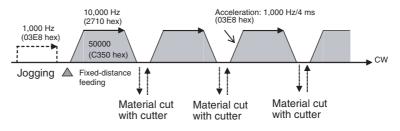
PLS2(887) can be used to set a starting frequency or unequal acceleration and deceleration rates, but there are limitations on the operating range because the end point must be specified in PLS2(887).

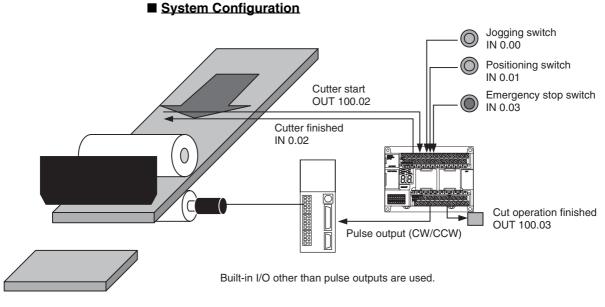
## **Cutting Long Material Using Fixed Feeding**

Specifications and Operation

### Outline

In this example, first jogging is used to position the material and then fixeddistance positioning is used to feed the material.





## Operation

- **1,2,3...** 1. The workpiece is set at the starting position using the Jogging Switch Input (IN 0.00).
  - 2. The workpiece is feed the specified distance (relative) using the Positioning Switch Input (IN 0.01).
  - 3. When feeding has been completed, the cutter is activated using the Cutter Start Output (OUT 100.02).
  - 4. Feeding is started again when the Cutter Finished Input (IN 0.02) turns ON.
  - 5. The feeding/cutting operation is repeated for the number of times specified for the counter (C0, 100 times).
  - 6. When the operation has been completed, the Cutting Operation Finished Output (OUT 100.03). is turned ON.

The feeding operation can be canceled and operation stopped at any point using the Emergency Switch Input (IN 0.03).

Instructions Used

SPED(885) PLS2(887)

#### Preparation

#### PLC Setup

There are no settings that need to be made in the PLC Setup.

#### ■ DM Area Settings

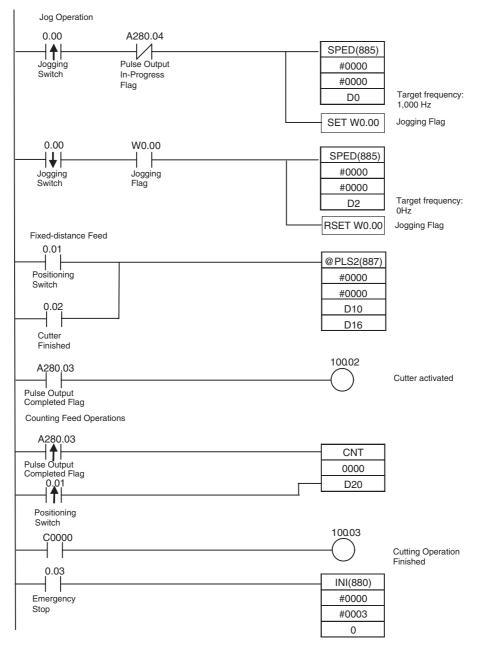
#### Speed Settings for Jogging (D0 to D3)

Setting details	Address	Data
Target frequency: 1,000 Hz	D0	03E8
	D1	0000
Target frequency: 0 Hz	D2	0000
	D3	0000

#### Settings for PLS2(887) for Fixed-distance Feeding (D10 to D20)

Setting details	Address	Data
Acceleration rate: 1,000 Hz/4 ms	D10	03E8
Deceleration rate: 1,000 Hz/4 ms	D11	03E8
Target frequency: 10,000 Hz	D12	2710
	D13	0000
Number of output pulses: 50,000 pulses	D14	C350
	D15	0000
Starting frequency: 0000 Hz	D16	0000
	D17	0000
Counter setting: 100 times	D20	0100

## Ladder Program



#### Remarks

- PLS22(887) used a relative pulse setting. This enables operation even if the origin is not defined. The present position in A276 (lower 4 digits) and A277 (upper 4 digits) is set to 0 before pulse output and then contains the specified number of pulses.
  - ACC(888) can be used instead of SPED(885) for the jog operation. If ACC(888) is used, acceleration/deceleration can be included in the jog operation.

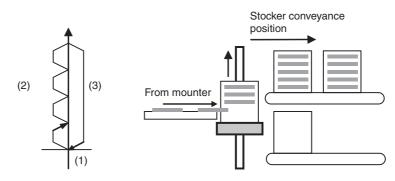
## Vertically Conveying PCBs (Multiple Progressive Positioning)

# Specifications and Operation

#### ■ Outline

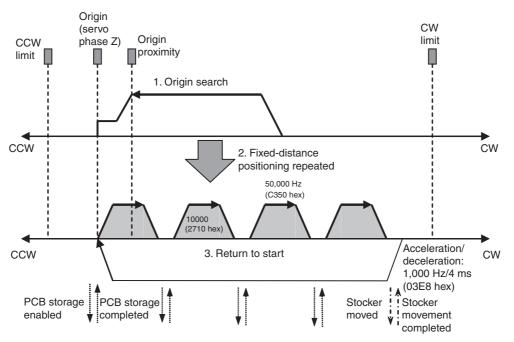
- *1,2,3...* 1. PCBs with components mounted are stored in a stocker.
  - 2. When a stocker becomes full, it is moved to the conveyance point.

### Positioning Operation for Vertical Conveyor

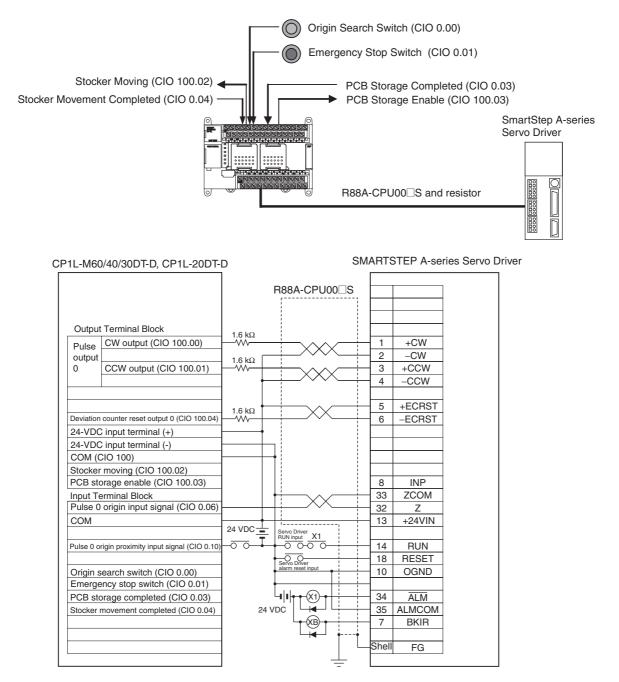


## Operation Pattern

- *1,2,3...* 1. An origin search is performed.
  - 2. Fixed-distance positioning is repeated.
  - 3. The system is returned to the original position.



## Wiring Example Using SmartStep A-series Servo Driver



#### Operation

- *1,2,3...* 1. An origin search is performed using the Origin Search Switch (CIO 0.00).
  - 2. When the origin search is finished, the PCB Storage Enabled Output (CIO 100.03) is turned ON.
  - 3. When a PCB has been stored, the stocker is raised (relative positioning) using the PCB Storage Completed Input (CIO 0.03).
  - 4. Storing PCBs is repeated until the stocker is full.
  - 5. The number of PCBs in the stocker is counted with counter C0 by counting the number of times the stocker is raised.

6. When the stocker is full, it is moved (CIO 100.02) and only the conveyor is lowered (absolute positioning) when stoker movement is completed (CIO 0.04).

The operation can be canceled and pulse output stopped at any point using the Emergency Switch Input (CIO 0.01).

#### Preparation

#### PLC Setup

	Setting details	
E	nable origin search function for pulse output 0.	

Note The origin search enable setting is read when the power supply is turned ON.

🙀 PLC Settings - NewPLC1	×
File Options Help	
Timings   Input constant   Serial Port 1   Serial Port 2   Peripheral Service   Built-in Input Pulse Output 0   Puls 4 +	
Base Settings Undefined Origin Hold Search/Return Initial Speed pps	
Limit Input Signal Operation Search Only 💌 Speed Curve Trapezium 💌	
Limit Input Signal NC 💌	
Define Origin Operation Settings	
✓         Use define origin operation         Speed	
Search Direction CCW Search High Speed 50000 pps 0 pps	
Detection Method Method Search Proximity Speed 1000 🚍 pps Acceleration Ratio	
Search Operation Invers 1 Search Compensation Value 0	
Operation Mode Mode 1 💌 Search Acceleration Ratio	
Origin Input Signal NO Search Deceleration Ratio	
Proximity Input Signal NO 💌 Positioning Monitor Time 0 🚔 ms	
CD11-M Offline	

### **DM Area Settings**

#### Settings for PLS2(887) for Fixed-distance Positioning (D0 to D7)

Setting details	Address	Data
Acceleration rate: 1,000 Hz/4 ms	D0	03E8
Deceleration rate: 1,000 Hz/4 ms	D1	03E8
Target frequency: 50,000 Hz	D2	C350
	D3	0000
Number of output pulses: 10,000 pulses	D4	2710
	D5	0000
Starting frequency: 0 Hz	D6	0000
	D7	0000

#### Settings for PLS2(887) to Return to Start (D10 to D17)

Setting details	Address	Data
Acceleration rate: 300 Hz/4 ms	D10	012C
Deceleration rate: 200 Hz/4 ms	D11	00C8
Target frequency: 50,000 Hz	D12	C350
	D13	0000

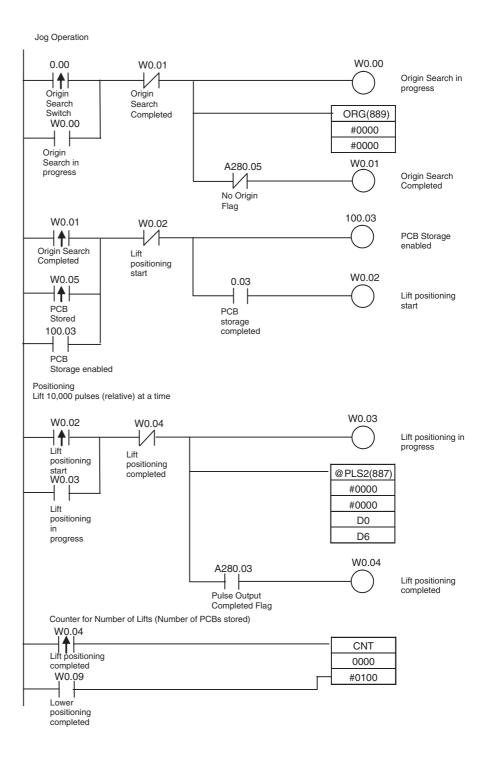
# Section 5-2

Setting details	Address	Data
Number of output pulses: $10,000 \times 15$ pulses	D14	49F0
	D15	0002
Starting frequency: 100 Hz	D16	0000
	D17	0000

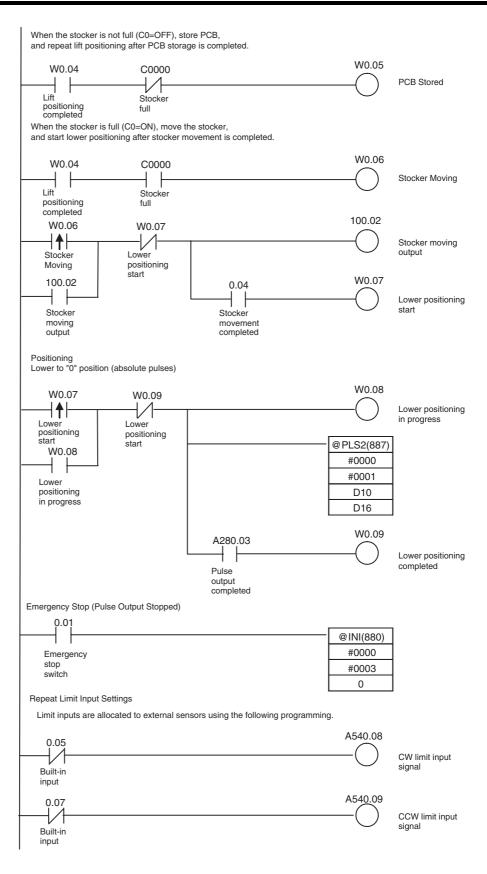
## Number of Repeats of Fixed-distance Positioning Operation (D20)

Setting details	Address	Data
Number of repeats of fixed-distance positioning operation (number of PCBs in stocker)	D20	0015

## Ladder Program



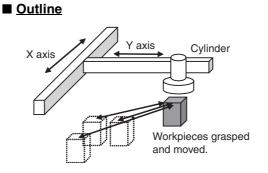
## Section 5-2



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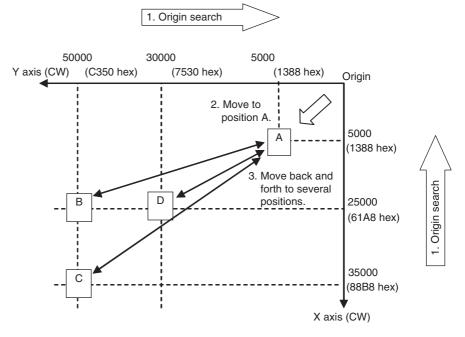
## Palletize: Two-axis Multipoint Positioning

Specifications and Operation



## ■ Operation Pattern

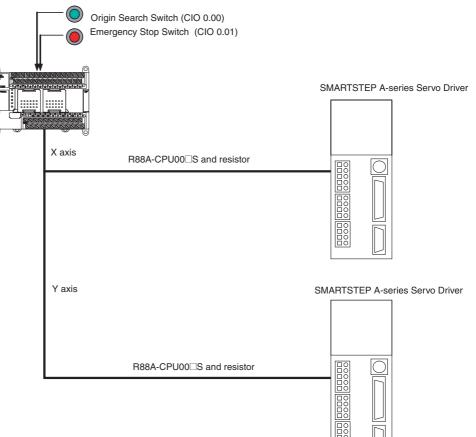
- 1,2,3... 1. An origin search is performed.
  - 2. A workpiece is grasped and moved to position A.
  - 3. The workpiece is grasped at one position and moved back and forth to several assembly positions.



Note The X and Y axes are moved independently, i.e., interpolation is not performed.

## Section 5-2

## Wiring Example Using SmartStep A-series Servo Driver

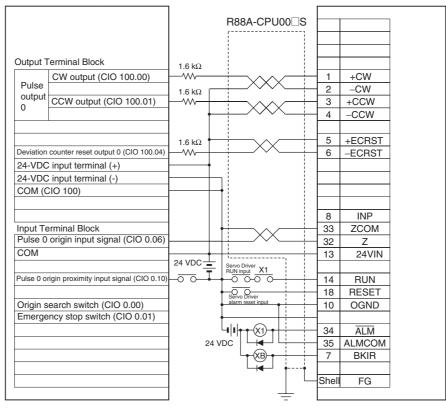


## Section 5-2

## X Axis

CP1L-M60/40/30DT-D, CP1L-L20DT-D

SMARTSTEP A-series Servo Driver



## Y Axis

CP1L-M60/40/30DT-D, CP1L-L20DT-D

#### SMARTSTEP A-series Servo Driver

Г

			R88A-CPU00	D⊡S			]
Output T Pulse output 1	Ferminal Block CW output (CIO 100.02) CCW output (CIO 100.03)	1.6 kΩ 			1 2 3 4	+CW -CW +CCW -CCW	
24-VDC 24-VDC	counter reset output 1 (CIO 100.05) C input terminal (+) C input terminal (-) CIO 100)	1.6 kΩ			6	+ECRST -ECRST	
	erminal Block origin input signal (CIO 0.07)	24 VDC	Serve Driver		8 33 32 13	INP ZCOM Z 24VIN	
Origin s	rigin proximity input signal (CIO 0.11) search switch (CIO 0.00) ency stop switch (CIO 0.01)		Servo Driver RUN input X1 OOOO Servo Driver alarm reset input		14 18 10	RUN RESET OGND	
		24		••	34 35 7	ALM ALMCOM BKIR	
		]	-	_	Shell	FG	]

#### 268

#### Operation

*1,2,3...* 1. An origin search is performed using the Origin Search Switch (CIO 0.00).

- When the origin search is finished, the following operations are performed continuously. Move to A.
   Move to B and return to A.
   Move to C and return to A.
  - Move to D and return to A.
  - 3. An emergency stop can be performed using the Emergency Stop Input (CIO 0.01)

#### Preparation

#### PLC Setup

Setting details		
Enable origin search function for pulse output 0 and 1.		

Note The origin search enable setting is read when the power supply is turned ON.

File       Options       Help         Timings       Input constant       Serial Port 1       Serial Port 2       Peripheral Service       Built-in Input       Pulse Output 0       Pulst I         Base Settings       Undefined Origin       Hold       Search/Return Initial Speed       Image: pps         Limit Input Signal Operation       Search Only       Speed Curve       Trapezium       Image: pps         Define Origin Operation Settings       Image: pps       Origin Return       Speed       Image: pps         V Use define origin operation       CCW       Search High Speed       50000       pps         Search Direction       CCW       Search Proximity Speed       1000       pps         Operation Method       Methd 0       Search Compensation Value       Image: pps         Search Operation       Invers 1       Search Compensation Value       Image: pps         Operation Mode       Mode 1       Search Acceleration Ratio       Image: pps         Origin Input Signal       NO       Search Deceleration Ratio       Image: pps         Proximity Input Signal       NO       Positioning Monitor Time       Image: pps         Image: proximity Input Signal       NO       Positioning Monitor Time       Image: pps	R PLC Settings - NewPLC1
Base Settings       Undefined Origin       Hold       Y       Search/Return Initial Speed       0	File Options Help
Undefined Origin       Hold       Search/Return Initial Speed       Image: pps         Limit Input Signal Operation       Search Only       Speed Curve       Trapezium         Limit Input Signal       NC       Image: pps       Image: pps         Define Origin Operation Settings       Image: pps       Image: pps       Image: pps         Image: Use define origin Operation       Search High Speed       50000       pps         Search Direction       CCW       Search Proximity Speed       Image: pps         Detection Method       Method 0       Search Proximity Speed       Image: pps         Search Operation       Invers 1       Search Compensation Value 0       Image: pps         Operation Mode       Mode 1       Search Acceleration Ratio       Image: pps         Origin Input Signal       NO       Search Deceleration Ratio       Image: pps	Timings   Input constant   Serial Port 1   Serial Port 2   Peripheral Service   Built-in Input   Pulse Output 0   Pulse   + +
Define Origin Operation Settings       Origin Return         Image: Search Direction       CCW       Search High Speed       50000 and pps         Search Direction       CCW       Search High Speed       50000 and pps         Detection Method       Method       Search Proximity Speed       1000 and pps         Search Operation       Invers 1       Search Compensation Value       Image: Compensation Value       Image: Compensation Value         Operation Mode       Mode 1       Search Acceleration Ratio       2000 and 0       Image: Compensation Value       Image: Compensation Value         Origin Input Signal       NO       Search Deceleration Ratio       2000 and 0       Image: Compensation Value       Image: Compensation Value	Undefined Origin Hold Search/Return Initial Speed
	Define Origin Operation Settings       Origin Return         Image: Search Direction       CCW       Search High Speed       50000 ± pps         Search Direction       CCW       Search Proximity Speed       1000 ± pps         Detection Method       Method 0       Search Proximity Speed       1000 ± pps         Search Operation       Invers 1       Search Compensation Value       0       ±         Operation Mode       Mode 1       Search Acceleration Ratio       2000 ±       Deceleration Ratio         Origin Input Signal       NO       Search Deceleration Ratio       2000 ±       0       ±
CP1L-M Offline	

erial Port 1   Serial F Base Settings	ort 2 Peripheral	Service   Bu	ilt-in Input Pulse C	lutput 0 Pulse	e Output 1   Ir	nverter Posit 💶
Undefined Origin	Hold	•	Search/Return I	nitial Speed 0	⊥ pps	:
Limit Input Signal O	peration Search	h Only 💌	Speed Curve	Tr	apezium _	-
Limit Input Signal	NC	-				
Define Origin Operat Use define origin Search Direction Detection Method Search Operation Operation Mode Origin Input Signal	Operation CCW Methd 0 Invers 1 Mode 1 N0	<ul> <li>Search</li> <li>Search</li> <li>Search</li> <li>Search</li> <li>Search</li> </ul>	High Speed Proximity Speed Compensation Valu Acceleration Ratio Deceleration Ratio	1000 🚽	pps Acce	pps eleration Ratio
Proximity Input Sign		Posidor	ing Monitor Time		ms	

## ■ <u>DM Area Settings</u>

## Starting Frequency

Setting details	Address	Data
X-axis starting frequency	D0	0000
Y-axis starting frequency	D2	0000

## PLS2(887) Settings to Move from Origin to Position A

	Setting details	Address	Data
X axis	Acceleration rate: 2,000 Hz/4 ms	D10	07D0
	Deceleration rate: 2,000 Hz/4 ms	D11	07D0
	Target frequency: 100,000 Hz	D12	86A0
		D13	0001
	Number of output pulses: 5,000 pulses	D14	1388
		D15	0000
Y axis	Acceleration rate: 2,000 Hz/4 ms	D20	07D0
	Deceleration rate: 2,000 Hz/4 ms	D21	07D0
	Target frequency: 100,000 Hz	D22	86A0
		D23	0001
	Number of output pulses: 5,000 pulses	D24	1388
		D25	0000

## PLS2(887) Settings to Move from Position A to Position B

	Setting details	Address	Data
X axis	Acceleration rate: 2,000 Hz/4 ms	D30	07D0
	Deceleration rate: 2,000 Hz/4 ms	D31	07D0
	Target frequency: 100,000 Hz	D32	86A0
		D33	0001
	Number of output pulses: 25,000 pulses	D34	61A8
		D35	0000

# Section 5-2

	Setting details	Address	Data
Y axis	Acceleration rate: 2,000 Hz/4 ms	D40	07D0
	Deceleration rate: 2,000 Hz/4 ms	D41	07D0
	Target frequency: 100,000 Hz	D42	86A0
		D43	0001
	Number of output pulses: 50,000 pulses	D44	C350
		D45	0000

## PLS2(887) Settings to Move from Position A to Position C

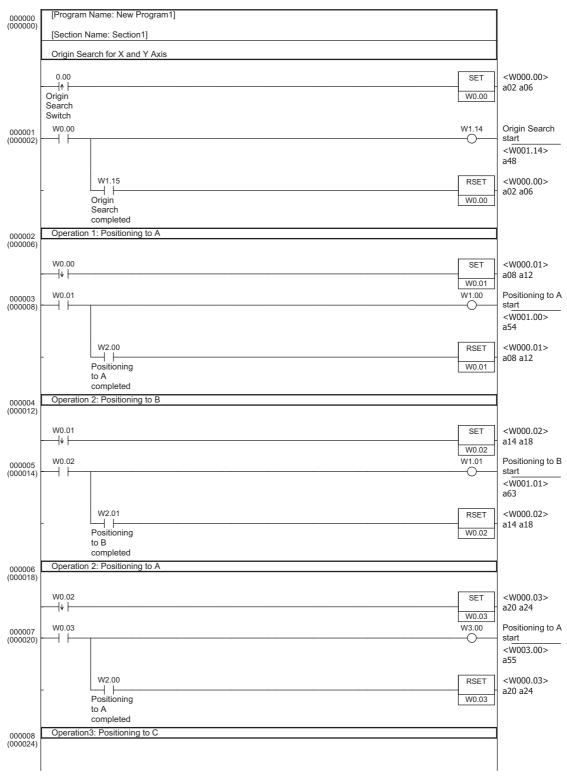
	Setting details	Address	Data
X axis	Acceleration rate: 2,000 Hz/4 ms	D50	07D0
	Deceleration rate: 2,000 Hz/4 ms	D51	07D0
	Target frequency: 100,000 Hz	D52	86A0
		D53	0001
	Number of output pulses: 35,000 pulses	D54	88B8
		D55	0000
Y axis	Acceleration rate: 2,000 Hz/4 ms	D60	07D0
	Deceleration rate: 2,000 Hz/4 ms	D61	07D0
	Target frequency: 100,000 Hz	D62	86A0
		D63	0001
	Number of output pulses: 50,000 pulses	D64	C350
		D65	0000

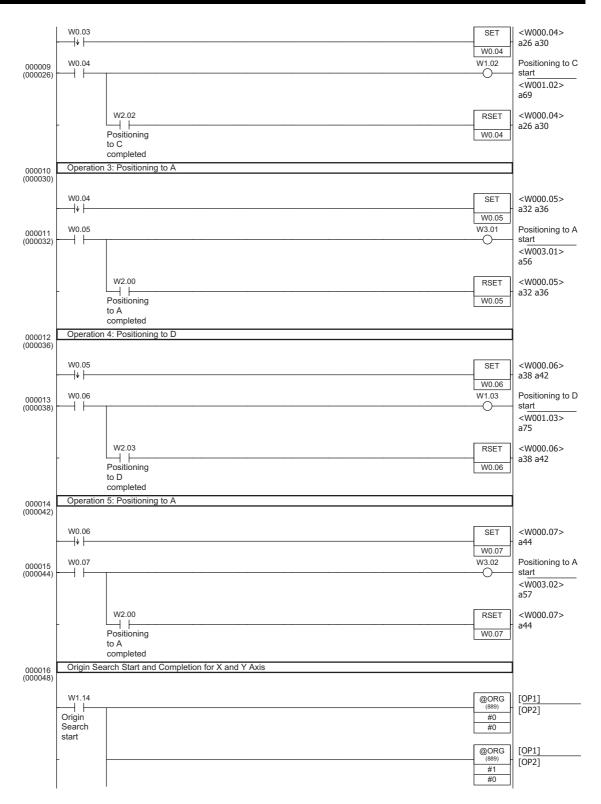
## PLS2(887) Settings to Move from Position A to Position D

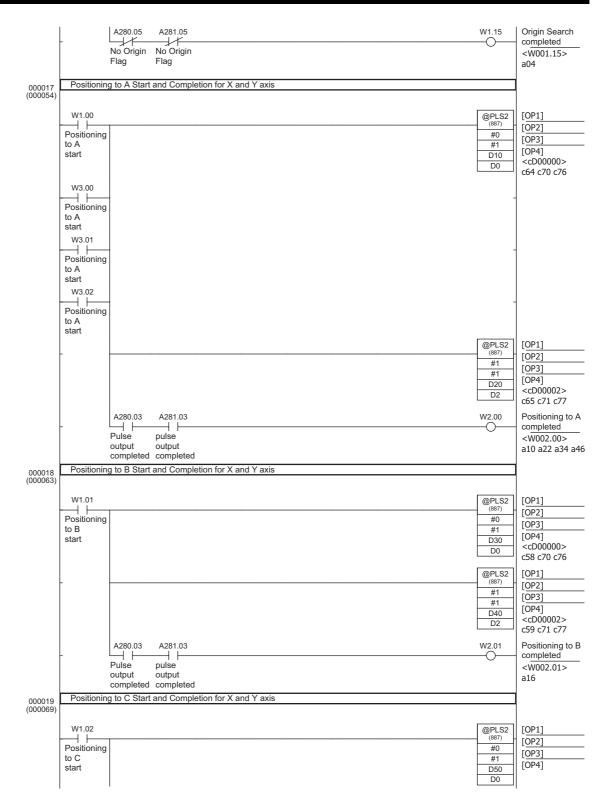
	Setting details	Address	Data
X axis	Acceleration rate: 2,000 Hz/4 ms	D70	07D0
	Deceleration rate: 2,000 Hz/4 ms	D71	07D0
	Target frequency: 100,000 Hz	D72	86A0
		D73	0001
	Number of output pulses: 25,000 pulses	D74	61A8
		D75	0000
Y axis	Acceleration rate: 2,000 Hz/4 ms	D80	07D0
	Deceleration rate: 2,000 Hz/4 ms	D81	07D0
	Target frequency: 100,000 Hz	D82	86A0
		D83	0001
	Number of output pulses: 30,000 pulses	D84	7530
		D85	0000

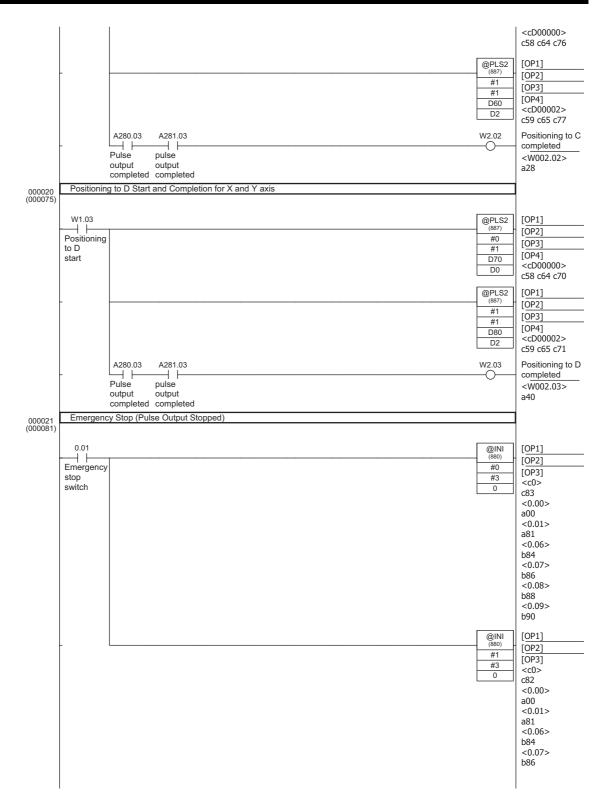
## Section 5-2

## Ladder Program







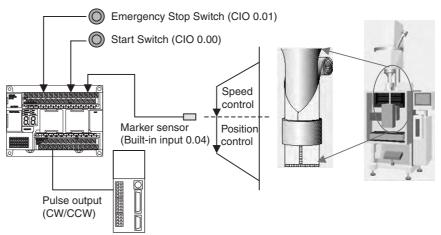


		<0.08> b88 <0.09> b90
000022 (000084)	Limit Input Setting	
()	0.04 A540.08 Built-in	CW limit input signal X axis
000023 (000086)	input	CCW limit input signal X axis
000024 (000088)	Built-in A541.08	CW limit input signal Y axis
000025 (000090)	input	CCW limit input signal Y axis
	Built-in input	

## Feeding Wrapping Material: Interrupt Feeding

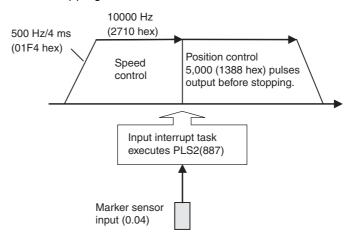
Specifications and Operation

## Feeding Wrapping Material in a Vertical Pillow Wrapper



## Operation Pattern

Speed control is used to feed wrapping material to the initial position. When the marker sensor input is received, fixed-distance positioning is performed before stopping.



## Operation

- **1,2,3...** 1. Speed control is used to feed wrapping material to the initial position when the Start Switch (CIO 0.00) is activated.
  - 2. When the Marker Sensor Input (0.04) is received, PLS2(887) is executed in interrupt task 140.
  - 3. Fixed-distance positioning is executed with PLS2(887) before stopping.
  - 4. An emergency stop is executed to stop pulse output with the Emergency Stop input (0.01).

## Preparation

## PLC Setup

Setti	ng details
Enable using built-in input	IN0 as an interrupt input.

## **Note** The interrupt input setting is read when the power supply is turned ON.

PLC Settings - NewPLC1			
File Options Help			
Serial Port 1   Serial Port 2   Peripheral Service   Built-in Input   Pulse Output 0   Pulse Output 1   Inverter Posit			
Base Settings Undefined Origin Hold Search/Return Initial Speed			
Limit Input Signal Operation Search Only Speed Curve Trapezium Speed Curve			
Define Origin Operation Settings           Image: Comparison of the origin operation         Origin Return           Image: Comparison operation         Speed			
Search Direction CCW Search High Speed 50000 pps 0 m pps			
Detection Method Method Search Proximity Speed 1000 - pps Acceleration Ratio			
Search Operation Invers 1 🔽 Search Compensation Value 0 📑			
Operation Mode 0 💌 Search Acceleration Ratio 2000 🛫 Deceleration Ratio			
Origin Input Signal NC 💌 Search Deceleration Ratio 2000 🔺 0 👘			
Proximity Input Signal NC  Positioning Monitor Time  ms			
CP1L-M Offli			

## ■ <u>DM Area Settings</u>

## Speed Control Settings to Feed Wrapping Material to Initial Position

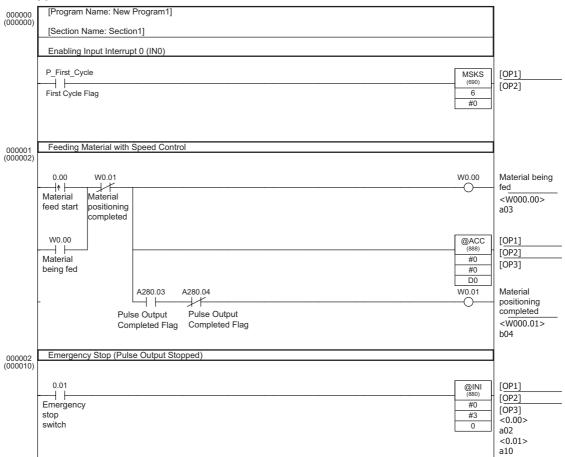
Setting details	Address	Data
Acceleration rate: 1,000 Hz/4 ms	D0	03E8
Target frequency: 10,000 Hz	D1	2710
	D2	0000

#### Positioning Control Settings for Wrapping Material

Setting details	Address	Data
Acceleration rate: 500 Hz/4 ms	D10	01F4
Deceleration rate: 500 Hz/4 ms	D11	01F4
Target frequency: 10,000 Hz	D12	2710
	D13	0000
Number of output pulses: 5,000 pulses	D14	1388
	D15	0000
Starting frequency: 0 Hz	D16	0000
	D17	0000

## Ladder Program

# Cyclic Task Program (Executed at Startup)



# Program for Interrupt Task 140

000000 (000000)	[Program Name: New Program2] [Section Name: Section1]		
	Interrupt Task for Master Sensor ON Starting interrupt Feed		
	P_On Hag Always ON Flag	PLS2 (887) #0 #0 D10 D16	[OP1] [OP2] [OP3] [OP4]

# 5-3 Inverter Positioning

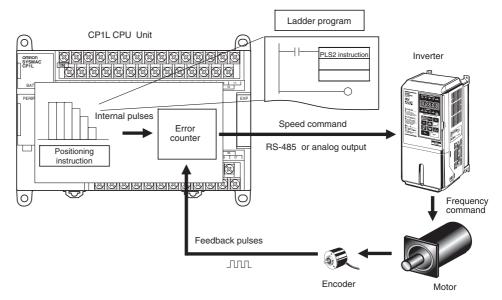
## 5-3-1 Features

Simple, accurate high-speed positioning can be achieved using an inverter. This enables a far more economical positioning system than with a servomotor.

Feedback Control with Error Counter

A position error counter built into the CP1L CPU Unit enables high-precision positioning with an Inverter using feedback control. The PULSE OUTPUT instruction is used in the ladder program in the CP1L CPU Unit to output internal pulses to a built-in error counter.

The error counter calculates the position error from the number of input internal pulses and the number of feedback pulses from the rotary encoder, and sends speed commands to the inverter so that the position error goes to zero.



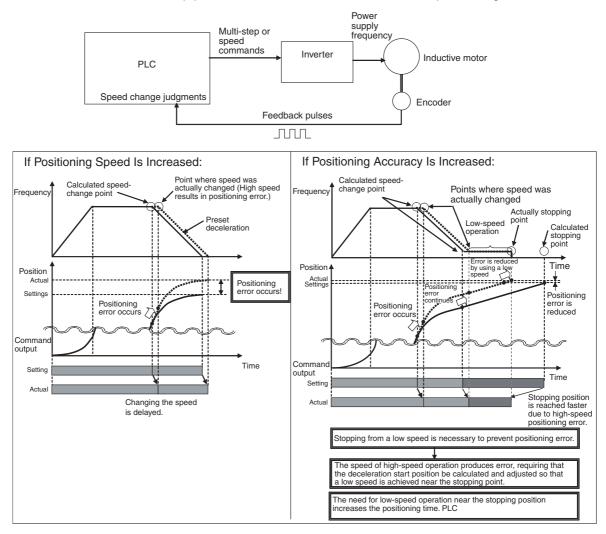
## Reducing Positioning Time

With traditional inverter positioning, positioning patterns are created in which set positions are detected to trigger changes in the speed. Pulses are read from the encoder and compared to set values during positioning to enable determining when a position requiring a speed change has been reached. This results in positioning errors at speed-change points when stopping at high speed, reducing stopping precision. To ensure high-precision positioning, sufficient deceleration was required before stopping, but this increases the positioning time.

With the CP1L's inverter positioning function, feedback pulses are used so that the prevent position is always known, increasing positioning accuracy. And because preset positioning patterns are used for deceleration and stopping, positioning time is reduced.

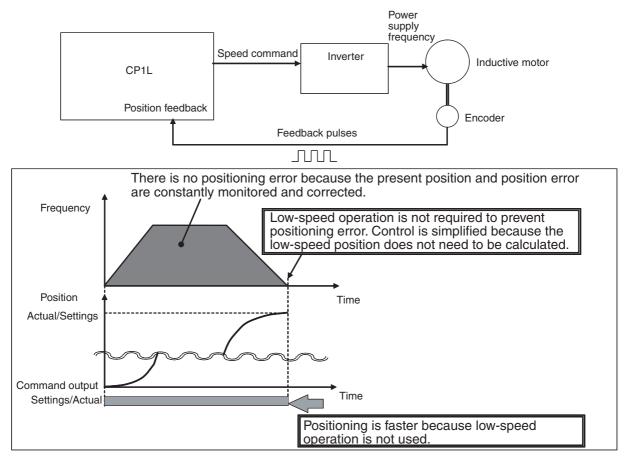
#### **Traditional Inverter Positioning**

The PLC counts the feedback pulses from the encoder using a high-speed counter. When a deceleration point is reached, the speed is changed to control the stop position. If the precision of the stop position must be increased, the stop position must also be detected to control positioning.



#### Inverter Positioning with the CP1L

With the CP1L's inverter positioning function, feedback is constantly read for the positioning data while controlling the position.



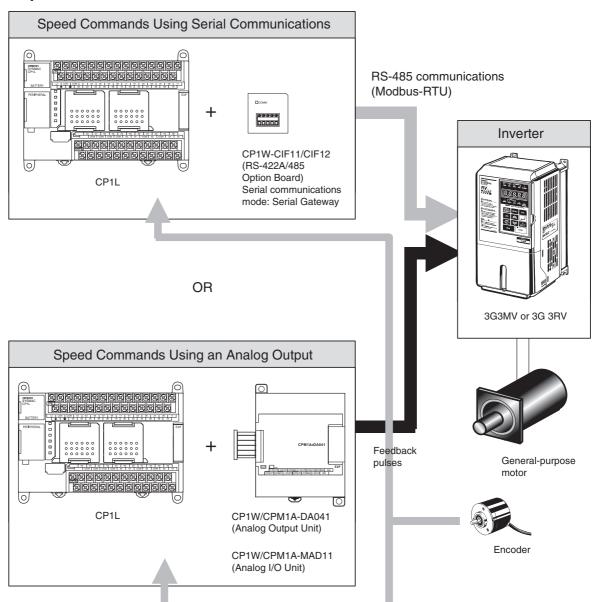
Note

- (1) The CP1L's inverter positioning function is designed to increase positioning speed and stopping precision by reading position information and using a feedback loop with an error counter to switch speeds. It does not increase the response, stopping precision, or speed change rate of the inverter and motor. These are characteristics of the inverter and motor. Refer to user documentation on your inverter and motor for details.
  - (2) The corresponding pulse output number (0 or 1) cannot be used for the PULSE WITH VARIABLE DUTY FACTOR instruction (PWM) if inverter positioning 0 or 1 is used. The high-speed counter of the same number (0 or 1) is used to input the feedback pulse.

# 5-3-2 System Configuration

## <u>Speed Commands</u> <u>Using Serial</u> <u>Communications or</u> <u>Analog Outputs</u>

There are two ways to send speed commands to the inverter: serial communications and analog outputs.

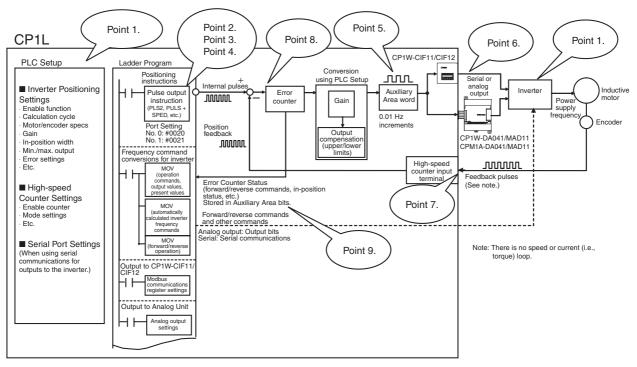


Note

- (1) The inverter positioning function uses either serial communications or an analog output, and is thus possible with a CP1L CPU Unit with either transistor or relay outputs.
  - (2) The inverter positioning function does not use external pulse outputs. Normal outputs are used for commands to the inverter (e.g., forward/reverse commands).

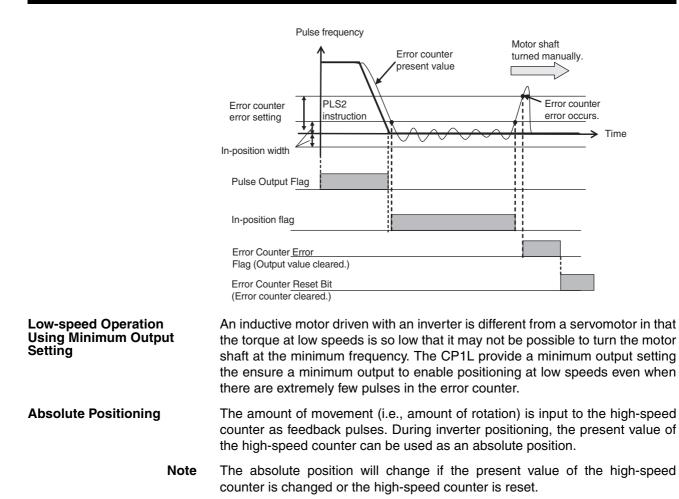
## 5-3-3 Functional Overview

## **Operation**



- 1. To use inverter positioning, the motor and encoder specifications, feedback gain, and other parameters must be set in the PLC Setup. The highspeed counter and inverter must also be set.
- 2. Pulse output instructions, such as PLS2 or PULS with SPED, are used to execute positioning. Although normally the pulse output instructions are used to output pulses from CP1L output contacts, when inverter positioning 0 or inverter positioning 1 is enabled in the PLC Setup, the internal position error counter (called simply the "error counter") is enabled and the pulse output instruction will output internal pulses to the error counter. Both error counters 0 and 1 can be used at the same time.
- 3. For the number of pulses (i.e., the amount of movement) set in the pulse output instruction, use the number of feedback pulses from the encoder. For the pulse frequency set in the pulse output instruction, use the motor power supply frequency converted to the feedback pulse frequency from the encoder. (Refer to *5-3-7 Determining the Internal Pulse Output Frequency* for details.)
- 4. Specify an inverter positioning port for the pulse output instruction (port 0: 0020, port 1: 0021). The internal pulses will be output to the error counter for the specified port.
- The number of pulses remaining in the error counter is converted to a power supply frequency command for the inverter according to a value set in the PLC Setup and output to a word in the Auxiliary Area in increments of 0.01 Hz.
- 6. The frequency command value output to the Auxiliary Area is output to the inverter from the ladder program according to the inverter command method (i.e., RS-485 communications or analog output). (Refer to *5-3-9 Automatic Calculation of Inverter Frequency Command Value* for details.)

	7. When a speed command is sent to the inverter, the motor will turn at the command speed and feedback pulses (i.e., the amount of movement) from the encoder will be returned to a high-speed counter of the CP1L. The CP1L will continue to send a speed command to the inverter until the error counter (i.e., the position error) goes to zero, i.e., until positioning has been completed.	
	8. When the error counter goes to zero, the speed command to the inverter will also go to zero. Even after the completion of internal pulse output (i.e., position command) from the pulse output instruction, the CP1L will maintain the error counter so that is remains at zero.	
	<ol> <li>The status of the error counter (such as the command direction and in-po- sition status) will be stored in the Auxiliary Area. This status can be read from the user program to enable controlling output of commands to the in- verter.</li> </ol>	
	For example, if a change in the load causes the motor shaft to turn, feedbac pulses from the encoder will enter the error counter, the value in the error counter will be reduced, and the Reverse Command Flag in the Auxiliary Are will turn ON. By writing the ladder program to output a reverse operation con mand to the inverter for the Reverse Command Flag, a command in the oppo site direction of motor shaft movement will be output from the CP1L to the inverter, causing the motor to return to its original position. This compensation operation to continuously maintain the current stop position is called a serv lock.	
Other Functions		
Servo Locks with Vector Control Inverters	The servo lock on an inverter can be used to stop positioning. By using the inverter's servo lock, the inverter positioning function and the output command to the inverter can be stopped from the user program without using feedback control even if the error counter value is not zero. This enables servo locks when using an inverter with vector control.	
<b>Clearing the Error Counter</b> for Errors If the motor shaft is moved manually for error stops or when stopped, feedback pulses will accumulate in the error counter very dangerous because it may cause the motor to sudden original position at high speed when operation is started ag such problems, an error counter error output can be produce than a set number of pulses accumulated in the error counter ing operations are stopped.		



5-3-4 Specifications

## Inverter Positioning Specifications

Item	Specification	
Applicable inverters	Inverter that receives frequency commands from an analog input or via Modbus-RTU communications. (Control method: V/f control, vector control, etc.)	
Applicable motors	Depends on the inverter (e.g., squirrel-cage inductive motor)	
Number of position- ing ports and response frequency	Two ports at 100 kHz (J models: 20kHz) (within the speed command range of the pulse output instructions)	
Inverter command output method	Modbus-RTU communications commands or analog output (from ladder program)	
Present value coor-	With origin: Absolute coordinate system	
dinate system	Without origin: Relative coordinate system	
Present value range	32 bits: 8000 000 to 7FFF FFFF hex (range of position com- mand values and present values for pulse output instructions)	
Output modes	Continuous output (Number of pulses not specified.) Independent mode (Number of pulses specified.)	
Acceleration/decel- eration control	Trapezoidal or S-curve acceleration/deceleration	

Item	Specification	
Specifications of number of pulses	Relative positions: 0000 0000 to 7FFF FFFF hex (2,147,483,647 incrementing and decrementing)	
	Absolute positions: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	
	(Ranges of position command values and present values for pulse output instructions)	
Origin searches	Motor driver and signal wire modes: 3 modes Origin search modes: 2 modes Origin detection methods: 3 methods	
Feedback pulse	High-speed counter 0 and high-speed counter 1 (fixed)	
input ports	Maximum response frequency: 100 kHz (J models: 20kHz)	
Present value range for feedback pulses	•	
Error counter range	8000 to 7FFF hex (signed)	
Error counter calcu- lation cycle	4 to 1,020 ms (x4)	

Note

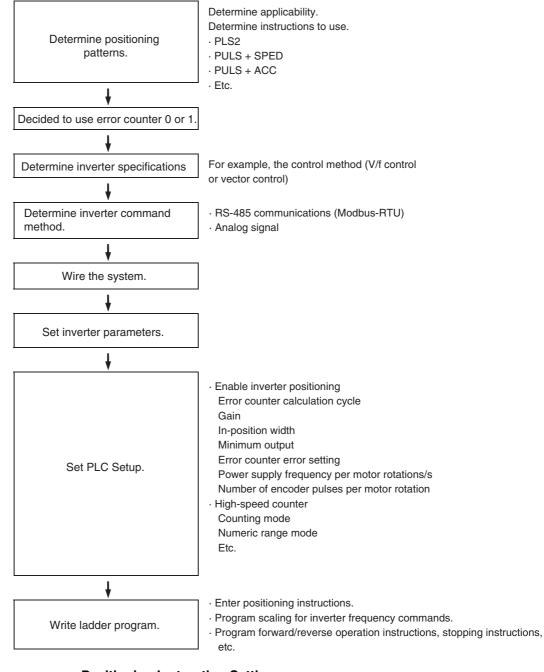
- (1) If inverter positioning 0 is used, pulse output 0 and PWM0 cannot be used. If inverter positioning 1 is used, pulse output 1 and PWM1 cannot be used.
- (2) If inverter positioning 1 is used with a CPU Unit with 14 I/O Points, origin searches cannot be used.
- (3) If the continuous output mode is specified (i.e., if the number of pulses is not specified), be sure to use the high-speed counter (linear mode) so that it does not overflow.

#### High-speed Counter Specifications for Inverter Positioning

Item		Specification	
Response frequency and num- ber of counters		Two 2-phase counters at 50 kHz and two single- phase counters at 100 kHz	
Counting mode		Differential-phase inputs (x4), up/down pulse inputs, or pulse plus direction inputs	
Numeric range mode		Linear mode	
		Note Always set linear mode when using inverter positioning.	
Numeric range		32 bits (-2,147,483,648 to 2,147,483,647)	
Reset method		Phase Z signal (reset input) + software reset, or software reset	
Interrupts (See note.)	Target value matching	Up to 48 target values and interrupt task numbers can be registered.	
	Zone compari- son	Up to 8 sets of upper values, lower values, and interrupt task numbers can be registered.	

**Note** Target value matching and zone comparisons can be used for high-speed counters with a feedback pulse input from an encoder even when using inverter positioning.

# 5-3-5 Application Procedure for Inverter Positioning



#### Positioning Instruction Settings

- PULSE OUTPUT (PLS2) Port: Inverter positioning, Mode: Absolute pulse
- SET PULSES (PULS) Port: Inverter positioning, Mode: Absolute pulse
   + SPEED OUTPUT (SPED) Mode: Independent
- SET PULSES (PULS)
   Port: Inverter positioning, Mode: Absolute pulse
   + ACCELERATION CONTROL (ACC)
   Port: Inverter positioning, Mode: Independent

- MODE CONTROL (INI)
   Port: Inverter positioning, stopping inverter positioning
- HIGH-SPEED COUNTER PV READ (PRV) Port: Inverter positioning, Operation: Reading error counter, inverter positioning status, or error counter present value
- Automatic Calculation of Inverter Frequency Commands
  - For either serial communications or an analog output, the power supply frequency per motor revolutions/s, the number of encoder pulses per motor revolution, and the error counter calculation cycle can be set in the PLC Setup to automatically calculate the inverter frequency command values and store it in A23/A33 in increments of 0.01 Hz.
  - For serial communications, the ladder program is used to output the value in A23/A33 to the inverter using serial communications.
  - For analog output, the value in A23/A33 can be scaled to analog output values and output from the Analog Unit to the inverter.

#### ■ Forward/Reverse Operation Commands, Stopping Commands, Etc.

- The Forward Command Flag (A26.01/A36.01) and Reverse Command Flag (A26.02/A36.02) can be used as input conditions for forward and reverse operation commands.
- The Operation Command Flag (A26.00/A36.00) and In-position Flag (A26.03/A36.03) can be used as input conditions to execute scaling to inverter frequency commands and to execute stop commands.

## 5-3-6 Instruction Specifications

The normal pulse output instructions are used (PLS2, PULS + SPED, or PULS + ACC). One of the inverter positioning ports is specified as the port for the instruction. Just like pulses are output externally for the normal pulse output instructions, error counter pulses are accumulated in the internal error counter when executing inverter positioning.

Port Designation Operand Specifications When executing pulse output instructions or status read instructions for inverter positioning, a port number for inverter positioning is specified for the port operand of the instruction. The following values are used.

0020 hex: Inverter positioning 0

0021 hex: Inverter positioning 1

When reading the present value of inverter positioning, use the following values to specified the port number for inverter positioning.

0030 hex: Inverter positioning 0 (signed) 0031 hex: Inverter positioning 1 (signed)

Set value	Specified port	Applicable instructions
0000	Pulse output 0	
0001	Pulse output 1	
0002	Pulse output 2	
0003	Pulse output 3	
0010	High-speed counter input 0	
0011	High-speed counter input 1	
0012	High-speed counter input 2	
0013	High-speed counter input 3	
0020	Inverter positioning 0	SPED, PULS, ACC, PLS2, INI, PRV, ORG
0021	Inverter positioning 1	SPED, PULS, ACC, PLS2, INI, PRV, ORG

Set value	Specified port	Applicable instructions
0030	Error counter 0 (signed)	PRV
0031	Error counter 1 (signed)	PRV
0100	Interrupt input 0 (counter mode)	
:	:	:
0107	Interrupt input 7 (counter mode)	
1000	PWM output 0	
1001	PWM output 1	

# Applicable Instructions

The following seven instructions can be used to execute inverter positioning. The relationship between the instructions and internal pulse outputs is as follows:

Instruction	Overview	Positio	oning (Independe	nt Mode)	Origin searches	
		Pulse output with no		Pulse output with acceleration/ deceleration		
		acceleration/ deceleration	Trapezoid, same rate for acceleration/ deceleration	Trapezoid, different rates for acceleration/ deceleration		
PULS(886) SET PULSES	Sets the number of internal pulses to output.	Applicable				
SPED(885) SPEED OUTPUT	Controls pulse output without acceleration or deceleration. (The number of internal pulses must be set in advance with PULS(886).)	Applicable				
ACC(888) ACCELERATION CONTROL	Controls pulse output with accel- eration or deceleration using the same rate for both. (The number of internal pulses must be set in advance with PULS(886).)		Applicable			
PLS2(882) PULSE OUTPUT	Controls pulse output with accel- eration or deceleration using a dif- ferent rate for each (The number of internal pulses is also set.)			Applicable		
ORG(889) ORIGIN SEARCH	Actually moves the motor to establish the origin using origin proximity input, origin input, etc.				Applica- ble	
INI(880) MODE CONTROL	Used to stop internal pulse output and inverter positioning. It can also be used to change the present value of pulse output (thus establishing the origin).	Applicable	Applicable	Applicable		
PRV(881) HIGH-SPEED COUNTER PV READ	Reads the present value of the internal pulse output or error counter.	Applicable	Applicable	Applicable		

### Section 5-3

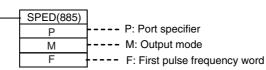
#### SET PULSES: PULS(886)

PULS(886) is used to set the pulse output amount (number of output pulses) for pulse outputs that are started later in the program using SPED(885) or ACC(888) in independent mode.

	PULS(886)       P     P       T     P       T     P       N     P       N     P					
	Operand		Description			
Ρ	Port specifier	0020 hex: Inverter positioning 0				
		0021 hex: Inverter positioning 1				
Т	Pulse type	0000 hex: Relative 0001 hex: Absolute				
Ν	Number of	N (lower 4 digits)	• Relative pulses: 0000 0000 to 7FFF FFFF			
	pulses	N+1 (upper 4 digits)	hex (0 to 2,147,489,647) • Absolute pulses: 8000 0000 to 7FFF FFFF hex (-2,147,489,648 to 2,147,489,647)			

#### SPEED OUTPUT: SPED(885)

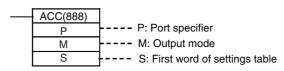
SPED(885) is used to start pulse output without acceleration or deceleration. It is used together with PULS(886). SPED(885) can also be executed during pulse output to change the output frequency.



	Opera	nd	Description	
Ρ	Port specifier		0020 hex: Inverter positioning 0	
			0021 hex: Inverter positioning 1	
М	Output mode	Bits 0 to 3	Mode 0 hex: Continuous 1 hex: Independent	
		Bits 4 to 7	Direction 0 hex: CW 1 hex: CCW	
		Bits 8 to 11	Not used: Always set to 0 hex.	
		Bits 9 to 15	Not used: Always set to 0 hex.	
F	First pulse fre- quency word	F (lower 4 dig- its)	Output Frequency in Hz Pulse output 0 or 1: 0000 0000 to 0001 86A0	
		F+1 (upper 4	hex (0 to 100 kHz)	
		digits)	J models: 0000 0000 to 0000 4E20 hex (0 to 20kHz)	

#### ACCELERATION CONTROL: ACC(888)

ACC(888) outputs pulses to the specified output port at the specified frequency using the specified acceleration and deceleration rate. (Acceleration rate is the same as the deceleration rate.) For positioning, ACC(888) is used in combination with PULS(886). ACC(888) can also be executed during pulse output to change the target frequency or acceleration/deceleration rate.

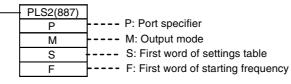


	Opera	nd	Description
Ρ	Port specifier		0020 hex: Inverter positioning 0
		_	0021 hex: Inverter positioning 1
М	Output mode	Bits 0 to 3	Mode 1 hex: Independent
		Bits 4 to 7	Direction 0 hex: CW 1 hex: CCW
		Bits 8 to 11	Not used: Always set to 0 hex.
		Bits 9 to 15	Not used: Always set to 0 hex.
S	First word of settings table	S	Acceleration/Deceleration Rate 1 to 65,535 Hz (0001 to FFFF hex)
		S+1 (lower 4	Target Frequency in Hz
		digits)	Pulse output 0 to 3: 0000 0000 to 0001 86A0
		S+2 (upper 4	hex (0 to 100 kHz)
		digits)	J models: 0000 0000 to 0000 4E20 hex (0 to 20kHz)

# PULSE OUTPUT: PLS2(887)

PLS2(887) outputs a specified number of pulses to the specified port. Pulse output starts at a specified startup frequency, accelerates to the target frequency at a specified acceleration rate, decelerates at the specified deceleration rate, and stops at approximately the same frequency as the startup frequency. Only independent mode positioning is supported.

PLS2(887) can also be executed during pulse output to change the number of output pulses, target frequency, acceleration rate, or deceleration rate. PLS2(887) can thus be used for sloped speed changes with different acceleration and deceleration rates, target position changes, target and speed changes, or direction changes.



	Opera	nd	Description
Ρ	Port specifier		0020 hex: Inverter positioning 0
			0021 hex: Inverter positioning 1
М	Output mode	Bits 0 to 3	Mode 0 hex: Relative pulses 1 hex: Absolute pulses
	Bits 4 to 7		Direction 0 hex: CW 1 hex: CCW
	Bits 8 to 11		Not used: Always set to 0 hex.
		Bits 9 to 15	Not used: Always set to 0 hex.

	Opera	nd	Descr	iption		
S	First word of settings table	S1	Acceleration rate 0001 to FFFF hex (1 to 65,535 Hz)	Specify the increase or decrease in the fre- quency in Hz per pulse		
		S1+1	Deceleration rate 0001 to FFFF hex (1 to 65,535 Hz)	control period (4 ms).		
		S1+2 (lower 4	Target Frequency in Hz			
		digits)	Pulse output 0 or 1: 0000 0000 to 0001 86A0			
		S1+3 (upper 4	hex (0 to 100 kHz)			
		digits)	J models: 0000 0000 to 0000 4E20 hex (0 to 20kHz)			
		S1+4 (lower 4	Number of Pulses			
		digits)		0000 to 7FFF FFFF hex		
		S1+5 (upper 4	(0 to 2,147,489,647)			
		digits)	• Absolute pulses: 8000 0000 to 7FFF FFF hex (-2,147,489,648 to 2,147,489,647)			
F	First word of starting fre-	F (lower 4 dig- its)	Starting Frequency in Hz Pulse output 0 or 1: 0000 0000 to 0001 86A0			
	quency	F+1 (upper 4	hex (0 to 100 kHz)			
		digits)	J models: 0000 0000 to 0000 4E20 hex (0 to 20kHz)			

#### ORIGIN SEARCH: ORG(889)

ORG(889) performs an origin search or origin return operation.

• Origin Search:

Pulses are output to establish the origin based on origin proximity input and origin input signals.

• Origin Return:

The positioning system is returned to the origin.

The parameters for pulse output 0 or pulse output 1 must be set in advance in the PLC Setup to perform either an origin search or origin return operation.



	Opera	and	Description		
Ρ	Port specifier		0020 hex: Inverter positioning 0		
			0021 hex: Inverter positioning 1		
С	Control data	Bits 0 to 3	Not used: Always set to 0 hex		
	Bits 4 to 7		Not used: Always set to 0 hex		
		Bits 8 to 11	Not used: Always set to 0 hex		
		Bits 9 to 15	Mode 0 hex: Origin search 1 hex: Origin return		

### Section 5-3

### MODE CONTROL: INI(880)

INI(880) changes the present value of inverter positioning or stops positioning.



	Opera	nd	Description	
Ρ	Port specifier		0020 hex: Inverter positioning 0	
			0021 hex: Inverter positioning 1	
С	Control data		0002 hex: Changes the PV of the internal pulse output.	
			0003 hex: Stops internal pulse output. Position- ing will continue and the output value will not be cleared.	
			0004 hex: Stops inverter positioning. Internal pulse output will be stopped, positioning will be stopped, and the output value will be cleared. The next operation will not be accepted until the error counter is cleared.	
NP	First word with new PV	NP (lower 4 digits)	New PV 0000 0000 to FFFF FFFF hex	
		NP+1 (upper 4 digits)		

#### HIGH-SPEED COUNTER PV READ: PRV(881)

PRV(881) is used to read the present value and status of inverter positioning. The following status can be read.

- Operation Command Flag
   Forward Command Flag
   Reverse Command Flag
   Internal Pulse Acceleration/ Deceleration Flag
   Error Counter Error Flag
  - Error Counter Alarm Flag
- In-position FlagInternal Pulse Output Flag
- Error Counter Sign Flag



P: Port specifier

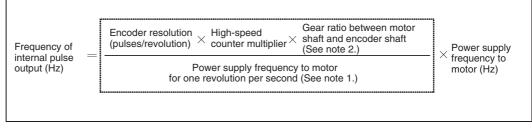
D ---- D: First destination word

	Operand	Description	
Ρ	Port specifier	0020 hex: Inverter positioning 0	
		0021 hex: Inverter positioning 1	
		0030 hex: Error counter 0	
		0031 hex: Error counter 1	
С	Control data	0000 hex: Read present value.	
		0001 hex: Read status.	

<b></b>	Operand			Description
D	<u>_</u>		Lawar 4	
	First destina- tion word for present value	D	Lower 4 digits	When a present value is read, the following data is stored in D and D+1 as an 8-digit hexa- decimal value.
	present value	D+1	Upper 4 digits	P = #0020/#0021: The actual movement from the internal pulse origin.
				P = #0030/#0031: The present value of the error counter.
	Destination word for inverter posi-	D	Bit 0	Operation Command Flag ON: Operation command in progress OFF: Stopped
	tioning status (P = #0020 or #0021)		Bit 1	Forward Command Flag ON: Forward command in progress OFF: Reverse command in progress or stopped
			Bit 2	Reverse Command Flag ON: Reverse command in progress OFF: Forward command in progress or stopped
			Bit 3	In-position Flag ON: In position OFF: Not in position
			Bit 4	Error Counter Error Flag ON: Error occurred in error counter OFF: No error
			Bit 5	Internal Pulse Output Flag ON: Pulses being output OFF: Pulse output stopped
			Bit 6	Internal Pulse Acceleration/Deceleration Flag ON: Acceleration/deceleration in progress for internal pulse output (i.e., frequency being changed) OFF: Constant frequency for internal pulse out- put
			Bit 7	Error Counter Alarm Flag ON: Alarm occurred for error counter OFF: No alarm
			Bit 15	Error Counter Sign Flag ON: Positive OFF: Negative

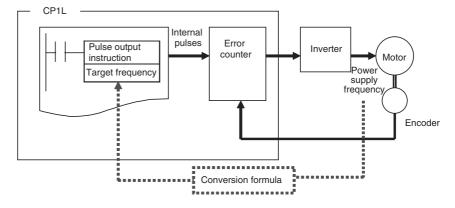
# 5-3-7 Determining the Internal Pulse Output Frequency

Use the following formula to calculate the internal pulse frequency (Hz) to output from the pulse output instruction (e.g., PLS2) based on the power supply frequency (Hz) to be output from the inverter to the motor.



Note (1) Calculate the power supply frequency for one revolution per second from the motor specifications. For example, with a 1,800-r/min (60-Hz) motor (30 r/s), the power supply frequency for one revolution per second would be calculated as follows: 60 [Hz] ÷ 30 [r/s] = 2 [Hz].

(2) The encoder resolution times the counter multiplier times the gear ratio equals the number of pulses output by the encoder for one motor shaft revolution.



Example of Calculating Conversion Factor

#### Conditions

- Frequency for 1 revolution/s for inductive motor: 2 Hz (motor specification)
- Rotary encoder resolution: 1,000 pulses/revolution (encoder specification)
- High-speed counter multiplier: x4 (PLC Setup)
- Gear ratio between motor and encoder shafts: 1/4 (machine specification)

### Calculations

The factor goes into the formula as shown below.

Frequency of internal pulse output (Hz)	=	$\frac{1000 \times 4 \times 1/4}{2}$	×	Power supply frequency to motor (Hz)
	=	$500 \times Power$ supply frequen	cy to	o motor (Hz)

For example, to output a power supply frequency of 10 Hz to the motor:

#### Frequency of internal pulse output = 500 × 10 Hz = 5,000 Hz = 5 kHz

Therefore, set a pulse output frequency of 5 kHz in the pulse output instructions (e.g., PLS2).

# 5-3-8 PLC Setup

The following settings must be made in advance when using inverter positioning 0 or 1.

### **Basic Settings**

The following settings are required to use inverter positioning.

#### Inverter Positioning Function

Setting	Description	Set value	Default	Application	Refresh timing
Use inverter positioning	Select this option to use inverter positioning. High-speed counter 0 will be allocated to inverter posi- tioning 0 and high-speed counter 1 will be allocated to inverter posi- tioning 1. The high-speed counter mode that is set will be used.	Use/Do not use	Do not use		When CPU Unit power is turned ON
	Note If inverter positioning 1 is used with a CPU Unit with 14 I/O Points, origin searches cannot be used. (Origin searches are possi- ble even if inverter position- ing 0 is used.)				

### Gain

Setting	Description	Set value	Default	Application	Refresh timing
Gain	The error counter present value times the gain setting will be used as the out- put command to the inverter. Inverter output command Gain > 1 Gain > 1 Gain < 1 Error counter present value Note The setting is made in incre- ments of 0.1. The gain will thus be 1/10 of the set value. For example, if 50 is set, the gain will be 5. It's best to initially try a gain of from 5 to 10 (settings of 50 to 100) and then adjust from there.	1 to 65,535 (0.1 increments) 0 sets a value of 10 (0.1 incre- ments)	0: 10 (0.1 incre- ments) This will set a gain of 1.	Adjusting the following char- acteristic of the motor	When CPU Unit power is turned ON

### In-position Range

Setting	Description	Set value	Default	Application	<b>Refresh timing</b>
In-position range	The In-position Flag (A26.03) will turn ON when pulse output to the error counter has been completed and the error counter present value is less equal to or less than the in-position range.	1 to 65,535 Setting 0 is the same as setting 1.	0: 1	When using the inverter's servo lock, the command value to the inverter is set to zero during in-position status.	When CPU Unit power is turned ON

### Minimum Output Value

Setting	Description	Set value	Default	Application	Refresh timing
Min. output value	If the error counter present value times the gain setting is less than the minimum output value, the minimum output value will be output. Set the minimum output value so that it is equal to or smaller than the maximum output value. Output command to inverter Output command to inverter Fror counter Present value	1 to 65,535 Setting 0 is the same as setting 1.	0: 1	A minimum output value can be set to ensure an output of a specified size even when the error counter present value is very small.	When CPU Unit power is turned ON

# Maximum Output Value

Setting	Description	Set value	Default	Application	Refresh timing
Max. output value	If the error counter present value times the gain setting is greater than the maximum output value, the maximum output value will be output. Set the maximum output value so that it is equal to or greater than the minimum output value. Output command to inverter Output command to inverter Error counter present value	1 to 4,294,967,29 5 Setting 0 is the same as setting 2,000,000.	0: 2,000,000	A maximum output value can be set to prevent the output value from becom- ing too large.	When CPU Unit power is turned ON

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# Error Counter Overflow Detection Value

Setting	Description	Set value	Default	Application	Refresh timing
Error counter overflow detection value		1 to 32,767 Setting 0 is the same as setting 10,000.	,	excessive pulses in the	When CPU Unit power is turned ON

# Error Counter Alarm Detection Value

Setting	Description	Set value	Default	Application	Refresh timing
Error counter alarm detection value	If the absolute value of the error counter present value is greater than the error counter alarm detection value, the Error Counter Alarm Flag (A26.08) will turn ON.	1 to 32,767 Setting 0 is the same as setting 10,000.	0: 10,000	Provides notification of excessive pulses in the error counter, e.g., when encoder wiring breaks dur- ing positioning.	When CPU Unit power is turned ON

### **Error Counter Cycle**

Setting	Description	Set value	Default	Application	Refresh timing
Error counter cycle	The calculation cycle of the error counter can be set. If the cycle is too short when using a motor with a slow response, pulses may easily accumulate in the error counter. Change the error counter cycle according to the machine load and motor response.	1 to 255 (in 4- ms increments) Setting 0 is the same as setting 3 (4-ms incre- ments)	0: 3 (4-ms incre- ments) The error counter cycle will be 12 ms.	Set when using a motor with a slow response.	When CPU Unit power is turned ON
	Note The setting is made in incre- ments of 4 ms. The error counter cycle will thus be the set value times 4 ms. For example, if the set value is 10, the error counter cycle will be 40 ms.				

### Power Supply Frequency for One Motor Revolution per Second

Setting	Description	Set value	Default	Application	Refresh timing
Power Supply Freq. for One Motor Revolution per Sec.	Calculate the power supply fre- quency for one revolution per second from the motor specifications. For example, with a 1,800-r/min (60-Hz) motor (30 r/s), the power supply fre- quency for one revolution per second would be calculated as follows: $60 [Hz] \div 30 [r/s] = 2 [Hz].$	0 to 65,535 Hz (0.1-Hz incre- ments)	0 (0.1-Hz incre- ments)	This setting is used when con- verting the out- put value to an inverter fre- quency com- mand.	When CPU Unit power is turned ON
	Note The setting is made in incre- ments of 0.1 Hz. The fre- quency will thus be the set value times 0.1 Hz. For exam- ple, if the set value is 20, the frequency will be 2 Hz.				

#### Number of Encoder Pulses for One Motor Revolution

Setting	Description	Set value	Default	Application	Refresh timing
Number of Encoder Pulses for One Motor Revolution	Calculate the number of encoder pulses for one motor revolution from the encoder res- olution (pulses/revolution), high-speed counter's multiplier, and motor-encoder shaft gear ratio. For example, if the encoder resolution is 1,000, the high- speed counter multiplier is 4, and the gear ratio is 1/4, the number of encoder pulses for one motor revolution is 1,000 $\times$ 4 $\times$ (1/4) = 1,000.	0 to 65,535	0	This setting is used when con- verting the out- put value to an inverter fre- quency com- mand.	When CPU Unit power is turned ON

### Operation Adjustment Settings

Use the following settings if the gain adjustment in the basic settings does not produce stable operation.

#### Limit Output during Acceleration and Constant Speed

Setting	Description	Set value	Default	Application	Refresh timing
acceleration and	Select this option to limit the upper and lower values of the output value based on the pulse output value during internal pulse output acceleration or constant speed.	Use/Do not use	Do not use	when positioning	When CPU Unit power is turned ON

#### Limit Output during Deceleration and When Stopped

Setting	Description	Set value	Default	Application	Refresh timing
deceleration and when stopped	Select this option to multiply the error of the output value by a coefficient during internal pulse output deceleration or after output has been completed.			when positioning	When CPU Unit power is turned ON

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### Output Coefficient during Acceleration and Constant Speed

Setting	Description	Set value	Default	Application	Refresh timing
Output coefficient during acceleration and constant speed	Upper and lower limits are placed on the output value by multiplying the pulse output value by a coefficient during internal pulse output acceleration or constant speed. Output Upper Limit = Internal pulse output value + Internal pulse output value × Output coefficient Output Lower Limit = Internal pulse output value – Internal pulse output value × Output coefficient Unternal pulse output value – Internal pulse output value × Output coefficient Unternal pulses Output command to inverter Note The setting is made in incre- ments of 0.01. The coefficient will thus be the set value times 0.01. For example, if the set value is 10, the coefficient will be 0.1 ms.	1 to 255 (0.01 incre- ments) Setting 0 is the same as setting 6 (0.01 incre- ments).	0: 6 (0.01 incre- ments)	This coefficient can be used to restrict the output range to prevent excessive values, based on the internal pulse output value when the motor response is slow even if a large error is produced.	When CPU Unit power is turned ON

# Output Coefficient during Deceleration

Setting	Description	Set value	Default	Application	Refresh timing
Output coefficient during deceleration	The output value can be changed by multiplying the value in the error counter by a coefficient during decelera- tion of internal pulse output. Output value = Error $\times$ Error counter cycle (s) $\times$ Gain $\times$ Coefficient	1 to 255 (0.01 incre- ments) Setting 0 is the same as setting 96 (0.01 incre- ments).	0: 96 (0.01 incre- ments)	This coefficient can be used to reduce the output value when the motor response is slow and the target position is exceeded when stopping.	When CPU Unit power is turned ON
	Note The setting is made in increments of 0.01. The coefficient will thus be the set value times 0.01. For exam- ple, if the set value is 10, the coefficient will be 0.1 ms.				

#### Output Coefficient after Pulse Output

Setting	Description	Set value	Default	Application	Refresh timing
Output coefficient after pulse output	The output value can be changed by multiplying the value in the error counter by a coefficient after deceleration of internal pulse output. Output value = Error × Error counter cycle (s) × Gain × Coefficient	1 to 255 (0.01 incre- ments) Setting 0 is the same as setting 50 (0.01 incre- ments).	0: 50 (0.01 incre- ments)	This coefficient can be used to reduce the output value when it the value in the error counter is too large after completing internal pulse output.	
	Note The setting is made in increments of 0.01. The coefficient will thus be the set value times 0.01. For example, if the set value is 10, the coeffi- cient will be 0.1 ms.				

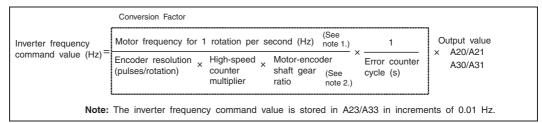
# 5-3-9 Automatic Calculation of Inverter Frequency Command Value

Set the Power Supply Frequency for One Motor Revolution per Second, Number of Encoder Pulses for One Motor Revolution, and Error Counter Cycle in the PLC Setup to automatically calculate the inverter frequency command value and store it in A23 for inverter positioning 0 and A33 for inverter positioning 1.

**Note** The inverter frequency command values are stored in A23 and A33 in increments of 0.01 Hz. Divide the value in A23 or A33 by 100 to obtain the value in hertz.

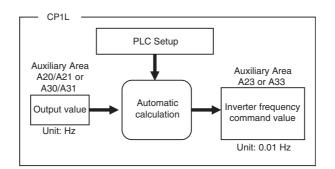
The values stored in A23 and A33 can be used in converting the output value to the frequency command value for the inverter. This value can be output to the inverter from the program using serial communications or an Analog Output Unit.

**Note** The following formula is used inside the PLC to automatically calculate the inverter frequency command value from the output value (i.e., the error counter present value multiplied by the gain). (The output value is stored in A20 and A21 for inverter positioning 0 and in A30 and A31 for inverter positioning 1.)



Note

- (1) Calculate the power supply frequency for one revolution per second from the motor specifications. For example, with a 1,800-r/min (60-Hz) motor (30 r/s), the power supply frequency for one revolution per second would be calculated as follows: 60 [Hz] ÷ 30 [r/s] = 2 [Hz].
  - (2) The encoder resolution times the counter multiplier times the gear ratio equals the number of pulses output by the encoder for one motor shaft revolution.



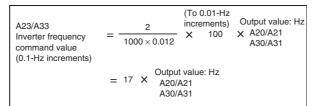
Example of Calculating Conversion Factor

#### Conditions

- Power Supply Frequency for One Motor Revolution per Second: 2 Hz (PLC Setup)
- Number of Encoder Pulses for One Motor Revolution: 1,000 (PLC Setup)
  - Rotary encoder resolution: 1,000 pulses/revolution (encoder specification)
  - High-speed counter multiplier: x4 (PLC Setup)
  - Gear ratio between motor and encoder shafts: 1/4 (machine specification)
- Error Counter Cycle: 12 ms (PLC Setup)

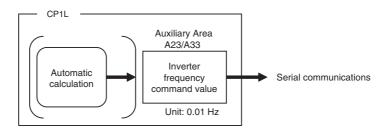
#### Calculation

The calculation performed inside the PLC is as shown below.



#### Serial Communications

The command value calculated above is used in the Modbus-RTU command frame, adjusting for the frequency unit. (See note.)

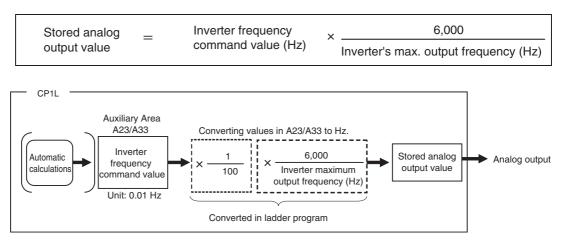


Refer to *6-3-3 Modbus-RTU Easy Master Function* and to the inverter manual for details on Modbus-RTU communications.

**Note** If the frequency command unit set in the inverter is 0.1 Hz, divide the command frequency in A23 or A33 by 10.

Analog Output The following example is for the CP1W-DA041. The analog output resolution is 6,000, so the command value calculated above is multiplied by 6,000 divided by the inverter's maximum output frequency.

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Refer to 7-3 Analog Output Units for operating procedures for the Analog Output Unit.

### ■ Calculation Example

### Conditions

Inverter's maximum output frequency: 60 Hz

### Calculation

The stored analog output value is calculated as follows:

Stored analog = output value	Auxiliary Area A23/A33 (Unit: 0.01 Hz)	$\times \frac{1}{100} \times \frac{6,000}{60}$
=	Auxiliary Area A23/A33 (Unit: 0.01 Hz)	× 1

# 5-3-10 Memory Allocations

### **Built-in Input Area**

Input terminal block		Default	Pulse output origin searches enabled	Inverter positioning	
Word			Origin search	enabled	
CIO 0 (See note 1.)	00	Normal input 0		High-speed counter 0: Phase A	
	01	Normal input 1		High-speed counter 0: Phase B	
	02	Normal input 2	Pulse output 0: Origin proximity input signal (CPU Units with 14 I/O (See note 3.))	High-speed counter 1: Phase A	
	03	Normal input 3	Pulse output 1: Origin proximity input signal (CPU Units with 14 I/O (See note 3.)) Pulse output 0: Origin proximity input signal (CPU Units with 10 I/O (See note 3.))	High-speed counter 1: Phase B	
	04	Normal input 4			
	05	Normal input 5	Pulse output 0: Origin input signal (CPU Units with 10 I/O (See note 3.))		
	06(See note 2.)	Normal input 6	Pulse output 0: Origin input signal		
	07(See note 2.)	Normal input 7	Pulse output 1: Origin input signal		
	08 (See note 2.)	Normal input 8			
	09 (See note 2.)	Normal input 9			
	10 (See note 2.)	Normal input 10	Pulse output 0: Origin proximity input signal (CPU Units with 20, 30,40 or 60 I/O)		
	11 (See note 2.)	Normal input 11	Pulse output 1: Origin proximity input signal (CPU Units with 20, 30,40 or 60 I/O)		

Note

- (1) The above table shows only allocations related to inverter positioning.
- (2) Bits 08 to 11 are not supported by CPU Units with 14 I/O Points. Bits 06 to 11 are not supported by CPU Units with 10 I/O Points.
- (3) If inverter positioning 1 is used with a CPU Unit with 14 I/O Points, origin searches (i.e., the origin proximity input signal) cannot be used.

### **Built-in Output Area**

This area is not used for inverter positioning.

When inverter positioning is enabled, bits 00 to 03 in CIO 100 can be used as normal outputs 0 to 3. The corresponding pulse output and PWM output cannot be used.

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# **Auxiliary Area**

**Read Area** 

### ■ Inverter Positioning 0

Use one of the following for the inverter frequency command.

Word	Bits	Function	Data range	Refresh timing	Application examples
A20	00 to 15	Lower 4 digits of present value of unsigned output value (output value = present value of error counter × error counter cycle (s) × gain) <b>Note</b> The maxi- mum and min- imum output values are applied.	0000 0000 to 8000 0000 hex (0 to 2,147,483,648)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle	This value can be used when not using automatic frequency com- mand calculations and instead to con- vert the output value provided here in the user program for output to the inverter. This value is used when signed data
A21	00 to 15	Upper 4 digits of present value of unsigned output value (output value = present value of error counter × error counter cycle (s) × gain) Note The maxi- mum and min- imum output values are applied.			is not required, i.e., when using com- munications or nor- mal I/O to specify the direction.

Word	Bits	Function	Data range	Refresh timing	Application examples
A23	00 to 15	Inverter frequency command value (0.01-Hz increments, unsigned) Note Set the Power Supply Fre- quency for One Motor Revolution per Second, Num- ber of Encoder Pulses for One Motor Revolution, and Error Counter Cycle in the PLC Setup before using this value.	0000 to FFFF hex (0.00 to 655.35 Hz)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: Cyclically according to error counter cycle	These words con- tain the automati- cally calculated frequency com- mand value for the inverter. (This value is normally used.) For example, if the frequency setting unit of the inverter is 0.01 Hz, this value can be used as it in serial com- munications with the inverter. When converting to an analog output (0 to 5 V, 1 to 5 V, 0 to 10 V, 0 to 20 mA, or 4 to 20 mA), this value can be used to simplify the con- version. This value is used when signed data is not required, i.e., when using com- munications or nor- mal I/O to specify the direction.
A24	00 to 15 00 to 15	Lower 4 digits of present value of signed output value = present value of error counter × error counter cycle (s) × gain) Note The maxi- mum and min- imum output values are applied. Upper 4 digits of present value of signed output value (output value = present value of error counter × error counter cycle (s) × gain) Note The maxi- mum and min- imum output values are applied.	8000 0000 to 7FFF FFFF hex (-214,748,348 to 214,748,347)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle	This value can be used when not using automatic frequency com- mand calculations and instead to con- vert the output value provided here in the user program for output to the inverter. This value is used when signed data is required, i.e., when outputting the frequency com- mand with an ana- log output from -10 to 10 V.

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# **Inverter Positioning**

Word	Bits	Function	Data range	Refresh timing	Application examples
A26	00	Operation Command Flag	ON: Operation command exe- cuted. OFF: Stop com- mand executed.	<ul> <li>Turned ON at following times:</li> <li>When inverter positioning is started</li> <li>Turned OFF at following times:</li> <li>When power to CPU Unit is turned ON</li> <li>At start of operation</li> <li>When CPU Unit operation stops</li> <li>When inverter positioning is stopped using INI instruction</li> </ul>	This flag is used as a NO input condi- tion when calculat- ing the frequency command value in the user program. It is also used as a NC input condition when clearing the frequency com- mand value to zero.
	01	Forward Operation Command Flag	ON: Forward com- mand in progress OFF: Reverse command in progress or stopped	<ul> <li>Turned ON at following times:</li> <li>When error counter present value is greater than 0 (i.e., positive)</li> <li>Turned OFF at following times:</li> <li>When error counter present value is less than 0 (i.e., negative) or zero</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used as a NO input condi- tion when output- ting a forward operation com- mand to the inverter from the user program It is also used as a NC input condition when outputting a reverse command to the inverter.
	02	Reverse Operation Command Flag	ON: Reverse com- mand in progress OFF: Forward command in progress or stopped	<ul> <li>Turned ON at following times:</li> <li>When error counter present value is less than 0 (i.e., negative)</li> <li>Turned OFF at following times:</li> <li>When error counter present value is greater than 0 (i.e., positive) or zero</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used as a NO input condi- tion when output- ting a reverse operation com- mand to the inverter from the user program It is also used as a NC input condition when outputting a forward command to the inverter.

Use the following for inverter positioning status and the workpiece position.

Word	Bits	Function	Data range	Refresh timing	Application examples
A26	03	In-position Flag	ON: In position OFF: Not in posi- tion	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is less than inposition range</li> <li>Turned OFF at following times:</li> <li>When pulses are being output to error counter</li> <li>When absolute value of error counter present value is greater than in-position range.</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used as an NO condition when clearing the frequency com- mand value to zero from the user pro- gram.
	04	Error Counter Error Flag	ON: Error counter error OFF: No error	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is greater than or equal to error counter error detection value</li> <li>Turned OFF at following times:</li> <li>When error counter error is reset</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag can be used to provide notification of excessive pulses in the error counter, e.g., when manu- ally moving the motor shaft while positioning is stopped.
	05	Error Counter Pulse Output Flag	ON: Pulses being output OFF: Pulse output stopped	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is started</li> <li>Turned OFF at following times:</li> <li>When pulse output to error counter is stopped (including immediate stops and deceleration stops)</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used to determine whether pulses are being output to the error counter. This flag can be used to determine when internal pulse output has been completed and start the next instruction.
	06	Error Counter Pulse Output Acceleration/ Deceleration Flag	ON: Pulse output to the error counter is accelerating or decelerating (i.e., the frequency is changing) OFF: Pulse output to the error counter is constant	<ul> <li>Turned ON at following times:</li> <li>When pulse output frequency to error counter is changed by ACC or PLS2 instruction</li> <li>Turned OFF at following times:</li> <li>During output of a constant pulse frequency to error counter</li> <li>When pulse output to error counter is stopped (including immediate stops and deceleration stops)</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used to detect changes in the output fre- quency when the frequency is changed stepwise for internal pulses are being output by the ACC or PLS2 instruction. It can be used as a condi- tion for executing ACC or PLS2 dur- ing internal pulse output.

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Word	Bits	Function	Data range	Refresh timing	Application examples
A26	07	Error Counter Alarm Flag	ON: Error counter alarm OFF: No error counter alarm	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is greater than or equal to error counter alarm detection value</li> <li>Turned OFF at following times:</li> <li>When error counter alarm is reset</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag can be used to provide notification of excessive pulses in the error counter, e.g., when encoder wiring breaks dur- ing positioning.
	08 to 14	Not used.			
	15	Inverter Positioning Output Value Sign Flag	ON: Positive value OFF: Negative value	<ul> <li>Turned ON at following times:</li> <li>When signed output value is between 0000 0000 and 7FFF FFFF hex.</li> <li>Turned OFF at following times:</li> <li>When signed output value is between FFFF FFFF and 8000 0000 hex.</li> </ul>	This flag can be used as a direction signal
A270	00 to 15	Lower 4 digits of high-speed counter present value	8000 000 to 7FFF FFFF hex (-2,147,483,648 to	The present value of the feedback pulse from the encoder. Operation is the same as for a high-	Use as the abso- lute position of the workpiece posi-
A271	00 to 15	Upper 4 digits of high-speed counter present value	2,147,483,647)	speed counter.	tioned with inverter positioning.

# Use the following for the present values of the internal pulse and error counter of inverter positioning.

Word	Bits	Function	Data range	Refresh timing	Application examples
A22	00 to 15	Error counter 0 present value (signed)	8000 to 7FFF hex (-32,768 to 32,767)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle Held at following times: • When Error Counter Disable Bit (A562.01) is turned ON.	Use to monitor the difference between the target value and the present value.
A28	00 to 15	Lower 4 digits of present value of pulse output to inverter (relative value)	8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Contains relative internal pulse output value when pulses are output to error counter. Cleared to zero at following times: • When power to CPU Unit is turned ON	These values can be used to monitor the present value of internal pulse output.
A29	00 to 15	Upper 4 digits of present value of pulse output to inverter (relative value)		<ul> <li>When operation is started</li> <li>When pulse output to error counter is started</li> <li>Updated at following times:</li> </ul>	
				<ul> <li>Cyclically on error counter cycle</li> </ul>	

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Word	Bits	Function	Data range	Refresh timing	Application examples
A276	00 to 15	Lower 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)	8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Contains absolute movement value from the internal pulse origin when pulses are output to error counter. Cleared to zero at following times: • When power to CPU Unit is turned ON	This value can be used to monitor the present value of the internal pulse output as an abso- lute value when
A277	00 to 15	Upper 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)		<ul> <li>When operation is started Updated at following times:</li> <li>Cyclically on error counter cycle</li> </ul>	using absolute coordinates.

# Inverter Positioning 1

Word	Bits	Function	Data range	Refresh timing	Application examples
A30	00 to 15	present value of unsigned output value (output value = present value of error counter × error counter cycle (s) × gain) Note The maxi- mum and min- imum output values are applied.	0000 0000 to 8000 0000 hex (0 to 2,147,483,648)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle	This value can be used when not using automatic frequency com- mand calculations and instead to con- vert the output value provided here in the user program for output to the inverter. This value is used when signed data is not required, i.e.,
A31	00 to 15	Upper 4 digits of present value of unsigned output value (output value = present value of error counter × error counter cycle (s) × gain) <b>Note</b> The maxi- mum and min- imum output values are applied.			when using com- munications or nor- mal I/O to specify the direction.

# Use one of the following for the inverter frequency command.

Word	Bits	Function	Data range	Refresh timing	Application examples
A33	00 to 15	Inverter frequency command value (0.01-Hz increments, unsigned) <b>Note</b> Set the Power Supply Fre- quency for One Motor Revolution per Second, Num- ber of Encoder Pulses for One Motor Revolution, and Error Counter Cycle in the PLC Setup before using this value.	0000 to FFFF hex (0.00 to 655.35 Hz)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: Cyclically according to error counter cycle	These words con- tain the automati- cally calculated frequency com- mand value for the inverter. (This value is normally used.) For example, if the frequency setting unit of the inverter is 0.01 Hz, this value can be used as it in serial com- munications with the inverter. When converting to an analog output (0 to 5 V, 1 to 5 V, 0 to 10 V, 0 to 20 mA, or 4 to 20 mA), this value can be used to simplify the con- version. This value is used when signed data is not required, i.e., when using com- munications or nor- mal I/O to specify the direction.
A34 A35	00 to 15 00 to 15	Lower 4 digits of present value of signed output value (output value = present value of error counter × error counter cycle (s) × gain) Note The maxi- mum and min- imum output values are applied. Upper 4 digits of present value of signed output value	8000 0000 to 7FFF FFFF hex (-214,748,348 to 214,748,347)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle	This value can be used when not using automatic frequency com- mand calculations and instead to con- vert the output value provided here in the user program for output to the inverter. This value is used when signed data is required, i.e., when outputting the frequency com- mand with an ana-
		(output value = present value of error counter × error counter cycle (s) × gain) <b>Note</b> The maxi- mum and min- imum output values are applied.			log output from –10 to 10 V.

Word	Bits	Function	Data range	Refresh timing	Application examples
A36	00	Operation Command Flag	ON: Operation command exe- cuted. OFF: Stop com- mand executed.	<ul> <li>Turned ON at following times:</li> <li>When inverter positioning is started</li> <li>Turned OFF at following times:</li> <li>When power to CPU Unit is turned ON</li> <li>At start of operation</li> <li>When CPU Unit operation stops</li> <li>When inverter positioning is stopped using INI instruction</li> </ul>	This flag is used as a NO input condi- tion when calculat- ing the frequency command value in the user program. It is also used as a NC input condition when clearing the frequency com- mand value to zero.
	01	Forward Operation Command Flag	ON: Forward com- mand in progress OFF: Reverse command in progress or stopped	<ul> <li>Turned ON at following times:</li> <li>When error counter present value is greater than 0 (i.e., positive)</li> <li>Turned OFF at following times:</li> <li>When error counter present value is less than 0 (i.e., negative) or zero</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used as a NO input condi- tion when output- ting a forward operation com- mand to the inverter from the user program It is also used as a NC input condition when outputting a reverse command to the inverter.
	02	Reverse Operation Command Flag	ON: Reverse com- mand in progress OFF: Forward command in progress or stopped	<ul> <li>Turned ON at following times:</li> <li>When error counter present value is less than 0 (i.e., negative)</li> <li>Turned OFF at following times:</li> <li>When error counter present value is greater than 0 (i.e., positive) or zero</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used as a NO input condi- tion when output- ting a reverse operation com- mand to the inverter from the user program It is also used as a NC input condition when outputting a forward command to the inverter.

Use the following for inverter positioning status and the workpiece position.

Word	Bits	Function	Data range	Refresh timing	Application examples
A36	03	In-position Flag	ON: In position OFF: Not in posi- tion	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is less than inposition range</li> <li>Turned OFF at following times:</li> <li>When pulses are being output to error counter</li> <li>When absolute value of error counter present value is greater than in-position range.</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> </ul>	This flag is used as an NO condition when clearing the frequency com- mand value to zero from the user pro- gram.
	04	Error Counter Error Flag	ON: Error counter error OFF: No error	<ul> <li>When CPU Unit operation stops</li> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is greater than or equal to error counter error detection value</li> <li>Turned OFF at following times:</li> <li>When error counter error is reset</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag can be used to provide notification of excessive pulses in the error counter, e.g., when manu- ally moving the motor shaft while positioning is stopped.
	05	Error Counter Pulse Output Flag	ON: Pulses being output OFF: Pulse output stopped	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is started</li> <li>Turned OFF at following times:</li> <li>When pulse output to error counter is stopped (including immediate stops and deceleration stops)</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used to determine whether pulses are being output to the error counter. This flag can be used to determine when internal pulse output has been completed and start the next instruction.
	06	Error Counter Pulse Output Acceleration/ Deceleration Flag	ON: Pulse output to the error counter is accelerating or decelerating (i.e., the frequency is changing) OFF: Pulse output to the error counter is constant	<ul> <li>Turned ON at following times:</li> <li>When pulse output frequency to error counter is changed by ACC or PLS2 instruction</li> <li>Turned OFF at following times:</li> <li>During output of a constant pulse frequency to error counter</li> <li>When pulse output to error counter is stopped (including immediate stops and deceleration stops)</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag is used to detect changes in the output fre- quency when the frequency is changed stepwise for internal pulses are being output by the ACC or PLS2 instruction. It can be used as a condi- tion for executing ACC or PLS2 dur- ing internal pulse output.

# Section 5-3

Word	Bits	Function	Data range	Refresh timing	Application examples
A36	07	Error Counter Alarm Flag	ON: Error counter alarm OFF: No error counter alarm	<ul> <li>Turned ON at following times:</li> <li>When pulse output to error counter is stopped and absolute value of error counter present value is greater than or equal to error counter alarm detection value</li> <li>Turned OFF at following times:</li> <li>When error counter alarm is reset</li> <li>When power to CPU Unit is turned ON</li> <li>When CPU Unit operation starts</li> <li>When CPU Unit operation stops</li> </ul>	This flag can be used to provide notification of excessive pulses in the error counter, e.g., when encoder wiring breaks dur- ing positioning.
	08 to 14	Not used.			
	15	Inverter Positioning Output Value Sign Flag	ON: OFF:	<ul> <li>Turned ON at following times:</li> <li>When signed output value is between 0000 0000 and 7FFF FFFF hex.</li> <li>Turned OFF at following times:</li> <li>When signed output value is between</li> </ul>	This flag can be used as a direction signal.
				FFFF FFFF and 8000 0000 hex.	
A272	00 to 15	Lower 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)	8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Contains absolute movement value when pulses are output to error counter. Cleared to zero at following times: • When power to CPU Unit is turned ON	This value can be used to monitor the present value of the internal pulse output as an abso- lute value when
A273	00 to 15	Upper 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)		<ul> <li>When operation is started</li> <li>Updated at following times:</li> <li>Cyclically on error counter cycle</li> </ul>	using absolute coordinates.

Use the following for the present values of the internal pulse and error counter of inverter positioning.

Word	Bits	Function	Data range	Refresh timing	Application examples
A32	00 to 15	Error counter 0 present value (signed)	8000 to 7FFF hex (-32,768 to 32,767)	Cleared to zero at following times: • When power to CPU Unit is turned ON • At start of operation • When an error counter error occurs Updated at following times: • Cyclically according to error counter cycle Saved at following times: • When Error Counter Disable Bit (A562.01) is turned ON.	Use to monitor the difference between the target value and the present value.
A38	00 to 15	Lower 4 digits of present value of pulse output to inverter (relative value)	8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Contains relative internal pulse output value when pulses are output to error counter. Cleared to zero at following times: • When power to CPU Unit is turned ON	These values can be used to monitor the present value of internal pulse output.
A39	00 to 15	present value of pulse output to inverter (relative		<ul> <li>When operation is started</li> <li>When pulse output to error counter is started</li> </ul>	
		value)		Updated at following times: • Cyclically on error counter cycle	

### Section 5-3

Word	Bits	Function	Data range	Refresh timing	Application examples
A278	00 to 15	Lower 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)	8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Contains absolute movement value from the internal pulse origin when pulses are output to error counter. Cleared to zero at following times: • When power to CPU Unit is turned ON	This value can be used to monitor the present value of the internal pulse output as an abso- lute value when
A279	00 to 15	Upper 4 digits of the present value of the internal pulse output (absolute value for absolute coordi- nates)		<ul> <li>When operation is started Updated at following times:</li> <li>Cyclically on error counter cycle</li> </ul>	using absolute coordinates.

#### **Read/Write Area**

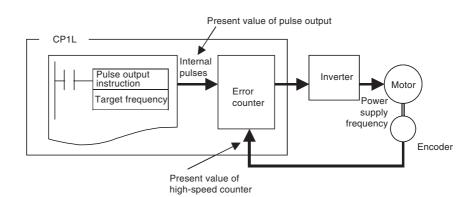
Word	Bits	Fur	iction	Data range	Refresh timing	Application
A562	00	Inverter positioning 0	Error Counter Reset Bit	Turned ON: Error counter 0 present value (A22) reset and Error Counter Error Flag cleared.		Turn ON this bit to clear the error counter error status.
	01		Error Counter Disable Bit	While ON: Error counter value held.		Turn ON this bit, for example, to disable accumulating pulses in the error counter when stop- ping positioning and moving the motor shaft manually.
	02 to 15	Not used.				
A563	00	Inverter positioning 1	Error Counter Reset Bit	Turned ON: Error counter 0 present value (A32) reset and Error Counter Error Flag cleared.		Turn ON this bit to clear the error counter error status.
	01		Error Counter Disable Bit	While ON: Error counter value held.		Turn ON this bit, for example, to disable accumulating pulses in the error counter when stop- ping positioning and moving the motor shaft manually.
	02 to 15	Not used.		•	1	1

#### Note

### Present Values of High-speed Counter and Pulse Outputs

The present value of the high-speed counter when inverter positioning is used is stored in the same memory location as for normal high-speed counter application. This value can be used as the present value of feedback pulses from the encoder, i.e., as the absolute position of inverter positioning. Target value and range comparisons for high-speed counters are also valid.

The present value of the pulse output (A276/A277 or A278/A279), i.e., the pulse output value to the error counter, is an absolute position if an absolute coordinate system is specified and is a relative position if a relative coordinate system is specified.



# 5-3-11 Application Example with Serial Communications

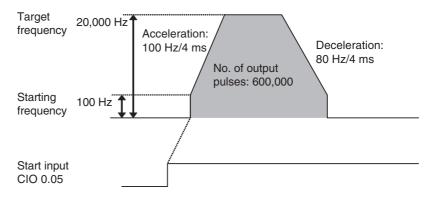
### **Positioning with Trapezoidal Control**

Specifications and **Operation** 

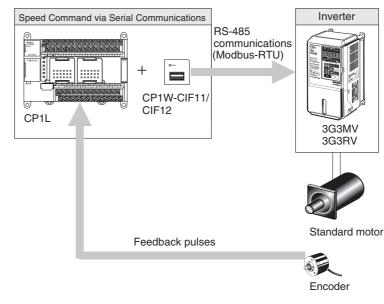
Note

When start input CIO 1.04 turns ON, 600,000 pulses are output internally for inverter positioning 0 to turn the motor shaft.

Refer to 5-3-7 Determining the Internal Pulse Output Frequency for the formula to convert the frequency and use the converted internal pulse frequency. The number of output pulses is calculated from the encoder specifications and the high-speed counter multiplier.



### **System Configuration**

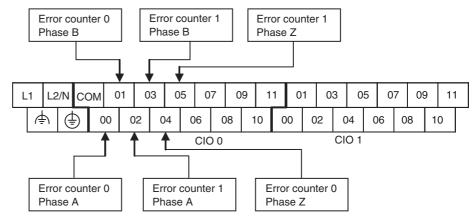


### Instructions Used

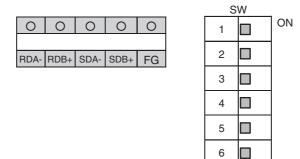
PLS2(887)

### **Terminal Allocations**

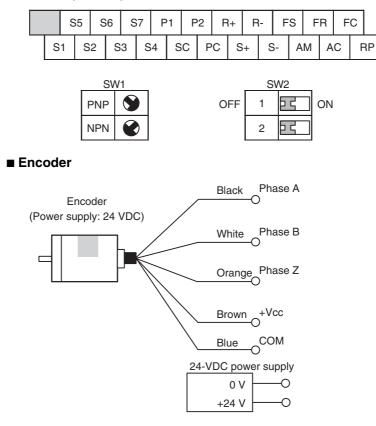
### Error Counter



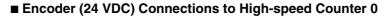
### ■ RS-422A/485 Communications (CP1W-CIF11/CIF12)

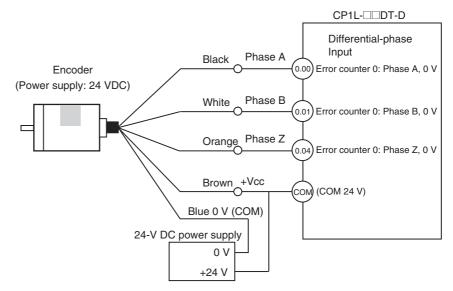


#### ■ Inverter (3G3MV)

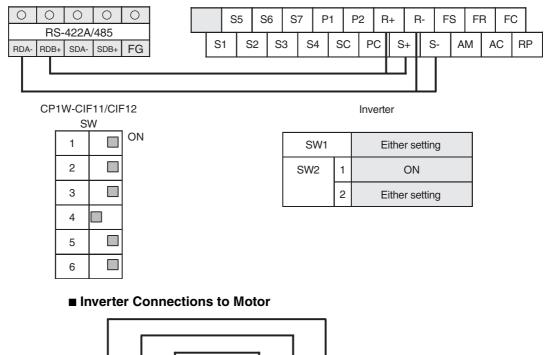


# **Connection Example**

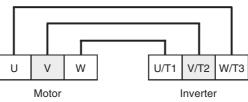




# Section 5-3



### RS-422A/485 (CP1W-CIF11/CIF12) Connections to Inverter



### Parameter Settings for 3G3MV Inverter

When connecting the Inverter to the PLC, communications parameters must be set in the Inverter. The settings of parameters n152 to n157 cannot be changed while communications are in progress. Always set them before starting communications.

# Section 5-3

Example settings of 3G3MV parameters are listed below. Refer to the *User's Manual* of the Inverter for details on the parameters.

Parameter No.	Name	Description	Default	Setting
n003	RUN command selection	0: The RUN Key and STOP/RESET Key on the Digital Operator are enabled.	0	2
		1: Multi-function input is enabled through the con- trol circuit terminals.		
		2: RS-422A/485 communications are enabled.		
		3: Input is enabled from the optional Communica- tions Unit.		
n004	Frequency reference selection	0: Frequency reference adjustment	0	6
		1: Frequency reference 1 (n024)		
		2: Frequency reference control terminal (0 to 10 V)		
		3: Frequency reference control terminal (4 to 20 mA)		
		4: Frequency reference control terminal (0 to 20 mA)		
		5: Pulse train reference control terminal		
		6: Frequency reference through RS-422A/RS-485		
		7: Multi-function analog voltage input (0 to 10 V)		
		8: Multi-function analog current input (4 to 20 mA)		
		9: Frequency reference input through optional		
		Communications Unit.		
n005	Stopping method selection	0: Decelerates to stop	0	0
		1: Coasts to stop		
n006	Reverse rotation-prohibit	0: Reverse enabled	0	0
	selection	1: Reverse disabled		
n011	Maximum frequency (FMAX)	50.0 to 400.0 Hz (0.1-Hz increments)	60.0 Hz	60.0 Hz (Depends on machine configura- tion.)
n016	Minimum output frequency (FMIN)	0.1 Hz to 10.0 Hz (0.1-Hz increments)	1.5 Hz	0.1 Hz
n018	Acceleration/deceleration time	0: 0.1 s	0	0
	setting unit	1: 0.01 s		
n019	Acceleration time 1	0 to 6,000 s	10.0 s	0
n020	Deceleration time 1	0 to 6,000 s	10.0 s	0
n151	RS-422A/485 communications timeover detection selection	0: Detects time-over, fatal error, and the Inverter coasts to a stop.	0	0
	(The time between receiving PLC signals is monitored, Timeout time: 2 s.)	1: Detects time-over, detects fatal error, and the Inverter decelerates to a stop in deceleration time 1.		
		2: Detects time-over, detects fatal error, and the Inverter decelerates to a stop in deceleration time 2.		
		3: Detects time-over, detects nonfatal error warn- ing, and the Inverter continues operating.		
		4: No time-over is detected.		
n152	RS-422A/485 communications	0: 0.1 Hz	0	1
	frequency reference/display unit selection	1: 0.01 Hz		
		2: Converted value based on 30,000 decimal as maximum frequency		
		3: 0.1% (Maximum frequency: 100%)		

# Section 5-3

Parameter No.	Name	Description	Default	Setting
n153	RS-422A/485 communications	Setting range: 0 to 32	0	1
	Slave address	00: Communications disabled		
		01 to 32: Slave address		
n154	RS-422A/485 baud rate selec-	0: 2,400 bps	2	2
	tion	1: 4,800 bps		
		2: 9,600 bps		
		3: 19,200 bps		
n155	RS-422A/485 parity selection	0: Even	0	0
		1: Odd		
		2: No parity		
n156	RS-422A/485 send wait time	Set value: 10 to 65 ms	10 ms	10 ms
		Setting unit: 1 ms		
n157	RS-422A/485 RTS control	0: RTS control enabled	0	0
	selection	1: RTS control disabled		

# PLC Setup

### Serial Port Communications Settings

R PLC Settings - NewPLC1
File Options Help
Startup       Settings       Timings       Input constant       Serial Port 1       Serial Port 2       Peripheral Service       Built-in Input       E • • •         Communications       Settings       Serial Port 2       Peripheral Service       Built-in Input       E • •         C Standard (9600 ; 1,7,2,E)       Mode       Input       Input       Input       Input         9600       9600       9,1,E       Mode       Input       Input       Input
Start Code     End Code     PC Link Mode       Image: Construction of the start of the sta
Response Timeout     Unit Number     Delay     NT/PC Link Max     PC Link Unit No.       0     *100 ms     *10 ms     ************************************
CP1L-M Offline

### Note

- (1) Set the baud rate and parity check settings to the same value as for the Inverter communications parameters.
  - (2) Set the serial port to the serial gateway communications mode.

PLC Settings - NewPLC1 e Options Help	
Startup   Settings   Timings   Input constant   Serial Port 1	Serial Port 2 Peripheral Service Built-in Input
High Speed Counter 0 ✓ Use high speed counter 0 Counting mode  C Linear mode  C Circular mode Circular Max. Count 0	High Speed Counter 1 Use high speed counter 1 Counting mode <sup>®</sup> Linear mode <sup>©</sup> Circular mode Circular Max. Count
Reset Z phase, software reset 💌	Reset Z phase, software reset 💌
Input Setting Differential phase input	Input Setting Differential phase input
High Speed Counter 2 Use high speed counter 2 Counting mode C Linear mode C Circular mode Circular Max. Count	High Speed Counter 3 Use high speed counter 3 Counting mode C Linear mode C Circular mode Circular Max. Count
Reset Z phase, software reset 💌	Reset Z phase, software reset 💌
Input Setting Increment pulse input	Input Setting Increment pulse input
Interrupt Input IND Normal IN1 Normal IN1 IN4 Normal IN5 Normal I	IN2 Normal VIN3 Normal V

■ High-speed Counter Settings (on Built-in Input Tab Page)

- **Note** (1) Set high-speed counter 0 when using inverter positioning 0. Set high-speed counter 1 when using inverter positioning 1.
  - (2) Use linear mode for inverter positioning.

■ Inverter Positioning Settings (on Inverter Positioning 0 or 1 Tab Page)

Inverter Positioning Use inverter positioning. Gain (default 0: 10"0.1) In-position range (default 0: 1) Min. output value (default 0: 1) Max. output value (default 0: 1) Max. output value (default 0: 200000) Error counter overflow detection valu (default 0: 200000) Error counter alarm detection value (default 0: 10000) Error counter cycle (default 0: 12ms) Power Supply Freq. for One Motor Revolution per Sec. Number of Encoder Pulses for One Motor Revolution	0	e *0.1		Limit output during acceleration and constant speed. Output coefficient during acceleration and constant speed (default 0: 6*0.01) Limit output during deceleration and when stopped. Output coefficient during deceleration (default 0: 96*0.01) Output coefficient after pulse output (default 0: 50*0.01) (default 0: 50*0.01) (default 0: 50*0.01) (default 0: 50*0.01)
---	---	--------	--	--

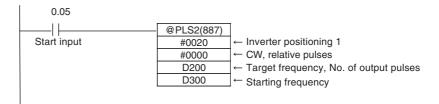
### Ladder Program

The following Modbus-RTU communications parameters are used.

	Baud rate	9,600 bits/s		
Format		8, 1, E		
	Serial communications mode	Serial Gateway		

#### Starting Inverter Positioning

Serial port 1 is used for communications with the Inverter.

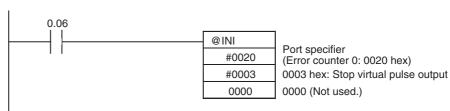


### ■ PLS2(887) Settings

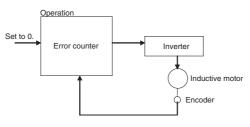
Setting details	Address	Data
Acceleration rate: 100 Hz/4 ms	D200	0064
Deceleration rate: 80 Hz/4 ms	D201	0050
Target frequency: 20,000 Hz	D202	4E20
	D203	0000
Number of output pulses: 600,000 pulses	D204	27C0
	D205	0009
Starting frequency: 100 Hz	D300	0064
	D301	0000

• High-speed counter 0 (i.e., error counter 0) is used for the feedback pulse input port.

#### Stopping Internal Pulse Output to the Error Counter

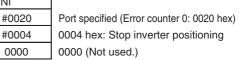


- Internal pulse output is stopped immediately.
- Inverter positioning (i.e., the error counter) will continue to function.



0.07

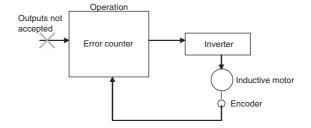
### Stopping Inverter Positioning



- Internal pulse output is stopped immediately.
- The output value will remain at 0 until the error counter is reset.

@INI

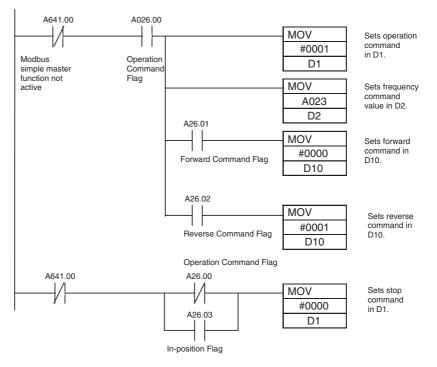
• Pulse outputs will not be accepted until the error counter is reset. (Executing a pulse output instruction will cause an error.)



Referencing the Automatically Calculated Inverter Frequency Command Value If the following settings are made in the PLC Setup, the inverter frequency command value will be calculated automatically and set in A23 in the Auxiliary Area. These settings are on the Inverter Positioning 0 Tab Page in the PLC Setup.

- Power Supply Frequency for One Motor Revolution per Second (0.1-Hz increments)
- Number of Encoder Pulses for One Motor Revolution
- Error Counter Cycle (x 4 ms)

The inverter frequency command value in A23 is accessed. The value is stored in 0.01-Hz increments.



#### ■ Internal Work Addresses

Address	Usage
D1	Bits 00 to 03: Run/Stop Command
D2	Bits 00 to 15: Frequency Command Value
D10	Bits 00 to 03: Forward/Reverse Command

### **Inverter Positioning**

Setting Modbus Communications Registers

A641.00		
	MOV	Slave address: 01 hex
Modbus	#0001	
simple master function not	D32200	
active	MOV	Function code:
	#0010	10 hex (write data)
	D32201	
	MOV	Number of
	#0009	communications data
	D32202	bytes: 09 hex (9 bytes)
	DOLLOL	
	MOV	Register number of write start data: 0001
	#0001	hex
	D32203	
	MOV	Number of write data
	MOV	registers: 0002 hex
	#0002	
	D32204	
	MOV	Number of attached
	#0400	data bytes: 04 hex (4 bytes)
	D32205	byles)
	XFRB	Moves bits 00 to 03 of D1 (Run/Stop
	#0480	Command) to D32206
	D1	(register 0001) bits 08 to 11.
	D32206	
	XFRB	Moves bit 00 of D10
	#0190	(Forward/Reverse
	D10	Command) to bit 09 of D15.
	D15	
	ORW	ORs D15 and D32206 (register 0001) and
	D15	stores the result in
	D32206	D32206. (Reflect bit 09 of D15 in D32206
	D32206	(register 0001).
		Move bits 08 to 15 of D2
	XFRB #0808	(frequency command
	D2	value) to bits 00 to 07 of D32206 (register 0001).
	D32206	
	032200	-
	XFRB	Move bits 00 to 07 of D2
	#0880	(frequency command value) to bits 08 to 15 of
	D2	D32207 (register 0002).
	D32207	

# Section 5-3

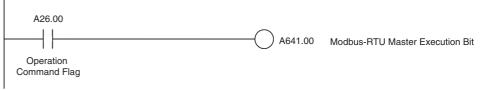
#### Internal Work Addresses

Address	Usage
D1	Bits 00 to 03: Run/Stop Command
D2	Bits 00 to 15: Frequency Command Value
D10	Bits 00 to 03: Forward/Reverse Command
D15	Bit 09: Forward/Reverse Command

#### Settings Addresses

Address	Usage	Data
D32200	Bits 00 to 07: Slave address	01
D32201	Bits 00 to 07: Function code	10
D32202	Bits 00 to 07: Number of communications data bytes	09
D32203	Bits 00 to 15: Register number of write start data	0001
D32204	Bits 00 to 15: Number of data registers to write	0002
D32205	Bits 08 to 15: Number of attached data bytes	04
D32206	Bits 00 to 07: Upper bytes of frequency command value in D2	
	Bit 08: Run/Stop Command	
	Bit 09: Forward/Reverse Command	
D32207	Bits 08 to 15: Lower bytes of frequency command value in D2	

#### **Modbus Communications**



Add the above instructions to the end of the program as a starting condition for the ladder programming example. For error processing, refer to the ladder program in *6-3-3 Modbus-RTU Easy Master Function* and to the inverter's manual.

# 5-3-12 Application Example with an Analog Output

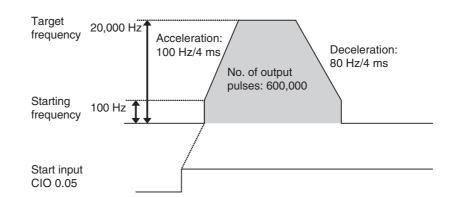
Positioning with Trapezoidal Control

Specifications and<br/>OperationWhen start input CIO 1.04 turns ON, 600,000 pulses are output internally for<br/>inverter positioning 0 to turn the motor shaft.

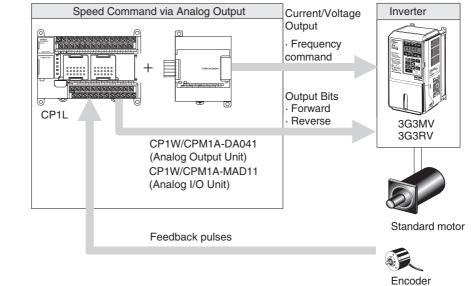
**Note** Refer to *5-3-7 Determining the Internal Pulse Output Frequency* for the formula to convert the frequency and use the converted internal pulse frequency. The number of output pulses is calculated from the encoder specifications and the high-speed counter multiplier.

### Inverter Positioning

### Section 5-3



# **System Configuration**

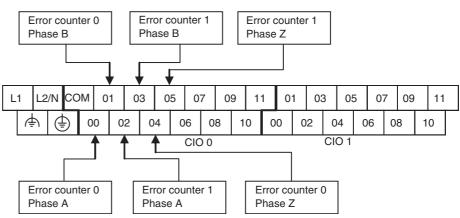


### **Instructions Used**

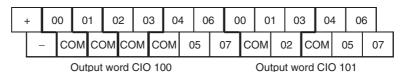
PLS2(887)

### **Terminal Allocations**

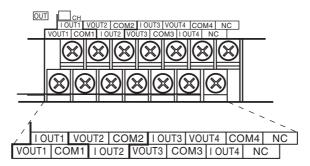
#### Error Counter



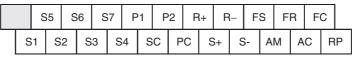
#### Built-in Outputs



■ CP1W/CPM1A-DA041



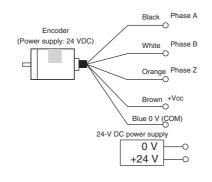
#### ■ Inverter (3G3MV)



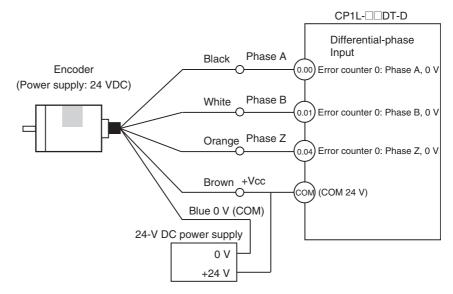


_	SV	N2	
OFF	1		ON
	2		

Encoder

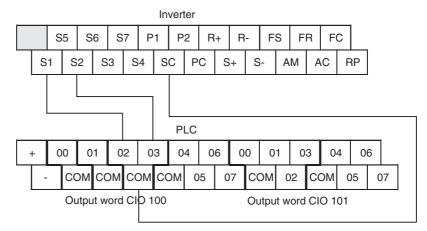


### **Connection Example**

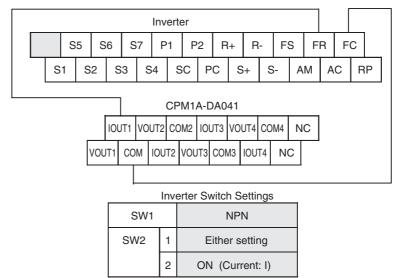


#### ■ Encoder (24 VDC) Connections to High-speed Counter 0

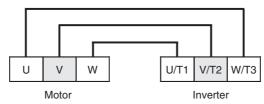
### Output Terminal Connections to Inverter



### ■ CP1W/CPM1A-DA041 (Current Output) Connections to Inverter



#### Inverter Connections to Motor



### Parameter Settings for 3G3MV Inverter

When connecting the Inverter to the PLC, communications parameters must be set in the Inverter.

Example settings of 3G3MV parameters are listed below. Refer to the *User's Manual* of the Inverter for details on the parameters.

Parameter No.	Name	Description	Default	Setting
n003	RUN command selection	0: The RUN Key and STOP/RESET Key on the Digital Operator are enabled.	0	1
		1: Multi-function input is enabled through the con- trol circuit terminals.		
		2: RS-422A/485 communications are enabled.		
		3: Input is enabled from the optional Communica- tions Unit.		
n004	Frequency reference selection	0: Digital Operator	0	4
		1: Frequency reference 1 (n024)		
		2: Frequency reference control terminal (0 to 10 V)		
		3: Frequency reference control terminal (4 to 20 mA)		
		4: Frequency reference control terminal (0 to 20 mA)		
		5: Pulse train reference control terminal		
		6: Frequency reference through RS-422A/RS-485		
		7: Multi-function analog voltage input (0 to 10 V)		
		8: Multi-function analog current input (4 to 20 mA)		
		9: Frequency reference input through optional Communications Unit.		
n050	Multi-function input 1	1 to 25	1	1
n051	Multi-function input 2	1 to 25	2	2
n060	Frequency reference gain	0% to 255% (1% increments)	100%	100%
n061	Frequency reference bias	-100% to 100% (1% increments)	0%	0%
n005	Stopping method selection	0: Decelerates to stop	0	0
		1: Coasts to stop		
n006	Reverse rotation-prohibit	0: Reverse enabled	0	0
	selection	1: Reverse disabled		
n011	Maximum frequency (FMAX)	50.0 to 400.0 Hz (0.1-Hz increments)	60.0 Hz	60.0 Hz (Depends on machine configura- tion.)
n016	Minimum output frequency (FMIN)	0.1 Hz to 10.0 Hz (0.1-Hz increments)	1.5 Hz	0.1 Hz
n018	Acceleration/deceleration time setting unit	ne 0: 0.1 s 0 1: 0.01 s		0
n019	Acceleration time 1	0 to 6,000 s	10.0 s	0
n020	Deceleration time 1			0

## PLC Setup

High-speed	Counter	Settings (	(on	<b>Built-in</b>	Input	Tab	Page	١
Ingn-speed	Counter	Settings		Duntin	mput	Iab	raye	,

Reversion - NewPLC1	
File Options Help	
Built-in Input Pulse Output 0 Pulse Output 1 Inverter Po	sitioning 0   Inverter Positioning 1   FINS Protection
High Speed Counter 0 Use high speed counter 0 Counting mode C Linear mode C Circular mode Circular Max. Count C Reset Z phase, software reset Input Setting Differential phase input	High Speed Counter 1 Use high speed counter 1 Counting mode C Linear mode C Circular mode Circular Max. Count Reset Z phase, software reset Input Setting Differential phase input
High Speed Counter 2 Use high speed counter 2 Counting mode © Linear mode © Circular mode	High Speed Counter 3
Circular Max. Count 0 Reset Z phase, software reset Input Setting Increment pulse input	Circular Max. Count 0 Reset Z phase, software reset Input Setting Increment pulse input
Interrupt Input INO Normal INI Normal INI IN4 Normal IN5 Normal I	IN2 Normal V IN3 Normal V

**Note** (1) Set high-speed counter 0 when using inverter positioning 0. Set high-speed counter 1 when using inverter positioning 1.

(2) Use linear mode for inverter positioning.

■ Inverter Positioning Settings (on Inverter Positioning 0 or 1 Tab Page)

😽 PLC Settings - NewPLC1		×
File Options Help		
File Options Help Built-in Input Pulse Output 0 Pulse Outp Inverter Positioning ✓ Use inverter positioning. Gain (default 0: 10°0.1) In-position range (default 0: 1) Min. output value (default 0: 1) Max. output value (default 0: 1) Max. output value (default 0: 1) Error counter overflow detection value (default 0: 1000) Error counter alarm detection value (default 0: 1000) Error counter cycle (default 0: 12ms) Power Supply Freq. for One Motor Revolution per Sec. Number of Encoder Pulses for One Motor Revolution	50       *0.1       Limit output during acceleration and constant speed.         20       Output coefficient during acceleration and constant speed         40       (default 0: 6*0.01)       *0.01         2000000       Limit output during deceleration and when	
	CP1L-M Offline	

### Ladder Program

Starting Inverter Positioning

0.05		
	PLS2(887)	
Start input	#0020	← Inverter positioning 1
	#0000	← CW, relative pulses
	D200	← Target frequency, No. of output pulses
	D300	← Starting frequency

**Note** The pulse output method (CCW/CW or pulse + direction) setting and direction setting are not used.

#### ■ PLS2(887) Settings

Setting details	Address	Data
Acceleration rate: 100 Hz/4 ms	D200	0064
Deceleration rate: 80 Hz/4 ms	D201	0050
Target frequency: 20,000 Hz	D202	4E20
	D203	0000
Number of output pulses: 600,000 pulses	D204	27C0
	D205	0009
Starting frequency: 100 Hz	D300	0064
	D301	0000

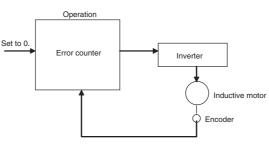
• High-speed counter 0 (i.e., error counter 0) is used for the feedback pulse input port.

#### Stopping Internal Pulse Output to the Error Counter



Port specifier (Error counter 0: 0020 hex) 0003 hex: Stop virtual pulse output 0000 (Not used.)

- Internal pulse output is stopped immediately.
- Inverter positioning (i.e., the error counter) will continue to function.



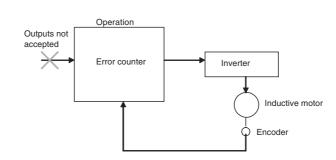
#### Stopping Inverter Positioning



Port specified (Error counter 0: 0020 hex) 0004 hex: Stop inverter positioning 0000 (Not used.)

- Internal pulse output is stopped immediately.
- The output value will remain at 0 until the error counter is reset.
- Pulse outputs will not be accepted until the error counter is reset. (Executing a pulse output instruction will cause an error.)

### **Inverter Positioning**



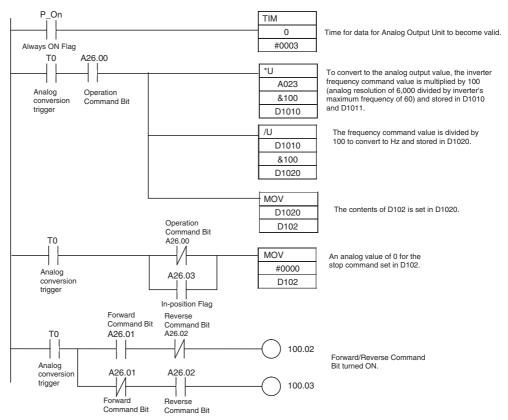
Referencing the Automatically Calculated Inverter Frequency Command Value If the following settings are made in the PLC Setup, the inverter frequency command value will be calculated automatically and set in A23 in the Auxiliary Area. These settings are on the Inverter Positioning 0 Tab Page in the PLC Setup.

- Power Supply Frequency for One Motor Revolution per Second (0.1-Hz increments)
- Number of Encoder Pulses for One Motor Revolution
- Error Counter Cycle (x 4 ms)

The inverter frequency command value in A23 is accessed and converted to an analog output signal. The CP1W/CPM1A-DA041 has a resolution of 6,000, so the conversion to an analog signal is performed as follows:

 $6,000 \div 60$  Hz (inverter's maximum output frequency)  $\div 100 = 1$ 

The conditions are as follows:



In this example, the results of \*U and /UL are 1, so the value in A23 is moved directly to D102 with MOV.

#### Internal Work Addresses

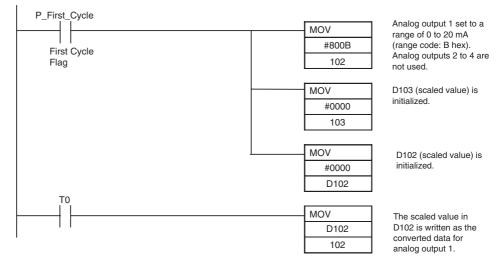
Address	Usage
D1010	Holds the frequency command value converted for the analog
D1011	output resolution.
D1020	Holds the frequency command value converted from 0.01-Hz increments to hertz.
Т0	Analog conversion trigger

#### Settings Addresses

Address	Usage
D102	Bits 00 to 15: Analog output value
CIO 100.02	Forward (external output)
CIO 100.03	Reverse (external output)

#### CP1W/CPM1A-DA041 Analog Output Settings

Analog output 1 is used in this example. It is set to a range of 4 to 20 mA. The scaled value is set in the analog conversion area of the Analog Output Unit.



Refer to the first line in the programming example in *Referencing the Automatically Calculated Inverter Frequency Command Value* on page 334 for a timer for the time required for the Analog Output Unit's data to be valid (analog conversion trigger: T0).

#### Internal Work Addresses

Address	Usage
D102	Bits 00 to 15: Analog output value
Т0	Analog conversion trigger

#### Settings Addresses

Address Usage					
CIO 102	Bits 00 to 15: Analog conversion area				
CIO 103	Bits 00 to 15: Analog conversion area				

# 5-3-13 Supplemental Information

Restrictions

Precautions

- Inverter positioning 0 and inverter positioning 1 each use one high-speed counter and one serial port (except that a serial port is not used when an Analog Output Unit is used). (High-speed counter 0 is allocated to inverter positioning 0 and high-speed counter 1 is allocated to inverter positioning 1.)
- When inverter positioning 0 or 1 is used, the corresponding pulse output (0 or 1) and the corresponding PWM command (pulse output 0 or 1) cannot be used.
- Determine the in-position range based on the mechanical system. Use a smaller range if positioning precision is required. If the range is too small, however, time may be required when stopping. If stopping quickly is more important than precision, increase the in-position range.
- The error counter cycle also affects the conversion between the output value and the inverter frequency command value. Refer to 5-3-9 Automatic Calculation of Inverter Frequency Command Value for details.
- If inverter positioning does not end normally, adjust the following settings. Reduce the acceleration/deceleration rates.

Lower rates will stabilize operation at the end of acceleration/deceleration. Reduce the target frequency.

Change the error counter cycle. Increasing the error counter cycle improve stopping precision, but it may also cause unstable speeds during operation.

Adjust the gain.

Increasing the gain will improve stopping precision, but it may also cause unstable speeds during operation.

# SECTION 6 Advanced Functions

This section describes all of the advanced functions of the CP1L that can be used to achieve specific application needs.

6-1	Interruj	pt Functions
	6-1-1	Overview of CP1L Interrupt Functions
	6-1-2	Input Interrupts (Direct Mode)
	6-1-3	Input Interrupts (Counter Mode)
	6-1-4	Scheduled Interrupts
	6-1-5	High-speed Counter Interrupts
6-2	Quick-	response Inputs
6-3		Communications
	6-3-1	Overview
	6-3-2	No-protocol Communications
	6-3-3	Modbus-RTU Easy Master Function
	6-3-4	Communications: Smart Active Parts and Function Blocks
	6-3-5	Serial PLC Links
	6-3-6	1:1 Links
	6-3-7	1:N NT Links
	6-3-8	1:1 NT Links
	6-3-9	Host Link Communications
6-4	Analog	Adjuster and External Analog Setting Input
	6-4-1	Analog Adjuster
	6-4-2	External Analog Setting Input
6-5	Battery	r-free Operation
	6-5-1	Overview
	6-5-2	Using Battery-free Operation
6-6	Memor	ry Cassette Functions
	6-6-1	Overview
	6-6-2	Mounting and Removing a Memory Cassette
	6-6-3	Operation Using the CX-Programmer
	6-6-4	Memory Cassette Data Transfer Function
	6-6-5	Procedures for Automatic Transfer from the Memory Cassette at Startup.
6-7	Progra	m Protection
	6-7-1	Read Protection
	6-7-2	Write Protection
	6-7-3	Protecting Program Execution Using the Lot Number
6-8	Failure	Diagnosis Functions
	6-8-1	Failure Alarm Instructions: FAL(006) and FALS(007)
	6-8-2	Failure Point Detection: FPD(269)
	6-8-3	Simulating System Errors
	6-8-4	Output OFF Bit
6-9	Clock.	• ••••••

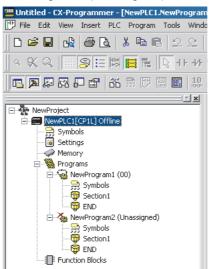
# 6-1 Interrupt Functions

# 6-1-1 Overview of CP1L Interrupt Functions

	The CP1L CPU Unit's processing is normally cyclical (overseeing processing $\rightarrow$ program execution $\rightarrow$ I/O refreshing $\rightarrow$ peripheral servicing), with cyclic tasks executed in the program execution stage of the cycle. The interrupt functions can be used to temporarily interrupt this cyclic processing and execute a particular program when a predefined condition occurs.
<u>Types of Interrupt</u> Functions	
Input Interrupts (Direct Mode)	When one of the CPU Unit's built-in inputs goes from OFF to ON (or ON to OFF), the corresponding interrupt task is executed. Interrupt tasks 140 to 145 are allocated to the 8 input terminals used for the input interrupts.
Input Interrupts (Counter Mode)	This function counts input pulses at one of the CPU Unit's built-in inputs and executes the corresponding interrupt task when the count reaches the SV. The maximum input response frequency for input interrupts (in counter mode)
	is 5 kHz.
Scheduled Interrupts	This function executes an interrupt task at a fixed time interval measured by the CPU Unit's built-in timer. The time interval units can be set to 10 ms, 1 ms, or 0.1 ms. The minimum timer SV is 0.5 ms. Interrupt task 2 is allocated to scheduled interrupt.
High-speed Counter Interrupts	This function counts input pulses with the CPU Unit's built-in high-speed counter and executes an interrupt task when the count reaches the preset value or falls within a preset range (target-value or zone comparison). An interrupt task between 0 and 255 can be allocated with an instruction. Refer to <i>5-1 High-speed Counters</i> for details on high-speed counters.
Note	Power OFF interrupts cannot be used with CP1L CPU Units.

### Creating an Interrupt Task Program

 1. Right-click NewPLC1 [CP1L] Offline in the project workspace and select Insert Program from the pop-up menu. A new program called NewProgram2 (unassigned) will be inserted in the project workspace.



2. Right-click *NewProgram2 (unassigned)* and select *Properties* from the pop-up menu to display the Program Properties Window.

Progra	am Properties		×
-(#I	General Prote	ction Comments	1
	<u>N</u> ame:	NewProgram2	
	Task <u>t</u> ype:	Unassigned 💌	
		Cperation start	

3. Set the *Task type* in the Program Properties Window. In this example, interrupt task 140 was allocated to NewProgram2.

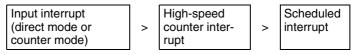
Progra	am Properties		×
-ja	General Protec	stion Comments	
	<u>N</u> ame:	NewProgram2	
	Task <u>t</u> ype:	Interrupt Task 140 💌	
		Interrupt Task 140 🛛 🔺	
		Interrupt Task 141	
		Interrupt Task 142	
		Interrupt Task 143	
		Interrupt Task 144	
		Interrupt Task 145	
		Interrupt Task 146	

If you click the  $\mathbf{X}$  Button in the upper-right corner of the window, you can create the program that will be executed as interrupt task 140.

The programs allocated to each task are independent and an END(001) instruction must be input at the end of each program.

**Interrupt Task Priority** The input interrupts (direct mode and counter mode), high-speed counter interrupts, scheduled interrupts, and external interrupts all have the same priority. If interrupt task A (an input interrupt, for example) is being executed when interrupt task B (a scheduled interrupt, for example) is called, task A processing will not be interrupted. Task B processing will be started when task A is completed.

If two different types of interrupt occur simultaneously, they are executed in the following order:



If two of the same type interrupt occur simultaneously, the task with the lower interrupt task number is executed first.

**Note** If a user program is likely to generate multiple interrupts simultaneously, the interrupt tasks will be executed in the order shown above, so it may take some time from the occurrence of the interrupt condition to the actual execution of the corresponding interrupt task. In particular, it is possible that scheduled interrupts will not be executed in the preset time, so the program must be designed to avoid interrupt conflicts if necessary.

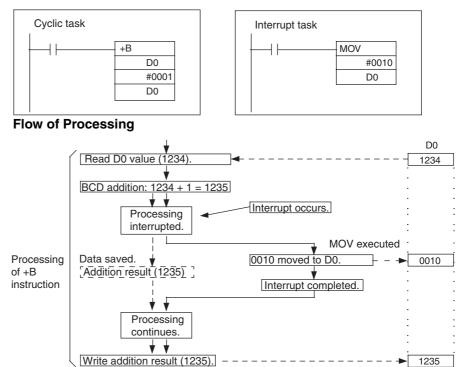
#### Duplicate Processing in Cyclic and Interrupt Tasks

If a memory address is processed both by a cyclic task and an interrupt task, an interrupt mask must be set to disable interrupts.

When an interrupt occurs, execution of the cyclic task will be interrupted immediately, even during execution of a cyclic task's instruction, and the partially processed data is saved. After the interrupt task is completed, processing returns to the cyclic task and the interrupted processing restarts with the data saved before the interrupt processing. If the interrupt task overwrites a memory address used by one of the interrupted instruction's operands, that overwrite may not be reflected after the saved data is restored as processing returns to the cyclic task.

To prevent an instruction from being interrupted during processing, enter DI(693) just before the instruction to disable interrupts and EI(694) just after the instruction to enable interrupts again.

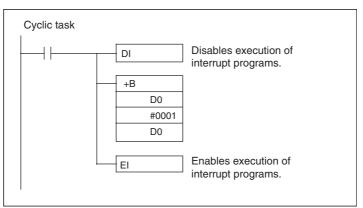
a. The following example shows duplicate processing by an interrupt task, which interrupts processing of a +B instruction between the first and third operands and overwrites the same memory address.



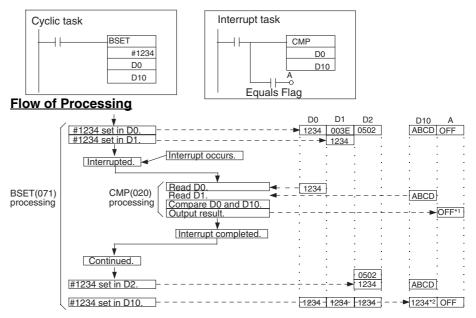
The interrupt occurs during processing of the +B instruction and the result is saved temporarily without being written to the destination word (D0).

The interrupt task transfers the value of #0010 to D0, but the saved result of the +B instruction (1235) is written to D0 when processing returns to the cyclic task. In the end, the interrupt task's processing has no effect.

#### Prevention of Duplicate Processing



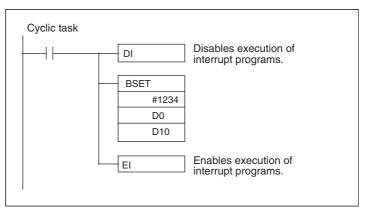
b. The following example shows duplicate processing by an interrupt task, which interrupts processing while BSET is writing to a block of words and yields an incorrect comparison result.



Since the interrupt occurs during BSET(071) processing and before #1234 is set in D10, the content of D0 and D10 do not match when the comparison is made in the interrupt task (\*1) and output A remains OFF.

In the end (\*2), the D0 and D10 both contain #1234 and match, but the correct comparison result is not reflected in comparison result output A.

### Prevention of Duplicate Processing



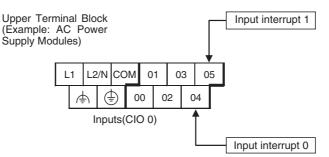
# 6-1-2 Input Interrupts (Direct Mode)

This function executes an interrupt task when the corresponding input signal (up or down differentiated) is received.

### Input Interrupt Bit and Terminal Allocations

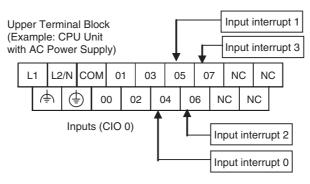
Input Terminal Block of CPU Units with 10 I/O Points The following diagrams show the input bits and terminals that are used for the input interrupt function in each CPU Unit.

The 2 input bits CIO 0.04 to CIO 0.05 can be used for input interrupts.

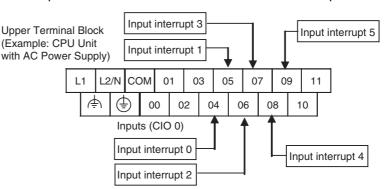


#### Input Terminal Block of CPU Units with 14 I/O Points

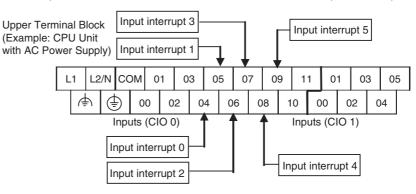
The 4 input bits CIO 0.04 to CIO 0.07 can be used for input interrupts.



Input Terminal Block of CPU Units with 20 I/O Points The 6 input bits CIO 0.04 to CIO 0.09 can be used for input interrupts.

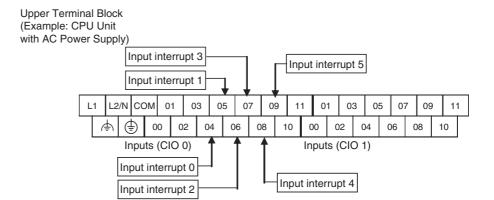


Input Terminal Block of CPU Units with 30 I/O Points The 6 input bits CIO 0.04 to CIO 0.09 can be used for input interrupts.



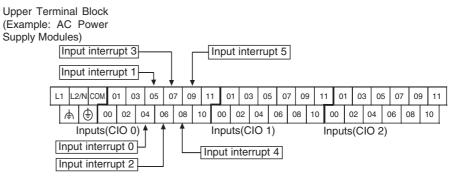
#### Input Terminal Block of CPU Units with 40 I/O Points

### The 6 input bits CIO 0.04 to CIO 0.09 can be used for input interrupts.



#### Input Terminal Block of CPU Units with 60 I/O Points

#### The 6 input bits CIO 0.04 to CIO 0.09 can be used for input interrupts.



# Section 6-1

### Section 6-1

### Setting the Input Functions in the PLC Setup

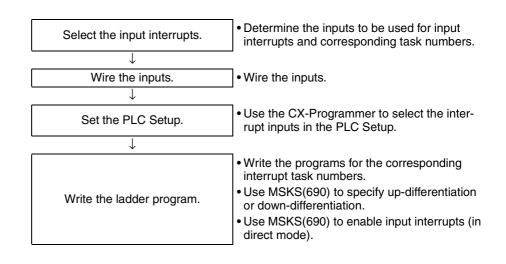
Normally, bits CIO 0.04 to CIO 0.09 are used as normal inputs. When using these inputs for input interrupts, use the CX-Programmer to change the input's setting in the PLC Setup.

Input te blo				CPU	Unit			Input interrupt	Task number
Word	Bit	CPU Units with 60 I/O Points	CPU Units with 40 I/O Points	CPU Units with 30 I/O Points	CPU Units with 20 I/O Points	CPU Units with 14 I/O Points	CPU Units with 10 I/O Points		
CIO 0	00	Normal input 0							
	01	Normal input 1							
	02	Normal input 2							
	03	Normal input 3							
	04	Normal input 4	Input interrupt 0	Interrupt task 140					
	05	Normal input 5	Input interrupt 1	Interrupt task 141					
	06	Normal input 6		Input interrupt 2**	Interrupt task 142**				
	07	Normal input 7		Input interrupt 3**	Interrupt task 143**				
	08	Normal input 8	Normal input 8	Normal input 8	Normal input 8			Input interrupt 4*	Interrupt task 144*
	09	Normal input 9	Normal input 9	Normal input 9	Normal input 9			Input interrupt 5*	Interrupt task 145*
	10	Normal input 10	Normal input 10	Normal input 10	Normal input 10				
	11	Normal input 11	Normal input 11	Normal input 11	Normal input 11				
CIO 1	00 to 05	Normal input 12 to 17	Normal input 12 to 17	Normal input 12 to 17					
	06 to 11	Normal inputs 18 to 23	Normal inputs 18 to 23						
CIO 2	00 to 11	Normal inputs 24 to 35							

Note \*Input interrupts 4 and 5 are not supported by CPU Units with 10 or 14 I/O Points.

\*\*Input interrupts 2 and 3 are not supported by CPU Units with 10 I/O Points.

### **Procedure**



### Section 6-1

### PLC Setup

Click the Built-in Input Tab to display the *Interrupt Input* settings (at the bottom of the tab). Set the input function to *Interrupt* for each input that will be used as an input interrupt.

Revealed the second sec	_
Startup   Settings   Timings   Input constant   Serial Port 1	Serial Port 2 Peripheral Service Built-in Input
High Speed Counter 0 Use high speed counter 0 Counting mode © Linear mode © Circular mode Circular Max. Count 0 Reset Z phase, software reset Input Setting Differential phase input	High Speed Counter 1 Use high speed counter 1 Counting mode C Linear mode C Circular mode Circular Max. Count Reset Z phase, software reset Input Setting Differential phase input
High Speed Counter 2 Use high speed counter 2 Counting mode © Linear mode C Circular mode Circular Max. Count	High Speed Counter 3 Use high speed counter 3 Counting mode C Linear mode C Lincular mode Circular Max. Count
Reset         Z phase, software reset         Image: so	Reset         Z phase, software reset         Image: contract of the software resoftware reset         Image: contract of the
Interrupt Input IN0 Interrupt IN1 Normal IN4 Normal IN5 Interrupt Quick	IN2 Normal V IN3 Normal V

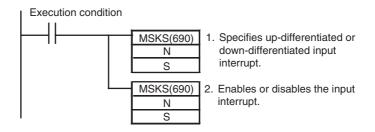
Note

- (1) Interrupt Input settings IN0 to IN7 correspond to input interrupt numbers 0 to 7.
  - (2) When using an input as a general-purpose (normal) input, set the input function to *Normal*.

### Writing the Ladder Program MSKS(690) Settings

The MSKS(690) instruction must be executed in order to use input interrupts. The settings made with MSKS(690) are enabled with just one execution, so in general execute MSKS(690) in just one cycle using an up-differentiated condition.

MSKS(690) has the following two functions and two of the instructions are used in combination. If an up-differentiated input interrupt is being used, the first MSKS(690) instruction can be omitted since the input is set for up-differentiation by default.



#### MSKS(690) Operands

Input interrupt number	Interrupt task		entiation or erentiation	2. Enabling/Disabling the input interrupt		
	number	N	S	N	S	
		Input interrupt number	Execution condition	Input interrupt number	Enable/ Disable	
Input interrupt 0	140	110 (or 10)	#0: Up-dif-	100 (or 6)	#0: Enable	
Input interrupt 1	141	111 (or 11)	ferentiated	101 (or 7)	interrupt	
Input interrupt 2**	142	112 (or 12)	#1: Down- differenti-	102 (or 8)	#1: Disable interrupt	
Input interrupt 3**	143	113 (or 13)	ated	103 (or 9)	menupi	
Input interrupt 4*	144	114		104		
Input interrupt 5*	145	115	1	105		

**Note** \*Input interrupts 4 and 5 are not supported by the CPU Units with 10 or 14 I/O Points.

 $^{\ast\ast}$  Input interrupts 2 and 3 are not supported by the CPU Units with 10 I/O Points.

Writing the Interrupt<br/>Task's ProgramCreate programs for interrupt tasks 140 to 145, which are executed by the cor-<br/>responding input interrupt. Always put an END(001) instruction at the last<br/>address of the program.

This example shows how to execute interrupt task 140 when input CIO 0.04 goes ON.

# **Operation**

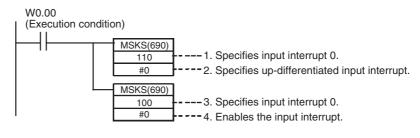
Input Interrupt

Settings and

### Settings

1,2,3	1.	Connect an input device to input 0.04.	
-------	----	--	--

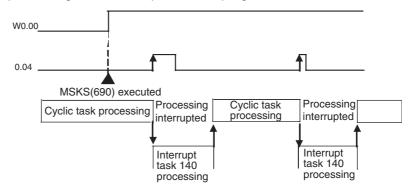
- 2. Use the CX-Programmer to set input 0 as an input interrupt in the PLC Setup.
- 3. Use the CX-Programmer to create the program to use for interrupt processing and allocate the program to interrupt task 140.
- 4. Use the CX-Programmer to write MSKS(690) in the program.



#### Operation

When execution condition W0.00 goes ON, MSKS(690) is executed to enable CIO 0.04 as an up-differentiated input interrupt.

If CIO 0.04 goes from OFF to ON (up-differentiation), processing of the cyclic task that is currently being executed will be interrupted and processing of interrupt task 140 will start. When the interrupt task processing is completed, processing of the interrupted ladder program will restart.



### **Restrictions**

Inputs cannot be used for input interrupts when they are being used as general-purpose (normal) inputs or quick-response inputs.

# 6-1-3 Input Interrupts (Counter Mode)

### **Overview**

This function counts up-differentiated or down-differentiated input signals and executes an interrupt task when the count reaches the set value.

- The counter-mode input interrupts use the same input terminals as the direct-mode input interrupts. Refer to 6-1-2 Input Interrupts (Direct Mode) for details.
- The counter input mode can be set to up or down (incrementing or decrementing) with MSKS(690).
- The counter-mode input interrupts start the same interrupt tasks (140 to 145) as the direct-mode input interrupts.
- The maximum input response frequency is 5 kHz total for all countermode input interrupts.

#### Relationship of Input Bits, Task Numbers, and Counters

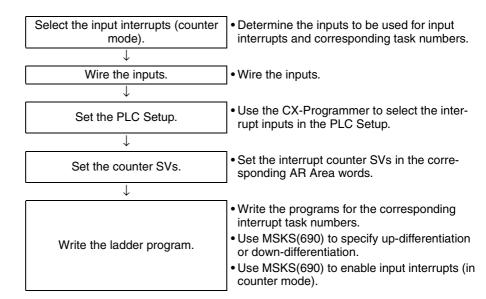
Input bits	Func	tion	Counter words		
	Input interrupt number	Interrupt task number	SV (0000 to FFFF)	PV	
0.04	Input interrupt 0	140	A532	A536	
0.05	Input interrupt 1	141	A533	A537	
0.06**	Input interrupt 2**	142	A534	A538	
0.07**	Input interrupt 3**	143	A535	A539	
0.08*	Input interrupt 4*	144	A544	A548	
0.09*	Input interrupt 5*	145	A545	A549	

**Note** \*Input interrupts 4 and 5 are not supported by CPU Units with 10 or 14 I/O Points.

\*\*Input interrupts 2 and 3 are not supported by CPU Units with 10 I/O Points.

### Interrupt Functions

### **Procedure**



**Note** The input interrupt (counter mode) function is one of the input interrupt functions and executes an interrupt based on the pulse count. If the input pulse frequency is too high, interrupts will occur too frequently and prevent normal cyclic task processing. In this case, cycle time too long errors may occur or the pulse input may not be read.

The maximum total frequency of the counter-mode interrupt inputs is 5 kHz. Even in this case, the high frequencies may adversely affect other devices' operation or the system load, so check the system's operation thoroughly before using the counters at high frequencies.

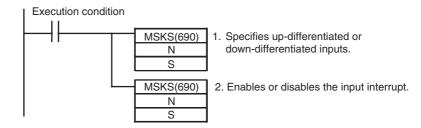
PLC SetupThe procedures for using the CX-Programmer to set the PLC Setup are the<br/>same as the procedures for input interrupts (direct mode). Refer to 6-1-2 Input<br/>Interrupts (Direct Mode) for details.

### Writing the Ladder Program

MSKS(690) Settings

The MSKS(690) instruction must be executed in order to use input interrupts. The settings made with MSKS(690) are enabled with just one execution, so in general execute MSKS(690) in just one cycle using an up-differentiated condition.

MSKS(690) has the following two functions and three of the instructions are used in combination. If up-differentiated input pulses are being used, the first MSKS(690) instruction can be omitted since the input is set for up-differentiation by default.



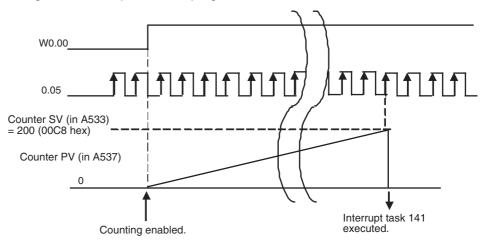
	Input interrupt number	Interrupt task	1. Up-differentiation or Down-differentiation		2. Enablin inpu	g/Disabling the t interrupt
		muber Count	Ν	S	N	S
		oount	Input interrupt number	Count trigger	Input interrupt number	Enable/ Disable
	Input interrupt 0	140	110 (or 10)	#0: Up-dif- ferentiated	100 (or 6)	#2: Start count- ing down (dec-
	Input interrupt 1	141	111 (or 11)	pulses	101 (or 7)	rementing) and
	Input interrupt 2**	142**	112 (or 12)	#1: Down- differenti-	102 (or 8)	enable inter- rupts
	Input interrupt 3**	143**	113 (or 13)	ated pulses	103 (or 9)	#3: Start count- ing up (incre-
	Input interrupt 4*	144*	114		104	menting) and enable inter-
	Input interrupt 5*	145*	115		105	rupts
Note	*Input interrupts Points.	4 and 5 a	are not supp	oorted by CF	PU Units w	ith 10 or 14 I/O
	**Input interrupts	2 and 3 a	are not supp	orted by CP	U Units with	n 10 I/O Points.
Writing the Interrupt Task's Program	Create programs responding input address of the pr	t interrupt				
Input Interrupt Settings and Operation	This example sho ated pulses have menting counter.	e been co		•		
Settings						
1 <i>,2,3</i>	1. Connect an i	nput devid	e to input 0	05.		
	2. Use the CX-I Setup.	Programm	er to set inp	ut 0.05 as a	n input inte	rrupt in the PLC
	3. Use the CX- cessing and					or interrupt pro-
	4. Use the CX-F decimal) in A	•	er to set a hi	gh-speed co	ounter SV o	f 00C8 hex (200
	5. Use the CX-I	Programm	er to write N	/ISKS(690) ii	n the progra	am.
	W0.00 (Execution conditio	n) MSKS(6 111 #0 MSKS(6 111 #3	590) Sr Sr	pecifies input in pecifies up-diffe pecifies input in pecifies an incre arts counting, a	rentiated puls terrupt 1. ementing coun	ter,

### MSKS(690) Operands

Operation

When execution condition W0.00 goes ON, MSKS(690) is executed to enable operation of the input interrupt in counter mode.

When CIO 0.05 goes from OFF to ON 200 times, processing of the cyclic task that is currently being executed will be interrupted and processing of interrupt task 141 will start. When the interrupt task processing is completed, processing of the interrupted ladder program will restart.



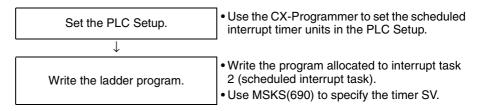
### **Restrictions**

Inputs cannot be used for input interrupts when they are being used as general-purpose (normal) inputs or quick-response inputs.

# 6-1-4 Scheduled Interrupts

This function executes an interrupt task at a fixed time interval measured by the CPU Unit's built-in timer. Interrupt task 2 is allocated to scheduled interrupt.

### **Procedure**



### PLC Setup

Click the **Timings** Tab and set the input function to *Scheduled Interrupt Interval* (the scheduled interrupt timer's units). The timing units can be set to 10 ms, 1 ms, or 0.1 ms. The scheduled interrupt timer SV is calculated by multiplying this interval setting by the timer SV set with MSKS(690).

#### Scheduled Interrupt Interval Setting

PLC Settings - NewPLC1	_ 🗆 X
File Options Help	
Startup   Settings   Timings   Input constant   Serial Port 1   Serial Port 2   Peripheral Service   Br	uilt-in Input   F. 🕨
Watch Cycle Time (default 1000ms) 🔽 🛛 👘 👘 🖓 👘 🖓 👘	
Cycle Time (No Setting)	
Scheduled Interrupt Interval 10 ms	
	CP1L-M Offline

Note

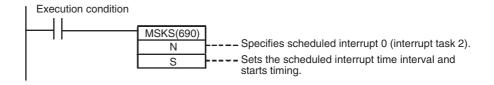
- (1) Set a scheduled interrupt time (interval) that is longer than the time required to execute the corresponding interrupt task.
  - (2) If the scheduled time interval is too short, the scheduled interrupt task will be executed too frequently, which may cause a long cycle time and adversely affect the cyclic task processing.
  - (3) If an interrupt task is being executed for another interrupt (input interrupt, high-speed counter interrupt, or external interrupt) when the scheduled interrupt occurs, the scheduled interrupt will not be executed until the other interrupt task is completed.

When different kinds of interrupts are being used, design the program to handle multiple interrupts smoothly. Even if two interrupts occur at the same time, the scheduled interrupts will continue as programmed, so the scheduled interrupt tasks will continue to occur at the scheduled times even if specific scheduled interrupts are delayed.

### Writing the Ladder Program

MSKS(690) Settings

The MSKS(690) instruction must be executed in order to use the scheduled interrupt. The settings made with MSKS(690) are enabled with just one execution, so in general execute MSKS(690) in just one cycle using an up-differentiated condition.



#### MSKS(690) Operands

Operan	d	Interrupt time interval (period)		
N	S	Time units set in	Scheduled time	
Scheduled interrupt number	Interrupt time	PLC Setup	interval	
Scheduled interrupt 0	#0000 to #270F	10 ms	10 to 99,990 ms	
(interrupt task 2)	(0 to 9999)	1 ms	1 to 9,999 ms	
14: Reset start		0.1 ms	0.5 to 999.9 ms	
4: Start without reset				

#### Writing the Scheduled Interrupt Task's Program

Create the program for interrupt task 2 (scheduled interrupt 0), which is executed by the input interrupt. Always put an END(001) instruction at the last address of the program.

#### Selecting the Scheduled Interrupt Task

Program Properties 🛛 🕹							
-121	General Protec	ction Comments					
	<u>N</u> ame:	NewProgram2					
	Task <u>t</u> ype:	•					
		Interrupt Task 02 (Interval Timer 0)					
		Interrupt Task 03 (Interval Timer 1)					
		Interrupt Task 04					
		Interrupt Task 05					
		Interrupt Task 06					
		Interrupt Task 07					
		Interrupt Task 08					

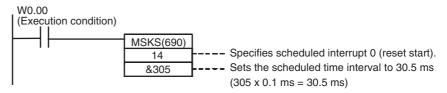
### Input Interrupt Settings and Operation

Settings

*1,2,3...* 1. Use the CX-Programmer to set the scheduled interrupt time units to 0.1 ms.

This example shows how to execute interrupt task 2 at 30.5 ms intervals.

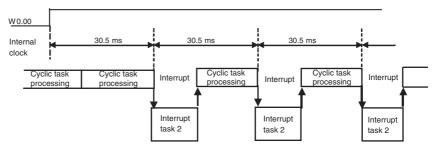
2. Use the CX-Programmer to create the interrupt program allocated to interrupt task 2.



#### Operation

When execution condition W0.00 goes ON, MSKS(690) is executed to enable the scheduled interrupt with the reset start specified. The timer is reset and timing starts.

Scheduled interrupt 2 is executed every 30.5 ms.



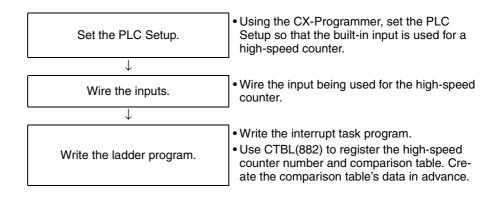
# 6-1-5 High-speed Counter Interrupts

This function executes the specified interrupt task (0 to 255) when the CP1L CPU Unit's built-in high-speed counter PV matches a pre-registered value (target value comparison) or lies within a pre-registered range (range comparison).

- CTBL(882) is used to register the comparison table.
- Either CTBL(882) or INI(880) can be used to start comparison.
- INI(880) is used to stop comparison.

For details on the built-in high-speed counter, refer to 5-1 High-speed Counters.

### **Procedure**



## Section 6-1

### PLC Setup

Click the **Built-in Input** Tab to and set the high-speed counters that will be used for interrupts.

REC Settings - NewPLC1 File Options Help	×		
	Serial Port 2 Peripheral Service Built-in Input		
Startup   Settings   Timings   Input constant   Serial Port 1			
High Speed Counter 0	High Speed Counter 1		
Counting mode 💿 Linear mode 🔘 Circular mode	Counting mode  Circular mode		
Circular Max. Count 🛛 🛛 🕄	Circular Max. Count		
Reset Z phase, software reset 💌	Reset Z phase, software reset 💌		
Input Setting Differential phase input	Input Setting Software reset		
High Speed Counter 2	Z phase, software reset(comparin High Speed Court Software reset(comparing)		
Use high speed counter 2 Counting mode  Linear mode  Circular mode	Use high speed counter 3 Counting mode  Linear mode  Circular mode		
Circular Max. Count	Circular Max. Count		
Reset Z phase, software reset 💌	Reset Z phase, software reset		
Input Setting Increment pulse input	Input Setting Increment pulse input		
Interrupt Input			
IND Interrupt VIN1 Normal V	IN2 Normal IN3 Normal IN3		
IN4 Normal V IN5 Normal V			
P	CP1L-M Offline		

### Settings

Item	Setting
Use high speed counter 0 to 3	Use counter
Counting mode	Linear mode
	Circular mode (ring mode)
Circular Max. Count	0 to FFFF FFFF hex
	(When circular (ring) mode is selected as the count- ing mode, set maximum ring value here.)
Reset method	Phase Z and software reset
	Software reset
	Phase Z and software reset (continue comparing)
	Software reset (continue comparing)
Input Setting	Differential phase inputs (4x)
	Pulse + direction inputs
	Up/Down inputs
	Increment pulse input

#### Input Function Settings According the PLC Setup Setting

If the built-in inputs are set to be used as high-speed counters 0 to 3, the function of the input bits will change as shown in the following table. If a highspeed counter is set to be used, the bits in CIO 0 and CIO 1 can no longer be used for normal inputs, input interrupts, or quick-response inputs.

Add	ress		Default	setting		High-speed	counter operation se	ettings:
Word	Bit	CPU Units with 60 I/O Points	CPU Units with 40 I/O Points	CPU Units with 30 I/O Points	CPU Units with 20 I/O Points	Single-phase (increment pulse input)	Two-phase (differential phases x4, up/down, or pulse/direction)	Origin searches
CIO 0	00	Normal input 0	Normal input 0	Normal input 0	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1	Normal input 1	Normal input 1	Normal input 1	Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2	Normal input 2	Normal input 2	Normal input 2	Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3	Normal input 3	Normal input 3	Normal input 3	Counter 3, increment input	Counter 1, B phase, down, or direction input	
	04	Normal input 4	Normal input 4	Normal input 4	Normal input 4	Counter 0, phase-Z reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Normal input 5	Normal input 5	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	
	06	Normal input 6	Normal input 6	Normal input 6	Normal input 6	Counter 2, phase-Z reset input		Pulse output 0: Origin input signal
	07	Normal input 7	Normal input 7	Normal input 7	Normal input 7	Counter 3, phase-Z reset input		Pulse output 1: Origin input signal
	08	Normal input 8	Normal input 8	Normal input 8	Normal input 8			
	09	Normal input 9	Normal input 9	Normal input 9	Normal input 9			
	10	Normal input 10	Normal input 10	Normal input 10	Normal input 10			Pulse output 0: Origin proxim- ity input signal
	11	Normal input 11	Normal input 11	Normal input 11	Normal input 11			Pulse output 1: Origin proxim- ity input signal
CIO 1	00 to 05	Normal input 12 to 17	Normal input 12 to 17	Normal input 12 to 17				
	06 to 11	Normal input 18 to 23	Normal input 18 to 23					
CIO 2	00 to 11	Normal input 24 to 35						

■ <u>CPU Units with 20, 30, 40 or 60 I/O Points</u>

Input ter	rminal block	Default setting	Hi	gh-speed counter setting	js
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	Origin searches
CIO 0	00	Normal input 0	High-speed counter 0: Increment input	High-speed counter 0: Phase A, Increment, or Count input	
	01	Normal input 1	High-speed counter 1: Increment input	High-speed counter 0: Phase B, Decrement, or Direction input	
	02	Normal input 2	High-speed counter 2: Increment input	High-speed counter 1: Phase A, Increment, or Count input	Pulse output 0: Origin proximity input signal
	03	Normal input 3	High-speed counter 3: Increment input	High-speed counter 1: Phase B, Decrement, or Direction input	Pulse output 1: Origin proximity input signal
	04	Normal input 4	High-speed counter 0: Phase Z or reset input	High-speed counter 0: Phase Z or reset input	
	05	Normal input 5	High-speed counter 1: Phase Z or reset input	High-speed counter 1: Phase Z or reset input	
	06	Normal input 6	High-speed counter 2: Phase Z or reset input		Pulse output 0: Origin input signal
	07	Normal input 7	High-speed counter 3: Phase Z or reset input		Pulse output 1: Origin input signal

■ <u>CPU Units with 14 I/O Points</u>

### ■ CPU Units with 10 I/O Points

Address		Default setting	High-sp	ettings:	
Word	Bit		Single-phase (increment pulse input)	Two-phase (differential phase x4, up/down, or pulse/direction)	Origin searches
CIO 0	00	Normal input 0	Counter 0, increment input	Counter 0, A phase, up, or count input	
	01	Normal input 1	Counter 1, increment input	Counter 0, B phase, down, or direction input	
	02	Normal input 2	Counter 2, increment input	Counter 1, A phase, up, or count input	
	03	Normal input 3	Counter 3, increment input	Counter 1, B phase, down, or direction input	Pulse output 0: Origin proximity input signal
	04	Normal input 4	Counter 0, phase-Z reset input	Counter 0, phase-Z reset input	
	05	Normal input 5	Counter 1, phase-Z reset input	Counter 1, phase-Z reset input	Pulse output 0: Origin input signal

### High-speed Counter Memory Areas

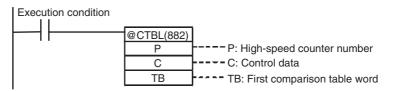
Co	High-speed counter		
		0	1
PV	Leftmost 4 digits	A271	A273
	Rightmost 4 digits	A270	A272
Range Comparison Condi-	ON for match in range 1	A274.00	A275.00
tion Met Flags	ON for match in range 2	A274.01	A275.01
	ON for match in range 3	A274.02	A275.02
	ON for match in range 4	A274.03	A275.03
	ON for match in range 5	A274.04	A275.04
	ON for match in range 6	A274.05	A275.05
	ON for match in range 7	A274.06	A275.06
	ON for match in range 8	A274.07	A275.07
Comparison In-progress Flags	ON while the comparison is in progress.	A274.08	A275.08
Overflow/Underflow Flags	ON if a PV overflow or under- flow occurred while operating in linear mode.	A274.09	A275.09
Count Direction Flags	0: Decrementing 1: Incrementing	A274.10	A275.10

Note

The comparison table and comparison conditions 1 to 8 are different for target-value comparison and range comparison operations. For details, refer to next page.

### REGISTER COMPARISON TABLE Instruction: CTBL(882)

CTBL(882) compares the PV of a high-speed counter (0 to 3) to target values or target value ranges and executes the corresponding interrupt task (0 to 255) when the specified condition is met.

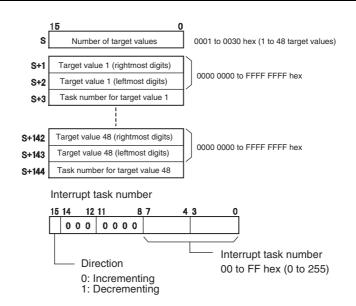


	Operand		Settings	
Ρ	High-speed	#0000	High-speed counter 0	
	counter number	#0001	High-speed counter 1	
С	Control data	#0000	Registers a target-value comparison table and starts the comparison operation.	
		#0001	Registers a range comparison table and starts the comparison operation.	
		#0002	Registers a target-value comparison table.	
		#0003	Registers a range comparison table.	
ТΒ	First comparison table word	Specifies the leading word address of the comparison table, which is described below.		

Contents of the Comparison Table

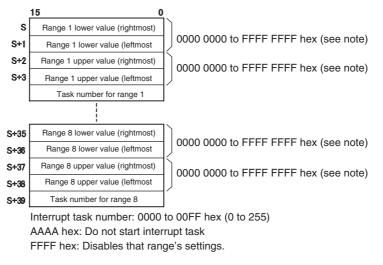
#### Target-value Comparison Table

Depending on the number of target values in the table, the target-value comparison table requires a continuous block of 4 to 145 words.



#### **Range Comparison Table**

The range comparison table requires a continuous block of 40 words because comparison conditions 1 to 8 require 5 words each (2 words for the upper range value, 2 words for the lower range value, and one word for the interrupt task number).



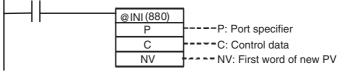
Note

Always set the upper limit greater than or equal to the lower limit in each range.

### MODE CONTROL Instruction: INI(880)

INI(880) can be used to start/stop comparison with the high-speed counter's comparison table, change the high-speed counter's PV, change the PV of interrupt inputs in counter mode, and control the pulse output functions.

Execution condition



	Operand		Settings	
Ρ	Port specifier	#0000, #0001	Pulse outputs 0 or 1	
		#0010	High-speed counter 0	
		#0011	High-speed counter 1	
		#0100 to #0105	Input interrupts 0 to 5 (in counter mode)	
		#1000 or #1001	PWM(891) output 0 or 1	
С	Control data	#0000	Start comparison.	
		#0001	Stop comparison.	
		#0002	Change the PV.	
		#0003	Stop pulse output.	
NV	First word of new PV	NV and NV+1 contain the new PV when C is set to #0002 (change the PV).		

### New PV Setting in NV and NV+1

	15	0
s	New PV (rightmost 4 digits)	
S+1	New PV (leftmost 4 digits)	ПЛ

Setting range for pulse outputs and high-speed counter inputs: 0000 0000 to FFFF FFFF hex Setting range for input interrupts (counter mode): 0000 0000 to 0000 FFFF hex

### Ladder Program Examples

Example 1: High-speed Counter (Linear Mode)

In this example, high-speed counter 0 operates in linear mode and starts interrupt task 10 when the PV reaches 30,000 (0000 7530 hex).

### 1,2,3... 1. Set high-speed counter 0 in the PLC Setup's Built-in Input Tab.

Item	Setting	
High-speed counter 0	Use counter	
Counting mode	Linear mode	
Circular Max. Count		
Reset method	Software reset	
Input Setting	Up/Down inputs	

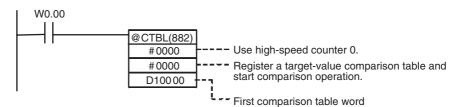
2. Set the target-value comparison table in words D10000 to D10003.

Word	Setting	Function	
D10000	#0001	Number of target values = 1	
D10001	#7530	Rightmost 4 digits of the target value 1 data	Target value =
D10002	#0000	Leftmost 4 digits of the target value 1 data	30,000 (0000 7530 hex)
D10003	#000A	Bit 15: 0 (incrementing)	
		Bits 0 to 7: A hex (interrupt task number 10)	

3. Create the program for interrupt task 10. Always put an END(001) instruction at the program's last address.

### Interrupt Functions

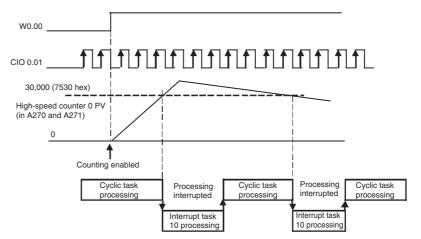
4. Use CTBL(882) to start the comparison operation with high-speed counter 0 and interrupt task 10.



5. Operation

When execution condition W0.00 goes ON, the comparison starts with high-speed counter 0.

When the PV of high speed counter 0 reaches 30,000, cyclic task processing is interrupted, and interrupt task 10 is processed. When interrupt task 10 processing is completed, processing of the interrupted cyclic task resumes.



#### Example 2: High-speed Counter (Ring Mode)

In this example, high-speed counter 1 operates in circular (ring) mode and starts interrupt task 12 when the PV is between 25,000 (0000 61A8 hex) and 25,500 (0000 639C hex).

The maximum ring count is set at 50,000 (0000 C350 hex).

*1,2,3...* 1. Set high-speed counter 1 in the PLC Setup's Built-in Input Tab.

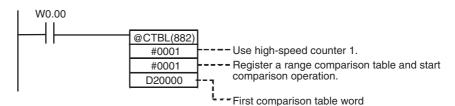
Item	Setting
High-speed counter 1	Use counter
Counting mode	Circular mode
Circular Max. Count	50,000
Reset method	Software reset (continue comparing)
Input Setting	Up/Down inputs

2. Set the range comparison table starting at word D20000. Even though range 1 is the only range being used, all 40 words must still be dedicated to the range comparison table.

Word	Setting	Function	
D20000	#61A8	Rightmost 4 digits of range 1 lower limit	Lower limit value:
D20001	#0000	Leftmost 4 digits of range 1 lower limit	25,000
D20002	#639C	Rightmost 4 digits of range 1 upper limit	Upper limit value:
D20003	#0000	Leftmost 4 digits of range 1 upper limit	25,500

Word	Setting	Function		
D20004	#000C	Range 1 interrupt task number = 12 (C hex)		
D20005 to D20008	All #0000	Range 2 lower and upper limit values (Not used and don't need to be set.)	Range 2 settings	
D20009	#FFFF	Disables range 2.		
~				
D20014	#FFFF	Set the fifth word for ranges 3 to 7 (listed at left) to #FFFF to disable those ranges.		
D20019				
D20024				
D20029				
D20034				
~				
D20035 to D20038	All #0000	Range 8 lower and upper limit values (Not used and don't need to be set.)	Range 8 settings	
D20039	#FFFF	Disables range 8.		

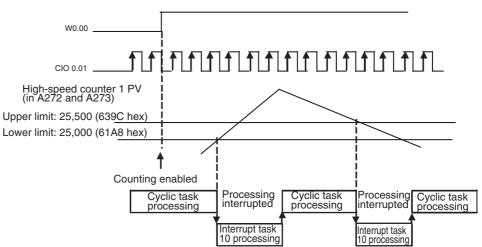
- 3. Create the program for interrupt task 12. Always put an END(001) instruction at the program's last address.
- 4. Use CTBL(882) to start the comparison operation with high-speed counter 1 and interrupt task 12.



### 5. Operation

When execution condition W0.00 goes ON, the comparison starts with high-speed counter 1.

When the PV of high speed counter 1 is between 25,000 and 25,500, cyclic task processing is interrupted, and interrupt task 12 is processed. When interrupt task 12 processing is completed, processing of the interrupted cyclic task resumes.



## 6-2 Quick-response Inputs

### **Overview**

The quick-response inputs can read pulses with an ON time shorter than the cycle time (as short as  $50 \ \mu$ s). Use the quick-response inputs to read signals shorter than the cycle time, such as inputs from photomicrosensors.

## PLC Setup

Use the CX-Programmer to set a built-in input as a quick-response input in the PLC Setup. Click the Built-in Input Tab to display the *Interrupt Input* settings (at the bottom of the tab). Set the input function from *Normal* to *Quick* for each input that will be used as a quick-response input.

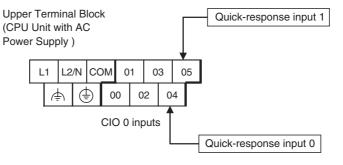
artup   Settings	Timings   Input constant   Serial Port 1	Serial Port 2 P	eripheral Service Built-in Input
High Speed Co		High Speed Cou	
Counting mo	de 💿 Linear mode 🔿 Circular mode		le 💿 Linear mode 🔿 Circular mode
Circular N	fax. Count 0	Circular M	ax. Count 0
Reset	Z phase, software reset 🛛 💌	Reset	Z phase, software reset 🛛 🔽
Input Setting	Differential phase input	Input Setting	Differential phase input
High Speed Co	unter 2	High Speed Cou	unter 3
🔲 Use high sp		🔲 🗌 Use high sp	eed counter 3
Counting mo	de 🖸 Linear mode 🔿 Circular mode	Counting mod	le 🖲 Linear mode 🔿 Circular mode
Circular N	fax. Count	Circular M	ax. Count 0
Reset	Z phase, software reset 🛛 💌	Reset	Z phase, software reset 🛛 💌
Input Setting	Increment pulse input	Input Setting	Increment pulse input
Interrupt Input			
INO Quick	IN1 Quick 💌	IN2 Normal	IN3 Normal
IN4 Normal	Normal		

Bit Allocation for Quick-Response Inputs

CPU Units with 10 I/O Points

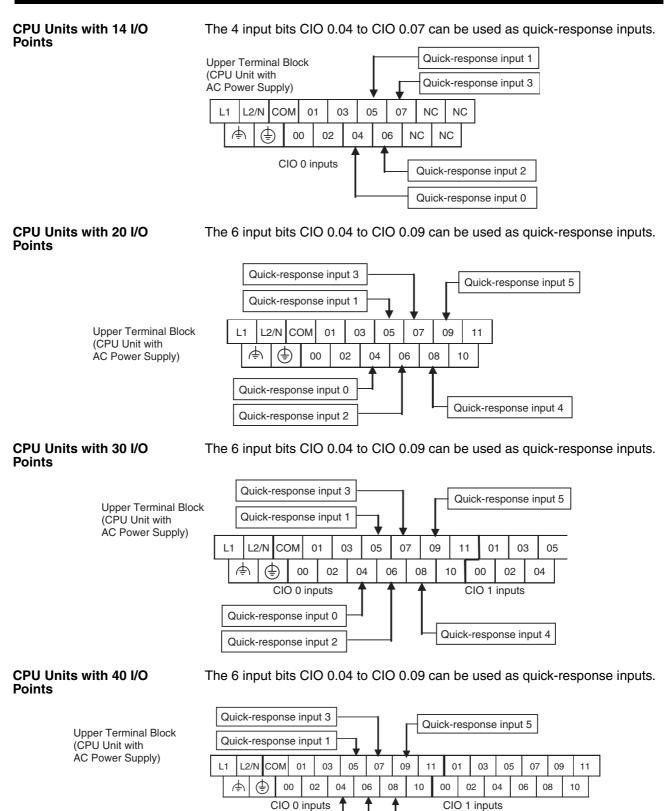
The following diagrams show the input bits and terminals that can be used for quick-response inputs in each CPU Unit.

The 2 input bits CIO 0.04 to CIO 0.05 can be used as quick-response inputs.



#### Quick-response Inputs

### Section 6-2



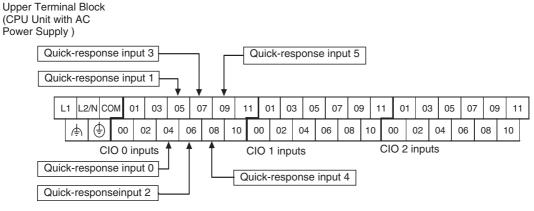
Quick-response input 0

Quick-response input 2

Quick-response input 4

# CPU Units with 60 I/O Points

#### The 6 input bits CIO 0.04 to CIO 0.09 can be used as quick-response inputs.



### Setting the Input Functions in the PLC Setup

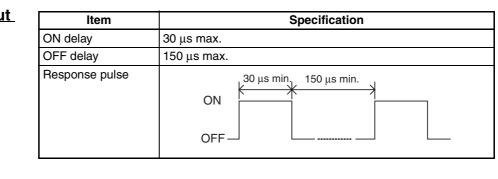
Normally, bits CIO 0.04 to CIO 0.09 are used as normal inputs. When using these inputs as quick-response inputs, use the CX-Programmer to change the input's setting in the PLC Setup.

	terminal lock			CPU	Unit			Quick- response	
Word	Bit	CPU Units with 60 I/O Points	CPU Units with 40 I/O Points	CPU Units with 30 I/O Points	CPU Units with 20 I/O Points	CPU Units with 14 I/O Points	CPU Units with 10 I/O Points	inputs	
CIO 0	00	Normal input 0							
	01	Normal input 1							
	02	Normal input 2							
	03	Normal input 3							
	04	Normal input 4	Quick-response input 0						
	05	Normal input 5	Quick-response input 1						
	06	Normal input 6		Quick-response input 2**					
	07	Normal input 7		Quick-response input 3**					
	08	Normal input 8	Normal input 8	Normal input 8	Normal input 8			Quick-response input 4*	
	09	Normal input 9	Normal input 9	Normal input 9	Normal input 9			Quick-response input 5*	
	10	Normal input 10	Normal input 10	Normal input 10	Normal input 10				
	11	Normal input 11	Normal input 11	Normal input 11	Normal input 11				
CIO 1	00 to 05	Normal input 12 to 17	Normal input 12 to 17	Normal input 12 to 17					
	06 to 11	Normal input 18 to 23	Normal input 18 to 23						
CIO 2	00 to 11	Normal input 24 to 35							

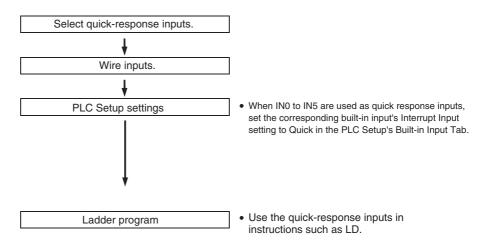
Note \*Input interrupts 4 and 5 are not supported by CPU Units with 10 or 14 I/O Points.

\*\*Input interrupts 2 and 3 are not supported by CPU Units with 10 I/O Points.

#### Interrupt Input and Quick-response Input Specifications



## **Procedure**



## **Restrictions**

Inputs cannot be used as quick-response inputs when they are being used as general-purpose (normal) inputs, input interrupts, or high-speed counter inputs.

## 6-3-1 Overview

The CP1L CPU Units support the following serial communications functions.

Protocol	Connected devices	Description	Serial port 1	Serial port 2
No-protocol	Standard devices supporting serial communications	Communicates with standard devices with an RS-232C or RS-422A/485 port without a command-response format. Instead the TXD(236) and RXD(235) instructions are exe- cuted from the program to transmit data from the trans- mission port or read data in the reception port. The frame headers and end codes can be specified.	ОК	ОК
Serial gate- way (to Compo- Way/F or Modbus- RTU)	OMRON components supporting CompoWay/F or Mod- bus-RTU slave devices	Converts received FINS com- mands into CompoWay/F or Modbus-RTU commands and transfers them on the serial communications path.	ОК	ОК

## Section 6-3

Protocol	Connected devices	Description	Serial port 1	Serial port 2
Serial PLC Link	CP-series CPU Units or CJ1M CPU Units	Up to ten words per Unit can be shared by up to nine CPU Units, including one Polling Unit and eight Polled Units. An RS-422A/485 Option Boards (CP1W-CIF11/CIF12) are used to communicate via RS-422A/485, or RS-232C Option Boards (CP1W-CIF01) can be used to communicate between two CPU Units via an RS-232C connection. CJ1M CPU Units can also be included in Serial PLC Links, and the Serial PLC Links can also include PTs as Polled Units via 1:N NT Links. <b>Note</b> Serial PLC Links can be created on serial port 1 or serial port 2, but not on both ports at the same time.	ок	ОК
1:N NT links (1:N NT Links are also used for 1:1 connec- tions.)	OMRON PTs (Programmable Terminals)	Data can be exchanged with PTs without using a communi- cations program in the CPU Unit.	ОК	ОК
Host Link	Host computer or OMRON PT (Programmable Terminal)	<ol> <li>Various control commands such as reading and writing I/O memory, changing the operating mode, and force- setting/resetting bits can be executed by sending C- mode host link commands or FINS commands from the host computer to the CPU Unit.</li> <li>It is also possible to send FINS commands from the CPU Unit to the host com- puter to send data or infor- mation.</li> <li>Use Host Link communica- tions to monitor data, such as operating status, error informa- tion, and quality data in the PLC or send data, such as pro- duction planning information, to the PLC.</li> </ol>	ОК	ОК

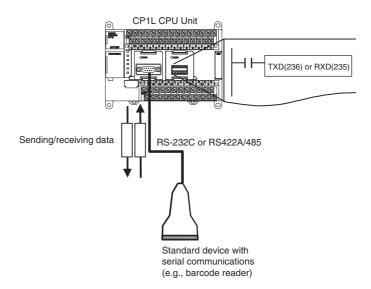
## Section 6-3

Protocol	Connected devices	Description	Serial port 1	Serial port 2
Peripheral bus (toolbus)	CX-Programmer Personal computer running the CX-Programmer RS-232C RS-232C Peripheral bus (toolbus)	Provides high-speed communi- cations with the CX-Program- mer. (Remote programming through modems is not supported.)	ОК	ОК
1:1 NT Links	OMRON PTs (Programmable Terminals) NS-series PT RS-232C NT Link	Enables data exchange with a PT without communications programming in the CPU Unit. (The 1:N NT Link protocol is used for communications even for 1:1 connections.)	ОК	ОК
1:1 Links	CP1L CPU Unit C-series CPU Unit C-series CPU Unit CPM1A-V1 CPM1A-V1 CQM1H CQM1H CQM1H C200HX/HG/HE RS-232C 1:1 Link	Enables linking data in a 64- word Link Area between two PLCs connected by an RS- 232C cable.	ОК	ОК

## 6-3-2 No-protocol Communications

No-protocol communications enable sending and receiving data using the TRANSMIT (TXD(236)) and RECEIVE (RXD(235)) instructions without using a protocol and without data conversion (e.g., no retry processing, data type conversion, or process branching based on received data). The communications mode for the serial port must be set for no-protocol communications in the PLC Setup.

No-protocol communications are used to send data in one direction to or from standard devices that have an RS-232C or RS-422A/485 port using TXD(236) or RXD(235).

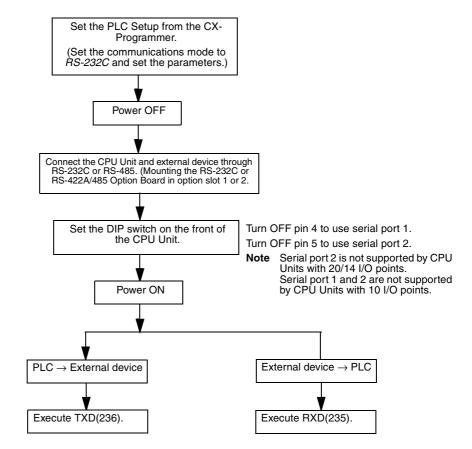


For example, simple (non-protocol) communications can be used to input data from a barcode reader or output data to a printer.

The following table lists the no-protocol communication functions supported by CP1L PLCs.

Transfer direction	Method	Max.		Frame format	Other functions
		amount of data	Start code	End code	
Data transmission (PLC → External device)	Execution of TXD(236) in the program	256 bytes	Yes: 00 to FF No: None	Yes: 00 to FF or CR+LF No: None (The amount of data to receive is specified between 1 and 256 bytes when no end code is speci- fied.)	<ul> <li>Send delay time (delay between TXD(236) execu- tion and sending data from specified port): 0 to 99,990 ms (unit: 10 ms)</li> <li>Controlling RS and ER signals</li> </ul>
Data reception (External device $\rightarrow$ PLC)	Execution of RXD(235) in the program	256 bytes			Monitoring CS and DR signals

#### Procedure



Message Frame Formats Data can be placed between a start code and end code for transmission by TXD(236) and data between a start code and end code can be received by RXD(235). When transmitting with TXD(236), data from I/O memory is transmitted, and when receiving with RXD(235), the data (without start/end codes) is stored in I/O memory. Up to 256 bytes (including the start and end codes) can be transferred in no-protocol mode.

The start and end codes are set in the PLC Setup.

The following table shows the message formats that can be set for transmissions and receptions in no-protocol mode.

Start code	End code						
	No	Yes	CR+LF				
No	data 256 bytes max.	data ED 256 bytes max.	data CR+F 256 bytes max.				
Yes	ST data 256 bytes max.	ST data ED 256 bytes max.	ST data CR+LF				

- When more than one start code is used, the first start code will be effective.
- When more than one end code is used, the first end code will be effective.
- If the data being transferred contains the end code, the data transfer will be stopped midway. In this case, change the end code to CR+LF.

**Note** A setting can be made to delay the transmission of data after the execution of TXD(236).



Execution of TXD(230)

Refer to the *SYSMAC CP Series CP1L CPU Unit Programming Manual* (W451) for more details on TXD(236) and RXD(235).

## 6-3-3 Modbus-RTU Easy Master Function

#### **Overview**

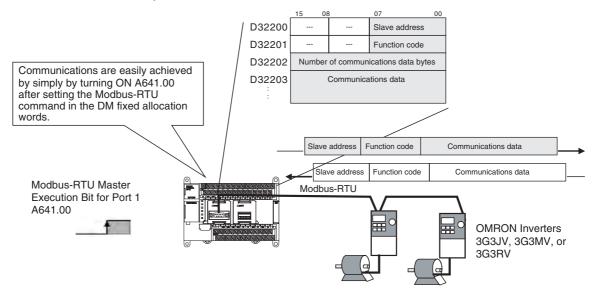
If an RS-232C or RS-422A/485 Option Board is used, the CP1L CPU Unit can function as a Modbus-RTU Master to send Modbus-RTU commands by manipulating software switches. This enables easily controlling Modbus-compliant slaves, such as Inverters, through serial communications.

The following OMRON Inverters support Modbus-RTU slave operation: 3G3JV, 3G3MV, and 3G3RV.

The communications mode in the PLC Setup must be set to the Gateway Mode to enable this functionality.

🐺 PLC Settings - NewPLC1	<u> </u>
File Options Help	
Startup       Settings       Timings       Input constant       Serial Port 1       Serial Port 2       Peripheral Service       Built-in Input         Communications       Settings       Input constant       Serial Port 2       Peripheral Service       Built-in Input         Communications       Settings       Input constant       Mode       Input       Input         Custom       Baud       Format       Mode       Input       Input       Input         Start Code       End Code       PC Link, Mode       PC Link, Mode       Input       Input         Start Code       Received Bytes       256       Input       ALL	
C Set 0x0000 = C CR,LF C Set End Code 0x0000 = NT/PC Link Max Response Timeout Unit Number Delay 0 = NT/PC Link Max 0 = *100 ms 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0	No. 1
(default 5000ms)	
CP1L-M	Offline

Modbus-RTU commands can be set simply by turning ON a software switch after setting the Modbus slave address, function, and data in the DM fixed allocation words for the Modbus-RTU Easy Master. The response when received is also store in the DM fixed allocation words for the Modbus-RTU Easy Master.



#### DM Fixed Allocation Words for the Modbus-RTU Easy Master

The Modbus-RTU command is stored in the following words in the DM Area.

- M-type CPU Units Serial port 1: D32200 to D32249 Serial port 2: D32300 to D32349
- L-type CPU Units Serial port 1: D32300 to D32349

When a response is received after turning ON the Modbus-RTU Master Execution Bit, it is sotred in the following words in the DM Area.

- M-type CPU Units Serial port 1: D32250 to D32299 Serial port 2: D22250 to D32299
  - Serial port 2: D32350 to D32399
- L-type CPU Units Serial port 1: D32350 to D32399

Wo	rds	Bits		Contents
Serial port 1 on M-type CPU Unit	Serial port 2 on M-type CPU Unit or Serial port 1 on L-type CPU Unit			
D32200	D32300	00 to 07	Command	Slave address (00 to F7 hex)
		08 to 15		Reserved (Always 00.)
D32201	D32301	00 to 07		Function code
		08 to 15		Reserved (Always 00.)
D32202	D32302	00 to 15		Number of communications data bytes (0000 to 005E hex)
D32203 to D32249	D32303 to D32349	00 to 15		Communications data (94 bytes maximum)

## Section 6-3

Wo	rds	Bits		Contents
Serial port 1 on M-type CPU Unit	Serial port 2 on M-type CPU Unit or Serial port 1 on L-type CPU Unit			
D32250	D32350	00 to 07	Response	Slave address (00 to F7 hex)
		08 to 15		Reserved (Always 00.)
D32251	D32351	00 to 07		Function code
		08 to 15		Reserved
D32252	D32352	00 to 07		Error code
		08 to 15		Reserved (Always 00.)
D32253	D32353	00 to 15		Number of response bytes (0000 to 03EA hex)
D32254 to D32299	D32354 to D32399	00 to 15		Response data (92 bytes maximum)

#### **Error Codes**

The following error codes are stored in an allocated DM Area word when an error occurs in Modbus-RTU Easy Master function execution.

Code	Name	Description
0x00	Normal end	Not an error.
0x01	Illegal address	The slave address specified in the parameter is illegal (248 or higher).
0x02	Illegal function code	The function code specified in the parameter is illegal.
0x03	Data length overflow	There are more than 94 data bytes.
0x04	Serial communica- tions mode error	The Modbus-RTU Easy Master function was executed when the serial communications mode was not the Serial Gateway Mode.
0x80	Response timeout	A response was not received from the Servo.
0x81	Parity error	A parity error occurred.
0x82	Framing error	A framing error occurred.
0x83	Overrun error	An overrun error occurred.
0x84	CRC error	A CRC error occurred.
0x85	Incorrect confirmation address	The slave address in the response is differ- ence from the one in the request.
0x86	Incorrect confirmation function code	The function code in the response is difference from the one in the request.
0x87	Response size over- flow	The response frame is larger than the storage area (92 bytes).
0x88	Exception response	An exception response was received from the slave.
0x89	Service being exe- cuted	A service is already being executed (reception traffic congestion).
0x8A	Execution canceled	Executing the service has been canceled.
0x8f	Other error	Other FINS response code was received.

#### Auxiliary Area Flags and Bits

The Modbus-RTU command set in the DM fixed allocation words for the Modbus-RTU Easy Master is automatically sent when the Modbus-RTU Master Execution Bit is turned ON. The results (normal or error) will be given in corresponding flags.

Word	Bit	Port	Contents
A640	00	M-type	Modbus-RTU Master Execution Bit
		CPU	Turned ON: Execution started
		Units: Serial	ON: Execution in progress.
		port 2	OFF: Not executed or execution completed.
	01	L-type	Modbus-RTU Master Execution Normal Flag
		CPU	ON: Execution normal.
		Units: Serial	OFF: Execution error or still in progress.
	02	port 1	Modbus-RTU Master Execution Error Flag
			ON: Execution error.
			OFF: Execution normal or still in progress.
A641	00	M-type	Modbus-RTU Master Execution Bit
		CPU Unit:	Turned ON: Execution started
		Serial	ON: Execution in progress.
		port 1	OFF: Not executed or execution completed.
	01		Modbus-RTU Master Execution Normal Flag
			ON: Execution normal.
			OFF: Execution error or still in progress.
	02		Modbus-RTU Master Execution Error Flag
			ON: Execution error.
			OFF: Execution normal or still in progress.

## 6-3-4 Communications: Smart Active Parts and Function Blocks

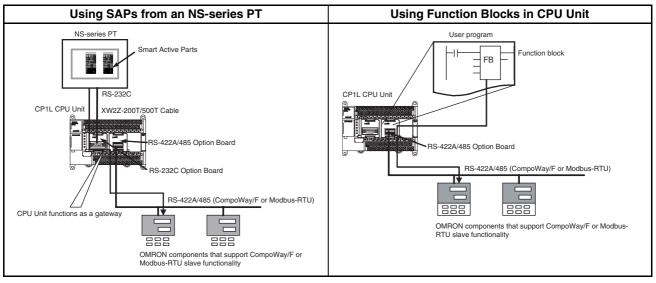
### **Overview**

OMRON components that support CompoWay/F communications or Modbus-RTU slave functionality (such as Temperature Controllers) can be easily accessed from a CP1L CPU Unit equipped with an RS-422A/485 or RS-232C Option Board using Smart Active Parts (SAPs) on an NS-series PT or using function blocks in the ladder program in the CP1L CPU Unit.

The communications mode in the PLC Setup must be set to the Gateway Mode to enable this functionality.

Note Function blocks cannot be used in the CP1L-J CPU Unit.

## System Configuration



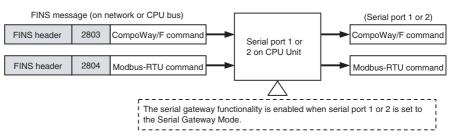
**Note** Refer to OMRON's Smart Library website for the most recent information on using SAPs and function blocks.

#### **Serial Gateway Function**

When a FINS command is received, it is automatically converted to the protocol corresponding to the message and sent on the serial communications path. Responses are also converted in the same way.

- **Note** Serial ports 1 and 2 on the CP1L CPU Unit can be used to convert to the following protocols.
  - CompoWay/F
  - Modbus-RTU

This functionality is enabled when the serial communications mode is set to *Serial Gateway.* 



Item	Specification
Pre-conversion data	FINS (via FINS network, Host Link FINS, toolbus, NT Link, or CPU bus)
Conversion functions	FINS commands addressed to serial port 1 or 2 on the CPU Unit are converted to CompoWay/F commands (after removing the header) if the FINS command code is 2803 hex and to Modbus-RTU commands (after removing the header) if the FINS command code is 2804 hex.
Post-conversion data	CompoWay/F command or Modbus-RTU command
Serial communications method	1:N half-duplex
Maximum number of nodes	31
Enabling serial commu- nications mode	Serial Gateway Mode
Response timeout	The time from when a message converted to a different pro- tocol is set until a response is received is monitored by the serial gateway function.
	Default: 5 s, User setting: 0.1 to 25.5 s
	<b>Note</b> A FINS response code of 0205 hex (response time- out) is sent to the source of the FINS command if a timeout occurs.
Send delay function	None

<b>CPU Unit Seria</b>	I Gateway	/ Function	Specifications
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Note

e If a CJ-series Serial Communications Unit is connected via a CJ Unit Adapter, messages can also be converted to Modbus-ASCII or Host Link FINS. Refer to the SYSMAC CS/CJ Series Serial Communications Boards/Units Operation Manual (W336) for details.

## 6-3-5 Serial PLC Links

#### **Overview**

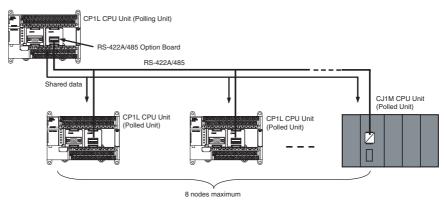
Serial PLC Links can be used to allow data to be exchanged among CP1L and CJ1M CPU Units via the RS-422A/485 or RS-232C Option Boards mounted to the CPU Units without requiring special programming. The communications mode in the PLC Setup must be set to the Serial PLC Link Mode to enable this functionality.

- Either serial port 1 or 2 can be used. (See note.)
- Words are allocated in memory in the Serial PLC Link Words (CIO 3100 to CIO 3199).
- A maximum of 10 words can be transferred by each CP1L CPU Unit, but the number of linked words can be set to fewer words. (The size must be the same for all CP1L CPU Units.)
- **Note** Serial PLC Links cannot be used on serial ports 1 and 2 at the same time. If one port is set as a Serial PLC Link slave or master, it will not be possible to set the other port for a Serial PLC Link. A PLC Setup error will occur if an attempt is made to set both ports for Serial PLC Links.

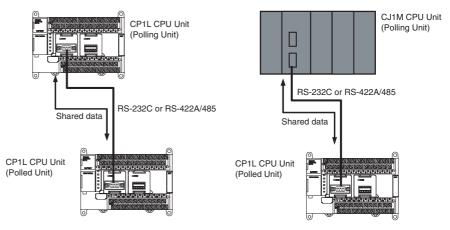
### Section 6-3

## **Configuration**

#### 1:N Connections between CP1L/CJ1M CPU Units (8 Nodes Maximum)



#### 1:1 Connections between CP1L/CJ1M CPU Units



## **Specifications**

ltem	Specifications
Applicable serial ports	Serial port 1 or 2. Both ports cannot be used for PLC Links at the same time. If both ports are set for PLC Links (either as polling node or polled node), a PLC Setup setting error (non- fatal error) will occur and the PLC Setup Setting Error Flag (A402.10) will turn ON.
Connection method	RS-422A/485 or RS-232C connection via RS-422A/485 or RS-232C Option Board.
Allocated data area	Serial PLC Link Words: CIO 3100 to CIO 3199 (Up to 10 words can be allocated for each CPU Unit.)
Number of Units	9 Units max., comprising 1 Polling Unit and 8 Polled Units (A PT can be placed on the same network in an 1:N NT Link, but it must be counted as one of the 8 Polled Units.)
Link methods (data refresh methods)	Complete link method or Polling Unit link method

### **Data Refresh Methods**

The following two methods can be used to refresh data.

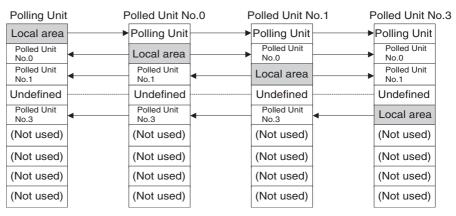
- Complete link method
- Polling Unit link method

#### **Complete Link Method** The data from all nodes in the Serial PLC Links are reflected in both the Polling Unit and the Polled Units. (The only exceptions are the address allocated

to the connected PT's unit number and the addresses of Polled Units that are not present in the network. These data areas are undefined in all nodes.)

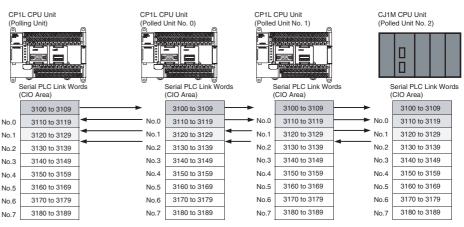
#### Example: Complete Link Method, Highest Unit Number: 3

In the following diagram, Polled Unit No. 2 is either a PT or is a Unit not present in the network, so the area allocated for Polled Unit No. 2 is undefined in all nodes.



#### Example: Complete Link Method, Number of Link Words: 10

Each CPU Unit (either CP1L or CJ1M) sends data to the same words in all other CPU Units for the Polling Unit and all Polled Units. The Polling Unit is a CP1L CPU Unit in the following example, but it could also be a CJ1M CPU Unit.



**Polling Unit Link Method** The data for all the Polled Units in the Serial PLC Links ar reflected in the Polling Unit only, and each Polled Unit reflects the data of the Polling Unit only. The advantage of the Polling Unit link method is that the addresses allocated for the local Polled Unit data are the same in each Polled Unit, allowing data to be accessed using common ladder programming. The areas allocated for the unit numbers of the PT or Polled Units not present in the network are undefined in the Polling Unit only.

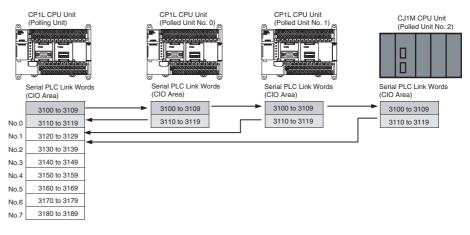
#### Example: Polling Unit Link Method, Highest Unit Number: 3

In the following diagram, Polled Unit No. 2 is a PT or a Unit not participating in the network, so the corresponding area in the Polling Unit is undefined.

Polling Unit	Polled Unit No	0.0 Polled Unit No	.1 Polled Unit No.3
Local area	Polling Unit	Polling Unit	►Polling Unit
Polled Unit No.0	Local area	Local area	Local area
Polled Unit No.1	(Not used.)	(Not used.)	(Not used.)
Undefined	(Not used.)	(Not used.)	(Not used.)
Polled Unit No.3	(Not used.)	(Not used.)	(Not used.)
(Not used.)	(Not used.)	(Not used.)	(Not used.)
(Not used.)	(Not used.)	(Not used.)	(Not used.)
(Not used.)	(Not used.)	(Not used.)	(Not used.)
(Not used.)	(Not used.)	(Not used.)	(Not used.)

#### Example: Polling Unit Link Method, Number of Link Words: 10

The CPU Unit that is the Polling Unit (either CP1L or CJ1M) sends its data (CIO 3100 to CIO 3109) to the same words (CIO 3100 to CIO 3109) in all other CPU Units. The Polled Units send their data (CIO 3110 to CIO 3119) to consecutive sets of 10 words in the Polling Unit. The Polling Units is a CP1L CPU Unit in the following example, but it could also be a CJ1M CPU Unit. (Only the first three Polled Units are shown below.)



### Section 6-3

10 words

CIO 3100 to

CIO 3110 to

CIO 3109

CIO 3119

## Allocated Words

<b>Complete Link Method</b>		
Address	Link words	1 word
CIO 3100	Polling Unit	CIO 3100
	Polled Unit No. 0	CIO 3101
	Polled Unit No. 1	CIO 3102
	Polled Unit No. 2	CIO 3103

CIO 3104 to CIO 3106 to CIO 3120 to CIO 3105 CIO 3108 CIO 3129 CIO 3106 to CIO 3109 to CIO 3130 to olled Unit No. 2 CIO 3103 CIO 3107 CIO 3111 CIO 3139 Polled Unit No. 3 CIO 3104 CIO 3108 to CIO 3112 to CIO 3140 to CIO 3109 CIO 3114 CIO 3149 Serial PLC Polled Unit No. 4 CIO 3105 CIO 3110 to CIO 3115 to CIO 3150 to Link Words CIO 3111 CIO 3117 CIO 3159 Polled Unit No. 5 CIO 3106 CIO 3112 to CIO 3118 to CIO 3160 to CIO 3113 CIO 3120 CIO 3169 CIO 3114 to Polled Unit No. 6 CIO 3107 CIO 3121 to CIO 3170 to CIO 3115 CIO 3123 CIO 3179 CIO 3180 to Polled Unit No. 7 CIO 3108 CIO 3116 to CIO 3124 to CIO 3117 CIO 3126 CIO 3189 CIO 3199 Not used. CIO 3109 CIO 3118 to CIO 3127 to CIO 3190 to to CIO 3199 CIO 3199 CIO 3199 CIO 3199

2 words

CIO 3100 to

CIO 3102 to

CIO 3101

CIO 3103

3 words

CIO 3100 to

CIO 3103 to

CIO 3102

CIO 3105

to

#### Polling Unit Link Method

Address		Link words	1 word	2 words	3 words	to	10 words
CIO 3100		Polling Unit	CIO 3100	CIO 3100 to CIO 3101	CIO 3100 to CIO 3102		CIO 3100 to CIO 3109
		Polled Unit No. 0	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
		Polled Unit No. 1	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
		Polled Unit No. 2	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
	Sorial PLC	Polled Unit No. 3	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
	Serial PLC Link Words	Polled Unit No. 4	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
		Polled Unit No. 5	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
		Polled Unit No. 6	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
		Polled Unit No. 7	CIO 3101	CIO 3102 to CIO 3103	CIO 3103 to CIO 3105		CIO 3110 to CIO 3119
CIO 3199		Not used.	CIO 3102 to CIO 3199	CIO 3104 to CIO 3199	CIO 3106 to CIO 3199		CIO 3120 to CIO 3199

#### **Procedure**

The Serial PLC Links operate according to the following settings in the PLC Setup in the Polling Unit and Polled Units.

Settings at the Polling Unit

- *1,2,3...* 1. Set the serial communications mode of serial port 1 or 2 to Serial PLC Links (Polling Unit).
  - 2. Set the link method to the Complete Link Method or Polling Unit Link Method.
  - 3. Set the number of link words (up to 10 words for each Unit).
  - 4. Set the maximum unit number in the Serial PLC Links (0 to 7).

#### Settings at the Polled Units

- **1,2,3...** 1. Set the serial communications mode of serial port 1 or 2 to Serial PLC Links (Polled Unit).
  - 2. Set the unit number of the Serial PLC Link Polled Unit.

### PLC Setup

#### Settings at the Polling Unit

	Item	Set value	Default	Refresh timing
Serial port	Mode: Communications mode	PC Link (Master): PLC Link Polling Unit	Host Link	Every cycle
1 or 2	Baud: Baud rate	38,400 bps, 115,200 bps	9,600 bps	
	PC link mode: PLC Link method	ALL: Complete link method	ALL	
		Masters: Polling Unit method		
	Link words: No. of link words	1 to 10 words	10 words	
	PC Link Unit No.: Max. unit No.	0 to 7	0 hex	

#### Settings at the Polled Unit

	Item	Set value	Default	Refresh timing
	Mode: Communications mode	PC Link (Slave): PLC Link Polled Unit	Host Link	Every cycle
1 or 2	Baud: Baud rate	38,400 bps, 115,200 bps	9,600 bps	
	Unit number	0 to 7	0	

**Note** Both serial ports cannot be used for PLC Links at the same time. If both ports are set for PLC Links (either as polling node or polled node), a PLC Setup setting error (non-fatal error) will occur and the PLC Setup Setting Error Flag (A402.10) will turn ON. If PLC Links is set for one serial port, set the other serial port to a different mode.

<b>Related Auxiliary</b>	Area Flags for	Serial Port 1	of an M-type CPU l	Jnit
	,		<b>7</b>	

Name	Address	Details	Read/write	Refresh timing
Serial Port 1 Communica- tions Error Flag	A392.12	Turns ON when a com- munications error occurs at serial port 1. ON: Error OFF: Normal	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON when a communications error occurs at serial port 1.</li> <li>Turns OFF when the port is restarted.</li> <li>Disabled in peripheral bus mode and NT link mode.</li> </ul>
Serial Port 1 Communicating with PT Flags (See note.)	A394.00 to A394.07	When serial port 1 is being used in NT link mode, the bit correspond- ing to the Unit performing communications will be ON. Bits 00 to 07 corre- spond to unit numbers 0 to 7, respectively. ON: Communicating OFF: Not communicating	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON the bit corresponding to the unit number of the PT/Polled Unit that is communicating via serial port 1 in NT link mode or Serial PLC Link mode.</li> <li>Bits 00 to 07 correspond to unit numbers 0 to 7, respectively.</li> </ul>
Serial Port 1 Restart Bit	A526.01	Turn ON this bit to restart serial port 1.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turn ON to restart serial port 1, (except when communicating in peripheral bus mode).</li> <li>Note: The bit is automatically turned OFF by the system when restart processing has been completed.</li> </ul>
Serial Port 1 Error Flags	A528.08 to A528.15	When an error occurs at serial port 1, the corre- sponding error bit is turned ON. Bit 08: Not used. Bit 09: Not used. Bit 10: Parity error Bit 11: Framing error Bit 12: Overrun error Bit 13: Timeout error Bit 14: Not used. Bit 15: Not used.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>When an error occurs at serial port 1, the corresponding error bit is turned ON.</li> <li>The flag is automatically turned OFF by the system when serial port 1 is restarted.</li> <li>Disabled during peripheral bus mode.</li> <li>In NT link mode, only bit 05 (timeout error) is enabled.</li> <li>In Serial PLC Link mode, only the following bits are enabled.</li> <li>Errors at the Polling Unit: Bit 05: Timeout error</li> <li>Errors at Polled Units: Bit 05: Timeout error Bit 04: Overrun error Bit 03: Framing error</li> </ul>
Serial Port 1 Set- tings Changed Flag	A619.01	Turns ON when the com- munications conditions of serial port 1 are being changed. ON: Changed OFF: No change	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON while communications conditions settings for serial port 1 are being changed.</li> <li>Turns ON when the CHANGE SERIAL PORT SETUP instruction (STUP(237)) is executed.</li> <li>Turns OFF when the changes to settings are completed.</li> </ul>

**Note** In the same way as for the existing 1:N NT Link, the status (communicating/not communicating) of PTs in Serial PLC Links can be checked from the Polling Unit (CPU Unit) by reading the Serial Port 1 Communicating with PT Flag (A394 bits 00 to 07 for unit numbers 0 to 7).

<b>Related Auxiliar</b>	Area Flags for Serial	Port 2 of an M-type CPU Unit
	, <b>-</b>	

Name	Address	Details	Read/write	Refresh timing
Serial Port 2 Communica- tions Error Flag	A392.04	Turns ON when a com- munications error occurs at Serial Port 2. ON: Error OFF: Normal	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON when a communications error occurs at Serial Port 2.</li> <li>Turns OFF when the port is restarted.</li> <li>Disabled in peripheral bus mode and NT link mode.</li> </ul>
Serial Port 2 Communicating with PT Flags (See note.)	A393.00 to A393.07	When Serial Port 2 is being used in NT link mode, the bit correspond- ing to the Unit performing communications will be ON. Bits 00 to 07 corre- spond to unit numbers 0 to 7, respectively. ON: Communicating OFF: Not communicating	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON the bit corresponding to the unit number of the PT/Polled Unit that is communicating via Serial Port 2 in NT link mode or Serial PLC Link mode.</li> <li>Bits 00 to 07 correspond to unit numbers 0 to 7, respectively.</li> </ul>
Serial Port 2 Restart Bit	A526.00	Turn ON this bit to restart Serial Port 2.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turn ON to restart Serial Port 2, (except when communicating in peripheral bus mode).</li> <li>Note: The bit is automatically turned OFF by the system when restart processing has been completed.</li> </ul>
Serial Port 2 Error Flags	A528.00 to A528.07	When an error occurs at Serial Port 2, the corre- sponding error bit is turned ON. Bit 00: Not used. Bit 01: Not used. Bit 02: Parity error Bit 03: Framing error Bit 04: Overrun error Bit 05: Timeout error Bit 06: Not used. Bit 07: Not used.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>When an error occurs at Serial Port 2, the corresponding error bit is turned ON.</li> <li>The flag is automatically turned OFF by the system when Serial Port 2 is restarted.</li> <li>Disabled during peripheral bus mode.</li> <li>In NT link mode, only bit 05 (timeout error) is enabled.</li> <li>In Serial PLC Link mode, only the following bits are enabled.</li> <li>Errors at the Polling Unit: Bit 05: Timeout error</li> <li>Errors at Polled Units: Bit 05: Timeout error Bit 04: Overrun error Bit 03: Framing error</li> </ul>
Serial Port 2 Set- tings Changed Flag	A619.02	Turns ON when the com- munications conditions of Serial Port 2 are being changed. ON: Changed OFF: No change	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON while communications conditions settings for Serial Port 2 are being changed.</li> <li>Turns ON when the CHANGE SERIAL PORT SETUP instruction (STUP(237)) is executed.</li> <li>Turns OFF when the changes to settings are completed.</li> </ul>

**Note** In the same way as for the existing 1:N NT Link, the status (communicating/not communicating) of PTs in Serial PLC Links can be checked from the Polling Unit (CPU Unit) by reading the Serial Port 2 Communicating with PT Flag (A393 bits 00 to 07 for unit numbers 0 to 7).

<b>Related Auxiliary</b>	Area Flags fo	or Serial Port	1 of an L-type CPU Unit

Name	Address	Details	Read/write	Refresh timing
Serial Port 1 Communica- tions Error Flag	A392.04	Turns ON when a com- munications error occurs at Serial Port 1. ON: Error OFF: Normal	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON when a communications error occurs at Serial Port 1.</li> <li>Turns OFF when the port is restarted.</li> <li>Disabled in peripheral bus mode and NT link mode.</li> </ul>
Serial Port 1 Communicating with PT Flags (See note.)	A393.00 to A393.07	When Serial Port 1 is being used in NT link mode, the bit correspond- ing to the Unit performing communications will be ON. Bits 00 to 07 corre- spond to unit numbers 0 to 7, respectively. ON: Communicating OFF: Not communicating	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON the bit corresponding to the unit number of the PT/Polled Unit that is communicating via Serial Port 1 in NT link mode or Serial PLC Link mode.</li> <li>Bits 00 to 07 correspond to unit numbers 0 to 7, respectively.</li> </ul>
Serial Port 1 Restart Bit	A526.00	Turn ON this bit to restart Serial Port 1.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turn ON to restart Serial Port 1, (except when communicating in peripheral bus mode).</li> <li>Note: The bit is automatically turned OFF by the system when restart processing has been completed.</li> </ul>
Serial Port 1 Error Flags	A528.00 to A528.07	When an error occurs at Serial Port 1, the corre- sponding error bit is turned ON. Bit 00: Not used. Bit 01: Not used. Bit 02: Parity error Bit 03: Framing error Bit 04: Overrun error Bit 05: Timeout error Bit 06: Not used. Bit 07: Not used.	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>When an error occurs at Serial Port 1, the corresponding error bit is turned ON.</li> <li>The flag is automatically turned OFF by the system when Serial Port 1 is restarted.</li> <li>Disabled during peripheral bus mode.</li> <li>In NT link mode, only bit 05 (timeout error) is enabled.</li> <li>In Serial PLC Link mode, only the following bits are enabled.</li> <li>Errors at the Polling Unit: Bit 05: Timeout error</li> <li>Errors at Polled Units: Bit 05: Timeout error Bit 04: Overrun error Bit 03: Framing error</li> </ul>
Serial Port 1 Set- tings Changed Flag	A619.02	Turns ON when the com- munications conditions of Serial Port 1 are being changed. ON: Changed OFF: No change	Read/write	<ul> <li>Cleared when power is turned ON.</li> <li>Turns ON while communications conditions settings for Serial Port 1 are being changed.</li> <li>Turns ON when the CHANGE SERIAL PORT SETUP instruction (STUP(237)) is executed.</li> <li>Turns OFF when the changes to settings are completed.</li> </ul>

In the same way as for the existing 1:N NT Link, the status (communicating/not communicating) of PTs in Serial PLC Links can be checked from the Polling Unit (CPU Unit) by reading the Serial Port 1 Communicating with PT Flag (A393 bits 00 to 07 for unit numbers 0 to 7).

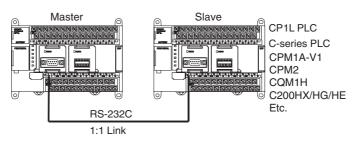
## 6-3-6 1:1 Links

Two PLCs can be connected through their RS-232C ports to create Link Areas.

Applicable PLCs A 1:1 Link can be create between any of the following SYSMAC PLCs: CP1L, CQM1H, C200HX/HG/HE(-Z), CPM1A-V1, CPM2A, CPM2B, CPM2C, and SRM1(-V2)

Connections

To create a 1:1 Link, connect the RS-232C ports on the two PLCs.



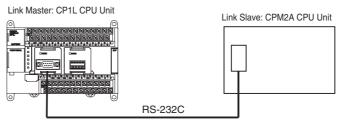
#### **PLC Setup**

Set the PLC to a 1:1 Link Master or a 1:1 Link Slave in the PLC Setup. Set the other PLC to the opposite setting.

PLC Settings - NewPLC1
File Options Help
Startup       Settings       Timings       Input constant       Serial Port 1       Serial Port 2       Peripheral Service       Built-in Input       Image: Communications         Communications       Settings       Standard (9500 ; 1,7,2,E)       Image: Communications       Link Words         Custom       Baud       Format       Mode       Image: Communications       Image: Communications         Start Code       End Code       PC Link (Slave)       PC Link (Master)       PC Link Mode         Set       Dx0000       C CR,LF       Image: Communication (Slave)       Image: Communication (Slave)         Set       Dx0000       Set End Cod       Set End Cod       Image: Communication (Slave)       Image: Communication (Slave)
Response Timeout Unit Number Delay NT/PC Link Max PC Link Unit No.
CP1L-M Offline

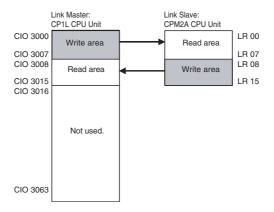
Link Area SizeThe 1:1 Link Area in the CP1L is from CIO 3000 to CIO 3015 (16 words).<br/>Even if a 1:1 Link is created with a CQM1H or C200HX/HG/HE(-Z) PLC, the<br/>1:1 Link Area will be only 16 words on both sides of the link, and only LR 00 to<br/>LR 15 will be used in the CQM1H or C200HX/HG/HE(-Z) PLC. LR 16 to LR 63<br/>cannot be used for 1:1 LinksOperationHere, operation is described assuming that the master is the CP1L and the

Here, operation is described assuming that the master is the CP1L and the slave is the CPM2A.



1:1 Link

1:1 Link Area

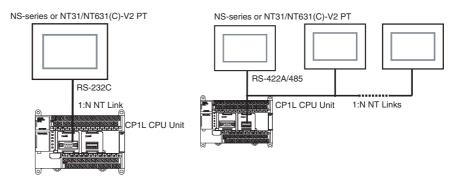


CP1L is set as the link master, so CIO 3000 to CIO 3007 are its write area. Any data written to these words with the OUT or MOV instructions will be automatically transferred to LR 00 to LR 07 in the CPM2A. The CPM2A will use these words as its read area.

CIO 3008 to 3015 are the read area of the CP1L. The contents of LR 08 to LR 15 in the CPM2A will automatically be transferred to CIO 3008 to 3015 in the CP1L. The words in the PLC's read area cannot be written using the OUT, MOV, or any other write instructions.

### 6-3-7 1:N NT Links

In the CP Series, communications are possible with PTs (Programmable Terminals) using NT Links in 1:N mode.



Note Communications are not possible using the 1:1-mode NT Link protocol.

High-speed NT Links are possible in addition to the previous standard NT Links by using the PT system menu and the following PLC Setup. High-speed NT Links are possible, however, only with NS-series PTs or with the NT31(C)-V2 or NT631(C)-V2 PTs.

#### **PLC Setup**

PLC Settings - NewPLC1	
File Options Help	
Startup         Settings         Timings         Input constant         Serial Port 1         Serial Port 2         Peripheral Service           Communications         Settings         Link Word           Standard (9600 ; 1,7,2,E)         Link Word	
9600 V 7,1,E V NT Link (1:N) V 10 (defau	
Start Code     End Code     NT Link (1N)       © Disable     © Received E ToolBus       © Set     0x0000 #	PC Link Mode
Response Timeout Cunit Number Clay Control Response Timeout Chink Max C	PC Link Unit No.
0 ≠ *100 ms 0 ≠ 0 ≠ *10 ms 0 ≠ (default 5000ms)	
	CP1L-M Offline

Port	Name	Settings contents	Default values	Other conditions
Serial port	Mode: Communications mode	NT Link (1:N): 1:N NT Links		Turn OFF pin 4 on the CPU
1 or 2	Baud: Baud rate	38,400 (standard) 115,200 (high speed)	(-   )	Unit DIP switch hen using serial port 1 and turn OFF pin 5 when using serial port 2.
	NT/PC Link Max: Highest unit number	0 to 7	0	

#### **PT System Menu**

Set the PT as follows:

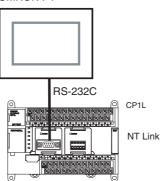
- *1,2,3...* 1. Select NT Link (1:N) from Comm. A Method or Comm. B Method on the Memory Switch Menu under the System Menu on the PT Unit.
  - 2. Press the SET Touch Switch to set the Comm. Speed to High Speed.

## 6-3-8 1:1 NT Links

The NT Link communications protocol was developed to enable high-speed communications between PLC and Programmable Terminals (PTs). There are two communications modes supported by the NT Link protocol: 1:1 NT Links, in which one PLC is connected to one PT, and 1:N NT Links, in which one PLC is connected to more than one PT.

Connections

#### OMRON PT



With the NT Link protocol, the PLC automatically responds to commands sent from the PT, so no communications programming is required in the CP1L.

#### **PLC Setup**

Select "NT Link (1:1) as the serial communications mode.

PLC Settings - NewPLC1				_ 🗆 🗙
ile Options Help				
Startup Settings Timings Communications Settings Standard (9600 ; 1,7,2 C Custom Baud		al Port 1 Serial Port	2 Peripheral Servic	re   Built-in Input   F ( )
Start Code C Disable C Set Dx0000	T.1.E  End Code  Receiver C CR,LF C Set End	1:1Link (Slave)		efault)
Response Timeout	nit Number	)elay	NT/PC Link Max	PC Link Unit No.
				CP1L-M Offline

## 6-3-9 Host Link Communications

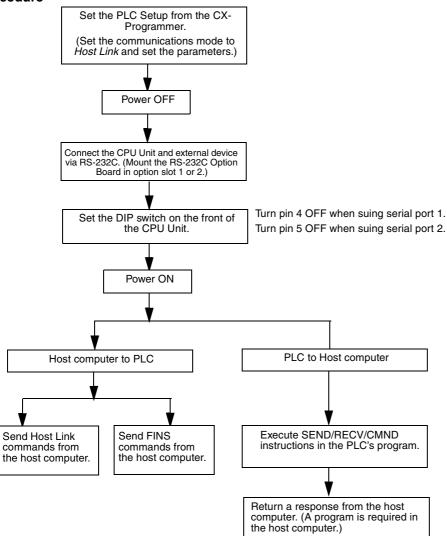
The following table shows the host link communication functions available in CP1L PLCs. Select the method that best suits your application.

Command flow	Command type	Communications method	Configuration
Host computer	Host link command (C Mode) Host link command	Create frame in the host com- puter and send the command to the PLC. Receive the response from the PLC. Application: Use this method when commu- nicating primarily from the host computer to the PLC.	Directly connect the host computer in a 1:1 or 1:N system.

## Section 6-3

Command flow	Command type	Communications method	Configuration
	FINS command (with Host Link header and terminator) sent. FINS Header Terminator	Create frame in the host com- puter and send the command to the PLC. Receive the response from the PLC. Application: Use these methods when com- municating primarily from the host computer to PLCs in the network. Remarks: The FINS command must be placed between a Host Link header and terminator and then sent by the host computer.	Directly connect the host computer in a 1:1 or 1:N system.
Host computer	FINS command (with Host Link header and terminator) is sent. FINS Header Terminator	Send the command frame with the CPU Unit's SEND, RECV, or CMND instruction. Receive response from the host com- puter. Application: Use this method when commu- nicating primarily from the PLC to the host computer to transmit status information, such as error information. Remarks: The FINS command will be placed between a Host Link header and terminator when it is sent. The FINS command must be interpreted at the host com- puter and then the host com- puter must return a response.	Directly connect the host computer in a 1:1 system.

#### Procedure



#### **Host Link Commands**

The following table lists the host link commands. Refer to the *SYSMAC CS/CJ-series Communications Commands Reference Manual* (W342) for more details.

Туре	Header code	Name	Function
I/O mem- RR ory read		CIO AREA READ	Reads the contents of the specified number of CIO Area words starting from the specified word.
commands	RL	LINK AREA READ	Reads the contents of the specified number of Link Area words starting from the specified word.
	RH	HR AREA READ	Reads the contents of the specified number of Holding Area words starting from the specified word.
	RC	PV READ	Reads the contents of the specified number of timer/counter PVs (present values) starting from the specified timer/counter.
	RG	T/C STATUS READ	Reads the status of the Completion Flags of the specified number of tim- ers/counters starting from the specified timer/counter.
	RD	DM AREA READ	Reads the contents of the specified number of DM Area words starting from the specified word.
	RJ	AR AREA READ	Reads the contents of the specified number of Auxiliary Area words starting from the specified word.

## Section 6-3

Туре	Header code	Name	Function
I/O mem- ory write	WR	CIO AREA WRITE	Writes the specified data (word units only) to the CIO Area, starting from the specified word.
commands	WL	LINK AREA WRITE	Writes the specified data (word units only) to the Link Area, starting from the specified word.
	WH	HR AREA WRITE	Writes the specified data (word units only) to the Holding Area, starting from the specified word.
	WC	PV WRITE	Writes the PVs (present values) of the specified number of timers/counters, starting from the specified timer/counter.
	WD	DM AREA WRITE	Writes the specified data (word units only) to the DM Area, starting from the specified word.
	WJ	AR AREA WRITE	Writes the specified data (word units only) to the Auxiliary Area, starting from the specified word.
Timer/ counter SV	R#	SV READ 1	Reads the 4-digit BCD constant or word address in the SV of the specified timer/counter instruction.
read commands	R\$	SV READ 2	Searches for the specified timer/counter instruction beginning at the speci- fied program address and reads the 4-digit constant or word address in the SV.
	R%	SV READ 3	Searches for the specified timer/counter instruction beginning at the speci- fied program address and reads the 4-digit BCD constant or word address in the SV.
Timer/ counter SV	W#	SV CHANGE 1	Changes the 4-digit BCD constant or word address in the SV of the specified timer/counter instruction.
write commands	W\$	SV CHANGE 2	Searches for the specified timer/counter instruction beginning at the speci- fied program address and changes the 4-digit constant or word address in the SV.
	W%	SV CHANGE 3	Searches for the specified timer/counter instruction beginning at the speci- fied program address and changes the 4-digit constant or word address in the SV.
CPU Unit status com-	MS	STATUS READ	Reads the operating status of the CPU Unit (operating mode, force-set/reset status, fatal error status).
mands	SC	STATUS CHANGE	Changes the CPU Unit's operating mode.
	MF	ERROR READ	Reads and clears errors in the CPU Unit (non-fatal and fatal).
Force-	KS	FORCE SET	Force-sets the specified bit.
set/force-	KR	FORCE RESET	Force-resets the specified bit.
reset com- mands	FK	MULTIPLE FORCE SET/RESET	Force-sets, force-resets, or clears the forced status of the specified bits.
	KC	FORCE SET/RESET CAN- CEL	Cancels the forced status of all force-set and force-reset bits.
Model read command	MM	PLC MODEL READ	Reads the model type of the PLC.
Test com- mand	TS	TEST	Returns, unaltered, one block of data transmitted from the host computer.
Program area	RP	PROGRAM READ	Reads the contents of the CPU Unit's user program area in machine lan- guage (object code).
access commands	WP	PROGRAM WRITE	Writes the machine language (object code) program transmitted from the host computer into the CPU Unit's user program area.
I/O mem- ory com-	QQMR	COMPOUND COMMAND	Registers the desired bits and words in a table.
pound read commands	QQIR	COMPOUND READ	Reads the registered words and bits from I/O memory.

Туре	Header code	Name	Function
Host Link communi-	XZ	ABORT (command only)	Aborts the host link command that is currently being processed.
processing mand only)		INITIALIZE (com- mand only)	Initializes the transmission control procedure of all PLCs connected to the host computer.
commands	IC	Undefined com- mand (response only)	This response is returned if the header code of a command was not recog- nized.

#### **FINS Commands**

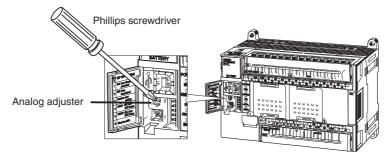
The following table lists the FINS commands. Refer to the *FINS Commands Reference Manual (W227)* for more details.

Type Command code			Name	Function
I/O Memory	01	01	MEMORY AREA READ	Reads consecutive data from the I/O memory area.
Area Access Commands	01	02	MEMORY AREA WRITE	Writes consecutive data to the I/O memory area.
Commanus	01	03	MEMORY AREA FILL	Fills the specified range of I/O memory with the same data.
	01	04	MULTIPLE MEMORY AREA READ	Reads non-consecutive data from the I/O memory area.
	01	05	MEMORY AREA TRANSFER	Copies and transfers consecutive data from one part of the I/O memory area to another.
Parameter	02	01	PARAMETER AREA READ	Reads consecutive data from the parameter area.
Area Access Commands	02	02	PARAMETER AREA WRITE	Writes consecutive data to the parameter area.
Commands	02	03	PARAMETER AREA FILL	Fills the specified range of the parameter area with the same data.
Program Area	03	06	PROGRAM AREA READ	Reads data from the user program area.
Access Com-	03	07	PROGRAM AREA WRITE	Writes data to the user program area.
mands	03	08	PROGRAM AREA CLEAR	Clears the specified range of the user program area.
Execution	04	01	RUN	Switches the CPU Unit to RUN or MONITOR mode.
Control Com- mands	04	02	STOP	Switches the CPU Unit to PROGRAM mode.
Configuration	05	01	CONTROLLER DATA READ	Reads CPU Unit information.
Read Com- mands	05	02	CONNECTION DATA READ	Reads the model numbers of the specified Units.
Status Read	06	01	CONTROLLER STATUS READ	Reads the CPU Unit's status information.
Commands	06	20	CYCLE TIME READ	Reads the average, maximum, and minimum cycle times.
Clock Access	07	01	CLOCK READ	Reads the clock.
Commands	07	02	CLOCK WRITE	Sets the clock.
Message Access Com- mands	09	20	MESSAGE READ/CLEAR	Reads/clears messages and FAL (FALS) messages.
Access Right	0C	01	ACCESS RIGHT ACQUIRE	Acquires the access right if no other device holds it.
Commands	0C	02	ACCESS RIGHT FORCED ACQUIRE	Acquires the access right even if another device cur- rently holds it.
	0C	03	ACCESS RIGHT RELEASE	Releases the access right regardless of what device holds it.
Error Access	21	01	ERROR CLEAR	Clears errors and error messages.
Commands	21	02	ERROR LOG READ	Reads the error log.
	21	03	ERROR LOG CLEAR	Clears the error log pointer to zero.
Forced Status Commands	23	01	FORCED SET/RESET	Force-sets, force-resets, or clears the forced status of the specified bits.
	23	02	FORCED SET/RESET CANCEL	Cancels the forced status of all force-set and force-reset bits.

## 6-4 Analog Adjuster and External Analog Setting Input

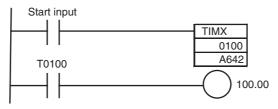
## 6-4-1 Analog Adjuster

By turning the analog adjuster on the CP1L CPU Unit with a Phillips screwdriver, the PV in the Auxiliary Area (A642) can be changed to any value within a range of 0 to 255.



### **Application Example**

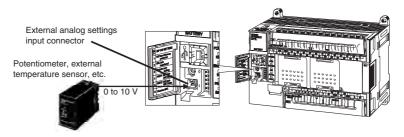
Setting the value for timer T100 in A642 makes it possible to use T100 as a variable timer with a range of 0 to 25.5 s (0 to 255). A change in the set value is reflected with the next scan.



**Note** Set values from the analog adjuster may vary with changes in the ambient temperature and the power supply voltage. Do not use it for applications that require highly precise set values.

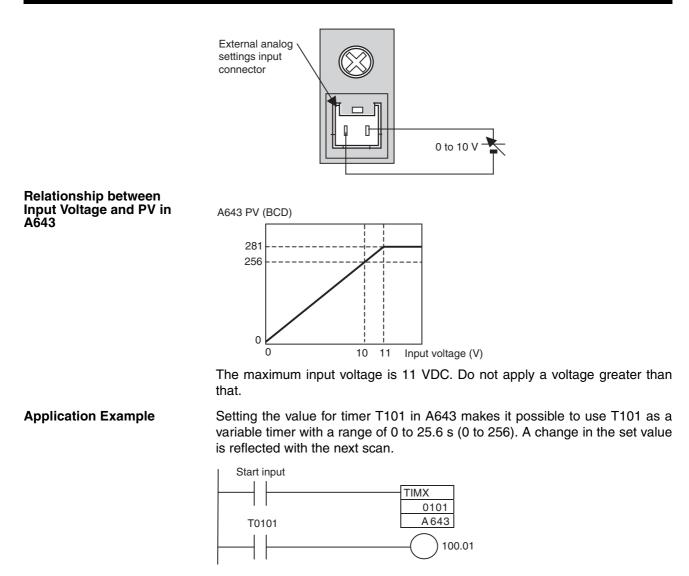
## 6-4-2 External Analog Setting Input

When a voltage of 0 to 10 V is applied to the CP1L CPU Unit's external analog setting input terminal, the voltage is converted from analog to digital and the PV in A643 can be changed to any value within a range of 0 to 256 (0000 to 0100 hex).



# External Analog Setting Input Wiring

Use the 1-m lead wire (included) for wiring to the external analog setting input connector on the CP1L CPU Unit.



**Note** External analog setting input values may vary with changes in the ambient temperature. Do not use the external analog setting input for applications that require highly precise set values.

## 6-5 Battery-free Operation

## 6-5-1 Overview

With the CP1L CPU Unit, saving backup data in the built-in flash memory (non-volatile memory) enables operation with no battery mounted (i.e., battery-free operation).

I/O memory (such as CIO), however, is constantly refreshed during operation, so backup data is not saved in the built-in flash memory. When battery-free operation is used, therefore, programs must be created assuming that I/O memory data will not be saved.

For example, if a battery is mounted, then HR, CNT, and DM data is saved during power interruptions if a battery is mounted but not when battery-free operation is used. In that case it is necessary to set the required values in the ladder program. It is also possible to save to the built-in flash memory in advance the DM initial values that are to be set for the DM on RAM at startup.

## 6-5-2 Using Battery-free Operation

#### Precautions when Creating Programs for Battery-free Operation

Be careful of the following points, and create programs for which it will not be a problem even if the correct I/O memory values are not held.

- For unstable parts of I/O memory, include programming at the start of operation to set required data.
- When battery-free operation is used, the Output OFF Flag (A500.15) in the Auxiliary Area becomes unstable. When the Output OFF Flag turns ON, all outputs turn OFF, so include the following program for clearing the Output OFF Flag at the start of operation.

First Cycle Flag	
	RSET
A200.11	_
A200.11	A500.15

• Do not reference the clock function, (the clock data in words A351 to A354 of the Auxiliary Area, or the various kinds of time data).

#### Saving DM Initial Values (Only when Required)

Use the following procedure to save to the built-in flash memory the DM initial values that are to be set at startup.

- *1,2,3...* 1. First set in the DM Area the data that is to be set as initial values at startup.
  - Execute a backup to flash memory from the CX-Programmer's Memory Cassette Transfer/Data Memory Backup Dialog Box. The procedure is as follows:
    - a. Select PLC Edit Memory Cassette/DM.

The following Memory Cassette Transfer/DM Backup Dialog Box will be displayed.

mory Cassette		
Transfer Data Area	PLC => Memory Cassette	
🔽 User Program	FLO -/ Memory Cassette	
Parameters		
🔽 Data Memory	Memory Cassette => PLC	
V Symbol Table		
Comment	Compare	
🔽 Program Index		
☑ DM initial value	Format	
PLC Startup Execution Mode		
💽 Program Mode (default)		
C Using startup's mode setting in PLC Setup		
ackup to Fash Memory		
F Call Lemon	Back Up	
	Close	

- Select the Data Memory Option in the Backup to Flash Memory Area and click the Backup Button.
   The DM data will be written to the built in flash memory.
- The DM data will be written to the built-in flash memory.
- **Note** The DM data that is saved and written at startup is the entire DM Area (D0 to D32767).

## PLC Setup

- *1,2,3...* 1. Set *Do not detect Low Battery (run without battery)* to *Do not detect.* 
  - 2. Set IOM Hold Bit Status at Startup and Forced Status Hold Bit Status at Startup to Clear (OFF).
  - 3. Set *Read DM from flash memory* to *Read.* (Only when DM initial values have been saved as described above.)
- ▲ Caution The CP1L CPU Units automatically back up the user program and parameter data to flash memory when these are written to the CPU Unit. Also, the CX-Programmer can be used to save all of the data in the DM Area to the flash memory for use as initial values when the power supply is turned ON. Neither of these functions saves the I/O memory data (including HR Area data, counter PVs and Completion Flags, and DM Area data other than initial values). The HR Area data, counter PVs and Completion Flags, and DM Area data other than initial values are held during power interruptions with a battery. If there is a battery error, the contents of these areas may not be accurate after a power interruption. If HR Area data, counter PVs and Completion Flags, and DM Area data other than initial values are used to control external outputs, prevent inappropriate outputs from being made whenever the Battery Error Flag (A402.04) is ON.

## 6-6 Memory Cassette Functions

## 6-6-1 Overview

CP1L CPU Units have Memory Cassette functions that enable data in the CPU Unit to be stored on and read from a special CP1W-ME05M Memory Cassette. These functions can be used for the following applications.

- · Copying data to other CPU Units to produce duplicate devices.
- Backing up data in case the CPU Unit needs to be replaced due to any malfunction.
- Writing and updating data when existing device versions are upgraded.
- Note Memory Cassette cannot be used in CP1L-J CPU Unit.

Memory Cassette Specifications Use the following Memory Cassette.

Model	Specifications		
CP1W-ME05M	<ul> <li>Memory size</li> </ul>	512 Kwords	
	<ul> <li>Storage capacity</li> </ul>	The following CPU Unit data (for each Unit)	
		User programs	
		Parameters	
		Comment memory	
		<ul> <li>Function Block (FB) sources</li> </ul>	
		• DM initial values in the built-in flash memory	
		• DM in RAM	
	<ul> <li>Write method</li> </ul>	Operations from the CX-Programmer	
	<ul> <li>Read method</li> </ul>	Powering up with DIP switch pin SW2 set to ON, or operations from the CX-Programmer	

## Section 6-6

#### Data that Can be Stored on a Memory Cassette

The following data can be stored on a Memory Cassette.

Data stored on Memory Cassette		Location in CPU Unit		
User programs		Built-in RAM, built-in flash memory (User Program Area)		
Parameters	PLC Setup, CPU Bus Unit set- tings, routing tables	Built-in RAM, built-in flash memory (Parameter Area)		
Comment data for user pro- grams	Variable tables	Built-in flash memory (Com- ment Memory Area)		
	(I/O comments, rung com- ments, program comments)	Built-in flash memory (Com- ment Memory Area)		
	Program indexes (section names, section comments, program comments)	Built-in flash memory (Com- ment Memory Area)		
Function Block (FB) sources		Built-in flash memory (FB Source Memory Area)		
DM		Built-in RAM (D0 to D32767 in DM Area)		
DM initial values (See note.)		Built-in flash memory (DM Ini- tial Values Area)		

The areas for storing various types of data have fixed allocations in the Memory Cassette, and a single Memory Cassette corresponds to a single CPU Unit.

Therefore it is not possible to simultaneously store multiple items of the same type of data (e.g., two user programs).

Also, the data can only be read to a CPU Unit. It cannot be directly managed from a personal computer like files.

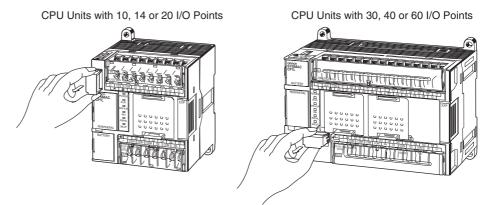
The only data that can be stored on a Memory Cassette is the data from a CPU Unit.

**Note** The CX-Programmer's function for saving DM initial values is used for saving the values in the DM Area (D0 to D32767) to the built-in flash memory as initial values. By means of a setting in the PLC Setup, these initial values can then be automatically written to the DM Area (D0 to D32767) when the power is turned ON.

## 6-6-2 Mounting and Removing a Memory Cassette

## Mounting

*1,2,3...* 1. Turn OFF the power supply to the PLC and removed the cover to the Memory Cassette socket.

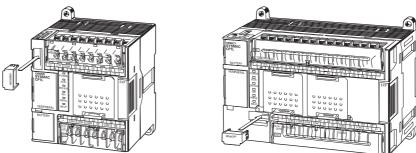


#### Memory Cassette Functions

## Section 6-6

2. Holding the Memory Cassette with the side with the nameplate facing upwards, insert the Memory Cassette all the way into the slot.

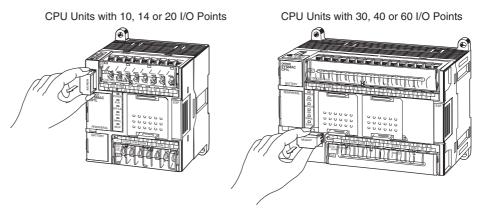
CPU Units with 10, 14 or 20 I/O Points CPU Units with 30, 40 or 60 I/O Points



#### **Removal**

1,2,3...

- 1. Turn OFF the power supply to the PLC.
  - 2. Grasp the end of the Memory Cassette between the thumbnail and index finger, and slide it upwards to remove it.



#### Note

- (1) Turn OFF the power supply before mounting or removing the Memory Cassette.
  - (2) Absolutely do not remove the Memory Cassette while the BKUP indicator is flashing (i.e., during a data transfer or verification). Doing so could make the Memory Cassette unusable.
  - (3) The Memory Cassette is small, so be careful to not let it be dropped or lost when it is removed.

# 6-6-3 Operation Using the CX-Programmer

Use the following procedure for the Memory Cassette function.

#### 1,2,3... 1. Select PLC - Edit - Memory Cassette/DM.

The following Memory Cassette Transfer/Data Memory Backup Dialog Box will be displayed.

mory Cassette ransfer Data Area	PLC => Memory Cassette
✓ <u>User Program</u> ✓ Parameters ✓ Data Memory	Memory Cassette => PLC
⊽ Symbol Table ▼ Comment ▼ Program Index	Compare
✓ Mean Look ✓ DM initial value	Format
PLC Startup Execution Mode Frogram Mode (default) Using startup's mode setting in PLC Setup	
ackup to Fash Memory	
Dill Venore	Back Up
Company of the second se	Close

2. Under *Transfer Data Area*, check whatever types of data are to be transferred.

Click the **Valid Area Check** Button to check the valid areas in the Memory Cassette mounted in the CPU Unit and the operating mode after automatic transfer at startup. If the user program is specified to be written, select the operating mode after automatic transfer at startup.

- PROGRAM mode (default): Used, e.g., to copy the system.
- Use PLC Setup: Used, e.g., for operation with the Memory Cassette.
- 3. Execute any of the following operations.
  - To write data from the CPU Unit to the Memory Cassette: Click the **PLC**  $\Rightarrow$  **Memory Cassette** Button.
  - To read data from the Memory Cassette to the CPU Unit: Click the **Memory Cassette** ⇒ **PLC** Button.
  - To verify data transferred between the CPU Unit and the Memory Cassette:

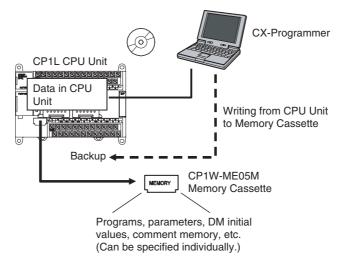
Click the **Compare** Button. This will cause all areas to be verified regardless of the items checked under Transfer Area.

• To format the Memory Cassette: Click the **Format** Button. This will cause all areas to be formatted regardless of the items checked under Transfer Area.

# 6-6-4 Memory Cassette Data Transfer Function

#### Writing from the CPU Unit to the Memory Cassette

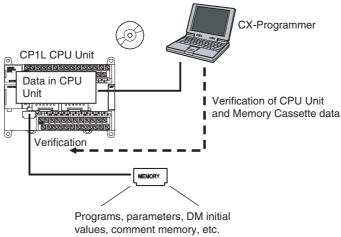
The CX-Programmer's Memory Cassette function can be used to write data from the CPU Unit to the Memory Cassette. The data to be written can be individually specified.



- When creating a Memory Cassette for a device version upgrade, select and save only the required data (such as the user program and DM).
- When creating a Memory Cassette for backup or duplication, save all of the data to the Memory Cassette.

#### <u>CPU Unit and Memory</u> <u>Cassette Verification</u>

When using the CX-Programmer's Memory Cassette function to store data in the Memory Cassette, verify that data by comparing it to the data in the CPU Unit. The data to be verified can be specified individually



(Can be specified individually.) nction can be used for operations such as confirm

This function can be used for operations such as confirmation after data has been written to the Memory Cassette, or confirming that the data in the backup matches the data in the CPU Unit.

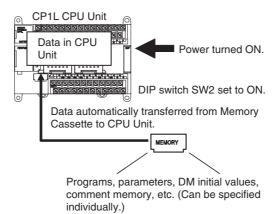
Automatic Transfer from the Memory Cassette at Startup

With just a simple DIP switch setting, data stored in advance in the Memory Cassette can be automatically read when the power is turned ON, and written to the corresponding areas in the CPU Unit.

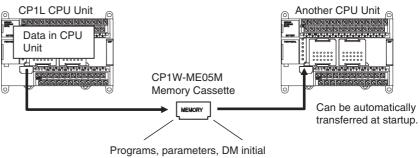
Mount a Memory Card and set DIP switch pin SW2 to ON, and then turn the power OFF and back ON.

All valid data in the Memory Card will be automatically transferred to the CPU Unit.

**Note** When this function is executed, at least the user program must be stored on the Memory Cassette.



This function can be used to copy data to another CPU Unit without using the CX-Programmer.



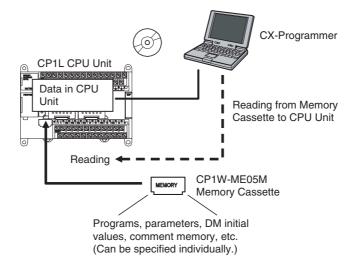
values, comment memory, etc.

User programs can be overwritten to upgrade equipment versions without using the CX-Programmer.

If writing data from the CPU Unit to the Memory Cassette and the CPU Unit is set to use the operating mode specified in the PLC Setup as the operating mode after automatic transfer at startup, operation can be started without cycling the power, enabling operation from the Memory Cassette.

#### <u>Reading Data from</u> <u>the Memory Cassette</u> <u>to the CPU Unit</u>

The CX-Programmer's Memory Cassette function can be used to read data stored on the Memory Cassette, and transfer it to the corresponding areas in the CPU Unit. The data to be read can be individually specified.



This function can be used for operations such as writing the required backup data to the CPU Unit for maintenance.

#### Precautions when Using the Memory Cassette Data Transfer Function

- In order for Memory Cassette data to be transferred, the Memory Cassette must be mounted in the CPU Unit.
- The BKUP indicator will light while data is being transferred to or verified in a Memory Cassette. Never turn OFF the power to the PLC or remove the Memory Cassette while the BKUP indicator is lit. Doing either may make it impossible to use the Memory Cassette.
- Memory Cassette data transfers and verification are possible only when the CPU Unit operating mode is PROGRAM mode. The Memory Cassette transfer function cannot be used in either RUN or MONITOR mode.
- When using automatic transfer from a Memory Cassette at startup, be sure to transfer the data to the Memory Cassette if any changes are made using online editing.
- The operating mode cannot be switched from PROGRAM mode to RUN or MONITOR mode while a Memory Cassette data transfer or verification is in progress.
- The following table shows whether data transfers are enabled when the CPU Unit is protected in various ways.

Type of protection	Transfer from CPU Unit to Memory Cassette	Transfer from Memory Cassette to CPU Unit
Not protected.	Yes	Yes
System protected by DIP switch pin SW1 set to ON.	Yes	No
Protected by password. Over- writing and duplication both per- mitted.	Yes	Yes
Protected by password. Over- writing prohibited and duplica- tion permitted.	Yes	Transfer enabled only at startup.

Type of protection	Transfer from CPU Unit to Memory Cassette	Transfer from Memory Cassette to CPU Unit
Protected by password. Over- writing permitted and duplica- tion prohibited.	No	Yes
Protected by password. Over- writing and duplication both pro- hibited.	No	Transfer enabled only at startup.

- If a Memory Cassette is not mounted, data will be read from the flash memory built into the CPU Unit to start operation regardless of the setting of DIP switch pin SW2.
- CP1L CPU Units with 10, 14 or 20 I/O points. do not have D10000 to D31999. These words will be treated as follows when data from a CPU Unit with 10, 14 or 20 I/O points is transferred to a CPU Unit with 30, 40 or 60 I/O points or visa versa.

5	"0000" will be written to D10000 to D31999 in the CPU Unit with 30, 40 or 60 I/O points.
	D10000 to D31999 in the CPU Unit with 30, 40 or 60 I/O points will be ignored.

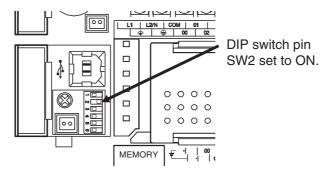
# 6-6-5 Procedures for Automatic Transfer from the Memory Cassette at Startup

Copying the System

1,2,3...

Use the following procedure to enable automatic transfer at startup.

- Prepare a Memory Cassette containing the required data. When transferring the data to the Memory Cassette, set the operating mode after automatic transfer at startup to PROGRAM mode (default).
  - 2. With the power supply turned OFF to the CPU Unit, remove the cover from the Memory Cassette slot and insert the Memory Cassette.
  - 3. Open the cover for the CPU Unit's PERIPHERAL section and set DIP switch pin SW2 to ON.



- 4. Turn ON the power supply to the CPU Unit.
- 5. The automatic transfer from the Memory Cassette will begin. The rest of the procedure assumes that the operating mode after automatic transfer at startup to PROGRAM mode (default).
- 6. After the automatic transfer has been completed, turn OFF the power supply to the CPU Unit.
- 7. Remove the Memory Cassette, and replace the Memory Cassette slot cover.
- 8. Return the setting of DIP switch pin SW2 to OFF, and close the cover.

- 9. Turn the power supply to the CPU Unit back ON.
- **Note** After the automatic transfer from the Memory Cassette at startup has been completed with the operating mode after automatic transfer at startup set to PROGRAM mode (default), the transfer will not start again automatically (regardless of the Startup Mode setting in the PLC Setup). As described in the procedure above, to start operation turn the power supply OFF, return the setting of DIP switch SW2 to OFF, and then turn the power supply back ON. If the the operating mode specified in the PLC Setup is set as the operating mode after automatic transfer at startup, operation will start without changing the DIP switch SW2 or Memory Cassette.

#### Operating from a Memory Cassette

- 1,2,3...1. Prepare a Memory Cassette containing the required data. When transferring the data to the Memory Cassette, set the operating mode after automatic transfer at startup to PROGRAM mode (default).
  - 2. With the power supply turned OFF to the CPU Unit, remove the cover from the Memory Cassette slot and insert the Memory Cassette.
  - 3. Open the cover for the CPU Unit's PERIPHERAL section and set DIP switch pin SW2 to ON.
  - 4. Turn ON the power supply to the CPU Unit.
- **Note** If, when the data is transferred to the Memory Cassette, the operating mode specified in the PLC Setup is set as the operating mode after automatic transfer at startup, operation will start automatically after data transfer, even if the power is not cycled. Be sure that starting operation will cause no problems before using automatic transfer at startup.

# 6-7 Program Protection

The following protection functions are supported by the CP1L CPU Units.

- · Read protection from the CX-Programmer
- Write protection using a DIP switch setting
- Write protection setting from the CX-Programmer
- Write protection against FINS commands sent to the CPU Unit via networks
- Prohibiting creating a program file for file memory

# 6-7-1 Read Protection

## **Overview**

It is possible to read-protect individual program tasks (called task read protection) or the entire user program (called UM read protection).

Read protection prevents anyone from displaying or editing the read-protected set of tasks or entire user program from CX-Programmer without inputting the correct password. If the password is input incorrectly five times consecutively, password input will be disabled for two hours, providing even better security for PLC data.

#### **Operating Procedure**

1,2,3...1. Go online and select *PLC - Protection - Release Password.* The following Release Read Protection Dialog Box will be displayed.

lease Read Protection	
PLC: NewPLC1	Ōt.
Items to release:	Cancel
✓UM read protection ✓ Task read protection	
JM read protection	

2. Input the password. If the password is incorrect, one of the following messages will be displayed and protection will not be released.

#### **UM Read Protection**

CX-Progr	ammer v6.1
1	Error releasing read protection Release Read Protection failed. Online-edit history area is full or the set parameter is invalid. Try Release password' again after Backup process is finished or check the password.

#### **Task Read Protection**

CX-Progr	ammer v6.1	×
1	Error releasing read p Writing to UM is prohit	
	OK	

3. If an incorrect password is input five times consecutively, read protection will not be released even if the correct password is input on the sixth attempt and displaying and editing the entire user program or the specified tasks will be disabled for two hours.

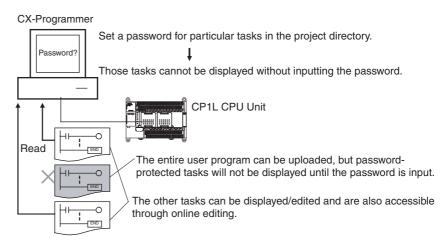
#### **Read Protection for Individual Tasks Using Passwords**

#### Overview

It is possible to read-protect individual program tasks (referred to as "task read protection" below) or the entire PLC. The same password controls access to all of the read-protected tasks.

Task read protection prevents anyone from displaying or editing the read-protected set of tasks from CX-Programmer without inputting the correct password. In this case, the entire program can be uploaded, but the read-protected tasks cannot be displayed or edited without inputting the correct password. Tasks that are not read-protected can be displayed, edited, or modified with online editing.

**Note** Task read protection cannot be set if UM read protection is already set. However, it is possible to set UM read protection after task read protection has been set.

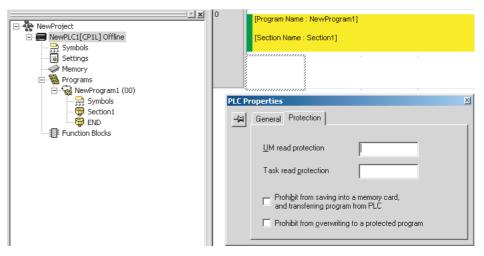


#### **Operating Procedure**

1. Right-click the tasks that will be password-protected, select *Properties* from the pop-up menu, and select the *Task read protect* Option on the *Protection* Tab Page.

Progra	im Prope	rties	$\ge$
-)¤	General	Protection Comments	
	Ta:	sk read protect	

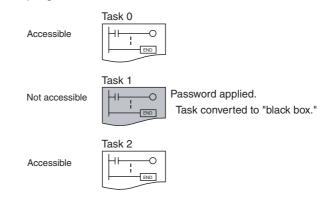
2. Display the *Protection* Tab of the PLC Properties Dialog Box and register a password in the *Task read protection* Box.



- Connect online and select *PLC Transfer To PLC* to transfer the program. The tasks registered in step 2 will be password-protected.
  - **Note** The program can be transferred after step 1, above, and then password protection be set by selecting *PLC Protection Set Password*. The tasks registered in step 1 will be password-protected.

#### Usage

Apply read protection to tasks when you want to convert those task programs to "black box" programs.



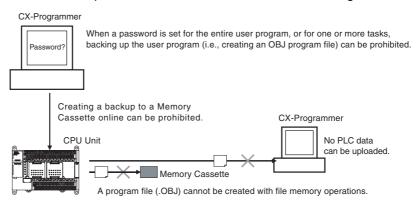
Note

- e 1. If the CX-Programmer is used to read a task with task read protection applied, an error will occur and the task will not be read. Likewise, if the PT Ladder Monitor function is used to read a password protected task, an error will occur and the task will not be read.
  - 2. The entire program can be transferred to another CPU Unit even if individual tasks in the program are read-protected. The task read protection will remain in effective for the password-protected tasks.
  - 3. When the CX-Programmer is used to compare a user program in the computer's memory with a user program in the CPU Unit, password-protected tasks will be compared too.

Function block definitions can be read even if the entire program or individual tasks in a program containing function blocks are read-protected. If required, set read protection individually for each function block.

#### Overview

When a password is set for the entire user program or for a task from the CX-Programmer, prohibiting backing up the user program can be set as an option. Doing so will make it impossible to upload PLC data to the CX-Programmer and make it impossible to save PLC data offline to a storage device.



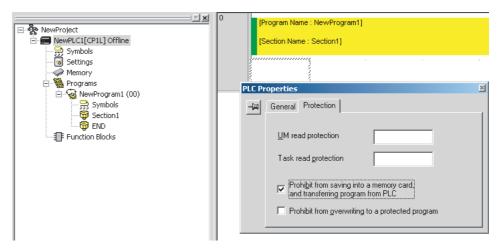
#### **Operating Procedure**

 1. When registering a password in the UM read protection password Box or Task read protection Box, select the Prohibit from saving to a memory card, and transferring program from PLC Option.

Restrictions to Function Block Use

Prohibiting Backing Up the Programs to a Memory Cassette

# Section 6-7



2. Go online and then either select *PLC - Transfer - To PLC* to transfer the program or select *PLC - Protection - Set Password* and click the **OK** button.

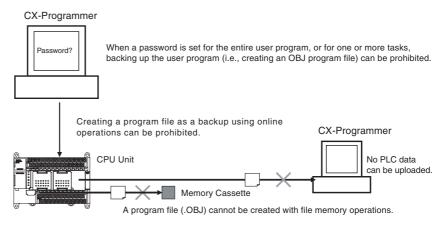
#### Application

The above procedure enables using a password to protect against disclosure of the program to unauthorized persons.

Note

- (1) Copying the program is possible if read protection is not set.
  - (2) The setting to prohibit backing up the program is not effective until the program is transferred to the PLC. Always transfer the program after changing the setting.

When a password is set for the entire user program or for a task from the CX-Programmer, prohibiting creating a program file (.OBJ) as a backup can be set as an option. Doing so will make it impossible to create a program file in file memory using the file memory operations. (This setting will also prohibit uploading PLC data to the CX-Programmer and saving PLC data to a storage device.)



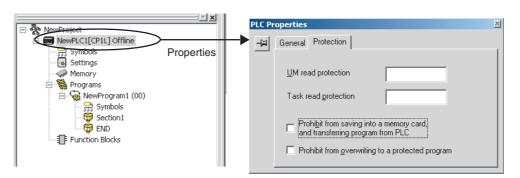
#### **Operating Procedure**

 1. When registering a password in the UM read protection password Box or Task read protection Box, select the Prohibit from saving to a memory card, and transferring program from PLC Option.

Prohibiting Creating Program Files in File Memory

## Section 6-7

#### **Program Protection**



 Go online and then either select *PLC - Transfer - To PLC* to transfer the program or select *PLC - Protection - Set Password* and click the OK button.

#### Application

The above procedure enables using a password to protect against disclosure of the program to unauthorized persons.

Note

- (1) Copying the program is possible if read protection is not set.
- (2) The setting to prohibit backing up the program is not effective until the program is transferred to the PLC. Always transfer the program after changing the setting.

#### Auxiliary Area Flags and Bits Related to Password Protection

Name	Bit address	Description
UM Read Protection Flag	A99.00	Indicates whether or not the PLC (the entire user program) is read-protected.
		OFF: UM read protection is not set.
		ON: UM read protection is set.
Task Read Protection Flag	A99.01	Indicates whether or not selected program tasks are read-protected.
		OFF: Task read protection is not set.
		ON: Task read protection is set.
Program Write Protec- tion for Read Protec- tion	A99.02	Indicates whether or not the write protection option has been selected to prevent overwriting of password-protected tasks or programs.
		OFF: Overwriting allowed
		ON: Overwriting prohibited (write-protected)
Enable/Disable Bit for Program Backup	A99.03	Indicates whether or not a backup program file (.OBJ file) can be created when UM read protec- tion or task read protection is set.
		OFF: Creation of backup program file allowed
		ON: Creation of backup program file prohibited
UM Read Protection Release Enable Flag	A99.12	Indicates when UM read protection cannot be released because an incorrect password was input five times consecutively.
		OFF: Protection can be released
		ON: Protection cannot be released
Task Read Protection Release Enable Flag	A99.13	Indicates when task read protection cannot be released because an incorrect password was input five times consecutively.
		OFF: Protection can be released
		ON: Protection cannot be released

# 6-7-2 Write Protection

#### Write-protection Using the DIP Switch

The user program can be write-protected by turning ON pin 1 of the CPU Unit's DIP switch. When this pin is ON, it won't be possible to change the user program or parameter area (e.g., PLC Setup and routing tables) from the CX-Programmer. This function can prevent the program from being overwritten inadvertently at the work site.

It is still possible to read and display the program from the CX-Programmer when it is write-protected.

#### CPU Unit DIP Switch

Pin	Name	Settings
SW1	User Program Memory Write Protection	ON: Protected
		OFF: Not protected

#### Confirming the User Program Date

The dates the program and parameters were created can be confirmed by checking the contents of A90 to A97.

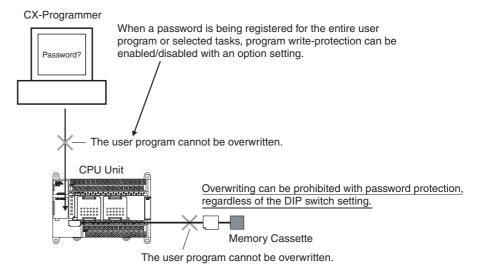
#### Auxiliary Area Words

Name	Address	D	Description
User Program Date	A90 to A93	The time and date the user program was last over- written in memory is given in BCD.	
		A90.00 to A90.07	Seconds (00 to 59 BCD)
		A90.08 to A90.15	Minutes (00 to 59 BCD)
		A91.00 to A91.07	Hour (00 to 23 BCD)
		A91.08 to A91.15	Day of month (01 to 31 BCD)
		A92.00 to A92.07	Month (01 to 12 BCD)
		A92.08 to A92.15	Year (00 to 99 BCD)
		A93.00 to A93.07	Day (00 to 06 BCD)
			Day of the week: 00: Sunday, 01: Monday, 02: Tuesday, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday
Parameter Date	A94 to A97	The time and date the parameters were last overwrit- ten in memory is given in BCD. The format is the same as that for the User Program Date given above.	

### Section 6-7

#### Write-protection Using Passwords

The program (or selected tasks) can also be write-protected if the write protection option is selected from the CX-Programmer when a password is being registered for the entire program or those selected tasks. The write protection setting can prevent unauthorized or accidental overwriting of the program.



- Note 1. If the selected tasks are write-protected by selecting this option when registering a password, only the tasks (program) that are password-protected will be protected from overwriting. It will still be possible to overwrite other tasks with operations such as online editing and task downloading.
  - 2. All tasks (programs) can be overwritten when program read protection is not enabled.

#### **Operating Procedure**

*1,2,3...* Table 1 When registering a password in the *UM read protection password* Box or *Task read protection* Box, select the *Prohibit from overwriting to a protected program* Option.

RewProject     NewPC1[CP1L] Offline     Symbols	0 [Program Name : NewProgram1] [Section Name : Section1]
⊡ 🍓 Programs ⊡ 🙀 NewProgram1 (00)	PLC Properties
	General Protection
	UM read protection
	Task read protection
	Prohibit from saving into a memory card, and transferring program from PLC
	Prohibit from gverwriting to a protected program

- 3. Either select *PLC Transfer To PLC* to transfer the program or select *PLC Protection Set Password* and click the OK button.
- **Note** The setting to enable/disable creating file memory program files will not take effect unless the program is transferred to the CPU Unit. Always transfer the program after changing this setting.

<u>Write Protection</u> against FINS <u>Commands Sent to</u> the CPU Unit via Networks It is possible to prohibit write operations and other editing operations sent to the PLC's CPU Unit as FINS commands through a network (including write operations from CX-Programmer, CX-Protocol, CX-Process, and other applications using Fins Gateway). Read processes are not prohibited.

FINS write protection can disable write processes such as downloading the user program, PLC Setup, or I/O memory, changing the operating mode, and performing online editing.

It is possible to exclude selected nodes from write protection so that data can be written from those nodes.

An event log in the CPU Unit automatically records all write processes sent through the network and that log can be read with a FINS command.

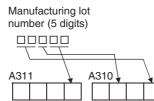
# 6-7-3 Protecting Program Execution Using the Lot Number

The lot number is stored in A310 and A311 and can be used to prevent the program from being executed on a CPU Unit with the wrong lot number.

The following instructions can be added to the program to create a fatal error and thus prevent program execution if an attempt is made to execute the program on a CPU Unit with the incorrect lot number. A password can also be set to read-protect the program so that it cannot be copied, e.g., using a Memory Cassette.

The lot number stored in A310 and A311 cannot be changed by the user.

The upper digits of the lot number are stored in A311 and the lower digits are stored in A310, as shown below.



X, Y, and Z in the lot number are converted to 10, 11, and 12, respectively, in A310 and A311. Some examples are given below.

Lot number	A311	A310
01805	0005	0801
30Y05	0005	1130

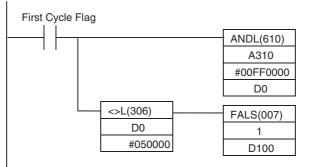
#### Ladder Programming Example

• The following instructions will create a fatal error to prevent the program from being executed when the lot number is not 23905.

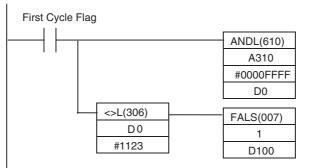


1 1		
—     -		ANDL(610)
		A310
		#00FFFFFF
		D0
	<>L(306)	FALS(007)
	D0	1
	#050923	D100

• The following instructions will create a fatal error to prevent the program from being executed when the lot number does not end in 05.



• The following instructions will create a fatal error to prevent the program from being executed when the lot number does not begin with 23Y.



# 6-8 Failure Diagnosis Functions

This section introduces the following functions.

- Failure Alarm Instructions: FAL(006) and FALS(007)
- Failure Point Detection: FPD(269)
- Output OFF Bit

# 6-8-1 Failure Alarm Instructions: FAL(006) and FALS(007)

The FAL(006) and FALS(007) instructions generate user-defined errors. FAL(006) generates a non-fatal error that allows program execution to continue and FALS(007) generates a fatal error that stops program execution.

When the user-defined error conditions (i.e., the execution conditions for FAL(006) or FAL(007)) are met, the instruction will be executed and the following processing will be performed.

- *1,2,3...* 1. The FAL Error Flag (A402.15) or FALS Error Flag (A401.06) is turned ON.
  - 2. The corresponding error code is written to A400.
  - 3. The error code and time of occurrence are stored in the Error Log.
  - 4. The error indicator on the front of the CPU Unit will flash or light.
  - If FAL(006) has been executed, the CPU Unit will continue operating. If FALS(007) has been executed, the CPU Unit will stop operating. (Program execution will stop.)

#### **Operation of FAL(006)**



When execution condition A goes ON, an error with FAL number 002 is generated, A402.15 (FAL Error Flag) is turned ON, and A360.02 (FAL Number 002 Flag) is turned ON. Program execution continues.

Errors generated by FAL(006) can be cleared by executing FAL(006) with FAL number 00 or performing the error read/clear operation from the CX-Programmer.

#### Operation of FALS(007)



When execution condition B goes ON, an error with FALS number 003 is generated, and A401.06 (FALS Error Flag) is turned ON. Program execution is stopped.

Errors generated by FAL(006) can be cleared by eliminating the cause of the error and performing the error read/clear operation from the CX-Programmer.

# 6-8-2 Failure Point Detection: FPD(269)

FPD(269) performs time monitoring and logic diagnosis. The time monitoring function generates a non-fatal error if the diagnostic output isn't turned ON within the specified monitoring time. The logic diagnosis function indicates which input is preventing the diagnostic output from being turned ON.

<u>**Time Monitoring**</u> <u>**Function**</u> **FPD**(269) starts timing when it is executed and turns ON the Carry Flag if the diagnostic output isn't turned ON within the specified monitoring time. The Carry Flag can be programmed as the execution condition for an error processing block. Also, FPD(269) can be programmed to generate a non-fatal FAL error with the desired FAL number.

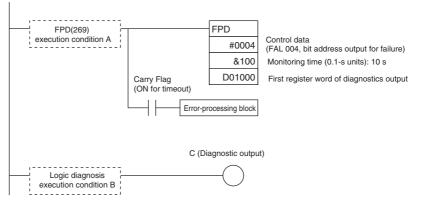
When an FAL error is generated, a preset message will be registered and can be displayed on the CX-Programmer. FPD(269) can be set to output the results of logic diagnosis (the address of the bit preventing the diagnostic output from being turned ON) just before the message.

The teaching function can be used to automatically determine the actual time required for the diagnostic output to go ON and set the monitoring time.

<u>Logic Diagnosis</u> <u>Function</u> FPD(269) determines which input bit is causing the diagnostic output to remain OFF and outputs the result. The output can be set to bit address output (PLC memory address) or message output (ASCII).

If bit address output is selected, the PLC memory address of the bit can be transferred to an Index Register and the Index Register can be indirectly addressed in later processing.

If the message output is selected, an error message can be displayed on the CX-Programmer at the same time as a FAL error is generated for time monitoring.



#### **Time Monitoring**

Monitors whether output C goes ON with 10 seconds after input A. If C doesn't go ON within 10 seconds, a failure is detected and the Carry Flag is turned ON. The Carry Flag executes the error-processing block. Also, an FAL error (non-fatal error) with FAL number 004 is generated.

#### **Logic Diagnosis**

FPD(269) determines which input bit in block B is preventing output C from going ON. That bit address is output to D1000 and D1001.

#### **Auxiliary Area Flags and Words**

Name	Address	Operation
Error Code	A400	When an error occurs, the error code is stored in A400.
FAL Error Flag	A402.15	Turns ON when FAL(006) is executed.
FALS Error Flag	A401.06	Turns ON when FALS(007) is executed.
Executed FAL Num- ber Flags	A360 to A391	The corresponding flag turns ON when an FAL(006) error occurs.
Error Log Area	A100 to A199	The Error Log Area contains information on the most recent 20 errors.
Error Log Pointer	A300	When an error occurs, the Error Log Pointer is incremented by 1 to indicate where the next error record will be recorded as an offset from the beginning of the Error Log Area (A100).
Error Log Pointer Reset Bit	A500.14	Turn this bit ON to reset the Error Log Pointer (A300) to 00.
FPD Teaching Bit	A598.00	Turn this bit ON when you want the monitoring time to be set automatically when FPD(269) is executed.

# 6-8-3 Simulating System Errors

FAL(006) and FALS(007) can be used to intentionally create fatal and nonfatal system errors. This can be used in system debugging to test display messages on Programmable Terminals (PTs) or other operator interfaces. Use the following procedure.

- *1,2,3...* 1. Set the FAL or FALS number to use for simulation in A529. A529 is used when simulating errors for both FAL(006) and FALS(007).
  - 2. Set the FAL or FALS number to use for simulation as the first operand of FAL(006) or FALS(007).

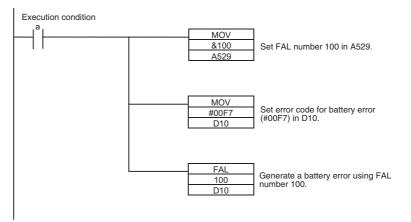
3. Set the error code and error to be simulated as the second operand (two words) of FAL(006) or FALS(007). Indicate a nonfatal error for FAL(006) and a fatal error for FALS(007).

To simulate more than one system error, use more than one FAL(006) or FALS(007) instruction with the same value in A529 and different values for the second operand.

#### **Auxiliary Area Flags and Words**

Name	Address	Operation
FAL/FALS Number for System Error	A529	Set a dummy FAL/FALS number to use to simu- late a system error.
Simulation		0001 to 01FF hex: FAL/FALS numbers 1 to 511
		0000 or 0200 to FFFF hex: No FAL/FALS number for system error simulation.

#### Example for a Battery Error



**Note** Use the same methods as for actual system errors to clear the simulated system errors. Refer to the *10-2 Troubleshooting* for details. All system errors simulated with FAL(006) and FALS(007) can be cleared by cycling the power supply.

# 6-8-4 Output OFF Bit

As an emergency measure when an error occurs, all outputs from Output Units can be turned OFF by turning ON the Output OFF Bit (A500.15). The operating mode will remain in RUN or MONITOR mode, but all outputs will be turned OFF.

**Note** Normally (when IOM Hold Bit = OFF), all outputs from Output Units are turned OFF when the operating mode is changed from RUN/MONITOR mode to PROGRAM mode. The Output OFF Bit can be used to turn OFF all outputs without switching to PROGRAM mode.

# Application Precaution for<br/>DeviceNetWhen the CPM1A-DRT21 is used, all slave outputs will be turned OFF, i.e., all<br/>inputs to the master will be OFF.

# 6-9 Clock

Name	Addresses	Function
Clock data: A351.00 to A351.07		Second: 00 to 59 (BCD)
A351 to A354	A351.08 to A351.15	Minute: 00 to 59 (BCD)
	A352.00 to A352.07	Hour: 00 to 23 (BCD)
	A352.08 to A352.15	Day of the month: 00 to 31 (BCD)
	A353.00 to A353.07	Month: 00 to 12 (BCD)
	A353.08 to A353.15	Year: 00 to 99 (BCD)
	A354.00 to A354.07	Day of the week: 00: Sunday, 01: Monday, 02: Tuesday, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday

A clock is built into the CP1L CPU Unit and is backed up by a battery. The current data is stored in the following words and refreshed each cycle.

**Note** The clock cannot be used if a battery is not installed or the battery voltage is low.

Name	Addresses	Contents
Start-up Time	A510 and A511	The time at which the power was turned ON (year, month, day of month, hour, minutes, and seconds).
Power Interruption Time	A512 and A513	The time at which the power was last interrupted (year, month, day of month, hour, minutes, and seconds).
Power ON Clock Data 1	A720 to A722	Consecutive times at which the power
Power ON Clock Data 2	A723 to A725	was turned ON (year, month, day of month, hour, minutes, and seconds).
Power ON Clock Data 3	A726 to A728	The times are progressively older from
Power ON Clock Data 4	A729 to A731	number 1 to number 10.
Power ON Clock Data 5	A732 to A734	
Power ON Clock Data 6	A735 to A737	
Power ON Clock Data 7	A738 to A740	
Power ON Clock Data 8	A741 to A743	
Power ON Clock Data 9	A744 to A746	
Power ON Clock Data 10	A747 to A749	
Operation Start Time	A515 to A517	The time that operation started (year, month, day of month, hour, minutes, and seconds).
Operation End Time	A518 to A520	The time that operation stopped (year, month, day of month, hour, minutes, and seconds).
User Program Date	A90 to A93	The time when the user program was last overwritten (year, month, day of month, hour, minutes, and seconds).
Parameter Date	A94 to A97	The time when the parameters were last overwritten (year, month, day of month, hour, minutes, and seconds).

#### Auxiliary Area Flags and Words

### **Time-related Instructions**

Name	Mnemonic	Function
HOURS TO SECONDS	SEC(065)	Converts time data in hours/minutes/sec- onds format to an equivalent time in seconds only.
SECONDS TO HOURS	HMS(066)	Converts seconds data to an equivalent time in hours/minutes/seconds format.
CALENDAR ADD	CADD(730)	Adds time to the calendar data in the speci- fied words.
CALENDAR SUBTRACT	CSUB(731)	Subtracts time from the calendar data in the specified words.
CLOCK ADJUSTMENT	DATE(735)	Changes the internal clock setting to the set- ting in the specified source words.

# **SECTION 7** Using Expansion Units and Expansion I/O Units

This section describes how to use CP-series/CPM1A-series Expansion Units and Expansion I/O Units.

7-1	Connecting Expansion Units and Expansion I/O Units				
7-2	Analog Input Units	421			
7-3	Analog Output Units	430			
7-4	Analog I/O Units	438			
	7-4-1 CPM1A-MAD01 Analog I/O Units	438			
	7-4-2 CP1W-MAD11/CPM1A-MAD11 Analog I/O Units	448			
7-5	Temperature Sensor Units	461			
7-6	CompoBus/S I/O Link Units	476			
7-7	DeviceNet I/O Link Units	482			

# 7-1 Connecting Expansion Units and Expansion I/O Units

CP-series and CPM1A-series Expansion Units and Expansion I/O Units can be connected to the CP1L. Up to three Expansion Units or Expansion I/O Units can be connected to a CPU Unit with 30, 40 or 60 I/O points and one Expansion Unit or Expansion I/O Unit can be connected to a CPU Unit with 20 or 14 I/O points.

The functionality and performance of CP-series Expansion Units and Expansion I/O Units is the same as the functionality and performance of CP1MAseries Expansion Units and Expansion I/O Units. CP-series Units are black, and CPM1A-series Units are ivory.

Unit name		Model	Cu	rrent	I/O words	
			consumption (mA)			
			5 VDC	24 VDC	Input	Output
Expansion Units	Analog Input Unit	CP1W-AD041 CPM1A-AD041	100	90	4	2
	Analog Output Unit	CP1W-DA041 CPM1A-DA041	80	124		4
	Analog I/O Unit	CPM1A-MAD01	66	66	2	1
		CP1W-MAD11 CPM1A-MAD11	83	110		
	Temperature Control Unit	CP1W-TS001 CPM1A-TS001	40	59	2	
		CP1W-TS101 CPM1A-TS101	54	73		
		CP1W-TS002 CPM1A-TS002	40	59	4	
		CP1W-TS102 CPM1A-TS102	54	73		
	CompoBus/S I/O Link Unit	CP1W-SRT21 CPM1A-SRT21	29		1	1
	DeviceNet I/O Link Unit	CPM1A-DRT21	48		2	2
Expansion I/O Units	40-point I/O Unit	CP1W-40EDR CPM1A-40EDR	80	90	2	2
		CP1W-40EDT CPM1A-40EDT	160			
		CP1W-40EDT1 CPM1A-40EDT1	160			
	32-point Output Unit	CP1W-32ER	49	131		4
		CP1W-32ET	113			
		CP1W-32ET1	113			
	20-point I/O Unit	CP1W-20EDR1 CPM1A-20EDR1	103	44	1	1
		CP1W-20EDT CPM1A-20EDT	130			
		CP1W-20EDT1 CPM1A-20EDT1	130			
	16-point Output Unit	CP1W-16ER CPM1A-16ER	42	90		2
		CP1W-16ET	76			
		CP1W-16ET1	76			
	8-point Input Unit	CP1W-8ED CPM1A-8ED	18		1	
	8-point Output Unit	CP1W-8ER CPM1A-8ER	26	44		1
		CP1W-8ET CPM1A-8ET	75		]	
		CP1W-8ET1 CPM1A-8ET1	75			

# Number of I/O Words

Note CP1W-32ER/32ET/32ET1's maximum number of simultaneously ON points is 24 (75%).

Analog Input Units				Section 7-2
Allocation of I/O Words	the Units are con CPU Unit is turr	and Expansion I/O Un nnected starting from the ned ON, the CPU Unit nits connected to it and	he CPU Unit. Wh checks for any E	nen the power to the Expansion Units and
	40-point I/O Unit CPU Unit	First Unit: Temperature Control Unit	Second Unit: Analog I/O Unit	Third Unit: 40-point I/O Unit
Input bits	CIO 0.00 to CIO 0.11 CIO 1.00 to CIO 1.11 24 input points 16 output points	CIO 2 to CIO 5 TS002	None DA041	CIO 6.00 to CIO 6.11 CIO 7.00 to CIO 7.11 24 input points 16 output points

None

# 7-2 Analog Input Units

Output bits

Each CP1W-AD041/CPM1A-AD041 Analog Input Unit provides four analog inputs.

• The analog input signal ranges are 0 to 5 V, 1 to 5 V, 0 to 10 V, -10 to +10 V, 0 to 20 mA, and 4 to 20 mA. The resolution is 1/6,000. The open-circuit detection function is activated in the ranges of 1 to 5 V and 4 to 20 mA.

CIO 102 to CIO 105

CIO 106.00 to CIO 106.07

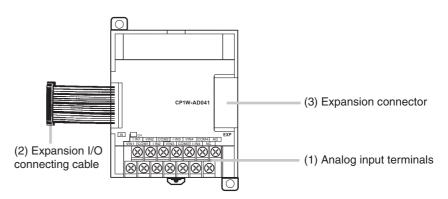
IO 107.00 to CIO 107.07

• The Analog Input Unit uses four input words and two output words, so a maximum of three Units can be connected.

## Part Names

#### CP1W-AD041/CPM1A-AD041

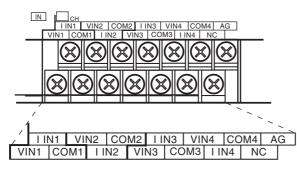
CIO 100.00 to CIO 100.07 CIO 101.00 to CIO 101.07



1. Analog Input Terminals Connected to analog output devices.

### Analog Input Units

# Input Terminal Arrangement

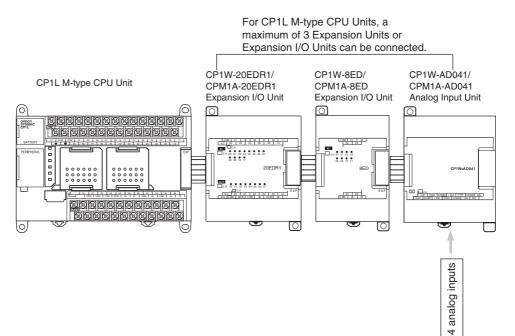


V IN1	Voltage input 1
I IN1	Current input 1
COM1	Input common 1
V IN2	Voltage input 2
I IN2	Current input 2
COM2	Input common 2
V IN3	Voltage input 3
I IN3	Current input 3
COM3	Input common 3
V IN4	Voltage input 4
I IN4	Current input 4
COM4	Input common 4

- **Note** When using current inputs, voltage input terminals must be short-circuited with current input terminals.
  - 2. Expansion I/O Connecting Cable Connected to the CPU Unit or Expansion Unit expansion connector. The cable is attached to the Analog Input Unit and cannot be removed.
- **Note** Do not touch the cables during operation. Static electricity may cause operating errors.
  - 3. Expansion Connector Connected to the next Expansion Unit or Expansion I/O Unit to enable expansion.

#### Main Analog Input Unit Specifications

Analog Input Units are connected to a CP1L CPU Unit. For CP1L M-type CPU Units, a maximum of three Units can be connected, including other Expansion Units and Expansion I/O Units.



Item		Voltage Input	Current Input		
Number of inputs		4 inputs (4 words allocated)			
Input signal range		0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC	0 to 20 mA or 4 to 20 mA		
Max. rated input		±15 V	±30 mA		
External input impeda	ance	1 MΩ min.	Approx. 250 Ω		
Resolution		1/6000 (full scale)			
Overall accuracy	25°C	0.3% full scale	0.4% full scale		
	0 to 55°C	0.6% full scale	0.8% full scale		
A/D conversion data		16-bit binary (4-digit hexadecimal)	digit hexadecimal)		
		Full scale for –10 to 10 V: F448 to 0BB8 Hex Full scale for other ranges: 0000 to 1770 Hex			
Averaging function		Supported (Set in output words n+1 a	and n+2.)		
Open-circuit detection	n function	Supported			
Conversion time		2 ms/point (8 ms/all points)			
Isolation method		Photocoupler isolation between analog I/O terminals and internal circuits. No isolation between analog I/O signals.			
Current consumption		5 VDC: 100 mA max.; 24 VDC: 90 mA max.			

# Analog Input Signal Ranges

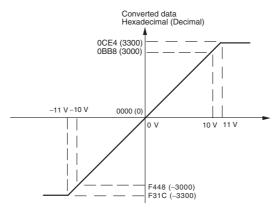
Analog input data is digitally converted according to the input signal range as shown below.

Note

When the input exceeds the specified range, the A/D conversion data will be fixed at either the lower limit or upper limit.

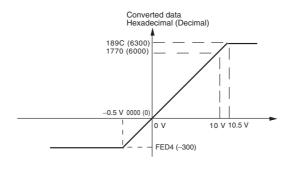
#### Analog Input Signal Ranges

#### ■ <u>–10 to 10 V Inputs</u>



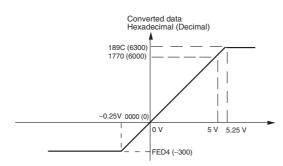
Voltage in the -10 to 10 V range corresponds to hexadecimal values F448 to 0BB8 (-3,000 to 3,000). The range of data that can be converted is F31C to 0CE4 hex (-3,300 to 3,300). A negative voltage is expressed as two's complement.

#### 0 to 10 V Inputs



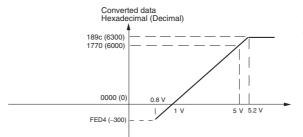
Voltage in the 0 to 10 V range corresponds to hexadecimal values 0000 to 1770 (0 to 6,000). The range of data that can be converted is FED4 to 189C hex (-300 to 6,300). A negative voltage is expressed as two's complement.

#### 0 to 5 V Inputs



Voltage in the 0 to 5 V range corresponds to hexadecimal values 0000 to 1770 (0 to 6,000). The range of data that can be converted is FED4 to 189C hex (-300 to 6,300). A negative voltage is expressed as two's complement.

#### ■ 1 to 5 V Inputs

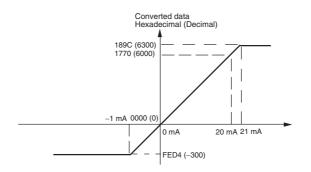


Voltage in the 1 to 5 V range corresponds to hexadecimal values 0000 to 1770 (0 to 6,000). The range of data that can be converted is FED4 to 189C hex (-300 to 6,300). Voltage in the range of 0.8 to 1 V is expressed as two's complement.

If an input is below the range (i.e., less than 0.8 V), the open-circuit detection function is activated and the data becomes 8,000.

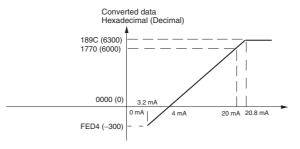
# Section 7-2

#### 0 to 20 mA Inputs



Current in the 0 to 20 mA range corresponds to hexadecimal values 0000 to 1770 (0 to 6,000). The range of data that can be converted is FED4 to 189C hex (-300 to 6,300). A negative current is expressed as two's complement.

#### 4 to 20 mA Inputs



Current in the 4 to 20 mA range corresponds to hexadecimal values 0000 to 1770 (0 to 6,000). The range of data that can be converted is FED4 to 189C hex (-300 to 6,300). Current in the range of 3.2 to 4 mA is expressed as two's complement.

If an input is below the range (i.e., less than 3.2 mA), the open-circuit detection function is activated and the data becomes 8,000.

**Averaging Function** For analog inputs, the averaging function operates when the averaging bit is set to 1. The averaging function outputs the average (a moving average) of the last eight input values as the converted value. If there is only a slight variation in inputs, it is handled by the averaging function as a smooth input. The averaging function stores the average (a moving average) of the last eight input values as the converted value. Use this function to smooth inputs that vary at a short interval. **Open-circuit Detection** The open-circuit detection function is activated when the input range is set to Function 1 to 5 V and the voltage drops below 0.8 V, or when the input range is set to 4 to 20 mA and the current drops below 3.2 mA. When the open-circuit detection function is activated, the converted data will be set to 8,000. The time for enabling or clearing the open-circuit detection function is the same as the time for converting the data. If the input returns to the convertible

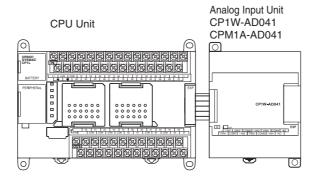
returns to the normal range.

range, the open-circuit detection is cleared automatically and the output

#### Section 7-2 Analog Input Units Procedure • Connect Analog Input Units. Connect and wire Units. • Wire to analog output devices. • Write set data to output words (n+1, n+2). Create a ladder program · Set use of inputs. • Select input signals using range codes. · Set use of averaging. • Read A/D conversion values from input words (m+1 to m+4). · For current inputs, confirm that there is no open circuit. Writing Set Data and Reading A/D **Conversion Values** CPU Unit Analog Input Unit Ladder program (n+1) CH Set data (inputs 1, 2) (n+2) CH Set data (inputs 3, 4) MOV (m+1) CH Analog input 1 conversion value Analog devices (m+2) CH Analog input 2 conversion value Temperature sensor (m+3) CH Analog input 3 conversion value Pressure sensor Writes the set data (use Speed sensor Flow sensor Voltage/current meter Other devices of inputs, averaging, range codes). Reads the conversion (m+4) CH Analog input 4 conversion value The last input word allocated to the CPU Unit or already connected Expansion (I/O) Unit is m and the value. last output word is n.

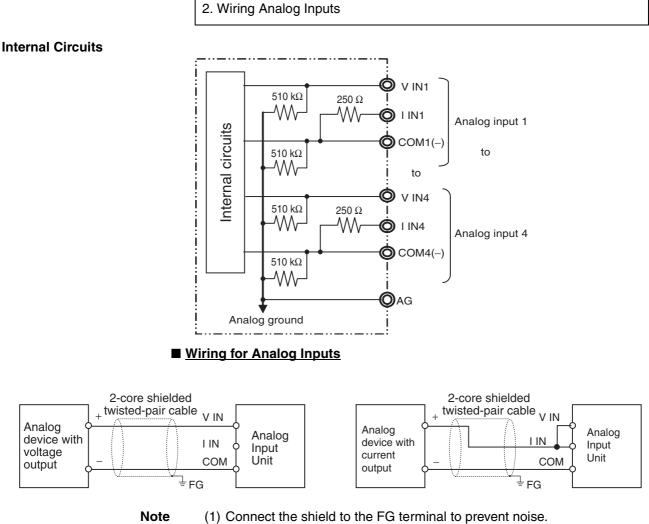
#### 1. Connecting the Analog Input Unit

Connect the Analog Input Unit to the CPU Unit.

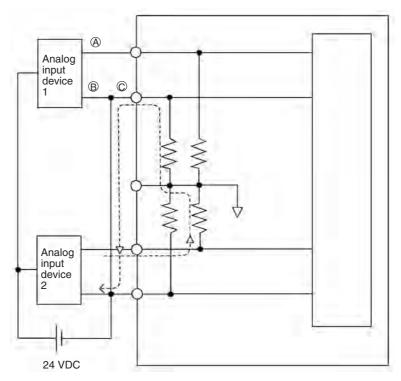


#### Analog Input Units

### Section 7-2



- (2) When an input is not being used, short the + and terminals.
- (3) Separate wiring from power lines (AC power supply lines, high-voltage lines, etc.)
- (4) When there is noise in the power supply line, install a noise filter on the input section and the power supply.
- (5) Refer to the following information on open circuits when using voltage inputs.



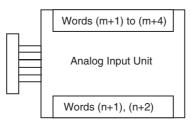
For example, if analog input device 2 is outputting 5 V and the same power supply is being used as shown above, about 1/3, or 1.6 V, will be applied at the input for input device 1.

Consider the following information on open input circuits when using voltage inputs. Either use separate power supplies, or install an isolator at each input.

If the same power supply is used as shown in the following diagram and an open circuit occurs at point A or B, an unwanted current flow will occur as shown by the dotted lines in the diagram, creating a voltage at the other input of about 1/3 to 1/2. If the 1 to 5-V range is being used, the open-circuit detection function will not operate. Also, if there is an open circuit at C, the open-circuit detection function will not operate because the negative sides are the same.

#### 3. Creating the Ladder Program

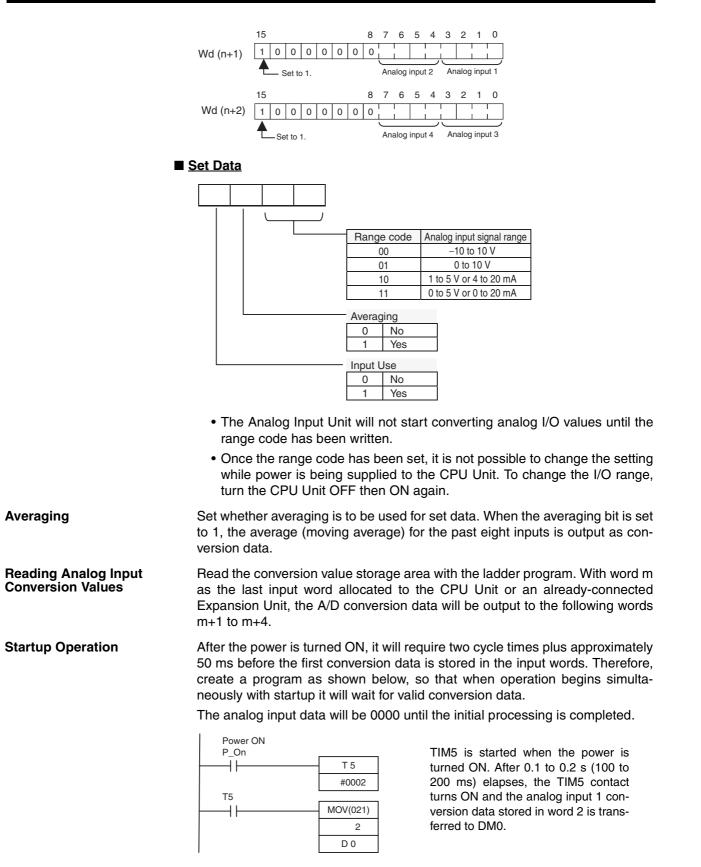
Four input words and two output words are allocated from the next words following the last I/O words allocated to the CPU Unit or an existing Expansion Unit or Expansion I/O Unit.



#### Writing Set Data

Allocating I/O Words

Write the settings for input use, averaging use, and range codes for words n+1 and n+2. When the set data is transferred from the CPU Unit to the Analog I/O Unit, the A/D conversion will be started.



#### Handling Unit Errors

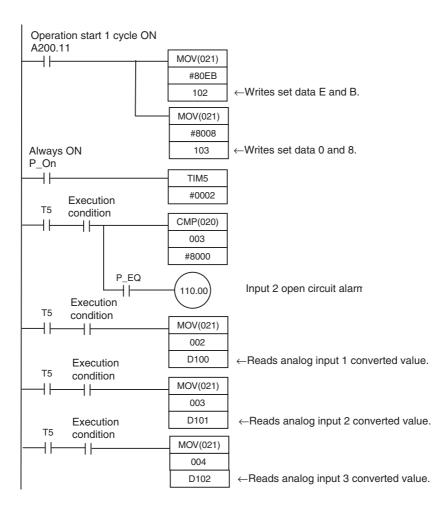
• When an error occurs in an Analog Input Unit, the analog input conversion data becomes 0000.

#### Section 7-3

• Expansion Unit errors are output to bits 0 to 6 of word A436. The bits are allocated from A436.00 in order starting with the Unit nearest the CPU Unit. Use these flags in the program when it is necessary to detect errors.

#### Ladder Program Example

Analog input	Input range	Range code	Averaging	Set data	Destination word
Input 1	0 to 10 V	01	Yes	1101 (B hex)	n+1
Input 2	4 to 20 mA	10	Yes	1110 (E hex)	n+1
Input 3	-10 to +10 V	00	No	1000 (8 hex)	n+2
Input 4	Not used.	-(00)		0000 (0 hex)	n+2



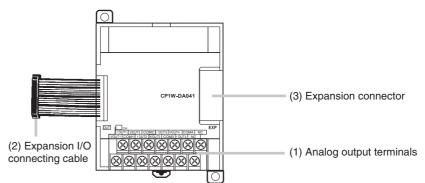
# 7-3 Analog Output Units

Each CP1W-DA041/CPM1A-DA041 Analog Output Unit provides four analog outputs.

- The analog output signal ranges are 1 to 5 V, 0 to 10 V, -10 to +10 V, 0 to 20 mA, and 4 to 20 mA. The resolution is 1/6,000. The open-circuit detection function is activated in the ranges of 1 to 5 V and 4 to 20 mA.
- The Analog Input Unit uses four output words, so a maximum of three Units can be connected.

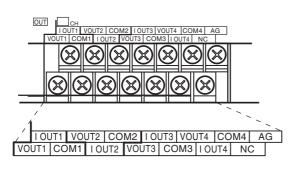
### Part Names

#### CP1W-DA041/CPM1A-DA041



1. Analog Output Terminals Connected to analog input devices.

#### Output Terminal Arrangement



V OUT1	Voltage output 1			
I OUT1	Current output 1			
COM1	Output common 1			
V OUT2	Voltage output 2			
I OUT2	Current output 2			
COM2	Output common 2			
V OUT3	Voltage output 3			
I OUT3	Current output 3			
COM3	Output common 3			
V OUT4	Voltage output 4			
I OUT4	Current output 4			
COM4	Output common 4			

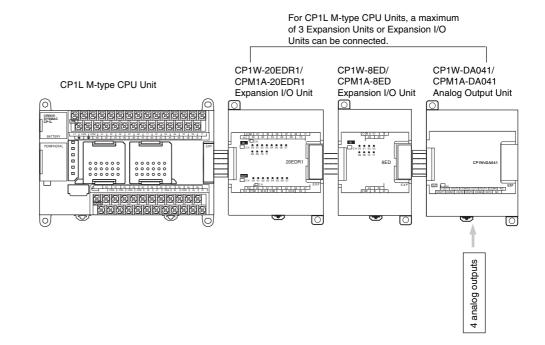
2. Expansion I/O Connecting Cable

Connected to the CPU Unit or previous Expansion Unit. The cable is provided with the Unit and cannot be removed.

- **Note** Do not touch the cables during operation. Static electricity may cause operating errors.
  - Expansion Connector Connected to the next Expansion Unit or Expansion I/O Unit.

<u>Main Analog Output</u> <u>Unit Specifications</u> Analog Output Units are connected to a CP1L CPU Unit. For CP1L M-type CPU Units, a maximum of three Units can be connected, including other Expansion Units and Expansion I/O Units.

# Section 7-3



Item			Voltage Output	Current Output	
Analog	Number o	f outputs	4 outputs (4 words allocated)		
output sec-	Output signal range		1 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC 0 to 20 mA or 4 to 20 mA		
tion	External output allow- able load resistance		$2 \text{ k}\Omega$ min.	350 Ω max.	
	External output impedance		0.5 Ω max.		
	Resolution		1/6000 (full scale)		
	Overall accuracy	25°C	0.4% full scale		
		0 to 55°C	0.8% full scale		
	D/A conversion data		16-bit binary (4-digit hexadecimal)		
			Full scale for –10 to 10 V: F448 to 0BB8 Hex Full scale for other ranges: 0000 to 1770 Hex		
Conversion time			2 ms/point (8 ms/all points)		
Isolation method			Photocoupler isolation between analog I/O terminals and internal circuits. No isolation between analog I/O signals.		
Current consumption			5 VDC: 80 mA max.; 24 VDC: 124 mA max.		

## Analog Output Signal Ranges

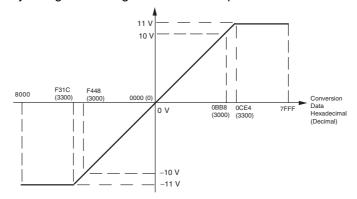
The analog values depend on the output signal ranges, as shown in the following diagrams.

**Note** When the output exceeds the specified range, the output signal will be fixed at either the lower limit or upper limit.

#### Analog Output Signal Ranges

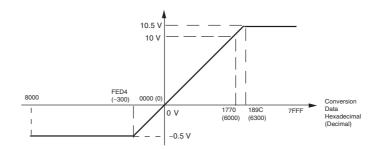
#### ■ <u>-10 to 10 V</u>

The hexadecimal values F448 to 0BB8 (-3000 to 3000) correspond to an analog voltage range of -10 to 10 V. The entire output range is -11 to 11 V. Specify a negative voltage as a two's complement.



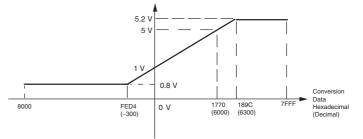
#### ■ <u>0 to 10 V</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 10 V. The entire output range is -0.5 to 10.5 V. Specify a negative voltage as a two's complement.



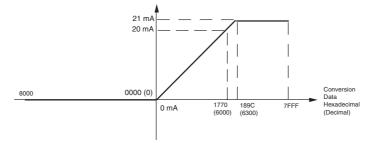
#### ■ <u>1 to 5 V</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 1 to 5 V. The entire output range is 0.8 to 5.2 V.



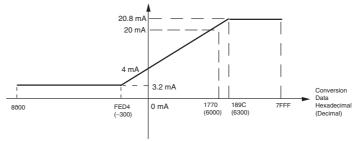
## ■ <u>0 to 20 mA</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog current range of 0 to 20 mA. The entire output range is 0 to 21 mA.

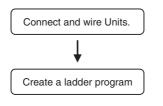


## ■ <u>4 to 20 mA</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog current range of 4 to 20 mA. The entire output range is 3.2 to 20.8 mA.

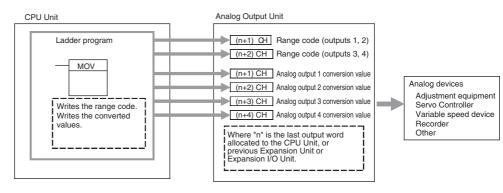


## **Procedure**



- Connect Analog Output Units.
- Wire to analog input devices.
- Write range code to output words (n+1, n+2).
  - · Set use of outputs.
  - Select output signals using range codes.
- Write D/A conversion values to output words (n+1 to n+4).

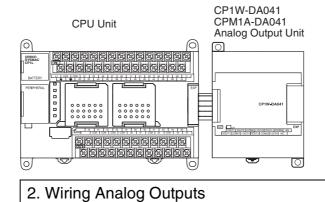
# Writing D/A Conversion Data



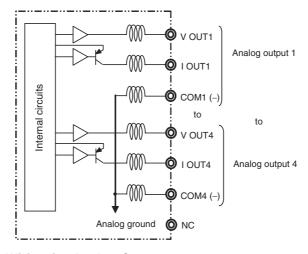
# Section 7-3



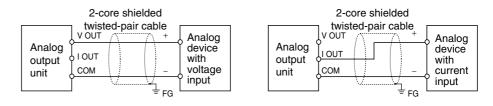
#### Connect the Analog Output Unit to the CPU Unit.



### **Internal Circuits**



Wiring for Analog Outputs



#### Note

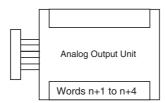
(1) Connect the shield to the FG terminal to prevent noise.

- (2) Separate wiring from power lines (AC power supply lines, high-voltage lines, etc.)
- (3) When there is noise in the power supply line, install a noise filter on the input section and the power supply.
- (4) When external power is supplied (when range codes are set), or when the power is interrupted, there may be a pulse status analog output of up to 1 ms. If this status is a problem, take the following measures.
  - Turn ON the power to the CP1L CPU Unit, check the operation status, and then turn ON the power at the load.
  - Turn OFF the power to the load and then turn OFF the power to the CP1L CPU Unit.

# Analog Output Units

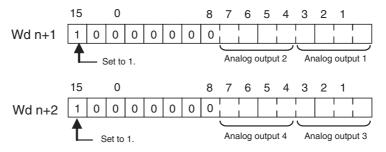
# 3. Ladder Program

Allocation of Output Words Four output words are allocated, beginning from the first word following the last I/O word allocated to the CPU Unit or already-connected Expansion I/O Unit or Expansion Unit.

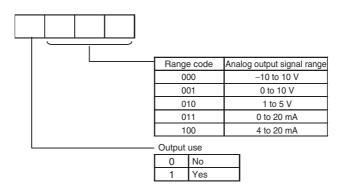


## Writing the Range Code

Write the output use and the range code to words n+1 and n+2. The D/A conversion will start when the set data is transferred from the CPU Unit to the Analog Output Unit.



## ■ <u>Range Code</u>

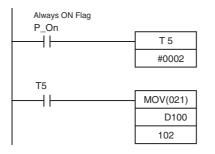


- The Analog Output Unit will not start converting analog I/O values until the range code has been written. The output will be 0 V or 0 mA.
- From when the range code has been written until data in the analog output convertible range is written, 0 V or 0 mA will be output in the 0 to 10 V, -10 to +10 V, and 0 to 20 mA ranges, and 1 V or 4 mA will be output in the 1 to 5 V and 4 to 20 mA ranges.
- Once the range code has been set, it is not possible to change the setting while power is being supplied to the CPU Unit. To change the I/O range, turn the CPU Unit OFF then ON again.

Writing Analog Output Set Values	The ladder program can be used to write data to the output word where the set value is stored. The output word will be "n+1" when "n" is the last output word allocated to the CPU Unit, or previous Expansion Unit or Expansion I/O Unit.
Startup Operation	After power is turned ON, it will require two cycle times plus approximately 50 ms before the first data is converted.
	The following table shows the output status after the initial processing is com- pleted.

Output type	Voltage output		Current output	
Output range	0 to 10 V, 1 to 5 V -10 to +10 V		0 to 20 mA	4 to 20 mA
Before range code is written	0 V		0 mA	
After range code is written	0 V	1 V	0 mA	4 mA

Therefore, create a program as shown below, so that when operation begins simultaneously with startup it will wait for valid set data.



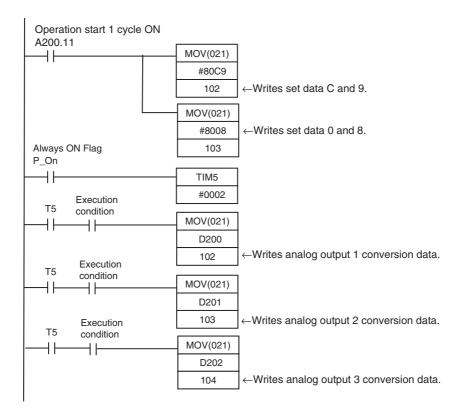
TIM 005 will start as soon as power turns ON. After 0.1 to 0.2 s (100 to 200 ms), the Completion Flag for TIM 005 will turn ON, and the data stored in DM 0100 will be moved to IR 102 as the conversion data for analog output 1.

## Handling Unit Errors

- When an error occurs at the Analog Output Unit, the analog output will be 0 V or 0 mA. If a CPU Unit fatal error occurs when analog outputs are set in the 1 to 5 V or 4 to 20 mA range, 0 V or 0 mA will be output for a CPU error I/O bus error, and 1 V or 1 mA will be output for all other errors.
- Expansion Unit errors are output to bits 0 to 6 of word A436. The bits are allocated from A436.00 in order starting with the Unit nearest the CPU Unit. Use these flags in the program when it is necessary to detect errors.

## **Program Example**

Analog output	Output range	Range code	Set data	Destination word
Output 1	0 to 10 V	001	1001 (9 hex)	Wd n+1
Output 2	4 to 20 mA	100	1100 (C hex)	Wd n+1
Output 3	-10 to 10 V	000	1000 (8 hex)	Wd n+2
Output 4	Not used.	-(000)	0000 (0 hex)	Wd n+2



# 7-4 Analog I/O Units

# 7-4-1 CPM1A-MAD01 Analog I/O Units

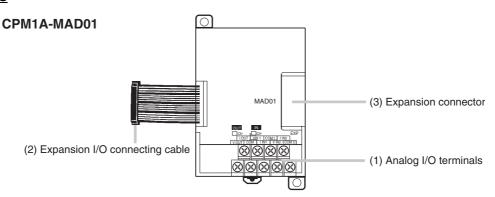
Each CPM1A-MAD01 Analog I/O Unit provides 2 analog inputs and 1 analog output.

• The analog input range can be set to 0 to 10 VDC, 1 to 5 VDC, or 4 to 20 mA with a resolution of 1/256.

An open-circuit detection function can be used with the 1 to 5 VDC and 4 to 20 mA settings.

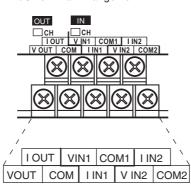
• The analog output range can be set to 0 to 10 VDC, -10 to 10 VDC, or 4 to 20 mA. The output has a resolution of 1/256 when the range is set to 0 to 10 VDC or 4 to 20 mA, or a resolution of 1/512 when set to -10 to 10 VDC.

# Part Names



## (1) Analog I/O Terminals Connected to analog I/O devices.

I/O Terminal Arrangement



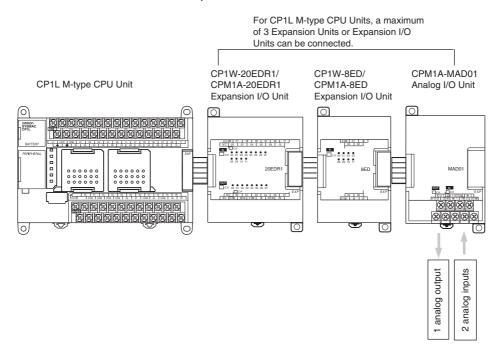
**Note** When using current inputs, short terminal V IN1 with I IN1 and terminal V IN2 with I IN2.

V OUT	Voltage output	
IOUT	Current output	
COM	Output common	
V IN1	Voltage input 1	
I IN1	Current input 1	
COM1	Input common 1	
V IN2	Voltage input 2	
1 IN2	Current input 2	
COM2	Input common 2	

- (2) Expansion I/O Connecting Cable Connected to the expansion connector of a CP1L CPU Unit or an Expansion Unit or Expansion I/O Unit. The cable is provided with the Analog I/ O Unit and cannot be removed.
- **Caution** Do not touch the cables during operation. Static electricity may cause operating errors.
  - (3) Expansion Connector Used for connecting Expansion Units or Expansion I/O Units.

# Main Analog I/O Unit Specifications

Analog I/O Units are connected to the CP1L CPU Unit. For CP1L M-type CPU Units, up to three Units can be connected, including any other Expansion Units and Expansion I/O Units that are also connected.



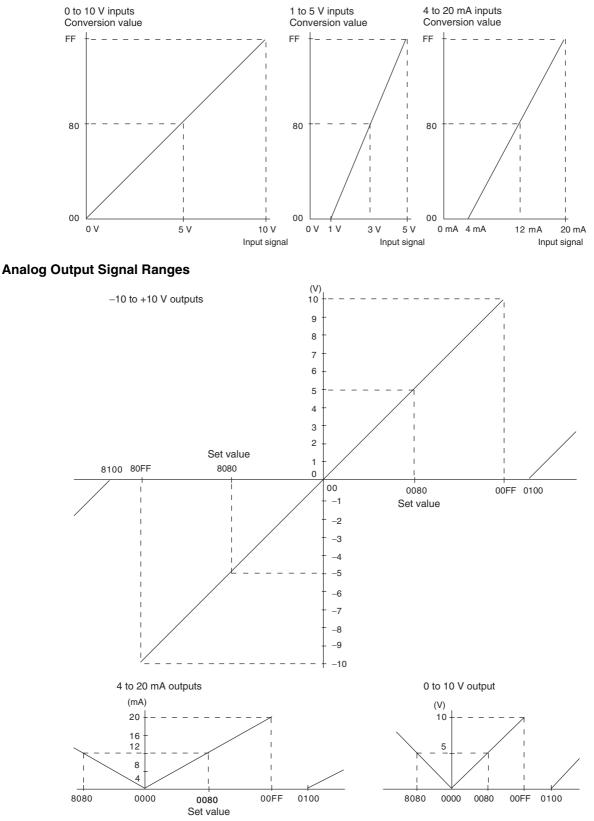
Item		Voltage I/O	Current I/O
Analog	Number of inputs	2	÷
Input	Input signal range	0 to 10 V/1 to 5 V	4 to 20 mA
Section	Max. rated input	±15 V	±30 mA
	External input impedance	1 M $\Omega$ min.	250 Ω rated current
	Resolution	1/256	·
	Accuracy	1.0% full scale	
	A/D conversion data	8-bit binary	
Analog	Number of outputs	1	
Output Section	Output signal range	0 to 10 V or -10 to 10 V	4 to 20 mA
(See	Max. external output current	5 mA	
note 2.)	Allowable external output load resistance		350 Ω
	Resolution	1/256 (1/512 when the output signal range is -10 to 10 V)	
	Accuracy	1.0% of full scale	
	Set data	8-bit signed binary	
Conversion	on time	10 ms max. per Unit (See note 1.)	
Isolation method		Photocoupler isolation between I/O terminals and PC signals. No isolation between analog I/O signals.	
Current c	onsumption	5 VDC: 66 mA max., 24 VDC: 66 mA max.	

Note

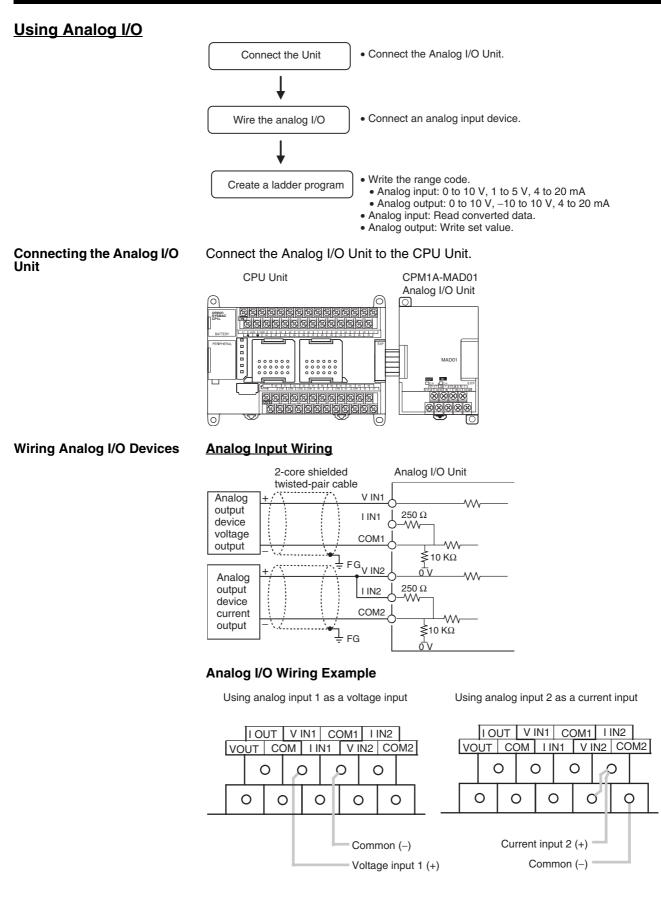
- (1) The conversion time is the total time for 2 analog inputs and 1 analog output.
  - (2) With analog outputs it is possible to use both voltage outputs and current outputs at the same time. In this case however, the total output current must not exceed 21 mA.

# Analog I/O Signal Ranges

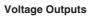
# **Analog Input Signal Ranges**

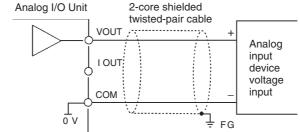


# Analog I/O Units

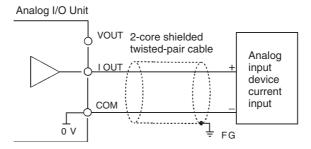


### **Analog Output Wiring**



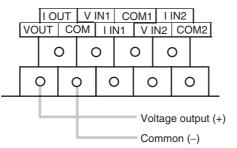


#### **Current Outputs**



#### Analog I/O Wiring Example

Using analog output as a voltage output



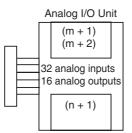
Note

- (1) For analog outputs it is possible to use both voltage outputs and current outputs at the same time, but the total current output must not exceed 21 mA.
  - (2) Use 2-core shielded twisted-pair cables.
  - (3) Wire away from power lines (AC power supply wires, power lines, etc.)
  - (4) When an input is not being used, short V IN and I IN to the COM terminal.
  - (5) Use crimp terminals. (Tighten terminals to a torque of 0.5 N·m.)
  - (6) When using current inputs, short  $V_{IN}$  to  $I_{IN}$ .
  - (7) When there is noise in the power supply line, install a noise filter on the input section and the power supply terminals.

Creating a Ladder Program

#### I/O Allocation

Two input words and one output word are allocated to the Analog I/O Unit, starting from the next word following the last allocated word on the CPU Unit or previous Expansion Unit or Expansion I/O Unit.



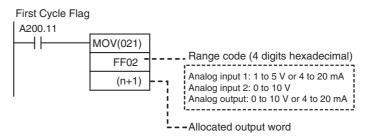
"m" is the last allocated input word and "n" the last allocated output word on the CPU Unit or previous Expansion Unit or Expansion I/O Unit.

## Writing the Range Code

Write the range code to word n+1. A/D or D/A conversion begins when the range code is transferred from the CPU Unit to the Analog I/O Unit. There are eight range codes, FF00 to FF07, that combine both the analog input 1 and 2 and analog output signal ranges, as shown below.

Range code	Analog input 1 signal range	Analog input 2 signal range	Analog output signal range
FF00	0 to 10 V	0 to 10 V	0 to 10 V/4 to 20 mA
FF01	0 to 10 V	0 to 10 V	-10 to 10 V/4 to 20 mA
FF02	1 to 5 V/4 to 20 mA	0 to 10 V	0 to 10 V/4 to 20 mA
FF03	1 to 5 V/4 to 20 mA	0 to 10 V	-10 to 10 V/4 to 20 mA
FF04	0 to 10 V	1 to 5 V/4 to 20 mA	0 to 10 V/4 to 20 mA
FF05	0 to 10 V	1 to 5 V/4 to 20 mA	-10 to 10 V/4 to 20 mA
FF06	1 to 5 V/4 to 20 mA	1 to 5 V/4 to 20 mA	0 to 10 V/4 to 20 mA
FF07	1 to 5 V/4 to 20 mA	1 to 5 V/4 to 20 mA	-10 to 10 V/4 to 20 mA

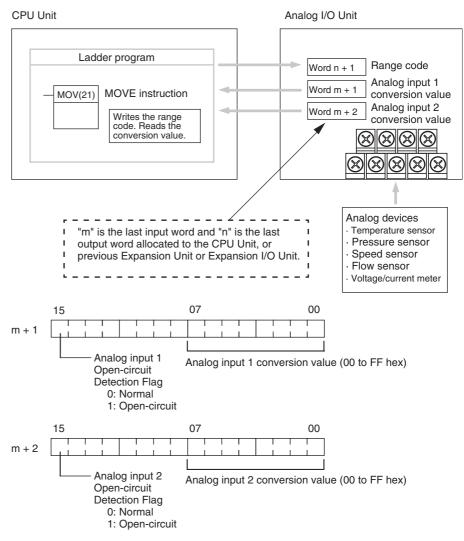
- The voltage/current selection is made by switching the wiring.
- Write the range code to the Analog I/O Unit output word (n + 1) in the first cycle of program execution.



- The Analog I/O Unit will not start converting analog I/O values until the range code has been written.
- Once the range code has been set, it is not possible to change the setting while power is being supplied to the CPU Unit. To change the I/O range, turn the CPU Unit OFF then ON again.
- If a range code other than those specified in the above table is written to n+1, the range code will not be received by the Analog I/O Unit and analog I/O conversion will not start.

## **Reading A/D Conversion Tables**

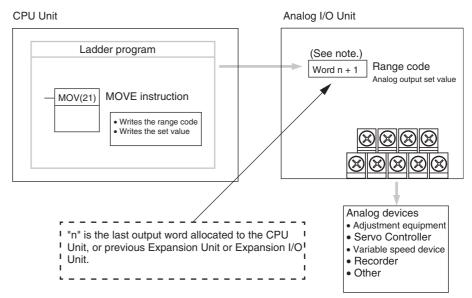
Data converted from analog to digital is output to bits 00 to 07 in words m+1 and m+2.

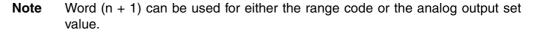


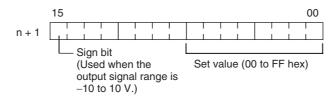
**Note** The Open-circuit Detection Flag is turned ON if the input signal range is set to 1 to 5 V or 4 to 20 mA and the input signal falls below 1 V or 4 mA. (Open circuits are not detected when the input signal range is set to 0 to 10 V.)

## Setting D/A Conversion Data

Output data is written to the Analog I/O Unit's allocated output word, word n+1.







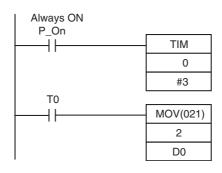
- *1,2,3...* 1. The set value range is 0000 to 00FF hex when the output signal range is 0 to 10 V/4 to 20 mA.
  - The set value range is divided into two parts: 8000 to 80FF hex (-10 to 0 V) and 0000 to 00FF hex (0 to 10 V) when the output signal range is -10 to 10 V.
  - 3. If  $FF\Box\Box$  is input, 0 V/4 mA will be output.
  - 4. If an output value is specified, the following bits will be ignored.
    - Output range of -10 to 10 V: Bits 08 to 14
    - Output range of 0 to 10 V/4 to 20 mA: Bits 08 to 15

#### Startup Operation

After power is turned ON, it will require two cycle times plus approx. 100 ms before the first data is converted. The following instructions can be placed at the beginning of the program to delay reading converted data from analog inputs until conversion is actually possible.

Analog input data will be 0000 until initial processing has been completed. Analog output data will be 0 V or 0 mA until the range code has been written. After the range code has been written, the analog output data will be 0 V or 4 mA if the range is 0 to 10 V, -10 to 10 V, or 4 to 20 mA.

# Section 7-4



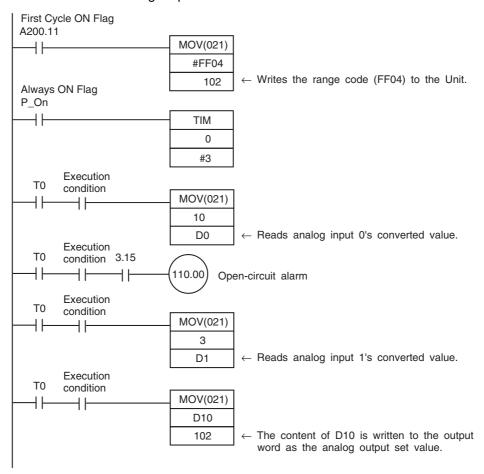
TIM 0 will start as soon as power turns ON. After 0.2 to 0.3 s (200 to 300 ms), the input for TIM 0 will turn ON, and the converted data from analog input 0 that is stored in word 2 will be transferred to D00000.

## Handling Unit Errors

- When an error occurs in the Analog I/O Unit, analog input data will be 0000 and 0 V or 4 mA will be output as the analog output.
- Expansion Unit/Expansion I/O Unit errors are output to bits 0 to 6 of word A436. The bits are allocated from A436.00 in order starting with the Unit nearest the CPU Unit. Use these flags in the program when it is necessary to detect errors.

## **Programming Example**

This programming example uses these ranges: Analog input 0: 0 to 10 V Analog input 1: 1 to 5 V or 4 to 20 mA Analog output: 0 to 10 V or 4 to 20 mA



# 7-4-2 CP1W-MAD11/CPM1A-MAD11 Analog I/O Units

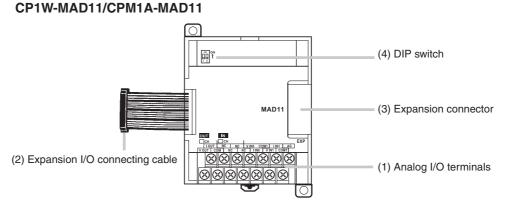
Each CP1W-MAD11/CPM1A-MAD11 Analog I/O Unit provides 2 analog inputs and 1 analog output.

• The analog input range can be set to 0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC, -10 to 10 VDC, 0 to 20 mA, or 4 to 20 mA. The inputs have a resolution of 1/6000.

An open-circuit detection function can be used with the 1 to 5 VDC and 4 to 20 mA settings.

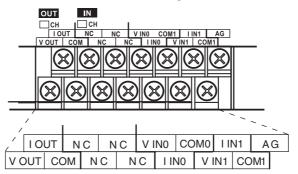
• The analog output range can be set to 1 to 5 VDC, 0 to 10 VDC, -10 to 10 VDC, 0 to 20 mA, or 4 to 20 mA. The outputs have a resolution of 1/6000.

# Part Names



(1) Analog I/O Terminals Connected to analog I/O devices.







V OUT	Voltage output
I OUT	Current output
COM	Output common
V IN0	Voltage input 0
I INO	Current input 0
COM0	Input common 0
V IN1	Voltage input 1
LIN1	Current input 1
COM1	Input common 1

- (2) Expansion I/O Connecting Cable Connected to the expansion connector of a CP1L CPU Unit or a CMP1A Expansion Unit or Expansion I/O Unit. The cable is provided with the Analog I/O Unit and cannot be removed.
- **Caution** Do not touch the cables during operation. Static electricity may cause operating errors.
  - (3) Expansion Connector

Used for connecting Expansion Units or Expansion I/O Units.

(4) DIP Switch

Used to enable or disable averaging.



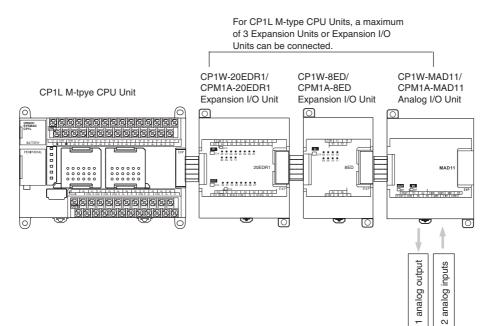
Pin1: Average processing for analog input 0

(OFF: Average processing not performed; ON: Average processing performed) Pin2: Average processing for analog input 1

(OFF: Average processing not performed; ON: Average processing performed)

## Main Analog I/O Unit Specifications

Analog I/O Units are connected to the CP1L CPU Unit. For CP1L M-type CPU Units, up to three Units can be connected, including any other Expansion Units and Expansion I/O Units that are also connected.



# Analog I/O Units

Item		Voltage I/O	Current I/O		
Analog	Number of inputs		2 inputs (2 words allocated)		
Input Section	Input signal range		0 to 5 VDC, 1 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC	0 to 20 mA or 4 to 20 mA	
	Max. rated input		±15 V	±30 mA	
	External input impedan	се	1 MΩ min.	Approx. 250 Ω	
	Resolution		1/6000 (full scale)		
	Overall accuracy	25°C	0.3% full scale	0.4% full scale	
		0 to 55°C	0.6% full scale	0.8% full scale	
	A/D conversion data	·	16-bit binary (4-digit hexadecimation	al)	
			Full scale for –10 to 10 V: F448 Full scale for other ranges: 0000		
	Averaging function		Supported (Settable for individual inputs via DIP switch)		
	Open-circuit detection function		Supported		
Analog	Number of outputs		1 output (1 word allocated)		
Output Section	Output signal range		1 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC,	0 to 20 mA or 4 to 20 mA	
	Allowable external outp	ut load resistance	1 kΩ min.	600 Ω max.	
	External output impeda	nce	0.5 Ω max.		
	Resolution		1/6000 (full scale)		
	Overall accuracy y	25°C	0.4% full scale		
		0 to 55°C	0.8% full scale		
	Set data (D/A conversion	on)	16-bit binary (4-digit hexadecimal)		
			Full scale for –10 to 10 V: F448 to 0BB8 hex Full scale for other ranges: 0000 to 1770 hex		
Conversion time		2 ms/point (6 ms/all points)			
Isolation method		Photocoupler isolation between analog I/O terminals and interna circuits. No isolation between analog I/O signals.			
Current c	consumption		5 VDC: 83 mA max., 24 VDC: 110 mA max.		

# Analog I/O Signal Ranges

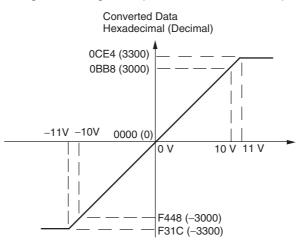
Analog I/O data is digitally converted according to the analog I/O signal range as shown below.

**Note** When the input exceeds the specified range, the AD converted data will be fixed at either the lower limit or upper limit.

Analog Input Signal Ranges

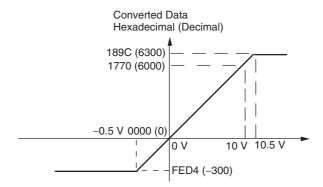
#### <u>-10 to 10 V</u>

The -10- to 10-V range corresponds to the hexadecimal values F448 to 0BB8 (-3000 to 3000). The entire data range is F31C to 0CE4 (-3300 to 3300). A negative voltage is expressed as a two's complement.



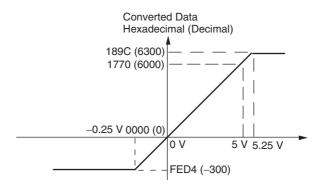
## <u>0 to 10 V</u>

The 0- to 10-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement.



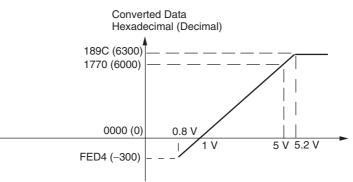
## <u>0 to 5 V</u>

The 0- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement.



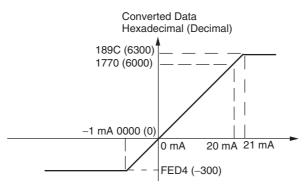
#### <u>1 to 5 V</u>

The 1- to 5-V range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). Inputs between 0.8 and 1 V are expressed as two's complements. If the input falls below 0.8 V, open-circuit detection will activate and converted data will be 8000.



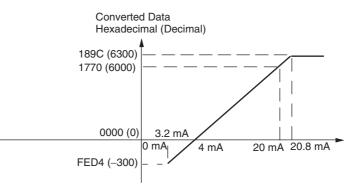
## <u>0 to 20 mA</u>

The 0- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). A negative voltage is expressed as a two's complement.



#### <u>4 to 20 mA</u>

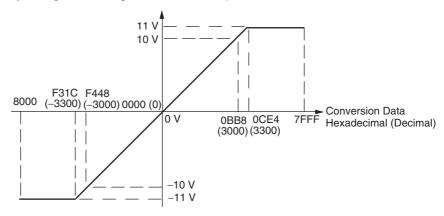
The 4- to 20-mA range corresponds to the hexadecimal values 0000 to 1770 (0 to 6000). The entire data range is FED4 to 189C (-300 to 6300). Inputs between 3.2 and 4 mA are expressed as two's complements. If the input falls below 3.2 mA, open-circuit detection will activate and converted data will be 8000.



Analog Output Signal Ranges

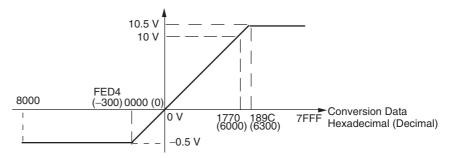
#### <u>-10 to 10 V</u>

The hexadecimal values F448 to 0BB8 (-3000 to 3000) correspond to an analog voltage range of -10 to 10 V. The entire output range is -11 to 11 V. Specify a negative voltage as a two's complement.



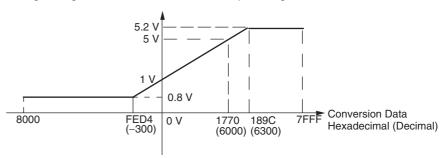
## <u>0 to 10 V</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 0 to 10 V. The entire output range is -0.5 to 10.5 V. Specify a negative voltage as a two's complement.



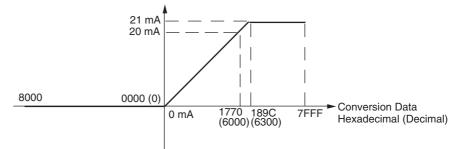
## <u>1 to 5 V</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog voltage range of 1 to 5 V. The entire output range is 0.8 to 5.2 V.



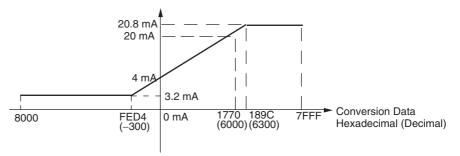
## <u>0 to 20 mA</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog current range of 0 to 20 mA. The entire output range is 0 to 21 mA.



## <u>4 to 20 mA</u>

The hexadecimal values 0000 to 1770 (0 to 6000) correspond to an analog current range of 4 to 20 mA. The entire output range is 3.2 to 20.8 mA.



Averaging Function for Analog Inputs

Open-circuit Detection Function for Analog Inputs The averaging function can be enabled for inputs using the DIP switch. The averaging function stores the average (a moving average) of the last eight input values as the converted value. Use this function to smooth inputs that vary at a short interval.

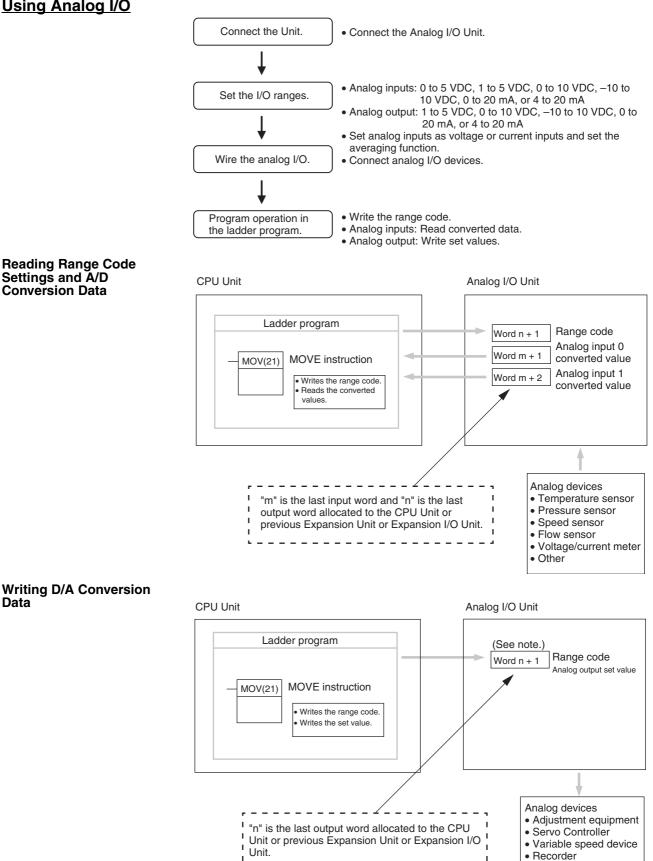
The open-circuit detection function is activated when the input range is set to 1 to 5 V and the voltage drops below 0.8 V, or when the input range is set to 4 to 20 mA and the current drops below 3.2 mA. When the open-circuit detection function is activated, the converted data will be set to 8,000.

The time for enabling or clearing the open-circuit detection function is the same as the time for converting the data. If the input returns to the convertible range, the open-circuit detection is cleared automatically and the output returns to the normal range.

# Analog I/O Units



Data

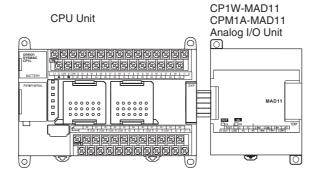


## Note

value.

Connecting the Analog I/O Unit and Setting the DIP Switch This section describes how to connect an Analog I/O Unit to the CPU Unit.

Word (n + 1) can be used for either the range code or the analog output set



## **Setting the Averaging Function**

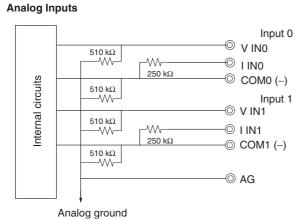
DIP switch pins 1-1 and 1-2 are used to set the averaging function. When averaging is enabled, a moving average of the last eight input values is output as the converted value. The averaging function can be set separately for analog inputs 1 and 2.



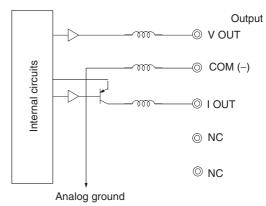
**Internal Circuits** 

DIP switch pin	Function	Setting	Default
1-1	Averaging	Analog input 0 OFF: Disabled; ON: Enabled	OFF
1-2		Analog input 1 OFF: Disabled; ON: Enabled	OFF

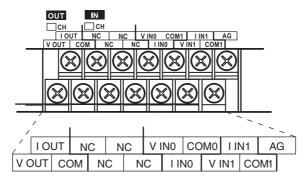
## Wiring Analog I/O Devices



#### **Analog Outputs**



## **Terminal Arrangements**



Note

For current inputs, short V IN0 to I IN0 and V IN1 to I IN1.

V OUT	Voltage output	
I OUT	Current output	
COM	Output common	
V IN0	Voltage input 0	
I INO	Current input 0	
COM0	Input common 0	
V IN1	Voltage input 1	
I IN1	Current input 1	
COM1	Input common 1	

## Wiring for Analog Inputs

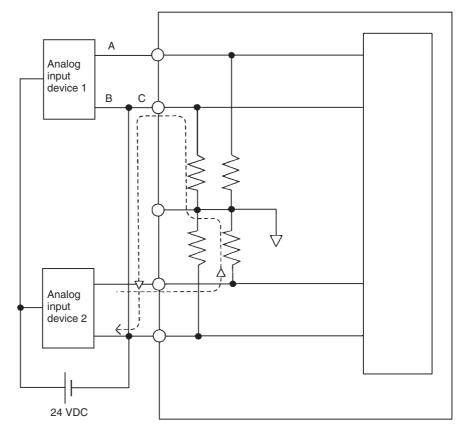
Analog device with voltage output	+ V IN   - COM	Analog I/O Unit	Analog device with current - output	+ VIN IIN Analog - COM //O Unit
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## Wiring for Analog Outputs



Note

- (1) Use shielded twisted-pair cables, but do not connect the shield.
  - (2) When an input is not being used, short the + and terminals.
  - (3) Separate wiring from power lines (AC power supply lines, high-voltage lines, etc.)
  - (4) When there is noise in the power supply line, install a noise filter on the input section and the power supply terminals.



(5) Refer to the following diagram regarding wiring disconnections when voltage input is being used.

Example: If analog input device 2 is outputting 5 V and the same power supply is being used for both devices as shown above, approximately 1/3, or 1.6 V, will be applied to the input for input device 1.

If a wiring disconnection occurs when voltage input is being used, the situation described below will result. Either separate the power supplies for the connected devices, or use an isolator for each input.

If the same power supply is being used by the connected devices and a disconnection occurs at points A or B in the above diagram, an unwanted circuit path will occur as shown along the dotted line in the diagram. If that occurs, a voltage of approximately 1/3 to 1/2 of the output voltage of the other connected device will be generated. If that voltage is generated while the setting is for 1 to 5 V, open-circuit detection may not be possible. Also, if a disconnection occurs at point C in the diagram, the negative (-) side will be used in for both devices and open-circuit detection will not be possible.

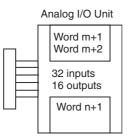
This problem will not occur for current inputs even if the same power supply is used.

- **Note** When external power is supplied (when setting the range code), or when there is a power interruption, pulse-form analog output of up to 1 ms may be generated. If this causes problems with operation, take countermeasures such as those suggested below.
  - Turn ON the power supply for the CP1L CPU Unit first, and then turn ON the power supply for the load after confirming correct operation.
  - Turn OFF the power supply for the load before turning OFF the power supply for the CP1L CPU Unit.

Creating a Ladder Program

## I/O Allocation

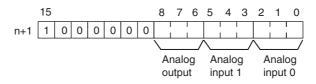
Two input words and one output word are allocated to the Analog I/O Unit starting from the next word following the last allocated word on the CPU Unit or previous Expansion Unit or Expansion I/O Unit.



## Writing the Range Code

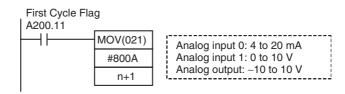
Write the range code to word n+1. A/D or D/A conversion begins when the range code is transferred from the CPU Unit to the Analog I/O Unit. There are five range codes, 000 to 100, that combine the analog input 1 and 2 and analog output signal ranges, as shown below.

Range code	Analog input 0 signal range	Analog input 1 signal range	Analog output signal range
000	-10 to 10 V	-10 to 10 V	-10 to 10 V
001	0 to 10 V	0 to 10 V	0 to 10 V
010	1 to 5 V/4 to 20 mA	1 to 5 V/4 to 20 mA	1 to 5 V
011	0 to 5 V/0 to 20 mA	0 to 5 V/0 to 20 mA	0 to 20 mA
100			4 to 20 mA



## Example

The following instructions set analog input 0 to 4 to 20 mA, analog input 1 to 0 to 10 V, and the analog output to -10 to 10 V.



- The Analog I/O Unit will not start converting analog I/O values until the range code has been written. Until conversion starts, inputs will be 0000, and 0 V or 0 mA will be output.
- After the range code has been set, 0 V or 0 mA will be output for the 0 to 10-V, -10 to 10-V, or 0 to 20-mA ranges, and 1 V or 4 mA will be output for the 1 to 5-V and 4 to 20-mA ranges until a convertible value has been written to the output word.
- Once the range code has been set, it is not possible to change the setting while power is being supplied to the CPU Unit. To change the I/O range, turn the CPU Unit OFF then ON again.

## **Reading Converted Analog Input Values**

The ladder program can be used to read the memory area words where the converted values are stored. Values are output to the next two words (m + 1, m + 2) following the last input word (m) allocated to the CPU Unit or previous Expansion Unit or Expansion I/O Unit.

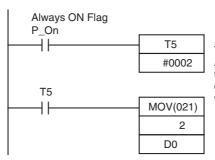
## Writing Analog Output Set Values

The ladder program can be used to write data to the memory area where the set value is stored. The output word will be "n+1," where "n" is the last output word allocated to the CPU Unit or previous Expansion Unit or Expansion I/O Unit.

## **Startup Operation**

After power is turned ON, it will require two cycle times plus approx. 50 ms before the first data is converted. The following instructions can be placed at the beginning of the program to delay reading converted data from analog inputs until conversion is actually possible.

Analog input data will be 0000 until initial processing has been completed. Analog output data will be 0 V or 0 mA until the range code has been written. After the range code has been written, the analog output data will be 0 V or 0 mA if the range is 0 to 10 V, -10 to 10 V, or 0 to 20 mA, or it will be 1 V or 4 mA if the range is 1 to 5 V or 4 to 20 mA.



TIM 5 will start as soon as power turns ON. After 0.1 to 0.2 s (100 to 200 ms), the input for TIM 5 will turn ON, and the converted data from analog input 0 that is stored in word 2 will be transferred to D00000.

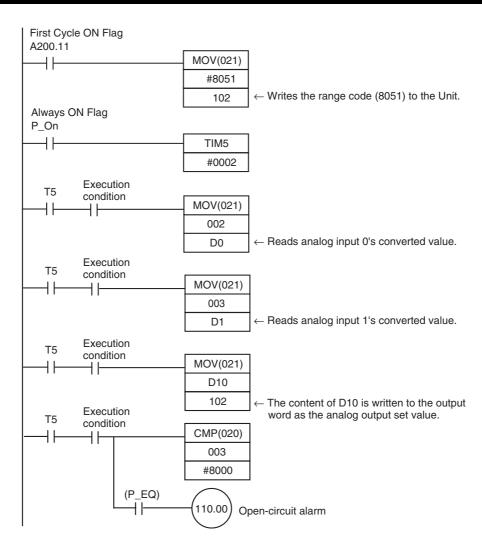
## Handling Unit Errors

- When an error occurs in the Analog I/O Unit, analog input data will be 0000 and 0 V or 0 mA will be output as the analog output.
  If a CPU error or an I/O bus error (fatal errors) occurs at the CPU Unit and the analog output is set to 1 to 5 V or 4 to 20 mA, 0 V or 0 mA will be output. For any other fatal errors at the CPU Unit, 1 V or 4 mA will be output.
- Expansion Unit and Expansion I/O Unit errors are output to bits 0 to 6 of word A436. The bits are allocated from A436.00 in order starting from the Unit nearest the CPU Unit. Use these flags in the program when it is necessary to detect errors.

#### **Programming Example**

This programming example uses these ranges: Analog input 0: 0 to 10 V Analog input 1: 4 to 20 mA Analog output: 0 to 10 V

# **Temperature Sensor Units**

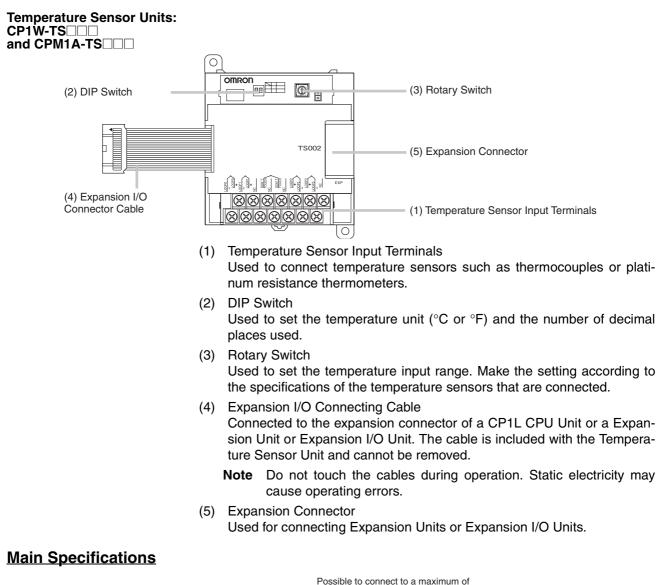


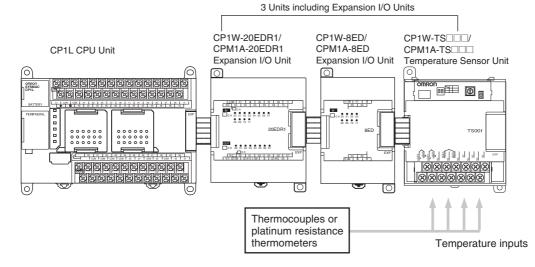
# 7-5 Temperature Sensor Units

CP1W-TS002/TS102 and CPM1A-TS002/TS102 Temperature Sensor Units each provide up to four input points, and CP1W-TS001/TS001 and CPM1A-TS001/TS101 Temperature Sensor Units each provide up to two input points. The inputs can be from thermocouples or platinum resistance thermometers.

CP1W-TS002/TS102 and CPM1A-TS002/TS102 Temperature Sensor Units are each allocated four input words.

# Part Names





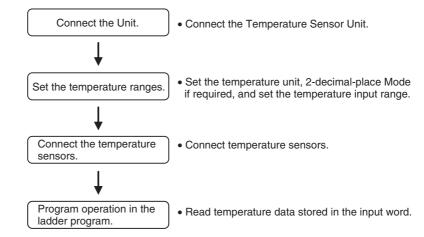
# Temperature Sensor Units

# Section 7-5

Item	CP1W-TS001 CPM1A-TS001	CP1W-TS002 CPM1A-TS002	CP1W-TS101 CPM1A-TS101	CP1W-TS102 CPM1A-TS102
Temperature sensors	ure sensors Thermocouples Switchable between K and J, but same type must be used for all inputs.		Platinum resistance thermometer	
			Switchable between Pt100 and JPt100, but same type must be used for all inputs.	
Number of inputs	2	4	2	4
Allocated input words	2	4	2	4
Accuracy	(The larger of $\pm 0.5\%$ of converted value or $\pm 2^{\circ}$ C) $\pm 1$ digit max. (See note.)		(The larger of $\pm 0.5\%$ of converted value or $\pm 1^{\circ}$ C) $\pm 1$ digit max.	
Conversion time	250 ms for 2 or 4 input points			
Converted temperature data	16-bit binary data (4-digit hexadecimal)			
Isolation	Photocouplers between all temperature input signals			
Current consumption	5 VDC: 40 mA max., 24 VDC: 59 mA max. 5 VDC: 54 mA max., 24 VDC: 73 mA max.			

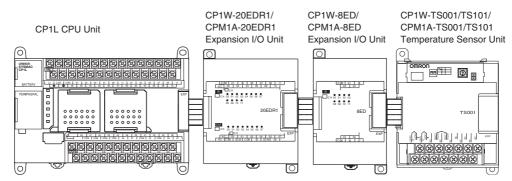
**Note** Accuracy for a K-type sensor at  $-100^{\circ}$ C or less is  $\pm 4^{\circ}$ C  $\pm 1$  digit max.

# **Using Temperature Sensor Units**



# Connecting Temperature Sensor Units

A maximum of three CPM1A-TS002 and CPM1A-TS102 Temperature Sensor Units can be connected, because each is allocated four words.



# **Setting Temperature Ranges**

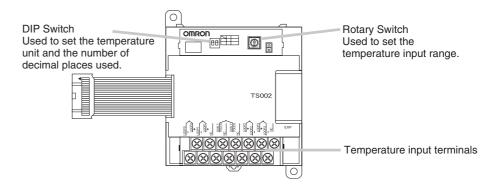
Note

- (1) Always turn OFF the power supply before setting the temperature range.
- (2) Never touch the DIP switch or rotary switch during Temperature Sensor Unit operation. Static electricity may cause operating errors.

The Temperature Sensor Unit's DIP switch and rotary switch are used to set the temperature unit, to select 2-decimal-place Mode is to be used, and to set the temperature input range.

# **Temperature Sensor Units**

# Section 7-5



## **DIP Switch Settings**

The DIP switch is used to set the temperature unit (°C or °F) and the number of decimal places used.



SW1	Setting		
1	Temperature unit	OFF	D°
		ON	°F
2	Number of decimal O places used (See note.)		Normal (0 or 1 digit after the decimal point, depending on the input range)
(0.01 expression)		ON	2-decimal-place Mode

**Note** For details on 2-decimal-place Mode, refer to *Two-decimal-place Mode* on page 471.

#### **Rotary Switch Setting**

- **Caution** Set the temperature range according to the type of temperature sensor connected to the Unit. Temperature data will not be converted correctly if the temperature range does not match the sensor.
- **Caution** Do not set the temperature range to any values other than those for which temperature ranges are given in the following table. An incorrect setting may cause operating errors.

The rotary switch is used to set the temperature range.

|--|

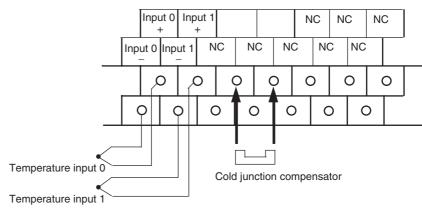
Setting	CP1W-TS001/TS002 CPM1A-TS001/002		CP1W-TS101/TS102 CPM1A-TS101/102			
	Input type	Range (°C)	Range (°F)	Input type	Range (°C)	Range (°F)
0	К	-200 to 1,300	-300 to 2,300	Pt100	-200.0 to 650.0	-300.0 to 1,200.0
1		0.0 to 500.0	0.0 to 900.0	JPt100	-200.0 to 650.0	-300.0 to 1,200.0
2	J	-100 to 850	-100 to 1,500		Cannot be set.	
3	-	0.0 to 400.0	0.0 to 750.0		_	
4 to F		Cannot be set.				

Connecting Temperature Sensors

### **Thermocouples**

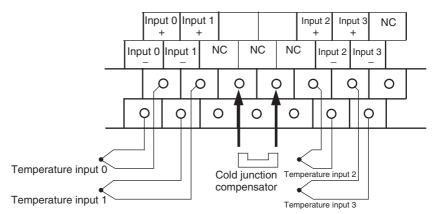
## CP1W-TS001/CPM1A-TS001

Either K or J thermocouples can be connected, but both of the thermocouples must be of the same type and the same input range must be used for each.



## CP1W-TS002/CPM1A-TS002

Either K or J thermocouples can be connected, but all four of the thermocouples must be of the same type and the same input range must be used for each.

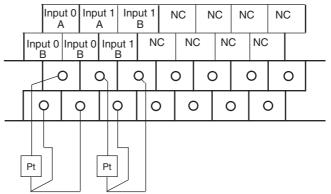


- **Note** When using a Temperature Sensor Unit with a thermocouple input, observe the following precautions:
  - Do not remove the cold junction compensator attached at the time of delivery. If the cold junction compensator is removed, the Unit will not be able to measure temperatures correctly.
  - Each of the input circuits is calibrated with the cold junction compensator attached to the Unit. If the Unit is used with the cold junction compensator from other Units, the Unit will not be able to measure temperatures correctly.
  - Do not touch the cold junction compensator. Doing so may result in incorrect temperature measurement.

## Platinum Resistance Thermometers

## CP1W-TS101/CPM1A-TS101

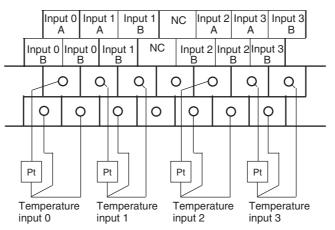
One or two Pt or JPt platinum resistance thermometers can be connected, but both of the thermometers must be of the same type and the same input range must be used for each.



Temperature input 0 Temperature input 1

## CP1W-TS102/CPM1A-TS102

Up to four Pt100 or JPt100 platinum resistance thermometers can be connected, but all four of the thermometers must be of the same type and the same input range must be used for each.



Note

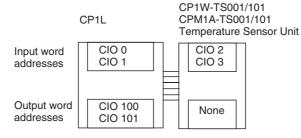
#### Do not connect anything to terminals not used for inputs.

Creating a Ladder Program

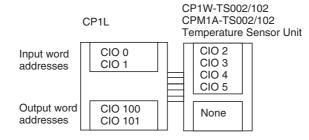
#### Word Allocations

Temperature Sensor Units are allocated words as Expansion Units, in order of connection. A Temperature Sensor Unit is allocated the next input words following the input words of the CPU Unit or previous Expansion Unit or Expansion I/O Unit. Four input words are allocated is to the 2-input CPM1A-TS001 or CPM1A-TS101 and four input words are allocated to the 4-input CPM1A-TS002 or CPM1A-TS102. No output words are allocated.

#### Example 1



#### Example 2

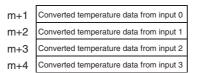


#### **Converted Temperature Data**

The temperature data will be stored in the input words allocated to the Temperature Sensor Unit in 4-digit hexadecimal.

TS002/TS102

#### TS001/TS101



m+1	Converted temperature data from input 0
m+2	Converted temperature data from input 1

"m" is the last input word allocated to the CPU Unit, Expansion I/O Unit, or Expansion Unit connected immediately before the Temperature Sensor Unit.

- Negative values are stored as 2's complements.
- Data for range codes that include one digit after the decimal point are stored without the decimal point, i.e., 10 times the actual value is stored.

Input		Data conversion examples		
Unit: 1°C	K or J	850°C → 0352 hex -200°C → FF38 hex		
Unit: 0.1°C	K, J, Pt100 or JPt100	-20.0°	C → 5000 → 1388 hex C → -200 → FF38 hex °C → -2000 → F830 hex	

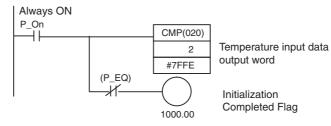
- If the input temperature exceeds the range that can be converted, the converted temperature data will be held at the maximum or minimum value in the range.
- If the input temperature exceeds the range by more than a specified amount, the open-circuit detection function will detect an open-circuit and the converted temperature data will be set to 7FFF.

The open-circuit detection function will also operate if the cold junction compensator is faulty.

• The open-circuit detection function will be automatically cleared and normal input temperature conversion will begin automatically when the input temperature returns to the convertible range.

## **Startup Operation**

After power is turned ON, approximately 1 s is required for the first conversion data to be stored in the input word. During that period, the data will be 7FFE. Therefore, create a program as shown below, so that when operation begins simultaneously with startup it will wait for valid conversion data.

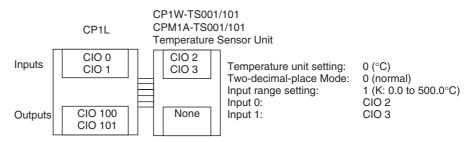


## Handling Unit Errors

- Expansion Unit and Expansion I/O Unit errors are output to bits 0 to 6 of word A436. The bits are allocated from A436.00 in order starting from the Unit nearest the CPU Unit. CP1W-/CPM1A-TS002 and CP1W-/CPM1A-TS102 Temperature Sensor Units are allocated two bits each. Use these flags in the program when it is necessary to detect Expansion Unit/Expansion I/O Unit errors.
- When an error occurs, the Temperature Sensor Unit data becomes 7FFF hex (the same as for an open-circuit detection). With an open-circuit detection, it is not reflected in word A436.

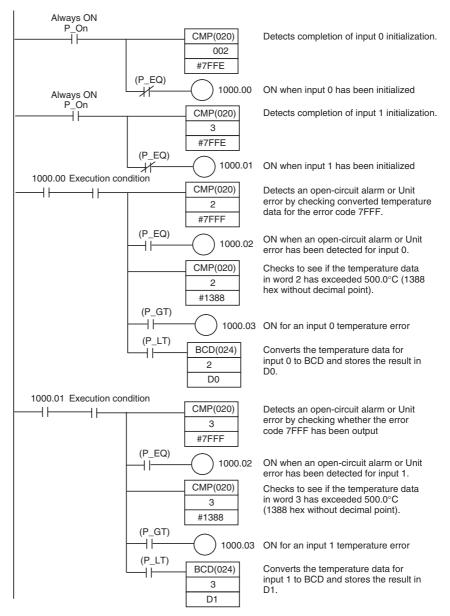
## **Programming Example**

**1,2,3...** 1. The following programming example shows how to convert the input data from 2 temperature sensor inputs to BCD and store the result in D0 and D1.

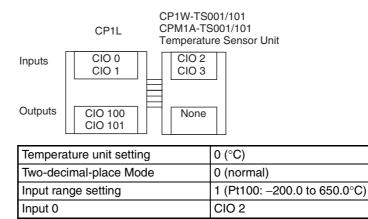


# Temperature Sensor Units

# Section 7-5

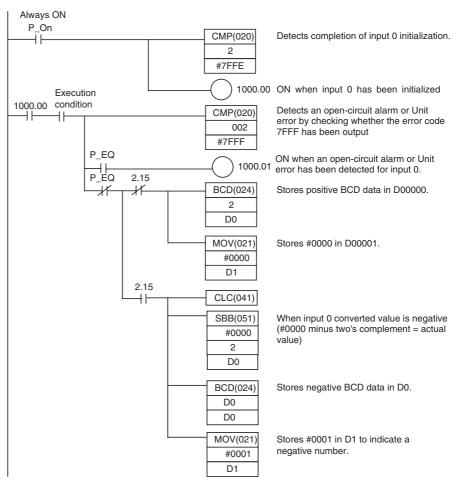


2. The following programming example shows how to convert the data for temperature input 0 to BCD and store the result in D0 and D1. "0001" is stored in D1 when the input data is a negative value. The following system configuration is used.

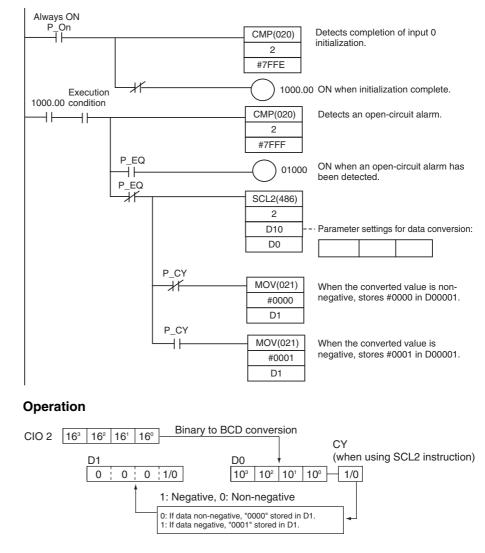


### Section 7-5

#### Programming with BCD(24) Instruction



### Section 7-5



#### Programming with SCL2(-) Instruction

### Two-decimal-place Mode

If pin 2 on the DIP switch is turned ON, values are stored to two decimal places. In this case, temperature data is stored as 6-digit signed hexadecimal (binary) data with 4 digits in the integer portion and 2 digits after the decimal point. The actual data stored in memory is 100 times the actual value, i.e., the decimal point is not indicated. Methods for handling this data are described in this section.

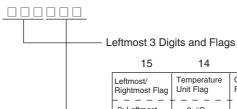
**Note** When set to store values to two decimal places, temperature data as far as two digits after the decimal point is converted to 6-digit binary data, but the actual resolution is not 0.01°C (°F). For this reason, there may be skipping and inaccuracies in the first digit after the decimal point (0.1). Treat any resolution above that specified for the normal data format as reference data.

#### **Temperature Sensor Units**

### Section 7-5

#### **Temperature Data Partitioning and Structure**

#### Temperature Data (Actual Temperature x 100 Binary)



_		9	,-					
	15	14	13	12	11 8	7 4	з с	)
	Leftmost/ Rightmost Flag	Temperature Unit Flag	Open-circuit Flag	Not used.	Temp	perature data		
	0: Leftmost 1: Rightmost	0: °C 1: °F	0: Normal 1: Error	Always 0	×16⁵	×16 <sup>4</sup>	×16 <sup>3</sup>	

#### 

15	14	13	12	11 8	7 4	3	0
Leftmost/ Rightmost Flag	Temperature Unit Flag	Open-circuit Flag	Not used.	Tem	perature data		
0: Leftmost 1: Rightmost	0: °C 1: °F	0: Normal 1: Error	Always 0	×16 <sup>2</sup>	×16 <sup>1</sup>	×1	6 <sup>0</sup>

Leftmost/Rightmost Flag: Indicates whether the leftmost or rightmost 3 digits are provided. Temperature Unit Flag: Indicates whether the temperature is in °C or °F. Open-circuit Flag: Turns ON (1) when an open-circuit is detected. The temperature data will be 7FF FFF if this flag is ON.

Data Conversion Examples

#### Example 1

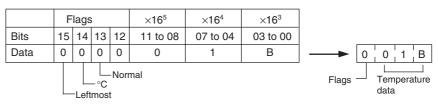
 Temperature:
 1,130.25°C

 ×100:
 113025

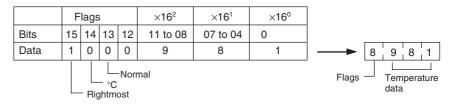
 Temperature Data:
 018091 (base)

Temperature Data: 01B981 (hexadecimal for 113025)

#### Leftmost 3 Digits and Flags



#### **Rightmost 3 Digits and Flags**

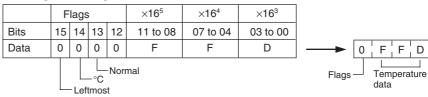


### Section 7-5

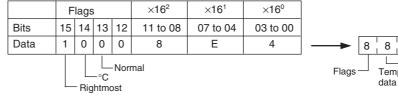
#### Example 2

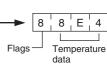
Temperature:	–100.12°C
×100:	-10012
Temperature Data:	FFD8E4 (hexadecimal for -10012)

#### Leftmost 3 Digits and Flags



#### **Rightmost 3 Digits and Flags**





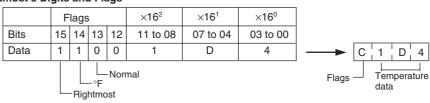
#### Example 3

Temperature:	–200.12°F
×100:	-20012
Temperature Data:	FFB1D4 (hexadecimal for -20012)

#### Leftmost 3 Digits and Flags

	F	Flags		lags ×16 <sup>5</sup> ×16 <sup>4</sup>		×16 <sup>3</sup>			
Bits	15	15 14 13 12		11 to 08	107 to 04	03 to 00			
Data	0	0 1 0 0		0 1 0 0 F F B		В		4 F F B	
				-Nori t	mal			Flags	Temperature data

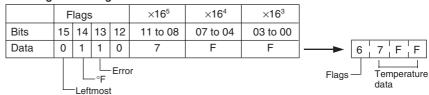
#### **Rightmost 3 Digits and Flags**



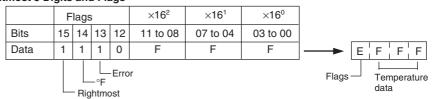
#### Example 4

Temperature:Open circuit (°F)Temperature Data:7FFF FFFF

#### Leftmost 3 Digits and Flags



#### **Rightmost 3 Digits and Flags**

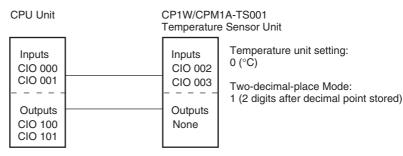


Note

- (1) Leftmost digits are stored in the lower memory addresses. Treat the data in the lower memory address as the leftmost digits when programming.
  - (2) Be sure that the data is read at least once every 125 ms to allow for the CPU Unit's cycle time and communications time. Correct data may not be obtained if the read cycle is greater than 125 ms.

#### **Programming Example**

The following programming example shows how to use 2-decimal-place Mode for the following PC configuration.

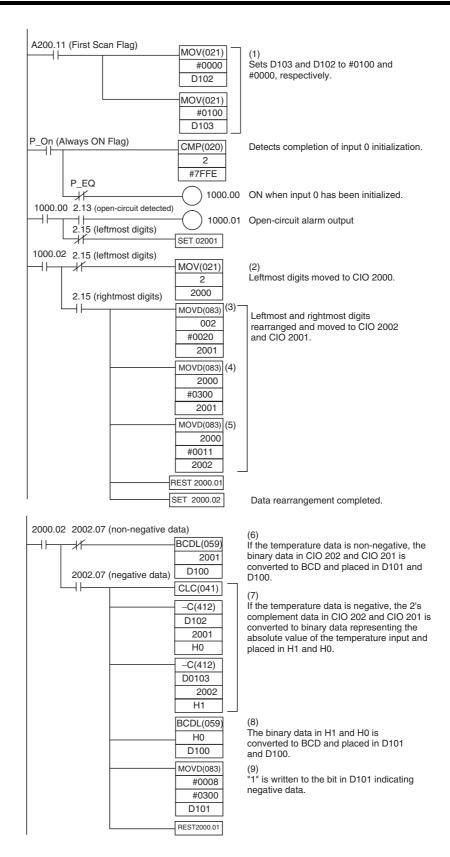


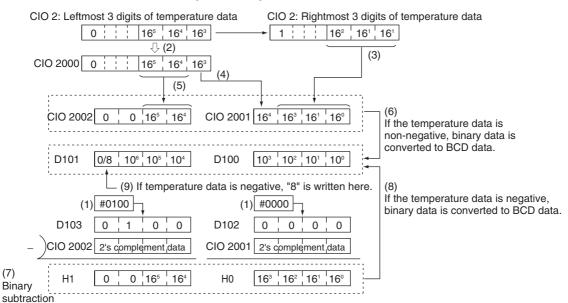
In this example, 100 times the temperature data for temperature input 0 is stored in binary form in D100 to D102.

Temperature input 0			O 2	-	ftmos ghtmo				<b>→</b>	С	10 2	200	]—					
	[	Bit	1	5 14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	-	D100	+	×1	6 <sup>3</sup>			×1	6 <sup>2</sup>			×1	6 <sup>1</sup>			×	60	
	►	D101		×1	6 <sup>7</sup>			×1	6 <sup>6</sup>			×1	6 <sup>5</sup>			×1	16 <sup>4</sup>	
		D102		Alwa	iys O	)	A	Alwa	iys C	)		Alwa	ays (	)	0	1		0
	-																	

Temperature Unit Flag (0: °C, 1: °F) — Open-circuit Flag (0: Normal, 1: Error) —

### **Temperature Sensor Units**



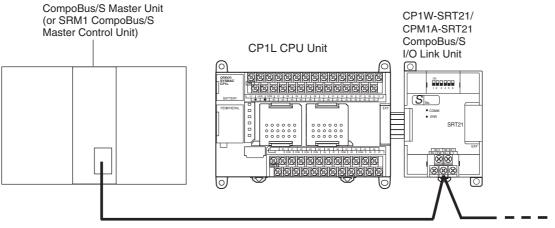


#### **Description of Operation**

# 7-6 CompoBus/S I/O Link Units

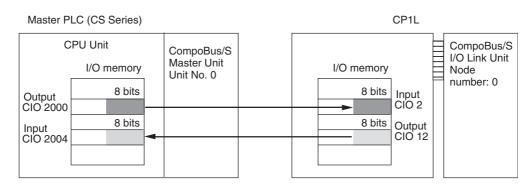
The CP1L can function as a slave to a CompoBus/S Master Unit (or SRM1 CompoBus/S Master Control Unit) when a CP1W-SRT21/CPM1A-SRT21 CompoBus/S I/O Link Unit is connected. The CompoBus/S I/O Link Unit establishes an I/O link of 8 inputs and 8 outputs between the Master Unit and the PLC. Up to three CompoBus/S I/O Link Units, including other Expansion I/ O Units, can be connected to a CP1L CPU Unit.

Section 7-6



Special flat cable or VCTF cable

From the standpoint of the CP1L CPU Unit, the 8 input bits and 8 output bits allocated to the CompoBus/S I/O Link Unit are identical to input and output bits allocated to Expansion I/O Units even though the CompoBus/S I/O Link Unit does not control actual inputs and outputs. The input and output bits allocated to the CompoBus/S I/O Link Unit are one side of an I/O link between the slave CPU Unit and the CPU Unit to which the Master Unit is connected.



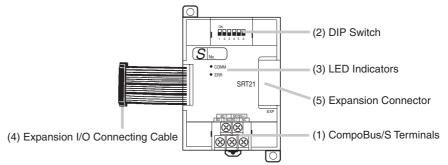
### **Specifications**

Model number	CP1W-SRT21/CPM1A-SRT21					
Master/slave	CompoBus/S Slave					
Number of I/O points	8 input points, 8 output points					
Number of words allocated in	1 input word, 1 output word					
CPU Unit I/O memory	(Allocated in the same way as Expansion Units and Expansion I/O Units.)					
Node number setting	Set using the DIP switch					
	(Set before turning on the CPU Unit's power supply.)					

### **LED Indicators**

Indicator	Name	Color	Meaning
COMM	Communications	Yellow	ON: Communications in progress.
	Indicator		OFF: Communications stopped or error has occurred.
ERR	Error indicator	Red	ON: A communications error has occurred.
			OFF: Indicates normal communications or stand-by.

#### CP1W-SRT21/CPM1A-SRT21 CompoBus/S I/O Link Unit



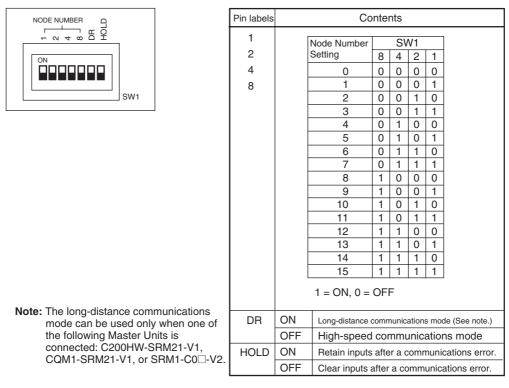
#### (1) CompoBus/S Terminals

The following CompoBus/S terminals are provided: CompoBus/S communications data high/low terminals, NC terminals for communications power supply plus (+) and minus (-), and an NC terminal. (Power is supplied internally for this Unit, so the NC terminals for communications power supply can be used as relay terminals.)

### Section 7-6

#### (2) DIP Switch

Used to specify the node number for the CompoBus/S I/O Link Unit. (Refer to the following table.)



#### (3) LED Indicators

Used to show the CompoBus/S communications status.

Indicator	Name	Color	Meaning
COMM	Communications	Yellow	ON: Communications in progress.
	indicator		OFF: Communications stopped or error has occurred.
ERR	Error indicator	Red	ON: A communications error has occurred.
			OFF: Indicates normal communications or stand-by.

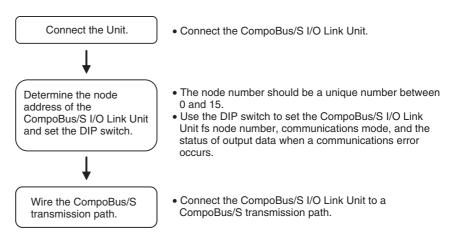
#### (4) Expansion I/O Connecting Cable

Connected to the expansion connector of a CP1L CPU Unit or a Expansion Unit or Expansion I/O Unit. The cable is provided with the Compo-Bus/S I/O Link Unit and cannot be removed.

**Note** Do not touch the cables during operation. Static electricity may cause operating errors.

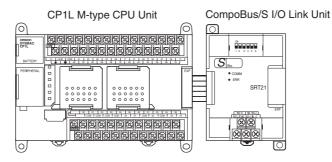
(5) Expansion Connector Used to connect Expansion Units or Expansion I/O Units.

### **Operating Procedure**



#### Connecting the CompoBus/S I/O Link Unit

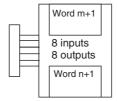
CompoBus/S I/O Link Units are connected to the CP1L CPU Unit. For CP1L M-type CPU Units, up to three Units can be connected, including any other Expansion Units and Expansion I/O Units that are also connected. The Units can be connected in any order from the CPU Unit.



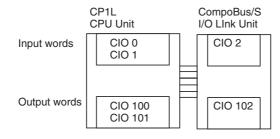
### I/O Allocation

I/O words are allocated to the CompoBus/S I/O Link Unit in the same way as to other Expansion Units and Expansion I/O Units, i.e., the next available input and output words are allocated. As shown below, when "m" is the last allocated input word and "n" is the last allocated output word, the CompoBus/S I/O Link Unit is allocated "m+1" as its input word and "n+1" as its output word.

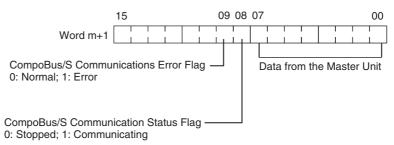
CompoBus/S I/O Link Unit



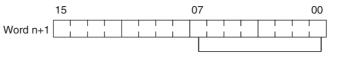
In the following example, a CompoBus/S I/O Link Unit is connected as the first Unit after the CP1L CPU Unit.



The input word (m+1) contains the 8 bits of data from the Master Unit and two CompoBus/S communications flags.



Write the data to be transmitted to the Master Unit in the output word (n+1).



Data to be transferred to the Master Unit

Note

(1) The 8 bits of I/O data are not always transmitted simultaneously. In other words, 8 bits of data transmitted from the Master CPU Unit at the same time will not always reach the Slave CPU Unit simultaneously, and 8 bits of data transmitted from the Slave CPU Unit at the same time will not always reach the Master CPU Unit simultaneously. When the 8 bits of input data must be read together, modify the ladder program in the CPU Unit receiving the data. For example, read the input data twice in succession and accept the data only when the two values

- match.(2) Unused bits in the CompoBus/S I/O Link Unit's output word can be used as work bits, but unused bits in the output slaves cannot be used as work bits.
- (3) Unused bits in input word cannot be used as work bits.

#### Node Number

- The CompoBus/S I/O Link Unit is a Slave Unit with 8 input bits and 8 output bits. The node number setting is made using the DIP switch; the inputs and outputs share the same node number.
- The range of possible node number settings is determined by the type of PLC the Master Unit is mounted to and the settings on the Master Unit. For details refer to the *CompoBus/S Operation Manual*.

Determining the Node Number and Making DIP Switch Settings

### Section 7-6

#### **DIP Switch Settings**

Use the DIP switch to set the CompoBus/S I/O Link Unit's node number, communications mode, and the status of output data when a communications error occurs.

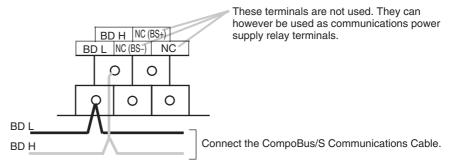
	Pin labels		Со	nter	nts			
	1		Node Number		SV	V1		
	2		Setting	8	4	2	1	
	4		0	0	0	0	0	
	8		1	0	0	0	1	
SW1			2	0	0	1	0	
			3	0	0	1	1	
			4	0	1	0	0	
			5	0	1	0	1	
			6	0	1	1	0	
			7	0	1	1	1	
			8	1	0	0	0	
			9	1	0	0	1	
			10	1	0	1	0	
			11	1	0	1	1	
			12	1	1	0	0	
			13	1	1	0	1	
			14	1	1	1	0	
		l	15	1	1	1	1	1
			1 = ON, 0 =	OFI	=			
Note: The long-distance communications mode can be used only when one of	DR	ON	Long-distance of	comm	nunica	ation	s moo	de (See note.)
the following Master Units is		OFF	High-speed	cor	ກmເ	inic	atior	ns mode
connected: C200HW-SRM21-V1, CQM1-SRM21-V1, or SRM1-C0□-V2.	HOLD	ON	Retain inputs					
		OFF	Clear inputs a	after	a co	mm	unica	ations error.

#### Note

Wiring the CompoBus/S Communications Path

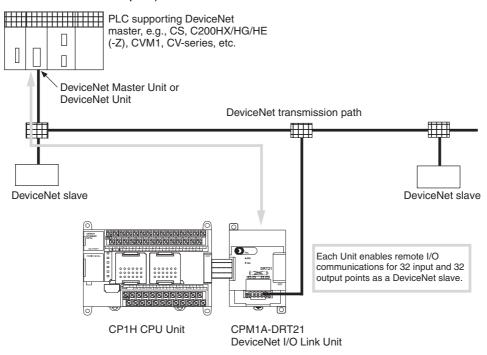
Wire the CompoBus/S communications path as shown in the following diagrams.

Always turn OFF the power supply before changing the DIP switch settings.



# 7-7 DeviceNet I/O Link Units

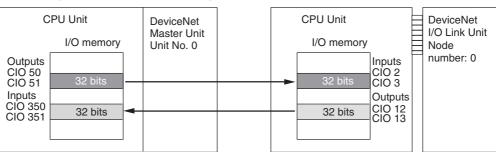
Connecting a CPM1A-DRT21 DeviceNet I/O Link Unit (with 32 inputs and 32 outputs as built-in I/O) to function as a slave allows the CP1L to be used as a DeviceNet slave. A maximum of three DeviceNet I/O Link Units can be connected to the CP1L to create I/O Links for up to 192 points (96 inputs and 96 outputs) between the CP1L and the DeviceNet master.



From the standpoint of the CP1L CPU Unit, the 32 input bits and 32 output bits allocated to the DeviceNet I/O Link Unit are identical to input and output bits allocated to Expansion I/O Units even though the DeviceNet I/O Link Unit does not control external inputs and outputs. The input and output bits allocated to the DeviceNet I/O Link Unit are one side of an I/O link between the slave CPU Unit and the CP1L CPU Unit to which the Master Unit is connected.

CP1L





**Note** Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on DeviceNet networks.

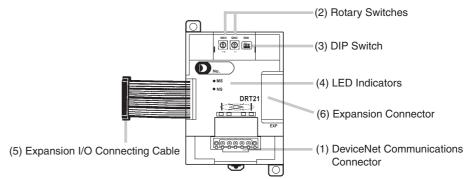
#### **Specifications**

М	odel number	CPM1A-DRT21
Ма	aster/slave	DeviceNet Slave

### DeviceNet I/O Link Units

Number of I/O points	32 input points, 32 output points
Number of words allocated in	2 input words, 2 output words
CPU Unit I/O memory	(Allocated in the same way as other Expansion Units and Expansion I/O Units.)
Node number setting	Set using the rotary switches
	(Set before turning ON the CPU Unit's power supply.)
Communications current con- sumption	48 mA

#### CPM1A-DRT21 DeviceNet I/O Link Unit



- DeviceNet Communications Connector Used to connect DeviceNet communications. For the wiring, use the connector provided with the CPM1A-DRT21 or use a connector purchased separately.
- (2) Rotary Switches (SW2, SW3) Used to set DeviceNet node numbers.



Setting range: 0 to 63 (Do not set 64 to 99.)

(3) DIP Switch (SW1)

Used to set the DeviceNet baud rate and the output hold function.



	Baud rate setting (See note.)				
Pin 1	Pin 2	Baud rate	Max. transmission path length		
OFF	OFF	125 kbps	500 m		
ON	OFF	250 kbps	250 m		
OFF	ON	500 kbps	100 m		
ON	ON	Not allowed.			

	Output hold function setting
Pin 4	DeviceNet baud rate
OFF	Clears remote outputs when communications error occurs. (Outputs turned OFF for each logic value.)
ON	Holds remote outputs when communications error occurs.

- **Note** When using Expansion Unit/Expansion I/O Unit Error Flags (A436) in the program, set pin 4 on the DIP switch to ON. If communications are set to be cleared, the timing for clearing outputs and setting the Error Flags may not agree.
- (4) LED Indicators
- Used to indicate CPM1A-DRT21 status, as shown in the following table.

Indicator	Color	Status	Condition	Meaning
MS	Green	Lit	Normal status	Normal status
		Flashing	Not set	<ul> <li>Switch settings being read</li> </ul>
	Red	Lit	Fatal error	<ul> <li>Fatal hardware error (watchdog timer)</li> </ul>
		Flashing	Nonfatal error	<ul> <li>Incorrect switch settings.</li> </ul>
		OFF	Power not supplied.	<ul> <li>Power not supplied.</li> <li>Waiting for initialization to start.</li> <li>Reset in progress.</li> </ul>
NS	Green	Lit	Online and commu- nications estab- lished.	<ul> <li>Network normal and com- munications established.</li> </ul>
		Flashing	Online and commu- nications not estab- lished.	<ul> <li>Network normal and com- munications not estab- lished.</li> </ul>
	Red	Lit	Fatal communica- tions error	Unit has detected network status preventing normal communications.
				<ul><li>Node number duplications</li><li>Bus OFF detected.</li></ul>
		Flashing	Nonfatal communi- cations error	• Communications timeout or communications error for one or more slaves.
		OFF	Online and power OFF.	Waiting for node number check by master.
				<ul><li>Switch setting error.</li><li>Power not supplied.</li></ul>

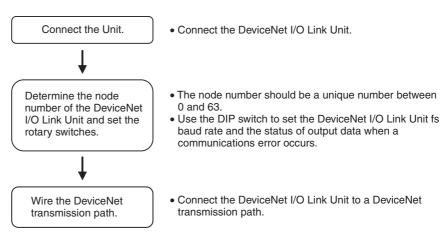
- (5) Expansion I/O Connecting Cable Connected to the expansion connector of a CP1L CPU Unit or an Expansion Unit or Expansion I/O Unit. The cable is included with the DeviceNet Unit and cannot be removed.
  - **Note** Do not touch the cables during operation. Static electricity may cause operating errors.
- (6) Expansion Connector
   Used for connecting Expansion Units or Expansion I/O Units.

#### Handling Unit Errors

If a communications error occurs while the slave is on standby, the appropriate bit in word A436 will turn ON. The appropriate bit is determined by the order in which the Expansion Units and Expansion I/O Units are connected. The Unit nearest to the CPU Unit uses A436.00. Use these flags in the program when it is necessary to detect errors.

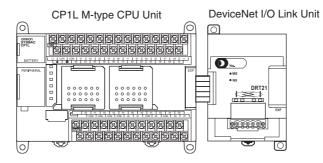
### Section 7-7

### **Operating Procedure**



# Connecting the DeviceNet I/O Link Unit

DeviceNet I/O Link Units are connected to the CP1L CPU Unit. For CP1L Mtype CPU Units, up to three Units can be connected, including any other Expansion Units and Expansion I/O Units that are also connected. The Units can be connected in any order from the CPU Unit.



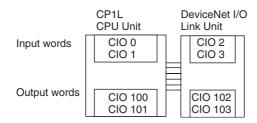
#### I/O Allocation

I/O words are allocated to the DeviceNet I/O Link Unit in the same way as to Expansion I/O Units or other Expansion Units, i.e., the next available input and output words are allocated. As shown below, when "m" is the last allocated input word and "n" is the last allocated output word, the DeviceNet I/O Link Unit is allocated "m+1" as its input word and "n+1" as its output word.

DeviceNet I/O Link Unit

Word m+1 Word m+2
32 inputs 32 outputs
Word n+1 Word n+2

In the following example, a CompoBus/S I/O Link Unit is connected as the first Unit after the CP1L CPU Unit.

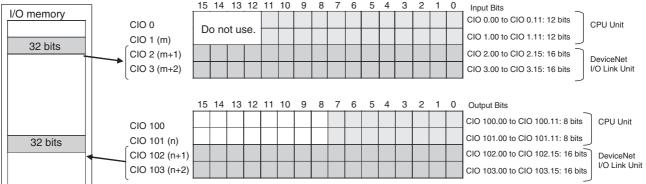


All of the words allocated to the DeviceNet I/O Link Unit are used to read and write data between the CPU Unit of the DeviceNet I/O Link Unit and the CPU Unit of the DeviceNet master, as shown in the following illustration.

### DeviceNet I/O Link Units

### Section 7-7

#### DeviceNet master



Note

- (1) The 32 bits each of I/O data are not always transmitted simultaneously. In other words, 32 bits of data transmitted from the Master CPU Unit at the same time will not always reach the CP1L CPU Unit simultaneously, and 32 bits of data transmitted from the CP1L CPU Unit at the same time will not always reach the Master CPU Unit simultaneously. When the 32 bits of input data must be read together, modify the ladder program in the CPU Unit receiving the data. For example, read the input data twice in succession and accept the data only when the two values match.
  - (2) Unused bits in the DeviceNet I/O Link Unit's output words can be used as work bits if they are not used for output from the slave.
  - (3) Unused bits in input words cannot be used as work bits.

#### Setting Node Numbers

Use rotary switches SW2 and SW3 to set DeviceNet node number. The setting range is from 00 to 63, and 64 to 99 cannot be set. Rotary switch settings go into effect when the power is turned ON.



Setting range: 0 to 63 (Do not set 64 to 99.)

**Note** The actual range of node numbers that can be set depends on the type of PLC to which the Master Unit is mounted, and on the Master Unit setting. For details, refer to the *DeviceNet DRT1-series Slaves Operation Manual*.

#### Setting the DIP Switch (SW1)

Used to set the DeviceNet baud rate and the output hold function.



#### **Baud Rate**

Pin 1	Pin 2	Baud rate	Max. transmission path length
OFF	OFF	125 kbps	500 m
ON	OFF	250 kbps	250 m
OFF	ON	500 kbps	100 m
ON	ON	Not allowed.	

Determining the Node Number and Making DIP Switch Settings

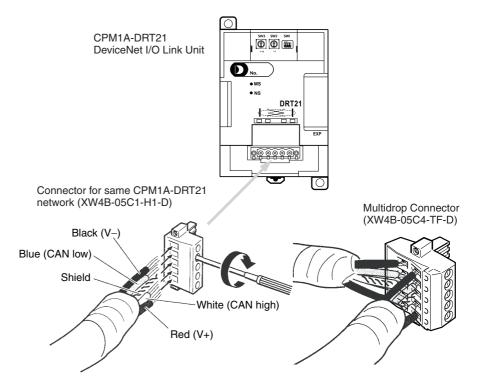
#### **Output Hold Function**

Pin 4	DeviceNet baud rate
OFF	Clears remote outputs when communications error occurs. (Outputs turned OFF for each logic value.)
ON	Holds remote outputs when communications error occurs.

**Note** When using Expansion Unit/Expansion I/O Unit Error Flags (A436) in the program, turn ON pin 4 on the DIP switch. If communications are set to be cleared, the timing for clearing outputs and setting the Error Flags may not agree.

#### Wiring the DeviceNet Communications Path

When using a CPM1A-DRT21 DeviceNet I/O Link Unit, wire the DeviceNet communications cable as shown in the following diagram.



#### **DeviceNet Connectors**

Use the following connectors.

Model	XW4B-05C1-H1-D	XW4B-05C4-TF-D
Form and specifications	OMRON connector with screws (provided with CPM1A-DRT21)	OMRON connector for multidrop connections (See note.)
	annun an	ALL IN IL IL

**Note** Use the XW4B-05C4-TF-D when wiring multidrop connections using Thick Cables.

Use the following screwdriver for the above connector.

### DeviceNet I/O Link Units

### Section 7-7



I/O Response Time

Refer to the *DeviceNet Slaves Operation Manual* (W347) for details on the response time. The data read/write time for one cycle for the CPM1A-DRT21 is approximately 0.5 ms. Add a maximum of 1 ms to the I/O response time.

# SECTION 8 LCD Option Board

This section gives an outline of the LCD Option Board, explains how to install and remove the LCD Option Board, and describes the functions including how to monitor and make settings for the PLC. It also lists the errors during operation and provides probable causes and countermeasures for troubleshooting.

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# 8-1 Features

LCD Option Board is small but has a wide range of functions and is easy to use.

### **Powerful Display and Setting Functions**

Equipped for easy display and set up of user-specified messages, time or other data of the PLC.

### User Monitor Screen

Preset the screen, including I/O memory and text string, which user will monitor frequently. So it is easy for user to acquire his necessary data. It is possible to register up to 16 screens.

### Timer Switch

Preset the timer, including Day, Weekly and Calendar Timer. Each timer can execute a trans-day, trans-week or trans-year operation. So a 24-hours control will be effected by one-step setting. It is possible to register up to 16 timers for each kind.

### Easier to Identify with Backlight

When PLC error occurs, the red backlight of LCD display screen will begin to blink, quickly altering you of the error.

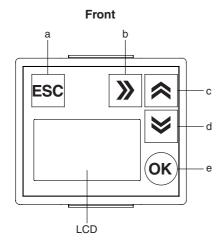
Normally the backlight is green. The automatic cutout time for the backlight can be set to occur from 2 to 30 minutes, or even set permanently to OFF or ON position.

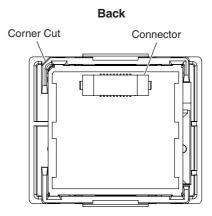
The contrast level can also be adjusted.

# 8-2 Specifications

ltem	Specification
Model	CP1W-DAM01
Туре	Built-in
Serial port	Only port 1
Communication protocol	Toolbus
DC consumption	5V : 40mA 24V : 0mA
Dimensions	43×36×23 mm (W×H×D)
Weight	20g max.
Screen size	2.6cm×1.45cm
Total characters on screen	4 lines×12 characters
Font size	5×7 dot
Backlight color	Green / Red
Display language	English / Japanese (Katakana)
Ambient operating temperature	0 to 55°C
Ambient operating humidity	10% to 90% (with no condensation)
Atmosphere	No corrosive gas.
	Humidity[%] 100 90 80 70 60 50 40 - 60 70 60 70 60 70 70°C, 60%) 100 100 100 100 100 100 100 10
Ambient storage condition	(with no condensation)

# 8-3 Part Names





### **Operation Button**

No.	В	utton	Function
а	ESC	ESC	Cancel the setting and return to the up-level menu.
			Move the column cursor.
b	<b>》</b>	Forward	Press and hold the button, the column cursor will move for- ward continuously.
			Move the line cursor up. Change numerals and parameters.
С	~	Up	Press and hold the button, the line cursor will move up contin- uously and the parameters will increase continuously.
		Down	Move the line cursor down. Change numerals and parameters.
d	>	Down	Press and hold the button, the line cursor will move down continuously and the parameters will decrease continuously.
е	ОК	ОК	Confirm the setting.

### Backlight

Color	Meaning
Green	PLC is normal.
Red	PLC error has occurred.

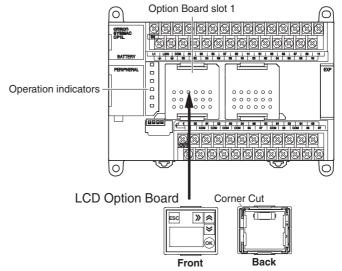
# 8-4 Installation and Removing

### **Installation**

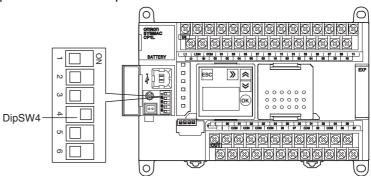
The following processing explains how to install and remove a LCD Option Board.

**Caution** Always turn OFF the power supply to the CPU Unit and wait until all the operation indicators go out before installing or removing the LCD Option Board.

- **1,2,3...** 1. Press the up/down lock levers on both sides of the Option Board slot cover 1 at the same time to unlock the cover, and then pull the cover out.
  - Check the alignment to make the corner cut of the LCD Option Board fit in the Option Board slot 1, and firmly press the LCD Option Board in until it snaps into place.

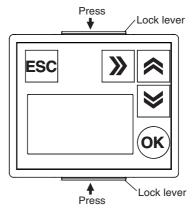


3. Switch DipSW4 of the CPU Unit to ON. **Note** DipSW4 is OFF at shipment



### **Removing**

Press the up/down lock levers on both sides of the LCD Option Board at the same time to unlock the Option Board, and then pull it out.



# 8-5 Basic Operation

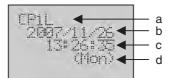
### 8-5-1 Startup

According to the operation status of the LCD Option Board, it will display different screens when the CPU Unit power is turned ON.

### Normal Startup

When the CPU Unit power is turned ON, the LCD Option Board will initialize hardware and check EEPROM, then check communication between the LCD Option Board and the CPU Unit. If startup is normal, LCD will display Clock Screen as shown below.

#### **Clock Screen**

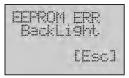


No.	Description
а	Type of the CPU Unit
b	Date of the CPU Unit
с	Time of the CPU Unit
d	Week abbreviation of the CPU Unit

### Startup Failure

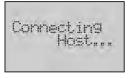
• If EEPROM is faulty, LCD will display EEPROM Error Screen and the red backlight will blink. Refer to *8-7 Trouble Shooting*.

#### **EEPROM Error Screen**



• If the communication between the LCD Option Board and the CPU Unit has failed, LCD will display NG screen. Refer to *8-7 Trouble Shooting*.

#### NG Screen

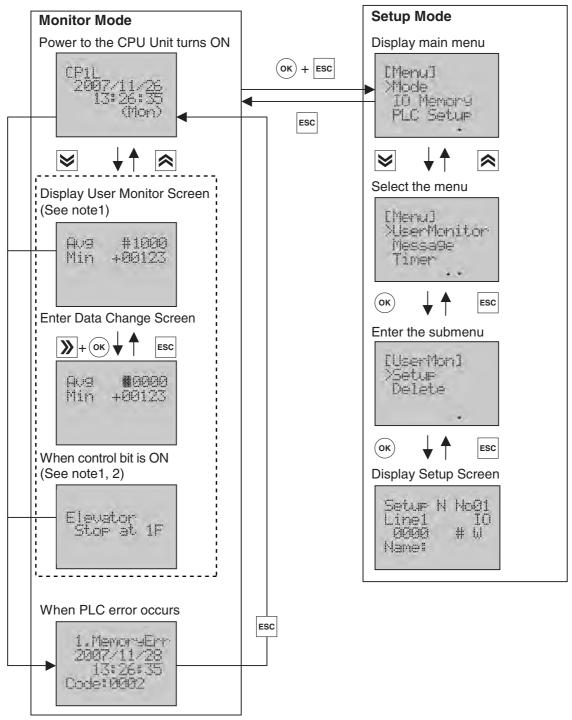


Note

If the LCD Option Board receives no response from the CPU Unit within 3 seconds during operation, it will also display NG screen.

### 8-5-2 Screen Transitions

The screen transition of the LCD Option Board as shown in the following diagram.



Note

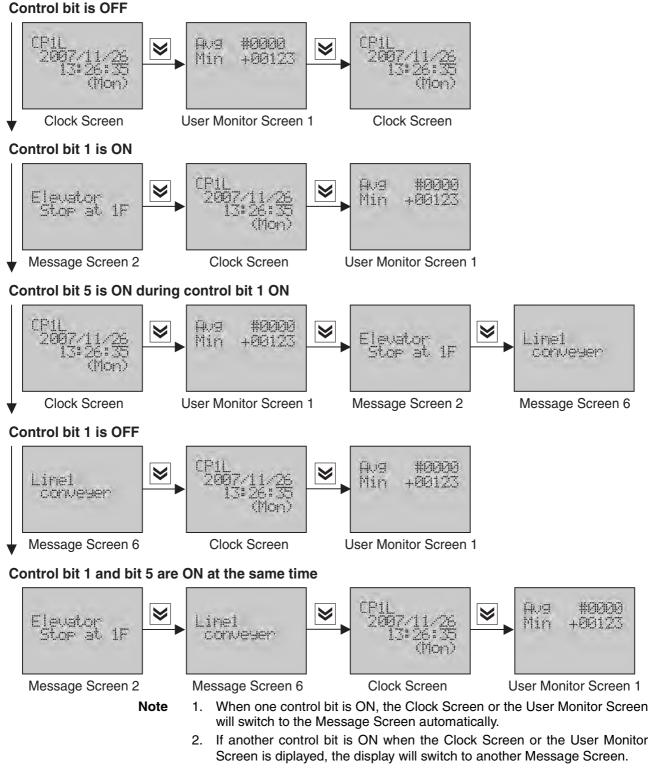
1. The screen will be displayed after making settings in the Setup Mode.

- 2. The Message Screen will disappeared automatically after control bit is OFF.
- 3. In the Setup Mode, if there is no operation for 10 minutes, LCD will automatically switch to the Monitor Mode.

### Section 8-5

### Screen Transition Example in the Monitor Mode

In this example, User Monitor Screen 1 and Message Screen 2, Message Screen 6 have been set.



3. If another control bit is ON when one Message Screen is diplayed, the display will not change until one of the control bit is OFF.

- 4. If another control bit is bigger, the display will swtich to another Message Screen after one of the control bit is OFF. If another control bit is smaller, the display will swtich to the Clock Screen after one of the control bit is OFF.
- 5. When no less than one control bit are ON at the same time, the Message Screen whose Screen No. is smaller will be displayed.
- 6. If one control bit is ON during the period that PLC error occurs, the display remains the Error Screen. Even if the error is eliminated, the display will not switch to the Message Screen, but return to the Clock Screen.

### 8-5-3 Operation Examples

With actual operation examples, the main operation flow of the LCD Option Board as shown below.

### Menu Selection

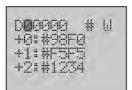
Display the Monitor Screen of I/O memory.

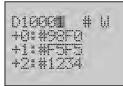
- 1,2,3... Mon. [Menu] Mode 10 Memory PLC Setur [Merau] Mode >10 Memory PLC Setup [10 Memory] >TIM CMT DM CIO Memory) TIM CNT >DM # 11 D**0**00000 +0:#98F0 +1:#F5F5 +2:#1234
- 1. Turn on the power to the CPU Unit. Clock Screen will be displayed.
- 2. Press the **OK** + **ESC** button simultaneously to switch to the main menu. The line cursor ">" is always displayed on the first line of menu items.
- 3. Press the **Down** or **Up** button to select the menu item. Move the line cursor to *IO Memory.*
- 4. Press the **OK** button to enter the submenu.
- 5. Press the **Down** or **Up** button to select the I/O memory type. Move the line cursor to **DM**.
- 6. Press the **OK** button to enter the Monitor Screen of I/O memory.

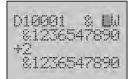
### **Displaying I/O Memory**

Display any data of I/O memory. In this example, two word data on D10001 to D10002, D10003 to D10004 with unsigned decimal number will be displayed.

1,2,3...







### **Changing I/O Memory**

1,2,3...

 Line 1 will display the default address D00000 in I/O memory, Line 2 to 4 will display one word data on D00000, D00001, D00002 with hex number when entering the Monitor Screen of I/O memory. The first digit of memory address "0" will flash. The column cursor is at the flashing position.

The digit under the column cursor can be changed, otherwise it is read only.

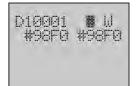
- Use the Forward button to move the column cursor to the digit to be set. Use the Down or Up button to change the value of each digit. The screen display will be updated immediately after the address is changed.
- 3. Use the **Forward** button to move the column cursor to another parameter to be set.

Use the  $\ensuremath{\text{Down}}$  or  $\ensuremath{\text{Up}}$  button to select the value of parameter.

The screen display will be updated immediately after the parameter is changed.

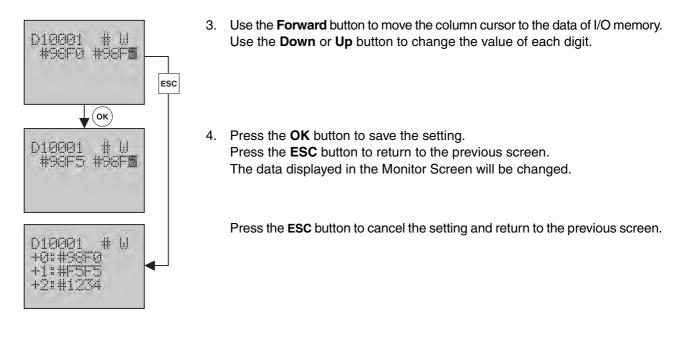
Change any data of I/O memory. In this example, the data of I/O memory on D10001 will be changed.

## D10001 # W +0:#98F0 +1:#F5F5 +2:#1234



- 1. Display I/O memory.
- Press the **OK** button to enter the Change Screen of I/O memory. The column cursor is at the "#" position. Use the **Down** or **Up** button to select the value of parameter.

### LCD Option Board Function



# 8-6 LCD Option Board Function

This section describes the functions of the LCD Option Board including how to monitor and make settings for the PLC.

### 8-6-1 Function Overview

PLC Mode

Display the present PLC mode and change the PLC mode. Refer to *Page 502* for details.



**I/O Memory Setting** 

Monitor and change the data of I/O Memory. Refer to *Page 503* for details.



**PLC Setup** 

Monitor and change the PLC Setup, especially fast access the CPU Unit Operating Mode.

Refer to Page 508 for details.



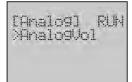
### LCD Option Board Function

### Section 8-6

#### Analog

Monitor the value from the analog adjuster and external analog setting input of the PLC.

Refer to Page 510 for details.



#### **Error History**

Display the list of error history and the details of each error. It is possible to display up to 20 screens. User can also monitor the occurring errors.

Refer to Page 512 for details.



#### Memory Cassette

The LCD Option Board can execute any of the following operations.

- Load data from memory cassette to PLC.
- Save data from PLC to memory cassette.
- Compare data between PLC and memory cassette.
- Clear data in memory cassette.

Refer to Page 514 for details.



#### User Monitor Screen

Set or delete User Monitor Screen, which includes some elements such as I/O word memory, bit memory or text string. It is possible to register up to 16 screens. User can monitor his necessory data in the User Monitor Screen.

Refer to Page 518 for details.

Delete	
Faile, T fei, C fei	

#### **Message Screen**

Set or delete Message Screen. It is possible to register up to 16 screens. User can monitor the text message in the Message Screen when control bit is ON.

Refer to Page 527 for details.

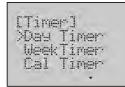


### Section 8-6

#### **Timer Switch**

Set day, weekly and calendar timers. It is possible to register up to 16 timers for each kind. Each timer can execute a trans-day, trans-week or trans-year operation.

Refer to Page 532 for details.



#### Data Backup

The LCD Option Board can execute any of the following operations.

- Load user settings from DM area.
- Save user settings to DM area.

So user can save the user settings to the DM area of the PLC from one LCD Option Board and load to other LCD Option Boards from the DM area. Refer to *Page 538* for details.

ĮD.	it a	Bad	skup)	
12				
			-	

#### Language

Change the language of the LCD display between English and Japanese. Refer to page *541* for details.



Other

- PLC Cycle Time
- PLC Clock Setting
- PLC System Information
- LCD Backlight Setting
- LCD Contrast Setting
- LCD Factory Setting

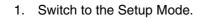
Refer to Page 543 to 546 for details.

cleTime
ockset stastacs
20-22-11-11-11-11-11-11-11-11-11-11-11-11-

### 8-6-2 PLC Mode

This function can display the present PLC mode and change the PLC mode.Example Change the PLC Mode from RUN to PRG.

### 1,2,3...



- Press the **OK** button to enter the Mode Screen. There is a choice of 3 PLC modes-RUN/MON/PRG. The line cursor will point to the present PLC mode. The present mode is *RUN*.
- 3. Press the **Down** button to select **PROGRAM**.
- 4. Press the OK button, then LCD will update the present mode to PRG.

# CMenul Mode IO Memory PLC Setup FLC Setup T Node] RUM MONITOR PROGRAM

Phila ata 1	P.P.A.
r thruthat 1	r rua
EN IN	
MARL IT TOTAT	
TRUCK LEARS	
>PPnappM	

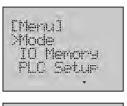
# 8-6-3 I/O Memory Setting

### **Displaying I/O Memory**

Example

Monitor two word data on D10001 to D10002, D10003 to D10004 with unsigned decimal number.

### 1*,2,3*...



[Mernu]

Mode >IO Memory PLC Setup

EIO Mem] >TIM CNT DM

[IO Mem]

TIM CNT >DM

а

D00000

+0:#98F0 +1:#F5F5 +2:#1234

A T

.

b c

# 1.1

- 1. Switch to the Setup Mode.
- 2. Press the Down button to select IO Memory.
- 3. Press the **OK** button to enter the I/O Memory menu.
- 4. Press the **Down** button to select **DM**.
- 5. Press the **OK** button to enter the Monitor Screen of I/O memory DM. The following table shows the setting items.

No.	Description
а	Leading word address
b	Display format
С	Data length

The first digit of the leading word address will be flashing.

The present setting is the default address.

Line 2 to 4 will display one word data on D00000, D00001, D00002 with hex number.

6. Use the **Forward** button to move the column cursor to the digit to be set. Use the **Up** button to change the leading word address to **10001**.



### Section 8-6

### LCD Option Board Function

The following table shows the default address and the setting range for each I/O memory type.

I/O memory type	Default address	Range
ТІМ	0000	0000 to 4095
CNT	0000	0000 to 4095
DM	00000	00000 to 32767
AR	000	000 to 959
IO	0000	0000 to 6143
WR	000	000 to 511
HR	000	000 to 511
DR	00	00 to 15
IR	00	00 to 15
тк	00	00 to 31

Note LongWord has only five display types, DM, IO, WR, HR and AR.

7. Use the **Forward** button to move the column cursor to the display format position.

Press the **Down** or **Up** button to select the display format **&**. Select the display format in the following table.

Display format	Meaning
#	Hex number
+	Signed decimal number
&	Unsigned decimal number

8. Use the **Forward** button to move the column cursor to the data length position.

Press the **Down** or **Up** button to select the data length *LW*. Select the data length in the following table.

Data length	Meaning
W	One word data
LW	Two word data

Then it will display two word data on D10001 to D10002, D10003 to D10004 with unsigned decimal number.

**Note** The screen display will be updated immediately after the address, display format or data length is changed.





### **LCD Option Board Function**

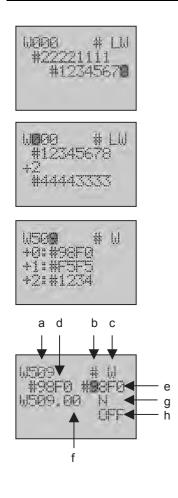
### Changing I/O Memory

Example	
	1,2,3
[Menu] Mode IO Memory PLC Satur	
[Menu] Mode >IO Memory PLC Setup	
CIO MemJ >TIM CHT DM	
CIO Mem] AR IO NAR	
UB00 # U +0:#98F0 +1:#F5F5 +2:#1234	
₩000 # <b>Ш</b> ₩ #22221111 +2 #444433333	
	]
#22221111 #22221111	<ul> <li>↓ 4</li> <li>↓ 5</li> </ul>

First change two word data on W000 to 12345678, then change one word data on W509 to 98F5 and set the control bit 509.05 to OFF.

- ,3...
  - 1. Switch to the Setup Mode.
  - 2. Press the Down button to select IO Memory.
  - 3. Press the **OK** button to enter the I/O Memory menu.
  - 4. Press the **Down** button to select **WR**.
  - 5. Press the **OK** button to enter the Monitor Screen of I/O memory WR.
  - Use the Forward button to move the column cursor to the data length position.
     Press the Down or Up button to select the data length LW.
  - Press the **OK** button to enter the Change Screen of I/O memory W000. The following table shows the setting items.

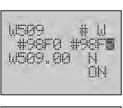
No.	Attributes
1	Head channel address (Read only)
2	Display format (Read only)
3	Data length (Read only)
4	Data of I/O memory before change (Read only)
5	Data of I/O memory after change

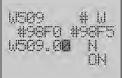


- 8. Press the **Forward** button to move the column cursor to the digit to be set. Use the **Down** or **Up** button to change the data to *12345678*.
- Press the OK button to save the setting. Press the ESC button to return to the previous screen. Then the data on W000 displayed in the Monitor Screen will be 12345678.
- 10. Change the leading word address to 509 to update the screen display.
- 11. Press the **OK** button to enter the Change Screen of I/O memory W509. The following table shows the setting items.

No.	Description
а	Leading word address(Read only)
b	Display format(Read only)
с	Data length(Read only)
d	Data of I/O memory before change (Read only)
е	Data of I/O memory after change
f	Bit address
g	Bit flag
h	Bit state

- **Note** If the display format is a decimal number (& or +), or the data length is a LongWord, user cannot make a setting for bit.
- Move the column cursor to the digit to be set.
   Use the Up button to change the data to 98F5.
- Use the Forward button to move the column cursor to the position of bit address. The present setting is the default address. The range is 00~15.



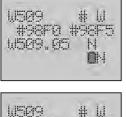


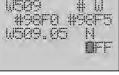


- 14. Use the Up button to change the bit address to 05.
- Use the Forward button to move the column cursor to the bit flag position. The present setting is the default setting. Select the bit flag in the following table.

Bit flag	Meaning
Ν	Normal
S	Force to SET
R	Force to RESET

- 16. Use the **Forward** button to move the column cursor to the bit state position. The present state is ON. The state ON or OFF is according to PLC.
- 17. Press the Down or Up button to select the bit state OFF.
- **Note** If bit flag is S or R, the setting of bit state is invalid.
- Press the OK button to save the setting.
   Press the ESC button to return to the previous screen.
   Then the data on W509 displayed in the Monitor Screen will be 98D5.





**US69** # 11 +0: #9805 <u>\_\_\_\_</u>

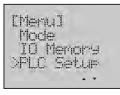
### 8-6-4 PLC Setup

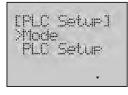
This function can display and change the settings in the PLC Setup.

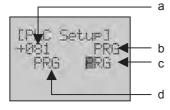
**Example 1** Change the CPU Unit Operating Mode from PRG to RUN.

### 1,2,3...







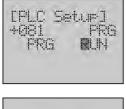


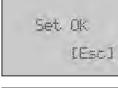
- 1. Switch to the Setup Mode.
- 2. Press the Down button to select PLC Setup.
- 3. Press the **OK** button to enter the PLC Setup menu.
- 4. Press the **OK** button to enter the CPU Unit Operating Mode Screen. The following table shows the setting items.

No.	Attributes
а	Address of CPU Unit Operating Mode (Read only)
b	Present PLC mode (Read only)
С	CPU Unit Operating Mode after change (Read only when PLC mode is RUN or MON)
d	CPU Unit Operating Mode before change (Read only)

The address of CPU Unit Operating Mode is always 081, so there is no need to change the address.

- 5. Use the Up button to select RUN.
- **Note** Before changing the CPU Unit Operating Mode, make sure that the present PLC mode is PRG. If PLC is in RUN or MON mode, the CPU Unit Operating Mode is unchangeable.
- 6. Press the **OK** button to save the setting.
- 7. Press the ESC or OK button to return to the previous menu.







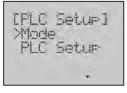
Example 2

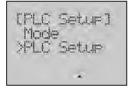
Display the value of PLC Setup on 080. Then change the value to 0195.

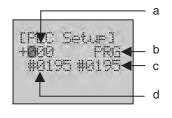
1,2,3...

[Merau] Mode 10 Memory PLC Setup









- 1. Switch to the Setup Mode.
- 2. Press the Down button to select PLC Setup.
- 3. Press the **OK** button to enter the PLC Setup menu.
- 4. Press the Down button to select PLC Setup.
- 5. Press the OK button to enter the PLC Setup Screen The following table shows the setting items.

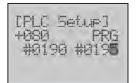
No.	Description
а	Address of PLC Setup
b	PLC mode (Read only)
с	Value of PLC Setup after change (Read only when PLC mode is RUN or MON)
d	Value of PLC Setup before change (Read only)

The first digit of PLC Setup address will be flashing. The range of the address is 000 to 511.

- 6. Use the Up button to change the address to 080. After the address is changed, the value of PLC Setup will be updated immediately.
- 7. Use the Forward button to move the column cursor to the value of PLC Setup. Use the Up button to change the value to 0195.
- Note Before changing the value of PLC Setup, make sure that the PLC mode is PRG. If PLC is in RUN or MON mode, the value is unchangeable.







9. Press the **ESC** or **OK** button to return to the PLC Setup Screen.

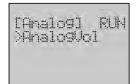
8. Press the **OK** button to save the setting.

# 8-6-5 Analog

#### **Displaying Analog Settings**

**Example** Monitor the external analog setting input with unsigned decimal number.

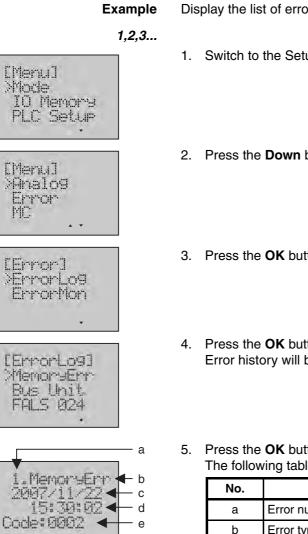
Example		Monitor the external analog setting input with unsigned decimal number.		
1,2,3	-	Civitale to the Cative Made		
[Plenu] Mode IO Memory PLC Setur	1.	Switch to the Setup Mode.		
EMenuj 29 Analog Error MC	2.	Press the <b>Down</b> button to select Analog.		
[Analog] RLM >AnalogUol	3.	Press the <b>OK</b> button to enter the Analog menu.		
AnalogUolume	4.	Press the <b>OK</b> button to enter the Monitor Screen of analog setting. Line 2 will display the value from the analog adjuster.		
# #0000 Analo9Input. # #0100		Line 4 will display the external analog setting input value. The display format on line 2 will be flashing.		
AnalogVolume # #0000 AnalogInput # #0100	5.	Use the <b>Forward</b> button to move the column cursor to the display format position on line 4.		
AnalogVolume # #0000 AnalogInput. & &256	6.	Press the <b>Down</b> or <b>Up</b> button to change the display format to <b>&amp;</b> .		



#### 8-6-6 Error

This function can display the list of error history and the details of each error. It is possible to display up to 20 screens. User can also monitor the occurring errors in the Error Monitor Screen.

#### **Displaying and Clearing Error History**



Display the list of error history and then clear it.

7. Press the ESC button to return to the previous screen.

- 1. Switch to the Setup Mode.
- 2. Press the Down button to select Error.
- 3. Press the **OK** button to enter the Error menu.
- 4. Press the OK button to enter the Error History Screen. Error history will be displayed in this screen.
- 5. Press the **OK** button to enter the Error Screen details. The following table shows the display items.

No.	Description			
а	Error number(1 to 20)			
b	Error type			
с	The date error occurred			
d	The time error occurred			
е	Error code			

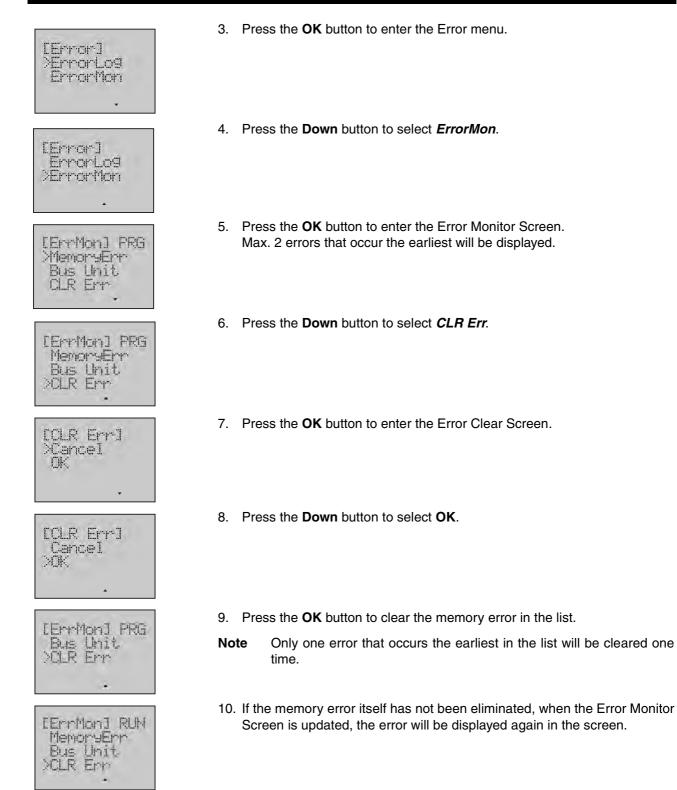
11.MemorsErr 2007/11/28 13:26:35 Code:0002	6. If there is more than one error, press the <b>Down</b> button to scroll the screen and display the details of the next error.
[ErrorLog] MemoryErr >CLR ErrLog	<ol> <li>Press the ESC button to return to the Error History Screen. Press the Down button to select CLR ErrLog which is always below the last error.</li> </ol>
ECLR ErrLog] >Cancel OK	8. Press the <b>OK</b> button to enter the Error Clear Screen.
[CLR EnrLo9] Cancel >OK	<ul> <li>9. Press the <b>Down</b> button to select <b>OK</b>.</li> <li><b>Note</b> Selecting <i>Cancel</i> will result in a return to the previous screen.</li> </ul>
CCLR ErrLog] Complete	10. Press the <b>OK</b> button to clear the error history. When the clearing is finished, it will display a complete screen.
[EmonLo9]	<ol> <li>Press the <b>ESC</b> button to return to the Error History Screen. All the errors have been cleared.</li> </ol>

### **Clearing Occurring Error List**

**Example** Clear memory error in the list that occurs at the present time.

1,2,3...

- [Menu] Mode IO Memory PLC Setue
- [Menu] Enalog >Error MC
- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select *Error*.



# 8-6-7 Memory Cassette

#### **Before Operation**

- Memory Cassette should be equipped into the PLC. Otherwise LCD cannot operate Memory Cassette.
- Make sure that the PLC mode is PRG. If the PLC is in RUN or MON mode, the operation of Memory Cassette cannot be executed.

#### Loading Data from Memory Cassette to PLC

**Example** Load data from Memory Cassette to the PLC.

#### 1,2,3...

- 1. Switch to the Setup Mode.
- [Menu] Mode IO Menory FLC Setup





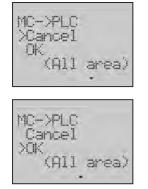
- 2. Press the Down button to select MC.
- 3. Press the **OK** button to enter the Memory Cassette menu. The following table shows the setting items.

I	No.	Description
	а	PLC mode (Read only)
	b	Operation mode

Select the operation mode in the following table.

Operation Mode	Meaning		
MC->PLC	Load data from memory cassette to PLC		
PLC->MC	Save data from PLC to memory cassette		
Compare	Compare data between PLC and MC		
Clear	Format memory cassette		

4. Press the **OK** button to enter the "MC->PLC" Operation Screen.



5. Press the **Down** button to select **OK**.

**Note** Selecting *Cancel* will result in a return to the previous menu.

MC->PLC Load 99%	6.	Press the <b>OK</b> button to start loading. A rate of loading will be displayed in the screen.
MC->PLC Complete	7.	When the rate comes up to 0%, the loading is finished. Then it will display a complete screen.

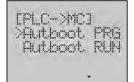
#### Saving Data from PLC to Memory Cassette

**Example** Save data from the PLC to Memory Cassette.

1. Switch to the Setup Mode.

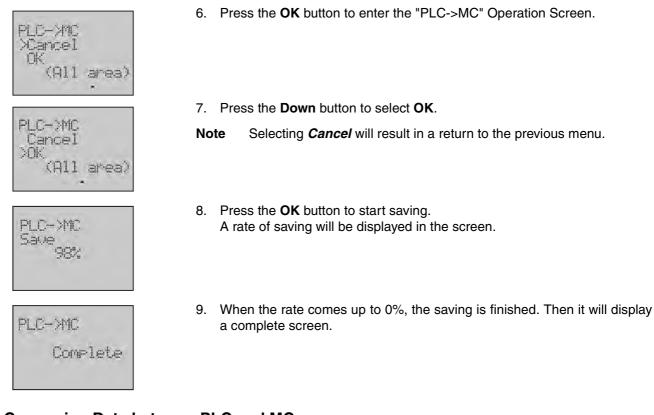
- 1*,2,3*...
- [Menu] Mode IO Memory PLC Setup
- EMenui Enalo9 Error MC
- EMCI PRG >MC->PLC PLC->MC Compare





- - 2. Press the **Down** button to select *MC*.
  - 3. Press the **OK** button to enter the Memory Cassette menu.
  - 4. Press the **Down** button to select **PLC->MC**.
  - 5. Press the **[OK]** button to enter the "PLC->MC" menu. Select the saving mode in the following table.

Saving Mode	Meaning		
Autoboot PRG	If the power turns ON, the operation cannot be executed.		
Autoboot RUN	Even if the power turns ON, the operation can be executed.		



# Comparing Data between PLC and MC

**Example** Compare the data between the PLC and Memory Cassette.

#### 1,2,3...

1. Switch to the Setup Mode.



2. Press the **Down** button to select *MC*.

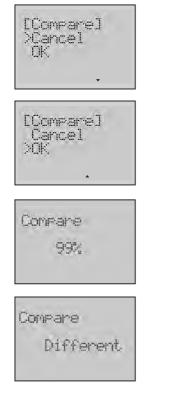






- 3. Press the **OK** button to enter the Memory Cassette Screen.
- 4. Press the **Down** button to select *Compare*.

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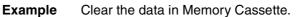


- 5. Press the **OK** button to enter the Compare Operation Screen.
- 6. Press the **Down** button to select **OK**.

**Note** Selecting *Cancel* will result in a return to the previous menu.

- 7. Press the **OK** button to start comparing. A rate of comparison will be displayed in the screen.
- 8. When the rate comes up to 0%, the comparing is finished. Then it will display a result of comparison.

#### **Clearing Memory Cassette**



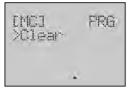
#### 1,2,3...

1. Switch to the Setup Mode.



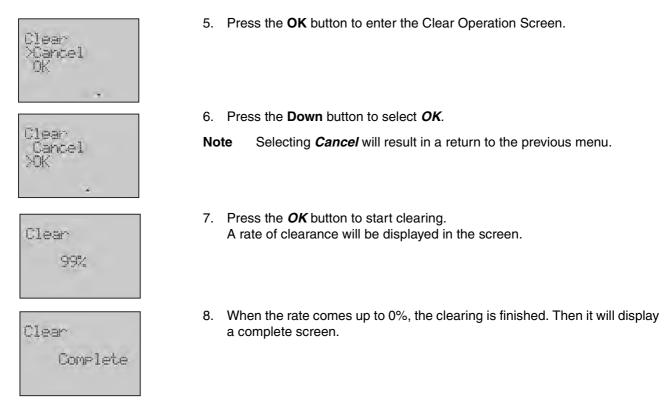
[Menu] Analog Error MC





- 3. Press the **OK** button to enter the Memory Cassette menu.
- 4. Press the **Down** button to select *Clear*.

2. Press the Down button to select MC.



### 8-6-8 User Monitor Screen

This function can set or delete User Monitor Screen. It is possible to register up to 16 screens. User can monitor his necessary data in the User Monitor Screen. Each User Monitor Screen includes 4 lines of content. Each line has three kinds of display type including word memory, bit memory and text string.

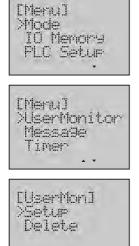
### Creating New User Monitor Screen

#### Example 1

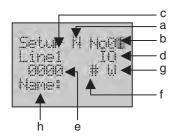
Monitor one word data on the word address D09000 with unsigned decimal number through User Monitor Screen 2, displayed on Line 1.

1,2,3...

1. Switch to the Setup Mode.



- 2. Press the **Down** button to select **UserMonitor**.
- 3. Press the **OK** button to enter the User Monitor menu.



Press the **OK** button to enter the User Monitor Setup Screen.
 The final digit of the Screen No. will be flashing.
 The following table shows the setting items for each display type.

		Display type		
No.	Description	Word	Bit	Text string
а	Monitor flag	Yes	Yes	Yes
b	User Monitor Screen No. (01 to 16)	Yes	Yes	Yes
с	Line No. (1 to 4) of the User Monitor Screen	Yes	Yes	Yes
d	Display type	Yes	Yes	Yes
е	I/O memory address	Yes	Yes	No
f	Display format	Yes	No	No
g	Date length	Yes	No	No
h	I/O memory name	Yes	Yes	Yes

- 5. Use the **Up** button to change the Screen No. to **2**.
- 6. Use the **Forward** button to move the column cursor to the monitor flag position. Select the monitor flag in the following table.

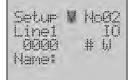
Monitor flag	Meaning
Υ	User Monitor Screen in use
Ν	User Monitor Screen not in use

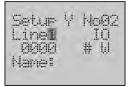
- 7. Press the **Up** button to select the monitor flag **Y**. Then user can monitor this screen after the setting is complete.
- 8. Use the **Forward** button to move the column cursor to the Line No. position. The present setting is Line *1*.
- 9. Use the **Forward** button to move the column cursor to the display type position.

The following table shows the display types which can be selected, including the default address and the setting range for each type.

Setur	М	N	582
Linel			IO
0000		#	h.
Namet			

Setup	卜	582
Line1 0000	#	IO W
Mame:		







D	isplay type	Default address	Range
Word	IO	0000	0000 to 6143
	WR	000	000 to 511
	HR	000	000 to 511
	AR	000	000 to 959
	ТІМ	0000	0000 to 4095
	CNT	0000	0000 to 4095
	DM	00000	00000 to 32767
	DR	00	00 to 15
	IR	00	00 to 15
	ТК	00	00 to 31
	TMF(Timer flag)	0000	0000 to 4095
	CTF(Timer flag)	0000	0000 to 4095
Bit	IOB	0000.00	0000.00 to 6143.15
	WRB	000.00	000.00 to 511.15
	HRB	000.00	000.00 to 511.15
	ARB	000.00	000.00 to 959.15
Text string	STR	-	-

- 10. Press the **Up** button to select **DM**.
- 11. Use the **Forward** button to move the column cursor to the memory address position.

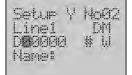
The present setting is the default address.

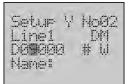
- Move the column cursor to the digit to be set.
   Use the Up button to change the memory address to 09000.
- 13. Use the **Forward** button to move the column cursor to the display format position.

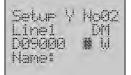
Select the display format in the following table.

Display format	Meaning
#	Hex number
+	Signed decimal number
&	Unsigned decimal number

Setur Y No02 Linel DM D00000 # W Name:







#### Section 8-6



- 14. Press the **Down** or **Up** button to select the display format &.
- 15. Use the **Forward** button to move the column cursor to the data length position. The present setting is **W**.

Select the data length in the following table.

Data length	Meaning
W	One word data
LW	Two word data

- 16. Use the **Forward** button to move the column cursor to the position of Name.
- 17. Use the **Down** or **Up** button to select the character of each digit. Name the word to *Counter*.
- **Note** 1. When selecting the character of the next digit, the leading character will be the character of the digit before.
  - 2. The max length of word or bit name is 7 characters.
- 18. Press the **OK** button to save the setting.
- 19. Press the ESC or OK button to return to the User Monitor Setup Screen.
- 20. Press the **ESC** button three times to return to the Monitor Mode. Switch to the User Monitor Screen 2 with the **Down** button.
- Setting of word or bit name is not necessary. The default name is NULL, and the memory address will be displayed at the name position in the User Monitor Screen.
  - 2. One line setting will take 1 or 2 lines of space. If word or bit name length is more than 5 characters or data length is a LongWord, it will take 2 lines of space.
  - 3. One screen only has 4 lines of space available. If one line setting has already taken 2 lines of space, the next line setting will be invalid. If the setting of line 4 takes 2 lines of space, its setting will be invalid.

[Menu] Mode

10 Memory PLC Setur

.

#### Example 2

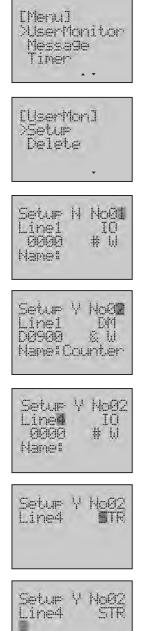
Display a text string "elevator" on the User Monitor Screen 2, Line 4, after the setting in example 1.

1,2,3...

- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **UserMonitor**.
- 3. Press the **OK** button to enter the User Monitor menu.
- 4. Press the **OK** button to enter the User Monitor Setup Screen.
- 5. Use the **Up** button to change the Screen No. to **2**. The setting in example 1 will be displayed.

Name.

- 6. Use the **Forward** button to move the column cursor to the Line No. position. Use the **Up** button to change the Line No. to *4*.
- Use the Forward button to move the column cursor to the display type position.
   Press the Up button to select STR.
- 8. Use the **Forward** button to move the column cursor to the position of String



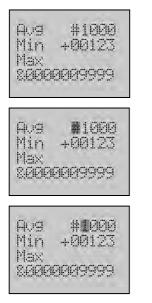
Note

- 1. The default text string is NULL.
  - 2. The max length of text string is 12 characters.

# **Changing User Monitor Screen**

User can not only change the date displayed in the User Monitor Screen in the Setup Mode, but also in the Monitor Mode.

- **Example 1** Change the average to 0100 and the minimum to -00123.
  - 1,2,3...
- 1. Display the User Monitor Screen.

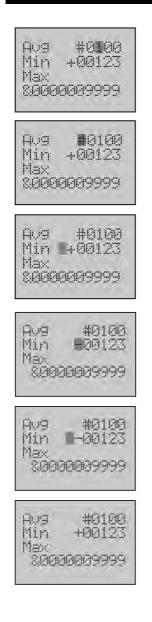


2. Press the **Forward + OK** button simultaneously to enter the Data Change Screen.

The column cursor will be flashing on the digit before the value.

3. Use the Forward button to move the column cursor to the digit to be set.

#### Section 8-6



- 4. Use the **Up** button to change the value to **0100**.
- 5. Press the **OK** button to save the setting. The column cursor will return to the digit before the value.
- 6. Use the **Down** button to move the cursor to line 2.
- **Note** Only when the cursor is on the digit before the value, press the **Down** or **Up** button to b move the cursor to other lines.
- 7. Use the **Forward** button to move the column cursor to the sign position. Press the **Down** or **Up** button to change the sign to -.
- Press the **OK** button to save the setting.
   If the setting is invalid, the screen display will have no change.
- 9. Press the **ESC** button to return to the User Monitor Screen. The average has been changed to 0100, but the minimum is still +00123.

OFF

OFF

I Barris

014

ON

Max

Bitø

Bitø

Max

Bite

Bite

Max

Bitø

800000099999

Max: &00000009999

8.0000009999

Max: 8,0000009999

800000099999

Example 2 C

Change bit0 from OFF to ON.

1*,2,3*...

- 1. Press the **Forward + OK** button simultaneously to enter the Data Change Screen.
- 2. Use the **Down** button to move the cursor to line 2.
- 3. Use the Forward button to move the column cursor to the bit state position.
- 4. Press the **Down** or **Up** button to change the bit state to **ON**.
- Press the **OK** button to save the setting.
   Press the **ESC** button to return to the User Monitor Screen.

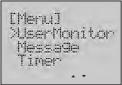
#### **Deleting User Monitor Screen**

Example

Delete the User Monitor Screen 2.

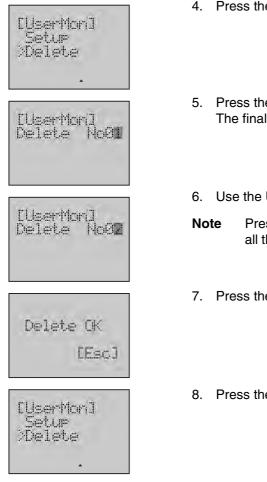
1,2,3...

[Menu] Mode IO Memory PLC Setur





- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **UserMonitor**.
- 3. Press the OK button to enter the User Monitor menu.



- 4. Press the **Down** button to select **Delete**.
- 5. Press the **OK** button to enter the User Monitor Delete Screen. The final digit of the Screen No. will be flashing.
- 6. Use the Up button to change the Screen No. to 2.
- **Note** Press and hold the **UP** button until the Screen No. changes to **ALL**, all the User Monitor Screen will be deleted if the setting is confirmed.
- 7. Press the **OK** button to delete the screen.
- 8. Press the ESC or OK button to return to the previous menu.

### 8-6-9 Message Screen

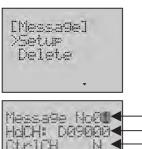
This function can set or delete Message Screen. It is possible to register up to 16 screens. User can monitor the text message in the Message Screen when control bit is ON.

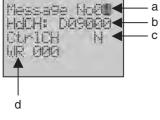
#### Creating New Message Screen

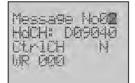
**Example** When control bit W100.01 is ON, the Message Screen 2 will display the data on the word adress D09040 to D09075.

1,2,3...

[Menu] >Mode IO Memory PLC Setup --CMenu] UserMonitor >Message Timer







- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select *Message*.
- 3. Press the OK button to enter the Message menu.
- Press the **OK** button to enter the Message Setup Screen. The final digit of the Screen No. will be flashing. The following table shows the setting items.

No.	Description					
а	Message Screen No. (01 to 16)					
b	Leading word (Only DM) address					
С	Message flag					
d	Word (Only WR) address of control bit					

 Use the Up button to change the Screen No. to 2. The following table shows the relation between the Screen No. and the control bit when the word address is W000.

Screen No.	Control bit
01	W000.00
02	W000.01
03	W000.02
04	W000.03
16	W000.15

Messa9e No02 HdCH: D <b>0</b> 9040 Ctr1CH N WR 000	6.	Use the <b>Forward</b> button to move the column cursor to the position of leading word address. The present setting is the default address. The following table shows the default address and the setting range for each screen when the leading word address is D09000.								
		Screen No.	Default address	Range						
		01	09000 to 09035							
		02	09040 to 09075							
		03	09080 to 09115	00000 to 32732						
		04	09120 to 09155							
		16	09600 to 09635							
Message No02	7.		n to move the column cursor to flag in the following table.	the message flag position.						
HdCH: D09040 CtrlCH N		Message flag	Meanir	ıg						
WR 999		Y	Message Screen in use							
		Ν	Message Screen not in use							
Message No82 HdCH: D09040 Ctr1CH <b>B</b> UR 000	8.		to select the message flag <b>Y</b> . ble for all the screens.							
Messa9e No02 HdCH: D09040 CtrICH Y WR <b>0</b> 00	9.	Use the <b>Forward</b> button to move the column cursor to the position of word address. The present setting is the default address. The range of the address is 000 to 511.								
Message No82 HdCH: D09040 CtrICH Y WR 100	10.	Use the <b>Up</b> button to	o change the word address to	100.						
Set OK [Esc]	11.	Press the <b>OK</b> button	to save the setting.							
Messa9e No8 <b>2</b> HdCH: D09040 CtrICH Y WR 100	12.	Press the <b>ESC</b> or <b>O</b>	<b>&lt;</b> button to return to the Mess	sage Setup Screen.						
Elevator Stop at IF	13.		n three times to return to the ge Screen 2 when control bit							

### **DM Area Settings**

The text message is stored in the DM area. One character is 1 byte and one DM word is 2 bytes, so 24 DM words need to be used to store one screen message. But not all of the area can be used.

The following table shows the setting area for each screen when the leading word address is D09000..

Screen No.	Word	0		1		2		3		4		5		6	7	8	9
01	D09000	1	2	3	4	5	6	7	8	9	10	11	12				
	D09010	13	14	15	16	17	18	19	20	21	22	23	24				
	D09020	25	26	27	28	29	30	31	32	33	34	35	36				
	D09030	37	38	39	40	41	42	43	44	45	46	47	48				
02	D09040	1	2	3	4	5	6	7	8	9	10	11	12				
	D09050	13	14	15	16	17	18	19	20	21	22	23	24				
	D09060	25	26	27	28	29	30	31	32	33	34	35	36		Do no	t use.	
	D09070	37	38	39	40	41	42	43	44	45	46	47	48				
16	D09600	1	2	3	4	5	6	7	8	9	10	11	12				
	D09610	13	14	15	16	17	18	19	20	21	22	23	24				
	D09620	25	26	27	28	29	30	31	32	33	34	35	36				
	D09630	37	38	39	40	41	42	43	44	45	46	47	48				

In this example, "Elevator Stop at 1F" is displayed on the Message Screen 2.

The data can be set in the DM area with the CX-Programmer.
The settings show as below.

Line No.	Word	Setting	Cha	aracter
1	D09040	2020		
	D09041	2020		
	D09042	2020		
	D09043	2020		
	D09044	2020		
	D09045	2020		
2	D09050	456C	E	I
	D09051	6576	е	v
	D09052	6174	а	t
	D09053	6F72	0	r
	D09054	2020		
	D09055	2020		
3	D09060	2053		S
	D09061	746F	t	0
	D09062	7020	р	
	D09063	6174	а	t
	D09064	2031		1
	D09065	4620	F	
4	D09070	2020		
	D09071	2020		
	D09072	2020		
	D09073	2020		
	D09074	2020		
	D09075	2020		

# Section 8-6

Upper Lower bits bits	1	2	3	4	5	6	7	8	9	Α	В	С	D	Е	F
0			<u>.</u>		\$**** } *****	•••	;,	;	20100 2000 20000		•••••		 ,	: 	<u>ب</u>
1		•	•••••			•••••	•;		 	:::	••••• •••	<b></b>	;		<b>.</b> 4
2		::	····· ····			į;	•••••	;		:	••••	•••			<u>;;;</u> ;
3	•	#	••••••	;***. ; 	2.000 2.000 2.000	:	••••	ند :			:**: 	••••	•••••	••••••	***
4		. <b>:</b> :-	ų	<b>.</b>	•••••	:	<b>†</b>		::	••		••	<b>†</b> .,	į	2 <sup></sup> 2
5	÷	**.• •**#	:				ŧ;			*	•••••• ••••	••••	•••		
6	··· •		;;		••	<b>.</b>	÷.,.;	::: •::::		••••	<u>†</u>	••••	 		50000 20000
7	÷			;		;;	<b>!</b> !	:	÷	••••• •*•		••••	•••	;;	π
8				<b>.</b>	₹ 2***2		••••	2.23 23	:;	.:		••••• ••••		•••	••••
9	::		·	••••	·	•••••	••	;	:	:	• <sup>1</sup>		; į.,	• :	3
A	<b>:</b> •	:‡:	**	•	•••• •••	••	••••••• •••••				•••••	•••	į	••••••••••••••••••••••••••••••••••••••	
В	<b>8</b>	•••••	# ;				•	•••	<b>:</b> ‡.		<b>†</b> ‡			*	<b>.</b>
с	•••••	:	••••			•••••		2		÷.,		••••	•••••	÷‡•	<u>.</u>
D		•••••	•••••		••••	<b>;</b> •;		<b>.</b>	·		••••	••••	•• ••• <sup>\$</sup>	••••	•••••
E	*		•••	<b>.</b>	••••	:":	•••••	;;					•••		
F			••••••		•••••	::	- <b>;-</b>	::: ::		:::	*. ; *	••••	:::	::	

Select the character codes in the following table.

# **Deleting Message Screen**

\*

Example	Delete the Message Screen 1.
1,2,3 Menu] Mode IO Memory FLC Setup	1. Switch to the Setup Mode.
[Menu] UserMonitor MessaJe Timer	2. Press the <b>Down</b> button to select <i>Message</i> .
[Message] >Setup Delete	3. Press the <b>OK</b> button to enter the Message menu.
[Messa9e] Setup >Delete	4. Press the <b>Down</b> button to select <b>Delete</b> .
[Message]	<ol> <li>Press the <b>OK</b> button to enter the Message Delete Screen.</li> <li>The present setting is Screen <i>01</i>.</li> </ol>
Delete No81	<b>Note</b> Press and hold the <b>UP</b> button until the Screen No. changes to <b>ALL</b> , all the User Monitor Screen will be deleted if the setting is confirmed.
Delete OK EESCl	6. Press the <b>OK</b> button to delete the screen.
[Messa9e] Setup >Delete	7. Press the <b>ESC</b> or <b>OK</b> button to return to the previous menu.

### 8-6-10 Timer Switch

There are 3 kinds of timer, including Day, Weekly and Calendar Timer. It is possible to register up to 16 timers for each kind.

Туре	Description
Day timer	Sometime in a day, set the related control bit to ON.
Weekly timer	Sometime in a week, set the related control bit to ON.
Calendar timer	Sometime in a year, set the related control bit to ON.

#### Setting Day Timer

#### Example

8:30 to 17:15 from Monday to Friday, control bit W509.15 is ON.

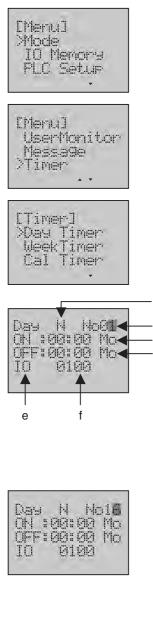
1,2,3...

а

b

С

d



- 1. Switch to the Setup Mode.
- 2. Press the Down button to select Timer.
- 3. Press the **OK** button to enter the Timer Switch menu.
- 4. Press the **OK** button to enter the Day Timer Screen. The final digit of the Timer No. will be flashing. The following table shows the setting items.

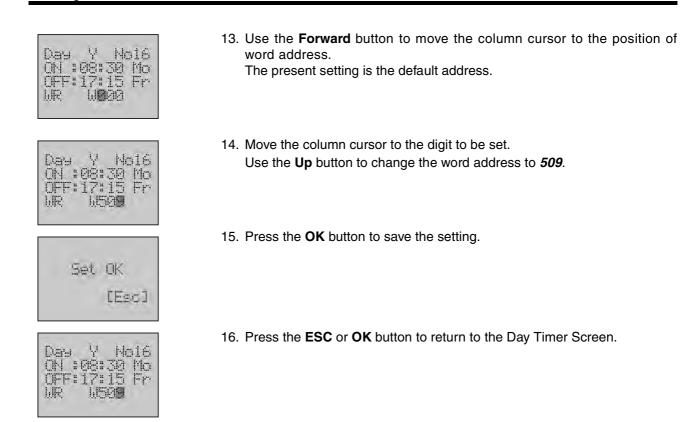
No.	Description			
а	imer flag			
b	imer No. (01 to 16)			
с	ON time of PLC			
d	OFF time of PLC			
е	Word type			
f	Word address			

 Use the Up button to change the Timer No. to 16. The following table shows the relation between the Timer No. and the control bit when the word address is W001.

Timer No.	Control bit
01	W001.00
02	W001.01
03	W001.02
04	W001.03
16	W001.15

Day № No16 <u>CN :00:00</u> Мо	6.	Use the <b>Forward</b> b Press the <b>Up</b> butto Select the timer fla	on to select the ti	mer flag <b>Y</b> .	e timer flag position.			
0FF:00:00 Mo 10 0100		Timer	lag	Mean	ing			
		Υ	Т	imer in use				
		Ν	Т	imer not in use				
Day Y No16 ON :08:30 Mo OFF:00:00 Mo IO 0100	7.	Use the <b>Forward</b> button to move the column cursor to the ON time position. Use the <b>Up</b> button to change time to <i>08:30</i> .						
Daw Y Noié CN :08:30 Ma OFF:09:00 Ma IO 0100	8.	Use the <b>Forward</b> tion. The present settin		ne column cursor to	the ON week posi-			
Day Y Hol6 ON :08:30 Mo OFF:17:18 Mo IO 0100	9.	Use the <b>Forward</b> button to move the column cursor to the OFF time position. Use the <b>Up</b> button to change time to <i>17:15</i> .						
Day Y Nol6 ON :08:30 Mo OFF:17:15 Fe IO 0100	10.	<ul> <li>Use the Forward button to move the column cursor to the OFF week position.</li> <li>Press the Down or Up button to select <i>Friday</i>.</li> </ul>						
Day Y Noi6 ON :08:30 Mo OFF:17:15 Fr 10 0100	11.	Use the <b>Forward</b> button to move the column cursor to the position of con- trol bit.						
Day Y Nol6 ON :08:30 Mo OFF:17:15 Fr	12.	the default addres	e shows the word s and the setting	range for each type	selected, including			
UR WOOD		Timer	Word	Default address	Range			
		All	10	0100	0100 to 6143			

Timer	Word	Default address	Range
All	Ю	0100	0100 to 6143
Day timer	WR	001	001 to 511
Weekly timer	WR	002	002 to 511
Calender timer	WR	003	003 to 511
All	HR	000	000 to 511
All	AR	448	448 to 959



### Setting Calendar Timer

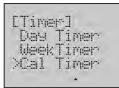
1,2,3...

**Example** From 1<sup>st</sup> June to 1<sup>st</sup> October, control bit H209.05 is ON.

# [Menu] Mode IO Memory PLC Setur







- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select *Timer*.
- 3. Press the **OK** button to enter the Timer menu.
- 4. Press the **Down** button to select *Cal Timer*.

Cal N No0I b	5.	Press the <b>OK</b> button to enter the Calendar Timer Screen. The final digit of the Timer No. will be flashing. The following table shows the setting items.	
CN : 00/00 < c OFF: 00/00 d d		No. Description	
IO 8888		a Timer flag	
		b Timer No. (01 to 16)	
e f		c ON date of PLC	
		d OFF date of PLC	
		e Word type	
		f Word address	
Cal N No06 CN : 01/01 CFF: 01/01 10 0100	6.	Use the <b>Up</b> button to change the Timer No. to <b>6</b> .	
Cal V No06 CN : 01/01 OFF: 01/01 IO 0100	7.	Use the <b>Forward</b> button to move the column cursor to the timer flag tion. Press the <b>Up</b> button to select the timer flag <b>Y</b> .	j posi-
Cal V No06 CN : 05/01 CFF: 01/01 IO 0100	8.	Use the <b>Forward</b> button to move the column cursor to the ON date pos Use the <b>Up</b> button to change the date to <b>06/01</b> .	ition.
Cal Y Ho06 CN : 06/01 CFF: 10/01 IO 0100	9.	Use the <b>Forward</b> button to move the column cursor to the OFF date tion. Use the <b>Up</b> button to change the date to <i>10/01</i> .	) posi-
Cal Y No06 CN : 06-/81 OFF: 10/81 MR H000	10.	Use the <b>Forward</b> button to move the column cursor to the position of trol bit. Press the <b>Up</b> button to select <i>HR</i> .	of con-
Cal Y No06 CN: 06/01 CFF: 10/01 HR H <b>0</b> 00	11.	Use the <b>Forward</b> button to move the column cursor to the position o address. The present setting is default address.	f word
Cal Y Ho06 CN : 06/01 CFF: 10/01 HR H20 <b>9</b>	12.	Move the column cursor to the digit to be set. Use the <b>Up</b> button to change the word address to <i>209</i> .	



- 13. Press the **OK** button to save the setting.
- 14. Press the **ESC** or **OK** button to return to the Calander Timer Screen.
- Note
- If a timer is in use, when the timer switch turns ON, the LCD Option Board will send command to PLC one time every 1 second to make control bit ON, when the timer switch turns OFF, the LCD Option Board will send command to PLC one time every 1 second to make control bit OFF.
  - 2. Move the LCD Option Board from one PLC to another, the result of timer operation will be different if the time of two PLCs is not the same.

#### **Timing Curve**

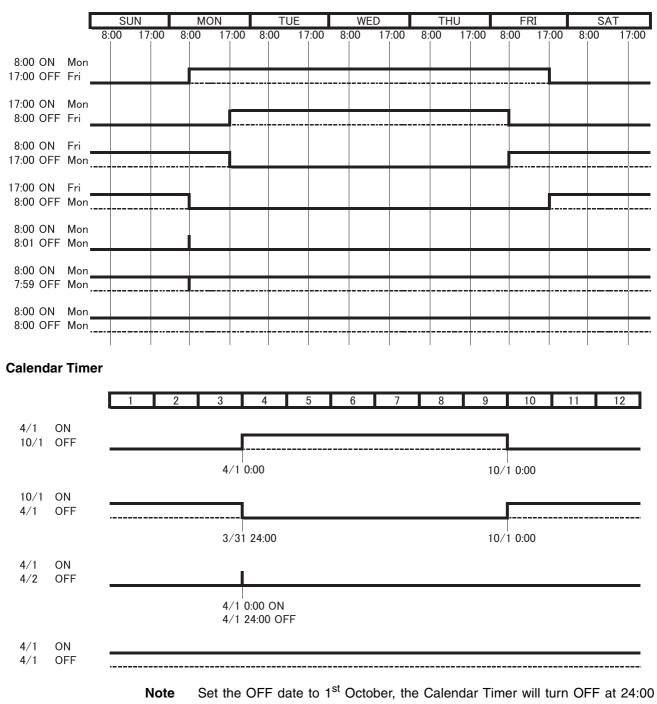
Each timer can execute a trans-day, trans-week or trans-year operation. The operation period will be shown in the following curve.

	S	UN	M	DN	TU	E	WE	D	TH	U	FF	रा	SA	Т
	8:00	17:00	8:00	17:00	8:00	17:00		17:00	8:00		8:00		8:00	17:00
8:00 ON Mon 17:00 OFF Fri									_	_	_			
17:00 ON Mon 8:00 OFF Fri				_		_						_		
8:00 ON Mon 17:00 OFF Mon						_					_			
17:00 ON Mon 8:00 OFF Mon				_										
8:00 ON Mon 8:01 OFF Mon														
8:00 ON Mon 7:59 OFF Mon			8:00 8:01											
8:00 ON Mon 8:00 OFF Mon			8:00		7:59									
8:00 ON Mon 8:00 OFF Sun			8:00		8:00									

#### **Day Timer**

#### Section 8-6

#### **Weekly Timer**



<sup>31&</sup>lt;sup>st</sup> September.

### 8-6-11 Data Backup

User can save the user settings to DM memory area from one LCD Option Board and load to other LCD Option Boards from the DM memory area.

Note Please do not take the DM area (D8000 to D8999) for other use.

User settings which can be backed up as shown below.

U	Quantity				
User Monitor screen	16 screens				
Message screen		16 screens			
Timer Switch		16 × 3 timers			
	Language	1			
Other	Backlight	1			
	Contrast	1			

### Loading User Setting

Example

Load user settings from DM memory area.

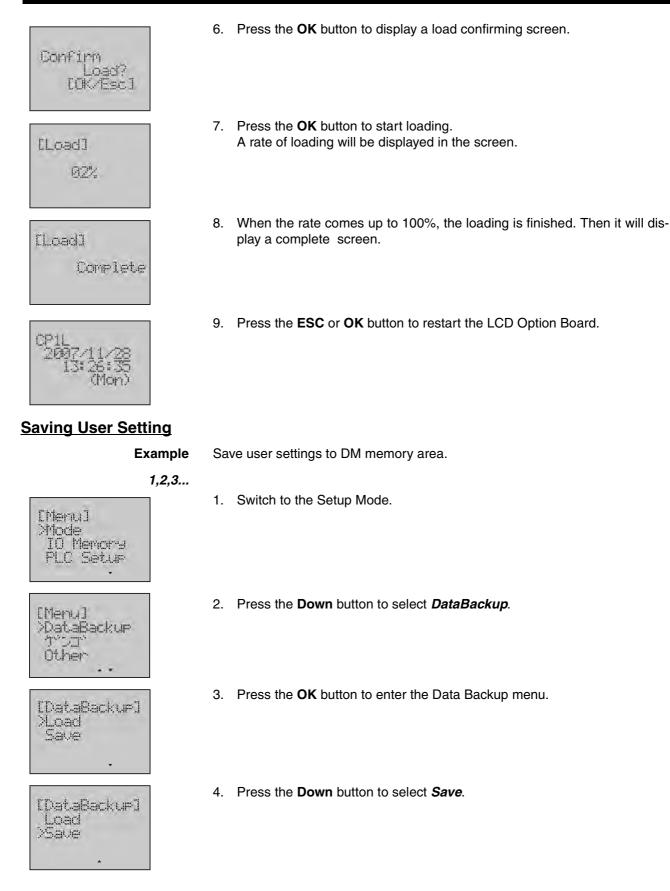
1*,2,3*...

	1,2
[Menu] Mode IO Memory PLC Setup	
[Menu] >DataBackur 1773 Other	3
[DataBackur >Load Save	5
[Load] >Cancel OK (A)	
ELoad] Cancel XXX (A)	y men

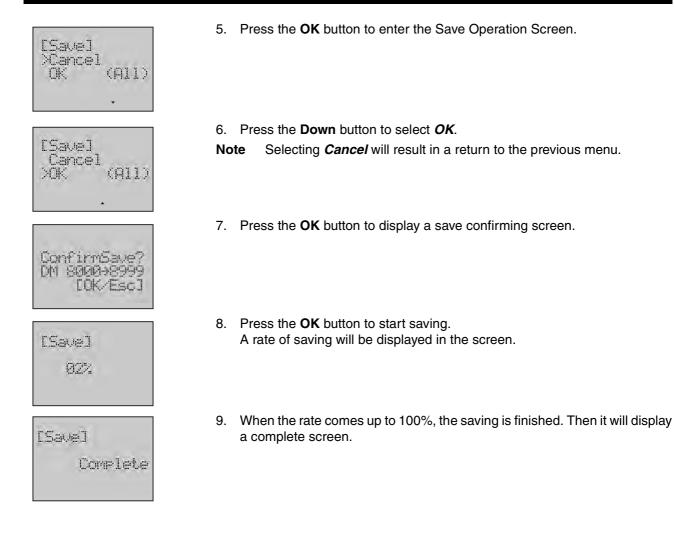
- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **DataBackup**.
- 3. Press the **OK** button to enter the Data Backup menu.
- 4. Press the **OK** button to enter the Load Operation Screen. Select the operation mode in the following table.

Operation Mode	Meaning
Load	Load user setting from DM area
Save	Save user setting into DM area

- 5. Press the **Down** button to select **OK**.
- Note Selecting *Cancel* will result in a return to the previous menu.



#### Section 8-6



### 8-6-12 Language Selection

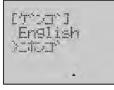
Display for the LCD Option Board is available in 2 languages - English and Japanese.

**Example** Change the display language from English to Japanese.

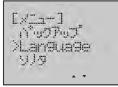
#### 1,2,3...

- [Menu] Mode IO Memory FLC Satur
- [Menu] DataBackup >Trog Other









- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select ゲンゴ.
- 3. Press the **OK** button to enter the Language Setup Screen. The present language is English.
- 4. Press the **Down** button to select ニホンゴ.
- 5. Press the **OK** button to save the setting.
- 6. Press the **ESC** or **OK** button return to the previous menu. The display language will change to Japanese.

# 8-6-13 PLC Cycle Time

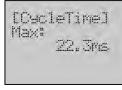
This function can display the cycle time of the CPU Unit. The operation method will be shown in the following example.

### 1,2,3...

## [Menu] Mode IO Memory PLC Setur L DetaBeckup Strong Other



[CycleTime] Avg: 1.5ms



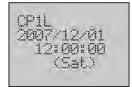
ICycleTime] Min: 0.5ms

- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **Other**.
- 3. Press the **OK** button to enter the Other menu.
- 4. Press the **OK** button to enter the Cycle Time Screen. The average cycle time of the CPU Unit will be displayed.
- 5. Press the **Down** button to display the max. cycle time of the CPU Unit.
- 6. Press the **Down** button to display the min. cycle time of the CPU Unit.

SystemInfo

# 8-6-14 PLC Clock Setting

This function can change the setting of the built-in clock in the CPU Unit. Example Change PLC time to 12:00:00, PLC week to Saturday. 1,2,3... 1. Switch to the Setup Mode. [Merau] Mode 10 Memory PLC Satur 2. Press the Down button to select Other. [Menu] DataBackup YT JT Other 3. Press the **OK** button to enter the Other menu. [Other] >CycleTime \_ClockSet SystemInfo -4. Press the Down button to select ClockSet. [Other] ČycleŤime >ClockSet SystemInfo . . 5. Press the **OK** button to enter the Clock Setup Screen. [ClockSet] 2007/12/01 12:05:30 The present date, time and week of the CPU Unit will be displayed. (Mon) 6. Use the Forward button to move the column cursor to the position of PLC IClockSet] 2007/12/01 12:00:00 time. Use the **Down** or **Up** button to change the time to 12:00:00. (Mon) 7. Use the Forward button to move the column cursor to the position of PLC [ClockSet] 2007/12/01 12:00:00 week. Use the Down or Up button to select Sat. (Sat) 8. Press the **OK** button to save the setting. Set OK [Esc] 9. Press the ESC or OK button to return to the previous menu. [Other] CycleTime >ClockSet



# 8-6-15 PLC System Information

This function can display the system information of the CPU Unit. The operation method will be shown in the following example.

10. Press the ESC button to return to the Monitor Mode.

1,2,0
-------

- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **Other**.
- 3. Press the **OK** button to enter the Other menu.
- 4. Press the Down button to select SystemInfo.
- 5. Press the **OK** button to enter the System Information Screen. Line 1 to 3 will display the CPU Unit model, line 4 the lot No.
- 6. Press the **Down** button to display the CPU Unit version.



[Memu] Mode

[Menu]

Strict Other

[Other]

OFF

10 Memory PLC Setur

DataBackup

# 8-6-16 LCD Backlight Setting

This function can make a setting for the LCD backlight.

Example The backlight turns off after LCD has not been used for 5 minutes.



- 1. Switch to the Setup Mode.
- 2. Press the Down button to select Other.
- 3. Press the **OK** button to enter the Other menu.
- kLight.
- klight Screen. items.

No.	Description		Meaning
а	Timer interval		The range is 02 to 30 minutes.
b Backlight mode		Timer	Backlight will turn OFF if LCD has not been used for the timer interval.
	ON	Backlight is always ON.	
	OFF	Backlight is always OFF.	

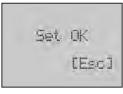
6. Use the Forward button to move the column cursor to the position of timer inerval.

Use the Up button to change the timer interval to 05.

- 7. Press the OK button to save the setting.
- 8. Press the ESC or OK button to return to the previous menu.

ClockSet SustemInfo				
[Other] >BackLight. Contrast FactorySet.	4.	Press the	<b>Down</b> button to select <b>Bac</b>	k
rc	5.		e <b>OK</b> button to enter the Back wing table shows the setting	-
IBackLight] >Timer]02min— a		No.	Description	
DN b		а	Timer interval	•







# 8-6-17 LCD Contrast Setting

This function can make a setting for the LCD contrast.

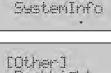
**Example** Change the contrast of LCD display to 8.

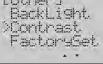
## 1,2,3...

[Menu] Mode IO Memory PLC Setup . . . .

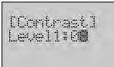
Other] CycleTime ClockSet

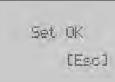
T





[Contrast] Level1:0**1** 







- 1. Switch to the Setup Mode.
- 2. Press the **Down** button to select **Other**.
- 3. Press the **OK** button to enter the Other menu.
- 4. Press the **Down** button to select **Contrast**.
- 5. Press the **OK** button to enter the Contrast Screen. The contrast level of LCD display is 1 to 16.
- 6. Use the **Up** button to change the level to **08**.
- 7. Press the **OK** button to save the setting.
- 8. Press the ESC or OK button to return to the previous menu.

# 8-6-18 LCD Factory Setting

This function can initialize the factory setting of the LCD Option Board. The operation method will be shown in the following example.

1,2,3... 1. Switch to the Setup Mode. [Merau] Mode 10 Memory PLC Setur 2. Press the **Down** button to select **Other**. [Menu] DataBackup Strict Other . 3. Press the **OK** button to enter the Other menu. [Other] >CycleTime ClockSet SystemInfo . 4. Press the Down button to select FactorySet. [Other] BackLight Contrast >FactorySet 5. Press the **OK** button to enter the Factory Setting Screen. [FactorySet] >Cancel 0K • 6. Press the Down button to select OK. [FactorsSet] Note Selecting *Cancel* will result in a return to the previous menu. Cancel XOK . 7. Press the OK button to start initializing. Initializing 9649 8. When the initializing is finished, it will display a complete screen. Finish to initialize [Esc] 9. Press the ESC or OK button to restart the LCD Option Board. (Mon)

# 8-7 Trouble Shooting

# 8-7-1 Symptom at Power ON or during Operation

Symptom	Probable cause	Possible solution
No LCD display	LCD connection error or no power supply from PLC.	Check if LCD is connected correctly and the PLC power supply is normal.
	Still in startup waiting time.	It's not error. Just wait a moment.
Display EEPROM Error	EEPROM is damaged.	Replace the LCD Option Board.
Screen and blinking red back- light	User settings in EEPROM are corrupted.	Press the ESC button to exit the screen. User settings backed up in EEPROM will be replaced by default settings. Then proceed to reset the screens. (See 8-7-3 for details.)
Display NG Screen	LCD connection error.	Check if LCD is connected correctly.
	Communication error between LCD and PLC.	Check the communication setting of PLC, switching DipSW4 to ON.
Display Error Screen and blinking red backlight	PLC error	Check PLC according to error code and eliminate the error.
Button unresponsing	Button is damaged.	Replace the LCD Option Board.
	User setting error. (See 8-7-4 for details.)	Check the settings and change it.
	Noise disturbing.	Retry after the noise is reduced.
Display too faint	Backlight is damaged.	Replace the LCD Option Board.
	Contrast level is too low or too high.	Reset the contrast level.

**Note** Do not repair the LCD Option Board by yourself.

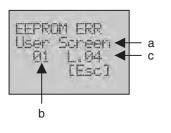
## 8-7-2 Communication Error Message during Operation

When communication error occurs, the error message will be displayed at the LCD Option Board and the red backlight will blink.

Error message	Probable cause	Possible solution
Parity Error or Framing Error or Overrun Error	Communication parameters or conditions of PLC are changed.	Check the communication setting of PLC.
	LCD connection error.	Check if LCD is still connected correctly.
	Noise disturbing.	<ul> <li>Return to normal automatically when the noise is reduced.</li> </ul>
		<ul> <li>If the display cannot return to normal, press the ESC button to restart LCD.</li> </ul>
FCS Error(Sum check)	Noise disturbing.	<ul> <li>Return to normal automatically when the noise is reduced.</li> </ul>
		<ul> <li>If the display cannot return to normal, press the ESC button to restart LCD.</li> </ul>
Buffer overflow	The length of receiving data is beyond the range of receiving memory.	Press the ESC button to restart LCD.
	Noise disturbing.	
Connecting Host	LCD connection error.	Check if LCD is still connected correctly.
	The communication between PLC and LCD is out of service.	Check if PLC is running normally.
Response code Error	Operation mistake.	Refer to CJ/CS Communication Manual for solutions according to an end code.
	Noise disturbing.	<ul> <li>Return to normal automatically if the noise is reduced.</li> </ul>
		• Press the ESC button to exit the screen.
	CX-Programmer and LCD execute some	Press the ESC button to exit the screen.
	function at the same time.	Execute this function by either CX-Pro- grammer or LCD.

# 8-7-3 Deleting EEPROM Error

1,2,3...

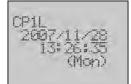


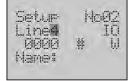
1. A flashing error screen will be displayed when an error occurs. The following table shows the display items.

No.	Description	
а	Error type	User Monitor setting error
		Message setting error
		Timer Switch setting error
		Language setting error
		Backlight setting error
		Contrast setting error
b	Screen No.	
С	Line No.	

According to the error message, the setting of User Monitor Screen 2, line 4 is corrupted.

- 2. Press the **ESC** button to exit the screen. Once the EEPROM Error Screen has disappeared, the display will return to normal.
- Enter the User Monitor Setup Screen 2, line 4. User settings backed up in EEPROM are replaced by default settings. Then reset the screen.





# SECTION 9 Program Transfer, Trial Operation, and Debugging

This section describes the processes used to transfer the program to the CPU Unit and the functions that can be used to test and debug the program.

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9-2	Trial Op	eration and Debugging	552
	9-2-1	Forced Set/Reset	552
	9-2-2	Differential Monitoring.	553
	9-2-3	Online Editing	554
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# 9-1 Program Transfer

The CX-Programmer is used to transfer the programs, PLC Setup, I/O memory data, and I/O comments to the CPU Unit with the CPU Unit in PROGRAM mode. The following procedure is used.

- *1,2,3...* 1. Select *PLC Transfer To PLC.* The Download Options Dialog Box will be displayed.
  - 2. Specify the items to transfer.
  - 3. Click the **OK** Button.
  - **Note** The program data on a Memory Cassette can be automatic transferred when the power is turned ON.

# 9-2 Trial Operation and Debugging

## 9-2-1 Forced Set/Reset

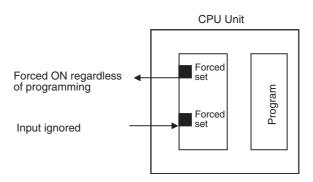
The CX-Programmer can force-set (ON) or reset (OFF) specified bits in the CIO Area, Auxiliary Area, and HR Area, as well as timer/counter Completion Flags. Forced status will take priority over status output from the program or I/O refreshing. This status cannot be overwritten by instructions, and will be stored regardless of the status of the program or external inputs until it is cleared from the CX-Programmer.

Force-set/reset operations are used to force input and output during a trial operation or to force certain conditions during debugging.

Force-set/reset operations can be executed in either MONITOR or PRO-GRAM modes, but not in RUN mode.

**Note** Turn ON the Forced Status Hold Bit (A500.13) and the IOM Hold Bit (A500.12) at the same time to retain the status of bits that have been force-set or reset when switching the operating mode.

Turn ON the Forced Status Hold Bit (A500.13) and the IOM Hold Bit (A500.12), and set the Forced Status Hold Bit at Startup parameter in the PLC Setup to retain the status of the Forced Status Hold Bit hold to retain the status of bits that have been force-set or reset when turning OFF the power.



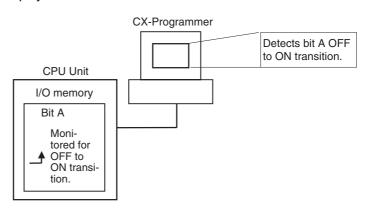
The following areas can be force-set and reset: CIO Area, Work Area, Timer Completion Flags, HR Area, Counter Completion Flags.

#### **CX-Programmer Operation**

- Selecting bits for forced setting/resetting
- Selecting forced set or forced reset status
- Clearing forced status (also clearing all forced status at the same time)

# 9-2-2 Differential Monitoring

When the CPU Unit detects that a bit set by the CX-Programmer has changed from OFF to ON or from ON to OFF, the results are indicated in the Differentiate Monitor Completed Flag (A508.09). The Flag will turn ON when conditions set for the differential monitor have been met. The CX-Programmer can monitor and display these results on screen.



### **CX-Programmer Operation**

- 1,2,3... 1. Right-click the bit for differential monitoring.
  - 2. Click *Differential Monitor* from the PLC Menu. The Differential Monitor Dialog Box will be displayed.
  - 3. Click *Rising* or *Falling*.
  - 4. Click the **Start** Button. The buzzer will sound when the specified change is detected and the count will be incremented.
  - 5. Click the Stop Button. Differential monitoring will stop.

### **Related Auxiliary Bits/Words**

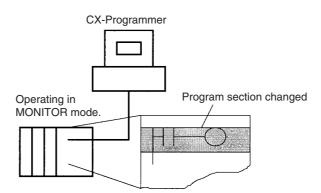
Name	Address	Description
Differentiate Monitor Completed Flag	A508.09	Turns ON when the differential monitoring condition has been met dur- ing differential monitoring.
		Note: The flag will be cleared when differential monitoring is started.

## 9-2-3 Online Editing

The Online Editing function is used to add to or change part of a program in a CPU Unit directly from the CX-Programmer when the CPU Unit is in MONI-TOR or PROGRAM mode. This function is designed for minor program changes without stopping the CPU Unit.

Online editing is possible simultaneously from more than one computer running the CX-Programmer as long as different tasks are edited.

**Online Editing** 



The cycle time will be increased by from one to several cycle times if the program in the CPU Unit is edited online in MONITOR mode. The cycle time will also be increased to back up data in the flash memory after online editing. The BKUP indicator will be lit during this period and the progress of the backup will be displayed on the CX-Programmer. The increases per cycle are listed in the following table.

CPU Unit	Increase in cycle time	
	Online editing	Backup to flash memory
CP1L CPU Units	16 ms max.	4% of cycle time

There is a limit to the number of edits that can be made consecutively. The actual number depends on the type of editing that is performed, but 40 edits should be used as a guideline. A message will be displayed on the CX-Programmer if the limit is exceeded, and further editing will not be possible until the CPU Unit has completed backing up the data.

The length of time that the cycle time is extended due to online editing is almost unaffected by the size of the task program being edited.

- PrecautionsThe cycle time will be longer than normal when a program is overwritten using<br/>Online Editing in MONITOR mode, so make sure that the amount of time that<br/>it is extended will not exceed the cycle monitoring time set in the PLC Setup. If<br/>it does exceed the monitoring time, then a Cycle Time Over error will occur,<br/>and the CPU Unit will stop. Restart the CPU Unit by selecting PROGRAM<br/>mode first before changing to RUN or MONITOR mode.
  - **Note** If the task being edited online contains a block program, then previous execution information, such as Standby (WAIT) or Pause status, will be cleared by online editing, and the next execution will be from the beginning.

#### **Online Editing from the CX-Programmer**

- *1,2,3...* 1. Display the program section that will be edited.
  - 2. Select the instructions to be edited.
  - 3. Select *Program Online Edit Begin.*

- 4. Edit the instructions.
- 5. Select *Program Online Edit Send Changes* The instructions will be check and, if there are no errors, they will be transferred to the CPU Unit. The instructions in the CPU Unit will be overwritten and cycle time will be increased at this time.
- Caution Proceed with Online Editing only after verifying that the extended cycle time will not adversely affect operation. Input signals may not be read if the cycle time is too long.

#### **Temporarily Disabling Online Editing**

It is possible to disable online editing for specific cycles to ensure response characteristics for machine control in those cycles. Online editing from the CX-Programmer will be disabled for those cycles and any requests for online editing received during those cycles will be held online editing is enables.

Online editing is disabled by setting the Online Editing Disable Bit Validator (A527.00 to A527.07) to 5A and then turning ON the Online Editing Disable Bit (A527.09). When these settings have been made and a request for online editing is received, online editing will be put on standby and the Online Editing Wait Flag (A201.10) will be turned ON.

When the Online Editing Disable Bit (A527.09) is turned OFF, online editing will be performed, the Online Editing Processing Flag (A201.11) will turn ON, and the Online Editing Wait Flag (A201.10) will turn OFF. When online editing has been completed, the Online Editing Processing Flag (A201.11) will turn OFF.

Online editing can also be temporarily disabled by turning ON the Online Editing Disable Bit (A527.09) while online editing is being performed. Here too, the Online Editing Wait Flag (A201.10) will turn ON.

If a second request for online editing is received while the first request is on standby, the second request will not be recorded and an error will occur.

Online editing can also be disabled to prevent accidental online editing. As described above, disable online editing by setting the Online Editing Disable Bit Validator (A527.00 to A527.07) to 5A and turning ON the Online Editing Disable Bit (A527.09).

#### Enabling Online Editing from the CX-Programmer

When online editing cannot be enabled from the program, it can be enabled from the CX-Programmer. If operations continue with online editing in standby status, CX-Programmer may go offline. If this occurs, reconnect the computer to the CPU Unit and turn OFF the Online Edit Disable Bit (A527.09).

**Note** When using automatic transfer from a Memory Cassette at startup, be sure to transfer the data to the Memory Cassette if any changes are made using online editing. If power is turned OFF before the changes are transferred, the data from before online editing was performed will be read from the Memory Cassette.

Name	Address	Description
Online Edit Disable Bit Validator	A527.00 to	Enables using the Online Edit Disable Bit (A527.09).
	A527.07	Not 5A: Online Edit Disable Bit disabled. 5A: Online Edit Disable Bit enabled.
Online Edit Disable Bit	A527.09	To disable online editing, set the Online Edit Disable Bit Validator (A527.00 to A527.07) to 5A and turn ON this bit ON.

#### **Related Auxiliary Bits/Words**

## Trial Operation and Debugging

### Section 9-2

Name	Address	Description
Online Editing Wait Flag	A201.10	ON while an online editing process is on standby because online editing is disabled.
Online Editing Processing Flag	A201.11	ON while an online editing process is being executed.

## 9-2-4 Tracing Data

The Data Trace function samples specified I/O memory data using any one of the following timing methods. It stores the sampled data in Trace Memory, where they can be read and checked later from the CX-Programmer.

- Specified sampling time (10 to 2,550 ms in 10-ms units)
- One sample per cycle
- When the TRACE MEMORY SAMPLING instruction (TRSM(045)) is executed

Up to 31 bits and 6 words in I/O memory can be specified for sampling.

### **Basic Procedure**

- *1,2,3...* 1. Sampling will start when the parameters have been set from the CX-Programmer and the command to start tracing has been executed.
  - 2. Sampled data (after step 1 above) will be traced when the trace trigger condition is met, and the data just after the delay (see note 1) will be stored in Trace Memory.
  - 3. Memory data will be sampled until the Trace Memory is full, and then the trace will be ended.
  - **Note** Delay value: Specifies how many sampling periods to offset the sampling in Trace Memory from when the trace condition is met. The setting ranges are shown in the following table.

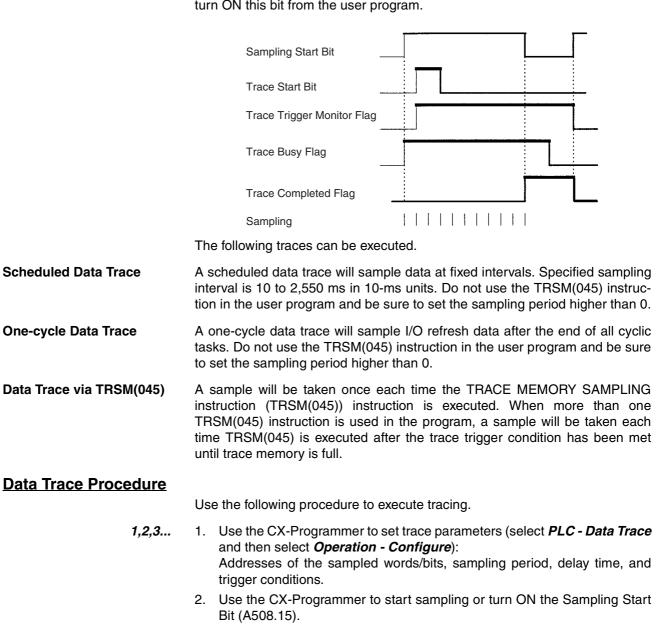
No. of words sampled	Setting range
0	-1999 to 2000
1	–1332 to 1333
2	–999 to 1000
3	–799 to 800
4	–665 to 666
5	–570 to 571
6	–499 to 500

Positive delay: Store data delayed by the set delay.

Negative delay: Store previous data according go to the set delay.

**Example:** Sampling at 10 ms with a -30 ms delay time yields  $-30 \times 10 = 300$  ms, so data 300 ms before the trigger will be stored.

#### Trial Operation and Debugging



**Note** Use the CX-Programmer to turn ON the Sampling Start Bit (A508.15). Never turn ON this bit from the user program.

- Put the trace trigger condition into effect.
   End tracing.
- 5. Use CX-Programmer to read the trace data.
  - a) Select *Data Trace* from the PLC Menu.
  - b) Select *Select* from the Operation Menu.
  - c) Select *Execute* from the Operation Menu.
  - d) Select *Read* from the Operation Menu.

# Trial Operation and Debugging

## **Related Auxiliary Bits/Words**

Name	Address	Description
Sampling Start Bit	A508.15	Use the CX-Programmer to turn ON this bit to start sampling. This bit must be turned ON from the CX-Programmer. Do not turn this bit ON and OFF from the user program.
		Note: The bit will be turned OFF when the Data Trace has been completed.
Trace Start Bit	A508.14	When this bit is turned ON, the trace trigger will be monitored and sampled data will be stored in Trace Memory when the trigger condition is met. The following traces are enabled with this bit.
		1) Scheduled trace (trace at fixed intervals of 10 to 2,550 ms)
		2) TRSM(045) instruction trace (trace when the TRSM(045) is executed)
		3) One-cycle trace (trace at the end of execution of all cyclic tasks)
Trace Trigger Monitor Flag	A508.11	This flag turns ON when the trace trigger condition has been met after the Trace Start Bit has turned ON. This flag will turn OFF when the sampling is started.
Trace Busy Flag	A508.13	This flag turns ON when sampling is started and turns OFF when the trace has been completed.
Trace Completed Flag	A508.12	This flag turns ON when Trace Memory becomes full after the trace trigger con- dition has been met during a trace operation and turns OFF when the next sam- pling operation is started.

# **SECTION 10 Troubleshooting**

This section provides information on hardware and software errors that occur during CP1L operation.

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# **10-1** Error Classification and Confirmation

## Error Categories

Errors in CP1L CPU Units can be broadly divided into the following four categories.

Category	Comments
CPU Error	A WDT (watchdog timer) error is generated in the CPU Unit, the CPU Unit will malfunction, and operation will stop.
CPU Standby	The CPU will go on standby because conditions for stating oper- ation have not yet been met.
Fatal Error	Operation cannot continue. Operation will stop due to a serious problem.
Non-fatal Error	A minor problem has occurred. Operation will continue

## **Confirming Errors**

There are three sources of information on errors that have occurred.

- CPU Unit indicators
- Auxiliary Area

## **CPU Unit Indicators**



These indicators show the operating status of the CPU Unit.

POWER	Lit	Power is ON.
(green)	Not lit	Power is OFF.
RUN (green)	Lit	The CPU Unit is executing a program in either RUN or MONITOR mode.
	Not lit	Operation is stopped in PROGRAM mode or due to a fatal error.
ERR/ALM (red)	Lit	A fatal error or CPU error (WDT error) has occurred. operation will stop and all outputs will be turned OFF.
	Flashing	A non-fatal error has occurred. Operation will continue.
	Not lit	Operation is normal.
		The Output OFF Bit (A500.15) was turned ON. All outputs will be turned OFF.
	Not lit	Operation is normal.
PRPHL (yellow)	Flashing	Communications (either sending or receiving) are in progress through the peripheral port.
	Not lit	Other than the above.
BKUP (yellow) (See note.)	Lit	<ul> <li>The user program, parameters, or DM Area data is being written to or accessed in the built-in flash memory (backup memory).</li> </ul>
or DN		• The user program, parameters, DM Area data or DM initial values are being written to or accessed in a Memory Cassette.
		<ul> <li>The BKUP indicator also lights while the user program is being restored when the power supply is turned ON.</li> </ul>
	Not lit	Other than the above.

Note Do not turn OFF the CPU Unit power supply when this indicator is lit.

Indicator	CPU error	CPU standby	Fatal error	Non- fatal error	Peripheral port communica- tions error	Output OFF Bit turned ON
POWER	Lit	Lit	Lit	Lit	Lit	Lit
RUN	Not lit	Not lit	Not lit	Lit	Lit	Lit
ERR/ALM	Lit	Not lit	Lit	Flashing		
INH	Not lit					Lit
PRPHL					Not lit	
BKUP						

## Auxiliary Area

#### Error Code Storage Word

The error code is stored in A400 when an error occurs. If two or more errors occur at the same time, the most serious error will be stored.

#### ■ Error Flags

Flags that indicate the type of error are allocated in the Auxiliary Area.

#### Error Information

This area indicates specific information on the meaning of error flags and provides information on error location and error details.

#### ■ Fatal Errors

Error	Error code	Error flag	Error information	
	(A400)		Meaning	Address
Memory error	80F1	A401.15	Memory error location	A403
I/O bus error	80C0 to 80C7, 80CA, 80CE, 80CF	A401.14	I/O bus error details	A404
Too many I/O error	80E1	A401.11	Details for too many I/O error	A407
Program error	80F0	A401.09	Program error details	A294 to A299
Cycle time too long error	809F	A401.08		
FALS instruction executed	C101 to C2FF	A401.06		

#### Non-fatal Errors

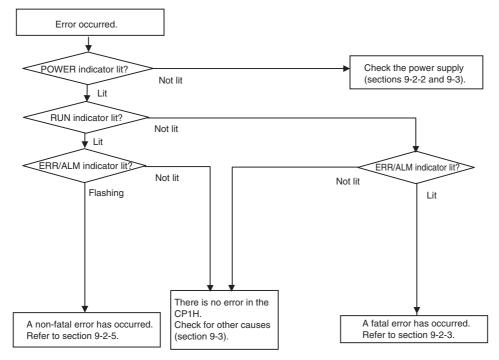
Error	Error code	Error flag	Error information	
	(A400)		Meaning	Address
FAL instruction executed	4101 to 42FF	A402.15	Executed FAL number	A360 to A391
Flash memory error	00F1	A315.15		
Interrupt task error	008B	A402.13	Interrupt task error unit num- ber	A426
PLC Setup error	009B	A402.10		A406
Option Board error	00D1, 00D2	A315.13	Error Option Board Flags	A424
Battery error	00F7	A402.04		

# 10-2 Troubleshooting

Use the following procedure to check error details and remove the cause of the error if the CPU Unit does not operate when the power supply is ON, operation suddenly stops and the error indicator (ERR/ALM indicator) lights, or if the error indicator (ERR/ALM indicator) flashes during operating.

# 10-2-1 Error Processing Flowchart

Confirm the error category by referring to the status of the CPU Unit indicators, investigate the cause for the error in the error tables, and take corrective actions.



# 10-2-2 No Operation When Power Is Supplied

First confirm that the POWER indicator (green) is lit.

### **POWER Indicator Not Lit**

The power supply may not match the Unit rating, wiring may not be correct, or the Unit may be faulty.

- *1,2,3...* 1. Confirm the Unit rating (i.e., is it 24 VDC or 100 to 240 VAC?) and see if the supply power matches the rating.
  - 2. Check the wiring to see if it is correct and that nothing is disconnected.
  - 3. Check the voltage at the power supply terminals. If the voltage is normal and the POWER indicator is lit, the Unit may be faulty. In that case, replace the Unit.

#### **POWER Indicator Turns OFF and ON**

There may be fluctuations in the power supply voltage, disconnected wiring, or poor contacts. Check the power supply system and wiring.

#### POWER Indicator Lit but No Operation

Check the RUN indicator if the POWER indicator is lit but the CPU Unit does not operate. The CPU Unit may be on standby if the RUN indicator is not lit.

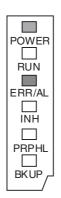
#### ■ <u>CPU Standby</u>

Detection of Special I/O Units and CPU Bus Units has not been completed.

- If a CPU Bus Unit has not started normally, check the Unit Setup.
- If a Special I/O Unit is not detected, replace the Special I/O Unit.

# 10-2-3 Fatal Errors

### CPU Unit Indicators



POWER	Lit
RUN	Not lit
ERR/ALM	Lit
INH	
PRPHL	
BKUP	

There may be a CPU error or a fatal error if operation stops (i.e., the RUN indicator turns OFF) and the ERR/ALM indicator lights.

Data on fatal errors is displayed on the Error Tab Page of the CX-Programmer's PLC Error Window.

Take corrective actions after checking error details based on the CX-Programmer display message together with the Auxiliary Area Error Flags and error information.

Note

- 1. Errors are listed in order with the most serious errors first.
- 2. If two or more errors occur at the same time, the most serious error code will be stored in A400.
- 3. I/O memory will be cleared if a fatal error occurs (except those created with FALS instructions).
- 4. I/O memory will be held when the I/O Memory Hold Bit is ON, but outputs will be turned OFF.

# Troubleshooting

# Memory Errors

Γ	Probable	cause	Possible remedy
a	utomatic transfer from t startup failed because ot on the Memory Case	e the required data is	Store the required data on the Memory Cassette.
m W	n error has occurred ir ore bits in A403 will tu here the error has occ etails.	rn ON to indicate urred. See below for	See below.
	Memory Error Loc		
	A403.00 is ON	A checksum error has occurred in the user program.	Transfer the user program again.
		The power supply was turned OFF when backing up the user program to flash memory.	
	A403.04 is ON	A checksum error has occurred in the PLC Setup.	Transfer the PLC Setup again.
	A403.07 is ON	A checksum error has occurred in the routing tables.	Transfer the routing tables again.
	A403.09 is ON	The contents of a Memory Cassette could not be nor- mally read to the CPU Unit when power was turned ON.	Check to see if the files required for automatic transfer at startup are present on the Memory Cassette.
	A403.10 is ON	There is a problem with flash memory.	A hardware error has occurred in the CPU Unit. Replace the CPU Unit.

## ■ <u>Reference Information</u>

Error flag	Memory Error Flag, A401.15	
Error code (A400)	80F1	
Error information	Memory Error Location, A403	

## I/O Bus Errors

An I/O bus error occurs in data transfer between the CPU Units and Units connected to the I/O bus. Cycle the power supply. If operation is not restored when the power supply has been cycled, turn OFF the power supply and check that connections are proper and that there is no damage.

Probable cause	Possible remedy
An error occurred in data transfer between the CPU Unit and an Expansion Unit or Expansion I/O Unit. <b>Note</b> 0A0A hex will be stored in A404.	Try cycling the power supply. If the problem persists, turn OFF the power sup- ply and check the Connecting Cables between the Units to see if they are connected properly.
	Check the Unit connections to be sure they are ok (e.g., that there is no damage).
	After correcting the problem, turn ON the power to the Units again.

#### Reference Information

Error flag	I/O Bus Error Flag, A401.14
Error code (A400)	80C0, 80CA, 80CE, 80CF
Error information	I/O bus error details, A404 (0A0A)

### Too Many I/O Points

The number of CP1W/CPM1A-series Expansion Units and Expansion I/O Units connected exceeds the restriction for the number of Units or words for the system configuration. Turn OFF the power supply and reconfigure the system within the restrictions.

Probable cause	Possible remedy
The number of CP1W/CPM1A-series Expansion Units and Expansion I/O Units exceeds the restriction.	• Connect a maximum of three Expansion Units and Expansion I/O Units to the CP1L-M60D, CP1L-M40D or CP1L-M30D
	Connect a maximum of one Expansion Unit or Expansion I/O Unit to the CP1L-L20D□-□ or CP1L- L14D□-□.

#### Reference Information

Error flag	Too Many I/O Points Flag, A401.11
Error code (A400)	80E1
Error information	Too Many I/O Points Details, A407

## Program Error

A program error indicates a problem with the user program. Refer to the error information, check the program, and correct the mistakes. Clear the error once the problem has been corrected.

Probable cause	Possible remedy
Instruction Processing Error	Refer to A298 and A299 (instruction program address when
	the program fails), check the specifications for the relevant instruction, and set the correct operand data.
instruction cannot be executed due to a problem in the operand data.	Alternatively, set the PLC Setup to not stop operation for an instruction error.
	Refer to A298 and A299 (instruction program address when
If the PLC Setup has been set to stop operation for an indi- rect DM BCD error, the Access Error Flag will turn ON when the content of an indirectly addressed DM operand is not	the program fails), and correctly set the content for the indi- rectly addressed DM operand (BCD mode) to BCD or change the specified destination.
3CD although BCD mode has been selected.	Alternatively, change the indirect addressing to binary mode or set the PLC Setup to not stop operation for an indi- rect DM addressing BCD error.

# Troubleshooting

Probable cause	Possible remedy
Illegal Area Access Error If the PLC Setup has been set to stop operation for an ille- gal access error, the Access Error Flag will turn ON when an illegal access error has occurred. The following operations are considered illegal access: • Reading/writing the parameter area • Writing to an area without memory installed • Writing to a write-protected area • Indirect DM addressing BCD error	Refer to A298 and A299 (instruction program address when the program fails) and take corrective actions so that illegal area access errors will not occur. Alternatively, set the PLC Setup so that PLC operation will not stop when an instruc- tion error occurs.
No END Error This error occurs when there is not an END(001) instruction in the program within a task.	Insert an END(001) instruction at the end of the program allocated to the task stored in A294 (task number when the program fails).
<ul> <li>Task Error</li> <li>This error is generated by any of the following conditions.</li> <li>1. There is not an executable cyclic task (active).</li> <li>2. There is no specified interrupt task when an interrupt is generated (input interrupt, high-speed counter interrupt, scheduled interrupt, or external interrupt).</li> </ul>	<ol> <li>Check the properties of the executable cyclic task and set at least one task to start when operation starts.</li> <li>Create a task for the number stored in A294 (task number when the program fails).</li> </ol>
Differentiation Overflow Error Differentiation instructions were repeatedly inserted or deleted using the online editor and the system restriction was exceeded.	Change the operating mode to PROGRAM mode and then return to MONITOR mode.
Illegal Instruction Error Execution of an unexecutable instruction was attempted. For a CPU Unit with 10, 14 or 20 I/O Points, the instruction operand will be given in D10000 to D31999.	Check the program, correct the problem, and transfer the program to the CPU Unit again.
UM Overflow Error An attempt was made to execute a program that exceeds the user program capacity.	Transfer the program again using the CX-Programmer.

### ■ <u>Reference Information</u>

Error flag	Program Error Flag, A401.09
Error code (A400)	80F0
Error information	Program error details, A294 to A299

# Cycle Time Too Long

Probable cause	Possible remedy
This error occurs when the cycle time PV exceeds the max- imum cycle time set in the PLC Setup.	Review the program to decrease the cycle time or change the maximum cycle time set in the PLC Setup.
	Refer to the Maximum Interrupt Task Processing Time (A440) and study the maximum cycle time.
	The cycle time can be decreased using the following methods.
	<ul> <li>Separate instructions not being executed into different tasks.</li> </ul>
	<ul> <li>Consider using jump instructions for areas in the task that are not executed.</li> </ul>
	• Prohibit cycle refreshing with Special I/O Units that do not require exchange of cycle data.

### Reference Information

Error flag	Cycle Time Too Long Error, A401.08
Error code (A400)	809F
Error information	

## **Errors Created with FALS Instructions**

Probable cause	Possible remedy
FALS instruction executed (FALS number 001)	C100 hex will be added to the FALS number (001 to 1FF hex) and the result will be stored in A400 as the error code (C100 to C2FF hex).
	Check the conditions for executing FALS instructions and remove any causes for the user-defined error.

#### ■ <u>Reference Information</u>

Error flag	FALS Error Flag, A401.06
Error code (A400)	C101 to C2FF
Error information	

## 10-2-4 CPU Errors

#### ■ <u>CPU Unit Indicators</u>



POWER	Lit
RUN	Not lit
ERR/ALM	Lit
INH	
BKUP	
PRPHL	

A CPU error or fatal error may have occurred if the ERR/ALM indicator lights during operation (RUN mode or MONITOR mode), the RUN indicator turns OFF, and operation stops.

## **CPU Errors**

Probable cause	Possible remedy
A WDT (watchdog) error occurred in the CPU Unit. (This does not occur in normal use.)	Cycle the power supply. The Unit may be faulty. Consult your OMRON representative.

#### ■ <u>Reference Information</u>

Error flag	None
Error code (A400)	None
Error information	None

**Note** Just as when a CPU error occurs, the RUN indicator will turn OFF and the ERR/ALM indicator will light when a fatal error occurs. Connecting the CX-Programmer, however, is possible for fatal errors but not for CPU errors. If the CX-Programmer cannot be connected (online), a CPU error has probably occurred.

## 10-2-5 Non-fatal Errors

A non-fatal error has occurred if both the RUN indicator and the ERR/ALM indicator are lit during operation (i.e., in RUN or MONITOR mode).

#### ■ <u>CPU Unit Indicators</u>



POWER	Lit
RUN	Lit
ERR/ALM	Flashing
INH	
BKUP	
PRPHL	

Information on the non-fatal error can be obtained from the Error Tab Page of the CX-Programmer's PLC Error Window. Take corrective actions after checking error details using the display messages and the Auxiliary Area Error Flags and error information.

- Errors are listed in the following table in order, with the most serious ones first.
- If two or more errors occur at the same time, the most serious error code will be stored in A400.

## **Errors Created with for FAL Instructions**

A FAL instruction was executed in the program to create a non-fatal error.

Probable cause	Possible remedy
The executed FAL number 001 to 511 will be stored in A360 to A391. The number 4 will be added to the front of 101 to 2FF (which correspond to executed FAL num- bers 001 to 511) and the result will be stored in A400 as error code 4101 to 42FF.	Check the conditions for executing FAL instructions and remove any causes of the user-defined error.

#### ■ <u>Reference Information</u>

Error flag	FAL Error Flag, A402.15
Error code (A400)	4101 to 42FF
Error information	None

#### **Flash Memory Errors**

Probable cause	Possible remedy
internal flash memory fails.	Replace the CPU Unit when the internal flash memory has been written to more than 100,000 times.

#### Reference Information

Error flag	Flash Memory Error Flag, A315.15
	Other non-fatal flags, A402.00
Error code (A400)	None
Error information	None

## Interrupt Task Errors

Probable cause	Possible remedy
An interrupt task error occurs when the <i>Detect Interrupt task errors setting</i> in the PLC Setup is set to <i>Detect</i> and an attempt is made to refresh a Special I/O Unit from an interrupt task with IORF(097) while the Unit's I/O is being refreshed by cyclic refreshing (duplicate refreshing).	Review the program to see whether detect- ing interrupt task errors can be disabled or avoided.

### Reference Information

Error flag	Interrupt Task Error Flag, A402.13
Error code (A400)	008B
Error information	Interrupt Task Error, A426

## PLC Setup Errors

Probable cause	Possible remedy
A set value error occurred in the PLC Setup.	Correct the PLC Setup with correct val- ues.
The address of the error is stored in A406 in 16-bit binary.	

#### Reference Information

Error flag	PLC Setup Error Flag, A402.10
Error code (A400)	009B
Error information	PLC Setup error location, A406

## **Option Board Errors**

Probable cause	Possible remedy
A315.13 will turn ON if the Option Board is removed while the power is being supplied.	

## Reference Information

Error flags	Option Board Error Flag, A315.13
	Other Non-fatal Error Flag, A402.00
Error code (A400)	
Error information	

## **Battery Error**

Probable cause	Possible remedy
If the PLC Setup is set to detect battery errors, this error will occur when there is an error in the battery in the CPU Unit (i.e., the voltage is low or a battery is not	Check the battery connections. When using battery-free operation, dis- able connecting battery errors in the PLC Setup.
mounted).	Setup.

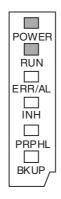
#### ■ <u>Reference Information</u>

Error flag	Battery Error Flag, A402.04
Error code (A400)	00F7
Error information	

# 10-2-6 Other Errors

# **Communications Errors**

#### CPU Unit Indicators



POWER	Lit
RUN	Lit
ERR/ALM	
INH	
PRPHL	
BKUP	Not lit

Probable cause	Possible remedy
An error has occurred in the communica- tions between the peripheral port and con-	Confirm that the peripheral port settings in the PLC Setup are correct.
nected device.	Check the USB cable and replace it if neces- sary.
An error has occurred in the communica- tions between the serial port and connected device.	Confirm that the serial port 1/2 settings in the PLC Setup are correct. Check the cable wiring. If a host computer is connected, check the serial port settings and program in the host computer.

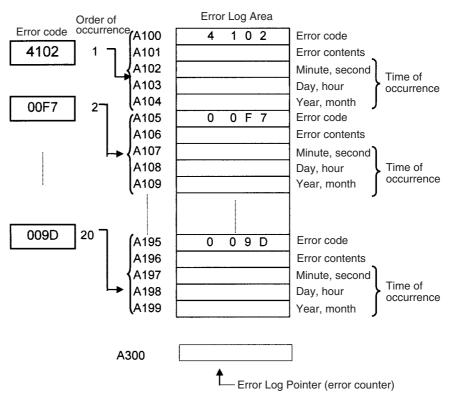
# 10-3 Error Log

Each time an error occurs, the CPU Unit stores error information in the Error Log Area of the Auxiliary Area (A100 to A199). The error information includes the error code (stored in A400), error contents, and time that the error occurred. Up to 20 records can be stored in the Error Log.

In addition to system-generated errors, the CPU Unit records user-defined errors, making it easier to track the operating status of the system.

When more than 20 errors occur, the oldest error data (stored in A100 to A104) is deleted, the 19 errors stored in A105 to A199 shift one record, and the newest record is stored in A195 to A199.

The number of records stored in the error log is stored in the Error Log Pointer (A300). The Error Log Pointer is not incremented after 20 records have been stored.



# **10-4 Troubleshooting Unit Errors**

## CPU Unit

Symptom	Cause	Remedy
POWER indicator is not lit.	PCB short-circuited or damaged.	Replace Unit.
RUN indicator is not lit.	(1) Error in program (fatal error)	Correct program.
	(2) Power line is faulty.	Replace Unit.
RUN indicator on the CPU Unit is lit.	Internal circuitry in the Unit is faulty.	
Bits do not operate past a certain point.	Ť	
Error occurs in units of 8 or 16 points.	Ť	
I/O bit turns ON.	Ť	
All bits in one Unit do not turn ON.		

# <u>Inputs</u>

Symptom	Cause	Remedy
Not all inputs turn ON or indi- cators are not lit.	<ol> <li>External power is not supplied for the input.</li> </ol>	Supply power
	(2) Supply voltage is low.	Adjust supply voltage to within rated range.
	(3) Terminal block mounting screws are loose.	Tighten screws.
	(4) Faulty contact of terminal block connector.	Replace terminal block connector.
Not all inputs turn ON even though the indicator is lit.	Input circuit is faulty. (There is a short at the load or something else that caused an over- current to flow.)	Replace Unit.
Not all inputs turn OFF.	Input circuit is faulty.	Replace Unit.
Specific bit does not turn ON.	(1) Input device is faulty.	Replace input devices.
	(2) Input wiring disconnected.	Check input wiring
	(3) Terminal block screws are loose.	Tighten screws
	(4) Faulty terminal block connector contact.	Replace terminal block connector.
	(5) Too short ON time of external input.	Adjust input device
	(6) Faulty input circuit	Replace Unit.
	(7) Input bit number is used for output instruction.	Correct program.
Specific bit does not turn	(1) Input circuit is faulty.	Replace Unit.
OFF.	(2) Input bit number is used for output instruction.	Correct program.
Input irregularly turns ON/ OFF.	(1) External input voltage is low or unstable.	Adjust external input voltage to within rated range.
	(2) Malfunction due to noise.	Take protective measures against noise, such as:
		<ul> <li>Install surge suppressor.</li> </ul>
		<ul> <li>Install insulation transformer. Install shielded cables between the Input Unit and the loads.</li> </ul>
	(3) Terminal block screws are loose.	Tighten screws
	(4) Faulty terminal block connector contact.	Replace terminal block connector.
Error occurs in units of	(1) Common terminal screws are loose.	Tighten screws
8 points or 16 points, i.e., for the same common.	(2) Faulty terminal block connector contact.	Replace terminal block connector.
	(3) Faulty data bus	Replace Unit.
	(4) Faulty CPU	Replace CPU Unit.
Input indicator is not lit in nor- mal operation.	Faulty indicator or indicator circuit.	Replace Unit.

# Troubleshooting Unit Errors

# <u>Outputs</u>

Symptom	Cause	Remedy
Not all outputs turn ON	(1) Load is not supplied with power.	Supply power
	(2) Load voltage is low.	Adjust voltage to within rated range.
	(3) Terminal block screws are loose.	Tighten screws
	(4) Faulty terminal block connector contact.	Replace terminal block connector.
	(5) An overcurrent (possibly caused by a short at the load) resulted in a blown fuse for the output or the Unit is faulty.	Replace fuse or Unit.
	(6) Faulty I/O bus connector contact.	Replace Unit.
	(7) Output circuit is faulty.	Replace Unit.
	(8) If the INH indicator is lit, the Output OFF Bit (A500.15) is ON.	Turn A500.15 OFF.
Not all outputs turn OFF	Output circuit is faulty.	Replace Unit.
Output of a specific bit num- ber does not turn ON or indi-	<ol> <li>Output ON time too short because of a mistake in programming.</li> </ol>	Correct program to increase the time that the output is ON.
cator is not lit	(2) Bit status controlled by multiple instruc- tions.	Correct program so that each output bit is controlled by only one instruction.
	(3) Faulty output circuit.	Replace Unit.
Output of a specific bit num-	(1) Faulty output device.	Replace output device.
ber does not turn ON (indica- tor lit).	(2) Break in output wiring.	Check output wiring.
	(3) Loose terminal block screws.	Tighten screws.
	(4) Faulty terminal block connector faulty.	Replace terminal block connector.
	(5) Faulty output bit (relay output only).	Replace Unit.
	(6) Faulty output circuit (relay output only).	Replace Unit.
Output of a specific bit num-	(1) Faulty output bit.	Replace Unit.
ber does not turn OFF (indi- cator is not lit).	(2) Bit does not turn OFF due to leakage current or residual voltage.	Replace external load or add dummy resis- tor.
Output of a specific bit num- ber does not turn OFF (indi-	(1) Bit status controlled by multiple instruc- tions.	Correct program.
cator lit).	(2) Faulty output circuit.	Replace Unit.
Output irregularly turns ON/	(1) Low or unstable load voltage.	Adjust load voltage to within rated range
OFF.	(2) Bit status controlled by multiple instruc- tions.	Correct program so that each output bit is controlled by only one instruction.
	(3) Malfunction due to noise.	Protective measures against noise:
		<ul> <li>Install surge suppressor.</li> </ul>
		<ul> <li>Install insulation transformer.</li> <li>Use shielded cables between the output terminal and the load.</li> </ul>
	(4) Terminal block screws are loose.	Tighten screws.
	<ul><li>(5) Faulty terminal block connector contact.</li></ul>	Replace terminal block connector.
Error occurs in units of	(1) Loose common terminal screw.	Tighten screws.
8 points or 16 points, i.e., for	(2) Faulty terminal block connector contact.	Replace terminal block connector.
the same common.	<ul> <li>(3) An overcurrent (possibly caused by a short at the load) resulted in a blown fuse for the output or the Unit is faulty.</li> </ul>	Replace fuse or Unit.
	(4) Faulty data bus.	Replace Unit.
	(5) Faulty CPU.	Replace CPU Unit.
Output indicator is not lit (operation is normal).	Faulty indicator.	Replace Unit.

# SECTION 11 Inspection and Maintenance

This section provides inspection and maintenance information.

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# 11-1 Inspections

Daily or periodic inspections are required in order to maintain the PLC's functions in peak operating condition.

# 11-1-1 Inspection Points

Although the major components in CP-series PLCs have an extremely long life time, they can deteriorate under improper environmental conditions. Periodic inspections are thus required to ensure that the required conditions are being kept.

Inspection is recommended at least once every six months to a year, but more frequent inspections will be necessary in adverse environments.

Take immediate steps to correct the situation if any of the conditions in the following table are not met.

No.	Item	Inspection	Criteria	Action
1	Source Power Supply	Check for voltage fluctuations at the power supply terminals.	The voltage must be within the allowable voltage fluctu- ation range. (See note.)	Use a voltage tester to check the power supply at the terminals. Take necessary steps to bring voltage fluctuations within limits.
2	I/O Power Sup- ply	Check for voltage fluctuations at the I/O terminals.	Voltages must be within specifications for each Unit.	Use a voltage tester to check the power supply at the terminals. Take necessary steps to bring voltage fluctuations within limits.
3	Ambient environ- ment	Check the ambient tempera- ture (inside the control panel if the PLC is in a control panel).	0 to 55°C	Use a thermometer to check the temperature and ensure that the ambient temperature remains within the allowed range of 0 to 55°C.
		Check the ambient humidity (inside the control panel if the PLC is in a control panel).	Relative humidity must be 10% to 90% with no condensation.	Use a hygrometer to check the humidity and ensure that the ambi- ent humidity remains within the allowed range.
		Check that the PLC is not in direct sunlight.	Not in direct sunlight	Protect the PLC if necessary.
		Check for accumulation of dirt, dust, salt, metal filings, etc.	No accumulation	Clean and protect the PLC if neces- sary.
		Check for water, oil, or chemi- cal sprays hitting the PLC.	No spray on the PLC	Clean and protect the PLC if neces- sary.
		Check for corrosive or flam- mable gases in the area of the PLC.	No corrosive or flammable gases	Check by smell or use a sensor.
		Check the level of vibration or shock.	Vibration and shock must be within specifications.	Install cushioning or shock absorb- ing equipment if necessary.
		Check for noise sources near the PLC.	No significant noise sources	Either separate the PLC and noise source or protect the PLC.

#### Inspections

No.	Item	Inspection	Criteria	Action
4	Installation and wiring	Check that each Unit is con- nected securely and locked in place.	No looseness	Press the connectors together completely and lock them with the sliders.
		Check that the Option Boards and cable connectors are fully inserted and locked.	No looseness	Correct any improperly installed connectors.
		Check for loose screws in external wiring.	No looseness	Tighten loose screws with a Phillips screwdriver.
		Check crimp connectors in external wiring.	Adequate spacing between connectors	Check visually and adjust if neces- sary.
		Check for damaged external wiring cables.	No damage	Check visually and replace cables if necessary.
5	User-service- able parts	Check whether the battery has reached its service life. CJ1W-BAT01 Battery	Service life expectancy is 5 years at 25°C, less at higher temperatures. (From 0.75 to 5 years depending on model, power supply rate, and ambient temperature.)	Replace the battery when its ser- vice life has passed even if a bat- tery error has not occurred.

**Note** The following table shows the allowable voltage fluctuation ranges for source power supplies.

CPU Unit	Supply voltage	Allowable voltage range
CP1L-MOD-A	100 to 240 V AC	85 to 264 V AC
CP1L-LODO-A		(+10%/–15%)
CP1L-MODD-D	24 V DC	20.4 to 26.4 V DC
CP1L-LODD-D		(+10%/–15%)

#### **Tools Required for Inspections**

#### Required Tools

- Phillips screwdrivers
- Voltage tester or digital voltmeter
- Industrial alcohol and clean cotton cloth

#### **Tools Required Occasionally**

- Synchroscope
- Oscilloscope with pen plotter
- Thermometer and hygrometer

## 11-1-2 Unit Replacement Precautions

Check the following when replacing any faulty Unit.

- Do not replace a Unit until the power is turned OFF.
- Check the new Unit to make sure that there are no errors.
- If a faulty Unit is being returned for repair, describe the problem in as much detail as possible, enclose this description with the Unit, and return the Unit to your OMRON representative.
- For poor contact, take a clean cotton cloth, soak the cloth in industrial alcohol, and carefully wipe the contacts clean. Be sure to remove any lint prior to remounting the Unit.
- **Note** When replacing a CPU Unit, be sure that not only the user program but also all other data required for operation is transferred to or set in the new CPU Unit before starting operation, including DM Area and HR Area settings. If

data area and other data are not correct for the user program, unexpected accidents may occur.

## 11-2 Replacing User-serviceable Parts

The following parts should be replaced periodically as preventative maintenance. The procedures for replacing these parts are described later in this section.

• Battery (backup for the CPU Unit's internal clock and RAM)

**Battery Functions** The battery maintains the internal clock and the following data of the CPU Unit's RAM while the main power supply is OFF.

• Retained regions of I/O memory (such as the Holding Area and DM Area)

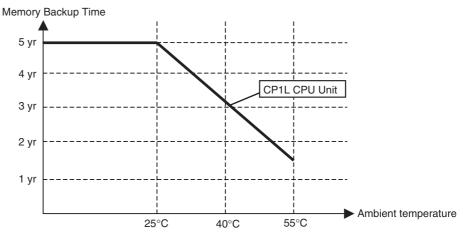
If the battery is not installed or battery voltage drops too low, the internal clock will stop and the data in RAM will be lost when the main power supply goes OFF.

Battery Service Life and<br/>Replacement PeriodAt 25°C, the maximum service life for batteries is five years whether or not<br/>power is supplied to the CPU Unit while the battery is installed. The battery's<br/>lifetime will be shorter when it is used at higher temperatures.

The following table shows the approximate minimum lifetimes and typical lifetimes for the backup battery (total time with power not supplied).

Model	Approx.	Approx. minimum	Typical lifetime
	maximum lifetime	lifetime (See note.)	(See note.)
CP1L-MODO-D	5 years	13,000 hours	43,000 hours
CP1L-LODO-D		(approx. 1.5 years)	(approx. 5 years)

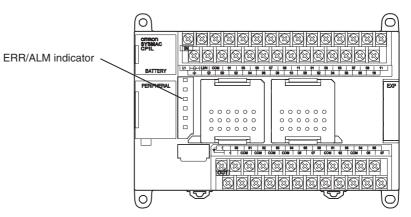
**Note** The minimum lifetime is the memory backup time at an ambient temperature of 55°C. The typical lifetime is the memory backup time at an ambient temperature of 25°C.



This graphic is for reference only.

#### Low Battery Indications

The ERR/ALM indicator on the front of the CPU Unit will flash when the battery is nearly discharged.



When the ERR/ALM indicator flashes, connect the CX-Programmer to the peripheral port and read the error messages. If a low battery message appears on the CX-Programmer (see note 1) and the Battery Error Flag (A402.04) is ON (see note 1), first check whether the battery is properly connected to the CPU Unit. If the battery is properly connected, replace the battery as soon as possible.

Once a low-battery error has been detected, it will take 5 days before the battery fails assuming that power has been supplied at lease once a day (see note 2). Battery failure and the resulting loss of data in RAM can be delayed by ensuring that the CPU Unit power is not turned OFF until the battery has been replaced.

- Note 1. The PLC Setup must be set to detect a low-battery error (Detect Low Battery). If this setting has not been made, the BATT LOW error message will not appear on the CX-Programmer and the Battery Error Flag (A402.04) will not go ON when the battery fails.
  - 2. The battery will discharge faster at higher temperatures, e.g., 4 days at  $40^{\circ}$ C and 2 days at  $55^{\circ}$ C.

**Replacement Battery** Use the CJ1W-BAT01 Battery Set. Be sure to install a replacement battery within two years of the production date shown on the battery's label.

Production Date	
OMRON CJ1W-BAT01 05-07	Manufactured in July 2005.

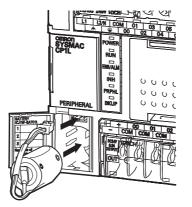
**Replacement Procedure** Use the following procedure to replace the battery when the previous battery has become completely discharged. You must complete this procedure within five minutes after turning OFF the power to the CPU Unit to ensure memory backup.

- **Note** 1. We recommend replacing the battery with the power OFF to prevent the CPU Unit's sensitive internal components from being damaged by static electricity. The battery can be replaced without turning OFF the power supply. To do so, always touch a grounded piece of metal to discharge static electricity from your body before starting the procedure.
  - 2. After replacing the battery, connect the CX-Programmer and clear the battery error.

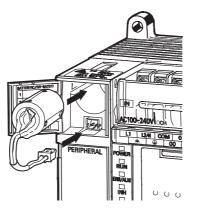
#### Procedure

- *1,2,3...* 1. Turn OFF the power to the CPU Unit.
  - **or** If the CPU Unit has not been ON, turn it ON for at least five minutes and then turn it OFF.
    - **Note** If power is not turned ON for at least five minutes before replacing the battery, the capacitor that backs up memory when the battery is removed will not be fully charged and memory may be lost before the new battery is inserted.
  - 2. Open the compartment on the CPU Unit and carefully draw out the battery.
  - 3. Remove the battery connector.
  - 4. Connect the new battery, place it into the compartment, and close the cover.

#### CPU Units with 10, 14 or 20 I/O Points



CPU Units with 30, 40 or 60 I/O Points



- **WARNING** Never short-circuit the battery terminals; never charge the battery; never disassemble the battery; and never heat or incinerate the battery. Doing any of these may cause the battery to leak, burn, or rupturing resulting in injury, fire, and possible loss of life or property. Also, never use a battery that has been dropped on the floor or otherwise subject to shock. It may leak.
  - Caution You must complete this procedure within five minutes after turning OFF the power to the CPU Unit to ensure memory backup. If the procedure is not completed within 5 minutes, data may be lost.
  - **Caution** UL standards require that batteries be replaced by experienced technicians. Always place an experienced technician in charge or battery replacement.

- ▲ Caution Turn ON the power after replacing the battery for a CPU Unit that has been unused for a long time. Leaving the CPU Unit unused again without turning ON the power even once after the battery is replaced may result in a shorter battery life.
  - Note The battery error will automatically be cleared when a new battery is inserted.

# Appendix A Standard Models

# **CPU Units**

Name and	Model		Specifications		Remarks
appearance		Power supply	Outputs	Inputs	
CPU Units with 10 I/O Points	CP1L-L10DR-A	100 to 240 VAC	4 relay outputs	24 VDC 6 inputs	Memory capacity: 5 Ksteps High-speed counters:
ବି	CP1L-L10DR-D	24 VDC	4 relay outputs		100 kHz, 4 counters
	CP1L-L10DT-A	100 to 240 VAC	4 transistor outputs, sinking		Pulse outputs: 2 axes at 100 kHz
	CP1L-L10DT-D	24 VDC	4 transistor outputs, sinking		
	CP1L-L10DT1-D		4 transistor outputs, sourcing		
CPU Units with 14 I/O Points	CP1L-L14DR-A	100 to 240 VAC	6 relay outputs	24 VDC 8 inputs	
0	CP1L-L14DR-D	24 VDC	6 relay outputs		
	CP1L-L14DT-A	100 to 240 VAC	6 transistor outputs, sinking		
	CP1L-L14DT-D	24 VDC	6 transistor outputs, sinking		
- DVUTTANA	CP1L-L14DT1-D		6 transistor outputs, sourcing		
CPU Units with 20 I/O Points	CP1L-L20DR-A	100 to 240 VAC	8 relay outputs	24 VDC 12 inputs	
0	CP1L-L20DR-D	24 VDC	8 relay outputs		
	CP1L-L20DT-A	100 to 240 VAC	8 transistor outputs, sinking		
	CP1L-L20DT-D	24 VDC	8 transistor outputs, sinking		
	CP1L-L20DT1-D		8 transistor outputs, sourcing		

# Standard Models

# Appendix A

Name and	Model		Specifications		Remarks
appearance		Power supply	Outputs	Inputs	
CPU Units with 30 I/O Points	CP1L-M30DR-A	100 to 240 VAC	12 relay outputs	24 VDC 18 inputs	Memory capacity: 10 Ksteps High-speed counters:
<u>e</u>	CP1L-M30DR-D	24 VDC	12 relay outputs		100 kHz, 4 counters
	CP1L-M30DT-A	100 to 240 VAC	12 transistor out- puts, sinking		Pulse outputs: 2 axes at 100 kHz
	CP1L-M30DT-D	24 VDC	12 transistor out- puts, sinking		
	CP1L-M30DT1-D	_	12 transistor out- puts, sourcing		
CPU Units with 40 I/O Points	CP1L-M40DR-A	100 to 240 VAC	16 relay outputs	24 VDC 24 inputs	
<u>A</u>	CP1L-M40DR-D	24 VDC	16 relay outputs		
	CP1L-M40DT-A	100 to 240 VAC	16 transistor out- puts, sinking		
	CP1L-M40DT-D	24 VDC	16 transistor out- puts, sinking		
	CP1L-M40DT1-D	_	16 transistor out- puts, sourcing		
CPU Units with 60 I/O Points	CP1L-M60DR-A	100 to 240 VAC	24 relay outputs	24 VDC 36 inputs	
	CP1L-M60DR-D	24 VDC	24 relay outputs		
	CP1L-M60DT-A	100 to 240 VAC	24 transistor out- puts, sinking		
	CP1L-M60DT-D	24 VDC	24 transistor out- puts, sinking		
	CP1L-M60DT1-D		24 transistor out- puts, sourcing		

# **Programming Devices**

Name and appearance	Model	Application	Remarks
CX-Programmer	WS02-CXPC1-E-	Programming and monitoring	<ul> <li>The CP1L L or M model with 14, 20, 30, 40 or 60 points is supported by CX-Programmer version 7.1 or higher.</li> <li>The CP1L J model is supported by CX-Programmer Version 7.22 or higher.</li> <li>The CP1L with 10 points is supported by CX-Programmer version 7.3 or higher.</li> <li>Use an off-the-shelf USB cable to connect the computer running the CX-Programmer to the USB port on the CP1L CPU Unit.</li> </ul>
Ver. 7.1	V71	from a Windows environment	

# **Optional Products**

Name and appearance	Model	Application	Remarks
RS-232C Option Board	CP1W-CIF01	Mounted in option slot 1 or 2 on the CPU Unit to function as an RS-232C port.	
RS-422A/485 Option Board	CP1W-CIF11/ CIF12	Mounted in option slot 1 or 2 on the CPU Unit to function as an RS-422A/485 port.	
LCD Option Board	CP1W-DAM01	Used to monitor and change user-specified messages, time or other data of the CPU Unit.	
Memory Cassette	CP1W-ME05M	Used to save CPU Unit user programming, parameters, and data or to copy these to another CPU Unit.	

# Expansion I/O Units

Name and	Model	Specifications		Remarks
appearance		Inputs	Outputs	
40-point I/O Units	CP1W-40EDR CPM1A-40EDR	24 VDC 24 inputs	16 relay outputs	
	CP1W-40EDT CPM1A-40EDT		16 transistor outputs, sinking	
	CP1W-40EDT1 CPM1A-40EDT1		16 transistor outputs, sourcing	
32-point Output Units	CP1W-32ER	None	32 relay outputs	
	CP1W-32ET		32 transistor outputs, sinking	
	CP1W-32ET1		32 transistor outputs, sourcing	
20-point I/O Units	CP1W-20EDR1 CPM1A-20EDR1	24 VDC 12 inputs	8 relay outputs	
	CP1W-20EDT CPM1A-20EDT		8 transistor outputs, sink- ing	
	CP1W-20EDT1 CPM1A-20EDT1		8 transistor outputs, sourcing	
16-point Output Units	CP1W-16ER CPM1A-16ER	None	16 relay outputs	
	CP1W-16ET	]	16 transistor outputs, sinking	
	CP1W-16ET1		16 transistor outputs, sourcing	

# Standard Models

# Appendix A

Name and	Model	Specifi	Remarks	
appearance		Inputs	Outputs	
8-point Input Units	CP1W-8ED CPM1A-8ED	24 VDC 8 inputs	None	
8-point Output Units	CP1W-8ER CPM1A-8ER	None	8 relay outputs	
	CP1W-8ET CPM1A-8ET		8 transistor outputs, sink- ing	
	CP1W-8ET1 CPM1A-8ET1		8 transistor outputs, sourcing	

# **Expansion Units**

Name and appearance	Model	Specifications	Remarks
Analog I/O Unit	CPM1A-MAD01	2 analog inputs 0 to 10 V, 1 to 5 V, 4 to 20 mA	
		1 analog output 0 to 10 V, –10 to +10 V, 4 to 20 mA	
		Resolution: 1/256	
Analog I/O Unit	CP1W-MAD11	2 analog inputs	
	CPM1A-MAD11	0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, 4 to 20 mA	
		1 analog output 1 to 5 V, 0 to 10 V, -10 to +10 V, 0 to 20 mA, 4 to 20 mA	
		Resolution: 1/6,000	
Analog Input Unit	CP1W-AD041 CPM1A-AD041	4 analog inputs 0 to 5 V, 1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, 4 to 20 mA	
overander Personance of O		Resolution: 1/6,000	
Analog Output Unit	CP1W-DA041	4 analog outputs	
	CPM1A-DA041	1 to 5 V, 0 to 10 V, –10 to +10 V, 0 to 20 mA, 4 to 20 mA	
		Resolution: 1/6,000	
Temperature Sensor	CP1W-TS001	Thermocouple inputs K or J, 2 inputs	
Units	CPM1A-TS001		
<u>0</u>	CP1W-TS002	Thermocouple inputs K or J, 4 inputs	
	CPM1A-TS002		
 ۱۹۹۹ ما ۱۹۹۹ –	CP1W-TS101	Platinum resistance thermometer inputs Pt100	
	CPM1A-TS101	or JPt100, 2 inputs	
	CP1W-TS102	Platinum resistance thermometer inputs Pt100	
	CPM1A-TS102	or JPt100, 4 inputs	

# Standard Models

# Appendix A

Name and appearance	Model	Specifications	Remarks
DeviceNet I/O Link Unit	CPM1A-DRT21	As a DeviceNet Slave, 32 inputs and 32 out	puts are allocated.
CompoBus/S I/O Link	CP1W-SRT21	As a CompoBus/S slave, 8 inputs and 8 out	puts are allocated.
Unit	CPM1A-SRT21		

## **Maintenance Products**

Name and appearance	Model	Specifications	Remarks
Battery	CJ1W-BAT01		Installed in the CPU Unit.

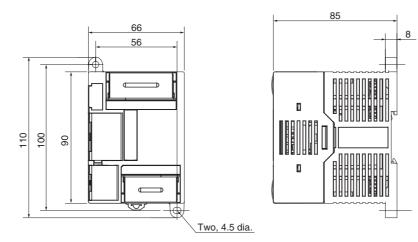
# Installation and Wiring Products

Name and appearance	Model	Specifications	Remarks
DIN Track	PFP-50N		
	PFP-100N		
	PFP-100N2		
End Plate	PFP-M		
5			
I/O Connecting Cable	CP1W-CN811	Used to install CP-series/CPM1A-series Expansion Units and Expansion I/O Units in a second row.	
		Only one I/O Connecting Cable can be used in each PLC.	

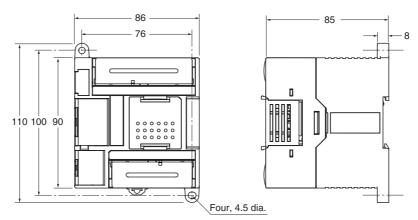
# Appendix B Dimensions Diagrams

# **CP1L CPU Units**

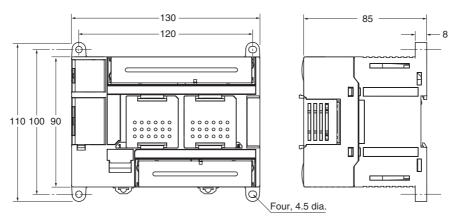
# CPU Units with 10 I/O Points



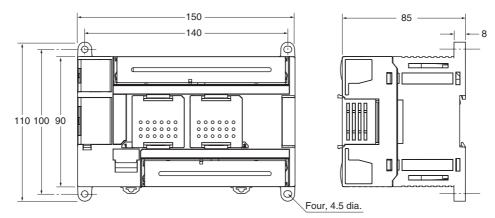
# CPU Units with 14 or 20 I/O Points



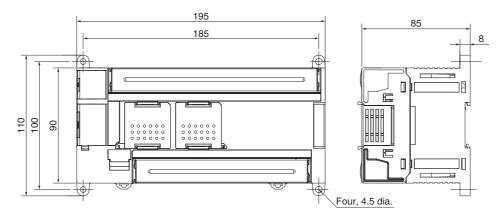
# CPU Units with 30 I/O Points



# CPU Units with 40 I/O Points

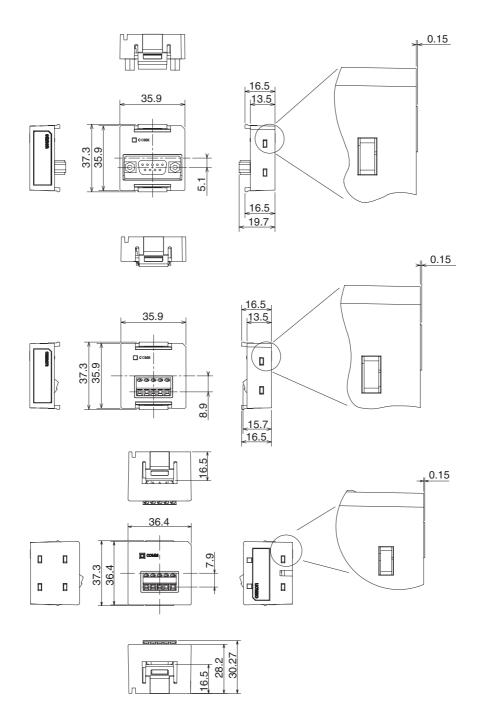


# CPU Units with 60 I/O Points

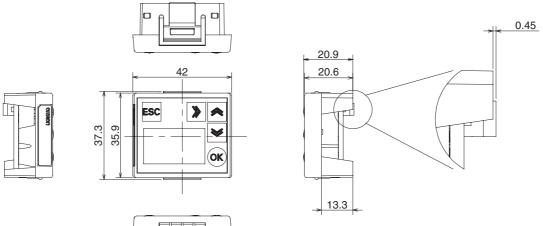


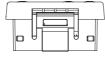
# **Optional Products**

# CP1W-CIF01/CIF11/CIF12 Option Boards



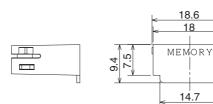
# **CP1W-DAM01 LCD Option Board**

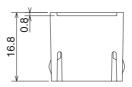




# **CP1W-ME05M Memory Cassette**

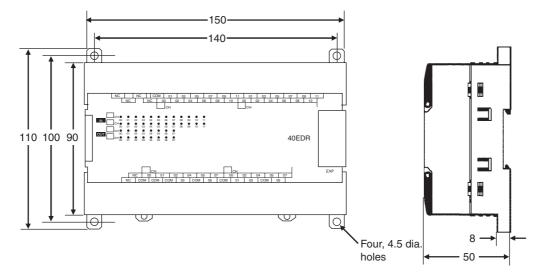




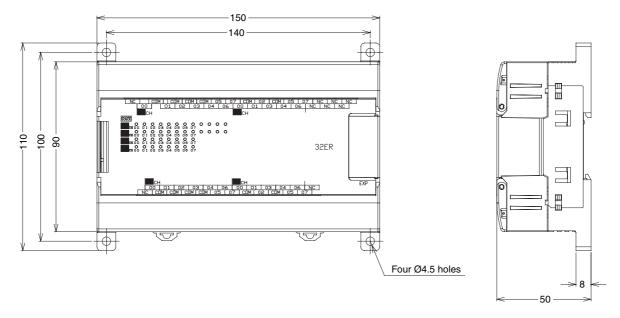


# **Expansion I/O Units**

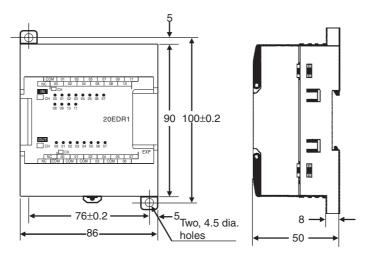
# 40-point I/O Units (CP1W/CPM1A-40EDR/40EDT/40EDT1)



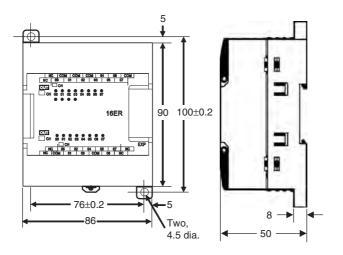
# 32-point Output Units (CP1W-32ER/32ET/32ET1)



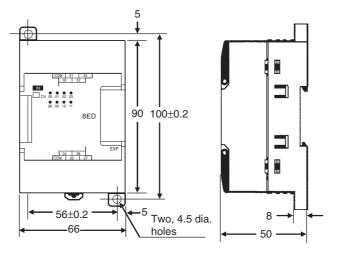
# 20-point I/O Units (CP1W/CPM1A-20EDR1/20EDT/20EDT1)



## 16-point Output Unit (CP1W/CPM1A-16ER/CP1W-16ET/16ET1)

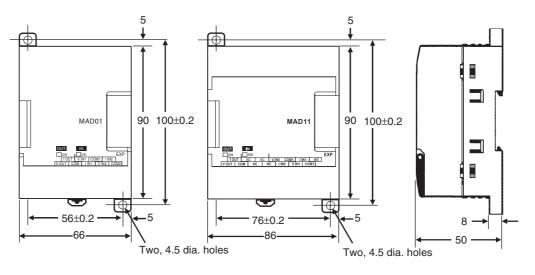


## 8-point I/O Units (CP1W/CPM1A-8ER/8ET/8ET1)

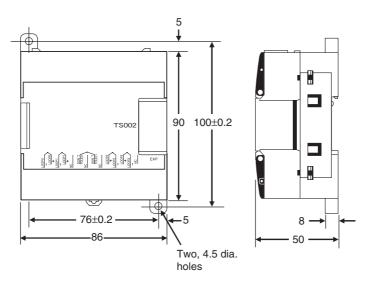


# **Expansion Units**

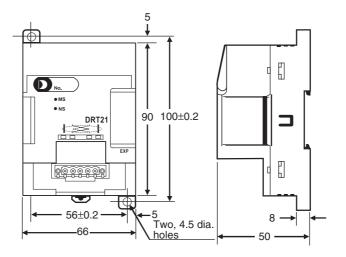
## CPM1A-MAD01/ CP1W/CPM1A/MAD11 Analog I/O Units



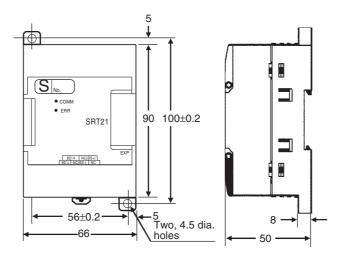
# CP1W/CPM1A-TS



# CPM1A-DRT21 DeviceNet I/O Link Unit



# CP1W/CPM1A-SRT21 CompoBus/S I/O Link Unit



# Appendix C Auxiliary Area Allocations by Function

# **Initial Settings**

Name	Address	Description	Access	Updated
IOM Hold Bit	A500.12	Turn this bit ON to retain the status of the I/O Memory when shift- ing from PROGRAM to RUN or MONITOR mode or vice versa or when turning ON the power supply.	Read/write	
		ON: I/O memory retained		
		OFF: I/O memory not retained		
Forced Status Hold Blt	A500.13	Turn this bit ON to preserve the status of bits that have been force- set or force-reset when shifting from PROGRAM to MONITOR mode or vice versa or when turning ON the power supply.	Read/write	

# **CPU Unit Settings**

Name	Address	Description	Access	Updated
Status of DIP Switch Pin 6	A395.12	The status of pin 6 on the DIP switch on the front of the CPU Unit is written to this flag every cycle.	Read-only	
Manufacturing Lot Number	A310 and A311	The manufacturing lot number is stored in 5 digits hexadecimal. X, Y, and Z in the lot number are converted to 10, 11, and 12, respectively.	Read-only	
		Examples: Lot number 23805 A310 = 0823, A311 = 0005		
		Lot number 15X05 A310 =1015, A311 = 0005		

# **DM Initial Value Settings**

Name	Address	Description	Access	Updated
DM Initial Values Flag	A345.04	ON when DM initial values are stored in the flash memory.	Read-only	
DM Initial Values Read Error Flag	A751.11	ON when an error occurred in transferring DM initial values from the DM initial value area in flash memory to the DM Area.	Read-only	
DM Initial Values Save Execution Error Flag	A751.12	ON when the DM Initial Values Transfer Password (A752) is incorrect or when the DM Initial values area was not specified when starting to transfer DM initial values from the DM Area to the DM initial value area in flash memory.	Read-only	
DM Initial Values Save Error Flag	A751.13	ON when an error occurred in transferring DM initial values from the DM Area to the DM initial value area in flash memory.	Read-only	
DM Initial Values Save Flag	A751.14	ON while DM initial values are being transferred from the DM Area to the DM initial value area in flash memory. OFF when the transfer has been completed.	Read-only	
DM Initial Values Save Start Bit	A751.15	Turn ON this bit to start transferring DM initial values. This bit is valid only when a correct password is stored in A752 and the DM Area Initial Value Area is specified (i.e., when A753.00 is ON). The system will turn this bit OFF automatically when the transfer has been completed.	Read/Write	
DM Initial Values Transfer Password	A752	Set the passwords here to transfer DM initial values between the DM area and the DM initial value area in flash memory. The transfer will not be started unless the correct password is set. The transfer is started when A751.15 is turned ON. The password will be cleared by the system when the transfer has been completed. A5A5 hex: Save initial values from DM to flash	Read/Write	
DM Initial Values Save Area Specifi- cations	A753.00	Specifies the area to be transferred to flash memory.	Read/Write	

# **Built-in Inputs**

#### Analog Adjustment and External Analog Setting Input

Name	Address	Description	Access	Updated
Analog Adjustment PV	A642	Stores the value set on the analog adjuster as a hexadecimal value (resolution: 1/256). 0000 to 00FF hex	Read-only	When analog adjustment is turned
External Analog Setting Input PV	A643	Stores the value set from the external analog setting input as a hexadecimal value (resolution: 1/256). 0000 to 00FF hex	Read-only	

### Input Interrupts, Interrupt Counters 0 to 5

Interrupt counter	Counter SV	Counter PV
Interrupt counter 0	A532	A536
Interrupt counter 1	A533	A537
Interrupt counter 2	A534	A538
Interrupt counter 3	A535	A539
Interrupt counter 4	A544	A548
Interrupt counter 5	A545	A549

Name	Description	Access	Updated
Interrupt Counter Counter SV	Used for an interrupt input in counter mode. Sets the count value at which the interrupt task will start. The corre- sponding interrupt task will start when the interrupt counter has counted this number of pulses.	Read/Write	<ul> <li>Retained when power is turned ON.</li> <li>Retained when opera- tion starts.</li> </ul>
Interrupt Counter Counter PV	These words contain the interrupt counter PVs for interrupt inputs operating in counter mode. In increment mode, the counter PV starts incrementing from 0. When the counter PV reaches the counter SV, the PV is automati- cally reset to 0. In decrement mode, the counter PV starts decrementing from the counter SV. When the counter PV reaches the 0, the PV is automat- ically reset to the SV.	Read/Write	<ul> <li>Retained when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated when interrupt is generated.</li> </ul>

### High-speed Counters 0 to 3

Item		High-speed counter 0	High-speed counter 1	High-speed counter 2	High-speed counter 3
High-speed Counter PV	Leftmost 4 digits	A271	A273	A317	A319
	Rightmost 4 digits	A270	A272	A316	A318
High-speed Counter Range	Range 1	A274.00	A275.00	A320.00	A321.00
Comparison Condition Met Flag	Range 2	A274.01	A275.01	A320.01	A321.01
	Range 3	A274.02	A275.02	A320.02	A321.02
	Range 4	A274.03	A275.03	A320.03	A321.03
	Range 5	A274.04	A275.04	A320.04	A321.04
	Range 6	A274.05	A275.05	A320.05	A321.05
	Range 7	A274.06	A275.06	A320.06	A321.06
	Range 8	A274.07	A275.07	A320.07	A321.07
High-speed Counter Comparison	In-progress Flag	A274.08	A275.08	A320.08	A321.08
High-speed Counter Overflow/Underflow Flag		A274.09	A275.09	A320.09	A321.09
High-speed Counter Count Direction		A274.10	A275.10	A320.10	A321.10
High-speed Counter Count Reset Bit		A531.00	A531.01	A531.02	A531.03
High-speed Counter Gate Flag		A531.08	A531.09	A531.10	A531.11

# Appendix C

Name	)	Description	Read/Write	Updated
High-speed Cou	inter PV	Contains the PV of the high-speed counter.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated each cycle during overseeing process.</li> <li>Updated when PRV(881) instruction is executed for the corresponding counter.</li> </ul>
High-speed Counter Range Comparison Condition Met Flags	Range 1 Range 2 Range 3 Range 4 Range 5 Range 6 Range 7	These flags indicate whether the PV is within the specified ranges when the high-speed counter is being operated in range-comparison mode. OFF: PV not in range ON: PV in range	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when range comparison table is registered.</li> <li>Updated each cycle during oversee- ing process.</li> <li>Updated when PRV(881) instruction is executed to read range compari- son results.</li> </ul>
Range 8 High-speed Counter Com- parison In-progress Flag		This flag indicates whether a comparison operation is being executed for the high-speed counter. OFF: Stopped. ON: Being executed.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated when comparison operation starts or stops.</li> </ul>
High-speed Counter Over- flow/Underflow Flag		This flag indicates when an overflow or underflow has occurred in the high-speed counter PV. (Used with the linear mode counting range only.) OFF: Normal ON: Overflow or underflow	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when the PV is changed.</li> <li>Updated when an overflow or underflow occurs.</li> </ul>
High-speed Counter Count Direction		This flag indicates whether the high-speed counter is currently being incremented or decremented. The counter PV for the current cycle is compared with the PLC in last cycle to determine the direction. OFF: Decrementing ON: Incrementing	Read-only	<ul> <li>Setting used for high-speed counter, valid during counter operation.</li> </ul>
High-speed Counter Reset Bit		When the reset method is set to Phase-Z signal + Software reset, the corresponding high-speed counter's PV will be reset if the phase-Z signal is received while this bit is ON. When the reset method is set to a software reset, the corresponding high-speed counter's PV will be reset in the cycle when this bit goes ON.	Read/Write	Cleared when power is turned ON.
High-speed Counter Gate Bit		When a counter's Gate Bit is ON, the counter's PV will not be changed even if pulse inputs are received for the counter. When the bit is turned OFF again, counting will restart and the high-speed counter's PV will be updated. When the reset method is set to Phase-Z signal + Software reset, the Gate Bit is disabled while the corresponding Reset Bit is ON.	Read/Write	Cleared when power is turned ON.

# **Built-in Outputs**

# Pulse Outputs 0, 1

Iter	Pulse output 0	Pulse output 1	
Pulse Output PV	Leftmost 4 digits	A277	A279
	Rightmost 4 digits	A276	A278
Pulse Output Accel/De	cel Flag	A280.00	A281.00
Pulse Output Overflow	Underflow Flag	A280.01	A281.01
Pulse Output, Output A	mount Set Flag	A280.02	A281.02
Pulse Output, Output C	Completed Flag	A280.03	A281.03
Pulse Output, Output In	n-progress Flag	A280.04	A281.04
Pulse Output No-origin	Flag	A280.05	A281.05
Pulse Output At-origin	A280.06	A281.06	
Pulse Output, Output Stopped Error Flag		A280.07	A281.07
PWM Output, Output Ir	n-progress Flag	A283.00	A283.08

Item	Pulse output 0	Pulse output 1
Pulse Output Stop Error Code	A444	A445
Pulse Output Reset Bit	A540.00	A541.00
Pulse Output CW Limit Input Signal Flag	A540.08	A541.08
Pulse Output CCW Limit Input Signal Flag	A540.09	A541.09
Pulse Output Positioning Completed Signal	A540.10	A541.10

Name	Description	Read/Write	Updated
Pulse Output PV	Contain the number of pulses output from the correspond- ing pulse output port. PV range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647) When pulses are being output in the CW direction, the PV is incremented by 1 for each pulse. When pulses are being output in the CCW direction, the PV is decremented by 1 for each pulse. PV after overflow: 7FFF FFFF hex PV after underflow: 8000 0000 hex Note If the coordinate system uses relative coordinates (undefined origin), the PV will be cleared to 0 when a pulse output starts, i.e. when a pulse output instruction (SPED(885), ACC(888), or PLS2(887)) is executed.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated each cycle during oversee process.</li> <li>Updated when the PV is changed by the INI(880) instruction.</li> </ul>
Pulse Output Accel/Decel Flag	This flag will be ON when pulses are being output accord- ing to an ACC(888) or PLS2(887) instruction and the output frequency is being changed in steps (accelerating or decel- erating). OFF: Constant speed ON: Accelerating or decelerating	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts or stops.</li> <li>Updated each cycle during over- see process.</li> </ul>
Pulse Output Over- flow/Underflow Flag	This flag indicates when an overflow or underflow has occurred in the pulse output PV. OFF: Normal ON: Overflow or underflow	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when the PV is changed by the INI(880) instruction.</li> <li>Updated when an overflow or underflow occurs.</li> </ul>
Pulse Output, Output Amount Set Flag	ON when the number of output pulses has been set with the PULS(886) instruction. OFF: No setting ON: Setting made	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts or stops.</li> <li>Updated when the PULS(886) instruction is executed.</li> <li>Updated when pulse output stops.</li> </ul>
Pulse Output, Output Completed Flag	ON when the number of output pulses set with the PULS(886) or PLS2(887) instruction has been output. OFF: Output not completed. ON: Output completed.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts or stops.</li> <li>Updated at the start or comple- tion of pulse output in indepen- dent mode.</li> </ul>
Pulse Output, Output In-progress Flag	ON when pulses are being output. OFF: Stopped ON: Outputting pulses.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts or stops.</li> <li>Updated when pulse output starts or stops.</li> </ul>
Pulse Output No-origin Flag	ON when the origin has not been determined and goes OFF when the origin has been determined. OFF: Origin established. ON: Origin not established.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated when pulse output starts or stops.</li> <li>Updated each cycle during the overseeing processes.</li> </ul>
Pulse Output At-origin Flag	ON when the pulse output PV matches the origin (0). OFF: Not stopped at origin. ON: Stopped at origin.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Updated each cycle during the overseeing processes.</li> </ul>

# Appendix C

Name	Description	Read/Write	Updated
Pulse Output, Output Stopped Error Flag	ON when an error occurred while outputting pulses in the pulse output 0 origin search function. OFF: No error ON: Stop error occurred.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Updated when origin search starts.</li> <li>Updated when a pulse output stop error occurs.</li> </ul>
PWM Output, Output In-progress Flag	ON when pulses are being output from the PWM output. OFF: Stopped ON: Outputting pulses.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts or stops.</li> <li>Updated when pulse output starts or stops.</li> </ul>
Pulse Output Stop Error Code	If a Pulse Output Stop Error occurs, the error code is writ- ten to this word.	Read-only	<ul> <li>Cleared when power is turned ON.</li> <li>Updated when origin search starts.</li> <li>Updated when a pulse output stop error occurs.</li> </ul>
Pulse Output Reset Bit	The pulse output PV will be cleared when this bit is turned ON.	Read/Write	Cleared when power is turned ON.
Pulse Output CW Limit Input Signal Flag	This is the CW limit input signal for the pulse output, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the lad- der program and output the result to this flag.	Read/Write	Cleared when power is turned ON.
Pulse Output CCW Limit Input Signal Flag	This is the CCW limit input signal for the pulse output, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the ladder program and output the result to this flag.	Read/Write	Cleared when power is turned ON.
Pulse Output Position- ing Completed Signal	This is the positioning completed input signal used in the origin search for the pulse output. The input signal from the servo driver is output to this bit from the ladder program to enable using the signal.	Read/Write	Cleared when power is turned ON.

## **Inverter Positioning**

## Inverter Positioning 0 and 1

Item		Inverter positioning 0	Inverter positioning 1
Inverter Frequency Command Value		A23	A33
Present Value of Unsigned Output	Leftmost 4 digits	A21	A31
Value	Rightmost 4 digits	A20	A30
Present Value of Signed Output	Leftmost 4 digits	A25	A35
Value	Rightmost 4 digits	A24	A34
Operation Command Flag		A26.00	A36.00
Forward Operation Command Flag	A26.01	A36.01	
Reverse Operation Command Flag	A26.02	A36.02	
In-position Flag	A26.03	A36.03	
Error Counter Error Flag	A26.04	A36.04	
Error Counter Pulse Output Flag	A26.05	A36.05	
Error Counter Pulse Output Accelera	tion/Deceleration Flag	A26.06	A36.06
Error Counter Alarm Flag		A26.07	A36.07
Inverter Positioning Output Value Sig	n Flag	A26.15	A36.15
Error Counter Present Value, Signed		A22	A32
Present Value of Pulse Output to	Leftmost 4 digits	A29	A39
Inverter, Relative Value	Rightmost 4 digits	A28	A38
Error Counter Reset Bit		A562.00	A563.00
Error Counter Disable Bit		A562.01	A563.01
Present Value of High-speed	Leftmost 4 digits	A271	A273
Counter	Rightmost 4 digits	A270	A272
Present Value of Internal Pulse Out-	Leftmost 4 digits	A271	A279
put	Rightmost 4 digits	A270	A278

# Appendix C

Name	Description	Read/Write	Updated
Inverter Fre- quency Com- mand Value	This word contains the automatically calculated fre- quency command value for the inverter. Data range: 0000 to FFFF hex (0.00 to 655.35 Hz) (0.01- Hz increments, unsigned) Set the Power Supply Frequency for One Motor Revolu- tion per Second, Number of Encoder Pulses for One Motor Revolution, and Error Counter Cycle in the PLC Setup before using this value.	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when an error occurs in the error counter.</li> <li>Updated each error counter cycle.</li> </ul>
Present Value of Unsigned Output Value	These words contain the present value of the unsigned output value (output value = present value of error counter $\times$ error counter cycle (s) $\times$ gain). Data range: 0000 0000 to 8000 0000 hex (0 to 2,147,483,648) The maximum and minimum output values are applied.	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when an error occurs in the error counter.</li> <li>Updated each error counter cycle.</li> </ul>
Present Value of Signed Output Value	These words contain the present value of the signed out- put value (output value = present value of error counter $\times$ error counter cycle (s) $\times$ gain). Data range: 8000 0000 to 7FFF FFFF hex (-214,748,348 to 214,748,347) The maximum and minimum output values are applied.	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when an error occurs in the error counter.</li> <li>Updated each error counter cycle.</li> </ul>
Operation Com- mand Flag	This flag turns ON during an inverter positioning opera- tion command. ON: Operation command executed. OFF: Stop command executed.	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when operation starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when inverter posi- tioning is stopped (immediate stop) using INI instruction.</li> </ul>
Forward Operation Command Flag	This flag turns ON during an inverter positioning forward operation command. ON: Forward command in progress OFF: Reverse command in progress or stopped	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when error counter present value is 0 or less than 0 (negative).</li> <li>Turned ON when error counter present value is greater than 0 (positive).</li> </ul>
Reverse Opera- tion Command Flag	This flag turns ON during an inverter positioning reverse operation command. ON: Reverse command in progress OFF: Forward command in progress or stopped	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when error counter present value is 0 or greater than 0 (positive).</li> <li>Turned ON when error counter present value is less than 0 (nega- tive).</li> </ul>
In-position Flag	This flag turns ON when inverter positioning is in position. ON: In position OFF: Not in position	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when pulses are being output to error counter.</li> <li>Turned OFF absolute value of error counter present value is greater than in-position range.</li> <li>Turned OFF when pulse output to error counter is stopped and abso- lute value of error counter present value is less than in-position range</li> </ul>

# Appendix C

Name	Description	Read/Write	Updated
Error Counter Error Flag	This flag turns ON when an error occurs in the error counter for inverter positioning. ON: Error counter error OFF: No error	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when error counter error is reset.</li> <li>Turned ON when pulse output to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter error detection value.</li> </ul>
Error Counter Pulse Output Flag	This flag is ON while pulses are being output to the out- put counter for inverter positioning. ON: Pulses being output OFF: Pulse output stopped	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when error counter error is reset.</li> <li>Turned ON when pulse output to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter error detection value.</li> </ul>
Error Counter Pulse Output Accelera- tion/Deceleration Flag	This flag is ON while pulse output to the output counter for inverter positioning is accelerating or decelerating. ON: Pulse output to the error counter is accelerating or decelerating (i.e., the frequency is changing) OFF: Pulse output to the error counter is constant	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF during output of a con- stant pulse frequency to error counter.</li> <li>Turned OFF when pulse output to error counter is stopped (including immediate stops and deceleration stops).</li> <li>Turned ON when pulse output fre- quency to error counter is changed by ACC or PLS2 instruction.</li> </ul>
Error Counter Alarm Flag	This flag turns ON when an alarm occurs in the error counter for inverter positioning. ON: Error counter alarm OFF: No alarm	Read	<ul> <li>Turned OFF when power is turned ON.</li> <li>Turned OFF when CPU Unit opera- tion starts.</li> <li>Turned OFF when CPU Unit opera- tion stops.</li> <li>Turned OFF when error counter alarm is reset.</li> <li>Turned ON when pulse output to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter alarm detection value.</li> </ul>
Inverter Position- ing Output Value Sign Flag	This flag is ON when the inverter positioning output value is positive and is OFF when it is negative. ON: Positive value OFF: Negative value	Read	<ul> <li>Turned ON when signed output value is between 0000 0000 and 7FFF FFFF hex.</li> <li>Turned OFF when signed output value is between FFFF FFFF and 8000 0000 hex.</li> </ul>
Error Counter Present Value, Signed	This word contains the present value of the error counter. Data range: 8000 to 7FFF hex (-32,768 to 32,767)	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when error counter is reset.</li> <li>Held when Error Counter Disable Bit (A562.01) is turned ON.</li> <li>Updated each error counter cycle.</li> </ul>
Present Value of Pulse Output to Inverter, Relative Value	These words contain the relative value of the internal pulse output value when pulses are being output to the error counter. Data range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Cleared when pulse output to error counter is started.</li> <li>Updated each error counter cycle.</li> </ul>

# Appendix C

Name	Description	Read/Write	Updated
Error Counter Reset Bit	Turn ON this bit to reset the Error Counter Present Value and turn OFF the Error Counter Error Flag.	Read/write	
Error Counter Dis- able Bit	Turn ON this bit to hold the error counter value. ON: Error counter value held. OFF: Error counter value not held.	Read/write	
Present Value of High-speed Counter	These words contain the present value of the high-speed counter.	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated each cycle during oversee process.</li> <li>Updated when present value is read using PRV instruction.</li> </ul>
Present Value of Internal Pulse Output, Absolute Value for Abso- lute Coordinates	These words contain the absolute value of the actual movement in relation to the internal pulse origin when pulses are being output to the error counter. Data range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)	Read	<ul> <li>Cleared when power is turned ON.</li> <li>Cleared when operation starts.</li> <li>Updated each error counter cycle.</li> </ul>

# System Flags

Name	Address	Description	Access	Updated
First Cycle Flag	A200.11	ON for one cycle after PLC operation begins (after the mode is switched from PROGRAM to RUN or MONITOR, for example).	Read-only	
Initial Task Execution Flag	A200.15	ON when a task is executed for the first time, i.e., when it changes from INI to RUN status.	Read-only	
Task Started Flag	A200.14	<ul> <li>When a task switches from WAIT or INI to RUN status, this flag will be turned ON within the task for one cycle only.</li> <li>Note The only difference between this flag and A200.15 is that this flag also turns ON when the task switches from WAIT to RUN status.</li> </ul>	Read-only	
Maximum Cycle Time	A262 to A263	These words contain the maximum cycle time since the start of PLC operation. The cycle time is recorded in 8-digit hexadecimal with the leftmost 4 digits in A263 and the rightmost 4 digits in A262. 0 to FFFFFFFF: 0 to 429,496,729.5 ms (0.1-ms units)	Read-only	
Present Cycle Time	A264 to A265	These words contain the present cycle time in 8-digit hexadecimal with the leftmost 4 digits in A265 and the rightmost 4 digits in A264.	Read-only	
10-ms Incrementing Free Running Timer	AO	<ul> <li>This word contains the system timer used after the power is turned ON.</li> <li>A value of 0000 hex is set when the power is turned ON and this value is automatically incremented by 1 every 10 ms. The value returns to 0000 hex after reaching FFFF hex (655,350 ms), and then continues to be automatically incremented by 1 every 10 ms.</li> <li>Note: The timer will continue to be incremented when the operating mode is switched to RUN mode.</li> <li>Example: The interval can be counted between processing A and processing B without requiring timer instructions. This is achieved by calculating the difference between the value in A0 for processing A and the value in A0 for processing B. The interval is counted in 10 ms units.</li> </ul>	Read-only	
100-ms Incrementing Free Running Timer	A1	<ul> <li>This word contains the system timer used after the power is turned ON.</li> <li>A value of 0000 hex is set when the power is turned ON and this value is automatically incremented by 1 every 100 ms. The value returns to 0000 hex after reaching FFFF hex (6,553,500 ms), and then continues to be automatically incremented by 1 every 100 ms.</li> <li>Note: The timer will continue to be incremented when the operating mode is switched to RUN mode.</li> <li>Example: The interval can be counted between processing A and processing B without requiring timer instructions. This is achieved by calculating the difference between the value in A0 for processing A and the value in A0 for processing A and the value in A0 for processing B. The interval is counted in 100 ms units.</li> </ul>	Read-only	

## **Task Information**

Name	Address	Description	Access	Updated
Task Number when Program Stopped	A294	This word contains the task number of the task that was being executed when program execution was stopped because of a program error.	Read-only	
Maximum Interrupt Task Processing Time	A440	Contains the Maximum Interrupt Task Processing Time in units of 0.1 ms as hexadecimal data.	Read-only	
Interrupt Task with Max. Processing Time	A441	Contains the task number of the interrupt task with the maximum processing time. Hexadecimal values 8000 to 80FF correspond to task numbers 00 to FF. Bit 15 is turned ON when an interrupt has occurred.	Read-only	
IR/DR Operation between Tasks	A99.14	ON when index and data registers are shared between all tasks. OFF: Independent ON: Shared (default)	Read-only	

# **Debugging Information**

### **Online Editing**

Name	Address	Description	Access	Updated
Online Editing Wait Flag	A201.10	ON when an online editing process is waiting.	Read-only	
Online Editing Processing Flag	A201.11	ON when an online editing process is being executed.	Read-only	
Online Editing Disable Bit Validator	A527.00 to A527.07	The Online Editing Disable Bit (A527.09) is valid only when this byte contains 5A.	Read/write	
Online Editing Disable Bit	A527.09	Turn this bit ON to disable online editing. The setting of this bit is valid only when A527.00 to A527.07 have been set to 5A.	Read/write	

### **Output Control**

Name	Address	Description	Access	Updated
Output OFF Bit	A500.15	Turn this bit ON to turn OFF all outputs from the CPU Unit, CPM1A Units, and Special I/O Units.	Read/write	

#### **Differentiate Monitor**

Name	Address	Description	Access	Updated
Differentiate Monitor Com- pleted Flag		ON when the differentiate monitor condition has been established during execution of differentiation monitoring.	Read/write	

### **Data Tracing**

Name	Address	Description	Access	Updated
Sampling Start Bit	A508.15	When a data trace is started by turning this bit ON from the CX-Programmer, the PLC will begin storing data in Trace Memory by one of the three following methods: Data is sampled at regular intervals (10 to 2,550 ms). Data is sampled when TRSM(045) is executed in the program. Data is sampled at the end of every cycle.	Read/write	
Trace Start Bit	A508.14	Turn this bit ON to establish the trigger condition. The off- set indicated by the delay value (positive or negative) determines which data samples are valid.	Read/write	
Trace Busy Flag	A508.13	ON when the Sampling Start Bit (A508.15) is turned ON. OFF when the trace is completed.	Read/write	
Trace Completed Flag	A508.12	ON when sampling of a region of trace memory has been completed during execution of a trace.	Read/write	
Trace Trigger Monitor Flag	A508.11	ON when a trigger condition is established by the Trace Start Bit (A508.14). OFF when the next data trace is started by the Sampling Start Bit (A508.15).	Read/write	

### **Comment Memory**

Name	Address	Description	Access	Updated
Program Index File Flag	A345.01	Turns ON when the comment memory contains a pro- gram index file. OFF: No file ON: File present	Read-only	
Comment File Flag	A345.02	Turns ON when the comment memory contains a com- ment file. OFF: No file ON: File present	Read-only	
Symbol Table File Flag	A345.03	Turns ON when the comment memory contains a symbol table file. OFF: No file ON: File present	Read-only	

### **Error Information**

#### Error Log, Error Code

Name	Address	Description	Access	Updated
Error Log Area	A100 to A199	When an error has occurred, the error code, error con- tents, and error's time and date are stored in the Error Log Area.	Read-only	
Error Log Pointer	A300	When an error occurs, the Error Log Pointer is incre- mented by 1 to indicate the location where the next error record will be recorded as a hexadecimal offset from the beginning of the Error Log Area (A100 to A199).	Read-only	
Error Log Pointer Reset Bit	A500.14	Turn this bit ON to reset the Error Log Pointer (A300) to 00.	Read/write	
Error Code	A400	When a non-fatal error (user-defined FALS(006) or sys- tem error) or a fatal error (user-defined FALS(007) or system error) occurs, the 4-digit hexadecimal error code is written to this word.	Read-only	

#### **Memory Error Information**

Name	Address	Description	Access	Updated
Memory Error Flag (fatal error)	A401.15	ON when an error occurred in memory or there was an error in automatic transfer from the Memory Cassette when the power was turned ON.	Read-only	
		CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light.		
		Note A403.09 will be turned ON if there was an error during automatic transfer at startup.		
		The automatic transfer at startup error cannot be cleared without turning OFF the PLC.		
Memory Error Location	A403.00 to A403.08	When a memory error occurs, the Memory Error Flag (A40115) is turned ON and one of the following flags is turned ON to indicate the memory area where the error occurred	Read-only	
		A403.00: User program		
		A403.04: PLC Setup		
		A403.07: Routing Table		
Startup Memory Card Trans- fer Error Flag	A403.09	ON when automatic transfer at startup has been selected and an error occurs during automatic transfer. An error will occur if there is a transfer error, the specified file does not exist, or the Memory Cassette is not installed.	Read-only	
		(This flag will be turned OFF when the error is cleared by turning the power OFF. The error cannot be cleared with- out turning the power OFF.)		
Flash Memory Error	A403.10	ON when the flash memory fails.	Read-only	

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#### **Program Error Information**

Name	Address	Description	Access	Updated
Other Fatal Error Flag	A401.00	ON when a fatal error that is not defined for A401.01 to A401.15 occurs. Detailed information is output to the bits of A314.		
		OFF: No other fatal error		
		ON: Other fatal error		
Program Error Flag	A401.09	ON when program contents are incorrect.	Read-only	When error
(fatal error)		CPU Unit operation will stop.		occurs
Program Error Task	A294	This word contains the task number of the task that was being executed when program execution was stopped because of a program error.	Read-only	
Instruction Processing Error Flag	A295.08	This flag and the Error Flag (ER) will be turned ON when an instruction processing error has occurred and the PLC Setup has been set to stop operation for an instruc- tion error.	Read-only	
Indirect DM/EM BCD Error Flag	A295.09	This flag and the Access Error Flag (AER) will be turned ON when an indirect DM BCD error has occurred and the PLC Setup has been set to stop operation an indirect DM BCD error. (This error occurs when the content of an indirectly addressed DM word is not BCD although BCD mode has been selected.)	Read-only	
Illegal Access Error Flag	A295.10	This flag and the Access Error Flag (AER) will be turned ON when an illegal access error has occurred and the PLC Setup has been set to stop operation an illegal access error. (This error occurs when a region of mem- ory is accessed illegally.)	Read-only	
No END Error Flag	A295.11	ON when there isn't an END(001) instruction in each pro- gram within a task	Read-only	
Task Error Flag	A295.12	ON when a task error has occurred. The following condi- tions generate a task error.	Read-only	
		There isn't even one regular task that is executable (started).		
		There isn't a program allocated to the task.		
Differentiation Overflow Error Flag	A295.13	ON when the allowed value for Differentiation Flags which correspond to differentiation instructions has been exceeded.	Read-only	
Illegal Instruction Error Flag	A295.14	ON when a program that cannot be executed has been stored.	Read-only	
UM Overflow Error Flag	A295.15	ON when the last address in UM (User Memory) has been exceeded	Read-only	
Program Address Where Program Stopped	A298 and A299	These words contain the 8-digit binary program address of the instruction where program execution was stopped due to a program error.	Read-only	
		A298: Rightmost 4 digits, A299: Leftmost 4 digits		

#### FAL/FALS Error Information

Name	Address	Description	Access	Updated
FAL Error Flag (non-fatal error)	A402.15	ON when a non-fatal error is generated by executing FAL(006). The CPU Unit will continue operating.	Read-only	
Executed FAL Number Flags	A360 to A391	The flag corresponding to the specified FAL number will be turned ON when FAL(006) is executed. Bits A360.01 to A391.15 correspond to FAL numbers 001 to 511.	Read-only	
FALS Error Flag (fatal error)	A401.06	ON when a fatal error is generated by the FALS(006) instruction. The CPU Unit will stop operating.	Read-only	
FAL/FALS Number for Sys- tem Error Simulation	A529	Set a dummy FAL/FALS number to use to simulate the system error using FAL(006) or FALS(007). Set the FAL/FALS number. 0001 to 01FF hex: FAL/FALS numbers 1 to 511 0000 or 0200 to FFFF hex: No FAL/FALS number for sys- tem error simulation. (No error will be generated.)	Read/write	

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#### **PLC Setup Error Information**

Name	Address	Description	Access	Updated
PLC Setup Error Flag (non-fatal error)	A402.10	ON when there is a setting error in the PLC Setup.	Read-only	
PLC Setup Error Location	A406	When there is a setting error in the PLC Setup, the loca- tion of that error is written to A406 in 4-digit hexadecimal.	Read-only	

#### I/O Information

Name	Address	Description	Access	Updated
Too Many I/O Points Flag (fatal error)	A401.11	ON when the number of Expansion Units and Expansion I/O Units exceeds the limit, when the number of words allocated to these Units exceeds the limit, are mounted.	Read-only	
Too Many I/O Points, Details	A407.00 to A407.12	Always 0000 hex.	Read-only	
Too Many I/O Points, Cause	A407.13 to A407.15	The 3-digit binary value of these bits indicates the cause of the Too Many I/O Points Error.	Read-only	
		010: Too many words		
		011: Too many Units		
I/O Bus Error Flag	A401.14	ON in the following cases:	Read-only	
(fatal error)		• When an error occurs in a data transfer between the CPU Unit and a Expansion Unit or Expansion I/O Unit. If this happens, 0A0A hex will be output to A404.		
		• When an error occurs in a data transfer between the CPU Unit. If this happens, 0000 hex will be output to A404 to indicate the first Unit, 0001 hex to indicate the second Unit, and 0F0F hex to indicate an undetermined Unit.		
		CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light.		
		(This flag will be turned OFF when the error is cleared.)		
I/O Bus Error Slot Number	A404	Contains information on I/O bus errors. The CPU Unit will stop operating and the ERR/ALM indi- cator on the front of the CPU Unit will light. (A401.04 (I/O Bus Error Flag) will turn ON.) (This information will be cleared when the error is cleared.) 0A0A hex: Expansion Unit or Expansion I/O Unit error	Read-only	
Duplication Error Flag	A401.13		Read-only	
(fatal error)	A401.13	<ul><li>ON in the following cases:</li><li>Two CPU Bus Units have been assigned the same unit number.</li></ul>	nead-only	
Unit Error Flags	A436.00 to A436.02	ON when an error occurs in an Expansion Unit or Expan- sion I/O Unit.	Read-only	
		A436.00: 1st Unit A436.10: 2nd Unit A436.02: 3rd Unit		
		CP1W/CPM1A-TS002 and CP1W/CPM1A-TS102 are each counted as two Units.		
Number of Connected Units	A437	Stores the number of Expansion Units and Expansion I/O Units connected as a hexadecimal number.	Read-only	
		Note This information is valid only when a Too Many I/O Points error has occurred. CP1W/CPM1A-TS002 and CP1W/CPM1A-TS102 are each counted as two Units.		

#### Other PLC Operating Information

Name	Address	Description	Access	Updated
Battery Error Flag (non-fatal error)	A402.04	ON if the CPU Unit's battery is disconnected or its volt- age is low and the Detect Battery Error setting has been set in the PLC Setup.	Read-only	
Cycle Time Too Long Flag (fatal error)	A401.08	ON if the cycle time exceeds the maximum cycle time set in the PLC Setup (the cycle time monitoring time).	Read-only	
FPD Teaching Bit	A598.00	Turn this bit ON to set the monitoring time automatically with the teaching function.	Read/write	

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Name	Address	Description	Access	Updated
Option Board Error Flag	A315.13	ON when the Option Board is removed while the power is being supplied.	Read-only	When an error occurs
		CPU Unit operation will continue and the ERR/ALM indi- cator will flash.		
		OFF when the error has been cleared.		
Flash Memory Error Flag	A315.15	ON when writing to the internal flash memory fails.		When an error
		CPU Unit operation will continue and the ERR/ALM indi- cator will flash.		occurs
		OFF when the error has been cleared.		
Other Fatal Error Flag	A402.00	ON when a non-fatal error that is not defined for A402.01 to A402.15 occurs. Detailed information is output to the bits of A314.	Read-only	When an error occurs
		OFF: No other fatal error		
		ON: Other fatal error		

## Clock

#### **Clock Information**

Name	Address	Description	Access	Updated
Clock Data	The clock data from the	The clock data from the clock built into the CPU Unit is stored here in BCD.		
	A351.00 to A351.07	Seconds: 00 to 59 (BCD)		
	A351.08 to A351.15	Minutes: 00 to 59 (BCD)		
	A352.00 to A352.07	Hour: 00 to 23 (BCD)		
	A352.08 to A352.15	Day of the month: 01 to 31 (BCD)		
	A353.00 to A353.07	Month: 01 to 12 (BCD)		
	A353.08 to A353.15	Year: 00 to 99 (BCD)		
	A354.00 to A354.07	Day of the week: 00: Sunday, 01: Monday, 02: Tuesday, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday		

Note The clock data is stored in the CPU Unit as BCD.

#### **Operation Start and End Times**

Name	Address	Description	Access	Updated
Operation Start Time	A515 to A517	The time that operation started as a result of changing the operating mode to RUN or MONITOR mode is stored here in BCD. A515.00 to A515.07: Seconds (00 to 59) A515.08 to A515.15: Minutes (00 to 59) A516.00 to A516.07: Hour (00 to 23) A516.08 to A516.15: Day of month (01 to 31) A517.00 to A517.07: Month (01 to 12) A517.08 to A517.15: Year (00 to 99) Note The previous start time is stored after turning ON	Read/write	
		the power supply until operation is started.		
Operation End Time	A518 to A520	The time that operation stopped as a result of changing the operating mode to PROGRAM mode is stored here in BCD. A518.00 to A518.07: Seconds (00 to 59) A518.08 to A518.15: Minutes (01 to 59) A519.00 to A519.07: Hour (00 to 23) A519.08 to A519.15: Day of month (01 to 31) A520.00 to A520.07: Month (01 to 12) A520.08 to A520.15: Year (00 to 99) Note If an error occurs in operation, the time of the	Read/write	
		error will be stored. If the operation, the time of the error will be stored. If the operating mode is then changed to PROGRAM mode, the time that PRO- GRAM mode was entered will be stored.		

# Appendix C

#### **Power Supply Information**

Name	Address	Description	Access	Updated
Startup Time	A510 and A511	These words contain the time at which the power was turned ON. The contents are updated every time that the power is turned ON. The data is stored in BCD.	Read/write	
		A510.00 to A510.07: Second (00 to 59) A510.08 to A510.15: Minute (00 to 59) A511.00 to A511.07: Hour (00 to 23) A511.08 to A511.15: Day of month (01 to 31)		
Power Interruption Time	A512 and A513	These words contain the time at which the power was interrupted. The contents are updated every time that the power is interrupted. The data is stored in BCD.	Read/write	
		A512.00 to A512.07: Second (00 to 59) A512.08 to A512.15: Minute (00 to 59) A513.00 to A513.07: Hour (00 to 23) A513.08 to A513.15: Day of month (01 to 31) (These words are not cleared at startup.)		
Number of Power Interruptions	A514	Contains the number of times that power has been inter- rupted since the power was first turned ON. The data is stored in binary. To reset this value, overwrite the current value with 0000.	Read/write	
Total Power ON Time	A523	Contains the total time that the PLC has been ON in 10- hour units. The data is stored in binary and it is updated every 10 hours. To reset this value, overwrite the current value with 0000.	Read/write	

# Flash Memory Backup Information

Name	Address	Description	Access	Updated
User Program Date	A90 to A93	These words contain in BCD the date and time that the user program was last overwritten.	Read-only	
		A90.00 to A90.07: Seconds (00 to 59) A90.08 to A90.15: Minutes (00 to 59) A91.00 to A91.07: Hour (00 to 23) A91.08 to A91.15: Day of month (01 to 31) A92.00 to A92.07: Month (01 to 12) A92.08 to A92.15: Year (00 to 99) A93.00 to A93.07: Day of the week (00 to 06) (00: Sunday, 01: Monday, 02: Tuesday, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday)		
Parameter Date	A94 to A97	These words contain in BCD the date and time that the parameters were last overwritten. A94.00 to A94.07: Seconds (00 to 59) A94.08 to A94.15: Minutes (00 to 59) A95.00 to A95.07: Hour (00 to 23) A95.08 to A95.15: Day of month (01 to 31) A96.08 to A96.15: Year (00 to 99) A97.00 to A97.07: Day of the week (00 to 06) (00: Sunday, 01: Monday, 02: Tuesday, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday)	Read-only	

# Appendix C

# Memory Cassette Information

Name	Address	Description	Access	Updated
Memory Cassette Access Status	A342	A342.03: ON when data is being written to the Memory Cassette or the Memory Cassette is being ini- tialized. OFF when processing has been com- pleted.	Read-only	
		A342.04: ON when data is being read from the Memory Cassette. OFF when processing has been completed.		
		A342.05: ON when data is being compared with data on the Memory Cassette. OFF when processing has been completed.		
		A342.07: ON when an error occurs in initializing the Memory Cassette.		
		OFF the next time the Memory Cassette is accessed normally (initialized, written, read, or compared).		
		A342.08: ON when an error occurs in writing the Mem- ory Cassette.		
		OFF the next time the Memory Cassette is accessed normally (initialized, written, read, or compared).		
		A342.10: ON when an error occurs in reading or com- paring the Memory Cassette.		
		OFF the next time the Memory Cassette is accessed normally (initialized, written, read, or compared).		
		A342.12: ON when the data in the CPU Unit is not the same as the data in the Memory Cassette when a verification operation is performed.		
		OFF the next time the Memory Cassette is accessed normally (initialized, written, read, or compared).		
		A342.13: ON when the Memory Cassette is being accessed. OFF when processing has been completed.		
		A342.15: ON when a Memory Cassette is mounted. OFF when a Memory Cassette is not mounted.		
Memory Casette Verifica- tion Results	A494	Stores the results of comparing data in the Memory Cas- sette and CPU Unit. Each bit turns ON to indicate status.	Read-only	
		A494.00: User program is different. A494.01: Function block sources are different. A494.02: Parameter area is different. A494.03: Symbol table is different. A494.04: Comments are different.		
		A494.05: Program indices are different. A494.06: Data memory is different. A494.07: DM initial values are different.		

# Appendix C

# Information on Read Protection Using a Password

Name	Address	Description	Access	Updated
UM Read Protection Flag	A99.00	Indicates whether the entire user program in the PLC is read-protected.	Read-only	
		OFF: UM not read-protected. ON: UM read-protected.		
Task Read Protection Flag	A99.01	Indicates whether read protection is set for individual tasks.	Read-only	
		OFF: Tasks not read-protected. ON: Tasks read-protected.		
Program Write Protection for Read Protection	A99.02	Indicates whether the program is write-protected.	Read-only	
		OFF: Write-enabled. ON: Write-protected.		
Enable/Disable Bit for Pro- gram Backup	A99.03	Indicates whether creating a backup program file (.OBJ) is enabled or disabled.	Read-only	
		OFF: Enabled. ON: Disabled.		
UM Read Protection Release Enable Flag	A99.12	Indicates when UM read protection cannot be released because an incorrect password was input five times consecutively.	Read-only	
		OFF: Protection can be released ON: Protection cannot be released		
Task Read Protection Release Enable Flag	A99.13	Indicates when task read protection cannot be released because an incorrect password was input five times consecutively.	Read-only	
		OFF: Protection can be released ON: Protection cannot be released		

## Communications

#### Networks

#### **Network Communications Information**

Name	Address	Description	Access	Updated
Communications Port Enabled Flags	A202.00 to A202.07	ON when a network instruction or background execution can be executed with the corresponding port number. Bits 00 to 07 correspond to communications ports 0 to 7.	Read-only	
Communications Port Completion Codes	A203 to A210	These words contain the completion codes for the corre- sponding port numbers when network instructions have been executed.	Read-only	
		Words A203 to A210 correspond to communications ports 0 to 7.		
Communications Port Error Flags	A219.00 to A219.07	ON when an error occurred during execution of a net- work instruction.	Read-only	
		OFF when a normal response is returned.		
		Bits 00 to 07 correspond to communications ports 0 to 7.		

#### Information When Automatically Allocating Communications Ports

Name	Address	Description	Access	Updated
Network Communications Port Allocation Enabled Flag	A202.15	ON when there is a communications port available for automatic allocation.	Read-only	
		<b>Note</b> Use this flag to confirm whether a communica- tions port is available for automatic allocation before executing communications instructions when using 9 or more communications instruc- tions simultaneously.		
First Cycle Flags after Net- work Communications Fin- ished	A214.00 to A214.07	Each flag will turn ON for just one cycle after communi- cations have been completed. Bits 00 to 07 correspond to ports 0 to 7. Use the Used Communications Port Num- ber stored in A218 to determine which flag to access.	Read-only	
		<b>Note</b> These flags are not effective until the next cycle after the communications instruction is executed. Delay accessing them for at least one cycle.		
First Cycle Flags after Net- work Communications Error	A215.00 to A215.07	Each flag will turn ON for just one cycle after a communi- cations error occurs. Bits 00 to 07 correspond to ports 0 to 7. Use the Used Communications Port Number stored in A218 to determine which flag to access. Determine the cause of the error according to the Communications Port Completion Codes stored in A203 to A210.	Read-only	
		Note These flags are not effective until the next cycle after the communications instruction is executed. Delay accessing them for at least one cycle.		
Network Communications Completion Code Storage Address	A216 to A217	The completion code for a communications instruction is automatically stored at the address with the I/O memory address given in these words. Place this address into an index register and use indirect addressing through the index register to read the com- munications completion code.	Read-only	
Used Communications Port Numbers	A218	Stores the communications port numbers used when a communications instruction is executed using automatic communication port allocations. 0000 to 0007 hex: Communications port 0 to 7	Read-only	

#### Serial Port 1 Information (CP1L CPU Units with M CPU Type)

Name	Address	Description	Access	Updated
Peripheral Port Communica- tions Error Flag	A392.12	ON when a communications error has occurred at the serial port 1.	Read-only	
Peripheral Port Restart Bit	A526.01	Turn this bit ON to restart the serial port 1.	Read/write	
Peripheral Port Settings Change Bit	A619.01	ON while the serial port 1's communications settings are being changed.	Read/write	
Peripheral Port Error Flags	A528.08 to A528.15	These flags indicate what kind of error has occurred at the serial port 1.	Read/write	
Serial Port 1 Send Ready Flag (No-protocol Mode)	A392.13	ON when the serial port 1 is able to send data in no-pro- tocol mode.	Read-only	

Name Address Description		Description	Access	Updated
Serial Port 1 Reception Completed Flag			Read-only	
(No-protocol Mode)				
Serial Port 1 Reception Overflow Flag	A392.15	ON when a data overflow occurred during reception through the serial port 1 in no-protocol mode.	Read-only	
(No-protocol Mode)				
Peripheral Port PT Commu- nications Flags	A394.00 to A394.07	The corresponding bit will be ON when the serial port 1 is communicating with a PT in NT link mode.	Read-only	
		Bits 0 to 7 correspond to units 0 to 7.		
Peripheral Port PT Priority Registered Flags	A394.08 to A394.15	The corresponding bit will be ON for the PT that has pri- ority when the serial port 1 is communicating in NT link mode.	Read-only	
Serial Port 1 Reception Counter	A394.00 to A394.15	Indicates (in binary) the number of bytes of data received when serial port 1 is in no-protocol mode.	Read-only	
(No-protocol Mode)				

#### Serial Port 1 Information (CP1L CPU Units with L CPU Type)

Name	Address	Description	Access	Updated
Serial Port 1 Communica- tions Error Flag	A392.04	ON when a communications error has occurred at the serial port 1.	Read-only	
		Note Not supported for 1:N NT Link Mode.		
Serial Port 1 Restart Bit	al Port 1 Restart Bit A526.00 Turn this bit ON to restart the serial port 1.		Read/write	
Serial Port 1 Settings Change Bit	A619.02	ON while the serial port 1's communications settings are being changed.	Read/write	
Serial Port 1 Error Flags	A528.00 to A528.07	These flags indicate what kind of error has occurred at the serial port 1.	Read/write	
Serial Port 1 Send Ready Flag (No-protocol mode)	A392.05	ON when the serial port 1 is able to send data in no-pro- tocol mode.	Read-only	
Serial Port 1 Reception A392.06 Completed Flag (No-proto- col Mode)		ON when the serial port 1 has completed the reception in no-protocol mode.	Read-only	
Serial Port 1 Reception Overflow Flag (No-protocol mode)	A392.07	ON when a data overflow occurred during reception through the serial port 1 in no-protocol mode.	Read-only	
Serial Port 1 PT Communi- cations Flags	A393.00 to A393.07	The corresponding bit will be ON when the serial port 1 is communicating with a PT in NT link mode.	Read-only	
		Bits 0 to 7 correspond to units 0 to 7.		
Serial Port 1 PT Priority Registered Flags	A393.08 to A393.15	The corresponding bit will be ON for the PT that has pri- ority when the serial port 1 is communicating in NT link mode.	Read-only	
		Bits 0 to 7 correspond to units 0 to 7.		
Serial Port 1 Reception Counter (No-protocol Mode)	A393.00 to A393.15	Indicates (in binary) the number of bytes of data received when serial port 1 is in no-protocol mode.	Read-only	

#### Serial Port 2 Information (CP1L CPU Units with M CPU Type)

Name	Address	Description	Access	Updated
Serial Port 2 Communica- tions Error Flag			Read-only	
Serial Port 2 Restart Bit	A526.00	Turn this bit ON to restart the serial port 2.	Read/write	
Serial Port 2 Settings Change Bit	A619.02	ON while the serial port 2's communications settings are being changed.	Read/write	
Serial Port 2 Error Flags	A528.00 to A528.07	These flags indicate what kind of error has occurred at the serial port 2.	Read/write	
Serial Port 2 Send Ready Flag (No-protocol mode)	A392.05	ON when the serial port 2 is able to send data in no-pro- tocol mode.	Read-only	
Serial Port 2 Reception Completed Flag (No-protocol Mode)	A392.06	ON when the serial port 2 has completed the reception in no-protocol mode.	Read-only	
Serial Port 2 Reception A392.07 ON when a data overflow occurred during rec		ON when a data overflow occurred during reception through the serial port 2 in no-protocol mode.	Read-only	

#### Appendix C

Name Address		Description	Access	Updated
Serial Port 2 PT Communi- cations Flags	A393.00 to A393.07	The corresponding bit will be ON when the serial port 2 is communicating with a PT in NT link mode.	Read-only	
		Bits 0 to 7 correspond to units 0 to 7.		
RS-232C Port PT Priority Registered Flags	A393.08 to A393.15	The corresponding bit will be ON for the PT that has pri- ority when the serial port 2 is communicating in NT link mode.	Read-only	
RS-232C Port Reception Counter (No-protocol Mode)	A393.00 to A393.15	Indicates (in binary) the number of bytes of data received when serial port 2 is in no-protocol mode.	Read-only	

## Modbus-RTU Easy Master Information (CP1L CPU Units with M CPU Type)

Name	Address	Description	Access	Updated
Serial Port 1 Modbus-RTU Master Execution Bit	A641.00	Turn ON this bit to send a command and receive a response for serial port 1 using the Modbus-RTU easy master function. This bit will be turned OFF automatically by the system when communications have been completed. Turned ON: Execution started ON: Execution in progress. OFF: Not executed or execution completed.	Read-only	
Serial Port 1 Modbus-RTU Master Execution Normal Flag	A641.01	ON when one command has been sent and the response received for serial port 1 using the Modbus- RTU easy master function. ON: Execution normal. OFF: Execution error or still in progress.	Read-only	
Serial Port 1 Modbus-RTU Master Execution Error Flag	A641.02	ON when an error has occurred in communications for serial port 1 using the Modbus-RTU easy master func- tion. The error code is output to D32352 in the DM fixed allocation words for Modbus-RTU Easy Master. ON: Execution error. OFF: Execution normal or still in progress.	Read-only	
Serial Port 2 Modbus-RTU Master Execution Bit	A640.00	Turn ON this bit to send a command and receive a response for serial port 2 using the Modbus-RTU easy master function. This bit will be turned OFF automatically by the system when communications have been completed. Turned ON: Execution started ON: Execution in progress. OFF: Not executed or execution completed.	Read-only	
Serial Port 2 Modbus-RTU Master Execution Normal Flag	A640.01	ON when one command has been sent and the response received for serial port 2 using the Modbus- RTU easy master function. ON: Execution normal. OFF: Execution error or still in progress.	Read-only	
Serial Port 2 Modbus-RTU Master Execution Error Flag	A640.02	ON when an error has occurred in communications for serial port 2 using the Modbus-RTU easy master func- tion. The error code is output to D32252 in the DM fixed allocation words for Modbus-RTU Easy Master. ON: Execution error. OFF: Execution normal or still in progress.	Read-only	

Note DM fixed allocation words for Modbus-RTU Easy Master for serial port 1: D32200 to D32299 DM fixed allocation words for Modbus-RTU Easy Master for serial port 2: D32300 to D32399

#### Modbus-RTU Easy Master Information (CP1L CPU Units with L CPU Type)

Name	Name Address Description		Access	Updated
Serial Port 1 Modbus-RTU Master Execution Bit	A640.00	Turn ON this bit to send a command and receive a response for serial port 2 using the Modbus-RTU easy master function.	Read-only	
		This bit will be turned OFF automatically by the system when communications have been completed.		
		Turned ON: Execution started ON: Execution in progress. OFF: Not executed or execution completed.		
Serial Port 1 Modbus-RTU Master Execution Normal Flag	A640.01	ON when one command has been sent and the response received for serial port 2 using the Modbus- RTU easy master function. ON: Execution normal. OFF: Execution error or still in progress.	Read-only	
Serial Port 1 Modbus-RTU Master Execution Error Flag	A640.02	ON when an error has occurred in communications for serial port 2 using the Modbus-RTU easy master func- tion. The error code is output to D32252 in the DM fixed allocation words for Modbus-RTU Easy Master. ON: Execution error. OFF: Execution normal or still in progress.	Read-only	

Note DM fixed allocation words for Modbus-RTU Easy Master for serial port 2: D32300 to D32399

## Instruction-related Information

Name Address		Description	Access	Updated
Step Flag	A200.12	ON for one cycle when step execution is started with STEP(008).	Read-only	
Macro Area Input Words	A600 to A603	Before the subroutine specified in MCRO(099) is exe- cuted, the source words for the subroutine are trans- ferred to A600 through A603 (input parameter words).	Read/write	
Macro Area Output Words	A604 to A607	After the subroutine specified in MCRO(099) has been executed, the results of the subroutine are transferred from A604 through A607 to the specified destination words (output parameter words).	Read/write	

#### **Function Block Information**

#### Function Block Memory Information

Name	Address	Description	Access	Updated
FB Program Data Flag		Turns ON if the FB program memory contains FB pro- gram data. OFF: No data ON: Data present	Read-only	

#### OMRON FB Library Information

Name	Address	Description	Access	Updated
FB Communications Instruc- tion Response Required	A580.15	0: Not required 1: Required	Read-only	
FB Communications Instruc- tion Port No.			Read-only	
FB Communications Instruc- tion Retries	A580.00 to A580.03	Automatically stores the number of retries in the FB com- munications instruction settings specified in the PLC Setup.	Read-only	
FB Communications Instruc- tion Response Monitoring Time	A581	Automatically stores the FB communications instruction response monitoring time set in the PLC Setup. 0001 to FFFF hex (Unit: 0.1 s; Range: 0.1 to 6553.5) 0000 hex: 2 s	Read-only	
FB DeviceNet Communica- tions Instruction Response Monitoring Time	A582	Automatically stores the FB DeviceNet communications instruction response monitoring time set in the PLC Setup. 0001 to FFFF hex (Unit: 0.1 s; Range: 0.1 to 6553.5) 0000 hex: 2 s	Read-only	

Note These Auxiliary Area bits/words are not to be written by the user. The number of resends and response monitoring time must be set by the user in the FB communications instructions settings in the PLC Setup, particularly when using function blocks from the OMRON FB Library to execute FINS messages or DeviceNet explicit messages communications. The values set in the Settings for

OMRON FB Library in the PLC Setup will be automatically stored in the related Auxiliary Area words A580 to A582 and used by the function blocks from the OMRON FB Library.

# Appendix D

# Auxiliary Area Allocations by Address

# Read-only Area (Set by System)

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A0		10-ms Incre- menting Free Running Timer	<ul> <li>This word contains the system timer used after the power is turned ON.</li> <li>A value of 0000 hex is set when the power is turned ON and this value is automatically incremented by 1 every 10 ms. The value returns to 0000 hex after reaching FFFF hex (655,350 ms), and then continues to be automatically incremented by 1 every 10 ms.</li> <li>Note: The timer will continue to be incremented when the operating mode is switched to RUN mode.</li> <li>Example: The interval can be counted between processing A and processing B without requiring timer instructions. This is achieved by calculating the difference between the value in A0 for processing A and the value in A0 for processing B. The interval is counted in 10 ms units.</li> </ul>		Retained	Cleared	Every 10 ms after power is turned ON	
A1		100-ms Incre- menting Free Running Timer	This word contains the system timer used after the power is turned ON. A value of 0000 hex is set when the power is turned ON and this value is automatically incremented by 1 every 100 ms. The value returns to 0000 hex after reaching FFFF hex (6,553,500 ms), and then continues to be automatically incremented by 1 every 100 ms. <b>Note:</b> The timer will continue to be incremented when the operat- ing mode is switched to RUN mode. Example: The interval can be counted between processing A and processing B without requiring timer instructions. This is achieved by calculating the difference between the value in A0 for processing B. The interval is counted in 100 ms units.		Retained	Cleared	Every 100 ms after power is turned ON	
A20 and A21		Present Value of Unsigned Output Value 0	These words contain the present value of the unsigned output value (output value = present value of error counter $\times$ error counter cycle (s) $\times$ gain) for inverter positioning 0. Data range: 0000 0000 to 8000 0000 hex (0 to 2,147,483,648) The maximum and minimum output values set for inverter positioning 0 in the PLC Setup are applied. A21 contains the leftmost 4 digits and A20 contains the rightmost 4 digits.			Cleared	Every error counter 0 cycle	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A22		Error Counter 0 Present Value, Signed	This word contains the present value of the error counter for inverter posi- tioning 0. Data range: 8000 to 7FFF hex (-32,768 to 32,767) (signed)			Cleared	Every error counter 0 cycle	
A23		Inverter Fre- quency 0 Command Value	This word contains the automatically calculated frequency command value for the inverter for inverter posi- tioning 0. Data range: 0000 to FFFF hex (0.00 to 655.35 Hz) (0.01-Hz increments, unsigned) Set the Power Supply Frequency for One Motor Revolution per Second, Number of Encoder Pulses for One Motor Revolution, and Error Counter Cycle for inverter positioning 0 in the PLC Setup before using this value.			Cleared	Every error counter 0 cycle	
A24 and A25		Present Value of Signed Out- put Value 0	These words contain the present value of the signed output value (out- put value = present value of error counter × error counter cycle (s) × gain) for inverter positioning 0. Data range: 8000 0000 to 7FFF FFFF hex (-214,748,348 to 214,748,347) (signed) The maximum and minimum output values set for inverter positioning 0 in the PLC Setup are applied. A25 contains the leftmost 4 digits and A24 contains the rightmost 4 digits.			Cleared	Every error counter 0 cycle	
A26	00	Operation Command Flag 0	This flag turns ON during an opera- tion command for inverter positioning 0.	ON: Opera- tion command executed. OFF: Stop command executed.		Cleared	When inverter positioning 0 is started	
	01	Forward Oper- ation Com- mand Flag 0	This flag turns ON during a forward operation command for inverter positioning 0.	ON: Forward command in progress OFF: Reverse command in progress or stopped		Cleared	When present value of error counter 0 is positive	
	02	Reverse Oper- ation Com- mand Flag 0	This flag turns ON during a reverse operation command for inverter posi- tioning 0.	ON: Reverse command in progress OFF: For- ward com- mand in progress or stopped		Cleared	When present value of error counter 0 is negative	
	03	In-position Flag 0	This flag turns ON when inverter positioning 0 is in position.	ON: In posi- tion OFF: Not in position		Cleared	When pulse out- put to error counter 0 is stopped and the present value of error counter 0 is within the in-posi- tion range	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A26	04	Error Counter Error Flag 0	This flag turns ON when an error occurs in the error counter for inverter positioning 0.	ON: Error counter error OFF: No error		Cleared	When pulse out- put to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter error detection value	
	05	Error Counter Pulse Output Flag 0	This flag is ON while pulses are being output to the output counter for inverter positioning 0.	ON: Pulses being output OFF: Pulse output stopped		Cleared	When pulse out- put to error counter 0 is started	
	06	Error Counter Pulse Output Acceleration/ Deceleration Flag 0	This flag is ON while pulse output to the output counter for inverter posi- tioning 0 is accelerating or decelerat- ing.	ON: Pulse output to the error counter is accelerat- ing or decel- erating (i.e., the fre- quency is changing) OFF: Pulse output to the error counter is constant		Cleared	When pulse out- put fre- quency to error counter is changed by ACC or PLS2 instruction	
	07	Error Counter Alarm Flag 0	This flag turns ON when an alarm occurs in the error counter for inverter positioning 0.	ON: Error counter alarm OFF: No error counter alarm		Cleared	When pulse out- put to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter alarm detection value	
	15	Inverter Posi- tioning Output Value Sign Flag 0	This flag is ON when the inverter positioning 0 output value is positive and is OFF when it is negative.	ON: Positive value OFF: Nega- tive value		Cleared	When signed out- put value is between 0000 0000 and 7FFF FFFF hex	
A28 and A29		Present Value of Pulse Out- put to Inverter 0, Relative Value	These words contain the relative value of the internal pulse output when pulses are being output to the error counter for inverter positioning 0. Data range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647)			Cleared	Every error counter 0 cycle	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A30 and A31		Present Value of Unsigned Output Value 1	These words contain the present value of the unsigned output value (output value = present value of error counter × error counter cycle (s) × gain) for inverter positioning 1. Data range: 0000 0000 to 8000 0000 hex (0 to 2,147,483,648) The maximum and minimum output values set for inverter positioning 1 in the PLC Setup are applied. A30 contains the leftmost 4 digits and A31 contains the rightmost 4 digits.			Cleared	Every error counter 1 cycle	
A32		Error Counter 1 Present Value, Signed	This word contains the present value of the error counter for inverter posi- tioning 1. Data range: 8000 to 7FFF hex (-32,768 to 32,767) (signed)			Cleared	Every error counter 1 cycle	
A33		Inverter Fre- quency Com- mand Value 1	This word contains the automatically calculated frequency command value for the inverter for inverter posi- tioning 1. Data range: 0000 to FFFF hex (0.00 to 655.35 Hz) (0.01-Hz increments, unsigned) Set the Power Supply Frequency for One Motor Revolution per Second, Number of Encoder Pulses for One Motor Revolution, and Error Counter Cycle in the PLC Setup before using this value.			Cleared	Every error counter 1 cycle	
A34 and A35		Present Value of Signed Out- put Value 1	These words contain the present value of the signed output value (out- put value = present value of error counter $\times$ error counter cycle (s) $\times$ gain) for inverter positioning 1. Data range: 8000 0000 to 7FFF FFF hex (-214,748,348 to 214,748,347) (signed) The maximum and minimum output values set for inverter positioning 1 in the PLC Setup are applied. A34 contains the leftmost 4 digits and A35 contains the rightmost 4 digits.			Cleared	Every error counter 1 cycle	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A36	00	Operation Command Flag 1	This flag turns ON during an opera- tion command for inverter positioning 1.	ON: Opera- tion command executed. OFF: Stop command executed.		Cleared	When inverter positioning 1 is started	
	01	Forward Oper- ation Com- mand Flag 1	This flag turns ON during a forward operation command for inverter positioning 1.	ON: Forward command in progress OFF: Reverse command in progress or stopped		Cleared	When present value of error counter 1 is positive	
	02	Reverse Oper- ation Com- mand Flag 1	This flag turns ON during a reverse operation command for inverter posi- tioning 1.	ON: Reverse command in progress OFF: For- ward com- mand in progress or stopped		Cleared	When present value of error counter 1 is negative	
	03	In-position Flag 1	This flag turns ON when inverter positioning 1 is in position.	ON: In posi- tion OFF: Not in position		Cleared	When pulse out- put to error counter 1 is stopped and the present value of error counter 1 is within the in-posi- tion range	
	04	Error Counter Error Flag 1	This flag turns ON when an error occurs in the error counter for inverter positioning 1.	ON: Error counter error OFF: No error		Cleared	When pulse out- put to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter error counter error detection value	
	05	Error Counter Pulse Output Flag 1	This flag is ON while pulses are being output to the output counter for inverter positioning 1.	ON: Pulses being output OFF: Pulse output stopped		Cleared	When pulse out- put to error counter 1 is started	
	06	Error Counter Pulse Output Acceleration/ Deceleration Flag 1	This flag is ON while pulse output to the output counter for inverter posi- tioning 1 is accelerating or decelerat- ing.	ON: Pulse output to the error counter is accelerat- ing or decel- erating (i.e., the fre- quency is changing) OFF: Pulse output to the error counter is constant		Cleared	When pulse out- put fre- quency to error counter is changed by ACC or PLS2 instruction	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A36	07	Error Counter Alarm Flag 1	This flag turns ON when an alarm occurs in the error counter for inverter positioning 1.	ON: Error counter alarm OFF: No error counter alarm		Cleared	When pulse out- put to error counter is stopped and abso- lute value of error counter present value is greater than or equal to error counter alarm detection value	
	15	Inverter Posi- tioning Output Value Sign Flag 1	This flag is ON when the inverter positioning 1 output value is positive and is OFF when it is negative.	ON: Positive value OFF: Nega- tive value		Cleared	When signed out- put value is between FFFF FFFF and 8000 0000	
A38 and A39		Present Value of Pulse Out- put to Inverter 1, Relative Value	These words contain the relative value of the internal pulse output when pulses are being output to the error counter for inverter positioning 1. Data range: 8000 0000 to 7FFF FFFF hex (-2,147,483,648 to 2,147,483,647) A38 contains the leftmost 4 digits and A39 contains the rightmost 4			Cleared	Every error counter 1 cycle	
A90 to A93	All	User Program Date	digits. These words contain in BCD the date and time that the user program was last overwritten. A90.00 to A90.07: Seconds (00 to 59) A90.08 to A90.15: Minutes (00 to 59) A91.00 to A91.07: Hour (00 to 23) A91.08 to A91.15: Day of month (01 to 31) A92.00 to A92.07: Month (01 to 12) A92.08 to A92.15: Year (00 to 99) A93.00 to A93.07: Day of the week (00: Sunday, 01: Monday, 02: Tues- day, 03: Wednesday, 04: Thursday, 05: Friday, 06: Saturday)		Retained	Retained		
A94 to A97	All	Parameter Date	These words contain in BCD the date and time that the parameters were last overwritten. The format is the same as above.		Retained	Retained		

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits	-			after mode change	at star- tup	timing	flags, set- tings
A99	A99.00	UM Read Pro- tection Status	Indicates whether the entire user program in the PLC is read-pro- tected.	OFF: UM not read-pro- tected. ON: UM read- protected.	Retained	Retained	When pro- tection is set or cleared	
	A99.01	Task Read Protection Status	Indicates whether read protection is set for individual tasks.	OFF: Tasks not read-pro- tected. ON: Tasks read-pro- tected.	Retained	Retained	When pro- tection is set or cleared	
	A99.02	Program Write Protection Status when Read Protec- tion Is Set	Indicates whether the program is write-protected.	OFF: Write- enabled. ON: Write- protected.	Retained	Retained	When pro- tection is set or cleared	
	A99.03	Enable/Dis- able Status for Backing Up the Program to a Memory Cassette	Indicates whether creating a backup program file (.OBJ) is enabled or dis- abled.	OFF: Enabled. ON: Disabled.	Retained	Retained	When pro- tection is set or cleared	
	A99.12	UM Read Pro- tection Release Enable Flag	Indicates when UM read protection cannot be released because an incorrect password was input five times consecutively.	OFF: Protec- tion can be released ON: Protec- tion cannot be released	Retained	Retained	When wrong pass word is input for the fifth time, when memory is	
	A99.13	Task Read Protection Release Enable Flag	Indicates when task read protection cannot be released because an incorrect password was input five times consecutively.	OFF: Protec- tion can be released ON: Protec- tion cannot be released	Retained	Retained	memory is cleared, and two hours after releasing protection is disabled	
	A99.14	IR/DR Opera- tion between Tasks Retained	ON when index and data registers are shared between all tasks. OFF when separate index and data registers are being used in each task.	OFF: Inde- pendent ON: Shared (default)	Retained	Retained		
	A99.15	Timer/Counter PV Refresh Mode Flag	Indicates whether the CPU Unit is operating in BCD mode or binary mode.	OFF: BCD mode ON: Binary mode	Retained	Retained		

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A100 to A199	All	Error Log Area	<ul> <li>When an error has occurred, the error code, error contents, and error's time and date are stored in the Error Log Area. Information on the 20 most recent errors can be stored.</li> <li>Each error record occupies 5 words; the function of these 5 words is as follows:</li> <li>1) Error code (bits 0 to 15)</li> <li>2) Error contents (bits 0 to 15)</li> <li>3) Minutes (bits 8 to 15), Seconds (bits 0 to 7)</li> <li>4) Day of month (bits 8 to 15), Hours (bits 0 to 7)</li> <li>5) Year (bits 8 to 15), Month (bits 0 to 7)</li> <li>5) Year (bits 8 to 15), Month (bits 0 to 7)</li> <li>5) Year (bits 8 to 15), Month (bits 0 to 7)</li> <li>7) Errors generated by FAL(006) and FALS(007) will also be stored in this Error Log.</li> <li>The Error Log Area can be reset from the CX-Programmer.</li> <li>If the Error Log Area is full (20 records) and another error occurs, the oldest record in A100 to A104 will be cleared, the other 19 records are shifted down, and the new record is stored in A195 to A199.</li> </ul>	Error code Error con- tents: Address of Aux. Area word with details or 0000. Seconds: 00 to 59, BCD Minutes: 00 to 59, BCD Hours: 00 to 23, BCD Day of month: 01 to 31, BCD Month: 01 to 12, BCD Year: 00 to 99, BCD	Retained	Retained	Refreshed when error occurs.	A500.14 A300 A400
A200	A200.11	First Cycle Flag	ON for one cycle after PLC operation begins (after the mode is switched from PROGRAM to RUN or MONI- TOR, for example).	ON for the first cycle				
	A200.12	Step Flag	ON for one cycle when step execu- tion is started with STEP(008). This flag can be used for initialization pro- cessing at the beginning of a step.	ON for the first cycle after execu- tion of STEP(008).	Cleared			
	A200.14	Task Started Flag	When a task switches from WAIT or INI to RUN status, this flag will be turned ON within the task for one cycle only. The only difference between this flag and A200.15 is that this flag also turns ON when the task switches from WAIT to RUN status.	ON: ON for first cycle (including transitions from WAIT and IN) OFF: Other	Cleared	Cleared		
	A20015	First Task Startup Flag	ON when a task is executed for the first time. This flag can be used to check whether the current task is being executed for the first time so that initialization processing can be performed if necessary.	ON: First exe- cution OFF: Not exe- cutable for the first time or not being exe- cuted.	Cleared			
A201	A201.10	Online Editing Wait Flag	ON when an online editing process is waiting. (If another online editing command is received while waiting, the other command won't be recorded and an error will occur.)	ON: Waiting for online edit- ing OFF: Not waiting for online editing	Cleared	Cleared		A527
	A201.11	Online Editing Flag	ON when an online editing process is being executed.	ON: Online editing in progress OFF: Online editing not in progress	Cleared	Cleared		A527

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A202	A202.00 to A202.07	Communica- tions Port Enabled Flags	ON when a network instruction (SEND, RECV, CMND, or PMCR) can be executed with the corre- sponding port number. Bits 00 to 07 correspond to communications ports 0 to 7. When two or more network instruc- tions are programmed with the same port number, use the corresponding flag as an execution condition to pre- vent the instructions from being exe- cuted simultaneously. (The flag for a given port is turned OFF while a network instruction with that port number is being executed.)	ON: Network instruction is not being exe- cuted OFF: Net- work instruc- tion is being executed (port busy)	Cleared			
	A202.15	Network Com- munications Port Alloca- tion Enabled Flag	ON when there is a communications port available for automatic alloca- tion. Note Use this flag to confirm whether a communications port is available for automatic allocation before executing communications instructions when using 9 or more com- munications instructions simultaneously.	ON: Port available OFF: Port not available	Cleared			
A203 to A210	All	Communica- tions Port Completion Codes	These words contain the completion codes for the corresponding port numbers when network instructions (SEND, RECV, CMND, or PMCR) have been executed. (The corresponding word will be cleared when background execution has been completed.) Words A203 to A210 correspond to communications ports 0 to 7.	Non-zero: Error code 0000: Normal condi- tion	Retained			
A214	A214.00 to A214.07	First Cycle Flags after Network Com- munications Finished	Each flag will turn ON for just one cycle after communications have been completed. Bits 00 to 07 corre- spond to ports 0 to 7. Use the Used Communications Port Number stored in A218 to determine which flag to access. Note These flags are not effective until the next cycle after the communications instruction is executed. Delay accessing them for at least one cycle.	ON: First cycle after communica- tions finish only OFF: Other status				
A215	A215.00 to A215.07	First Cycle Flags after Network Com- munications Error	Each flag will turn ON for just one cycle after a communications error occurs. Bits 00 to 07 correspond to ports 0 to 7. Use the Used Communi- cations Port Number stored in A218 to determine which flag to access. Determine the cause of the error according to the Communications Port Completion Codes stored in A203 to A210. Note These flags are not effective until the next cycle after the communications instruction is executed. Delay accessing them for at least one cycle.	ON: First cycle after communica- tions error only OFF: Other status				
A216 to A217	All	Network Com- munications Completion Code Storage Address	The completion code for a communi- cations instruction is automatically stored at the address with the I/O memory address given in these words. Place this address into an index reg- ister and use indirect addressing through the index register to read the communications completion code.	I/O memory address for the network communica- tions comple- tion code storage				

Add	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A218	All	Used Commu- nications Port Numbers	Stores the communications port numbers used when a communica- tions instruction is executed using automatic communication port allo- cations.	0000 to 0007 hex: Commu- nications port 0 to 7				
A219	A219.00 to A219.07	Communica- tions Port Error Flags	ON when an error occurred during execution of a network instruction (SEND, RECV, CMND, or PMCR). Bits 00 to 07 correspond to commu- nications ports 0 to 7.	ON: Error occurred OFF: Normal condition	Retained			
A262 and A263	All	Maximum Cycle Time	These words contain the maximum cycle time since the start of PLC operation. The cycle time is recorded in 8-digit hexadecimal with the leftmost 4 digits in A263 and the rightmost 4 digits in A262.	0 to FFFFFFFF: 0 to 429,496,729. 5 ms (0.1-ms units)				
A264 and A265	All	Present Cycle Time	These words contain the present cycle time in 8-digit hexadecimal with the leftmost 4 digits in A265 and the rightmost 4 digits in A264.	0 to FFFFFFFF: 0 to 429,496,729. 5 ms				
A270 to A271	All	High-speed Counter 0 PV	Contains the PV of high-speed counter 0. A271 contains the left- most 4 digits and A270 contains the rightmost 4 digits. The PV is cleared when operation starts.			Cleared	Refreshed each cycle during oversee process. Refreshed when PRV(881) instruction is exe- cuted.	
A272 to A273	All	High-speed Counter 1 PV	Contains the PV of high-speed counter 1. A273 contains the left- most 4 digits and A272 contains the rightmost 4 digits. The PV is cleared when operation starts.			Cleared	Refreshed each cycle during oversee process. Refreshed when PRV(881) instruction is exe- cuted.	

Ad	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A274	A274.00	High-speed Counter 0 Range 1 Com- parison Condi- tion Met Flag	These flags indicate whether the PV is within the specified ranges when high-speed counter 0 is being oper- ated in range-comparison mode. Cleared at beginning of operation.			Cleared	Refreshed each cycle during oversee process.	
	A274.01	High-speed Counter 0 Range 2 Com- parison Condi- tion Met Flag	Cleared when range comparison table is registered. OFF: PV not in range ON: PV in range				Refreshed when PRV(881) instruction is exe- cuted.	
	A274.02	High-speed Counter 0 Range 3 Com- parison Condi- tion Met Flag						
	A274.03	High-speed Counter 0 Range 4 Com- parison Condi- tion Met Flag						
	A274.04	High-speed Counter 0 Range 5 Com- parison Condi- tion Met Flag	T					
	A274.05	High-speed Counter 0 Range 6 Com- parison Condi- tion Met Flag						
	A274.06	High-speed Counter 0 Range 7 Com- parison Condi- tion Met Flag	t I					
	A274.07	High-speed Counter 0 Range 8 Com- parison Condi- tion Met Flag						
A274	A274.08	High-speed Counter 0 Comparison In-progress Flag	This flag indicates whether a com- parison operation is being executed for high-speed counter 0. Cleared at beginning of operation. OFF: Stopped. ON: Being executed.			Cleared	Refreshed when com- parison operation starts or stops.	
	A274.09	High-speed Counter 0 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the high-speed counter 0 PV. (Used with the linear mode counting range only.) Cleared when operation starts. Cleared when PV is changed. OFF: Normal ON: Overflow or underflow			Cleared	Refreshed when an overflow or underflow occurs.	
	A274.10	High-speed Counter 0 Count Direc- tion	This flag indicates whether the high- speed counter is currently being incremented or decremented. The counter PV for the current cycle is compared with the PLC in last cycle to determine the direction. OFF: Decrementing ON: Incrementing			Cleared	Setting used for high-speed counter, valid dur- ing counter operation.	Read only

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A275	A275.00	High-speed Counter 1 Range 1 Com- parison Condi- tion Met Flag	These flags indicate whether the PV is within the specified ranges when high-speed counter 1 is being oper- ated in range-comparison mode. Cleared when operation starts.			Cleared	Refreshed each cycle during oversee- ing pro- cess.	
	A275.01	High-speed Counter 1 Range 2 Com- parison Condi- tion Met Flag	Cleared when range comparison table is registered. OFF: PV not in range ON: PV in range				Refreshed when PRV(881) instruction is exe-	
	A275.02	High-speed Counter 1 Range 3 Com- parison Condi- tion Met Flag	T				cuted for the corre- sponding counter.	
	A275.03	High-speed Counter 1 Range 4 Com- parison Condi- tion Met Flag						
	A275.04	High-speed Counter 1 Range 5 Com- parison Condi- tion Met Flag						
	A275.05	High-speed Counter 1 Range 6 Com- parison Condi- tion Met Flag	*					
	A275.06	High-speed Counter 1 Range 7 Com- parison Condi- tion Met Flag	*					
	A275.07	High-speed Counter 1 Range 8 Com- parison Condi- tion Met Flag						
	A275.08	High-speed Counter 1 Comparison In-progress Flag	This flag indicates whether a com- parison operation is being executed for high-speed counter 1. Cleared when operation starts. OFF: Stopped. ON: Being executed			Cleared	Refreshed when com- parison operation starts or stops.	
A275	A275.09	High-speed Counter 1 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the high-speed counter 1 PV. (Used with the linear mode counting range only.) Cleared when operation starts. Cleared when the PV is changed. OFF: Normal ON: Overflow or underflow			Cleared	Refreshed when an overflow or underflow occurs.	
	A275.10	High-speed Counter 1 Count Direc- tion	This flag indicates whether the high- speed counter is currently being incremented or decremented. The counter PV for the current cycle is compared with the PC in last cycle to determine the direction. OFF: Decrementing ON: Incrementing			Cleared	Setting used for high-speed counter, valid dur- ing counter operation.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A276 and A277	All	Pulse Output 0 PV	Contain the number of pulses output from the corresponding pulse output port.			Cleared	Refreshed each cycle during	
A278 and A279	All	Pulse Output 1 PV	<ul> <li>PV range: 8000 0000 to 7FFF FFFF hex</li> <li>(-2,147,483,648 to 2,147,483,647)</li> <li>When pulses are being output in the CW direction, the PV is incremented by 1 for each pulse.</li> <li>When pulses are being output in the CCW direction, the PV is decremented by 1 for each pulse.</li> <li>PV after overflow: 7FFF FFFF hex</li> <li>PV after underflow: 8000 0000 hex</li> <li>A277 contains the leftmost 4 digits and A276 contains the rightmost 4 digits of the pulse output 0 PV.</li> <li>A279 contains the leftmost 4 digits and A278 contains the rightmost 4 digits of the pulse output 1 PV.</li> <li>Cleared when operation starts.</li> <li>Note If the coordinate system is relative coordinates (undefined origin), the PV will be cleared to 0 when a pulse output instruction (SPED(885), ACC(888), or PLS2(887)) is executed.</li> </ul>			Cleared	oversee process. Refreshed when the INI(880) instruction is exe- cuted (PV change).	
A280	A280.00	Pulse Output 0 Accel/Decel Flag	This flag will be ON when pulses are being output from pulse output 0 according to an ACC(888) or PLS2(887) instruction and the output frequency is being changed in steps (accelerating or decelerating). Cleared when operation starts or stops. OFF: Constant speed ON: Accelerating or decelerating			Cleared	Refreshed each cycle during oversee process.	
	A280.01	Pulse Output 0 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the pulse output 0 PV. Cleared when operation starts. OFF: Normal ON: Overflow or underflow			Cleared	Cleared when the PV is changed by the INI(880) instruction. Refreshed when an overflow or underflow occurs.	

Ad	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A280	A280.02	Pulse Output 0 Output Amount Set Flag	ON when the number of output pulses for pulse output 0 has been set with the PULS(886) instruction. Cleared when operation starts or stops. OFF: No setting ON: Setting made			Cleared	Refreshed when the PULS(886) instruction is exe- cuted. Refreshed when pulse output stops.	
	A280.03	Pulse Output 0 Output Completed Flag	ON when the number of output pulses set with the PULS(886) or PLS2(887) instruction has been out- put through pulse output 0. Cleared when operation starts or stops. OFF: Output not completed. ON: Output completed.			Cleared	Refreshed at the start or comple- tion of pulse out- put in inde- pendent mode.	
	A280.04	Pulse Output 0 Output In- progress Flag	ON when pulses are being output from pulse output 0. Cleared when operation starts or stops. OFF: Stopped ON: Outputting pulses.			Cleared	Refreshed when pulse output starts or stops.	
	A280.05	Pulse Output 0 No-origin Flag	ON when the origin has not been determined for pulse output 0 and goes OFF when the origin has been determined. Turned ON when power is turned ON. Turned ON when operation starts. OFF: Origin established. ON: Origin not established.			Cleared	Refreshed each cycle during the oversee- ing pro- cesses.	
	A280.06	Pulse Output 0 At-origin Flag	ON when the pulse output PV matches the origin (0). OFF: Not stopped at origin. ON: Stopped at origin.			Cleared	Refreshed each cycle during the oversee- ing pro- cesses.	
	A280.07	Pulse Output 0 Output Stopped Error Flag	ON when an error occurred while outputting pulses in the pulse output 0 origin search function. The Pulse Output 0 Output Stop Error code will be written to A444. OFF: No error ON: Stop error occurred.			Cleared	Refreshed when ori- gin search starts. Refreshed when a pulse out- put stop error occurs.	
A281	A281.00	Pulse Output 1 Accel/Decel Flag	This flag will be ON when pulses are being output from pulse output 1 according to an ACC(888) or PLS2(887) instruction and the output frequency is being changed in steps (accelerating or decelerating). Cleared when operation starts or stops. OFF: Constant speed ON: Accelerating or decelerating			Cleared	Refreshed each cycle during oversee process.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A281	A281.01	Pulse Output 1 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the pulse output 1 PV. Cleared when operation starts. OFF: Normal ON: Overflow or underflow			Cleared	Refreshed when the PV is changed by the INI(880) instruction. Refreshed when an overflow or underflow occurs.	
	A281.02	Pulse Output 1 Output Amount Set Flag	ON when the number of output pulses for pulse output 1 has been set with the PULS(886) instruction. Cleared when operation starts or stops. OFF: No setting ON: Setting made			Cleared	Refreshed when the PULS(886) instruction is exe- cuted.	
	A281.03	Pulse Output 1 Output Completed Flag	ON when the number of output pulses set with the PULS(886) or PLS2(887) instruction has been out- put through pulse output 1. Cleared when operation starts or stops. OFF: Output not completed. ON: Output completed.			Cleared	Refreshed when PULS(886) (886) instruction is exe- cuted. Refreshed at the start or comple- tion of pulse out- put.	
	A281.04	Pulse Output 1 Output In- progress Flag	ON when pulses are being output from pulse output 1. Cleared when operation starts or stops. OFF: Stopped ON: Outputting pulses.			Cleared	Refreshed when pulse output starts or stops.	
	A281.05	Pulse Output 1 No-origin Flag	ON when the origin has not been determined for pulse output 1 and goes OFF when the origin has been determined. Turned ON when power is turned ON. Turned ON when operation starts. OFF: Origin established. ON: Origin not established.			Cleared	Refreshed each cycle during oversee- ing pro- cesses.	
	A281.06	Pulse Output 1 At-origin Flag	ON when the pulse output PV matches the origin (0). OFF: Not stopped at origin. ON: Stopped at origin.			Cleared	Refreshed each cycle during oversee- ing pro- cesses.	
	A281.07	Pulse Output 1 Output Stopped Error Flag	ON when an error occurred while outputting pulses in the pulse output 1 origin search function. The Pulse Output 1 Output Stop Error code will be written to A445. OFF: No error ON: Stop error occurred.			Cleared	Refreshed when ori- gin search starts. Refreshed when pulse output stop error occurs.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A283	A283.00	PWM Output 0 Output In- progress Flag	ON when pulses are being output from PWM output 0. Cleared when operation starts or stops. OFF: Stopped ON: Outputting pulses.			Cleared	Refreshed when pulse output starts or stops.	
	A283.08	PWM Output 1 Output In- progress Flag	ON when pulses are being output from PWM output 1. OFF: Stopped ON: Outputting pulses.			Cleared		
A294	All	Task Number when Program Stopped	This word contains the task number of the task that was being executed when program execution was stopped because of a program error. (A298 and A299 contain the program address where program execution was stopped.)	Normal tasks: 0000 to 001F (task 0 to 31) Interrupt tasks: 8000 to 80FF (task 0 to 255)	Cleared	Cleared	When pro- gram error occurs.	A298/ A299
A295	A295.08	Instruction Processing Error Flag	This flag and the Error Flag (ER) will be turned ON when an instruction processing error has occurred and the PLC Setup has been set to stop operation for an instruction error. CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON.	ON: Error Flag ON OFF: Error Flag OFF	Cleared	Cleared	When pro- gram error occurs.	A294, A298/ A299 PLC Setup (Opera- tion when instruc-
			(The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)					tion error has occurred)
	A295.09	Indirect DM BCD Error Flag	This flag and the Access Error Flag (AER) will be turned ON when an indirect DM BCD error has occurred and the PLC Setup has been set to stop operation an indirect DM BCD error. (This error occurs when the content of an indirectly addressed DM word is not BCD although BCD mode has been selected.) CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON.	ON: Not BCD OFF: Normal	Cleared	Cleared	When pro- gram error occurs.	A294, A298/ A299 PLC Setup (Opera- tion when instruc- tion error has occurred)
			(The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)					
	A295.10	Illegal Access Error Flag	This flag and the Access Error Flag (AER) will be turned ON when an illegal access error has occurred and the PLC Setup has been set to stop operation an illegal access error. (This error occurs when a region of memory is accessed illegally.) CPU Unit operation will stop and the ERR/ ALM indicator will light when this flag goes ON. The following operations are consid- ered illegal access: 1) Reading/writing the system area	ON: Illegal access occurred OFF: Normal condition	Cleared	Cleared	When pro- gram error occurs.	A294, A298/ A299 PLC Setup (Opera- tion when instruc- tion error has occurred)
			<ul> <li>2) Indirect DM BCD error (in BCD mode)</li> <li>(The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)</li> </ul>					

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A295	A295.11	No END Error Flag	ON when there isn't an END(001) instruction in each program within a task. CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON. (The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)	ON: No END OFF: Normal condition	Cleared	Cleared		A294, A298/ A299
	A295.12	Task Error Flag	ON when a task error has occurred. The following conditions generate a task error. There isn't even one regular task that is executable (started). There isn't a program allocated to the task. (The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)	ON: Error OFF: Normal	Cleared	Cleared		A294, A298/ A299
	A295.13	Differentiation Overflow Error Flag	The allowed value for Differentiation Flags which correspond to differenti- ation instructions has been exceeded. CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON. (The task number where the error occurred will be stored in A294 and the program address will be stored in A298 and A299.)	ON: Error OFF: Normal	Cleared	Cleared		A294, A298/ A299
	A295.14	Illegal Instruc- tion Error Flag	ON when a program that cannot be executed has been stored. CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON.	ON: Error OFF: Normal	Cleared	Cleared		A294, A298/ A299
	A295.15	UM Overflow Error Flag	ON when the last address in UM (User Memory) has been exceeded. CPU Unit operation will stop and the ERR/ALM indicator will light when this flag goes ON.	ON: Error OFF: Normal	Cleared	Cleared		A294, A298/ A299
A298	All	Program Address Where Pro- gram Stopped (Rightmost 4 digits)	These words contain the 8-digit binary program address of the instruction where program execution was stopped due to a program error. (A294 contains the task number of the task where program execution	Right 4 digits of the pro- gram address	Cleared	Cleared		A294
A299	All	Program Address Where Pro- gram Stopped (Leftmost 4 digits)	was stopped.)	Left 4 digits of the program address	Cleared	Cleared		
A300	All	Error Log Pointer	When an error occurs, the Error Log Pointer is incremented by 1 to indi- cate the location where the next error record will be recorded as an offset from the beginning of the Error Log Area (A100 to A199). The Error Log Pointer can be cleared to 00 by turning A500.14 (the Error Log Reset Bit) ON. When the Error Log Pointer has reached 14 hex (20 decimal), the next record is stored in A195 to A199 when the next error occurs.	00 to 14 hexadecimal	Retained	Retained	Refreshed when error occurs.	A500.14

Ad	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A310	All	Manufactur- ing Lot Num- ber, Lower Digits	The manufacturing lot number is stored in 6 digits hexadecimal. X, Y, and Z in the lot number are con- verted to 10, 11, and 12, respec-		Retained	Retained		
A311	All	Manufactur- ing Lot Num- ber, Upper Digits	tively. Examples: Lot number 01805 A310 = 0801, A311 = 0005					
			Lot number 30Y05 A310 =1130, A311 = 0005					
A315 A	A315.13	Option Board Error Flag	ON when the Option Board is removed while the power is being supplied. CPU Unit operation will continue and the ERR/ALM indicator will flash.		Cleared	Cleared	Refreshed when error occurs.	A402.00, A424
			OFF when the error has been cleared.					
		Flash Mem- ory Error Flag	ON when writing to the internal flash memory fails. CPU Unit operation will continue and the ERR/ALM indicator will flash.		Cleared	Cleared	Refreshed when error occurs.	A402.00
			OFF when the error has been cleared.					
A316 to A317	All	High-speed Counter 2 PV	Contains the PV of high-speed counter 2. A317 contains the left- most 4 digits and A316 contains the rightmost 4 digits.			Cleared	Refreshed each cycle during oversee	
			The PV is cleared when operation starts.				process. Refreshed	
A318 to A319	All	High-speed Counter 3 PV	Contains the PV of high-speed counter 3. A319 contains the left- most 4 digits and A318 contains the rightmost 4 digits. The PV is cleared when operation starts.			Cleared	when PRV(881) instruction is exe- cuted.	
A320	A320.00	High-speed Counter 2 Range 1 Com- parison Condi- tion Met Flag	These flags indicate whether the PV is within the specified ranges when high-speed counter 2 is being oper- ated in range-comparison mode. Cleared at beginning of operation. Cleared when range comparison table is registered. OFF: PV not in range ON: PV in range			Cleared	Refreshed each cycle during oversee process. Refreshed when PRV(881) instruction is exe- cuted.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A320	A320.01	High-speed Counter 2 Range 2 Com- parison Condi- tion Met Flag	These flags indicate whether the PV is within the specified ranges when high-speed counter 2 is being oper- ated in range-comparison mode. Cleared at beginning of operation.			Cleared	Refreshed each cycle during oversee process.	
	A320.02	High-speed Counter 2 Range 3 Com- parison Condi- tion Met Flag	Cleared when range comparison table is registered. OFF: PV not in range ON: PV in range				Refreshed when PRV(881) instruction is exe- cuted.	
	A320.03	High-speed Counter 2 Range 4 Com- parison Condi- tion Met Flag	-					
	A320.04	High-speed Counter 2 Range 5 Com- parison Condi- tion Met Flag						
	A320.05	High-speed Counter 2 Range 6 Com- parison Condi- tion Met Flag	T					
	A320.06	High-speed Counter 2 Range 7 Com- parison Condi- tion Met Flag						
	A320.07	High-speed Counter 2 Range 8 Com- parison Condi- tion Met Flag						
	A320.08	High-speed Counter 2 Comparison In-progress Flag	This flag indicates whether a com- parison operation is being executed for high-speed counter 2. Cleared at beginning of operation. OFF: Stopped. ON: Being executed.			Cleared	Refreshed when com- parison operation starts or stops.	
	A320.09	High-speed Counter 2 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the high-speed counter 2 PV. (Used with the linear mode counting range only.) Cleared when operation starts. Cleared when PV is changed. OFF: Normal ON: Overflow or underflow			Cleared	Refreshed when an overflow or underflow occurs.	
	A320.10	High-speed Counter 2 Count Direc- tion	This flag indicates whether the high- speed counter is currently being incremented or decremented. The counter PV for the current cycle is compared with the PLC in last cycle to determine the direction. OFF: Decrementing ON: Incrementing			Cleared	Setting used for high-speed counter, valid dur- ing counter operation.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A321	A321.00	High-speed Counter 3 Range 1 Com- parison Condi- tion Met Flag	These flags indicate whether the PV is within the specified ranges when high-speed counter 3 is being oper- ated in range-comparison mode. Cleared when operation starts.			Cleared	Refreshed each cycle during oversee- ing pro- cess.	
	A321.01	High-speed Counter 3 Range 2 Com- parison Condi- tion Met Flag	Cleared when range comparison table is registered. OFF: PV not in range ON: PV in range				Refreshed when PRV(881) instruction is exe-	
	A321.02	High-speed Counter 3 Range 3 Com- parison Condi- tion Met Flag					cuted for the corre- sponding counter.	
	A321.03	High-speed Counter 3 Range 4 Com- parison Condi- tion Met Flag						
-	A321.04	High-speed Counter 3 Range 5 Com- parison Condi- tion Met Flag						
	A321.05	High-speed Counter 3 Range 6 Com- parison Condi- tion Met Flag						
	A321.06	High-speed Counter 3 Range 7 Com- parison Condi- tion Met Flag	*					
	A321.07	High-speed Counter 3 Range 8 Com- parison Condi- tion Met Flag						
	A321.08	High-speed Counter 3 Comparison In-progress Flag	This flag indicates whether a com- parison operation is being executed for high-speed counter 3. Cleared when operation starts. OFF: Stopped. ON: Being executed			Cleared	Refreshed when com- parison operation starts or stops.	
	A321.09	High-speed Counter 3 Overflow/ Underflow Flag	This flag indicates when an overflow or underflow has occurred in the high-speed counter 3 PV. (Used with the linear mode counting range only.) Cleared when operation starts. Cleared when the PV is changed. OFF: Normal ON: Overflow or underflow			Cleared	Refreshed when an overflow or underflow occurs.	
	A321.10	High-speed Counter 3 Count Direc- tion	This flag indicates whether the high- speed counter is currently being incremented or decremented. The counter PV for the current cycle is compared with the PC in last cycle to determine the direction. OFF: Decrementing ON: Incrementing			Cleared	Setting used for high-speed counter, valid dur- ing counter operation.	
A339 and A340	All	Maximum Dif- ferentiation Flag Number	These words contain the maximum value of the differentiation flag numbers being used by differentiation instructions.		See Function column.	Cleared	Written at the start of operation	A295.13

Add	dress	Name	Function	Settings	Status	Status	Write	Related		
Words	Bits				after mode change	at star- tup	timing	flags, set- tings		
A342	A342.03	Memory Cas- sette Write Flag	ON when data is being written to the Memory Cassette.	OFF: Not writ- ing ON: Writing	Retained	Cleared				
	A342.04	Memory Cas- sette Read Flag	ON when data is being read from the Memory Cassette.	OFF: Not reading ON: Reading	Retained	Cleared				
	A342.05	Memory Cas- sette Verify Flag	ON when data is being compared with data on the Memory Cassette.	OFF: Not veri- fying ON: Verifying	Retained	Cleared				
	A342.07	Memory Cas- sette Initializa- tion Error Flag	ON when an error occurs in initializ- ing the Memory Cassette. OFF the next time the Memory Cas- sette is accessed normally (initial- ized, written, read, or compared).	OFF: No error ON: Error	Retained	Cleared				
	A342.08	Memory Cas- sette Write Error Flag	ON when an error occurs in writing the Memory Cassette. OFF the next time the Memory Cas- sette is accessed normally (initial- ized, written, read, or compared).	OFF: No error ON: Error	Retained	Cleared				
	A342.10	Memory Cas- sette Read Error Flag	ON when an error occurs in reading the Memory Cassette. OFF the next time the Memory Cas- sette is accessed normally (initial- ized, written, read, or compared).	OFF: No error ON: Error	Retained	Cleared				
	A342.12	Memory Cas- sette Mis- match Flag	ON the data in the CPU Unit is not the same as the data in the Memory Cassette when a verification opera- tion is performed. OFF the next time the Memory Cas- sette is accessed normally (initial- ized, written, read, or compared).	OFF: Match ON: Mis- match	Retained	Cleared				
	A342.13	Memory Cas- sette Access Flag	ON when the Memory Cassette is being accessed. OFF when access is completed.	OFF: Not being accessed ON: Being accessed		Cleared				
	A342.15	Memory Cas- sette Flag	ON when a Memory Cassette is mounted. OFF when a Memory Cassette is not mounted.	OFF: No Memory Cas- sette ON: Memory Cassette mounted	Retained	Cleared				
A345	A345.00	FB Program Data Flag	Turns ON if the FB program memory contains FB program data.	OFF: No data ON: Data present	Retained	Cleared	Download- ing pro- grams from CX-Pro- grammer or Memory Cassette or clearing VM			
	A345.01	Program Index File Flag	Turns ON when the comment mem- ory contains a program index file.	OFF: No file ON: File present			Download- ing pro- grams from			
	A345.02	Comment File Flag	Turns ON when the comment mem- ory contains a comment file.	OFF: No file ON: File present				grannner	grammer or Memory	
	A345.03	Symbol Table File Flag	Turns ON when the comment mem- ory contains a symbol table file.	OFF: No file ON: File present						
	A345.04	DM Initial Val- ues Flag	ON when DM initial values are stored in the flash memory.	OFF: No val- ues stored ON: Values stored						

Ade	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A351 to A354	All	Calendar/ Clock Area	These words contain the CPU Unit's internal clock data in BCD. The clock can be set from the CX-Programmer such as a Programming Console, with the DATE(735) instruction, or with a FINS command (CLOCK WRITE, 0702).		Retained	Retained	Written every cycle	
	A351.00 to A351.07		Seconds (00 to 59) (BCD)					
	A351.08 to A351.15		Minutes (00 to 59) (BCD)					
	A352.00 to A352.07		Hours (00 to 23) (BCD)					
	A352.08 to A352.15		Day of the month (01 to 31) (BCD)					
	A353.00 to A353.07		Month (01 to 12) (BCD)					
	A353.08 to A353.15		Year (00 to 99) (BCD)					
	A354.00 to A354.07		Day of the week (00 to 06) (BCD) 00: Sunday, 01: Monday, 02: Tues- day,					
			03: Wednesday, 04: Thursday,					
			05: Friday, 06: Saturday					
A360 to A391	A360.01 to A391.15	Executed FAL Number Flags	The flag corresponding to the speci- fied FAL number will be turned ON when FAL(006) is executed. Bits A360.01 to A391.15 correspond to FAL numbers 001 to 511.	ON: That FAL was executed OFF: That FAL wasn't executed	Retained	Cleared	Refreshed when error occurs.	A402.15
			The flag will be turned OFF when the error is cleared.					

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A392	A392.04	Serial Port 2 Error Flag (CP1L M-type CPU Units)	ON when an error has occurred at serial port 2 of a CP1L M-type CPU Unit. (Not valid in Peripheral Bus Mode or NT Link mode.)	ON: Error OFF: No error	Retained	Cleared	Refreshed when error occurs.	
		Serial Port 1 Error Flag (CP1L L-type CPU Units)	ON when an error has occurred at serial port 1 of a CP1L L-type CPU Unit. (Not valid in Peripheral Bus Mode or NT Link mode.)					
	A392.05	Serial Port 2 Send Ready Flag (No-pro- tocol mode) (CP1L M-type CPU Units)	ON when the serial port 2 of a CP1L M-type CPU Unit is able to send data in no-protocol mode.	ON: Able-to- send OFF: Unable- to-send	Retained	Cleared	Written after trans- mission	
	A392.06	Serial Port 1 Send Ready Flag (No-pro- tocol mode) (CP1L L-type CPU Units)	ON when the serial port 1 of a CP1L L-type CPU Unit is able to send data in no-protocol mode.					
	A392.06	Serial Port 2 Reception Completed Flag (No-pro- tocol mode) (CP1L M-type CPU Units)	<ul> <li>ON when the serial port 2 of a CP1L M-type CPU Unit has completed the reception in no-protocol mode.</li> <li>When the number of bytes was specified: ON when the specified number of bytes is received.</li> <li>When the end code was specified: ON when the end code is received or 256 bytes are received.</li> </ul>	ON: Recep- tion com- pleted OFF: Recep- tion not com- pleted	Retained	Cleared	Written after reception	
		Serial Port 1 Reception Completed Flag (No-pro- tocol mode) (CP1L L-type CPU Units)	<ul> <li>ON when the serial port 1 of a CP1L L-type CPU Unit has completed the reception in no-protocol mode.</li> <li>When the number of bytes was specified: ON when the specified number of bytes is received.</li> <li>When the end code was specified: ON when the end code is received and the end code is received</li> </ul>					
	A392.07	Serial Port 2 Reception Overflow Flag (No-protocol mode) (CP1L M-type CPU Units)	<ul> <li>or 256 bytes are received.</li> <li>ON when a data overflow occurred during reception through the serial port 2 of a CP1L M-type CPU Unit in no-protocol mode.</li> <li>When the number of bytes was specified: ON when more data is received after the reception was completed but before RXD(235) was executed.</li> </ul>	ON: Overflow OFF: No overflow	Retained	Cleared		
			<ul> <li>When the end code was specified: ON when more data is received after the end code was received but before RXD(235) was exe- cuted.</li> <li>ON when 257 bytes are received before the end code.</li> </ul>					
		Serial Port 1 Reception Overflow Flag (No-protocol mode) (CP1L	ON when a data overflow occurred during reception through the serial port 1 of a CP1L L-type CPU Unit in no-protocol mode. • When the number of bytes was					
		L-type CPU Units)	specified: ON when more data is received after the reception was completed but before RXD(235) was executed.					
			<ul> <li>When the end code was specified: ON when more data is received after the end code was received but before RXD(235) was exe- cuted.</li> </ul>					
			ON when 257 bytes are received before the end code.					

Ade	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A392	A392.12	Serial Port 1 Communica- tions Error Flag (CP1L M- type CPU Units)	<ul> <li>ON when a communications error has occurred at the serial port 1 of a CP1L M-type CPU Unit. (Not valid in Peripheral Bus Mode or NT Link mode.)</li> <li>ON when a timeout error, overrun error, framing error, parity error, or BCC error occurs in Serial Gate- way mode.</li> </ul>	ON: Error OFF: No error	Retained	Cleared		
	A392.13	Serial Port 1 Send Ready Flag (No-pro- tocol Mode) (CP1L M-type CPU Units)	ON when the serial port 1 of a CP1L M-type CPU Unit is able to send data in no-protocol mode.	ON: Able-to- send OFF: Unable- to-send	Retained	Cleared	Written after trans- mission	
	A392.14	Serial Port 1 Reception Completed Flag (No-pro- tocol Mode) (CP1L M-type CPU Units)	<ul> <li>ON when the serial port 1 of a CP1L M-type CPU Unit has completed the reception in no-protocol mode.</li> <li>When the number of bytes was specified: ON when the specified number of bytes is received.</li> <li>When the end code was specified: ON when the end code is received or 256 bytes are received.</li> </ul>	ON: Recep- tion com- pleted OFF: Recep- tion not com- pleted	Retained	Cleared	Written after reception	
	A392.15	Serial Port 1 Reception Overflow Flag (No-protocol Mode) (CP1L M-type CPU Units)	<ul> <li>ON when a data overflow occurred during reception through the serial port 1 of a CP1L M-type CPU Unit in no-protocol mode.</li> <li>When the number of bytes was specified: ON when more data is received after the reception was completed but before RXD(235) was executed.</li> <li>When the end code was specified: ON when more data is received after the end code was received after the end code was received but before RXD(235) was executed.</li> <li>ON when 257 bytes are received before the end code.</li> </ul>	ON: Overflow OFF: No overflow	Retained	Cleared		

Add	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A393	A393.00 to A393.07	Serial Port 2 PT Communi- cations Flags (CP1L M-type CPU Units)	The corresponding bit will be ON when the serial port 2 of a CP1L M- type CPU Unit is communicating with a PT in NT Link or Serial PLC Link mode. Bits 0 to 7 correspond to units 0 to 7.	ON: Commu- nicating OFF: Not communicat- ing	Retained	Cleared	Refreshed when there is a nor- mal response to the	
		Serial Port 1 PT Communi- cations Flags (CP1L L-type CPU Units)	The corresponding bit will be ON when the serial port 1 of a CP1L L- type CPU Unit is communicating with a PT in NT Link or Serial PLC Link mode. Bits 0 to 7 correspond to units 0 to 7.				token.	
	A393.08 to A393.15	Serial Port 2 PT Priority Registered Flags (CP1L M-type CPU Units)	The corresponding bit will be ON for the PT that has priority when the serial port 2 of a CP1L M-type CPU Unit is communicating in NT link mode. Bits 0 to 7 correspond to units 0 to 7. These flags are written when the pri- ority registration command is received.	ON: Priority registered OFF: Priority not registered	Retained	Cleared	See Func- tion col- umn.	
		Serial Port 1 PT Priority Registered Flags (CP1L L-type CPU Units)	The corresponding bit will be ON for the PT that has priority when the serial port 1 of a CP1L L-type CPU Unit is communicating in NT link mode. Bits 0 to 7 correspond to units 0 to 7. These flags are written when the pri- ority registration command is received.					
	A393.00 to A393.15	Serial Port 2 Reception Counter (No- protocol Mode) (CP1L M-type CPU Units)	Indicates (in binary) the number of bytes of data received when the serial port 2 of a CP1L M-type CPU Unit is in no-protocol mode.		Retained Cleared	Cleared	Refreshed when data is received.	
		Serial Port 1 Reception Counter (No- protocol Mode) (CP1L L-type CPU Units)	Indicates (in binary) the number of bytes of data received when the serial port 1 of a CP1L L-type CPU Unit is in no-protocol mode.					
A394	A394.00 to A394.07	Serial Port 1 PT Communi- cations Flags (CP1L M-type CPU Units)	The corresponding bit will be ON when the serial port 1 of a CP1L M- type CPU Unit is communicating with a PT in NT link mode. Bits 0 to 7 correspond to units 0 to 7.	ON: Commu- nicating OFF: Not communicat- ing	Retained	Cleared	Refreshed when there is a nor- mal response to the token.	
	A394.08 to A394.15	Serial Port 1 PT Priority Registered Flags (CP1L M-type CPU Units)	The corresponding bit will be ON for the PT that has priority when the serial port 1 of a CP1L M-type CPU Unit is communicating in NT link mode. Bits 0 to 7 correspond to units 0 to 7.	ON: Priority registered OFF: Priority not registered	Retained	Cleared	See Func- tion col- umn.	
	A394.00 to A394.15	Serial Port 1 Reception Counter (No- protocol Mode) (CP1L L-type CPU Units)	Indicates (in binary) the number of bytes of data received when serial port 1 of a CP1L L-type CPU Unit is in no-protocol mode.		Retained	Cleared	Refreshed when data is received.	
A395	A395.12	DIP Switch Pin 6 Status Flag	The status of pin 6 on the DIP switch on the front of the CPU Unit is written to this flag every cycle.	ON: Pin 6 ON OFF: Pin 6 OFF	Retained	See Func- tion col- umn.	Written every cycle.	

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A400	All	Error code	When a non-fatal error (user-defined FALS(006) or system error) or a fatal error (user-defined FALS(007) or system error) occurs, the 4-digit hexadecimal error code is written to this word. When two or more errors occur simultaneously, the highest error code will be recorded.		Cleared	Cleared	Refreshed when error occurs.	
A401	A401.00	Other Fatal Error Flag	ON when a fatal error that is not defined for A401.01 to A401.15 occurs. Detailed information is output to the bits of A314. There are no errors that affect this flag at this time. This flag is reserved by the system.	OFF: No other fatal error ON: Other fatal error	Cleared	Cleared	Refreshed when error occurs.	A314
	A401.06	FALS Error Flag (fatal error)	ON when a fatal error is generated by the FALS(006) instruction. The CPU Unit will stop operating and the ERR/ALM indicator will light. The corresponding error code will be written to A400. Error codes C101 to C2FF correspond to FALS numbers 001 to 511. This flag will be turned OFF when the FALS errors are cleared.	ON: FALS(006) executed OFF: FALS(006) not executed	Cleared	Cleared	Refreshed when error occurs.	A400
	A401.08	Cycle Time Too Long Flag (fatal error)	ON if the cycle time exceeds the maximum cycle time set in the PLC Setup (the cycle time monitoring time). CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light. This flag will be turned OFF when the error is cleared.	OFF: Cycle time under max. ON: Cycle time over max.	Cleared	Cleared	Refreshed when the cycle time exceeds maximum.	PLC Setup (Cycle time moni- toring time)
	A401.09	Program Error Flag (fatal error)	ON when program contents are incorrect. CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light. The task num- ber where the error occurred will be stored in A294 and the program address will be stored in A298 and A299. The type of program error that occurred will be stored in A295.08 to A295.15. Refer to the description of A295 for more details on program errors. This flag will be turned OFF when the error is cleared.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A294, A295, A298 and A299

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A401	A401.11	Too Many I/O Points Flag (fatal error)	ON when the number of Expansion Units and Expansion I/O Units exceeds the limit, when the number of words allocated to these Units exceeds the limit, are mounted.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A407
			CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light.					
			This flag will be turned OFF when the error is cleared.					
	A401.14	I/O Bus Error Flag (fatal error)	<ul> <li>ON in the following cases:</li> <li>When an error occurs in a data transfer between the CPU Unit and a Expansion Unit or Expansion I/O Unit. If this happens, 0A0A hex will be output to A404.</li> <li>CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light.</li> <li>(This flag will be turned OFF when the error is cleared.)</li> </ul>	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A404
	A401.15	Memory Error Flag (fatal error)	ON when an error occurred in mem- ory or there was an error in auto- matic transfer from the Memory Cassette when the power was turned ON.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A403.00 to A403.08, A403.09
			CPU Unit operation will stop and the ERR/ALM indicator on the front of the CPU Unit will light.					
			The location where the error occurred is indicated in A403.00 to A403.08, and A403.09 will be turned ON if there was an error during auto- matic transfer at startup.					
			This flag will be turned OFF when the error is cleared. (The automatic transfer at startup error cannot be cleared without turning OFF the PLC.)					
A402	A402.00	Other Fatal Error Flag	ON when a non-fatal error that is not defined for A402.01 to A402.15 occurs. Detailed information is output to the bits of A314.	OFF: No other fatal error ON: Other	Cleared	Cleared	Refreshed when error occurs.	A315
			There are no errors that affect this flag at this time. This flag is reserved by the system.	fatal error				
	A402.04	Battery Error Flag (non-fatal error)	ON if the CPU Unit's battery is dis- connected or its voltage is low and the Detect Battery Error setting has been set in the PLC Setup.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	PLC Setup (Detect Battery
			The CPU Unit will continue operating and the ERR/ALM indicator on the front of the CPU Unit will flash.					Error)
			This flag can be used to control an external warning light or other indicator to indicate that the battery needs to be replaced.					
			(This flag will be turned OFF when the error is cleared.)					
	A402.10	PLC Setup Error Flag (non-fatal error)	ON when there is a setting error in the PLC Setup. The CPU Unit will continue operating and the ERR/ ALM indicator on the front of the CPU Unit will flash. The location of the error will be written to A406.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A406
			(This flag will be turned OFF when the error is cleared.)					

Ado	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A402	A402.15	FAL Error Flag (non-fatal error)	ON when a non-fatal error is gener- ated by executing FAL(006). The CPU Unit will continue operating and the ERR/ALM indicator on the front of the CPU Unit will flash.	ON: FALS(006) error occurred OFF: FALS(006)	Cleared	Cleared	Refreshed when error occurs.	A360 to A391, A400
			The bit in A360 to A391 that corre- sponds to the FAL number specified in FALS(006) will be turned ON and the corresponding error code will be written to A400. Error codes 4101 to 42FF correspond to FAL numbers 001 to 2FF (0 to 511).	not executed				
			(This flag will be turned OFF when the error is cleared.)					
A403	A403.00 to A403.08	Memory Error Location	When a memory error occurs, the Memory Error Flag (A40115) is turned ON and one of the following flags is turned ON to indicate the memory area where the error occurred A403.00: User program	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error occurs.	A401.15
			A403.04: PLC Setup A403.07: Routing Table					
			When a memory error occurs, the CPU Unit will continue operating and the ERR/ALM indicator on the front of the CPU Unit will flash.					
			(The corresponding flag will be turned OFF when the error is cleared.)					
	A403.09	Memory Cas- sette startup Transfer Error Flag	ON when automatic transfer at star- tup has been selected and an error occurs during automatic transfer. An error will occur if there is a transfer error, the specified file does not exist, or the Memory Cassette is not installed.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when power is turned ON.	
			(This flag will be turned OFF when the error is cleared by turning the power OFF. The error cannot be cleared without turning the power OFF.)					
	A403.10	Flash Mem- ory Error Flag	ON when the flash memory is physi- cally destroyed.	ON: Error OFF: No error	Cleared	Cleared	Refreshed when error is detected.	
A404	All	I/O Bus Error Details	Contains information on I/O bus errors. The CPU Unit will stop operating and the ERR/ALM indicator on the front of the CPU Unit will light. (A401.04 (I/O Bus Error Flag) will turn ON.) (This information will be cleared when the error is cleared.)	0A0A hex: CPM1A Unit error 0000 hex: CJ- series Unit error, 1st Unit 0001 hex: CJ- series Unit error, 2nd Unit 0F0F hex: CJ- series Unit error, unknown Unit	Cleared	Cleared	Refreshed when error is detected.	A401.14
				0E0E hex: CJ-series Unit error, no End cover				

Ade	dress	Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A406	All	PLC Setup Error Location	When there is a setting error in the PLC Setup, the location of that error is written to A406 in 4-digit hexadeci- mal. The CPU Unit will continue operating and the ERR/ALM indicator on the front of the CPU Unit will flash. (A406 will be cleared when the cause of the error is eliminated.)	0000 to 01FF hexadecimal	Cleared	Cleared	Refreshed when error occurs.	A402.10
A407	A407.00 to A407.12	Too Many I/O Points, Details	Always 0000 hex.	0000 hex	Cleared	Cleared		A401.11, A407.13 to A407.15
	A407.13 to A407.15	Too Many I/O Points, Cause	The 3-digit binary value of these bits indicates the cause of the Too Many I/O Points Error. Note These bits will be cleared when the error is cleared.	010: Too many Expan- sion Unit and Expansion I/O Unit words 011: Too many Expan- sion Units and Expan- sion I/O Units	Cleared	Cleared	Refreshed when error occurs.	
A424	A424.00 to A424.15	Error Option Board Flags	The bit corresponding to the option slot turns ON when an error occurs in an Option Board (A315.13 will be ON). Bit 00: Option slot 1 Bit 01: Option slot 2	ON: Error OFF: No error	Cleared	Cleared		A353.13
A436	A436.00 to A436.02	CPM1A Unit Error Flags	ON when an error occurs in a CP- series Expansion Unit or Expansion I/O Unit. A436.00: 1st Unit A436.10: 2nd Unit A436.02: 3rd Unit	OFF: No error ON: Error	Retained	Cleared		
A437	All	Number of Connected CPM1A Units	Stores the number of Expansion Units and Expansion I/O Units con- nected as a hexadecimal number. Note This information is valid only when a Too Many I/O Points error has occurred. CP1W/ CPM1A-TS002 and CP1W/ CPM1A-TS102 are each counted as two Units.	0000 to 0007 hex	Retained	Cleared		
A438	All	Pulse Output 2 Stop Error Code	If a Pulse Output Stop Error occurs for pulse output 2, the error code is stored.		Retained	Cleared	Refreshed when ori- gin search starts. Refreshed when a pulse out- put stop error occurs.	
A439	All	Pulse Output 3 Stop Error Code	If a Pulse Output Stop Error occurs for pulse output 3, the error code is stored.		Retained	Cleared	Refreshed when ori- gin search starts. Refreshed when a pulse out- put stop error occurs.	
A440	All	Max. Interrupt Task Process- ing Time	Contains the Maximum Interrupt Task Processing Time in units of 0.1 ms. (This value is written after the inter- rupt task with the max. processing time is executed and cleared when PLC operation begins.)	0000 to FFFF hexadecimal	Cleared	Cleared	See Func- tion col- umn.	

Address		Name	Function	Settings	Status	Status	Write	Related
Words	Bits				after mode change	at star- tup	timing	flags, set- tings
A441	All	Interrupt Task With Max. Processing Time	Contains the task number of the interrupt task with the maximum pro- cessing time. Hexadecimal values 8000 to 80FF correspond to task numbers 00 to FF. Bit 15 is turned ON when an interrupt has occurred. (This value is written after the inter- rupt task with the max. processing time is executed and cleared when PLC operation begins.)	8000 to 80FF hexadecimal	Cleared	Cleared	See Func- tion col- umn.	
A444	All	Pulse Output 0 Stop Error Code	If a Pulse Output Stop Error occurs for pulse output 0, the error code is written to this word.			Cleared	Refreshed when ori- gin search starts. Refreshed when a pulse out- put stop error occurs.	
A445		Pulse Output 1 Stop Error Code	If a Pulse Output Stop Error occurs for pulse output 1, the error code is written to this word.			•		
A494	A494.00 to A494.07	Casette Verifi-	Stores the results of comparing data in the Memory Cassette and CPU Unit. This information is cleared the next time the Memory Cassette is accessed normally (initialized, writ- ten, read, or compared).	OFF: Match ON: Mis- match			When Memory Cassette is compared.	
			A494.00: User program is different. A494.01: Function block sources are different. A494.02: Parameter area is different. A494.03: Symbol table is different. A494.04: Comments are different. A494.05: Program indices are differ- ent. A494.06: Data memory is different. A494.07: DM initial values are differ- ent.					

# Appendix D

# Read/Write Area (Set by User)

Addresses		Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A500	A500.12	IOM Hold Bit	Turn this bit ON to preserve the sta- tus of the I/O Memory when shifting from PROGRAM to RUN or MONI- TOR mode or vice versa. The I/O Memory includes the CIO Area, Transition Flags, Timer Flags and PVs, Index Registers, and Data Reg- isters. (If the status of the IOM Hold Bit itself is preserved in the PLC Setup (IOM Hold Bit Status), the status of the I/O Memory Area will be retained when the PLC is turned ON or power is interrupted.)	ON: Retained OFF: Not retained	Retained	See Function column.	See Function column.	PLC Setup (IOM Hold Bit Status setting)
	A500.13	Forced Sta- tus Hold Bit	Turn this bit ON to preserve the sta- tus of bits that have been force-set or force-reset when shifting from PRO- GRAM to MONITOR mode or vice versa. Bits that have been force-set or force-reset will always return to their default status when shifting to RUN mode.	ON: Retained OFF: Not retained	Retained	See Function column.	See Function column.	PLC Setup (Forced Status Hold Bit Status setting)
			(If the status of the Forced Status Hold Bit itself is preserved in the PLC Setup (Forced Status Hold Bit Sta- tus), the status of force-set and force-reset bits will be retained when the PLC is turned ON or power is interrupted.)					
	A500.14	Error Log Reset Bit	Turn this bit ON to reset the Error Log Pointer (A300) to 00. The contents of the Error Log Area itself (A100 to A199) are not cleared. (This bit is automatically reset to 0	OFF to ON: Clear	Retained	Cleared		A100 to A199, A300
			after the Error Log Pointer is reset.)					
	A500.15	Output OFF Bit	Turn this bit ON to turn OFF all out- puts from the CPU Unit, CPM1A Units, and Special I/O Units. The INH indicator on the front of the CPU Unit will light while this bit is ON.		Retained	Retained		
			(The status of the Output OFF Bit is retained through power interrup- tions.)					

		Settings	Status	Statusat	Write	Related		
Word	Bits				after mode change	startup	timing	Flags, Settings
A508	A508.09	Differentiate Monitor Completed Flag	ON when the differentiate monitor condition has been established dur- ing execution of differentiation moni- toring. (This flag will be cleared to 0 when differentiation monitoring starts.)	ON: Monitor condition established OFF: Not yet established	Retained	Cleared		
	A508.11	Trace Trig- ger Monitor Flag	ON when a trigger condition is estab- lished by the Trace Start Bit (A508.14). OFF when the next Data Trace is started by the Sampling Start bit (A508.15).	ON: Trigger condition established OFF: Not yet established or not tracing	Retained	Cleared		
	A508.12	Trace Com- pleted Flag	ON when sampling of a region of trace memory has been completed during execution of a Trace. OFF when the next time the Sam- pling Start Bit (A508.15) is turned ON.	ON: Trace completed OFF: Not trac- ing or trace in progress	Retained	Cleared		
	A508.13	Trace Busy Flag	ON when the Sampling Start Bit (A508.15) is turned ON. OFF when the trace is completed.	ON: Trace in progress OFF: Not trac- ing (not sam- pling)	Retained	Cleared		
	A508.14	Trace Start Bit	Turn this bit ON to establish the trig- ger condition. The offset indicated by the delay value (positive or negative) determines which data samples are valid.	ON: Trace trig- ger condition established OFF: Not established	Retained	Cleared		
	A508.15	Sampling Start Bit	<ul> <li>When a data trace is started by turning this bit ON from the CX-Programmer, the PLC will begin storing data in Trace Memory by one of the three following methods:</li> <li>1) Data is sampled at regular intervals (10 to 2,550 ms).</li> <li>2) Data is sampled when TRSM(045) is executed in the program.</li> <li>3) Data is sampled at the end of every cycle.</li> <li>The operation of A508.15 can be controlled only from the CX-Programmer.</li> </ul>	OFF to ON: Starts data trace (sam- pling) Turned ON from Program- ming Device.	Retained	Cleared		
A510 to A511	All	startup Time	These words contain the time at which the power was turned ON. The contents are updated every time that the power is turned ON. The data is stored in BCD. A510.00 to A510.07: Second (00 to 59) A510.08 to A510.15: Minute (00 to 59) A511.00 to A511.07: Hour (00 to 23) A511.08 to A511.15: Day of month (01 to 31)	See Function column.	Retained	See Function column.	Refresh- ed when power is turned ON.	
A512 to A513	All	Power Inter- ruption Time	These words contain the time at which the power was interrupted. The contents are updated every time that the power is interrupted. The data is stored in BCD. A512.00 to A512.07: Second (00 to 59) A512.08 to A512.15: Minute (00 to 59) A513.00 to A513.07: Hour (00 to 23) A513.08 to A513.15: Day of month (01 to 31) (These words are not cleared at star- tup.)	See Function column.	Retained	Retained	Written at power interrup- tion	

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A514	All	Number of Power Inter- ruptions	Contains the number of times that power has been interrupted since the power was first turned ON. The data is stored in binary. To reset this value, overwrite the current value with 0000.	0000 to FFFF hexadecimal	Retained	Retained	Refresh- ed when power is turned ON.	A395.11
			(This word is not cleared at startup, but it is cleared when the Memory Corruption Detected Flag (A395.11) goes ON.)					
A515 to A517	All	Operation Start Time	The time that operation started as a result of changing the operating mode to RUN or MONITOR mode is stored here in BCD. A515.00 to A515.07: Seconds (00 to 59) A515.08 to A515.15: Minutes (00 to 59) A516.00 to A516.07: Hour (00 to 23) A516.08 to A516.15: Day of month (01 to 31) A517.00 to A517.07: Month (01 to 12) A517.08 to A517.15: Year (00 to 99) Note The previous start time is	See at left.	Retained	Retained	See at left.	
			stored after turning ON the power supply until operation is started.					
A518 to A520	AII	Operation End Time	The time that operation stopped as a result of changing the operating mode to PROGRAM mode is stored here in BCD. A518.00 to A518.07: Seconds (00 to 59) A518.08 to A518.15: Minutes (01 to 59) A519.00 to A519.07: Hour (00 to 23) A519.08 to A519.15: Day of month (01 to 31) A520.00 to A520.07: Month (01 to 12) A520.08 to A520.15: Year (00 to 99) Note If an error occurs in operation, the time of the error will be stored. If the operating mode is then changed to PRO- GRAM mode, the time that PROGRAM mode was entered will be stored.	See at left.	Retained	Retained	See at left.	
A523	All	Total Power ON Time	Contains the total time that the PLC has been ON in 10-hour units. The data is stored in binary and it is updated every 10 hours. To reset this value, overwrite the current value with 0000. (This word is not cleared at startup, but it is cleared to 0000 when the Memory Corruption Detected Flag (A395.11) goes ON.)	0000 to FFFF hexadecimal	Retained	Retained		

Addı	resses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A526	A526.00	Serial Port 2 Restart Bit (CP1L M- type CPU Units)	Turn this bit ON to restart the serial port 2 of a CP1L M-type CPU Unit. (Do not use this bit when the port is operating in Peripheral Bus Mode.) Note This bit is turned OFF auto- matically when the restart processing is completed.	OFF to ON: Restart	Retained	Cleared		
		Serial Port 1 Restart Bit (CP1L L- type CPU Units)	Turn this bit ON to restart the serial port 1 of a CP1L L-type CPU Unit. (Do not use this bit when the port is operating in Peripheral Bus Mode.) <b>Note</b> This bit is turned OFF auto- matically when the restart processing is completed.					
	A526.01	Serial Port 1 Restart Bit (CP1L M- type CPU Units)	Turn this bit ON to restart the serial port 1 of a CP1L M-type CPU Unit. Note This bit is turned OFF auto- matically when the restart processing is completed.	0 to ON: Restart	Retained	Cleared		
A527	A527.00 to A527.07	Online Edit- ing Disable Bit Validator	The Online Editing Disable Bit (A527.09) is valid only when this byte contains 5A. To disable online editing from the CX-Programmer, set this byte to 5A and turn ON A527.09. (Online editing refers to changing or adding to the program while the PLC is operating in MONITOR mode.)	5A: A527.09 enabled Other value: A527.09 dis- abled	Retained	Cleared		A527.09
	A527.09	Online Edit- ing Disable Bit	Turn this bit ON to disable online editing. The setting of this bit is valid only when A527.00 to A527.07 have been set to 5A.	ON: Disabled OFF: Not dis- abled	Retained	Cleared		A527.00 to A527.07

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A528	A528.00 to A528.07	Serial Port 2 Error Flags (CP1L M- type CPU Units)	These flags indicate what kind of error has occurred at the serial port 2 of a CP1L M-type CPU Unit; they are automatically turned OFF when the serial port 2 is restarted. (These flags are not valid in periph- eral bus mode and only bit 5 is valid in NT Link mode.) PLC Link Polling Unit: Bit 05: ON for timeout error. PLC Link Polled Unit: Bit 03: ON for framing error. Bit 04: ON for overrun error. Bit 05: ON for timeout error. These bits can be cleared by the CX- Programmer.	Bits 00 and 01: Not used. Bit 02: ON for parity error. Bit 03: ON for framing error. Bit 04: ON for overrun error. Bit 05: ON for timeout error. Bits 06 and 07: Not used.	Retained	Cleared		
		Serial Port 1 Error Flags (CP1L L- type CPU Units)	These flags indicate what kind of error has occurred at the serial port 1 of a CP1L L-type CPU Unit; they are automatically turned OFF when the serial port 1 is restarted. (These flags are not valid in periph- eral bus mode and only bit 5 is valid in NT Link mode.) PLC Link Polling Unit: Bit 05: ON for timeout error. PLC Link Polled Unit:					
			t 03: ON for framing error. t 04: ON for overrun error. t 05: ON for timeout error. lese bits can be cleared by the CX- ogrammer.					
	A528.08 to A528.15	Serial Port 1 Error Code (CP1L M- type CPU Units)	These flags indicate what kind of error has occurred at the serial port 1 of a CP1L M-type CPU Unit; they are automatically turned OFF when the serial port 1 is restarted. (These flags are not valid in periph- eral bus mode and only bit 5 is valid in NT Link mode.) PLC Link Polling Unit: Bit 13: ON for timeout error. PLC Link Polled Unit: Bit 11: ON for framing error. Bit 12: ON for overrun error. Bit 13: ON for timeout error. These bits can be cleared by the CX- Programmer.	Bits 08 and 09: Not used. Bit 10: ON for parity error. Bit 11: ON for framing error. Bit 12: ON for overrun error. Bit 13: ON for timeout error. Bits 14 and 15: Not used.	Retained	Cleared		
A529	All	FAL/FALS Number for System Error Simu- lation	Set a dummy FAL/FALS number to use to simulate the system error using FAL(006) or FALS(007). When FAL(006) or FALS(007) is exe- cuted and the number in A529 is the same as the one specified in the operand of the instruction, the sys- tem error given in the operand of the instruction will be generated instead of a user-defined error.	dummy FAL/FALS number to o simulate the system error FAL(006) or FALS(007). n FAL(006) or FALS(007) is exe- and the number in A529 is the and of the instruction, the sys- reror given in the operand of the instruction will be generated instead		Cleared		
A531	A531.00 A531.01	High-speed Counter 0 Reset Bit High-speed Counter 1 Reset Bit	When the reset method is set to Phase-Z signal + Software reset, the corresponding high-speed counter's PV will be reset if the phase-Z signal is received while this bit is ON. When the reset method is set to Soft- ware reset, the corresponding high- speed counter's PV will be reset in the cycle when this bit turns ON.		Retained Retained	Cleared		

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A531	A531.08	High-speed Counter 0 Gate Bit	When a counter's Gate Bit is ON, the counter's PV will not be changed even if pulse inputs are received for		Retained	Cleared		
	A531.09	High-speed Counter 1 Gate Bit	the counter. When the bit is turned OFF again, counting will restart and the high- speed counter's PV will be refreshed. When the reset method is set to Phase-Z signal + Software reset, the Gate Bit is disabled while the corre- sponding Reset Bit (A531.00 or A531.01) is ON.		Retained	Cleared		
A532	All	Interrupt Counter 0 Counter SV	Used for interrupt input 0 in counter mode. Sets the count value at which the interrupt task will start. Interrupt task 140 will start when interrupt counter 0 has counted this number of pulses. Retained when operation starts.		Retained	Retained		
A533	All	Interrupt Counter 1 Counter SV	Used for interrupt input 1 in counter mode. Sets the count value at which the interrupt task will start. Interrupt task 141 will start when interrupt counter 1 has counted this number of pulses.		Retained	Retained		
A534	All	Interrupt Counter 2 Counter SV	Used for interrupt input 2 in counter mode. Sets the count value at which the interrupt task will start. Interrupt task 142 will start when interrupt counter 2 has counted this number of pulses.		Retained	Retained		
A535	All	Interrupt Counter 3 Counter SV	Used for interrupt input 3 in counter mode. Sets the count value at which the interrupt task will start. Interrupt task 143 will start when interrupt counter 3 has counted this number of pulses.		Retained	Retained		
A536	All	Interrupt Counter 0 Counter PV	These words contain the interrupt counter PVs for interrupt inputs oper- ating in counter mode.			Retained	Refresh- ed when interrupt	
A537	All	Interrupt Counter 1 Counter PV	In increment mode, the counter PV starts incrementing from 0. When the counter PV reaches the counter SV,				is gener- ated. Refresh-	
A538	All	Interrupt Counter 2 Counter PV	the PV is automatically reset to 0. In decrement mode, the counter PV starts decrementing from the counter SV. When the counter PV reaches				ed when INI(880) instruc- tion is	
A539	All	Interrupt Counter 3 Counter PV	the 0, the PV is automatically reset to the SV. Cleared when operation starts.				executed.	
A540	A540.00	Pulse Out- put 0 Reset Bit	The pulse output 0 PV (contained in A276 and A277) will be cleared when this bit is turned ON.		Retained	Cleared		A276 and A277
	A540.08	Pulse Out- put 0 CW Limit Input Signal Flag	This is the CW limit input signal for pulse output 0, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the ladder program and output the result to this flag.		Retained	Cleared		
	A540.09	Pulse Out- put 0 CCW Limit Input Signal Flag	This is the CCW limit input signal for pulse output 0, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the ladder program and output the result to this flag.		Retained	Cleared		

Addr	resses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A540	A540.10	Pulse Out- put 0 Posi- tioning Completed Signal	This is the positioning completed input signal used in the origin search for pulse output 0. The input signal from the servo driver is output to this bit from the ladder program to enable using the signal.		Retained	Cleared		
A541	A541.00	Pulse Out- put 1 Reset Bit	The pulse output 1 PV (contained in A278 and A279) will be cleared when this bit is turned ON.		Retained	Cleared		A278 and A279
	A541.08	Pulse Out- put 1 CW Limit Input Signal Flag	This is the CW limit input signal for pulse output 1, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the ladder program and output the result to this flag.		Retained	Cleared		
	A541.09	Pulse Out- put 1 CCW Limit Input Signal Flag	This is the CCW limit input signal for pulse output 1, which is used in the origin search. To use this signal, write the input from the actual sensor as an input condition in the ladder program and output the result to this flag.		Retained	Cleared		
	A541.10	Pulse Out- put 1 Posi- tioning Completed Signal	This is the positioning completed input signal used in the origin search for pulse output 1. The input signal from the servo driver is output to this bit from the ladder program to enable using the signal.		Retained	Cleared		
A562	A562.00	Error Counter 0 Reset Bit	Turn ON this bit to reset the Error Counter 0 Present Value and turn OFF the Error Counter 0 Error Flag.			Cleared		
	A562.01	Error Counter 0 Disable Bit	Turn ON this bit to hold the present value of error counter 0.	ON: Error counter value held. OFF: Error counter value not held.		Cleared		
A563	A563.00	Error Counter 1 Reset Bit	Turn ON this bit to reset the Error Counter 1 Present Value and turn OFF the Error Counter 0 Error Flag.			Cleared		
	A563.01	Error Counter 1 Disable Bit	Turn ON this bit to hold the present value of error counter 1.	ON: Error counter value held. OFF: Error counter value not held.		Cleared		
A580	A580.00 to A580.03	FB Commu- nications Instruction Retries	Automatically stores the number of retries in the FB communications instruction settings specified in the PLC Setup.	0 to F hex		Cleared	Written at start of operation	
A581	All	FB Commu- nications Instruction Response Monitoring Time	Automatically stores the FB commu- nications instruction response moni- toring time set in the PLC Setup.	0001 to FFFF hex (Unit: 0.1 s; Range: 0.1 to 6553.5) 0000 hex: 2 s		Cleared	Written at start of operation	

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A598	A598.00	FPD Teach- ing Bit	Turn this bit ON to set the monitoring time automatically with the teaching function. While A598.00 is ON, FPD(269) measures how long it takes for the diagnostic output to go ON after the execution condition goes ON. If the measured time exceeds the monitor- ing time, the measured time is multi- plied by 1.5 and that value is stored as the new monitoring time. (The teaching function can be used only when a word address has been specified for the monitoring time operand.)	ON: Teach monitoring time OFF: Teaching function OFF	Cleared	Cleared		
A600 to A603	All	Macro Area Input Words	Before the subroutine specified in MCRO(099) is executed, the source words for the subroutine are trans- ferred to A600 through A603 (input parameter words).	Input data: 4 words	Cleared	Cleared		
A604 to A607	All	Macro Area Output Words	After the subroutine specified in MCRO(099) has been executed, the results of the subroutine are trans- ferred from A604 through A607 to the specified destination words (out- put parameter words).	Output data: 4 words	Cleared	Cleared		
A619	A619.01	Serial Port 1 Settings Changing Flag (CP1L M-type CPU Units)	ON while the serial port 1's commu- nications settings are being changed for a CP1L M-type CPU Unit. This flag will be turned ON when STUP(237) is executed and it will be turned OFF after the settings have been changed.	ON: Changing OFF: Not changing	Retained	Cleared		
	A619.02	Serial Port 2 Settings Changing Flag (CP1L M-type CPU Units)	ON while the serial port 2's commu- nications settings are being changed for a CP1L M-type CPU Unit. This flag will be turned ON when STUP(237) is executed and it will be turned OFF after the settings have been changed.	ON: Changing OFF: Not changing	Retained	Cleared		
		Serial Port 1 Settings Changing Flag (CP1L L-type CPU Units)	ON while the serial port 1's commu- nications settings are being changed for a CP1L L-type CPU Unit. This flag will be turned ON when STUP(237) is executed and it will be turned OFF after the settings have been changed.					

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A640	A640.00	Serial Port 2 Modbus- RTU Easy Master Exe- cution Bit (CP1L M- type CPU Units)	Turn ON this bit to send a command and receive a response for serial port 2 of a CP1L M-type CPU Unit using the Modbus-RTU easy master func- tion. Note This bit will be turned OFF automatically by the system when communications have been completed.	Turned ON: Execution started ON: Execution in progress. OFF: Not exec- cuted or execu- tion completed.	Retained	Cleared		DM fixed allocation words for Modbus- RTU Easy Master: D32300 to D32399
		Serial Port 1 Modbus- RTU Easy Master Exe- cution Bit (CP1L L- type CPU Units)	Turn ON this bit to send a command and receive a response for serial port 1 of a CP1L L-type CPU Unit using the Modbus-RTU easy master func- tion. Note This bit will be turned OFF automatically by the system when communications have been completed.					
	A640.01 Serial Port 2 Modbus- RTU Easy Master Nor- mal End Flag (CP1L M-type CPU Units)		ON: Execution normal. OFF: Execution error or still in progress.	Retained	Cleared			
		Serial Port 1 Modbus- RTU Easy Master Nor- mal End Flag (CP1L L-type CPU Units)	ON when one command has been sent and the response received for serial port 1 of a CP1L L-type CPU Unit using the Modbus-RTU easy master function.					
	A640.02	Serial Port 2 Modbus- RTU Easy Master Error End Flag (CP1L M- type CPU Units)	ON when an error has occurred in communications for serial port 2 of a CP1L M-type CPU Unit using the Modbus-RTU easy master function. The error code is output to D32252 in the DM fixed allocation words for Modbus-RTU Easy Master.	ON: Execution error. OFF: Execution normal or still in progress.	Retained	Cleared		
		Serial Port 1 Modbus- RTU Easy Master Error End Flag (CP1L L- type CPU Units)	ON when an error has occurred in communications for serial port 1 of a CP1L L-type CPU Unit using the Modbus-RTU easy master function. The error code is output to D32252 in the DM fixed allocation words for Modbus-RTU Easy Master.					

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A641	A641.00	Serial Port 1 Modbus- RTU Master Execution Bit (CP1L M-type CPU Units)	Turn ON this bit to send a command and receive a response for serial port 1 of a CP1L M-type CPU Unit using the Modbus-RTU easy master func- tion. This bit will be turned OFF automati- cally by the system when communi- cations have been completed.	Turned ON: Execution started ON: Execution in progress. OFF: Not exe- cuted or execu- tion completed.	Retained	Cleared		DM fixed allocation words for Modbus- RTU Easy Master: D32200 to D32299
	A641.01	Serial Port 1 Modbus- RTU Master Execution Normal Flag (CP1L M- type CPU Units)	ON when one command has been sent and the response received for serial port 1 of a CP1L M-type CPU Unit using the Modbus-RTU easy master function.	ON: Execution normal. OFF: Execution error or still in progress.	Retained	Cleared		
	A641.02	Serial Port 1 Modbus- RTU Master Execution Error Flag (CP1L M- type CPU Units)	ON when an error has occurred in communications for serial port 1 of a CP1L M-type CPU Unit using the Modbus-RTU easy master function. The error code is output to D32352 in the DM fixed allocation words for Modbus-RTU Easy Master.	ON: Execution error. OFF: Execution normal or still in progress.	Retained	Cleared		
A642	All	Analog Adjustment PV	Stores the value set on the analog adjuster as a hexadecimal value (resolution: 1/256).	0000 to 00FF hex	Retained	Cleared		
A643	All	External Analog Set- ting Input PV	Stores the value set from the exter- nal analog setting input as a hexa- decimal value (resolution: 1/256).	0000 to 00FF hex	Retained	Cleared		
A720 to A722	All	Power ON Clock Data 1	These words contain the time at which the power was turned ON one time before the startup time stored in words A510 to A511. A720.00 to A720.07: Seconds (00 to 59) A720.08 to A720.15: Minutes (00 to 59) A721.00 to A721.07: Hour (00 to 23) A721.08 to A721.15: Day of month (00 to 31) A722.00 to A722.07: Month (01 to 12) A722.08 to A722.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A723 to A725	All	Power ON Clock Data 2	These words contain the time at which the power was turned ON two times before the startup time stored in words A510 to A511. A723.00 to A723.07: Seconds (00 to 59) A723.08 to A723.15: Minutes (00 to 59) A724.00 to A724.07: Hour (00 to 23) A724.08 to A724.15: Day of month (00 to 31) A725.00 to A725.07: Month (01 to 12) A725.08 to A725.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A726 to A728	All	Power ON Clock Data 3	These words contain the time at which the power was turned ON three times before the startup time stored in words A510 to A511. A726.00 to A726.07: Seconds (00 to 59) A726.08 to A726.15: Minutes (00 to 59) A727.00 to A727.07: Hour (00 to 23) A727.08 to A727.15: Day of month (00 to 31) A728.00 to A728.07: Month (01 to 12) A728.08 to A728.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	

Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A729 to A731	All	Power ON Clock Data 4	These words contain the time at which the power was turned ON four times before the startup time stored in words A510 to A511. A729.00 to A729.07: Seconds (00 to 59) A729.08 to A729.15: Minutes (00 to 59) A730.00 to A730.07: Hour (00 to 23) A730.08 to A730.15: Day of month (00 to 31) A731.00 to A731.07: Month (01 to 12) A731.08 to A731.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A732 to A734	All	Power ON Clock Data 5	These words contain the time at which the power was turned ON five times before the startup time stored in words A510 to A511. A732.00 to A732.07: Seconds (00 to 59) A732.08 to A732.15: Minutes (00 to 59) A733.00 to A733.07: Hour (00 to 23) A733.08 to A733.15: Day of month (00 to 31) A734.00 to A734.07: Month (01 to 12) A734.08 to A734.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A735 to A737	All	Power ON Clock Data 6	These words contain the time at which the power was turned ON six times before the startup time stored in words A510 to A511. A735.00 to A735.07: Seconds (00 to 59) A736.08 to A735.15: Minutes (00 to 59) A736.00 to A736.07: Hour (00 to 23) A736.08 to A736.15: Day of month (00 to 31) A737.00 to A737.07: Month (01 to 12) A737.08 to A737.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A738 to A740	All	Power ON Clock Data 7	These words contain the time at which the power was turned ON seven times before the startup time stored in words A510 to A511. A738.00 to A738.07: Seconds (00 to 59) A738.08 to A738.15: Minutes (00 to 59) A739.00 to A739.07: Hour (00 to 23) A739.08 to A739.15: Day of month (00 to 31) A740.00 to A740.07: Month (01 to 12) A740.08 to A740.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A741 to A743	All	Power ON Clock Data 8	These words contain the time at which the power was turned ON eight times before the startup time stored in words A510 to A511. A741.00 to A741.07: Seconds (00 to 59) A741.08 to A741.15: Minutes (00 to 59) A742.00 to A742.07: Hour (00 to 23) A742.08 to A742.15: Day of month (00 to 31) A743.00 to A743.07: Month (01 to 12) A743.08 to A743.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	

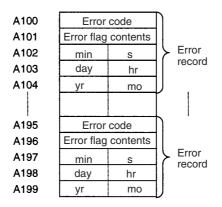
Addr	esses	Name	Function	Settings	Status	Statusat	Write	Related
Word	Bits				after mode change	startup	timing	Flags, Settings
A744 to A746	All	Power ON Clock Data 9	These words contain the time at which the power was turned ON nine times before the startup time stored in words A510 to A511. A744.00 to A744.07: Seconds (00 to 59) A744.08 to A744.15: Minutes (00 to 59) A745.00 to A745.07: Hour (00 to 23) A745.08 to A745.15: Day of month (00 to 31) A746.00 to A746.07: Month (01 to 12) A746.08 to A746.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A747 to A749	All	Power ON Clock Data 10	These words contain the time at which the power was turned ON ten times before the startup time stored in words A510 to A511. A747.00 to A747.07: Seconds (00 to 59) A747.08 to A747.15: Minutes (00 to 59) A748.00 to A748.07: Hour (00 to 23) A748.08 to A748.15: Day of month (00 to 31) A749.00 to A749.07: Month (01 to 12) A749.08 to A749.15: Year (00 to 99)	See at left.	Retained	Retained	Written when power is turned ON.	
A751	A751.11	DM Initial Values Read Error Flag	ON when an error occurred in trans- ferring DM initial values from the DM initial value area in flash memory to the DM Area.	OFF: Normal ON: Error (failed to load)	Retained	Cleared		
	A751.12	DM Initial Values Save Execution Error Flag	ON when the DM Initial Values Transfer Password (A752) is incor- rect or when the DM Initial values area was not specified when starting to transfer DM initial values from the DM Area to the DM initial value area in flash memory.	OFF: Normal ON: Error (failed to save)	Retained	Cleared		
	A751.13	DM Initial Values Save Error Flag	ON when an error occurred in trans- ferring DM initial values from the DM Area to the DM initial value area in flash memory.	OFF: Normal ON: Error (failed to save)	Retained	Cleared		
	A751.14	DM Initial Values Save Flag	ON while DM initial values are being transferred from the DM Area to the DM initial value area in flash mem- ory. OFF when the transfer has been completed.	OFF: Not being saved ON: Being saved	Retained	Cleared		
	A751.15	DM Initial Values Save Start Bit	Turn ON this bit to start transferring DM initial values. This bit is valid only when a correct password is stored in A752 and the DM Area Initial Value Area is specified (i.e., when A753.00 is ON). The system will turn this bit OFF automatically when the transfer has been completed.	Turned ON: Transfer started OFF: Not trans- ferring ON: Transfer- ring	Retained	Cleared		
A752	All	DM Initial Values Save Password	Set the passwords here to transfer DM initial values between the DM area and the DM initial value area in flash memory. The transfer will not be started unless the correct pass- word is set. The transfer is started when A751.15 is turned ON. The password will be cleared by the system when the transfer has been completed.	A5A5 hex: Save initial val- ues from DM to flash	Retained	Cleared		
A753	All	DM Initial Values Save Area Speci- fication	Specifies the area to be transferred to flash memory.	0001 hex: DM Area specified	Retained	Cleared		

**Note** The following flags are provided in a special read-only area and can be specified with the labels given in the table. These flags are not contained in the Auxiliary Area. Refer to *4-14 Condition Flags* and *4-15 Clock Pulses* for details.

Flag area	Name	Label	Meaning
Condition Code Area	Error Flag	ER	Turns ON when an error occurs in processing an instructions, indi- cating an error end to the instruction.
	Access Error Flag	AER	Turns ON when an attempt is made to access an illegal area. The status of this flag is maintain only during the current cycle and only in the task in which it occurred.
	Carry Flag	CY	Turns ON when there is a carry or borrow in a math operation, when a bit is shifted into the Carry Flag, etc.
	Greater Than Flag	>	Turns ON when the result of comparing two values is "greater than," when a value exceeds a specified range, etc.
	Equals Flag	=	Turns ON when the result of comparing two values is "equals," when the result of a math operation is 0, etc.
	Less Than Flag	<	Turns ON when the result of comparing two values is "less than," when a value is below a specified range, etc.
	Negative Flag	N	Turns ON when the MSB in the result of a math operation is 1.
	Overflow Flag	OF	Turns ON when the result of a math operation overflows.
	Underflow Flag	UF	Turns ON when the result of a math operation underflows.
	Greater Than or Equals Flag	>=	Turns ON when the result of comparing two values is "greater than or equals."
	Not Equal Flag	$\diamond$	Turns ON when the result of comparing two values is "not equal."
	Less than or Equals Flag	<=	Turns ON when the result of comparing two values is "less than or equals."
	Always ON Flag	A1	This flag is always ON.
	Always OFF Flag	A0	This flag is always OFF.
Clock Pulse	0.02-s clock pulse	0.02s	Repeatedly turns ON for 0.02 s and OFF for 0.02 s.
Area	0.1-s clock pulse	0.1s	Repeatedly turns ON for 0.1 s and OFF for 0.1 s.
	0.2-s clock pulse	0.2s	Repeatedly turns ON for 0.2 s and OFF for 0.2 s.
	1-s clock pulse	1s	Repeatedly turns ON for 1 s and OFF for 1 s.
	1-min clock pulse	1min	Repeatedly turns ON for 1 min and OFF for 1 min.

# **Details on Auxiliary Area Operation**

# A100 to A199: Error Log Area



The following data would be generated in an error record if a memory error (error code 80F1) occurred on 1 April 1998 at 17:10:30 with the error located in the PLC Setup (04 hex).

80	F 1
00	04
10	30
01	17
98	04

The following data would be generated in an error record if an FALS error with FALS number 001 occurred on 2 May 1997 at 8:30:15.

C 1	01	
00	00	
30	15	
02	08	
97	05	

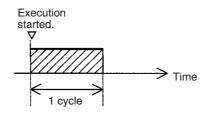
Classification	Error code	Meaning	Error flags
System-defined	80F1	Memory error	A403
fatal errors	80CA	I/O bus error	A404
	80E9	Duplicate number error	A410, A411 to 416 (See note 3.)
	80E1	Too many I/O error	A407
	80E0	I/O setting error	
	80F0	Program error	A295 to A299 (See note 4.)
	809F	Cycle time too long error	
User-defined fatal errors	C101 to C2FF	FALS instruction executed (See note 1.)	
User-defined non-fatal errors	4101 to 42FF	FAL instruction executed (See note 2.)	
System-defined	008B	Interrupt task error	A426
non-fatal errors	009A	Basic I/O error	A408
	009B	PLC Setup setting error	A406
	0200 to 020F	CPU Bus Unit error	A417
	0300 to 035F	Special I/O Unit error	A418 to A423 (See note 5.)
	00F7	Battery error	
	0400 to 040F	CPU Bus Unit setup error	A427
	0500 to 055F	Special I/O Unit setup error	A428 to A433 (See note 5.)

# **Error Codes and Error Flags**

Note 1. C101 to C2FF will be stored for FALS numbers 001 to 511.

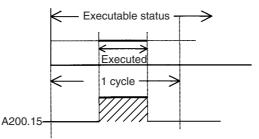
- 2. 4101 to 42FF will be stored for FAL numbers 001 to 511.
- 3. Only the contents of A295 is stored as the error flag contents for program errors.

# A200.11: First Cycle Flag

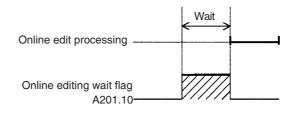


# A200.15: Initial Task Flag

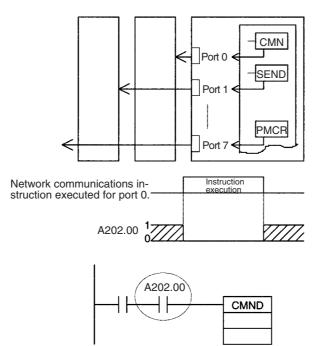
A200.15 will turn ON during the first time a task is executed after it has reached executable status. It will be ON only while the task is being executed and will not turn ON if following cycles.



# A201.10: Online Editing Wait Flag

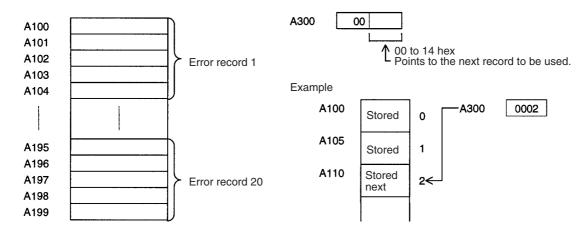


# A202.00 to A202.07: Communications Port Enabled Flags



The program is designed so that CMND(490) will be executed only when A202.00 is ON.

# A300: Error Record Pointer



# A401.09: Program Error Flag

	Error	Address
Program Error Flag	UM Overflow Error Flag	A295.15
(A4Ŏ1.09): ON	Illegal Instruction Flag	A295.14
	Distribution Overflow Error Flag	A295.13
	Task Error Flag	A259.12
	No END(001) Error Flag	A295.11
	Illegal Area Access Error Flag	A295.10
	Indirect DM Addressing Error Flag	A295.09
	Instruction Processing Error Flag (ER Flag goes ON)	A295.08

# Appendix E Memory Map

# **PLC Memory Addresses**

PLC memory addresses are set in Index Registers (IR00 to IR15) to indirectly address I/O memory. Normally, use the MOVE TO REGISTER (MOVR(560)) and MOVE TIMER/COUNTER PV TO REGISTER (MOVRW(561)) instructions to set PLC memory addresses into the Index Registers.

Some instructions, such as DATA SEARCH (SRCH(181)), FIND MAXIMUM (MAX(182)), and FIND MINIMUM (MIN(183)), output the results of processing to an Index Register to indicate an PLC memory address.

There are also instructions for which Index Registers can be directly designated to use the PLC memory addresses stored in them by other instructions. These instructions include DOUBLE MOVE (MOVL(498)), some symbol comparison instructions (=L, <>L, <L, >L, <=L, and >=L), DOUBLE COMPARE (CMPL(060)), DOUBLE DATA EXCHANGE (XCGL(562)), DOUBLE INCREMENT BINARY (++L(591)), DOUBLE DECREMENT BINARY (--L(593)), DOUBLE SIGNED BINARY ADD WITHOUT CARRY (+L(401)), DOUBLE SIGNED BINARY SUBTRACT WITHOUT CARRY (--L(411)), SET RECORD LOCATION (SETR(635)), and GET RECORD LOCATION (GETR(636)).

The PLC memory addresses all are continuous and the user must be aware of the order and boundaries of the memory areas. As reference, the PLC memory addresses are provided in a table at the end of this appendix.

**Note** Directly setting PLC memory addresses in the program should be avoided whenever possible. If PLC memory addresses are set in the program, the program will be less compatible with new CPU Unit models or CPU Units for which changes have been made to the layout of the memory.

# **Memory Configuration**

There are two classifications of the RAM memory (with battery backup) in a CP-series CPU Unit.

**Parameter Areas:** These areas contain CPU Unit system setting data, such as the PLC Setup, CPU Bus Unit Setups, etc. An illegal access error will occur if an attempt is made to access any of the parameter areas from an instruction in the user program.

**I/O Memory Areas:** These are the areas that can be specified as operands in the instructions in user programs.

# **Memory Map**

Classification	PLC memory addresses (hex)	User addresses	Area
I/O memory	0B100 to 0B7FF		Reserved for system.
areas	0B800 to 0B801	TK00 to TK31	Task Flag Area
	0B802 to 0B83F		Reserved for system.
	0B840 to 0B9FF	A0 to A447	Read-only Auxiliary Area
	0BA00 to 0BBFF	A448 to A959	Read/Write Auxiliary Area
	0BC00 to 0BDFF		Reserved for system.
	0BE00 to 0BEFF	T0000 to T4095	Timer Completion Flags
	0BF00 to 0BFFF	C0000 to C4095	Counter Completion Flags
	0C000 to 0D7FF	CIO 0 to CIO 6143	CIO Area
	0D800 to 0D9FF	H0 to H511	Holding Area
	0DA00 to 0DDFF		Reserved for system.
	0DE00 to 0DFFF	W0 to W511	Work Area
	0E000 to 0EFFF	T0000 to T4095	Timer PVs
	0F000 to 0FFFF	C0000 to C4095	Counter PVs
	10000 to 17FFF	D0 to D32767	DM Area (See note 2.)
	18000 to FFFFF		Reserved for system.

Note Do not access the areas indicated Reserved for system.

Note (1) Do not access areas reserved for the system.

(2) D10000 to D31999 (PLC memory addresses 12710 to 17CFF hex) cannot be used with CPU Units with 10, 14 or 20 I/O Points.

# Appendix F

# **Connections to Serial Communications Option Boards**

## **Connection Methods**

#### **Communications Modes and Ports**

The following table shows the relationship between the communications ports and the communications modes for the Serial Communications Option Boards.

Communications mode	RS-232C CP1W-CIF01		RS-422A/485 CP1W-CIF11/CIF12			
	1:1	1:N (See note 1.)	1:1 4-wire	1:N 4-wire	1:1 2-wire	1:N 2-wire
Host Link	YES	YES (See note 2.)	YES	YES	No	No
Serial PLC Links	YES	YES	YES	YES	YES	YES
Serial Gateway	YES	YES	YES	YES	YES	YES
No-protocol	YES	YES	YES	YES	YES	YES
1:N NT Link	YES	YES	YES	YES	YES	YES
1:1 NT Link	YES	No	YES	No	YES	No
1:1 Link Master	YES	No	YES	No	YES	No
1:1 Link Slave	YES	No	YES	No	YES	No

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

#### **Models of Serial Communications Option Board**

Model	Port	Maximum transmission distance	Connection method
CP1W-CIF01	One RS-232C port	15 m	Connector (D-sub, 9-pin female)
CP1W-CIF11	One RS-422A/485 port	50 m (See note.)	Terminal block (using ferrules)
CP1W-CIF12	One RS-422A/485 port	500 m	Terminal block (using ferrules)

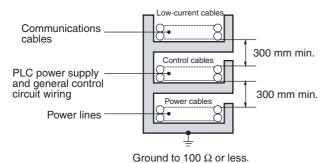
**Note** The CP1W-CIF11 is a non-isolated board, so the maximum transmission distance is 50 m. For distances over 50 m, use the RS-232C port on the CP1W-CIF01 and then connect through the NT-AL001-E Link Adapter, which is isolated. Doing so will enable a maximum transmission distance of 500 m.

#### Appendix F

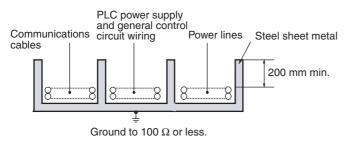
#### **Reducing Electrical Noise for External Wiring**

Observe the following precautions when wiring communications cables, PLC power lines, and high-power lines. When multi-conductor signal cable is being used, avoid using I/O wires and other control wires in the same cable.

• If wiring racks are running in parallel, allow at least 300 mm between them.

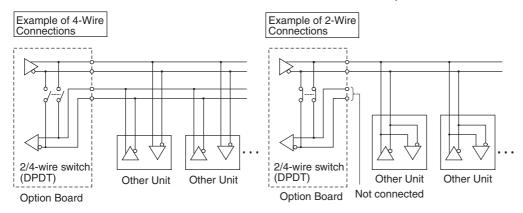


• If the I/O wiring and power cables must be placed in the same duct, they must be shielded from each other using grounded steel sheet metal.



#### 2-Wire and 4-Wire Connections

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



Note (1) Use the same transmission circuit (2-wire or 4-wire) for all nodes.

(2) Do not use 4-wire connections when the 2/4-wire switch on the Board is set to 2-wire.

### NT-AL001-E Link Adapter Settings

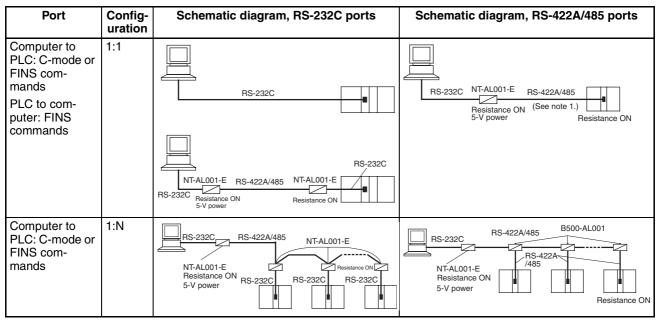
The NT-AL001-E Link Adapter has a DIP switch for setting RS-422A/485 communications conditions. When connecting the Serial Communications Option Board, refer to the DIP switch settings shown in the following table.

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

**Note** When connecting to a CP-series CPU Unit, turn OFF pin 5 and turn ON pin 6.

#### **Connections for Host Link Communications**

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



Note (1) Four-wire connections must be used for RS-422A/485 connections with Host Link communications.

- (2) "Resistance ON" indicates the terminating resistance must be turned ON.
- (3) "5-V power" indicates that a 5-V power supply is required for the Link Adapter. Refer to the Link Adapter manual for details. A 5-V power supply is not required for a Link Adapter connected to an RS-232C Option Board mounted on the CPU Unit because power is supplied from pin 6 of the connector.
- (4) The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.

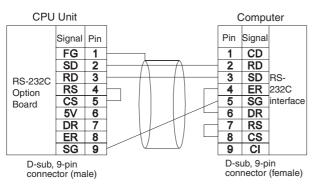
#### **Connection Examples**

The connection examples in the remainder of this section show only the basic connection diagrams. We recommend that appropriate noise countermeasures be taken in actual applications, including the use of shielded twisted-pair cables. Refer to *Recommended RS-422A/485 Wiring Examples* on page 689 for actual wiring methods.

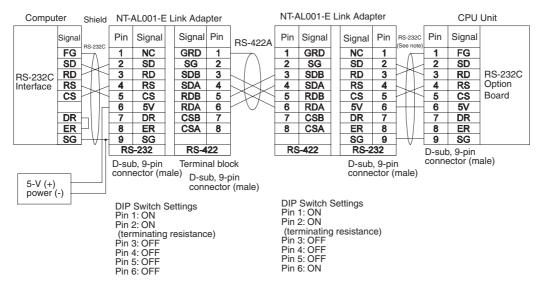
#### **Host Computer Connections**

#### 1:1 Connections Using RS-232C Ports

• IBM PC/AT or Compatible Computers



Using NT-AL001-E Converting Link Adapters



- Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters. XW2Z-070T-1: 0.7 m XW2Z-200T-1: 2 m
- Caution Do not use the 5-V power from pin 6 of the RS-232C Option Board for anything but the NT-AL001-E Link Adapter. Using this power supply for any other external device may damage the RS-232C Option Board or the external device.

#### Computer NT-AL001-E Link Adapter NT-AL001-E Link Adapter CPU Unit Shield RS-232C Signal Pin Signal Pin Pin Signal Pin Signal Pin Signal Signa RS-422A (See note) RS-2320 FG NC GRD GRD NC FG 1 1 1 1 1 SD RD 23 SD RD SG 23 23 SG SD 2 3 4 SD 2 3 4 SDB SDB RD RD RS-232C RS 4 RS-232C RS SDA SDA RS RS 4 4 Option CS 5V CS 5 5V 6 Interface CS 5 RDB 5 5 RDB 5 CS Board 6 RDA 6 6 RDA 6 5V CSB CSA DR DR CSB DR 7 8 DR 7 7 7 7 ER 8 ER CSA 8 8 ER 8 ER 9 SG RS-232 SG SG SG 9 9 SG RS-422 **RS-422** RS-232 D-sub, 9-pin D-sub, 9-pin 7 connector (male) connector (male) **DIP Switch Settings** Terminal block Pin 1: ON Pin 2: OFF 5-V (+) power (-) Pin 3: OFF Pin 4: OFF Pin 5: OFF Pin 6: ON **DIP Switch Settings** Pin 1: ON Pin 2: ON CPU Unit NT-AL001-E Link Adapter (terminating resistance) Pin 3: OFF Pin 4: OFF Pin 5: OFF Pin 5: OFF RS-232C Pin Pin Pin Signal Signal Signal See note) GRD NC FG 1 1 1 23 SG SD SD 2 3 2 3 SDB RD RD RS-232C 4 SDA RS 4 4 RS Option 5 RDB CS 5 5 CS Board 6 7 6 RDA 5∨ 6 5V CSB 7 DR 7 DR 8 CSA ER 8 ER 8 SG 9 RS-232 9 SG RS-422 D-sub, 9-pin connector (male) **DIP Switch Settings** Pin 1: ON Pin 2: ON (terminating resistance) Pin 3: OFF Pin 4: OFF Pin 5: OFF Pin 6: ON

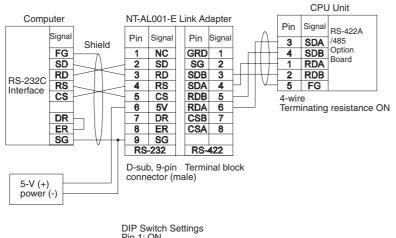
### 1:N Connections Using RS-232C Ports

Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters. XW2Z-070T-1: 0.7 m XW2Z-200T-1: 2 m

#### Appendix F

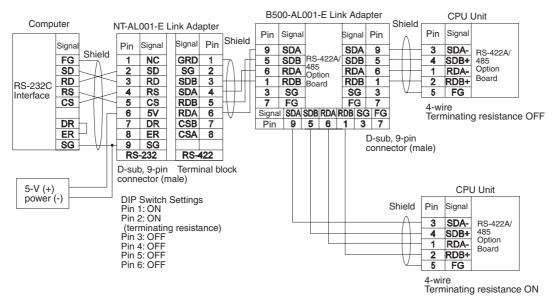
### Appendix F

#### 1:1 Connections Using RS-422A/485 Port

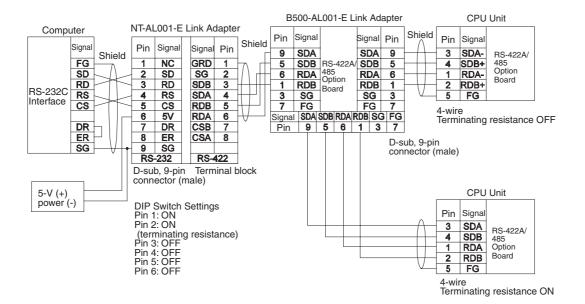


Pin 1: ON Pin 2: ON (terminating resistance) Pin 3: OFF Pin 4: OFF Pin 5: OFF

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

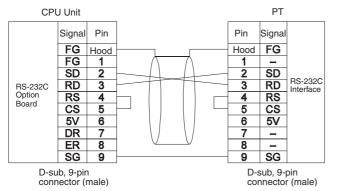


### Appendix F



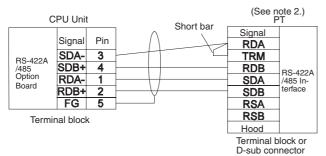
#### Programmable Terminal (PT) Connections

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



- Communications Mode: Host Link (unit number 0 only for Host Link) NT Link (1:N, N = 1 Unit only)
- OMRON Cables with Connectors: XW2Z-200T-1: 2 m XW2Z-500T-1: 5 m

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



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

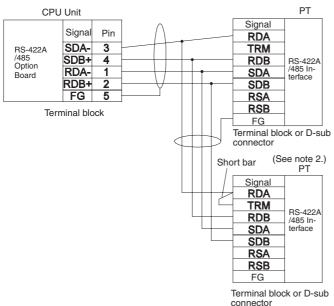
#### **Appendix F**

Note (1) RS-422A/485 Option Board settings:

Terminating resistance ON, 4-wire.

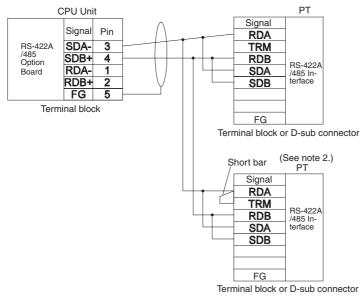
(2) The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

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



- Communications Mode: 1:N NT Link
- **Note** (1) RS-422A/485 Option Board settings: Terminating resistance ON, 4-wire.
  - (2) The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

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



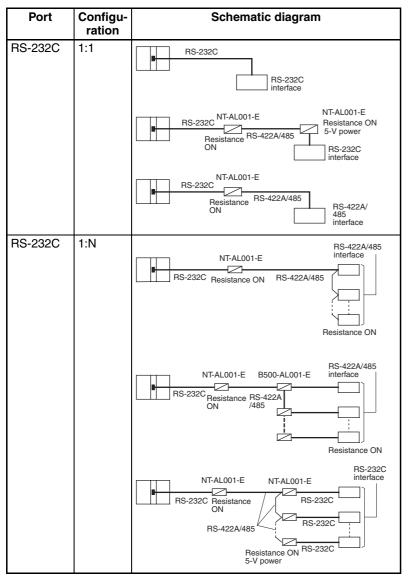
Communications Mode: 1:N NT Link

**Note** (1) RS-422A/485 Option Board settings: Terminating resistance ON, 2-wire.

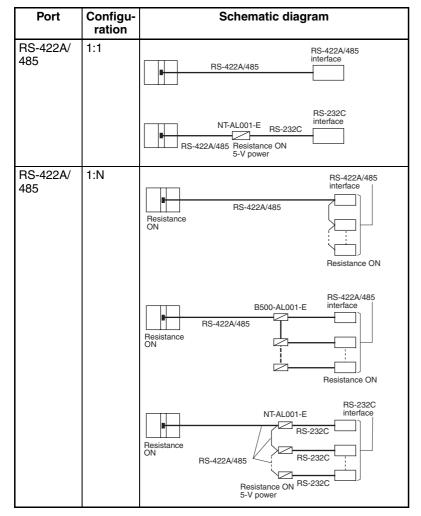
(2) The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

#### **Connections for Serial Gateway and No-protocol Communications**

This section describes the connections for Serial Gateway, and no-protocol communications. Up to 32 nodes can be used for 1:N connections.



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



- Note (1) The maximum cable length for RS-232C is 15 m. The RS-232C standard, however, does not cover baud rates above 19.2 Kbps. Refer to the manual for the device being connected to confirm support.
  - (2) The CP1W-CIF11 is a non-isolated board, so the maximum transmission distance is 50 m. The CP1W-CIF12 is an isolated board, so the maximum transmission distance is 500m. For distances over 50 m, use the RS-422A/485 port on the CP1W-CIF12 directly, or the RS-232C port on the CP1W-CIF01 and then connect through the NT-AL001-E Link Adapter, which is isolated. Doing so will enable a maximum transmission distance of 500 m.
  - (3) The maximum cable length is limited to 2 m when an NT-AL001-E Link Adapter is connected.
  - (4) Branch lines must be a maximum of 10 m long.

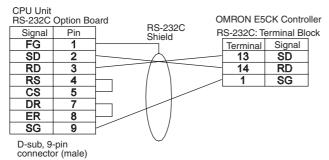
#### **Connection Examples**

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

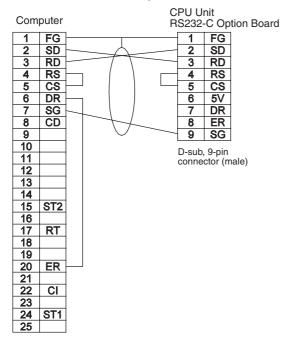
#### **Appendix F**

#### Connecting RS-232C Ports 1:1

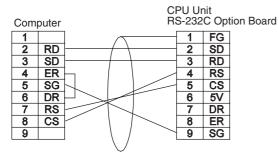
#### **Connections to E5CK Controller**



#### **Connections to a Host Computer**



#### **Connections to a Personal Computer with RTS-CTS Flow Control**

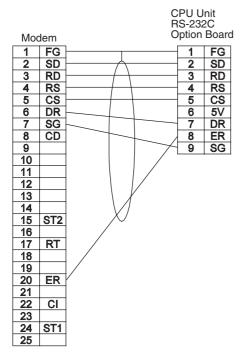


#### NT-AL001-E Link Adapter CPU Unit Computer RS-232C NT-AL001-E Link Adapter Signal Pin Signal Pin Signal Signal Pin Signal Pin Pin Signa RS-232C Shield RS-422A FG SD NC FG SD NC GRD GRD 1 1 1 1 1 2 3 2 3 2 SD SG 2 3 2 SG SD 3 RD SDB 3 SDB RD RD RD RS-232C RS-232C Option RS 4 4 RS SDA 4 4 SDA RS 4 RS Interface Board CS 5 5 CS RDB 5 5 RDB CS 5 CS 6 7 5V 6 5V RDA 6 6 RDA 5V 6 DR DR 7 DR CSB 7 7 CSB DR 7 ER ER ER 8 8 CSA 8 8 CSA ER 8 SG SG 9 RS-232 9 9 9 RS-422 **RS-232** RS-422 (See note D-sub, 9-pin connector (male) Terminal block D-sub, 9-pin connector (male) 5-V (+) power (-) DIP Switch Settings Pin 1: ON Pin 2: ON **DIP Switch Settings** Pin 1: ON Pin 2: ON (terminating resistance) Pin 3: OFF (4-wire) (terminating resistance) Pin 3: OFF (4-wire) Pin 4: OFF Pin 5: OFF Pin 6: OFF Pin 4: OFF Pin 5: OFF Pin 6: ON

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

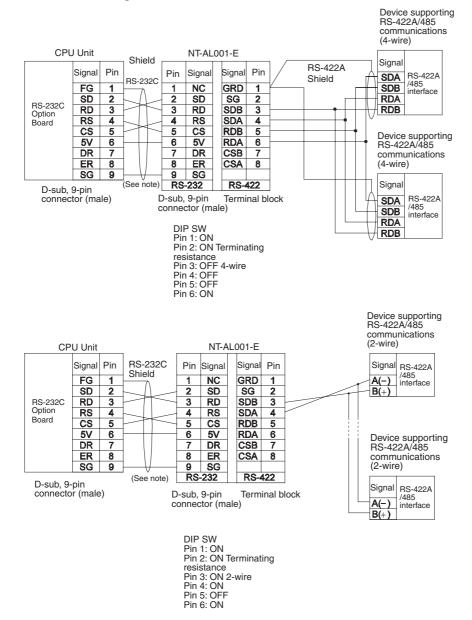
Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters. XW2Z-200T-1: 2 m XW2Z-500T-1:5 m

#### **Connections to a Modem**



#### Appendix F

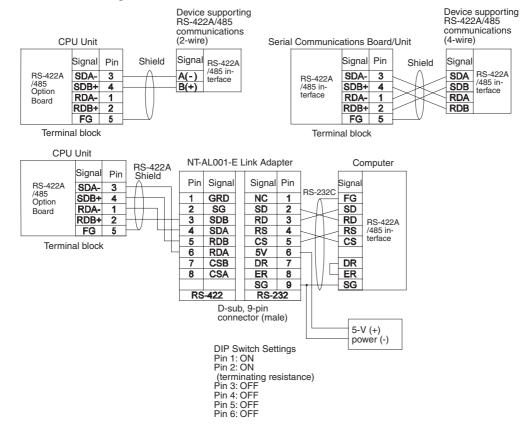
#### Appendix F



#### **1:N Connections Using RS-232C Ports**

Note We recommend using the following NT-AL001-E Link Adapter Connecting Cables to connect to NT-AL001-E Link Adapters. XW2Z-070T-1: 0.7 m XW2Z-200T-1: 2 m

#### **Appendix F**

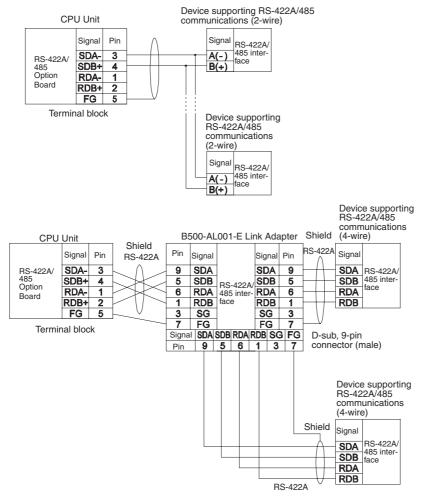


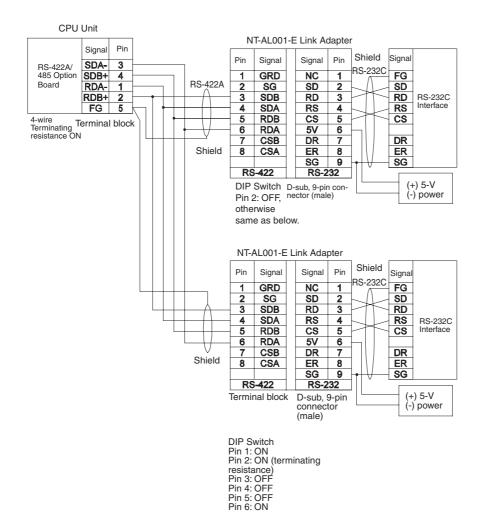
#### 1:1 Connections Using RS-422A/485 Ports

#### **Appendix F**

#### **Connections to Serial Communications Option Boards**

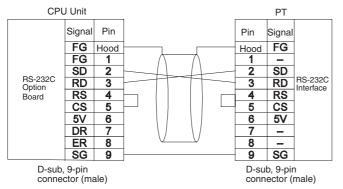
#### 1:N Connections Using RS-422A/485 Ports





### **1:N NT Link Connections with Programmable Terminals**

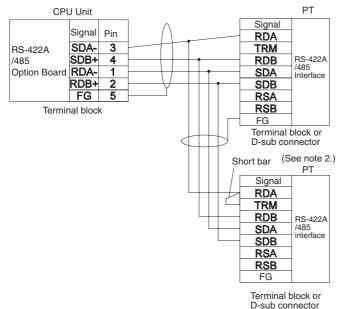
#### Direct Connections from RS-232C to RS-232C Ports



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

### Appendix F

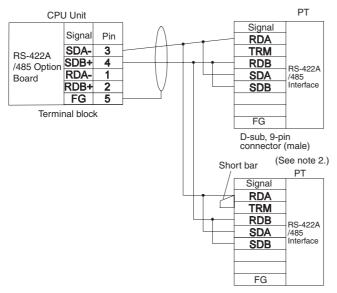
#### Appendix F



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

- Communications Mode: 1:N NT Link
- **Note** (1) RS-422A/485 Option Board settings: Terminating resistance ON, 4-wire.
  - (2) The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

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



Communications Mode: 1:N NT Link

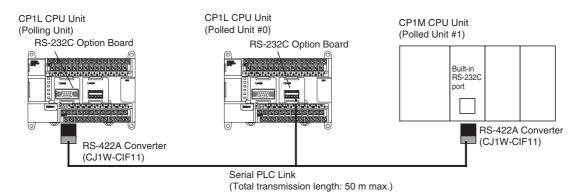
- **Note** (1) RS-422A/485 Option Board settings: Terminating resistance ON, 2-wire.
  - (2) The terminating resistant setting shown above is an example for the NT631/NT631C. The setting method varies with the PT. Refer to the manual for you PT for details.

#### Appendix F

#### Serial PLC Link Connection Examples

This section provides connection examples for using Serial PLC Link. The communications mode used here is Serial PLC Link.

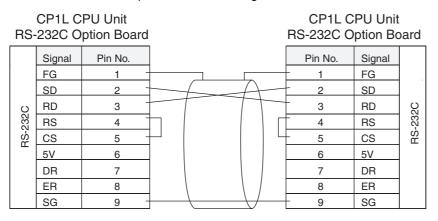
#### Connecting an RS-422A Converter



Note The CP1W-CIF11 is not insulated, so the total transmission distance for the whole transmission path is 50 m max. If the total transmission distance is greater than 50 m, use the RS-422A/485 port on the CP1W-CIF12 directly, or the insulated NT-AL001-E, and do not use the CP1W-CIF11. If the CP1W-CIF12 or NT-AL001-E is used, the total transmission distance for the whole transmission path is 500 m max.

#### Connection with an RS-232C Port

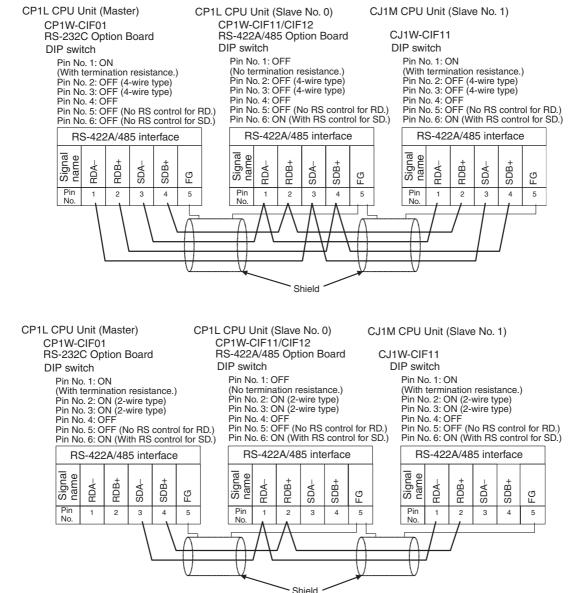
RS-232C connection is also possible when using a Serial PLC Link to connect two CP1L CPU Units.



#### **Appendix F**

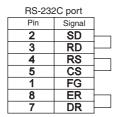
#### **Connections to Serial Communications Option Boards**

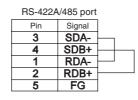
#### **Connection Examples**



#### **Connections in Loopback Test**

Connect the communications ports as shown below.





### RS-232C and RS-422A/485 Wiring

### Recommended RS-232C Wiring Examples

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

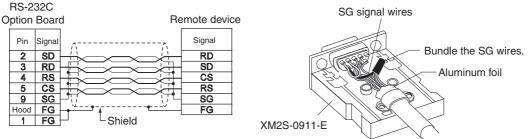
#### 1. Always use shielded twisted-pair cables as communications cables.

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

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

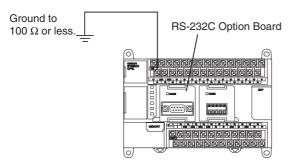
Example: Twisted-pair Cable Connecting SD-SG, RD-SG, RTS-SG, and CTS-SG Terminals in Toolbus Mode

**Actual Wiring Example** 



# Note The Hood (FG) is internally connected to the ground terminal (GR) on the CPU Unit. Therefore, FG is

**Note** The Hood (FG) is internally connected to the ground terminal (GR) on the CPU Unit. Therefore, FG is grounded by grounding the ground terminal (GR) on the power supply terminal block. Although there is conductivity between the Hood (FG) and pin 1 (FG), connect the Hood (FG) to the shield because the Hood (FG) has smaller contact resistance with the shield than pin 1 (FG), and thus provides better noise resistance.



#### Recommended RS-422A/485 Wiring Examples

Use the following wiring methods for RS-422A/485 to maintain transmission quality.

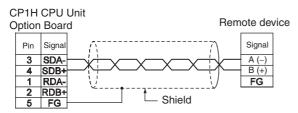
1. Always use shielded twisted-pair cables as communications cables.

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

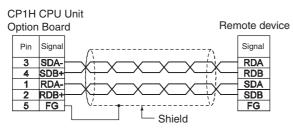
- 2. Connect the shield of the communications cable to the FG terminal on the RS-422A/485 Option Board. At the same time, ground the ground (GR) terminal of the CPU Unit to 100  $\Omega$  or less.
- **Note** Always ground the shield only at the RS-422A/485 Option Board end. Grounding both ends of the shield may damage the device due to the potential difference between the ground terminals.

Connection examples are shown below.

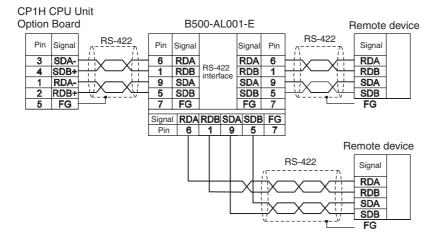
• 2-Wire Connections



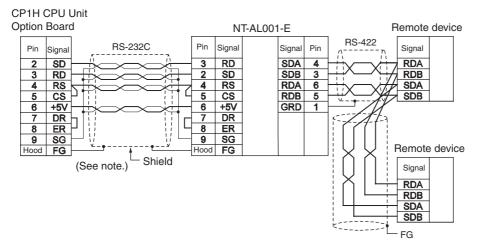
• 4-Wire Connections



• Using a B500-AL001-E Link Adapter



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

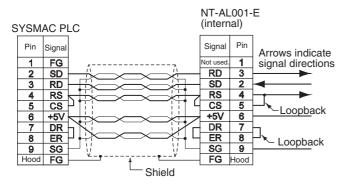


Note (1) The following cables are available for this connection.

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

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

• Wiring for the Recommended Cables (XW2Z-070T-1 and XW2Z-200T-1, 10-conductor Cables)



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

### Appendix F

#### **Wiring Connectors**

Use the following steps to wire connectors.

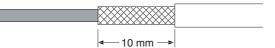
See the following diagrams for the length of the cable portion to be cut in each step.

#### Shield Connected to Hood (FG)

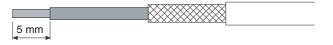
- 1. Cut the cable to the required length.
- 2. Remove the specified length of the sheath from the cable using a knife. Be careful not to scratch the braided shield.



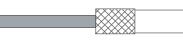
3. Trim off the braided shield using scissors so that the remaining shield length is 10 mm.



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



5. Fold back the braided shield.



6. Wrap aluminum foil tape around the folded shield.



#### Shield Not Connected to Hood (FG)

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

← 25 mm (RS-422A) → 40 mm (RS-232C)	

- 3. Trim off all the braided shield using scissors.
- 4. Remove the insulation from each conductor using a stripper so that the exposed conductor length is 5 mm.

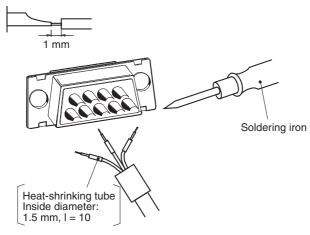


5. Wrap adhesive tape around the conductor from which the braided shield was removed.

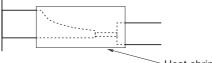


#### **Soldering**

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



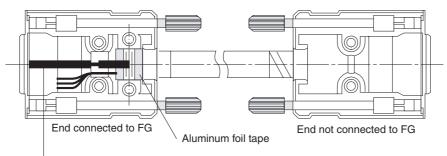
4. Return the heat-shrinking tube to the soldered portion, then heat the tube to shrink it in place.



Heat-shrinking tube

#### **Assembling Connector Hood**

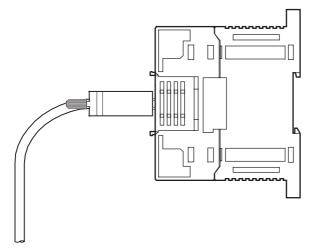
Assemble the connector hood as shown below.



Grounding plate

# Appendix F

### Connecting to Unit



# Appendix G PLC Setup

# **Startup Settings**

### **Startup Hold Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Force Status Hold Bit	Not held.	Not held.	When power is turned	80	14	0
			Held.	ON			1
2	IOM Hold Bit	Not held.	Not held.	When power is turned	80	15	0
			Held.	ON			1

### **Startup Data Read Setting**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Read DM from flash	Do not read.	Do not read.		82	15	0
	memory		Read.	ON			1

### Mode: CPU Unit Operating Mode

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings				
1	Use programming con- sole (RUN mode)	Use program- ming console	Use programming con- sole: RUN mode	When power is turned ON	81	00 to 15	0000 hex				
		(RUN mode) (See note.)					Program: PROGRAM mode				8000 hex
			Monitor: MONITOR mode				8001 hex				
			Run: RUN mode				8002 hex				

**Note** A Programming Console cannot be connected to the CP1L. If the default setting, "Use programming console," is set, the CPU Unit will start in RUN mode.

# **Settings: CPU Unit Settings**

### **Execute Process Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Do not detect Low Bat-	Detect.	Detect	Every cycle	128	15	0
	tery (run without battery)		Do not detect.				1
2	2 Detect Interrupt Task Error	Detect.	Detect	Every cycle	128	14	0
			Do not detect.				1
3	Stop CPU on Instruction	Do not stop.	Do not stop.	At start of operation	197	15	0
	Error		Stop				1
4	Don't resister FAL to	Register.	Register.	Every cycle	129	15	0
	error log	or log	Do not register.	]			1

### Comms Instructions Settings in FB: Settings for Communications Instructions in Function Blocks

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Retry Counts: Number of retries	0	0 to 15	At start of operation	200	00 to 03	0 hex : F hex
2	Response Timeout	Response Timeout default 2s), Comms nstructions in FB 2 s 2 s At start of operation 1: 1 × 0.1 s	At start of operation	201	00 to	0000 hex	
			1: 1 × 0.1 s			15	0001 hex
			:				:
			65535: 65,535 × 0.1 s				FFFF hex
3	Response Timeout	2 s	2 s	At start of operation	202	00 to	0000 hex
	(default 2s), DeviceNet Comms Instruction in FB		1: 1 × 0.1 s			15	0001 hex
		:	]			:	
			65535: 65,535 × 0.1 s	]			FFFF hex

# **Timings: Time and Interrupt Settings**

# Cycle Time Settings

		Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1		n Cycle Time ult 1000 ms)	Use default.	Use default. (Default: 1 s)	At start of operation	209	15	0
				Use user setting.				1
	1-1	Watch Cycle	me (default	1: 1 × 10 ms	At start of operation	209	00 to 14	001 hex
		1 ime (default 1000 ms)		:				:
				40,000: 40,000 × 10 ms				FA0 hex
2	Cycle Time			No minimum cycle time	At start of operation	208	00 to	0000 hex
	(No S	etting)	cycle time	1 ms			15	0001 hex
		:	:				:	
				32,000 ms				7D00 hex

# **Interrupt Setting**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Scheduled Interrupt	10 ms	10 ms	At start of operation		00 to	0 hex
	Interval	1 r	1 ms			03	1 hex
			0.1 ms				2 hex

# Input Constant Settings

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings										
1	0CH: CIO 0	8 ms	No filter (0 ms)	When power is turned	10	00 to 07	10 hex										
		Default (8ms)	0.5 ms	ON			11 hex										
			1 ms				12 hex										
			2 ms				13 hex										
			4 ms				14 hex										
			8 ms				15 hex										
			16 ms				16 hex										
			32 ms				17 hex										
2	1 CH: CIO 1	Same as	Same as above.	Same as above.	10	08 to 15	Same as										
3	2 CH: CIO 2	above.			11	00 to 07	above.										
4	3 CH: CIO 3				11	08 to 15											
5	4 CH: CIO 4				12	00 to 07											
6	5 CH: CIO 5				12	08 to 15											
7	6 CH: CIO 6				13	00 to 07											
8	7 CH: CIO 7				13	08 to 15											
9	8 CH: CIO 8	_					1					]			14	00 to 07	
10	9 CH: CIO 9						14	08 to 15									
11	10 CH: CIO 10				15	00 to 07											
12	11 CH: CIO 11				15	08 to 15											
13	12 CH: CIO 12				16	00 to 07											
14	13 CH: CIO 13				16	08 to 15											
15	14 CH: CIO 14				17	00 to 07											
16	15 CH: CIO 15				17	08 to 15											
17	16 CH: CIO 16				18	00 to 07											
18	17 CH: CIO 17				18	08 to 15											

# **Serial Port 1 Settings**

# **Serial Communications Settings**

		Nan	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Comn	nunicatic	ons Settings	Standard (9600; 1,7,2,E)	Standard (9600; 1,7,2,E) (The standard settings are as follows: 9,600 baud, 1 start bit, 7-bit data, even parity, and 2 stop bits.) Custom	Every cycle	144 (CP1L M- type CPU Unit) 160 (CP1L L- type CPU Unit)	15	0
2	Mode			Host Link	Host Link NT Link (1:N) RS-232C ToolBus (peripheral bus) Serial Gateway	Every cycle	144 (CP1L M- type CPU Unit) 160 (CP1L L- type CPU	08 to 11	0 hex 5 hex 2 hex 3 hex 4 hex 9 hex
	2-1	Host Lir			PC Link (Slave) PC Link (Master)		Únit)		7 hex 8 hex
		2-1-1	Baud	9,600 bps	300 bps 600 bps 1,200 bps 2,400 bps 4,800 bps 9,600 bps 19,200 bps 38,400 bps 57,600 bps	Every cycle	145 (CP1L M- type CPU Unit) 161 (CP1L L- type CPU Unit)	00 to 07	01 hex 02 hex 03 hex 04 hex 05 hex 00 or 06 hex 07 hex 08 hex
		2-1-2	Format (data length, stop bits, parity)	7,2,E: 7-bit data, 2 stop bits, even parity	57,600 bps 115,200 bps 7,2,E: 7-bit data, 2 stop bits, even parity 7,2,O: 7-bit data, 2 stop bits, odd parity 7,2,N: 7-bit data, 2 stop bits, no parity 7,1,E: 7-bit data, 2 stop bits, even parity 7,1,O: 7-bit data, 1 stop bit, no parity 8,2,E: 8-bit data, 2 stop bits, even parity 8,2,O: 8-bit data, 2 stop bits, odd parity 8,2,N: 8-bit data, 2 stop bits, no parity 8,2,N: 8-bit data, 2 stop bits, no parity 8,2,N: 8-bit data, 2 stop bits, no parity 8,1,E: 8-bit data, 1 stop bit, even parity	Every cycle	144 (CP1L M- type CPU Unit) 160 (CP1L L- type CPU Unit)	00 to 03	09 hex 0A hex 0 hex 1 hex 2 hex 4 hex 5 hex 6 hex 8 hex 9 hex A hex C hex
					8,1,0: 8-bit data, 1 stop bit, odd parity 8,1,N: 8-bit data, 1 stop bit, no parity	-			D hex E hex

		Nan	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
	2-1	2-1-3	Unit Num- ber	0	0 : 31	Every cycle	147 (CP1L M- type CPU Unit) 161 (CP1L L- type CPU	00 to 07	00 hex : 1F hex
	2-2	NT Link	(1:N): 1:N N	IT Links			Unit)		
		2-2-1	Baud	9,600 (disabled)	38,400 (standard) 115,200 (high speed)	Every cycle	145 (CP1L M- type CPU Unit)	00 to 07	00 hex 0A hex
	2-2-2					161 (CP1L L- type CPU Unit)			
		2-2-2	NT/PC Link Max: Highest unit num-	0	0 :	Every cycle	150 (CP1L M- type CPU Unit)	00 to 03	0 hex :
			ber		7		166 (CP1L L- type CPU Unit)	-	7 hex
ľ	2-3	RS-232	C						1
		2-3-1	Baud	9600 bps	300 bps 600 bps 1,200 bps 2,400 bps 4,800 bps 9,600 bps 19,200 bps 38,400 bps 57,600 bps	Every cycle	145 (CP1L M- type CPU Unit) 161 (CP1L L- type CPU Unit)	00 to 07	01 hex 02 hex 03 hex 04 hex 05 hex 00 or 06 hex 07 hex 08 hex 09 hex
		2-3-2	Format (data length,	7,2,E: 7-bit data, 2 stop bits, even parity	115,200 bps 7,2,E: 7-bit data, 2 stop bits, even parity 7,2,O: 7-bit data, 2 stop	Every cycle	144 (CP1L M- type CPU	00 to 03	0A hex 0 hex 1 hex
			stop bits, parity)		bits, odd parity 7,2,N: 7-bit data, 2 stop bits, no parity 7,1,E: 7-bit data, 2 stop		Únit) 160	-	2 hex 4 hex
					bits, even parity 7,1,0: 7-bit data, 1 stop bit, odd parity	-	(CP1L L- type CPU Unit)		5 hex
					7,1,N: 7-bit data, 1 stop bit, no parity 8,2,E: 8-bit data, 2 stop	_			6 hex 8 hex
					bits, even parity 8,2,O: 8-bit data, 2 stop bits, odd parity	-			9 hex
					8,2,N: 8-bit data, 2 stop bits, no parity 8,1,E: 8-bit data, 1 stop	-			A hex C hex
					bit, even parity 8,1,O: 8-bit data, 1 stop	-			D hex
					bit, odd parity 8,1,N: 8-bit data, 1 stop bit, no parity	-			E hex

	Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
2-3	2-3-3	Start Code	Disable.	Disable.	Every cycle	149 (CP1L M- type CPU Unit)	12	0
				Set.		165 (CP1L L- type CPU Unit)		1
	2-3-4	Start Code	00 hex0x0000	0x0000 :	Every cycle	148 (CP1L M- type CPU Unit)	08 to 15	00 hex :
				0x00FF	-	164 (CP1L L- type CPU Unit)	-	FF hex
	2-3-5	End Code	Received Bytes: Receive specified num- ber of bytes.	Received Bytes: Receive specified number of bytes.	Every cycle	149 (CP1L M- type CPU Unit)	08 and 09	00
				CR,LF Set End Code	-	165 (CP1L L- type CPU Unit)	-	10 01
	2-3-6	Received Bytes	256 bytes	256 bytes 1 byte :	Every cycle	149 (CP1L M- type CPU Unit)	00 to 07	00 hex 01 hex :
				255 bytes		165 (CP1L L- type CPU Unit)		FF hex
	2-3-7	Set End Code	0x0000	1 byte :	Every cycle	148 (CP1L M- type CPU Unit)	00 to 07	00 hex :
				255 bytes		164 (CP1L L- type CPU Unit)	-	FF hex
	2-3-8	Delay	0 ms	0: 0 × 10 ms :	Every cycle	146 (CP1L M- type CPU Unit)	00 to 15	0000 hex :
				9999: 9999 × 10 ms		162 (CP1L L- type CPU Unit)	00 to	270F he
2-4	ToolBu	s (peripheral	bus)					
	2-4-1	Baud	9,600 bps	9,600 bps	Every cycle	145 (CP1L M- type CPU		00 or 06 hex
				19,200 bps		Unit)		07 hex
				38,400 bps	4	161 (CP1L L-		08 hex
				57,600 bps	-	type CPU		09 hex
				115,200 bps		Únit)		0A hex

	Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Setting
2-5	Serial (	Gateway	I	L				
	2-5-1	Baud	9,600 bps	300 bps	Every cycle	145	00 to	01 hex
				600 bps		(CP1L M- type CPU	07	02 hex
				1,200 bps		Unit)		03 hex
				2,400 bps		161		04 hex
				4,800 bps		(CP1L L- type CPU		05 hex
				9,600 bps		Unit)		00 or 06 hex
				19,200 bps				07 hex
				38,400 bps				08 hex
				57,600 bps				09 hex
				115,200 bps				0A hex
	2-5-2	Format (data	7,2,E: 7-bit data, 2 stop	7,2,E: 7-bit data, 2 stop bits, even parity	Every cycle	144 (CP1L M-	00 to 03	0 hex
		length, stop bits, parity)	bits, even parity	7,2,O: 7-bit data, 2 stop bits, odd parity		type CPU Unit)	_	1 hex
		,		7,2,N: 7-bit data, 2 stop bits, no parity				2 hex
				7,1,E: 7-bit data, 2 stop bits, even parity		160 (CP1L L-		4 hex
				7,1,O: 7-bit data, 1 stop bit, odd parity		type CPU Unit)		5 hex
				7,1,N: 7-bit data, 1 stop bit, no parity				6 hex
				8,2,E: 8-bit data, 2 stop bits, even parity				8 hex
				8,2,O: 8-bit data, 2 stop bits, odd parity				9 hex
				8,2,N: 8-bit data, 2 stop bits, no parity				A hex
				8,1,E: 8-bit data, 1 stop bit, even parity				C hex
				8,1,O: 8-bit data, 1 stop bit, odd parity				D hex
				8,1,N: 8-bit data, 1 stop bit, no parity				E hex
	2-5-3	Response	50:	50: 50 × 100 ms = 5 s	Every cycle	151 (OD1) M	08 to	00 hex
		Timeout	50 × 100 ms = 5 s	1: 1 × 100 ms	-	(CP1L M- type CPU	15	01 hex
				:	_	Unit)	_	:
				255: 255 × 100 ms		167 (CP1L L- type CPU Unit)		FF hex
2-6	PC Lin	k (Slave)					<u> </u>	<u> </u>
	2-6-1	Baud	9,600 bps (disabled)	38,400 (standard)	Every cycle	145 (CP1L M- type CPU Unit)	00 to 07	00 hex
				115,200 (high speed)		161 (CP1L L- type CPU Unit)		0A hex
	2-6-2	PC Link Unit No.	0	0	Every cycle	151 (CP1L M- type CPU	00 to 03	0 hex :
				7	-	Unit) 167 (CP1L L- type CPU Unit)		7 hex

		Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
2	2-7	PC Lin	k (Master)				-	-	
		2-7-1	Baud	9,600 bps (disabled)	38,400 (standard)	Every cycle	145 (CP1L M- type CPU Unit)	00 to 07	00 hex
					115,200 (high speed)		161 (CP1L L- type CPU Unit)		0A hex
		2-7-2	Link Words	10 (default)	1 : 10 (default)	Every cycle	150 (CP1L M- type CPU Unit)	04 to 07	1 hex : 0 or A hex
							166 (CP1L L- type CPU Unit)		
		2-7-3	PC Link Mode	ALL	ALL	Every cycle	150 (CP1L M- type CPU Unit)	15	0
					Masters		166 (CP1L L- type CPU Unit)		1

# **Serial Port 2 Settings**

# **Serial Communications Settings**

		Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Comr	nunicatio	ons Settings	Standard (9600 ; 1,7,2,E)	Standard (9600; 1,7,2,E) (The standard settings are as follows: 9,600 baud, 1 start bit, 7-bit data, even parity, and 2 stop bits.)	Every cycle	160 (CP1L M- type CPU Unit)	15	0
					Custom				1
2	Mode	•		Host Link	Host Link	Every cycle	160 (CP1L M- type CPU	08 to 11	0 hex 5 hex
					NT Link (1:N): 1:N NT Links		Unit)		2 hex
					RS-232C				3 hex
					ToolBus (peripheral bus)				4 hex
					Serial Gateway				9 hex
					PC Link (Slave)				7 hex
					PC Link (Master)				8 hex
	2-1	Host Li	nk						
		2-1-1	Baud	9,600 bps	300 bps	Every cycle	161	00 to	01 hex
					600 bps		(CP1L M- type CPU	07	02 hex
					1,200 bps		Unit)		03 hex
					2,400 bps				04 hex
					4,800 bps				05 hex
					9,600 bps				00 or 06 hex
					19,200 bps				07 hex
					38,400 bps				08 hex
					57,600 bps				09 hex
					115,200 bps				0A hex
		2-1-2	Format (data	7,2,E: 7-bit data, 2 stop	7,2,E: 7-bit data, 2 stop bits, even parity	Every cycle	160 (CP1L M-	00 to 03	0 hex
			length, stop bits, parity)	bits, even parity	7,2,O: 7-bit data, 2 stop bits, odd parity	-	type CPU Unit)		1 hex
					7,2,N: 7-bit data, 2 stop bits, no parity				2 hex
					7,1,E: 7-bit data, 2 stop bits, even parity				4 hex
					7,1,0: 7-bit data, 1 stop bit, odd parity				5 hex
					7,1,N: 7-bit data, 1 stop bit, no parity	4			6 hex
					8,2,E: 8-bit data, 2 stop bits, even parity	-			8 hex
					8,2,0: 8-bit data, 2 stop bits, odd parity	-			9 hex
					8,2,N: 8-bit data, 2 stop bits, no parity	-			A hex
					8,1,E: 8-bit data, 1 stop bit, even parity	-			C hex
					8,1,O: 8-bit data, 1 stop bit, odd parity	-			D hex E hex
					8,1,N: 8-bit data, 1 stop bit, no parity		101		
		2-1-3	Unit Num- ber	0	0	Every cycle	161 (CP1L M-	00 to 07	00 hex
					:	4	type CPU		:
					31		Únit)		1F hex

	Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Setting
2-2	NT Lin	k (1:N)		·				
	2-2-1	Baud	9,600	38,400 (standard)	Every cycle	161	00 to	00 hex
			(disabled)	115,200 (high speed)		(CP1L M- type CPU Unit)	07	0A hex
	2-2-2	NT/PC	0	0	Every cycle	166	00 to	0 hex
		Link Max: Highest		:		(CP1L M- type CPU	03	:
		unit num- ber		7		Unit)		7 hex
2-3	RS-232	2C		I	1			
	2-3-1	Baud	9600 bps	300 bps	Every cycle	161	00 to	01 hex
				600 bps		(CP1L M- type CPU	07	02 hex
				1,200 bps		Unit)		03 hex
				2,400 bps		,		04 hex
				4,800 bps	-			05 hex
				9,600 bps	-			00 or
				0,000 500				06 hex
				19,200 bps				07 hex
				38,400 bps				08 hex
				57,600 bps				09 hex
				115,200 bps				0A hex
	2-3-2	Format (data	7,2,E: 7-bit data, 2 stop	7,2,E: 7-bit data, 2 stop bits, even parity		160 (CP1L M-	00 to 03	0 hex
		length, stop bits, parity)	bits, even parity	7,2,O: 7-bit data, 2 stop bits, odd parity		type CPU Unit)		1 hex
		punty		7,2,N: 7-bit data, 2 stop bits, no parity				2 hex
				7,1,E: 7-bit data, 2 stop bits, even parity				4 hex
				7,1,O: 7-bit data, 1 stop bit, odd parity				5 hex
				7,1,N: 7-bit data, 1 stop bit, no parity	_			6 hex
				8,2,E: 8-bit data, 2 stop bits, even parity				8 hex
				8,2,O: 8-bit data, 2 stop bits, odd parity	4			9 hex
				8,2,N: 8-bit data, 2 stop bits, no parity	-			A hex
				8,1,E: 8-bit data, 1 stop bit, even parity	-			C hex
				8,1,0: 8-bit data, 1 stop bit, odd parity				D hex
				8,1,N: 8-bit data, 1 stop bit, no parity				E hex
	2-3-3	Start Code	Disable.	Disable.	Every cycle	165	12	0
				Set.		(CP1L M- type CPU Unit)		1
1	2-3-4	Start Code	00 hex0x0000	0x0000	Every cycle	, 164	08 to	00 hex
1				:	1	(CP1L M- type CPU	15	:
				0x00FF	1	Unit)		FF hex
	2-3-5	End Code	Received Bytes: Receive specified num-	Received Bytes: Receive specified number of bytes.	Every cycle	165 (CP1L M- type CPU	08 and 09	00
1			ber of bytes.	CR,LF	1	Únit)		10
1				Set End Code	1			01

	Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
2-3	2-3-6	Received	256 bytes	256 bytes	Every cycle	165 (CP1L M-	00 to 07	00 hex
		Bytes		1 byte	_	type CPU	07	01 hex
				:	_	Únit)		:
				255 bytes				FF hex
	2-3-7	Set End Code	0x0000	0x0000	Every cycle	164 (CP1L M-	00 to 07	00 hex
				:	-	type CPU Unit)	_	:
	0.00	Delay	0:0 × 10 mg	0x00FF			00 to	FF hex
	2-3-8	Delay	0: 0 × 10 ms	0: 0 × 10 ms :	Every cycle	162 (CP1L M- type CPU	15	0000 hex
				9999: 9999 $\times$ 10 ms		Únit)		270F he
2-4	-	s (peripheral	1	1		1	1	1
	2-4-1	Baud	9,600 bps	9,600 bps	Every cycle	161 (CP1L M- type CPU	00 to 07	00 or 06 hex
				19,200 bps		Unit)		07 hex
				38,400 bps		,		08 hex
				57,600 bps				09 hex
				115,200 bps				0A hex
2-5	Serial (	Gateway						
	2-5-1	Baud	9,600 bps	300 bps	Every cycle	161 (OD1) M	00 to	01 hex
				600 bps		(CP1L M- type CPU	07	02 hex
				1,200 bps		Únit)		03 hex
				2,400 bps				04 hex
				4,800 bps				05 hex
				9,600 bps				00 or 06 hex
				19,200 bps				07 hex
				38,400 bps				08 hex
				57,600 bps				09 hex
		-	115,200 bps				0A hex	
	2-5-2	Format (data	7,2,E: 7-bit data, 2 stop	7,2,E: 7-bit data, 2 stop bits, even parity	Every cycle	160 (CP1L M- type CPU	00 to 03	0 hex
		length, stop bits, parity)	bits, even parity	7,2,O: 7-bit data, 2 stop bits, odd parity		type CPU Unit)		1 hex
		panty		7,2,N: 7-bit data, 2 stop bits, no parity				2 hex
				7,1,E: 7-bit data, 2 stop bits, even parity				4 hex
				7,1,O: 7-bit data, 1 stop bit, odd parity				5 hex
				7,1,N: 7-bit data, 1 stop bit, no parity				6 hex
				8,2,E: 8-bit data, 2 stop bits, even parity				8 hex
				8,2,O: 8-bit data, 2 stop bits, odd parity				9 hex
				8,2,N: 8-bit data, 2 stop bits, no parity				A hex
				8,1,E: 8-bit data, 1 stop bit, even parity				C hex
				8,1,O: 8-bit data, 1 stop bit, odd parity				D hex
				8,1,N: 8-bit data, 1 stop bit, no parity	qq			E hex
	2-5-3	Response	50:	50: 50 × 100 ms = 5 s	Every cycle	167	08 to	00 hex
		Timeout	50 × 100 ms = 5 s	1: 1 $\times$ 100 ms	]	167 (CP1L M- type CPU	15	01 hex
				:		Unit)		:
				255: 255 × 100 ms				FF hex

		Nai	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings			
2	2-6	PC Lin	k (Slave)									
		2-6-1	Baud	9,600 bps	38,400 (standard)	Every cycle	161	00 to	00 hex			
				(disabled)	115,200 (high speed)		(CP1L M- type CPU Unit)	07	0A hex			
		2-6-2	PC Link	0	0	Every cycle	167	00 to	0 hex			
			Unit No.		:		(CP1L M- type CPU	03	:			
					7		Unit)		7 hex			
	2-7	PC Lin	PC Link (Master)									
		· ·	Baud	9,600 bps	38,400 (standard)	Every cycle	161	00 to	00 hex			
				(disabled)	115,200 (high speed)		(CP1L M- type CPU Unit)	07	0A hex			
		2-7-2	Link Words	10 (default)	1 : 10 (default)	Every cycle	166 (CP1L M- type CPU Unit)	04 to 07	1 hex : 0 or A hex			
		2-7-3	PC Link	ALL	ALL	Every cycle	166	15	0			
			Mode		Masters		(CP1L M- type CPU Unit)		1			

# **Peripheral Service Settings**

# Set Time to All Events: Time Setting for Services

	Name		Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Set time to all events		e to all events Default Default (4% of cycle time)		At start of operation	218	15	0
				Use user setting.				1
	1-1	Time allocated to	0: 0 × 0.1 ms =	0: 0 × 0.1 ms = 0 ms	At start of operation	218	00 to	00 hex
	services		ervices 0 ms	:			07	:
				255: 255 $\times$ 0.1 ms				FF hex

# **Built-in Input Settings**

### **High Speed Counter Settings**

		Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Use ł	nigh spee	ed counter 0	Do not use.	Do not use.	When power is turned	50	12 to	0 hex
					Use.	ON		15	1 hex
	1-1	Countir	ng mode	Linear mode	Linear mode	At start of operation	50	08 to	0 hex
					Circular mode			11	1 hex
		1-1-1	Circular Max.	0	0	At start of operation	52 and 51	00 to 15	0000 0000 hex
			Count		:				:
					4,294,967,295				FFFF FFFF hex
	1-2	Reset		Z phase, soft-	Z phase, software reset	When power is turned	50	04 to	0 hex
				ware reset	Software reset	ON		07	1 hex
					Z phase, software reset (comparing)				2 hex
					Software reset (compar- ing)				3 hex
	1-3	Input S	etting	Differential	Differential phase input	When power is turned	50	00 to	0 hex
				phase input	Pulse + direction input	ON		03	1 hex
					Up/Down input				2 hex
					Increment pulse input				3 hex
2	Use ł	nigh spee	ed counter 1	Do not use.	Do not use.	When power is turned	53	12 to	0 hex
					Use.	ON		15	1 hex
	2-1	Countir	ng mode	Linear mode	Linear mode	At start of operation	53	08 to	0 hex
					Circular mode			11	1 hex
		2-1-1	Circular Max.	0	0	At start of operation	55 and 54	00 to 15	0000 0000 hex
			Count		:				:
					4,294,967,295				FFFF FFFF hex
	2-2	Reset		Z phase, soft-	Z phase, software reset	When power is turned	53	04 to	0 hex
				ware reset	Software reset	ON		07	1 hex
				Z phase, software reset (comparing)				2 hex	
			Software reset (compar- ing)				3 hex		
	2-3	Input S	etting	Differential	Differential phase input	When power is turned	53	00 to	0 hex
				phase input	Pulse + direction input	ON		03	1 hex
					Up/Down input	]			2 hex
					Increment pulse input				3 hex

		Nar	ne	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
3	Use I	nigh spee	ed counter 2	Do not use.	Do not use.	When power is turned	95	12 to	0 hex
					Use.	ON		15	1 hex
	3-1	Countir	ng mode	Linear mode	Linear mode	At start of operation	95	08 to	0 hex
					Circular mode			11	1 hex
		3-1-1	Circular Max.	0	0	At start of operation	97 and 96	00 to 15	0000 0000 hex
			Count		:				:
					4,294,967,295				FFFF FFFF hex
	3-2	Reset		Z phase, soft-	Z phase, software reset	When power is turned	95	04 to	0 hex
				ware reset	Software reset	ON		07	1 hex
					Z phase, software reset (comparing)				2 hex
					Software reset (comparing)				3 hex
	3-3	Input S	etting	Differential	Differential phase input	When power is turned	95	00 to	0 hex
				phase input	Pulse + direction input	ON		03	1 hex
					Up/Down input				2 hex
					Increment pulse input				3 hex
Ļ	Use I	nigh spee	ed counter 3	Do not use.	Do not use.	When power is turned	98	12 to	0 hex
					Use.	ON		15	1 hex
	4-1	Countir	ng mode	Linear mode	Linear mode	At start of operation	98	08 to	0 hex
					Circular mode			11	1 hex
		4-1-1	Circular Max.	0	0	At start of operation	100 and 99	00 to 15	0000 0000 hex
			Count		:				:
					4,294,967,295				FFFF FFFF hex
	4-2	Reset		Z phase, soft-	Z phase, software reset	When power is turned	98	04 to	0 hex
				ware reset	Software reset	ON		07	1 hex
					Z phase, software reset (comparing)				2 hex
					Software reset (comparing)				3 hex
	4-3	Input S	etting	Differential	Differential phase input	When power is turned	98	00 to	0 hex
				phase input	Pulse + direction input	ON		03	1 hex
					Up/Down input				2 hex
					Increment pulse input				3 hex

# Interrupt Input Settings

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	INO	Normal	Normal	When power is turned	60	00 to	0 hex
	(CIO 0.04)		Interrupt	ON		03	1 hex
			Quick				2 hex
2	IN1	Normal	Normal	When power is turned	60	04 to 07	0 hex
	(CIO 0.05)		Interrupt	ON			1 hex
			Quick				2 hex
3	IN2	Normal	Normal	When power is turned	60	08 to	0 hex
	(CIO 0.06)		Interrupt	ON		11	1 hex
			Quick				2 hex
4	IN3	Normal	Normal	When power is turned	60	12 to	0 hex
	(CIO 0.07)		Interrupt	ON		15	1 hex
			Quick				2 hex
5	IN4	Normal	Normal	When power is turned	59	00 to	0 hex
	(CIO 0.08)		Interrupt	ON		03	1 hex
			Quick				2 hex
6	IN5	Normal	Normal	When power is turned	59	04 to	0 hex
	(CIO 0.09)		Interrupt	ON		07	1 hex
			Quick				2 hex

# Pulse Output 0 Settings

# **Base Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Undefined Origin (oper-	Hold	Hold	At start of operation	268	12 to	0 hex
	ation for limit signal turn- ing ON)		Undefined			15	1 hex
2	Limited Input Signal	Search Only	Search Only	When power is turned	256	04 to	0 hex
	Operation		Always	ON		07	1 hex
3	Limit Input Signal	NC	NC	At start of operation	268	00 to	0 hex
			NO			03	1 hex
4	Search/Return Initial Speed	0 pps (disabled)	0 pps	At start of operation	259 and 258	00 to 15	0000 0001 hex
			:				:
			100,000 pps				0001 86A0 hex 000F 4240 hex
5	Speed Curve	Trapezium	Trapezium	When power is turned	256	12 to	0 hex
			S-shaped	ON		15	1 hex

# Define Origin Operation Settings: Origin Search Settings

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Setting
	lefine origin opera-	Do not use.	Do not use.	When power is turned	256	00 to	0 hex
tion			Use.	ON		03	1 hex
1-1	Search Direction	CW	CW	At start of operation	257	12 to	0 hex
			CCW			15	1 hex
1-2	Detection Method	Method 0	Method 0	At start of operation	257	08 to	0 hex
			Method 1			11	1 hex
			Method 2				2 hex
1-3	Search Operation	Inverse 1	Inverse 1	At start of operation	257	04 to	0 hex
			Inverse 2			07	1 hex
1-4	Operation Mode	Mode 0	Mode 0	At start of operation	257	00 to	0 hex
			Mode 1			03	1 hex
			Mode 2				2 hex
1-5	Origin Input Sig-	NC	NC	Unit version 1.0 and	268	08 to	0 hex
	nal		NO	earlier: At start of operation		11	1 hex
	(X/XA CPU Units)			Unit version 1.1 and later: When power is turned ON			
	Origin Input Sig-		NC (line driver)	At start of operation	-		2 hex
	nal		NO (line driver)				3 hex
	(Y CPU Units)	NO					
1-6	Proximity Input Signal	NC	NC	At start of operation	268	04 to 07	0 hex
	ů.		NO			-	1 hex
1-7	Search High Speed	0 pps (disabled)	0 pps :	At start of operation	261 and 260	00 to 15	0000 000 hex :
			100,000 pps				0001 86/
			100,000 pps				0001 80/ hex 000F 42/ hex
1-8	Search Proximity Speed	0 pps (disabled)	1 pps	At start of operation	263 and 262	00 to 15	0000 000 hex
			:				:
			100,000 pps				0001 864 hex 000F 424 hex
1-9	Search Compen- sation Value	0 pps	-2,147,483,648	At start of operation	265 and 264	00 to 15	8000 000 hex
			:				:
			0				0000 000 hex
			:				:
			+2,147,483,647				7FFF FF hex
1-10	Search Accelera-	0 (disabled)	1 (pulses/4 ms)	At start of operation	266	00 to	0001 hex
	tion Ratio		:			15	:
			65,535 (pulses/4 ms)				FFFF he
1-11	Search Decelera-	0 (disabled)	1 (pulses/4 ms)	At start of operation	267	00 to	0001 hex
	tion Ratio		:			15	:
			65,535 (pulses/4 ms)				FFFF he
1-12	Positioning Moni-	0 ms	0 ms	At start of operation	269	00 to	0000 he
	tor Time		:			15	:
			9,999 ms				270F hex

# Origin Return Settings

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Speed	0 pps (disabled)	1 pps	At start of operation 271 a 270	271 and 270	00 to 15	0000 0001 hex
			:				:
			100,000 pps				0001 86A0 hex 000F 4240 hex
2	Acceleration Ratio	0 (disabled)	1 (pulses/4 ms)	At start of operation	272	00 to 15	0001Hex
			:				:
			65535 (pulses/4 ms)				FFFF hex
3	Deceleration Ratio	0 (disabled)	1 (pulses/4 ms)	At start of operation	273	00 to 15	0001 hex
			:				:
			65535 (pulses/4 ms)				FFFF hex

# Pulse Output 1 Settings

# **Base Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Undefined Origin (oper-	Hold	Hold	At start of operation	286	12 to	0 hex
	ation for limit signal turn- ing ON)		Undefined			15	1 hex
2	Limited Input Signal	Search Only	Search Only	When power is turned	274	04 to	0 hex
	Operation		Always	ON		07	1 hex
3	Limit Input Signal	NC	NC	At start of operation	286	00 to	0 hex
			NO			03	1 hex
4	Search/Return Initial Speed	0 pps (disabled)	0 pps	At start of operation	277 and 276	00 to 15	0000 0001 hex
			:				:
			100,000 pps				0001 86A0 hex 000F 4240 hex
5	Speed Curve	Trapezium	Trapezium	When power is turned	274	12 to	0 hex
			S-shaped	ON		15	1 hex

# Define Origin Operation Settings: Origin Search Settings

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
Use of tion	define origin opera-	Do not use.	Do not use.	When power is turned	274	00 to 03	0 hex
uon			Use.			03	1 hex
1-1	Search Direction	CW	CW	At start of operation	275	12 to	0 hex
			CCW			15	1 hex
1-2	Detection Method	Method 0	Method 0	At start of operation	275	08 to	0 hex
			Method 1			11	1 hex
			Method 2				2 hex
1-3	Search Operation	Inverse 1	Inverse 1	At start of operation	275	04 to 07	0 hex
			Inverse 2			07	1 hex
1-4	Operation Mode	Mode 0	Mode 0	At start of operation	275	00 to 03	0 hex
			Mode 1			03	1 hex
			Mode 2				2 hex
1-5	Origin Input Sig-	NC	NC	Unit version 1.0 and	286	08 to	0 hex
	nal (X/XA CPU Units)		NO	earlier: At start of operation		11	1 hex
				Unit version 1.1 and later: When power is turned ON			
	Origin Input Sig-		NC (line driver)	At start of operation			2 hex
	nal		NO (line driver)				3 hex
	(Y CPU Units)						
1-6	Proximity Input Signal	NC	NC	At start of operation	286	04 to 07	0 hex
	°		NO			-	1 hex
1-7	Search High Speed	0 pps (disabled)	0 pps	At start of operation	279 and 278	00 to 15	0000 0001 hex
			:	_			:
			100,000 pps				0001 86A0 hex
							000F 4240 hex
1-8	Search Proximity Speed	0 pps (disabled)	1 pps	At start of operation	281 and 280	00 to 15	0000 0001 hex
	Opeed	(disabled)		_	200	15	:
			100,000 pps	_			0001 86A0
			100,000 pps				hex
							000F 4240 hex
1-9	Search Compen- sation Value	0 pps	-2,147,483,648	At start of operation	283 and 282	00 to 15	8000 0000 hex
			:	_			:
			0	_			0000 0000
			-				hex
			:				:
			+2,147,483,647				7FFF FFFF hex
1-10	Search Accelera- tion Ratio	0 (disabled)	1 (pulses/4 ms)	At start of operation	284	00 to	0001 hex
	lion Ralio		:			15	:
			65,535 (pulses/4 ms)				FFFF hex
1-11	Search Decelera-	0 (disabled)	1 (pulses/4 ms)	At start of operation	285	00 to	0001 hex
	tion Ratio		:			15	:
			65,535 (pulses/4 ms)				FFFF hex
1-12	Positioning Moni-	0 ms	0 ms	At start of operation	287	00 to	0000 hex
	tor Time		:			15	:
1			9,999 ms	7			270F hex

# **Origin Return Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Speed	0 pps (disabled)	1 pps	At start of operation	289 and 288	00 to 15	0000 0001 hex
			:				:
			100,000 pps				0001 86A0 hex 000F 4240 hex
2	Acceleration Ratio	0 (disabled)	1 (pulses/4 ms)	At start of operation	290	00 to 15	0001Hex
			:				:
			65535 (pulses/4 ms)				FFFF hex
3	Deceleration Ratio	0 (disabled)	1 (pulses/4 ms)	At start of operation	291	00 to 15	0001 hex
			:	]			:
			65535 (pulses/4 ms)				FFFF hex

# **Inverter Positioning 0**

# **Basic Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Use inverter positioning	Do not use	Use	When power is turned	416	00 to 03	0 hex
			Do not use	ON			1 hex
2	Gain	0: 10 (0.1 incre- ments)	0: 10 (0.1 incre- ments)	When power is turned ON	418	00 to 15	0000 hex
			1 (0.1 increments)				0001 hex
			:				:
			65,535 (0.1 increments)				FFFF hex
3	In-position range	0: 1	0: 1	When power is turned	419	00 to 15	0000 hex
			1	ON			0001 hex
			:				:
			65,535				FFFF hex
4	Min. output value	0: 1	0: 1	When power is turned	420	00 to 15	0000 hex
			1	ON			0001 hex
			:				:
			65,535				FFFF hex
5	Max. output value	0: 2,000,000	0: 2,000,000	When power is turned ON	421, 422	00 to 15	00000000 hex
			1				00000001 hex
			:				:
			4,294,967,295				FFFFFFF hex
6	Error counter overflow	0: 10,000	0: 10,000	When power is turned	423	00 to 15	0000 hex
	detection value		1	ON			0001 hex
			:				:
			32,767				7FFF hex
7	Error counter alarm	0: 10,000	0: 10,000	When power is turned	424	00 to 15	0000 hex
	detection value		1	ON			0001 hex
			:	]			:
			32,767	]			7FFF hex

# Appendix G

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
8	Error counter cycle	0: 3 (4-ms incre- ments)	0: 3 (4-ms incre- ments)	When power is turned ON	417	00 to 07	00 hex
			1 (4-ms incre- ments)				01 hex
			:				:
			255 (4-ms incre- ments)				FF hex
9	Power Supply Freq. for One Motor Revolution	0 (0.1-Hz incre- ments)	0 (0.1-Hz incre- ments)	When power is turned ON	436	00 to 15	0000 hex
	per Sec.		:				:
			65,535 Hz (0.1-Hz increments)				FFFF hex
10	Number of Encoder	0	0	When power is turned	437	00 to 15	0000 hex
	Pulses for One Motor Revolution		:	ON			:
			65,535				FFFF hex

# **Operation Adjustment Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Limit output during	Do not use	Use	When power is turned	432	00 to 03	0 hex
	acceleration and con- stant speed		Do not use	ON			1 hex
2	Limit output during	Do not use	Use	When power is turned	432	04 to 07	0 hex
	deceleration and when stopped		Do not use	ON			1 hex
3	Output coefficient dur- ing acceleration and	0: 6 (0.01 incre- ments)	0: 6 (0.01 incre- ments)	When power is turned ON	433	00 to 07	0 hex
	constant speed		1 (0.01 increments)				1 hex
			:				:
			255 (0.01 incre- ments)				FF hex
4	Output coefficient dur- ing deceleration	0: 96 (0.01 increments)	0: 96 (0.01 incre- ments)	When power is turned ON	434	00 to 07	0 hex
			1 (0.01 increments)				1 hex
			:				:
			255 (0.01 incre- ments)				FF hex
5	Output coefficient after pulse output	0: 50 (0.01 increments)	0: 50 (0.01 incre- ments)	When power is turned ON	435	00 to 07	0 hex
			1 (0.01 increments)				1 hex
			:	]			:
			255 (0.01 incre- ments)				FF hex

# **Inverter Positioning 1**

# **Basic Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Use inverter positioning	Do not use	Use	When power is turned	416	08 to 11	0 hex
			Do not use	ON			1 hex
2	Gain	0: 10 (0.1 incre- ments)	0: 10 (0.1 incre- ments)	When power is turned ON	425	00 to 15	0000 hex
			1 (0.1 increments)				0001 hex
			:				:
			65,535 (0.1 increments)				FFFF hex

# Appendix G

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
3	In-position range	0: 1	0: 1	When power is turned	426	00 to 15	0000 hex
			1	ON			0001 hex
			:				:
			65,535				FFFF hex
4	Min. output value	0: 1	0: 1	When power is turned	427	00 to 15	0000 hex
			1	ON			0001 hex
			:				:
			65,535				FFFF hex
5	Max. output value	0: 2,000,000	0: 2,000,000	When power is turned ON	429, 428	00 to 15	00000000 hex
			1				00000001 hex
			:				:
			4,294,967,295				FFFFFFF hex
6	Error counter overflow	0: 10,000	0: 10,000	When power is turned	430	00 to 15	0000 hex
	detection value		1	ON			0001 hex
			:				:
			32,767				7FFF hex
7	Error counter alarm	0: 10,000	0: 10,000	When power is turned	431	00 to 15	0000 hex
	detection value		1	ON			0001 hex
			:				:
			32,767				7FFF hex
8	Error counter cycle	0: 3 (4-ms incre- ments)	0: 3 (4-ms incre- ments)	When power is turned ON	417	00 to 07	00 hex
			1 (4-ms incre- ments)				01 hex
			:				:
			255 (4-ms incre- ments)				FF hex
9	Power Supply Freq. for One Motor Revolution	0 (0.1-Hz incre- ments)	0 (0.1-Hz incre- ments)	When power is turned ON	438	00 to 15	0000 hex
	per Sec.		:				:
			65,535 Hz (0.1-Hz increments)				FFFF hex
10	Number of Encoder	0	0	When power is turned	439	00 to 15	0000 hex
	Pulses for One Motor Revolution		:	ON			:
			65,535	]			FFFF hex

# **Operation Adjustment Settings**

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
1	Limit output during	Do not use	Use	When power is turned	432	08 to 11	0 hex
	acceleration and con- stant speed		Do not use	ON			1 hex
2	Limit output during	Do not use	Use	When power is turned	432	12 to 15	0 hex
	deceleration and when stopped		Do not use	ON			1 hex
3	Output coefficient dur- ing acceleration and	0: 6 (0.01 incre- ments)	0: 6 (0.01 incre- ments)	When power is turned ON	433	08 to 15	0 hex
	constant speed		1 (0.01 increments)				1 hex
			:				:
			255 (0.01 incre- ments)				FF hex

	Name	Default	Settings	When setting is read by CPU Unit	Internal address	Bits	Settings
4	Output coefficient dur- ing deceleration	0: 96 (0.01 increments)	0: 96 (0.01 incre- ments)	When power is turned ON	434	08 to 15	0 hex
			1 (0.01 increments)				1 hex
			:				:
			255 (0.01 incre- ments)				FF hex
5	Output coefficient after pulse output	0: 50 (0.01 increments)	0: 50 (0.01 incre- ments)	When power is turned ON	435	08 to 15	0 hex
			1 (0.01 increments)				1 hex
			:				:
			255 (0.01 incre- ments)				FF hex

# Appendix H Specifications for External Power Supply Expansion

When using the external power supply for AC-power-supply CPU Units, the following limitations apply:

#### • 30-point, 40-point and 60-point AC-power-supply CPU Units (Model CP1L-M□□DR-A)

The external power supply for the 30-point, 40-point and 60-point AC-power-supply CPU Units (Model CP1L-MDDR-A) can be used beyond 300mA within the capacity range of the power supply built in the CPU Units.

Please calculate the usable capacity of external power supply according to the following example.

#### Calculation example of the capacity limit of external power supply

Example 1

	CPU Units	E	Expansion (I/O) Units			Limit
		1 <sup>st</sup> unit	2 <sup>nd</sup> unit	3 <sup>rd</sup> unit		
	Model CP1L-M40DR-A	Model CP1W-DA041	Model CP1W-DA041	Model CP1W-DA041		
5V	0.22A	0.08A	0.08A	0.08A	0.46A	≤1.2A
24V	0.08A	0.124A	0.124A	0.124A	0.452A	≤0.7A
Power consumption	5V×0.46A=2.3W 24V×0.452A=10.			Total 13.148W	≤18.5W	
Usable capac- ity of external power supply	18.5W (Total of u 5.352W/24V=0.2		able power consumption)-13.148W=5.352W 3A			≤0.7A

#### Example 2

	CPU Units	E	Expansion (I/O) Units			Limit
		1 <sup>st</sup> unit	2 <sup>nd</sup> unit	3 <sup>rd</sup> unit		
	Model CP1L-M40DR-A	Model CP1W-20EDT	None	None		
5V	0.22A	0.130A	0.0A	0.0A	0.35A	≤1.2A
24V	0.08A	0.0A	0.0A	0.0A	0.08A	≤0.7A
Power consumption		5V×0.35A=1.75W 24V×0.08A=1.92W			Total 3.67W	≤18.5W
Usable capac- ity of external power supply	18.5W (Total of u 14.83W/24V=0.6		sumption)-3.67	0.618A	≤0.7A	

#### Specifications for External Power Supply Expansion

#### • 10-point, 14-point and 20-point AC-power-supply CPU Units (Model CP1L-L□DR-A)

The external power supply for 10-point AC-power-supply CPU Units (Model CP1L-L□□DR-A) as well as 14-point and 20-point power-supply CPU Units manufactured since May 2008 (Model CP1L-L□□DR-A) can be used beyond 200mA within the capacity range of the power supply built in the CPU Units.

Please calculate the usable capacity of external power supply according to the following example.

#### Calculation example of the capacity limit of external power supply

#### Example 1

	CPU Units	E	Expansion (I/O) Units			Limit
		1 <sup>st</sup> unit	2 <sup>nd</sup> unit	3 <sup>rd</sup> unit		
	Model CP1L-M20DR-A	Model CP1W-DA041	Disabled	Disabled		
5V	0.20A	0.08A	0.0A	0.0A	0.28A	≤0.85A
24V	0.05A	0.124A	0.0A	0.0A	0.174A	≤0.35A
Power consumption	5V×0.28A=1.4W 24V×0.174A=4.1	5V×0.28A=1.4W 24V×0.174A=4.176W				≤9.5W
Usable capac- ity of external power supply	18.5W (Total of u 3.924W/24V=0.1	able power consumption)-5.576W=3.924W 3A			0.163A	≤0.35A

#### Example 2

	CPU Units		Expansion (I/O) Units			Limit
		1 <sup>st</sup> unit	2 <sup>nd</sup> unit	3 <sup>rd</sup> unit		
	Model CP1L-M14DR-A	None	Disabled	Disabled		
5V	0.18A	0.0A	0.0A	0.0A	0.18A	≤0.85A
24V	0.04A	0.0A	0.0A	0.0A	0.04A	≤0.35A
Power consumption	5V×0.18A=0.9W 24V×0.04A=0.96	5V×0.18A=0.9W 24V×0.04A=0.96W				≤9.5W
Usable capac- ity of external power supply		18.5W (Total of usable power consumption)-1.860W=7.64W 7.64W/24V=0.318A			0.318A	≤0.35A

For 14-point and 20-point AC-power-supply CPU Units manufactured before May 2008, the specifications are as written in the section 1-2-3 Restrictions on System Configuration.

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### **Revision History**

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



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

Revision code	Date	Revised content
01	December 2007	Original production
02	April 2008	Information on CP1L CPU Units with 10 or 60 I/O points, CP1W Expansion I/O Units with 16 or 32 I/O points and LCD Option Board were added.
03	June 2008	Errors were corrected.
04	August 2008	CP1W-CIF12 added for Serial Communications Option Board.
		Errors were corrected.

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